INFORMATION SHEET

PRESIDING: Commissioner Brown-Bland, Presiding; and Chair Mitchell; Commissioners Gray, Clodfelter, Duffley, Hughes and McKissick
PLACE: Via Videoconference
DATE: Tuesday, September 21, 2021
TIME: 1:30 p.m. – 2:40 p.m.
DOCKET NOS.: E-2, Sub 1273
COMPANY: Duke Energy Progress, LLC
DESCRIPTION: Application for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. 62-133.9 and Commission Rule R8-69

VOLUME NUMBER: 2

APPEARANCES
(See attached)

WITNESSES
(See attached)

EXHIBITS
(See attached)

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TRANSCRIPT PAGES: 67
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PLACE: Via Videoconference

DATE: Tuesday, September 21, 2021

TIME: 1:30 p.m - 2:40 p.m.

DOCKET NO: E-2, Sub 1273

BEFORE: Commissioner ToNola D. Brown-Bland, Presiding
Chair Charlotte A. Mitchell
Commissioner Lyons Gray
Commissioner Daniel G. Clodfelter
Commissioner Kimberly W. Duffley
Commissioner Jeffrey A. Hughes
Commissioner Floyd B. McKissick, Jr.

IN THE MATTER OF:

Application of Duke Energy Progress, LLC,
Pursuant to N.C.G.S. § 62-133.9 and
Commission Rule R8-69 for Approval of
Demand-Side Management and
Energy Efficiency Cost Recovery Rider

VOLUME: 2

A P P E A R A N C E S:

FOR DUKE ENERGY PROGRESS, LLC:

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Associate General Counsel

Duke Energy Corporation

Post Office Box 1551 / NCRH 20

Raleigh, North Carolina 27602

FOR CAROLINA UTILITY CUSTOMERS ASSOCIATION, INC.:

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Craig D. Schauer, Esq.

Brooks Pierce

150 Fayetteville Street, Suite 1700

Raleigh, North Carolina 27601

FOR CAROLINA INDUSTRIAL GROUP FOR FAIR UTILITY RATES, II:

Christina Cress, Esq.

Bailey & Dixon, L.L.P.

434 Fayetteville Street, Suite 2500

Raleigh, North Carolina 27601

A P P E A R A N C E S (Cont'd.):

FOR NORTH CAROLINA JUSTICE CENTER, NORTH CAROLINA HOUSING COALITION, and THE SOUTHERN ALLIANCE FOR CLEAN ENERGY:

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Chapel Hill, North Carolina 27516

FOR THE USING AND CONSUMING PUBLIC:

Nadia Luhr, Esq.
Public Staff - North Carolina Utilities Commission
4326 Mail Service Center
Raleigh, North Carolina 27699-4300

1 T A B L E O F C O N T E N T S
2 E X A M I N A T I O N S
3 PAGE

E X H I B I T S

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: __9/16/2021_____ DOCKET NO.: _E-2, Sub 1273_____

ATTORNEY NAME and TITLE: _Christina Cress, Of Counsel_____

_____

FIRM NAME: __Bailey & Dixon, LLP_____

ADDRESS: _434 Fayetteville St., Ste. 2500_____

CITY: _Raleigh_____ STATE: ___NC_____ ZIP CODE: __27607_____

APPEARANCE ON BEHALF OF: __CIGFUR II_____

_____

APPLICANT: ___ COMPLAINANT: ___ INTERVENOR: _X

PROTESTANT: ___ RESPONDENT: ___ DEFENDANT: ___

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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 9/20/21 **DOCKET NO.:** E-2, Sub 1273

ATTORNEY NAME and TITLE: Craig D Schauer

FIRM NAME: Brooks Pierce

ADDRESS: 150 Fayetteville St, Suite 1700

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27601

APPEARANCE ON BEHALF OF: Carolina Utility Customers Association

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** x

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 9/21/21 **DOCKET NO.:** E-2, Sub 1273

ATTORNEY NAME and TITLE: Kendrick C. Fentress
Associate General Counsel

FIRM NAME: Duke Energy

ADDRESS: NCRH 20 / PO Box 1551

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27602

APPEARANCE ON BEHALF OF: Duke Energy

APPLICANT: ✓ **COMPLAINANT:** ___ **INTERVENOR:** ___

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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Email: Kendrick.Fentress@duke-energy.com

SIGNATURE: Kendrick C. Fentress

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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 9/20/21 **DOCKET NO.:** E-2, Sub 1273

ATTORNEY NAME and TITLE: Marcus Trathen

FIRM NAME: Brooks Pierce

ADDRESS: 150 Fayetteville St, Suite 1700

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27601

APPEARANCE ON BEHALF OF: Carolina Utility Customers Association

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** _x_

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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Email: mtrathen@brookspierce.com

SIGNATURE: /s/ Marcus Trathen

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NORTH CAROLINA UTILITIES COMMISSION
PUBLIC STAFF - APPEARANCE SLIP

DATE 9/21/2021 DOCKET #: E-2, Sub 1273

PUBLIC STAFF ATTORNEY Nadia Luhr

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COMMUNICATIONS
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LEGAL Nadia.Luhr@psncuc.nc.gov

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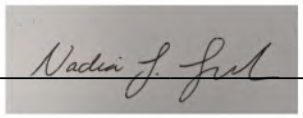

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: September 21, 2021 **DOCKET NO.:** E-2, Sub 1273

ATTORNEY NAME and TITLE: Tirrill Moore, Associate Attorney
David L. Neal, Senior Attorney

FIRM NAME: Southern Environmental Law Center

ADDRESS: 601 West Rosemary Street, Suite 220

CITY: Chapel Hill **STATE:** NC **ZIP CODE:** 27516

APPEARANCE ON BEHALF OF: NC Justice Center, NC Housing Coalition, and the Southern Alliance for Clean Energy

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** X

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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Email: tmoore@selcnc.org

SIGNATURE: /s/ Tirrill Moore

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/A

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-2, SUB 1273

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application of Duke Energy Progress, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69	)))))))	**APPLICATION OF DUKE ENERGY PROGRESS, LLC FOR APPROVAL OF DEMAND-SIDE MANAGEMENT AND ENERGY EFFICIENCY COST RECOVERY RIDER**

Duke Energy Progress, LLC ("DEP" or the "Company"), pursuant to N.C. Gen. Stat. § 62-133.9 and Rule R8-69 of the Rules and Regulations of the North Carolina Utilities Commission (the "Commission"), hereby applies to the Commission for approval of its demand-side management ("DSM") and energy efficiency ("EE") cost recovery rider for 2021. In support of this Application, DEP respectfully shows the Commission the following:

1. The Applicant's general offices are located at 410 South Wilmington Street, Raleigh, North Carolina 27601, and its mailing address is Post Office Box 1551, Raleigh, North Carolina 27602-1551.

2. The attorney for the Company, to whom all communications and pleadings should be addressed, is:

Kendrick Fentress
Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
Telephone: (919) 546-6733
Kendrick.Fentress@duke-energy.com

3. N.C. Gen. Stat. § 62-133.9(d) authorizes the Commission to approve an annual rider to the rates of electric public utilities to recover all reasonable and prudent costs incurred for the adoption and implementation of new DSM and EE programs. Recoverable costs include, but are not limited to, all capital costs, including cost of capital and depreciation expense, administrative costs, implementation costs, incentive payments to program participants, and operating costs. Such rider shall consist of the utility's forecasted costs during the rate period and an Experience Modification Factor ("EMF") to collect the difference between the utility's actual reasonable and prudent costs incurred during the test period and actual revenues realized during the test period. The Commission is also authorized to approve incentives to utilities for adopting and implementing new DSM and EE programs, including rewards based on the sharing of savings achieved by the programs.

4. Rule R8-69(b) provides that the Commission will each year conduct a proceeding for each electric public utility to establish an annual DSM/EE rider to recover DSM- and EE-related costs.

5. According to Rule R8-69(e), the electric public utility is to file its application for recovery of DSM and EE costs at the same time it files the information required by Rule R8-55, and the Commission is to conduct an annual DSM/EE rider hearing as soon as practicable after the hearing required by Rule R8-55.

6. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69, the Company requests the establishment of a rider to recover its reasonable and prudent DSM and EE costs, including program costs, net lost revenues, incentives, and an EMF. All costs, including net lost revenues and Portfolio Performance Incentive, are calculated pursuant to the *Order Approving Revised Cost Recovery and Incentive*

Mechanism and Granting Waivers issued by the Commission in Docket No. E-2, Sub 931 on January 20, 2015. In addition, pursuant to the Commission's October 20, 2020 *Order Approving Revisions to Demand-Side Management and Energy Efficiency Cost Recovery Mechanisms* issued in Docket Nos. E-2, Sub 931 and E-7, Sub 1032 the Income-Qualified EE and Weatherization programs are eligible to receive a Program Return Incentive ("PRI") based on shared savings achieved by these programs beginning in 2022.

The calculations of these costs, and the associated rider and EMF rates, are described in the Direct Testimony and Exhibits of Shannon R. Listebarger. The rider and EMF are intended to allow DEP to recover $189,738,629 of DSM and EE expenses, net lost revenues, and incentives. This amount includes the estimated under-collection of $12,551,970 associated with test period activities during the period beginning January 1, 2020 and ending December 31, 2020, and an estimated $177,186,661 for expenses, net lost revenues, and incentives to be incurred during the rate period from January 1, 2022 through December 31, 2022.

7. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69, the Company requests Commission approval of the annual billing adjustments as follows (all shown on a cents per kilowatt-hour ("kWh") basis with and without NC regulatory fee):

Excluding regulatory fee:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Residential	0.114	0.549	0.001	0.056	0.720
General Service EE		0.637		0.040	0.677
General Service DSM	0.061		(0.008)		0.053

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Lighting		0.119		0.005	0.124

Including regulatory fee:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Residential	0.114	0.550	0.001	0.056	0.721
General Service EE		0.638		0.040	0.678
General Service DSM	0.061		(0.008)		0.053
Lighting		0.119		0.005	0.124

The DSM/EE rider will be in effect for the twelve-month period January 1, 2022 through December 31, 2022.

8. Pursuant to Commission Rule R8-69(b)(6), DEP requests approval to defer prudently incurred costs to FERC account 182.3, "Other Regulatory Assets," until recovered. In addition, pursuant to Commission Rule R8-69(b)(6), DEP requests approval to defer the costs it incurs in adopting and implementing new DSM and EE measures up to six months prior to DEP filing for Commission approval of such measures in accordance with Commission Rule R8-68.

9. The Company has included herewith, as required by Commission Rule R8-69, the direct testimony and exhibits of witnesses Sharon R. Listebarger and Robert P. Evans in support of its filing and the requested change in rates.

WHEREFORE, the Company respectfully prays:

That, consistent with this Application, the Commission approve the changes to the Company's rates as set forth in paragraph 7 above.

Respectfully submitted this the 15th day of June 2021.

By: Kendrick C. Fentress

Kendrick Fentress
Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
Telephone: (919) 546-6733
Kendrick.Fentress@duke-energy.com

ATTORNEY FOR DUKE ENERGY
PROGRESS, LLC

VERIFICATION

STATE OF SOUTH CAROLINA)
) DOCKET NO. E-2, SUB 1273
COUNTY OF YORK)

Shannon R. Listebarger, being first duly sworn, deposes and says:

That she is Manager, Rates and Regulatory Strategy supporting Duke Energy Progress, LLC, applicant in the above-titled action; that she has read the foregoing Application and knows the contents thereof; that the same is true except as to the matters stated therein on information and belief; and as to those matters, she believes it to be true.

Shannon R. Listebarger

Signed and sworn to before me this day by Shannon R. Listebarger
Name of principal

Date: 6/8/21

Lori M. Allen
Official Signature of Notary

(Official Seal)

Lori M. Allen, Notary Public
Notary's printed or typed name

My commission expires: 5/21/31

ENERGY EFFICIENCY IN THE SOUTHEAST

THIRD ANNUAL REPORT – JANUARY, 26 2021

Southern Alliance for Clean Energy
P.O. Box 1842 | Knoxville, TN 37901 | 865.637.6055

cleanenergy.org
Southern Alliance for Clean Energy

INTRODUCTION

Efficiency is a proven low-cost clean energy resource, but Southeastern utilities and regulators continue to underinvest and deprioritize it. As a result, households in many Southeastern states have some of the highest electricity usage and monthly energy bills in the nation.

In 2020, COVID-19 fundamentally disrupted Southeast efficiency programs, while intensifying energy insecurity for millions of already-vulnerable households. The data in this report predates the pandemic, but its effects on the Southeast region are featured throughout our commentary.

This report also explores efficiency as a tool to reduce carbon emissions, a leading cause of the climate crisis. Despite commitments from local governments, utilities, and other corporate interests, to date there have been very few examples of utilities in the Southeast actually including carbon reduction strategies in resource plans or proposals to local regulators – a trend we will continue to monitor and engage with through intervention and advocacy.

The purpose of our "Energy Efficiency in the Southeast" annual report is to document recent policy developments and trends in electric utility efficiency data from 2019.

In this report utility energy efficiency programs are scored primarily on the basis of energy saved in 2019 as a percentage of the previous year's total electricity sales. Additional policy context is then added along with comparisons to state, regional, and national averages that highlight recent trends. Appendix A on page 28 details the Southeast utilities that fall within the reports scope.

ABOUT SACE

The Southern Alliance for Clean Energy (SACE) is a nonprofit organization that promotes responsible and equitable energy choices to ensure clean, safe, and healthy communities throughout the Southeast. As a leading voice for energy policy in our region, SACE is focused on transforming the way we produce and consume energy in the Southeast.

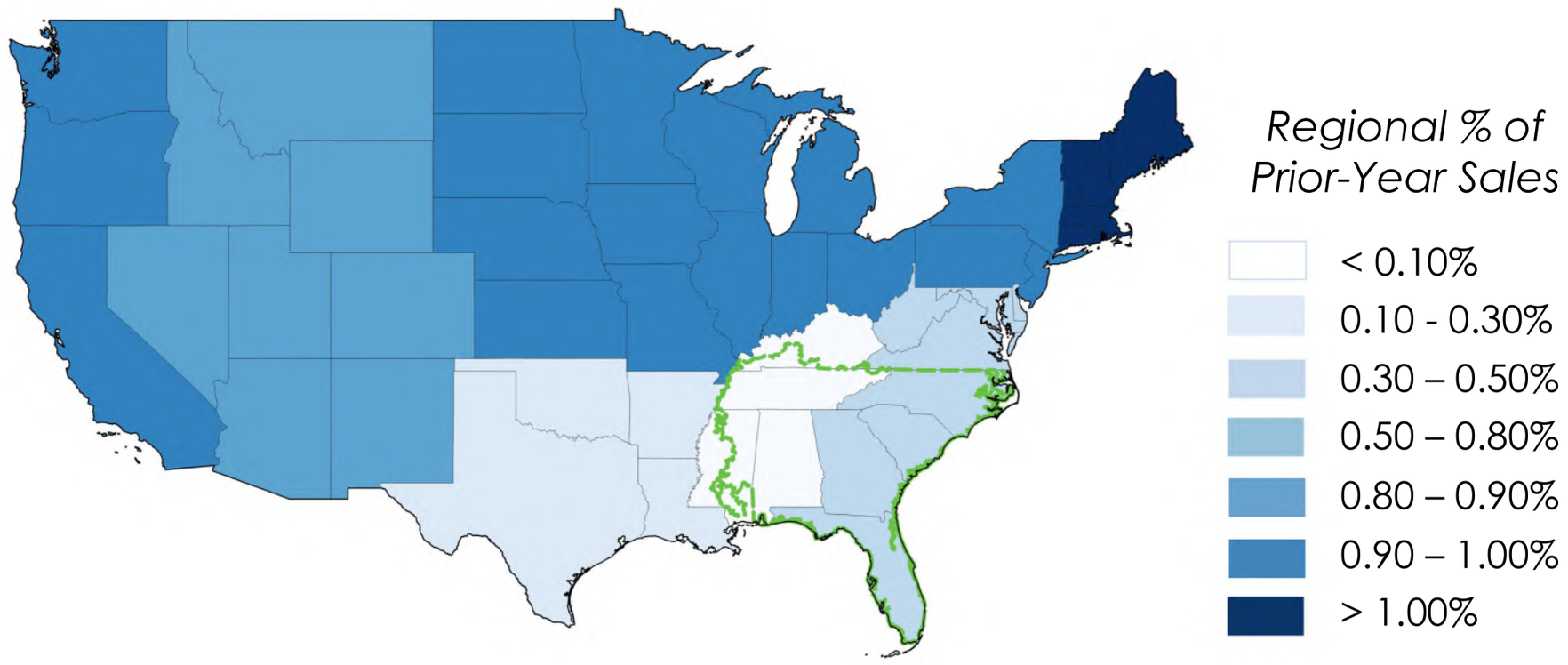
Proper citation for this report: Southern Alliance for Clean Energy (2021). *Energy Efficiency in the Southeast, Annual Report published January 2021.*

TABLE OF CONTENTS

EFFICIENCY PERFORMANCE ACROSS REGIONS

PERFORMANCE OF REGIONS

REGION	% OF SALES
NORTHEAST	2.15%
WEST-PACIFIC	0.87%
MIDWEST	0.97%
WEST-MOUNTAIN	0.87%
SOUTHEAST	0.26%
U.S. TOTAL	**0.67%**



Area outlined in green covered in report.

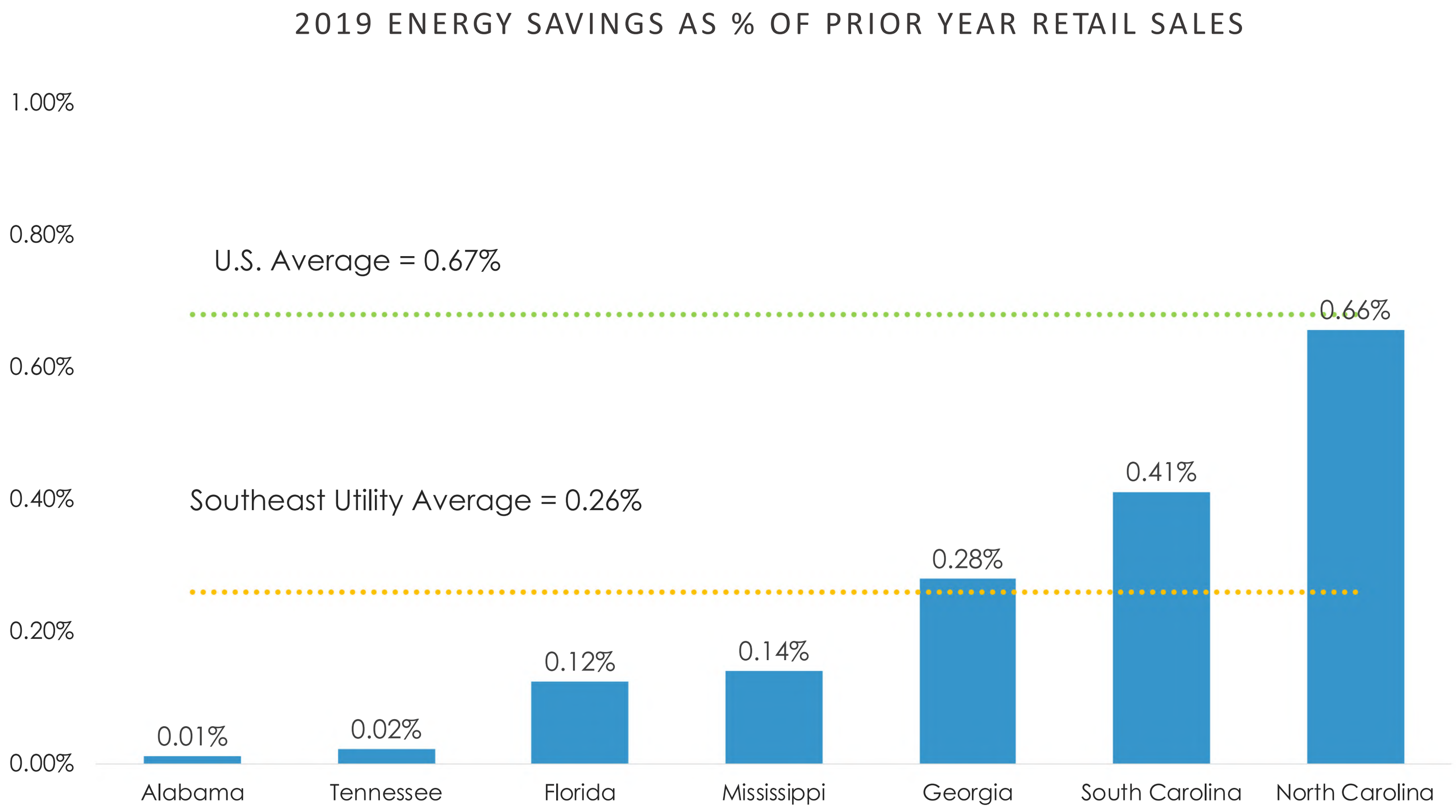
REGION-TO-REGION COMPARISON

Efficiency performance in the Southeast has consistently lagged behind other parts of the country, often falling dead last in regional rankings. 2019 was no exception with the Southeastern region remained solidly at the bottom, with just 0.26% annual savings. This is less than half the national average, and just a fraction of savings in the Northeast, which invested early in energy efficiency, built up an industry and workforce, and continued to expand its energy efficiency investments as the financial benefits rolled in. Despite total efficiency savings remaining fairly level, the national savings average went down from 2018 to 2019 due to an overall increase in electric sales.

EFFICIENCY OFFSETS FOSSIL FUELS

Like other parts of the country, the Southeast is starting to see states, cities, and utilities strive to reduce carbon emissions. Energy efficiency is a crucial tool for attaining climate reduction goals. It is helping the region retire its aging fleet of fossil fuel power plants, reducing the need for more expensive fossil gas generation, and making the transition to renewable energy more affordable. In 2019, efficiency eliminated an estimated 2,142 gigawatt hours (GWh) of energy waste across the Southeast, enough to power 162,000 homes for a year. Efficiency in the Southeast is reducing carbon emissions by approximately one million tons per year.

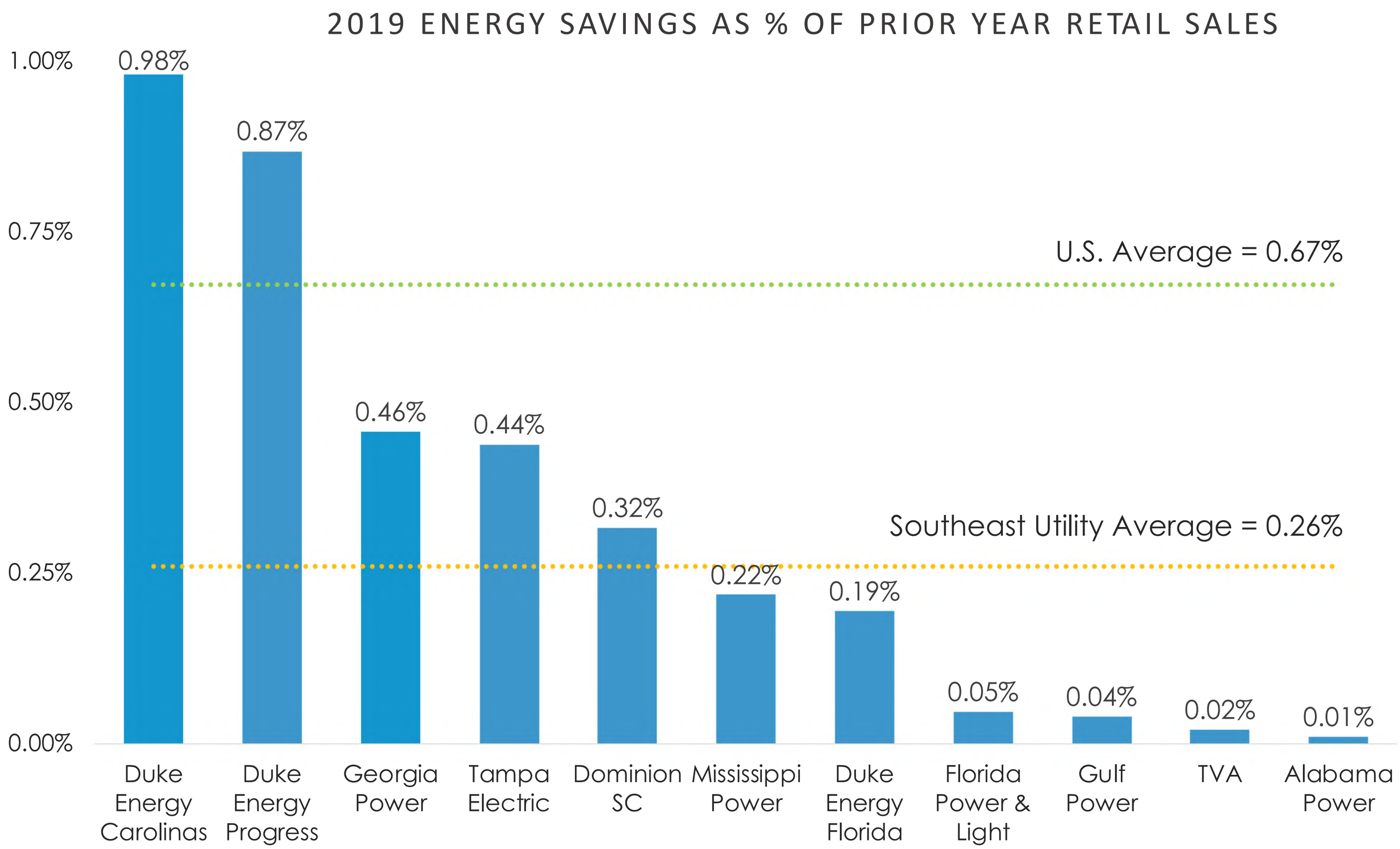
EFFICIENCY PERFORMANCE OF SOUTHEASTERN STATES



STATE RANKINGS IN THE SOUTHEAST

States in the Southeast continue to underperform compared to other regions and the country as a whole. In 2019, North Carolina had more than double the annual savings of the Southeast as a whole, but fell just short of the national average. South Carolina and Georgia also exceeded the regional average (if only barely), but trailed the nation as a whole. Florida and Mississippi continue to drag the regional average down, while Tennessee and Alabama now deliver virtually no utility efficiency savings for residents.

EFFICIENCY PERFORMANCE OF MAJOR SOUTHEASTERN UTILITIES



FROM THE TOP TO THE BOTTOM

In 2019, Duke's utilities in the Carolinas continued to lead the region in annual efficiency savings. They substantially exceeded the national average and delivered about twice as much efficiency as the next closest utilities. Georgia Power, Tampa Electric, and Dominion were above the regional average.

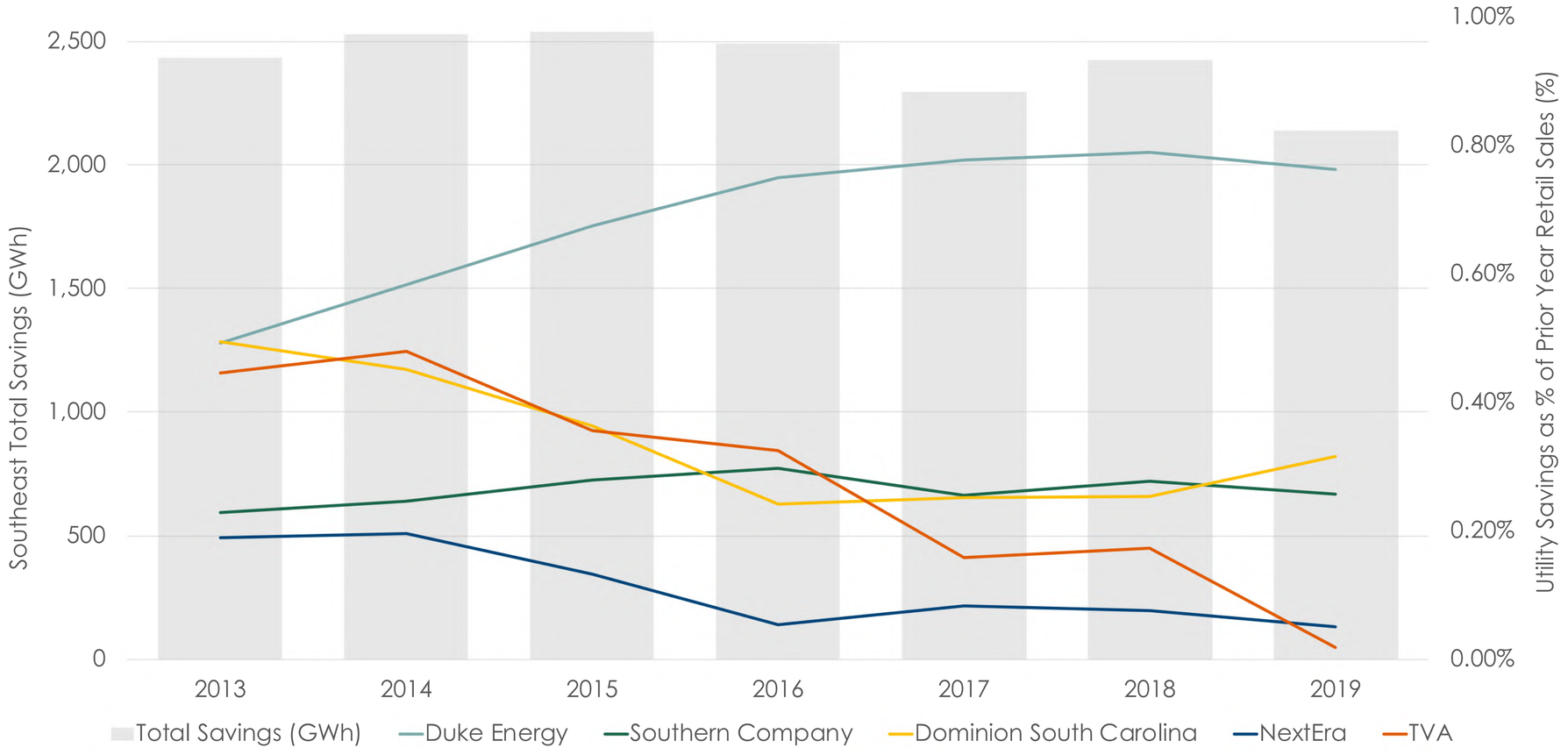
Two mega-utilities are having an outsized negative effect on efficiency in the Southeast. Just a few years ago, Tennessee Valley Authority (TVA) and Florida Power & Light (FPL) were important contributors to the region's total Southeast savings, despite comparatively poor performance when looking at regional and national peers. But since that time, TVA and FPL have slashed their efficiency programs to almost nothing. Because these are such large utilities, their lack of efficiency savings effectively drag the entire Southeast average sharply downward.

SOUTHEAST UTILITY SYSTEM BREAKDOWN

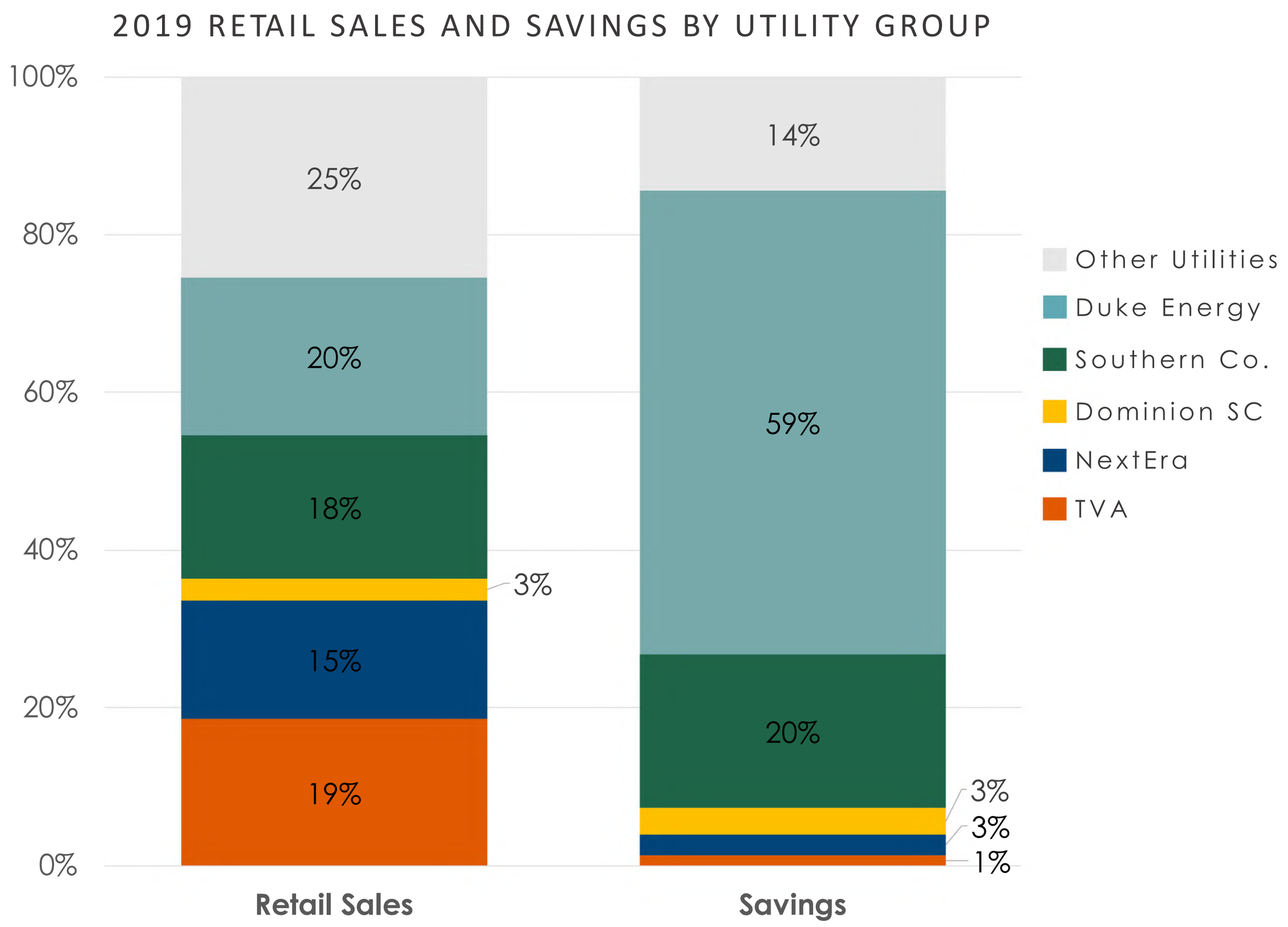
RISE AND FALL

TVA, NextEra (which owns Florida Power & Light and Gulf Power), and Dominion have all seen sharp declines in efficiency savings since 2013, while Duke has trended upwards. Over the past three years, total efficiency savings in the Southeast have fallen from their previous highs. The steepest drop occurred in 2019, driven almost entirely by TVA's decision to abruptly eliminate all direct financial incentive programs for customers who install efficiency upgrades. Looking ahead, recent regulatory decisions in South Carolina and Georgia are expected to lead to increased savings for Georgia Power and Dominion in coming years.

SAVINGS AS PERCENT OF PRIOR YEAR RETAIL SALES BY UTILITY GROUP COMPARED TO TOTAL REGIONAL SAVINGS



SOUTHEAST UTILITY SYSTEM BREAKDOWN



OVER-ACHIEVERS AND UNDER-PERFORMERS

A handful of the Southeast's 500+ electric utilities make up the bulk of the region's savings. Just three individual utilities, Duke Energy Carolinas, (DEC) Duke Energy Progress (DEP), and Georgia Power, account for nearly three quarters of the region's total efficiency savings.

While Georgia Power and Dominion Energy South Carolina (DESC) delivered efficiency savings levels that were roughly equal to their share of regional electric sales in 2019, Duke Energy delivered savings that were proportionately three times higher than their electric sales.

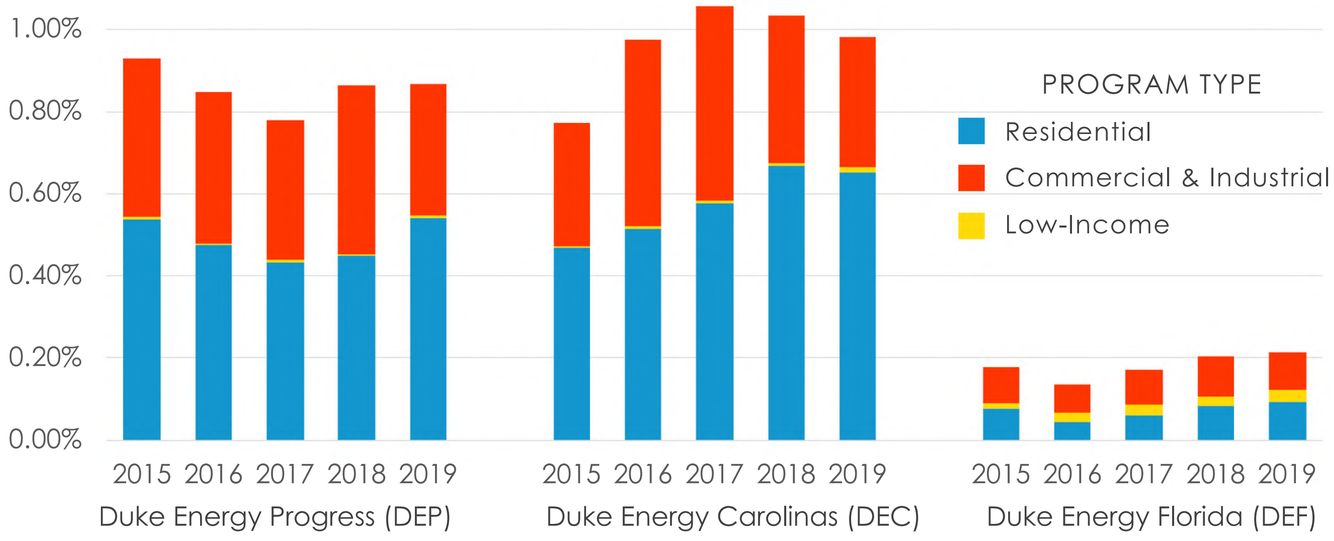
By contrast, other large utilities, delivered far less than their share. Most notably, NextEra accounts for 15% of total electric sales in the Southeast but a mere 3% of efficiency savings, While TVA is 19% of regional sales but a mere 1% of efficiency savings.

0.76%
System Avg.

DUKE ENERGY

FLEXIBILITY AND EVOLUTION KEY TO SAVINGS PERFORMANCE

ENERGY SAVINGS AS % OF PRIOR YEAR RETAIL SALES



SAVINGS GAP PERSISTS BETWEEN DUKE COMPANIES

Duke Energy Carolinas has raised the bar for its sister companies by reaching the 1% savings mark for two of the last three years. Despite identical state policies and a merger agreement that both companies would strive to deliver 1% annual savings, Duke Energy Progress has not yet reached that target. Florida State policies are far worse, and so is Duke's performance there. But Florida's efficiency rules are finally being reformed, giving Duke the chance to once again demonstrate its leadership, throw its weight in favor of modern efficiency policies, and close the savings gap between its Southeast subsidiaries.

MODIFICATIONS KEY TO HIGH SAVINGS

Technologies, consumer preferences, and efficiency standards for buildings and appliances are frequently changing, so it takes consistent effort to sustain high utility energy savings. More than any other Southeast utility, Duke's utilities in the Carolinas are perpetually developing new programs and ways to enhance program delivery - with considerable help from collaborative stakeholders like SACE. Recently, Duke proposed expanding residential new construction programs, financing for commercial upgrades, midstream delivery channels, and demand response to reduce winter peaks.

MAINTAINING EFFICIENCY IN THE COVID CRISIS

The pandemic caused efficiency programs to grind to a halt around the country. Too many utilities failed to innovate and likely experienced significant savings declines. In contrast, DEC and DEP modified their programs and instituted new safety protocols that minimized program disruption. As a result, both companies expect to hit their previously projected savings targets for 2020. More could still be done to direct efficiency services to families who are struggling to repay outstanding energy bills. But Duke has once again shown peer utilities why they lead the Southeast in energy savings– through adaptation and a commitment to sustain higher savings performance.

DUKE ENERGY

NEW POLICIES AND PRACTICES TO SPUR EFFICIENCY EXPANSION

UTILITY PERFORMANCE MECHANISM

The North Carolina Utilities Commission (NCUC) periodically reviews key policies related to energy efficiency operations in the state. In 2020 the NCUC approved changes that may spur additional savings:

- Created a new performance incentive for achieving 1% annual savings and higher savings for low-income customers.
- Called for a study of participation rates and savings impacts for low-income customers using non-income qualified programs. This is part of an overall effort to increase savings for low income households.
- Switched to using the Utility Cost Test, which compares only utility costs and benefits. The Commission also acknowledged issues with its previously used Total Resource Cost test approach, and directed the Collaborative to examine ways to better account for non-energy benefits.

CARBON REDUCTION TARGETS

Duke highlighted efficiency's role for achieving a net zero carbon future in its 2020 Climate Report, stating "Some of the most effective carbon reductions we can make involve helping customers avoid energy usage in the first place." Building on its commitment to cut carbon emissions 50% by 2030 and achieve net zero carbon by 2050, Duke's Board recently announced plans to add a new executive compensation metric tied to climate change starting in 2021.

INTEGRATED RESOURCE PLANNING

Commissions in both North and South Carolina have placed additional requirements on integrated resource planning in recent years, such as requiring utilities to model higher levels of efficiency, requiring analysis of existing coal plants, and showing how resource plans achieve state and corporate emissions targets. These are some of the key issues being reviewed in the company's recent IRP, filed September 2020. In parallel Duke has studied the impacts of demand resources on its winter peak load forecast, revealing an array of new savings opportunities. While these steps all point in the right direction, it still remains to be seen how much they will ultimately impact efficiency resource investments for North and South Carolina in the future. Despite increased focus on the subject, there is still no formal integrated resource planning requirements in Florida

ANNUAL SAVINGS TARGETS

While included in the recent North Carolina efficiency mechanism review, the Commission took no action towards establishing annual efficiency savings targets, which have been shown to be the most effective policy for increasing annual energy savings. Duke points to its leadership status in the Southeast and the effectiveness of financial performance incentives to suggest such targets are not needed. But the question remains whether Duke can ever reach national leadership status on efficiency without new policy requirements.

0.32%
0.27%
System Avg.
System Avg.

DOMINION SOUTH CAROLINA

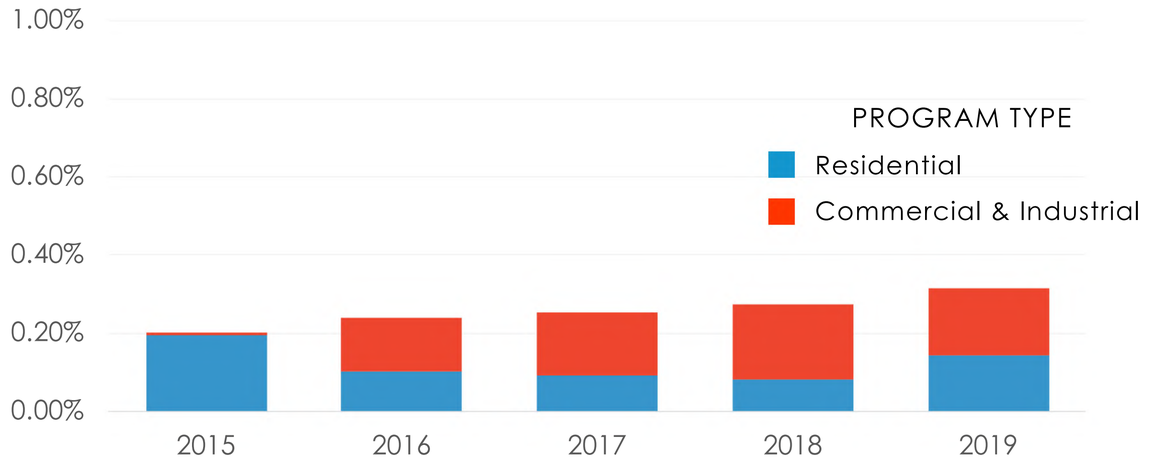
NEW COMPANY + NEW COMMISSION = NEW EXPECTATIONS

TIME TO PLAN FOR HIGH EFFICIENCY

For many years, South Carolina Electric & Gas (SCE&G) underinvested in efficiency while recklessly pursuing the expensive V.C. Summer nuclear power plant project. When the project went bust, the utility was bought by Dominion and renamed Dominion Energy South Carolina (DESC) in 2018. DESC proposed doubling its energy efficiency budget and increasing annual savings to 0.7%. With additional funding, the utility could expand efficiency program offerings to reach more customers with deeper savings.

The South Carolina Public Service Commission has entirely new members since the V.C. Summer debacle. This new PSC rejected DESC's IRP in late 2020 and required the utility to work with SACE, SC Coastal Conservation League, and other stakeholders to produce a new IRP within sixty days. As part of this new IRP, the PSC orders DESC to analyze higher levels of efficiency to at least 1% annual savings. In the future, Dominion must regularly engage stakeholders to consider changes to its IRP methodology, inputs, assumptions, and "*evaluate realistic options to achieve greater energy savings and model a high DSM scenario in the 2023 IRP.*"

ENERGY SAVINGS AS % OF PRIOR YEAR RETAIL SALES



POTENTIAL STUDIES SHOW THEIR LIMITATIONS

Dominion Energy argued against higher savings in its 2020 IRP by pointing to an efficiency potential study it commissioned the previous year. Utilities in other jurisdictions have often made similar claims, but later achieved higher savings when directed to do so by their regulators. This is because utility-funded potential studies often place their thumb on the scale, by:

- Failing to account for technology advances or price declines
- Skewing cost effectiveness analysis by excluding key benefits
- Unduly limiting participant adoption rates

This time, the Commission expects more from the utility.

0.28%
System Avg.

SOUTHERN COMPANY

PROGRAM SUSPENSIONS AND ROLLOUT DELAYS

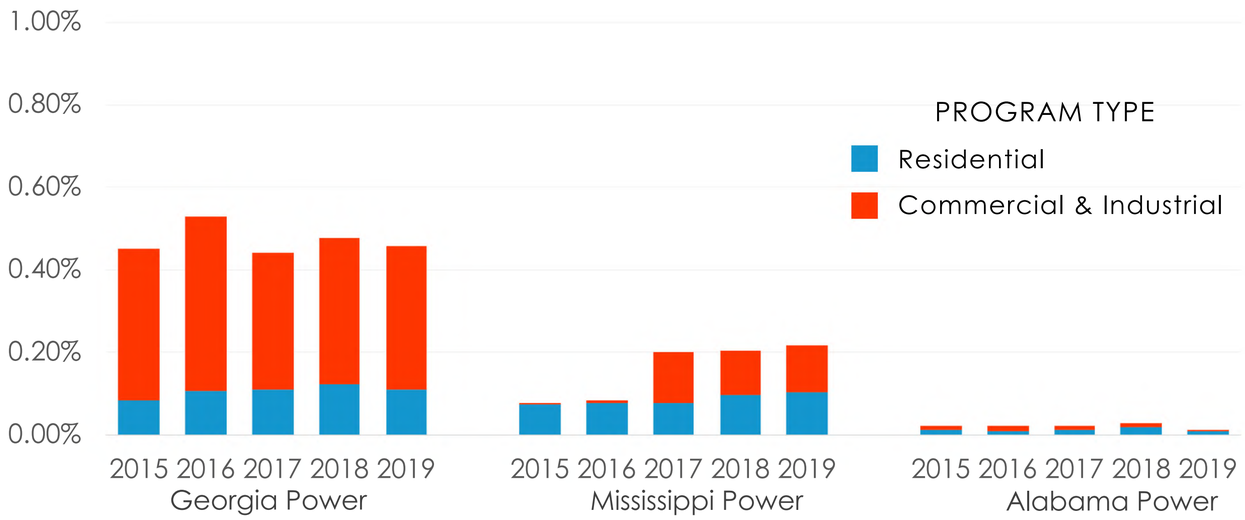
A SLOW START FOR GEORGIA POWER

Last year, the Georgia Public Service Commission (PSC) increased Georgia Power's efficiency savings target by 15% for each of the next three years. However, in 2020 the company switched many of its program implementers, causing both new and existing programs to get a late start. Some had not even begun when the COVID-19 pandemic struck, throwing 2020 savings levels into a tailspin. At just 27% of its annual savings target in September, it became clear the utility would not reach its first year savings goal – and has no plans for recovering the lost savings later.

RELUCTANT TO ADAPT: EFFICIENCY SAVINGS LIKELY TO PLUMMET DURING COVID CRISIS

In March of 2020, Georgia Power stopped all energy efficiency marketing and program operations because of the pandemic. Even as the economy collapsed, the utility was able to secure protection for its own profits against losses from unpaid customer bills. Meanwhile, efficiency programs for struggling low-income households were suspended until the year was nearly over. But peer utilities (even Mississippi Power) implemented new safety protocols and resumed program operations within a few months. Duke Energy and Entergy have both shown how adaptation, even during difficult times, is key to maintaining higher efficiency savings. With the pandemic still going in 2021, let's hope this year Southern Company will be up to the challenge.

ENERGY SAVINGS AS % OF PRIOR YEAR RETAIL SALES



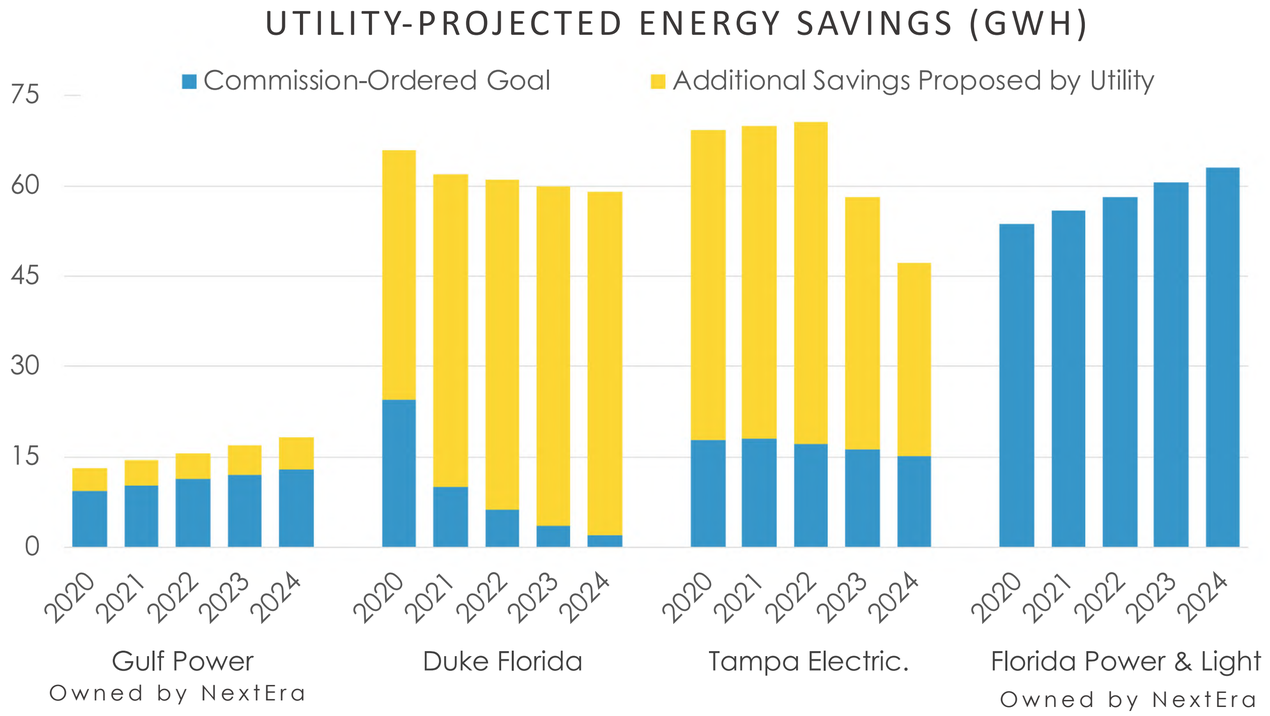
AN EFFICIENCY FINANCING BREAKTHROUGH?

The up-front costs for efficiency improvements prevent many customers from escaping the cycle of unaffordable high electric bills. But innovative inclusive financing mechanisms have proven to be a game-changer for several co-op utilities in the region. In 2019, the Commission approved a new Pay-As-You-Save (PAYS) pilot program, making Georgia Power the first investor owned utility in the Southeast to offer low-income customers on-bill repayment for a comprehensive package of efficiency measures.

0.05%
System Avg.

NEXTERA ENERGY

THE LEAST THEY COULD DO



SMALL STEPS FOR THOSE IN NEED

FPL historically provided among the lowest levels of efficiency savings for its low-income customers. Relative to size, Duke and TECO delivered 20 and 50 times more savings, respectively. While still lagging most of its peers, FPL is expected to more than triple participation in low income programs over the next five years. Still, this is only a small step forward for those in need and far short of what we should expect from the state's largest utility.

THE BOTTOM LINE:

NEXTERA COMPANIES AIM LOW

Florida utilities have a history of downplaying efficiency. In 2019 many Florida utilities used calculation tricks to slash proposed efficiency savings to zero. The Commission rejected these proposals in favor of keeping previous targets, and most utilities came back with plans to exceed the required savings - but not NextEra-owned Florida Power & Light (FPL). Instead, FPL filed plans to do the absolute minimum – less than TECO and Duke, which are far smaller utilities. Even NextEra's other utility in the state, Gulf Power, proposed additional savings above the Commission-ordered goal. FPL later admitted its rates will stay the same or decrease with the required higher savings levels.

NEW RULES: WILL FLORIDA'S BIGGEST MONOPOLY BE EFFICIENCY'S GREATEST OBSTACLE?

It's well known that FPL exerts considerable political influence over policies and practices in Florida. In the past, the utility supported seriously flawed restrictions *against* efficiency measures that pay back quickly or *might* effect rates. As a result, Florida utilities are often at the bottom of efficiency rankings. But after 27 years, Florida's efficiency rules are finally being updated. Will FPL continue to oppose reform, or be ready to move into the 21st Century?

0.02%
0.02%
System Avg.
System Avg.

TENNESSEE VALLEY AUTHORITY

AN INNOVATION LAB FOR THE FUTURE?

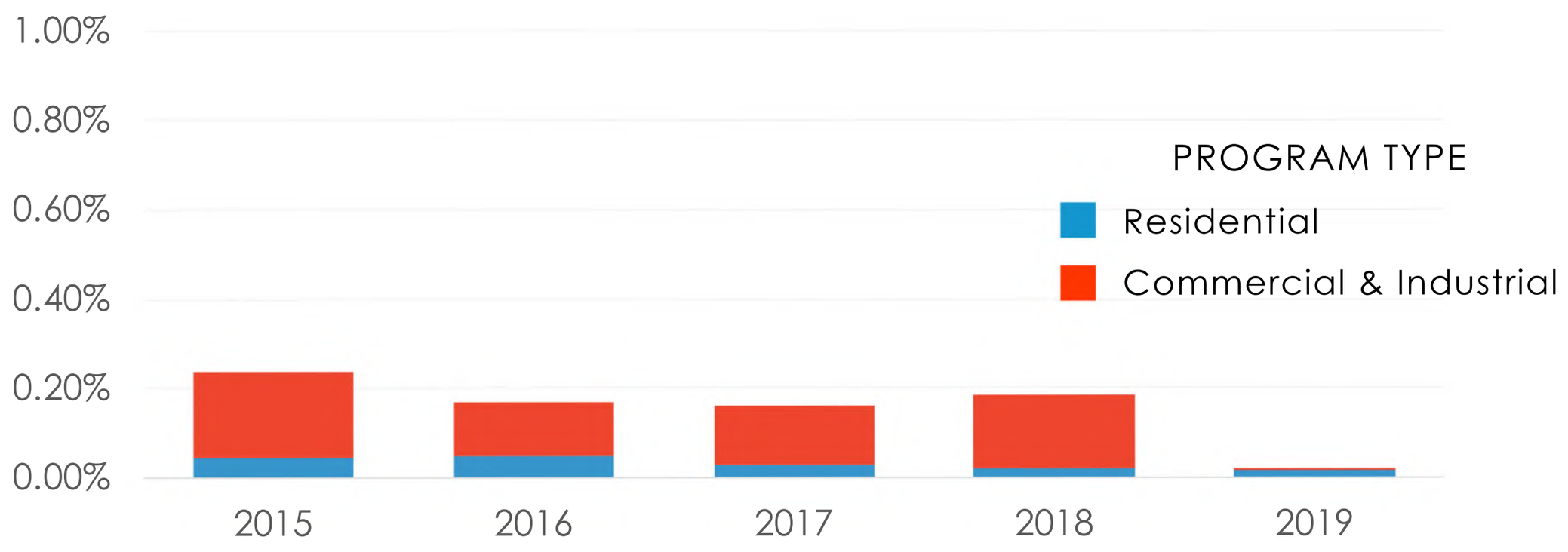
TVA COULD BECOME A LEADER FOR THE NATION

The Tennessee Valley Authority is the nation's largest public power utility. It was founded in the 1930s as part of the New Deal with a mission that included electrification and job creation.

TVA has gutted its investment in energy efficiency over the last decade. Its low-income weatherization program now requires matched funds from local utilities and residential programs are limited to educational resources that do not drive significant, long-term savings or jobs.

The Biden Administration has promised sweeping action on climate change as part of its Build Back Better proposal, including energy efficiency. As a federal utility, the administration could use TVA as a living laboratory to demonstrate the decarbonization and job-creation potential of efficiency. It could greatly expand and modernize TVA's current efficiency offerings, and then export the practices across the country to help meet the administration's climate goals. A major investment in energy efficiency could also help put people in the region back to work after the economic pains associated with the COVID-19 pandemic.

ENERGY SAVINGS AS % OF PRIOR YEAR RETAIL SALES

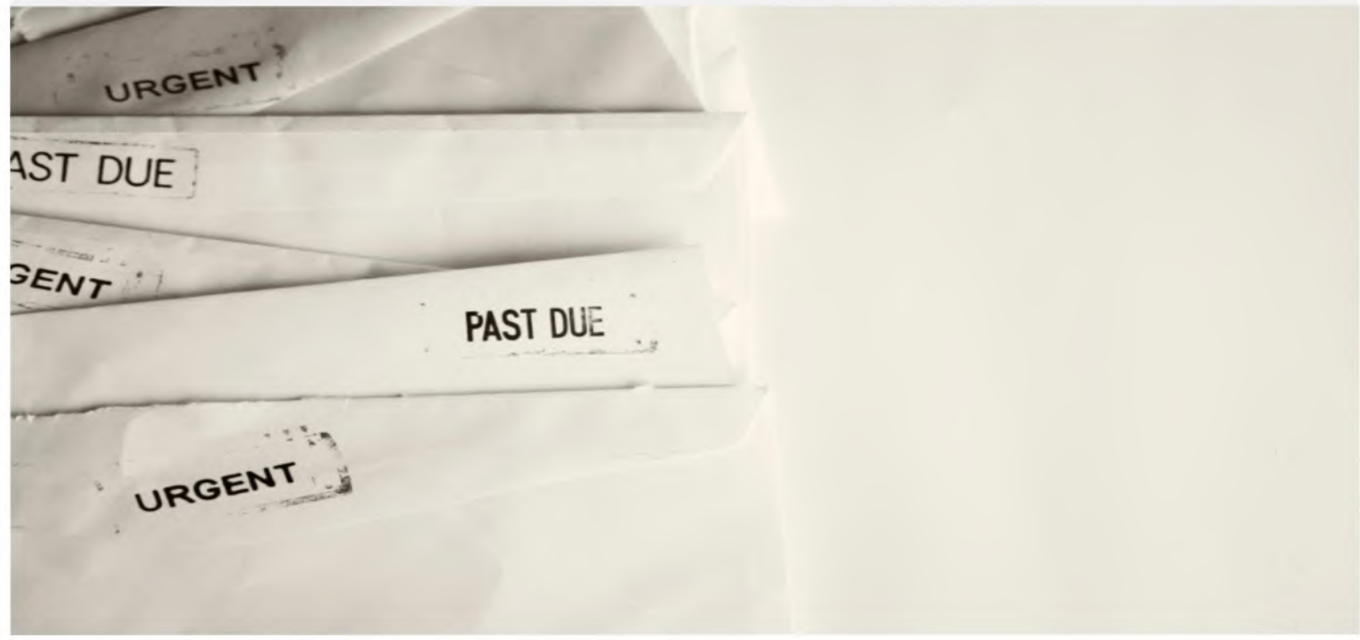


MEMPHIS CONSIDERS A FUTURE WITHOUT TVA

TVA requires all of the municipal and cooperative utilities it serves to source all their power generation needs exclusively from TVA. A few have challenged this arrangement in the past, but never in TVA history has a customer as large as Memphis Light, Gas, and Water (MLGW) gone so far towards breaking ties with TVA. In 2020 MLGW completed a study that showed it could get power cheaper and cleaner from sources other than TVA, which included saving 0.5% of annual retail sales from energy efficiency. That level of energy savings is 25 times higher than what the utility currently sees through TVA. If MLGW ultimately decides to follow through and break its ties with TVA, it could easily strive for even higher levels of efficiency savings for its customers.

COVID-19 SHINES A LIGHT ON EXISTING INEQUALITIES IN ACCESS TO EFFICIENCY

EVEN BEFORE THE PANDEMIC 17% OF HOUSEHOLDS ALREADY WORRIED ABOUT HOW TO KEEP THE LIGHTS ON AFTER RECEIVING A DISCONNECT NOTICE FROM THEIR UTILITY, ACCORDING TO THE ENERGY INFORMATION ADMINISTRATION.



ECONOMIC HARDSHIP MAKES ENERGY BILLS UNAFFORDABLE

In the ongoing pandemic and resulting unemployment crisis, moratoriums on utility disconnection provided vital short-term protection for customers in 2020. But with millions across the Southeast now behind on their electric bills, it is clear the severity of the problem was actually deeper and more acute than the effects of the recent economic downturn alone. It is now clearer than ever that many families have been struggling with energy affordability for years. When disconnection moratoriums ended, bills came due. Families continue to struggle with their high energy bills – but now must also bear the added cost of repaying the bills carried over from the pandemic.

The key to breaking the downward spiral caused by energy unaffordability is to combine gradual repayment plans and some degree of debt forgiveness with energy efficiency services. This will lower future energy bills and provide steady access to electricity, a basic need that promotes home safety and security.

HOW CAN PROGRAMS OPERATE SAFELY IN A PANDEMIC?

Energy efficiency programs were largely shut down in the early days of the pandemic to protect workers and customers from exposure to COVID-19. Direct install and deeper retrofit programs required additional safety planning. With new safety protocols and equipment, utilities like Duke were able to resume most in-home efficiency services after just a few months, while striving to sustain their annual efficiency savings levels. As a result, customers benefited from lower bills, workers received much-needed wages, and utilities were able to achieve savings.

COVID-19 CREATES NEW CHALLENGES AND INCREASED NEED FOR EFFICIENCY

FLEXIBILITY AND NEW PROGRAM STRATEGIES

Some examples of program delivery adaptations implemented in the Southeast include:

- Offering virtual audits in place of in-home visits
- Increasing distribution of do-it-yourself energy efficiency kits
- Deploying more LED light bulbs to make up for savings elsewhere
- Increasing customer rebates for select measures
- Shifting to midstream delivery channels for equipment replacement
- Expanding efficiency offerings through utility-run online marketplaces

MAJOR DIFFERENCES IN UTILITY EE RESPONSE TO COVID

Duke in the Carolinas was among the first utility to implement new safety protocols and resume in-home energy efficiency services. This, combined with several of the program adjustments described above, have helped the utility to get back on track to achieve its 2020 efficiency savings targets. By contrast, Georgia Power has struggled to adapt its programs, shift funding from underperforming programs, or resume in-home efficiency services. As a result, its low-income customers have been underserved, the utility will miss its 2020 savings by a large degree, and there are no plans to make up for lost savings in the future.

EE LEADERSHIP AS A RESPONSE TO COVID: CASE STUDY FROM OUTSIDE THE REGION

Leadership on how to use energy efficiency as an effective response to COVID-19 can be found outside the Southeast region. In Arizona, with input from a wide range of stakeholders and a request from the state's largest utility, Arizona commissioners approved an energy efficiency plan with adjustments related to the pandemic. These included substantially increased incentives for efficient residential and non-residential heating and cooling replacements, increasing per home spending for low-income households from $6,000 to $9,000, and increased flexibility to shift unused funds to higher performing programs.

STATE PROFILES

ALABAMA

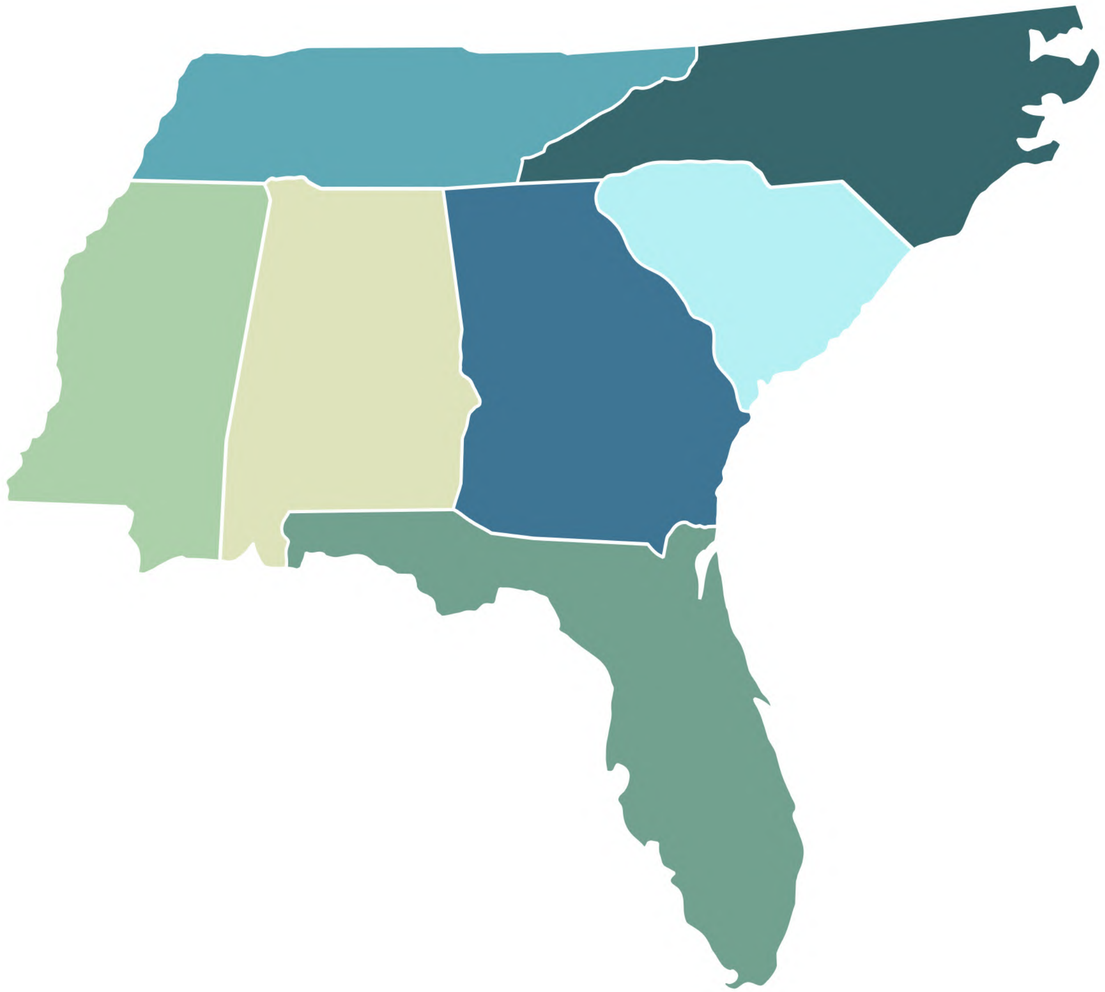
FLORIDA

GEORGIA

MISSISSIPPI

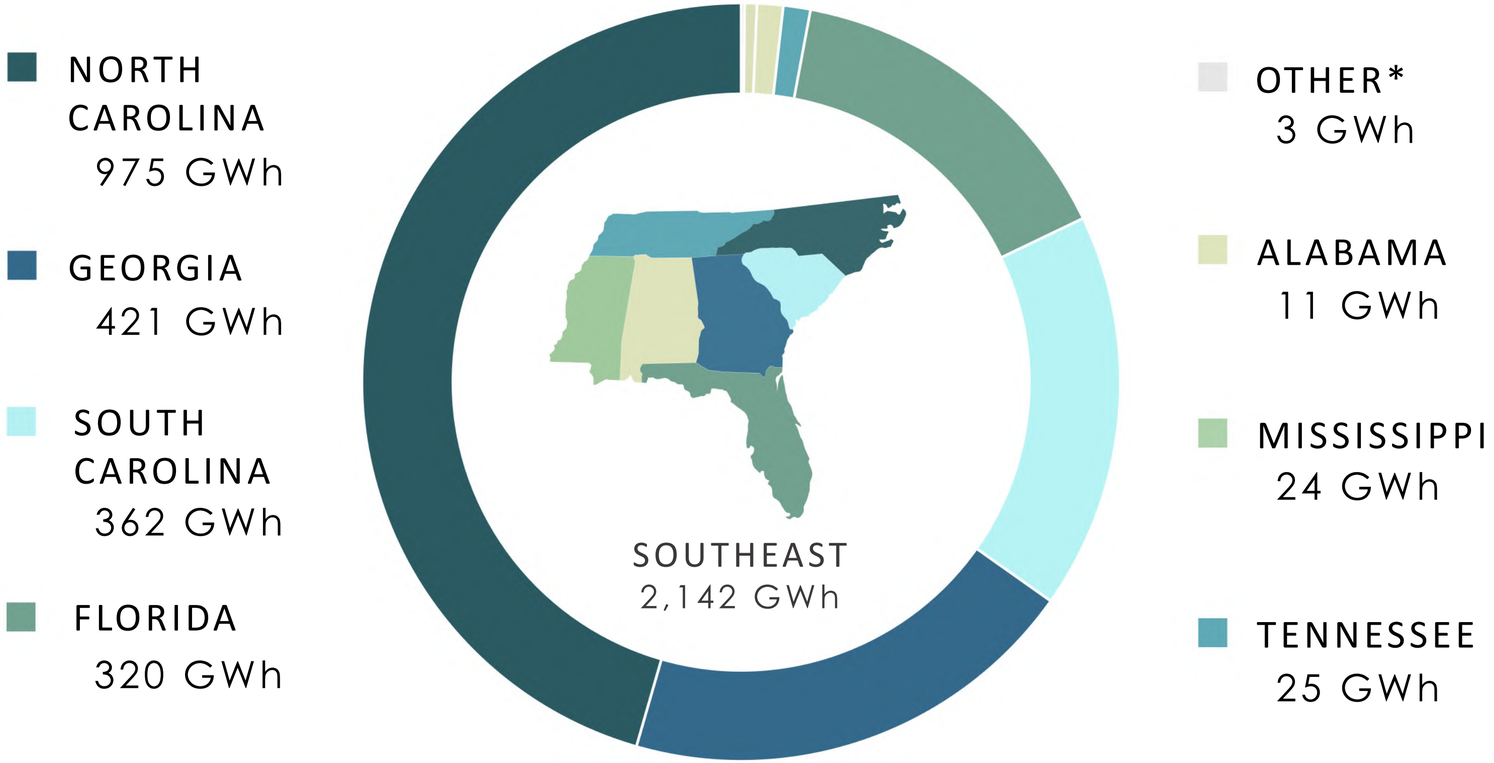
NORTH CAROLINA

SOUTH CAROLINA



For information on Tennessee, please refer to the page on the Tennessee Valley Authority, which provides electricity to most of the state.

SOUTHEASTERN STATES EFFICIENCY SAVINGS BREAKDOWN



- North Carolina accounts for 45% of the region's total GWh savings and just 17% of the total population. Duke Energy and Southern Company accounted for nearly 80% of regional savings, especially in the Carolinas and Georgia.
- At 21.5 million people, Florida has more than one third of the region's total population, but captures less total efficiency savings than South Carolina, which is one quarter the size. Florida Power & Light was the most responsible for holding the state back.
- TVA's decision to scrap nearly all of its residential incentive programs resulted in single year drops from 48 GWh in 2018 to 11 GWh in 2019 for Alabama and from 174 GWh in 2018 to 25 GWh in 2019 for Tennessee, a decline of 86%.

0.01%
State Avg.

ALABAMA

A GLIMMER OF HOPE, OR JUST A MIRAGE?

THE SOUTH'S WORST PERFORMANCE

For nearly a decade, Alabama has ranked worst in the region for energy efficiency performance, which has consistently kept it in the nation's top five for highest electric usage and household monthly electric bills. Alabama also has one of the highest poverty rates in the country. Without significant efficiency policy reform, high energy bills, and the energy savings gap between Alabama customers and the rest of the region, will only continue to worsen.

THE POTENTIAL OF 200 MEGAWATTS OF DSM

Alabama Power recently received approval to acquire 2,400 MW of fossil gas powered generation. The request also sought authorization to pursue 200 MW of demand-side management and distributed energy resources. Alabama Power currently offers almost no customer incentives for efficiency upgrades. So while this approval could open a window to expand Alabama Power's offerings to include the kinds of effective efficiency programs that are common throughout the country, it appears likely that the company will instead increase it interruptible load programs…or do nothing at all.

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	2019
SOUTHEAST AVERAGE	**0.26 %**
POWERSOUTH	0.04 %
ALABAMA AVERAGE	0.01 %
ALABAMA POWER	0.01 %
TENNESSEE VALLEY AUTHORITY	0.01 %

ALMOST NOTHING PASSES THE RIM TEST

Even if Alabama Power does pursue expanded energy efficiency programs, the Commission and utility continue to rely on the Ratepayer Impact Measure (RIM) test to determine what energy efficiency programs are cost effective. Neighboring Florida has shown this test eliminates nearly all efficiency measures. Why? Because the RIM test treats energy savings as a cost, rather than a benefit – since the utility takes in less revenue when customers reduce energy waste.

0.12%
State Avg.

FLORIDA

A LONG TIME COMING: EFFICIENCY RULE REFORM

IS FLORIDA READY FOR 21ST CENTURY EFFICIENCY?

A lot can change in 27 years. The last time the Florida Commission modified rules for the Florida Energy Efficiency Conservation Act (FEECA), most people hadn't even heard of the internet. Now that the rules are being revised, the question is: will the PSC modernize its badly outdated measure screening practices to be more in line with the rest of the country? Or merely tweak the margins with its procedural timeline?

EFFICIENCY'S IMPACT ON BILLS AND RATES

Despite utility claims during the 2019 FEECA goal setting proceeding that efficiency measures with low RIM test scores would lead to higher rates, the Commission rightly noted that costs under the new higher savings plans would in fact go down for nearly all customers, and that changes would be negligible for the rest. This is reason enough to justify increased utility investment in energy efficiency measures.

WHY FLORIDA IS SUCH AN OUTLIER

Florida is one of the lowest performing states for utility efficiency, and the only one that regularly eliminates the most cost-effective and impactful efficiency measures before setting savings targets. This is because Florida is the only state primarily relying on screening energy efficiency programs with the Ratepayer Impact Measure (RIM) test, a test which favors utility profits over customer bill savings. Florida is also the only state to automatically remove efficiency measures that pay back in two years or less, based on assumptions about customer behavior that have no supporting evidence. Illustrating just how ridiculous these practices are, last year most Florida utilities used them to argue for efficiency goals of zero. The Commission rejected the proposals and in 2021 will reform its FEECA efficiency rules.

FLORIDA ENERGY EFFICIENCY AND CONSERVATION ACT (FEECA) THROUGH THE YEARS

1980	1991/93	2008	2009	2014	2019	2019/20	2021
Florida legislature enacts FEECA.	The last time FPSC modified its FEECA rules.	Legislature amends FEECA law to emphasize pursuit of all cost-effective efficiency.	Despite new law, FPSC takes no action to amend its FEECA rules, but substantially increases utility efficiency targets.	Utilities and FPSC slash FEECA savings targets by 87%.	Utilities propose reducing efficiency savings even further (a 99.5% reduction from 2009 levels) with some proposing goals of zero.	FPSC rejects their proposal and calls for rule reform.	Rulemaking underway.

0.12%
State Avg.

FLORIDA

THE UTILITY DIVIDE

SOME UTILITIES STRIVE, OTHERS SLIDE

Tampa Electric, Jacksonville, and Orlando each delivered efficiency savings above the regional average in 2019, while Duke Energy Florida was below average. But FPL and Gulf Power, both owned by NextEra, scraped the bottom of the barrel. Because these two NextEra utilities serve over half the state, their poor performance effectively dragged the overall state average down to a truly disappointing 0.12% annual savings – less than one fifth of the national average.

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	EFFICIENCY AS % OF PRIOR YEAR SALES
TAMPA ELECTRIC	0.44 %
JACKSONVILLE ELECTRIC	0.40 %
ORLANDO UTILITIES COMMISSION	0.35 %
SOUTHEAST AVERAGE	**0.26 %**
DUKE ENERGY FLORIDA	0.19 %
FLORIDA AVERAGE	0.12 %
FLORIDA POWER AND LIGHT	0.05 %
GULF POWER	0.04 %

THE STRANGE CASE OF OUC AND JEA

Florida's largest municipal utilities have a strange relationship with energy efficiency.

- Orlando Utilities Commission publicly supports energy efficiency but regularly undermines it at the Public Service Commission. In front of its local board, OUC has committed to 1% annual savings, but its resource plans include just half that much.
- JEA offers fairly standard efficiency programs to its customers, but regularly pushes through dubious program plans at the Commission.

Instead of promoting sound efficiency policy, both argued for zero efficiency goals last year. With rulemaking underway, it is time for these public utilities to end the games.

LEADERSHIP AT THE LOCAL LEVEL

Many local communities like Tallahassee, Orlando, Sarasota, St. Petersburg, and South Miami Beach are committed to 100% renewable energy and/or reducing carbon emissions. Eliminating energy waste is key to achieving those goals. Depending on their actions during the efficiency rulemaking, utility companies will either be an ally or an obstacle to achieving local resilience policies.

0.28%
State Avg.

GEORGIA

EFFICIENCY ON MY MIND

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	EFFICIENCY AS % OF PRIOR YEAR SALES
GEORGIA POWER	0.48 %
GEORGIA AVERAGE	0.28 %
SOUTHEAST AVERAGE	**0.26 %**
TENNESSEE VALLEY AUTHORITY	0.14%
OGLETHORPE POWER	0.08 %
MUNICIPAL UTILITIES	0.00 %*

*efficiency savings round down to 0%

WILL CITIES BECOME EFFICIENCY LEADERS?

Savannah has added to the growing list of Georgia cities that have adopted 100% clean energy goals. Together, the population in Atlanta, Savannah, Augusta, and other municipalities represent nearly 850,000 residents. That's a lot of opportunity for energy efficiency! Meanwhile, savings at Georgia Power are somewhat stagnant, and membership cooperatives have yet to invest in energy efficiency. With a growing number of citizens living in cities with climate commitments, that also means a growing number of opportunities to advocate for new energy efficiency programs.

BILL PAY ASSISTANCE AND ENERGY EFFICIENCY

Even *before* the pandemic, an estimated 1% of households in the Atlanta metro area had experienced a utility disconnection due to nonpayment. Programs such as the Low Income Home Energy Assistance Program (LIHEAP), a federal bill assistance program, were intended to help avoid disconnections, but due chronic underfunding were only able to reach 16% of the eligible population in Georgia in 2019. States also generally have limitations of 25% of funds on bill-lowering measures, making it hard to address the chronic nature of high energy bills.

Until recently, *LIHEAP was even in danger of being cut from the federal budget altogether*. The Trump Administration originally set aside $0 for the program in Fiscal Year 2020. Yet LIHEAP was later deemed as *essential* in responding to the COVID-19 national emergency, and was granted $900 million in supplemental funding in the CARES Act, passed in March of 2020. With additional funding, Georgia may be able to reach more customers, or extend more assistance for bill-lowering measures to participating households.

0.14%
State Avg.

MISSISSIPPI

WAIT AND SEE

FUTURE OF EFFICIENCY PLANNING STILL UNCLEAR

Entergy and Mississippi Power both claim to have done integrated resource planning (IRP) for years – albeit behind closed doors and without including efficiency resources. With the Commission enacting rules for a public IRP process in 2019, future IRPs will include energy efficiency. But will the efficiency be competitively modeled against supply resources? At their first public hearings Entergy said yes, but Mississippi Power didn't know. For the past six years, both companies have operated limited scale quick start programs -- Mississippi EE rules define Quick Start as programs "that have been widely implemented in other jurisdictions -- but what comes next is still unclear.

EFFICIENCY LIMPS ALONG, AHEAD OF FIRST IRP

As part of interim reporting requirements for the IRP, Entergy Mississippi recently proposed increasing its spending on efficiency 16% in 2021 and indicated that it "intends to explore, implement, and test additional DSM offerings and develop a holistic, customer-centric DSM portfolio into 2021 and beyond." Mississippi Power also acknowledged the transition out of quick start, but is proposing to increase savings in 2021 just 2% over its 2019 levels. Prior to completing their respective IRPs, it does not appear either utility is set to deliver particularly impressive savings compared to regional and national leaders.

A HEAD START FOR LOW INCOME PROGRAMS

Despite historically low overall spending and savings in Mississippi, serving low income customers with efficiency has been a priority. In 2019, 34% of Entergy Mississippi's residential savings were delivered to income-qualified customers. While the percentage of annual savings appears to be lower for Mississippi Power, income qualified programs nevertheless accounted for more than half of its residential efficiency spending.

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	2019
SOUTHEAST AVERAGE	**0.26 %**
MISSISSIPPI POWER	0.22%
ENTERGY MISSISSIPPI	0.22%
MISSISSIPPI AVERAGE	0.14%
TENNESSEE VALLEY AUTHORITY	0.01 %

0.66%
State Avg.

NORTH CAROLINA

EFFICIENCY LEADER IMPLEMENTS CARBON POLICIES

PROGRESS ON GOVERENOR'S EXECUTIVE ORDER 80

In October 2018, Governor. Roy Cooper enacted Executive Order 80, aimed to reduce the state's carbon emissions 40% from 2005 levels by 2025. A year later, the Department of Environmental Quality issued its corresponding Clean Energy Plan. There is a long history of support for clean energy across government in North Carolina, which is fortunate, because implementation of EO 80 will ultimately require action by not only the executive branch, but also by the legislature, Utilities Commission, and the utilities themselves.

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	2019
DUKE ENERGY CAROLINAS	0.98%
DUKE ENERGY PROGRESS	0.87%
NORTH CAROLINA AVERAGE	0.66%
NC ELECTRIC COOPERATIVES	0.31 %
SOUTHEAST AVERAGE	**0.26 %**
NC MUNICIPAL POWER	0.03 %

SOURCES OF EMISSIONS AND TARGETED REDUCTIONS

SACE's most recent "Decarbonization in the Southeast" report, released in August 2020, shows North Carolina's energy-based carbon emissions are split nearly evenly between transportation and electric power, with additional emissions coming from direct fuel use in the industrial, residential, and commercial sectors. A multipronged approach will be needed to achieve sufficient emissions reductions within each sector. The electric power sector has already seen a reduction in carbon emissions since 2005 while emissions in other sectors have remained largely flat. Within the electricity sector, the most promising strategies for reducing emissions involve policies that reduce coal-fired generation and replace it with clean renewable energy and energy efficiency.

A robust stakeholder process has been a part of the implementation of EO80 to date. In 2021, the recommendations from stakeholders will go to the legislature to advise legislation to meet the EO 80 goals. Stakeholders have made clear that the transition to a clean energy future must include addressing issues of equity, to ensure a fair distribution of costs and benefits for North Carolina's citizens.

Note: The Southeast region for SACE does not include the portion of North Carolina in the PJM territory served by Dominion Energy.

0.41%
State Avg.

SOUTH CAROLINA

IMPLEMENTING THE ENERGY FREEDOM ACT

THE ENERGY FREEDOM ACT

Unanimous passage of the Energy Freedom Act (EFA) in 2019, driven in large part by the failed V.C. Summer nuclear project, marked a significant shift towards clean energy and utility accountability for South Carolina. The law included a new requirement that utilities fairly evaluate low, medium, and high levels of energy efficiency and demand response in future resource plans. But will utilities truly uphold the requirement for fair evaluation?

YES, THOSE ARE REAL REQUIREMENTS

Dominion Energy was the first utility to submit a full integrated resource plan to the PSC after the EFA took effect, but the utility initially took a dismissive approach to modeling higher efficiency levels. Advocates pushed back and the response from the Commission was swift and unambiguous – it rejected Dominion's IRP in late 2020 and made clear that the EFA's requirements will be enforced. As a result, Dominion must include analysis of annual savings of 1% or greater in its revised utility's resource plan, to be filed in early 2021. In this first test of the new EFA rules, the new Commission broke from the past, where excessive deference saddled customers with billions of dollars for utility boondoggles.

ENERGY SAVED AS A % OF ANNUAL SALES

UTILITY	2019
DUKE ENERGY CAROLINAS	0.98 %
DUKE ENERGY PROGRESS	0.87 %
SOUTH CAROLINA AVERAGE	0.41 %
SOUTHEAST AVERAGE	**0.26 %**
DOMINION ENERGY	0.32 %
SANTEE COOPER	0.07 %

SANTEE COOPER: OPPORTUNITY IN POTENTIAL SALE?

A big question from the 2020 South Carolina legislative session went unanswered: would the state sell its state-owned utility, Santee Cooper, to NextEra? The legislature will decide whether and how to reform Santee Cooper in 2021, and selling it to NextEra appears to still be on the table. With either option lies the opportunity to drive the utility to further invest in energy efficiency and make sure demand-side resources are accurately considered in the utility's integrated resource plan.

CONCLUSION

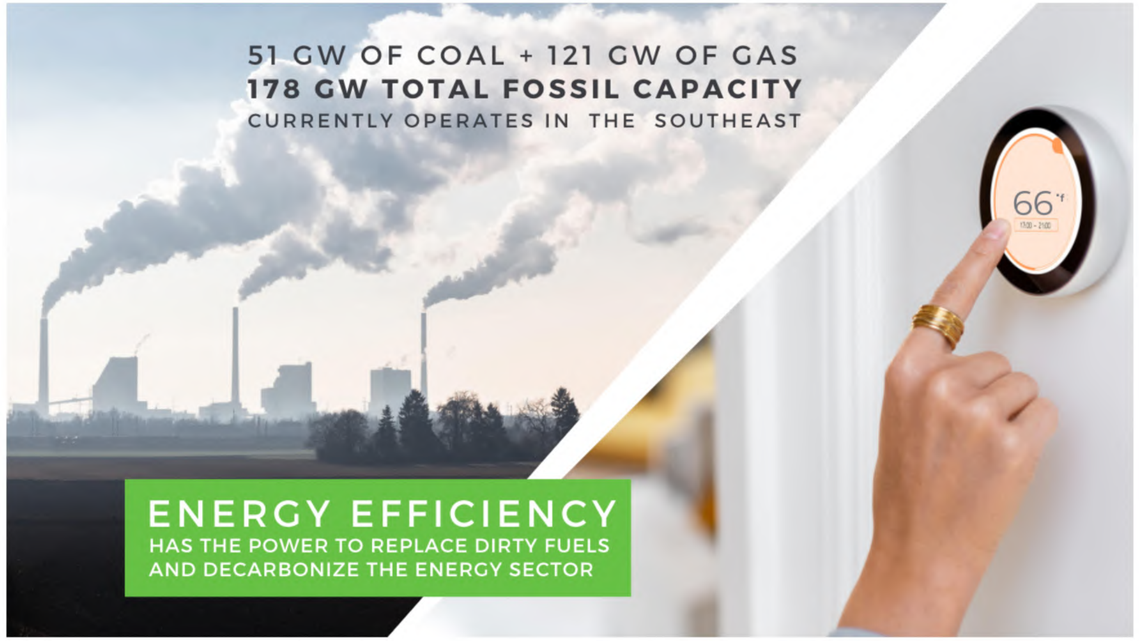
RETIRING FOSSIL FUELS FOR A CLEAN AND AFFORDABLE ENERGY FUTURE

EFFICIENCY IS THE CLEAR SOLUTION

It is no coincidence that the Southeast has among the highest electricity bills in the country, and the lowest investment in energy efficiency. This points to a clear solution: It is time that Southeastern utilities and regulators finally and fully embrace low cost energy efficiency for the sake of our people, our economy, and our planet.

CLEAN ENERGY LEADERSHIP

The new Biden Administration is prioritizing energy efficiency as a tool to reduce carbon emissions and build a stronger economy. The Southeast has historically lagged behind other regions, but examples of clean energy leadership are emerging in the region. Our nation's energy transition must include the South. With new federal investment in energy efficiency, renewable energy, battery storage, and electric vehicles there has never been a better time for our utilities, legislators, and regulators to push forward with energy efficiency. No utility is better matched for this opportunity than the nation's only federally administered utility, TVA, where innovation could usher in a new era for its customers while modeling innovation for the rest of the region and the nation.



AN INVESTMENT IN THE FUTURE

Retiring aged and dirty fossil fuel power plants is critical, but the path to a cleaner, more affordable energy future centers on renewable energy and energy efficiency. The current rush to build new fossil gas generation undermines clean energy investments and risks squandering billions of dollars customers simply cannot afford to waste.

DATA SOURCES, METHODS, AND ASSUMPTIONS

The primary metric in this report is net energy savings as a percentage of prior-year retail sales. SACE relies on two sources for historical efficiency savings, the first is annual energy efficiency reports that utilities are required to file by state regulators. In most cases, regulatory reporting requirements for investor-owned utilities allow SACE to gather detailed performance and budget data on specific programs on an annual basis.

In the absence of adequately detailed annual reports, SACE obtains energy efficiency savings data from EIA Form 861. For example, nearly all of our data for municipal and co-op utilities come from EIA-861. EIA-861 instructions state that savings are reported at the customer meter and as of 2016 specify that, "transmission and distribution or reserve requirement savings should be excluded." However, EIA's reporting instructions have shifted over the years, and have often lacked clarity surrounding who is responsible for reporting (utility or nonutility demand-side management administrators). As a result, we have greater confidence in the consistency and reliability of more recent data, particularly with respect to costs.

For the comparison with other regions of the country, our Southeast regional energy savings calculation is matched with EIA's regional and national averages. Our regional energy savings calculation differs from EIA's due to different geography and the additional data we include.

DSM/EE spending is inclusive of the total budget for each program approved or certified by a utility's respective regulator. Our review of data specific to programs may not reflect any sub-programs or add-ons. For example, income-qualified spending reflects standalone programs only.

Annual energy efficiency savings are generally viewed from the customer (at the meter) perspective. But to understand the impact on the utility's resources, the accumulated energy efficiency reduction to gross system demand is often viewed from the utility (at the generator) perspective. For MWh savings reported at the generator, an estimated average line loss of 7% is assumed.

Accumulated energy efficiency demand savings (MW) represents the maximum peak reduction to gross system demand. To capture the "maximum peak" and assign a nominal capacity to efficiency, SACE uses the summer demand reduction reported for programs and measures. Planning reserve margins for Southeastern utilities are historically highest in summer, and therefore best reflect how efficiency lowers peak demand in the months where reliability is at risk.

Due to the fact that some utilities report net savings reflecting technical adjustments to energy efficiency program impacts, while others do not, we apply a net to gross ratio of 80% where gross savings are reported.

APPENDIX A: SOUTHEAST UTILITY SYSTEMS

The geographic coverage of the demand side data encompasses Southeastern utilities outside of the PJM/MISO regions. The states of Alabama, Florida, Georgia, and South Carolina are fully covered. Relatively small portions of North Carolina and Tennessee are served by utilities that participate in PJM, and thus while statewide reports for these states are relatively comprehensive, they may not align exactly with other data sources. The states of Mississippi and Kentucky are only included insofar as they are part of TVA or the Southern Planning Area.

TENNESSEE VALLEY AUTHORITY

Consists of 154 distributor utilities

TN, KY, VA, AL, MS, GA, & NC

SOUTHERN PLANNING AREA

Gulf Power (FL) *

Mississippi Power

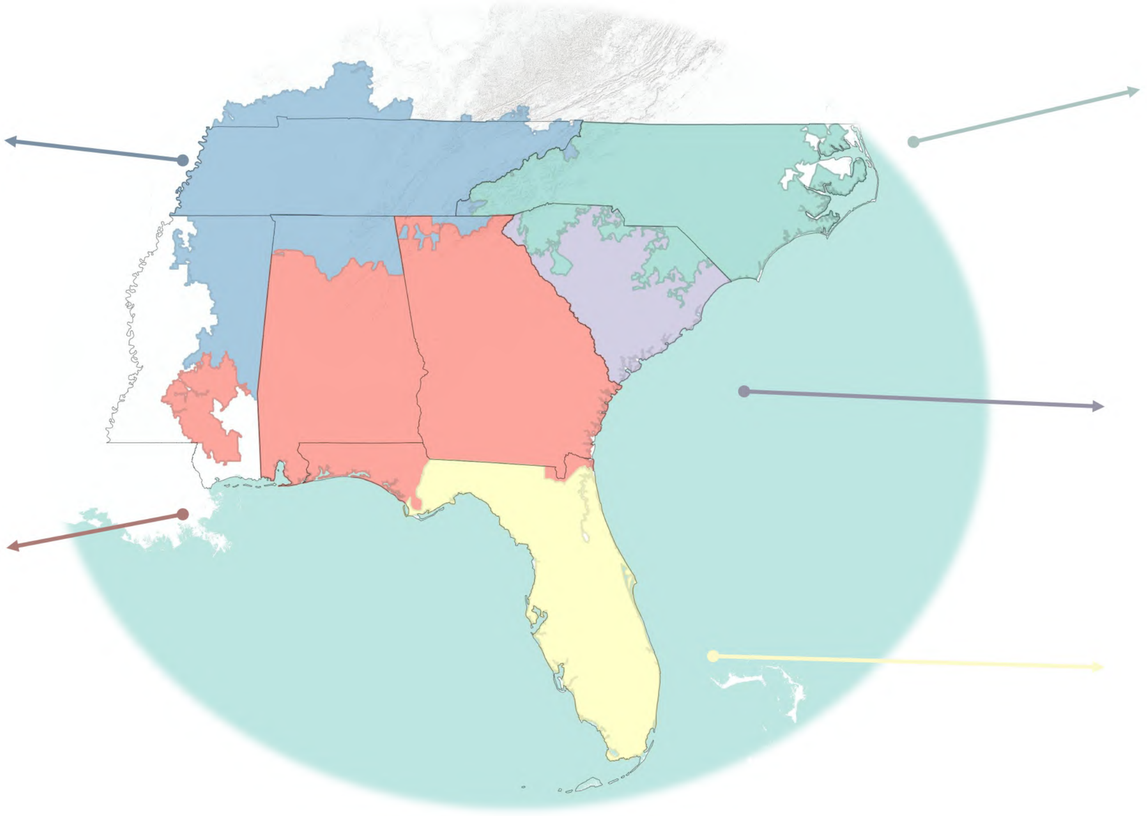
Alabama Power

Georgia Power

Oglethorpe Power (GA)

PowerSouth (AL/FL)

**Owned by NextEra but operating in the Southern Planning Area*



DUKE ENERGY PLANNING AREA

Duke Energy Carolinas

Duke Energy Progress

Municipal Utilities

Cooperative Utilities

SOUTH CAROLINA

Dominion South Carolina

Santee Cooper

FRCC

Duke Energy Florida

Tampa Electric

Florida Power & Light

Jacksonville Electric Authority

Orlando Utility Commission

Download Appendix B: Southeast Utility Data Tables

ENERGY EFFICIENCY IN THE SOUTHEAST

Annual Report, Released January 2021

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Duke Energy Progress
Evans Exhibit 1
Vintage 2018 True Up - January 1, 2018 to December 31, 2018
Docket Number E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

				A	B	C	D =(A-B)*C	E = (B+D)	F		G	H =O (from page 2)
	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	Unadjusted Rev Requirement (2)	NC Retail kWh Sales Allocation Factor		NC Residential Unadjusted Revenue Requirement (2)	NC Residential Adjusted Revenue Requirement
	EE Programs											
1	**Appliance Recycling Program**	-	-	$ -	$ -	11.75%	$ -	$ -	85.5608674%	E1 * F1	$ -	$ -
2	**Energy Efficiency Education Program**	766	2,563,019	$ 1,261,493	$ 676,815	0.00%	$ -	$ 676,815	85.5608674%	E2 * F2	$ 579,089	$ -
3	**Energy Efficient Lighting**	4,227	25,642,842	$ 25,967,772	$ 8,752,062	11.75%	$ 2,022,846	$ 10,774,908	85.5608674%	E3 * F3	$ 9,219,104	$ (10,718)
4	**Residential Smart $aver®**	1,805	7,228,648	$ 6,300,631	$ 7,168,833	11.75%	$ (102,014)	$ 7,066,819	85.5608674%	E4 * F4	$ 6,046,432	$ (186)
5	**Multi-Family Energy Efficiency Program**	1,802	13,834,972	$ 8,510,661	$ 2,409,743	11.75%	$ 716,858	$ 3,126,601	85.5608674%	E5 * F5	$ 2,675,147	$ (8,395)
6	**Multi-Family PipeWrap EMV Adjustment**						$ (103,989)	$ (103,989)	100.0000000%	E6 * F6	$ (103,989)	$ -
7	**Neighborhood Energy Saver**	486	3,538,968	$ 1,682,598	$ 1,845,739	0.00%	$ -	$ 1,845,739	85.5608674%	E7 * F7	$ 1,579,230	$ -
8	**Residential Energy Assessments**	935	7,751,895	$ 5,373,630	$ 1,851,965	11.75%	$ 413,796	$ 2,265,760	85.5608674%	E8 * F8	$ 1,938,604	$ (295)
9	**Residential New Construction**	5,440	14,263,235	$ 22,773,890	$ 13,189,949	11.75%	$ 1,126,113	$ 14,316,062	85.5608674%	E9 * F9	$ 12,248,947	$ (654)
10	**Energy Efficient Appliances and Devices**	5,058	15,252,311	$ 10,207,890	$ 825,279	11.75%	$ 1,102,457	$ 1,927,736	85.5608674%	E10 * F10	$ 1,649,387	$ (499)
11	**Residential Home Advantage**	-	-	$ -	$ -	11.75%	$ -	$ -	85.5608674%	E11 * F11	$ -	$ -
12	**Total for Residential Conservation Programs**	20,517	90,075,889	82,078,566	36,720,384		$ 5,176,067	$ 41,896,450			$ 35,831,951	$ (20,747)
13	**My Home Energy Report**	57,430	164,066,050	$ 9,855,291	$ 7,687,891	11.75%	$ 254,670	$ 7,942,560	85.5608674%	E13*F13	$ 6,795,724	$ (1,908)
14	**Total Residential Conservation and Behavioral Programs**	77,947	254,141,939	$ 91,933,857	$ 44,408,274		$ 5,430,736	$ 49,839,011			$ 42,627,675	$ (22,655)
									NC Residential Peak Demand Allocation Factor	**NC Allocation Factor (2)**		
15	**EnergyWise Home**	29,483	-	$ 55,969,845	$ 5,817,271	11.75%	$ 5,892,927	$ 11,710,199	86.5304240%	48.5812530%	$ 6,210,393	$ 769
16	**Total Residential**	107,430	254,141,939	$ 147,903,702	$ 50,225,546		$ 11,323,664	$ 61,549,209			$ 48,838,068	$ (21,886)

	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor		NC Non-Residential Unadjusted Revenue Requirement (2)	NC Non-Residential Adjusted Revenue Requirement
	EE Programs											
17	**Energy Efficient Lighting**	1,753	6,759,940	$ 7,800,687	$ 1,063,434	11.75%	$ 791,627	$ 1,855,061	85.5608674%	E17 * F17	$ 1,587,207	$ 8,916
18	**Smart $aver® Non Residential Prescriptive**	14,760	84,980,392	$ 65,320,575	$ 11,515,913	11.75%	$ 6,322,048	$ 17,837,961	85.5608674%	E18 * F18	$ 15,262,314	$ (5,434)
19	**Smart Saver® Non-Residential - Custom**	1,883	11,901,442	$ 8,907,939	$ 2,174,163	11.75%	$ 791,219	$ 2,965,382	85.5608674%	E19 * F19	$ 2,537,207	$ (734)
20	**Smart $aver(R) Non Residential Performance Incentive Progra**	129	1,519,117	$ 810,508	$ 201,559	11.75%	$ 71,551	$ 273,111	85.5608674%	E20 * F20	$ 233,676	$ (70)
21	**Small Business Energy Saver**	6,667	40,298,466	$ 22,343,579	$ 8,858,213	11.75%	$ 1,584,530	$ 10,442,743	85.5608674%	E21 * F21	$ 8,934,902	$ (1,858)
22	**Total for Non-Residential Conservation Programs**	25,192	145,459,357	$ 105,183,287	$ 23,813,283		$ 9,560,976	$ 33,374,258			$ 28,555,306	$ 821
23	**EnergyWise for Business**	2,661	39,728	$ 151,899	$ 2,108,030	11.75%	$ (229,845)	$ 1,878,185	86.5304240%	E23 * F23	$ 4,030,227	$ (71,380)
24	**Commercial, Industrial, & Governmental Demand Response**	1,629	-	$ 1,413,457	$ 1,154,642	11.75%	$ 30,411	$ 1,185,053	86.5304240%	E24 * F24	$ 2,542,897	$ 29,258
25	**Total for Non-Residential DSM Programs**	4,290	39,728	$ 1,565,356	$ 3,262,672		$ (199,435)	$ 3,063,237	86.5304240%	**NC Allocation Factor (2)** 51.4187470%	$ 6,573,124	$ (42,122)
26	**Total Non Residential**	29,482	145,499,085	$ 106,748,643	$ 27,075,954		$ 9,361,541	$ 36,437,495			$ 35,128,430	$ (41,302)
27	**Total All Programs**	136,912	399,641,024	$ 254,652,345	$ 77,301,500		$ 20,685,205	$ 97,986,705		6,573,124.09 0.613137155	$ 83,966,498	$ (63,187)

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak
(3) Multi-Family PipeWrap EMV Adjustment includes ($196,164) applied to line 5 as part of EMV application to the 2018 vintage year, of which ($43,806) is Lost Revenue and ($152,357) is Incentive. The remaining ($103,989) is reflected in line 6 for a total of ($300,153).

28	DSDR	277,039	48,056,048		$ 12,886,517			$ 12,886,517				
29	Total with DSDR	413,951	447,697,073	$ 254,652,345	$ 90,188,017		$ 20,685,205	$ 110,873,221			$ 83,966,498	$ (63,187)

Duke Energy Progress
Evans Exhibit 1
Vintage 2018 True Up - January 1, 2018 to December 31, 2018
Docket Number E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

		A	B	C	D	E	F	G	H	I	v2018 PPI True-Up J	K	L	M	N	O	P										K
				=A*B	=A+C			=-PMT(E,F,D)	=1-B			=J-I		=L*K	=M*L*E	=M+N										=J+I
	Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2018 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Original Vintage 2018 PPI	PPI Over / (Under) Collection	Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	PPI Over/(Under) Collection w/CCost	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	PPI Values for Test Period
	EE Programs																									
1	**Appliance Recycling Program**	$ -	23.50%	$ -	$ -	6.72%	10	$ -	76.50%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ 119,754	$ -	$ 28,547	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ 119,754
2	**Energy Education Program for Schools**	$ -	23.50%	$ -	$ -	6.72%	N/A	$ -	76.50%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	**Energy Efficient Lighting**	$ 1,730,765	23.50%	$ (406,792)	$ 1,323,972	6.72%	5	$ 320,499	76.50%	$ 418,973	$ 408,930	$ (10,043)	1	$ (10,043)	$ (675)	$ (10,718)	$ 3,766,708	$ -	$ 546,425	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 473,444	$ 4,185,681
4	**Residential Service – Smart Saver**	$ (87,284)	23.50%	$ 20,515	$ (66,769)	6.72%	10	$ (9,384)	76.50%	$ (12,268)	$ (12,442)	$ (174)	1	$ (174)	$ (12)	$ (186)	$ 354,745	$ 10,405	$ 75,357	$ 116,481	$ 108,864	0	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ 342,477
5	**Multi-Family**	$ 509,361	23.50%	$ (119,718)	$ 389,643	6.72%	5	$ 94,322	76.50%	$ 123,303	$ 115,436	$ (7,867)	1	$ (7,867)	$ (529)	$ (8,395)	$ 503,822	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329	$ 124,282	$ 186,211	$ 627,125
6	**Neighborhood Energy Saver**	$ -	23.50%	$ -	$ -	6.72%	N/A	$ -	76.50%	$ -	$	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	**Residential Energy Assessments**	$ 354,047	23.50%	$ (83,214)	$ 270,833	6.72%	5	$ 65,562	76.50%	$ 85,706	$ 85,429	$ (277)	1	$ (277)	$ (19)	$ (295)	$ 172,377	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 88,834	$ 258,083
8	**Residential New Construction**	$ 963,512	23.50%	$ (226,460)	$ 737,052	6.72%	10	$ 103,592	76.50%	$ 135,421	$ 134,808	$ (613)	1	$ (613)	$ (41)	$ (654)	$ 452,902	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 588,323
9	**Energy Efficient Appliances and Devices**	$ 943,272	23.50%	$ (221,703)	$ 721,569	6.72%	5	$ 174,673	76.50%	$ 228,341	$ 227,873	$ (468)	1	$ (468)	$ (31)	$ (499)	$ 717,765	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 396,792	$ 946,106
10	**Residential Home Advantage**	$ -	23.50%	$ -	$ -	6.72%	10	$ -	76.50%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ 176,476	$ 8,018	$ 27,550	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ -	$ 176,476
11	**Total for Residential Conservation Programs**	$ 4,413,672		$ (1,037,373)	$ 3,376,300			$ 749,263		$ 979,475	$ 960,035	$ (19,441)		$ (19,441)	$ (1,307)	$ (20,747)	$ 6,264,549	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 7,244,024
12	**My Home Energy Report**	$ 217,897	23.50%	$ (51,214)	$ 166,684	6.72%	1	$ 166,684	76.50%	$ 217,897	$ 216,110	$ (1,788)	1	$ (1,788)	$ (120)	$ (1,908)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 217,897
13	**Total Residential Conservation and Behavioral Programs**	$ 4,631,570		$ (1,088,587)	$ 3,542,983			$ 915,947		$ 1,197,373	$ 1,176,145	$ (21,228)		$ (21,228)	$ (1,427)	$ (22,655)	$ 6,264,549	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 7,461,922
14	**EnergyWise**	$ 5,099,175	23.50%	$ (1,198,491)	$ 3,900,684	6.72%	10	$ 548,237	76.50%	$ 716,684	$ 717,405	$ 721	1	$ 721	$ 48	$ 769	$ 4,952,048	$ 135,141	$ 1,043,048	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 796,851	$ 5,668,732
15	**Total Residential**	$ 9,730,745		$ (2,287,077)	$ 7,443,668			$ 1,464,184		$ 1,914,057	$ 1,893,550	$ (20,507)		$ (20,507)	$ (1,378)	$ (21,886)	$ 11,216,597	$ 153,564	$ 1,720,927	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 891,833	$ 2,045,018	$ 2,071,654	$ 13,130,654

	Non-Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2018 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Original Vintage 2018 PPI	PPI Over / (Under) Collection	Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	PPI Over/(Under) Collection	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	PPI Values for Test Period
	EE Programs																										
16	**Energy Efficient Lighting**	$ 677,323	23.50%	$ (159,195)	$ 518,128	6.72%	5	$ 125,425	76.50%	$ 163,962	$ 172,317	$ 8,355	1	$ 8,355	$ 562	$ 8,916	$ 1,213,534	$ -	$ 134,853	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 191,685	$ 1,377,497
17	**Non-Residential Smart Saver Prescriptive**	$ 5,409,199	23.50%	$ (1,271,358)	$ 4,137,841	6.72%	3	$ 1,568,710	76.50%	$ 2,050,699	$ 2,045,607	$ (5,092)	1	$ (5,092)	$ (342)	$ (5,434)	$ 6,903,157	$ 169,910	$ 452,376	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ 1,281,869	$ 2,139,886	$ 8,953,856
18	**Non-Residential Smart Saver Custom**	$ 676,974	23.50%	$ (159,113)	$ 517,860	6.72%	3	$ 196,328	76.50%	$ 256,650	$ 255,962	$ (687)	1	$ (687)	$ (46)	$ (734)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 256,650
19	**Non-Res SmartSaver Performance**	$ 61,220	23.50%	$ (14,389)	$ 46,831	6.72%	3	$ 17,754	76.50%	$ 23,209	$ 23,143	$ (66)	1	$ (66)	$ (4)	$ (70)	$ 7,194	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,194	$ 30,403
20	**Small Business Energy Saver**	$ 1,355,738	23.50%	$ (318,648)	$ 1,037,091	6.72%	3	$ 393,175	76.50%	$ 513,978	$ 512,237	$ (1,741)	1	$ (1,741)	$ (117)	$ (1,858)	$ 2,132,439	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ 900,609	$ 692,747	$ 2,646,417
21	**Total for Non-Residential Conservation Programs**	$ 8,180,454		$ (1,922,703)	$ 6,257,751			$ 2,301,392		$ 3,008,498	$ 3,009,267	$ 769		$ 769	$ 52	$ 821	$ 10,256,324	$ 169,910	$ 587,229	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 2,401,209	$ 3,031,512	$ 13,264,822
22	**EnergyWise for Business**	$ (198,886)	23.50%	$ 46,745	$ (152,141)	6.72%	1	$ (152,141)	76.50%	$ (198,886)	$ (265,771)	$ (66,884)	1	$ (66,884)	$ (4,496)	$ (71,380)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (198,886)
23	**Commercial, Industrial, & Governmental Demand Response**	$ 26,315	23.50%	$ (6,185)	$ 20,130	6.72%	3	$ 7,631	76.50%	$ 9,976	$ 37,391	$ 27,415	1	$ 27,415	$ 1,843	$ 29,258	$ 233,850	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 243,827
24	**Total for Non-Residential DSM Programs**	$ (172,572)		$ 40,561	$ (132,011)			$ (144,509)		$ (188,910)	$ (228,379)	$ (39,469)		$ (39,469)	$ (2,653)	$ (42,122)	$ 233,850	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 44,940
25	**Total Non Residential**	$ 8,007,882		$ (1,882,142)	$ 6,125,740			$ 2,156,883		$ 2,819,588	$ 2,780,887	$ (38,700)		$ (38,700)	$ (2,601)	$ (41,302)	$ 10,490,174	$ 169,910	$ 652,951	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 2,401,209	$ 3,114,403	$ 13,309,762
26	**Total All Programs**	$ 17,738,627		$ (4,169,220)	$ 13,569,407			$ 3,621,067		$ 4,733,645	$ 4,674,437	$ (59,208)		$ (59,208)	$ (3,980)	$ (63,187)	$ 21,706,772	$ 323,474	$ 2,373,878	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,658,908	$ 4,446,227	$ 5,186,057	$ 26,440,416

(1) Energy Efficient Benchmarking impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

Duke Energy Progress
Evans Exhibit 1
Vintage 2019 True Up - January 1, 2019 to December 31, 2019
Docket Number E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

Residential Programs

EE Programs

		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) Unadjusted Rev Requirement (2)	F NC Retail kWh Sales Allocation Factor		G NC Residential Unadjusted Revenue Requirement (2)	H =O (from page 2) NC Residential Adjusted Revenue Requirement
1	Appliance Recycling Program	-	-	$ -	$ -	11.75%	$ -	$ -	85.634%	E1 * F1	$ -	$ -
2	Energy Efficient Appliances and Devices	4,672	19,589,304	10,419,429	$ 2,160,799	11.75%	$ 970,389	$ 3,131,188	85.634%	E2 * F2	$ 2,681,351	$ 10,702
3	Energy Efficiency Education Program	392	3,283,839	1,039,694	$ 747,483	0.00%	$ -	$ 747,483	85.634%	E3 * F3	$ 640,097	$ -
4	Energy Efficient Lighting	5,497	33,349,231	27,067,315	$ 11,993,695	11.75%	$ 1,771,150	$ 13,764,845	85.634%	E4 * F4	$ 11,787,340	$ 0
5	Residential Smart $aver®	1,862	6,756,132	5,417,341	$ 6,411,758	11.75%	$ (116,844)	$ 6,294,914	85.634%	E5 * F5	$ 5,390,565	$ (0)
6	Weatherization Pilot	25	130,071	75,533	$ 27,356	0.00%	$ -	$ 27,356	85.634%	E6 * F6	$ 23,426	$ -
7	Multi-Family Energy Efficiency Program	1,583	11,855,149	5,977,179	$ 2,156,484	11.75%	$ 448,932	$ 2,605,416	85.634%	E7 * F7	$ 2,231,113	$ 4,011
8	Neighborhood Energy Saver	493	3,699,023	1,438,897	$ 1,671,298	0.00%	$ -	$ 1,671,298	85.634%	E8 * F8	$ 1,431,193	$ -
9	Residential Energy Assessments	943	7,834,474	4,344,111	$ 2,113,798	11.75%	$ 262,062	$ 2,375,860	85.634%	E9 * F9	$ 2,034,535	$ -
10	Residential New Construction	4,665	16,337,464	19,396,567	$ 15,113,951	11.75%	$ 503,207	$ 15,617,158	85.634%	E10* F11	$ 13,373,543	$ -
11	Residential Home Advantage	-	-	-	$ -	11.75%	$ -	$ -	85.634%	E11 * F11	$ -	$ -
12	Total for Residential Conservation Programs	20,131	102,834,686	75,176,065	42,396,623		$ 3,838,896	$ 46,235,519			$ 39,593,163	$ 14,713
13	My Home Energy Report	54,248	154,602,240	11,676,738	$ 6,299,307	11.75%	$ 631,848	$ 6,931,155	85.634%	E13*F13	$ 5,935,401	$ -
14	Total Residential Conservation and Behavioral Programs	74,380	257,436,926	$ 86,852,803	$ 48,695,930		$ 4,470,744	$ 53,166,674			$ 45,528,564	$ 14,713
									NC Residential Peak Demand Allocation Factor	NC Allocation Factor		
15	EnergyWise Home	28,993	-	53,221,850	$ 5,806,874	11.75%	$ 5,571,260	$ 11,378,134	86.691%	49.60%	$ 6,763,929	$ -
16	Total Residential	103,372	257,436,926	$ 140,074,653	$ 54,502,804		$ 10,042,004	$ 64,544,808			$ 52,292,493	$ 14,713

Non-Residential Programs

EE Programs

		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor		NC Non-Residential Unadjusted Revenue Requirement (2)	NC Non-Residential Adjusted Revenue Requirement
17	Energy Efficient Lighting	2,275	8,778,572	$ 8,347,756	$ 1,453,336	11.75%	$ 810,094	$ 2,263,431	85.634%	E17 * F17	$ 1,938,258	$ (1)
18	Smart $aver® Non Residential Prescriptive	9,068	49,683,398	31,482,596	$ 7,877,838	11.75%	$ 2,773,559	$ 10,651,397	85.634%	E18 * F18	$ 9,121,180	$ 130,132
19	Smart $aver® Non-Residential - Custom	3,124	13,129,686	9,658,177	$ 2,776,482	11.75%	$ 808,599	$ 3,585,082	85.634%	E19 * F19	$ 3,070,036	$ -
20	Smart $aver(R) Non Residential Performance Incentive Program	99	1,356,835	606,333	$ 267,186	11.75%	$ 39,850	$ 307,036	85.634%	E20 * F20	$ 262,926	$ -
21	Small Business Energy Saver	6,338	36,430,983	17,456,367	$ 7,301,790	11.75%	$ 1,193,163	$ 8,494,953	85.634%	E21 * F21	$ 7,274,538	$ (56,539)
22	Total for Non-Residential Conservation Programs	20,905	109,379,475	$ 67,551,229	$ 19,676,634		$ 5,625,265	$ 25,301,899			$ 21,666,938	$ 73,592
23	EnergyWise for Business	4,982	1,057,989	923,654	$ 2,412,880	11.75%	$ (174,984)	$ 2,237,896	86.691%		$ 3,533,824	$ (39,031)
24	Commercial, Industrial, Governmental Energy Efficiency (CIG EE, El	2,567	-	4,394,068	$ 1,811,347	11.75%	$ 303,470	$ 2,114,817	86.691%		$ 3,339,472	$ -
25	Total for Non-Residential DSM Programs	7,549	1,057,989	$ 5,317,723	$ 4,224,227		$ 128,486	$ 4,352,712	86.691%	NC Allocatio 50.40%	$ 6,873,297	$ (39,031)
26	Total Non Residential	28,454	110,437,464	$ 72,868,951	$ 23,900,860		$ 5,753,751	$ 29,654,611		#####	$ 28,540,235	$ 34,561
27	Total All Programs	131,826	367,874,390	$ 212,943,604	$ 78,403,665		$ 15,795,754	$ 94,199,419		0.51414	$ 80,832,727	$ 49,274

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

28	DSDR	334,197	38,083,660		$ 18,305,182			$ 18,305,182				
29	Total with DSDR	466,023	405,958,050	$ 212,943,604	$ 96,708,846		$ 15,795,754	$ 112,504,601			$ 80,832,727	$ 49,274

Duke Energy Progress
Evans Exhibit 1
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Load Impacts and Estimated Revenue Requirements by Program

		A	B	C	D	E	F	G	H	I	v2019 PPI True-Up J	K	L	M	N	O	P												K
				=A*B	=A+C			=-PMT(E,F,D)	=1-B			=J-I		=L*K	=M*L*E	=M+N												=J+I
	Residential Programs	**NC Incentive**	**Income Tax Rate**	**Income Taxes**	**Net-of-Tax PPI - Total NPV**	**Discount Rate**	**PPI Amortization Period**	**Vintage Year 2019 - Year 1 PPI**	**Income Tax Gross-Up Factor**	**Adjusted PPI**	**Original Vintage 2019 PPI**	**PPI Over / (Under) Collection**	**Years at Original PPI Level**	**Cumulative PPI Over / (Under) Collection**	**Carrying Costs**	**PPI Over/(Under) Collection w/CCost**	**Σ Prior Period PPI**	**Vintage 2009 PPI**	**Vintage 2010 PPI**	**Vintage 2011 PPI**	**Vintage 2012 PPI**	**Vintage 2013 PPI**	**Vintage 2014 PPI**	**Vintage 2015 PPI**	**Vintage 2016 PPI**	**Vintage 2017 PPI**	**Vintage 2018 PPI**	**PPI Values for Test Period**
	EE Programs																											
1	**Appliance Recycling Program**	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ 119,754	$ -	$ 28,547	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ -	$ 119,754
2	**Appliances and Devices**	$ 830,980	23.17%	$ (192,532)	$ 638,447	6.64%	5	$ 154,220	76.83%	$ 200,727	$ 210,763	$ 10,035	1	$ 10,035	$ 667	$ 10,702	$ 946,106	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 396,792	$ 228,341	$ 1,146,834
3	**Energy Education Program for Schools**	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	**Energy Efficient Lighting**	$ 1,516,701	23.17%	$ (351,409)	$ 1,165,292	6.64%	5	$ 281,482	76.83%	$ 366,366	$ 366,366	$ 0	1	$ 0	$ 0	$ 0	$ 4,185,681	$ -	$ 546,425	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 473,444	$ 418,973	$ 4,552,047
5	**Residential Service – Smart Saver**	$ (100,058)	23.17%	$ 23,183	$ (76,875)	6.64%	10	$ (10,765)	76.83%	$ (14,011)	$ (14,011)	$ (0)	1	$ (0)	$ (0)	$ (0)	$ 332,072	$ -	$ 75,357	$ 116,481	$ 108,864	$ 0	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ (12,268)	$ 318,061
6	**Low Income Weatherization Pilot**	$ -	23.17%	$ -	$ -	6.64%	5	$ -	76.83%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	**Multi-Family Energy Efficiency Program**	$ 384,437	23.17%	$ (89,071)	$ 295,365	6.64%	5	$ 71,347	76.83%	$ 92,863	$ 96,624	$ 3,761	1	$ 3,761	$ 250	$ 4,011	$ 627,125	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329	$ 124,282	$ 186,211	$ 123,303	$ 719,987
8	**Neighborhood Energy Saver**	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9	**Residential Energy Assessments**	$ 224,413	23.17%	$ (51,995)	$ 172,418	6.64%	5	$ 41,648	76.83%	$ 54,208	$ 54,208	$ -	1	$ -	$ -	$ -	$ 258,083	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 88,834	$ 85,706	$ 312,291
10	**Residential New Construction**	$ 430,915	23.17%	$ (99,840)	$ 331,075	6.64%	10	$ 46,360	76.83%	$ 60,340	$ 60,340	$ -	1	$ -	$ -	$ -	$ 588,323	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 135,421	$ 648,663
11	**Residential Home Advantage**	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ -	$ -	1	$ -	$ -	$ -	$ 168,458	$ -	$ 27,550	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ -	$ -	$ 168,458
12	**Total for Residential Conservation Programs**	$ 3,287,387		$ (761,665)	$ 2,525,722			$ 584,292		$ 760,493	$ 774,290	$ 13,797		$ 13,797	$ 916	$ 14,713	$ 7,225,601	$ -	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 979,475	$ 7,986,094
13	**My Home Energy Report**	$ 541,075	23.17%	$ (125,363)	$ 415,711	6.64%	1	$ 415,711	76.83%	$ 541,075	$ 541,075	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 541,075
14	**Total Residential Conservation and Behavioral Progr**	$ 3,828,461		$ (887,028)	$ 2,941,434			$ 1,000,004		$ 1,301,568	$ 1,315,365	$ 13,797		$ 13,797	$ 916	$ 14,713	$ 7,225,601	$ -	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 979,475	$ 8,527,169
15	**EnergyWise**	$ 4,829,780	23.17%	$ (1,119,026)	$ 3,710,754	6.64%	10	$ 519,609	76.83%	$ 676,304	$ 676,304	$ -	1	$ -	$ -	$ -	$ 5,533,592	$ -	$ 1,043,048	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 796,851	$ 716,684	$ 6,209,896
16	**Total Residential**	$ 8,658,241		$ (2,006,054)	$ 6,652,187			$ 1,519,613		$ 1,977,872	$ 1,991,669	$ 13,797		$ 13,797	$ 916	$ 14,713	$ 12,759,192	$ -	$ 1,720,927	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 891,833	$ 2,045,018	$ 2,071,654	$ 1,696,160	$ 14,737,064

	Non-Residential Programs	**NC Incentive**	**Income Tax Rate**	**Income Taxes**	**Net-of-Tax PPI - Total NPV**	**Discount Rate**	**PPI Amortization Period**	**Vintage Year 2019 - Year 1 PPI**	**Income Tax Gross-Up Factor**	**Adjusted PPI**	**Original Vintage 2018 PPI**	**PPI Over / (Under) Collection**	**Years at Original PPI Level**	**Cumulative PPI Over / (Under) Collection**	**Carrying Costs**	**PPI Over/(Under) Collection**	**Σ Prior Period PPI**	**Vintage 2009 PPI**	**Vintage 2010 PPI**	**Vintage 2011 PPI**	**Vintage 2012 PPI**	**Vintage 2013 PPI**	**Vintage 2014 PPI**	**Vintage 2015 PPI**	**Vintage 2016 PPI**	**Vintage 2017 PPI**	**Vintage 2018 PPI**	**PPI Values for Test Period**
	EE Programs																											
17	**Energy Efficient Lighting**	$ 693,713	23.17%	$ (160,729)	$ 532,985	6.64%	5	$ 128,745	76.83%	$ 167,570	$ 167,569	$ (1)	1	$ (1)	$ -	$ (1)	$ 1,377,497	$ -	$ 134,853	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 191,685	$ 163,962	$ 1,545,066
18	**Non-Residential Smart $aver Prescriptive**	$ 2,375,100	23.17%	$ (550,294)	$ 1,824,806	6.64%	3	$ 690,797	76.83%	$ 899,116	$ 1,021,143	$ 122,027	1	$ 122,027	$ 8,105	$ 130,132	$ 7,502,076	$ -	$ 452,376	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ -	$ 2,139,886	$ 2,050,699	$ 8,401,192
19	**Non-Residential Smart $aver Custom**	$ 692,433	23.17%	$ (160,432)	$ 532,001	6.64%	3	$ 201,394	76.83%	$ 262,127	$ 262,127	$ -	1	$ -	$ -	$ -	$ 256,650	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 256,650	$ 518,776
20	**Non-Res SmartSaver Performance**	$ 34,125	23.17%	$ (7,906)	$ 26,218	6.64%	3	$ 9,925	76.83%	$ 12,918	$ 12,918	$ -	1	$ -	$ -	$ -	$ 30,403	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,194	$ 23,209	$ 43,321
21	**Small Business Energy Saver**	$ 1,021,749	23.17%	$ (236,732)	$ 785,017	6.64%	3	$ 297,175	76.83%	$ 386,792	$ 333,775	$ (53,018)	1	$ (53,018)	$ (3,521)	$ (56,539)	$ 1,745,807	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ -	$ 692,747	$ 513,978	$ 2,132,600
22	**Total for Non-Residential Conservation Programs**	$ 4,817,120		$ (1,116,093)	$ 3,701,027			$ 1,328,036		$ 1,728,523	$ 1,797,532	$ 69,009		$ 69,009	$ 4,583	$ 73,592	$ 10,912,433	$ -	$ 587,229	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 218,730	$ 3,031,512	$ 3,008,498	$ 12,640,956
23	**EnergyWise for Business**	$ (151,695)	23.17%	$ 35,147	$ (116,549)	6.64%	1	$ (116,549)	76.83%	$ (151,695)	$ (190,726)	$ (39,031)	1	$ (39,031)	$ -	$ (39,031)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (151,695)
24	**Commercial, Industrial, & Governmental Demand Re**	$ 263,081	23.17%	$ (60,954)	$ 202,127	6.64%	3	$ 76,517	76.83%	$ 99,592	$ 99,592	$ -	1	$ -	$ -	$ -	$ 243,827	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 9,976	$ 343,418
25	**Total for Non-Residential DSM Programs**	$ 111,386		$ (25,807)	$ 85,578			$ (40,032)		$ (52,104)	$ (91,135)	$ (39,031)		$ (39,031)	$ -	$ (39,031)	$ 243,827	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 9,976	$ 191,723
26	**Total Non Residential**	$ 4,928,505		$ (1,141,900)	$ 3,786,605			$ 1,288,005		$ 1,676,419	$ 1,706,397	$ 29,978		$ 29,978	$ 4,583	$ 34,561	$ 11,156,260	$ -	$ 652,951	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 218,730	$ 3,114,403	$ 3,018,474	$ 12,832,679
27	**Total All Programs**	$ 13,586,747		$ (3,147,954)	$ 10,438,793			$ 2,807,617		$ 3,654,291	$ 3,698,066	$ 43,775		$ 43,775	$ 5,500	$ 49,275	$ 23,915,452	$ -	$ 2,373,878	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,658,908	$ 2,263,748	$ 5,186,057	$ 4,714,633	$ 27,569,743

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

Duke Energy Progress
Evans Exhibit 1
Vintage 2020 True Up - January 1, 2020 to December 31, 2020
Docket Number E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

Residential Programs

EE Programs

		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) Unadjusted Rev Requirement (2)	F NC Retail kWh Sales Allocation Factor		G NC Residential Unadjusted Revenue Requirement (2)	H =K (from page 2) NC Residential Adjusted Revenue Requirement
1	Appliance Recycling Program	-	-	$ -	$ -	11.75%	$ -	$ -	85.754%	E1 * F1	$ -	$ 91,207
2	Energy Efficient Appliances and Devices	2,049	18,783,681	$ 8,646,551	$ 3,051,854	11.75%	$ 657,377	$ 3,709,231	85.754%	E2 * F2	$ 3,180,829	$ 1,283,005
3	Energy Efficiency Education Program	174	1,455,424	$ 456,210	$ 388,273	0.00%	$ -	$ 388,273	85.754%	E3 * F3	$ 332,961	$ -
4	Energy Efficient Lighting	3,123	18,942,865	$ 15,408,720	$ 5,385,332	11.75%	$ 1,177,748	$ 6,563,080	85.754%	E4 * F4	$ 5,628,131	$ 4,249,585
5	Residential Smart $aver®	1,925	6,893,070	$ 5,453,175	$ 6,517,089	11.75%	$ (125,010)	$ 6,392,079	85.754%	E5 * F5	$ 5,481,490	$ 227,693
6	Weatherization Pilot	21	107,608	$ 61,168	$ 51,370	0.00%	$ -	$ 51,370	85.754%	E6 * F6	$ 44,052	$ -
7	Multi-Family Energy Efficiency Program	369	2,816,526	$ 1,389,245	$ 892,251	11.75%	$ 58,397	$ 950,647	85.754%	E7 * F7	$ 815,222	$ 538,755
8	Neighborhood Energy Saver	67	505,268	$ 196,865	$ 401,046	0.00%	$ -	$ 401,046	85.754%	E8 * F8	$ 343,914	$ -
9	Residential Energy Assessments	861	7,151,467	$ 4,050,428	$ 2,160,729	11.75%	$ 222,040	$ 2,382,769	85.754%	E9 * F9	$ 2,043,329	$ 358,285
10	Residential New Construction	5,358	20,007,860	$ 22,840,461	$ 18,861,261	11.75%	$ 467,556	$ 19,328,817	85.754%	E10* F11	$ 16,575,314	$ 704,807
11	Residential Home Advantage	-	-	$ -	$ -	11.75%	$ -	$ -	85.754%	E11 * F11	$ -	$ 140,907
12	Total for Residential Conservation Programs	13,945	76,663,769	58,502,824	37,709,204		$ 2,458,108	$ 40,167,312			$ 34,445,242	$ 7,594,245
13	My Home Energy Report	54,395	154,961,344	$ 10,897,311	$ 7,369,336	11.75%	$ 414,537	$ 7,783,873	85.754%	E13*F13	$ 6,675,015	$ 355,484
14	Total Residential Conservation and Behavioral Programs	68,340	231,625,113	$ 69,400,134	$ 45,078,540		$ 2,872,645	$ 47,951,185			$ 41,120,257	$ 7,949,729
									NC Residential Peak Demand Allocation Factor	NC Allocation Factor		
15	Power Manager	17,810	-	$ 8,817,400	$ 1,110,200	11.75%	$ 905,596	$ 2,015,796	86.339%	48.01%	$ 2,201,887	$ 5,276,333
16	Total Residential	86,150	231,625,113	$ 78,217,534	$ 46,188,741		$ 3,778,241	$ 49,966,981			$ 43,322,144	$ 13,226,062

Non-Residential Programs

EE Programs

		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor		NC Non-Residential Unadjusted Revenue Requirement (2)	NC Non-Residential Adjusted Revenue Requirement
17	Energy Efficient Lighting	1,294	4,993,362	$ 4,684,106	$ 610,362	11.75%	$ 478,665	$ 1,089,027	85.754%	E17 * F17	$ 933,888	$ 1,509,366
18	Smart $aver® Non Residential Prescriptive	7,700	46,353,186	$ 28,517,362	$ 7,863,953	11.75%	$ 2,426,776	$ 10,290,728	85.754%	E18 * F18	$ 8,824,754	$ 6,596,738
19	Smart $aver® Non-Residential - Custom	3,024	12,768,124	$ 9,481,018	$ 3,514,807	11.75%	$ 701,030	$ 4,215,837	85.754%	E19 * F19	$ 3,615,266	$ 746,352
20	Smart $aver(R) Non Residential Performance Incentive Program	223	3,104,355	$ 1,239,947	$ 386,339	11.75%	$ 100,299	$ 486,638	85.754%	E20 * F20	$ 417,313	$ 68,688
21	Small Business Energy Saver	3,895	23,471,981	$ 10,837,185	$ 5,004,816	11.75%	$ 685,303	$ 5,690,119	85.754%	E21 * F21	$ 4,879,529	$ 1,662,323
22	Total for Non-Residential Conservation Programs	16,137	90,691,008	$ 54,759,618	$ 17,380,276		$ 4,392,073	$ 21,772,349			$ 18,670,750	$ 10,583,467
23	EnergyWise for Business	5,063	548,603	$ 686,030	$ 1,896,524	11.75%	$ (142,233)	$ 1,754,291	86.339%		$ 1,269,074	$ (122,803)
24	Commercial, Industrial, Governmental Energy Efficiency (CIG EE, EI	1,928	-	$ 2,964,614	$ 1,352,902	11.75%	$ 189,376	$ 1,542,278	86.339%		$ 1,115,701	$ 256,702
25	Total for Non-Residential DSM Programs	6,991	548,603	$ 3,650,644	$ 3,249,426		$ 47,143	$ 3,296,569	86.339%	NC Allocatio 51.99%	$ 2,384,775	$ 133,899
26	Total Non Residential	23,128	91,239,612	$ 58,410,262	$ 20,629,702		$ 4,439,216	$ 25,068,918		#####	$ 21,055,525	$ 10,717,366
27	Total All Programs	109,278	322,864,725	$ 136,627,796	$ 66,818,443		$ 8,217,456	$ 75,035,899		0.53216	$ 64,377,669	$ 23,943,428

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

28	DSDR	205,053	32,097,809		$ 16,923,949			$ 16,923,949				
29	Total with DSDR	314,331	354,962,533	$ 136,627,796	$ 83,742,392		$ 8,217,456	$ 91,959,848			$ 64,377,669	$ 23,943,428

Duke Energy Progress
Evans Exhibit 1
Vintage 2020 True Up - January 1, 2020 to December 31, 2020
Docket Number E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

	A	B	C	D	E	F	G	H	I	J												K
			=A*B	=A+C			=-PMT(E,F,D)	=1-B														=J+I
Residential Programs	**NC Incentive**	**Income Tax Rate**	**Income Taxes**	**Net-of-Tax PPI - Total NPV**	**Discount Rate**	**PPI Amortization Period**	**Vintage Year 2020 - Year 1 PPI**	**Income Tax Gross-Up Factor**	**Adjusted PPI**	**Σ Prior Period PPI**	**Vintage 2009 PPI**	**Vintage 2010 PPI**	**Vintage 2011 PPI**	**Vintage 2012 PPI**	**Vintage 2013 PPI**	**Vintage 2014 PPI**	**Vintage 2015 PPI**	**Vintage 2016 PPI**	**Vintage 2017 PPI**	**Vintage 2018 PPI**	**Vintage 2019 PPI**	**PPI Values for Test Period**
EE Programs																						
1 **Appliance Recycling Program**	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ 91,207	$ -	$ -	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ -	$ -	$ 91,207
2 **Appliances and Devices**	$ 563,730	23.17%	$ (130,612)	$ 433,118	6.64%	5	$ 104,622	76.83%	$ 136,172	$ 1,146,834	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 396,792	$ 228,341	$ 200,727	$ 1,283,005
3 **Energy Education Program for Schools**	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4 **Energy Efficient Lighting**	$ 1,009,971	23.17%	$ (234,003)	$ 775,968	6.64%	5	$ 187,439	76.83%	$ 243,963	$ 4,005,622	$ -	$ -	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 473,444	$ 418,973	$ 366,366	$ 4,249,585
5 **Residential Service – Smart $aver**	$ (107,201)	23.17%	$ 24,838	$ (82,364)	6.64%	10	$ (11,533)	76.83%	$ (15,011)	$ 242,704	$ -	$ -	$ 116,481	$ 108,864	0	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ (12,268)	$ (14,011)	$ 227,693
6 **Low Income Weatherization Pilot**	$ -	23.17%	$ -	$ -	6.64%	5	$ -	76.83%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7 **Multi-Family Energy Efficiency Program**	$ 50,078	23.17%	$ (11,603)	$ 38,475	6.64%	5	$ 9,294	76.83%	$ 12,097	$ 526,658	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 124,282	$ 186,211	$ 123,303	$ 92,863	$ 538,755
8 **Neighborhood Energy Saver**	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9 **Residential Energy Assessments**	$ 190,409	23.17%	$ (44,116)	$ 146,292	6.64%	5	$ 35,338	76.83%	$ 45,994	$ 312,291	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 88,834	$ 85,706	$ 54,208	$ 358,285
10 **Residential New Construction**	$ 400,950	23.17%	$ (92,897)	$ 308,053	6.64%	10	$ 43,136	76.83%	$ 56,144	$ 648,663	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 135,421	$ 60,340	$ 704,807
11 **Residential Home Advantage**	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ 140,907	$ -	$ -	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ -	$ -	$ -	$ 140,907
12 **Total for Residential Conservation Programs**	$ 2,107,936		$ (488,394)	$ 1,619,542			$ 368,295		$ 479,359	$ 7,114,886	$ -	$ -	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 433,132	$ 1,133,704	$ 1,274,803	$ 979,475	$ 760,493	$ 7,594,245
13 **My Home Energy Report**	$ 355,484	23.17%	$ (82,363)	$ 273,121	6.64%	1	$ 273,121	76.83%	$ 355,484	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 355,484
14 **Total Residential Conservation and Behavioral Progra**	$ 2,463,420		$ (570,757)	$ 1,892,663			$ 641,415		$ 834,843	$ 7,114,886	$ -	$ -	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 433,132	$ 1,133,704	$ 1,274,803	$ 979,475	$ 760,493	$ 7,949,729
15 **EnergyWise**	$ 781,886	23.17%	$ (181,157)	$ 600,728	6.64%	10	$ 84,119	76.83%	$ 109,486	$ 5,166,848	$ -	$ -	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 796,851	$ 716,684	$ 676,304	$ 5,276,333
16 **Total Residential**	$ 3,245,305		$ (751,915)	$ 2,493,391			$ 725,534		$ 944,328	$ 12,281,734	$ -	$ -	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 698,504	$ 2,045,018	$ 2,071,654	$ 1,696,160	$ 1,436,797	$ 13,226,062

Non-Residential Programs	**NC Incentive**	**Income Tax Rate**	**Income Taxes**	**Net-of-Tax PPI - Total NPV**	**Discount Rate**	**PPI Amortization Period**	**Vintage Year 2020 - Year 1 PPI**	**Income Tax Gross-Up Factor**	**Adjusted PPI**	**Σ Prior Period PPI**	**Vintage 2009 PPI**	**Vintage 2010 PPI**	**Vintage 2011 PPI**	**Vintage 2012 PPI**	**Vintage 2013 PPI**	**Vintage 2014 PPI**	**Vintage 2015 PPI**	**Vintage 2016 PPI**	**Vintage 2017 PPI**	**Vintage 2018 PPI**	**Vintage 2019 PPI**	**PPI Values for Test Period**
EE Programs																						
17 **Energy Efficient Lighting**	$ 410,476	23.17%	$ (95,104)	$ 315,372	6.64%	5	$ 76,180	76.83%	$ 99,153	$ 1,410,213	$ -	$ -	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 191,685	$ 163,962	$ 167,570	$ 1,509,366
18 **Non-Residential Smart $aver Prescriptive**	$ 2,081,067	23.17%	$ (482,169)	$ 1,598,899	6.64%	3	$ 605,278	76.83%	$ 787,807	$ 5,808,931	$ -	$ -	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ -	$ -	$ 2,050,699	$ 899,116	$ 6,596,738
19 **Non-Residential Smart $aver Custom**	$ 601,164	23.17%	$ (139,285)	$ 461,879	6.64%	3	$ 174,848	76.83%	$ 227,576	$ 518,776	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 256,650	$ 262,127	$ 746,352
20 **Non-Res SmartSaver Performance**	$ 86,011	23.17%	$ (19,928)	$ 66,083	6.64%	3	$ 25,016	76.83%	$ 32,560	$ 36,128	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,209	$ 12,918	$ 68,688
21 **Small Business Energy Saver**	$ 587,678	23.17%	$ (136,161)	$ 451,517	6.64%	3	$ 170,926	76.83%	$ 222,471	$ 1,439,853	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ -	$ -	$ 513,978	$ 386,792	$ 1,662,323
22 **Total for Non-Residential Conservation Programs**	$ 3,766,396		$ (872,648)	$ 2,893,749			$ 1,052,248		$ 1,369,566	$ 9,213,901	$ -	$ -	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 218,730	$ 191,685	$ 3,008,498	$ 1,728,523	$ 10,583,467
23 **EnergyWise for Business**	$ (122,803)	23.17%	$ 28,453	$ (94,350)	6.64%	1	$ (94,350)	76.83%	$ (122,803)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (122,803)
24 **Commercial, Industrial, & Governmental Demand Res**	$ 163,506	23.17%	$ (37,883)	$ 125,623	6.64%	3	$ 47,556	76.83%	$ 61,897	$ 194,805	$ -	$ -	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ -	$ 9,976	$ 99,592	$ 256,702
25 **Total for Non-Residential DSM Programs**	$ 40,703		$ (9,431)	$ 31,272			$ (46,795)		$ (60,906)	$ 194,805	$ -	$ -	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ -	$ 9,976	$ 99,592	$ 133,899
26 **Total Non Residential**	$ 3,807,099		$ (882,078)	$ 2,925,021			$ 1,005,453		$ 1,308,660	$ 9,408,706	$ -	$ -	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 218,730	$ 191,685	$ 3,018,474	$ 1,828,114	$ 10,717,366
27 **Total All Programs**	$ 7,052,405		$ (1,633,993)	$ 5,418,412			$ 1,730,987		$ 2,252,989	$ 21,690,439	$ -	$ -	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,465,580	$ 2,263,748	$ 2,263,339	$ 4,714,633	$ 3,264,912	$ 23,943,428

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

Duke Energy Progress
Evans Exhibit 1
Vintage 2022 Estimate - January 1, 2022 to December 31, 2022
Docket No. E-2, Sub 1273
Load Impacts and Estimated Revenue Requirements by Program

					A	B	C	D =(A-B)*C	E = (B+D)	F	G		H	I =K (from page 2)
	Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	Unadjusted Rev Requirement (2)	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Unadjusted Revenue Requirement (2)	NC Residential Adjusted Revenue Requirement
	EE Programs													
1	**Energy Efficient Appliances and Devices**	2,721	3,614	34,103,786	$ 13,976,572	$ 5,440,134	10.60%	$ 904,862	$ 6,344,996	85.9138342%		E1 * F1	$ 5,451,229	$ 1,030,914
2	**Appliance Recycling Program**	-	-	-	-	-	10.60%	$ -	$ -	85.9138342%		E2 * F2	$ -	$ 31,968
3	**Energy Efficiency Education Program**	690	1,076	5,777,606	1,850,249	1,369,049	10.60%	$ 196,126	$ 1,565,175	85.9138342%		E3 * F3	$ 1,344,702	$ 168,500
4	**Energy Efficient Lighting**	2,603	1,159	15,793,393	9,761,285	5,499,808	10.60%	$ 451,717	$ 5,951,525	85.9138342%		E4 * F4	$ 5,113,183	$ 2,546,988
5	**Residential Smart $aver®**	1,475	572	5,747,317	3,338,996	3,563,126	10.60%	$ (23,758)	$ 3,539,368	85.9138342%		E5 * F5	$ 3,040,807	$ (33,910)
6	**Weatherization Pilot**	27	31	159,960	85,792	89,917		$ -	$ 89,917	85.9138342%		E6 * F6	$ 77,251	$ -
7	**Multi-Family Energy Efficiency Program**	1,389	1,802	10,550,408	4,982,779	2,074,370	10.60%	$ 308,291	$ 2,382,661	85.9138342%		E7 * F7	$ 2,047,036	$ 394,652
8	**Neighborhood Energy Saver**	1,018	877	4,699,288	2,590,613	3,306,653	10.60%	$ 274,605	$ 3,581,258	85.9138342%		E8 * F8	$ 3,076,796	$ 235,924
9	**Residential Energy Assessments**	1,826	1,421	15,281,862	7,838,136	3,696,823	10.60%	$ 438,979	$ 4,135,802	85.9138342%		E9 * F9	$ 3,553,226	$ 364,347
10	**Residential New Construction**	5,191	5,967	17,933,111	20,458,026	16,382,458	10.60%	$ 432,010	$ 16,814,468	85.9138342%		E10 * F10	$ 14,445,954	$ 809,645
11	**Save Energy and Water Kit**	-	-	-	-	-	10.60%	$ -	$ -	85.9138342%		E10 * F10	$ -	$ -
12	**Residential Home Advantage**	-	-	-	-	-	10.60%	$ -	$ -	85.9138342%		E11 * F11	$ -	$ 517
13	**Total for Residential Conservation Programs**	16,940	16,519	110,046,730	64,882,448	41,422,338		2,982,833	44,405,171				$ 38,150,184	$ 5,549,545
14	**My Home Energy Report**	54,936	50,914	157,153,012	10,729,556	7,073,989	10.60%	$ 387,490	$ 7,461,479	85.9138342%		E12 * F12	$ 6,410,443	$ 332,908
15	**Total Residential Conservation and Behavioral Programs**	71,876	67,433	267,199,742	$ 75,612,004	$ 48,496,327		$ 3,370,323	$ 51,866,651				$ 44,560,627	$ 5,882,452
										NC Residential Peak Demand Allocation Factor				
16	**Power Manager**	23,138	8,091	-	4,145,545	3,054,545	10.60%	$ 115,646	$ 3,170,191	86.8663950%	49.74%	(E13+E23) *F13 *G13	$ 3,710,047	$ 4,252,220
17	**Total Residential**	95,015	75,524	267,199,742	$ 79,757,549	$ 51,550,872		$ 3,485,969	$ 55,036,841				$ 48,270,674	$ 10,134,673

	Non-Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	Unadjusted Rev Requirement (2)	NC Retail kWh Sales Allocation Factor			NC Residential Unadjusted Revenue Requirement (2)	NC Non-Residential Adjusted Revenue Requirement
	EE Programs													
18	**Energy Efficient Lighting**	1,078	236	4,158,893	2,653,112	666,587	10.60%	$ 210,572	$ 877,159	85.9138342%		E15 * F15	$ 753,601	$ 943,798
19	**Smart $aver® Non-Residential - Custom**	2,925	2,925	20,862,620	10,548,581	5,061,855	10.60%	$ 581,593	$ 5,643,448	85.9138342%		E16 * F16	$ 4,848,503	$ 640,148
20	**Smart $aver® Non Residential Prescriptive**	12,751	12,236	70,901,100	39,447,957	14,014,784	10.60%	$ 2,695,916	$ 16,710,700	85.9138342%		E17 * F17	$ 14,356,803	$ 4,174,035
21	**Smart $aver(R) Non Residential Performance Incentive Program**	290	290	2,544,145	1,123,866	442,995	10.60%	$ 72,172	$ 515,168	85.9138342%		E18 * F18	$ 442,600	$ 96,968
22	**Small Business Energy Saver**	10,523	7,606	52,365,662	25,640,082	11,358,395	10.60%	$ 1,513,859	$ 12,872,254	85.9138342%		E19 * F19	$ 11,059,047	$ 1,519,614
23	**Total for Non-Residential Conservation Programs**	27,568	23,295	150,832,421	$ 79,413,599	$ 31,544,617		$ 5,074,112	$ 36,618,729				$ 31,460,554	$ 7,374,563
										NC Non-Residential Peak Demand Allocation Factor				
24	**EnergyWise for Business**	7,934	483	-	804,045	3,198,425	10.60%	$ (253,804)	$ 2,944,621				$ 2,038,027	$ (220,471)
25	**Commercial, Industrial, Governmental DR**	3,153	1,766	-	4,671,542	2,210,806	10.60%	$ 260,838	$ 2,471,644				$ 1,710,671	$ 263,724
26	**Total for Non-Residential DSM Programs**	11,087	2,249	-	$ 5,475,587	$ 5,409,231		$ 7,034	$ 5,416,265	86.8663950%	50.26%	(E13+E23) *F23 *G23	$ 3,748,698	$ 43,253
27	**Total Non Residential**	38,655	25,544	150,832,421	$ 84,889,185	$ 36,953,848		$ 5,081,146	$ 42,034,994				$ 35,209,252	$ 7,417,816
28	**Total All Programs**	133,670	101,068	418,032,163	$ 164,646,734	$ 88,504,720		$ 8,567,115	$ 97,071,835				$ 83,479,925	$ 17,552,489

	DSDR	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	Unadjusted Rev Requirement (2)	NC Retail kWh Sales Allocation Factor	NC Retail kWh Sales Allocation Factor		NC DSDR Unadjusted Revenue Requirement (2)	NC DSDR Adjusted Revenue Requirement
1	**DSDR**	281,340	261,646	44,325,569		$ 16,984,169	N/A	$ -	$ 16,984,169				$ -	$ -
	Total All Programs with DSDR	415,009	362,714	462,357,732	$ 164,646,734	$ 105,488,889		$ 8,567,115	$ 114,056,004				$ 83,479,925	$ 17,552,489

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak
(3) Excluding DSDR, DEP's EE/DSM portfolio estimates a Winter Peak reduction of 89,984 kW systemwide in 2021.

PPI Margin 9.7%

I/A

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Load Impacts and Estimated Revenue Requirements by Program

	A	B	C	D	E	F	G	H	I	J													K
			=A*B	=A+C			=-PMT(E,F,D)	=1-B															=J+I
Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2021 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	Vintage 2018 PPI	Vintage 2019 PPI	Vintage 2020 PPI	Vintage 2021 PPI	PPI Values for Test Period
EE Programs																							
1 **Appliances and Devices**	$ 777,402	23.13%	$ (179,836)	$ 597,566	6.48%	5	$ 143,735	76.87%	$ 186,991	$ 843,923	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 228,341	$ 200,727	$ 136,172	$ 278,683	$ 1,030,914
2 **Appliance Recycling Program**	$ -	23.13%	$ -	$ -	6.48%	10	$ -	76.87%	$ -	$ 31,968	$ -	$ -	$ -	$ -	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ -	$ -	$ -	$ -	$ 31,968
3 **Energy Education Program for Schools**	$ 168,500	23.13%	$ (38,979)	$ 129,521	6.48%	1	$ 129,521	76.87%	$ 168,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 168,500
4 **Energy Efficient Lighting**	$ 388,087	23.13%	$ (89,776)	$ 298,311	6.48%	5	$ 71,754	76.87%	$ 93,348	$ 2,453,640	$ -	$ -	$ -	$ -	$ 636,857	$ 397,825	$ 332,048	$ -	$ -	$ 418,973	$ 366,366	$ 243,963	$ 57,607	$ 2,546,988
5 **Residential Service – Smart $aver**	$ (20,411)	23.13%	$ 4,722	$ (15,690)	6.48%	10	$ (2,181)	76.87%	$ (2,837)	$ (31,072)	$ -	$ -	$ -	$ -	$ -	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ (12,268)	$ (14,011)	$ (15,011)	$ (33,420)	$ (33,910)
6 **Weatherization Pilot**	$ -	23.13%	$ -	$ -	6.48%	N/A	$ -	76.87%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7 **Multi-Family**	$ 264,865	23.13%	$ (61,271)	$ 203,594	6.48%	5	$ 48,971	76.87%	$ 63,709	$ 330,943	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 123,303	$ 92,863	$ 12,097	$ 102,682	$ 394,652
8 **Neighborhood Energy Saver**	$ 235,924	23.13%	$ (54,576)	$ 181,347	6.48%	1	$ 181,347	76.87%	$ 235,924	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 235,924
9 **Residential Energy Assessments**	$ 377,144	23.13%	$ (87,245)	$ 289,899	6.48%	5	$ 69,730	76.87%	$ 90,716	$ 273,631	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 85,706	$ 54,208	$ 45,994	$ 87,723	$ 364,347
10 **Residential New Construction**	$ 371,157	23.13%	$ (85,860)	$ 285,297	6.48%	10	$ 39,657	76.87%	$ 51,592	$ 758,053	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 135,421	$ 60,340	$ 56,144	$ 53,246	$ 809,645
11 **Save Energy and Water Kit**	$ -	23.13%	$ -	$ -	6.48%	5	$ -	76.87%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12 **Residential Home Advantage**	$ -	23.13%	$ -	$ -	6.48%	10	$ -	76.87%	$ -	$ 517	$ -	$ -	$ -	$ -	$ 517	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 517
13 **Total for Residential Conservation Prog**	2,562,666		(592,822)	1,969,845			682,534		887,942	4,661,603	-	-	-	-	702,066	474,715	433,132	156,321	129,522	979,475	760,493	479,359	546,520	5,549,545
14 **My Home Energy Report**	$ 332,908	23.13%	$ (77,012)	$ 255,896	6.48%	1	$ 255,896	76.87%	$ 332,908	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 332,908
15 **Total Residential Conservation and Beh**	2,895,574		(669,833)	2,225,741			938,430		1,220,849	4,661,603	-	-	-	-	702,066	474,715	433,132	156,321	129,522	979,475	760,493	479,359	546,520	5,882,452
16 **EnergyWise ® Home**	$ 100,458	23.13%	$ (23,239)	$ 77,219	6.48%	10	$ 10,734	76.87%	$ 13,964	$ 4,238,256	$ -	$ -	$ -	$ -	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 796,851	$ 716,684	$ 676,304	$ 109,486	$ 91,338	$ 4,252,220
17 **Total Residential**	2,996,032		(693,072)	2,302,960			949,164		1,234,813	8,899,859	-	-	-	-	1,003,450	844,237	698,504	1,067,635	926,373	1,696,160	1,436,797	588,845	637,859	10,134,673

Non-Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2021 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	Vintage 2018 PPI	Vintage 2019 PPI	Vintage 2020 PPI	Vintage 2021 PPI	PPI Values for Test Period
EE Programs																								
18 **Energy Efficient Lighting**	$ 180,910	23.13%	$ (41,850)	$ 139,060	6.48%	5	$ 33,449	76.87%	$ 43,515	$ 900,283	$ -	$ -	$ -	$ -	$ 171,971	$ 116,186	$ 152,430	$ -	$ -	$ 163,962	$ 167,570	$ 99,153	$ 29,011	$ 943,798
19 **Non-Residential Smart $aver Custom**	$ 499,669	23.13%	$ (115,588)	$ 384,080	6.48%	3	$ 144,978	76.87%	$ 188,609	$ 451,539	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 227,576	$ 223,963	$ 640,148
20 **Non-Residential Smart $aver Prescripti**	$ 2,316,165	23.13%	$ (535,798)	$ 1,780,367	6.48%	3	$ 672,031	76.87%	$ 874,277	$ 3,299,757	$ -	$ -	$ -	$ -	$ 678,479	$ 438,885	$ 369,180	$ -	$ -	$ -	$ -	$ 787,807	$ 1,025,406	$ 4,174,035
21 **Non-Res SmartSaver Performance**	$ 62,006	23.13%	$ (14,344)	$ 47,662	6.48%	3	$ 17,991	76.87%	$ 23,405	$ 73,563	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 32,560	$ 41,003	$ 96,968
22 **Small Business Energy Saver**	$ 1,300,614	23.13%	$ (300,871)	$ 999,743	6.48%	3	$ 377,371	76.87%	$ 490,940	$ 1,028,675	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ -	$ -	$ -	$ -	$ 222,471	$ 267,122	$ 1,519,614
23 **Total for Non-Residential Conservation**	4,359,364		(1,008,452)	3,350,912			1,245,819		1,620,746	5,753,817	-	-	-	-	931,159	772,394	762,661	-	-	163,962	167,570	1,369,566	1,586,505	7,374,563
24 **EnergyWise ® for Business**	$ (220,471)	23.13%	$ 51,001	$ (169,469)	6.48%	1	$ (169,469)	76.87%	$ (220,471)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (220,471)
25 **Commercial, Industrial, & Governmenta**	$ 226,581	23.13%	$ (52,415)	$ 174,166	6.48%	3	$ 65,742	76.87%	$ 85,527	$ 178,197	$ -	$ -	$ -	$ -	$ 9,714	$ 25,139	$ 4,414	$ -	$ -	$ -	$ -	$ 61,897	$ 77,033	$ 263,724
26 **Total for Non-Residential DSM Program**	6,110		(1,413)	4,697			(103,727)		(134,944)	178,197	-	-	-	-	9,714	25,139	4,414	-	-	-	-	61,897	77,033	43,253
27 **Total Non Residential**	4,365,474		(1,009,865)	3,355,609			1,142,092		1,485,802	5,932,014	-	-	-	-	940,873	797,533	767,075	-	-	163,962	167,570	1,431,463	1,663,538	7,417,816
28 **Total All Programs**	7,361,506		(1,702,937)	5,658,569			2,091,256		2,720,616	14,831,873	-	-	-	-	1,944,323	1,641,770	1,465,580	1,067,635	926,373	1,860,122	1,604,367	2,020,308	2,301,396	17,552,489

Duke Energy Progress
For the Period January 1, 2017 - December 31, 2022
Docket No. E-2, Sub 1273
North Carolina Net Lost Revenue for Vintages 2017 - 2022

Vintage 2017

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program	$ 75,158	$ 82,127	$ 71,730	$ 28,278	$ -	$ -	$ 257,293
2	Energy Efficient Appliances and Devices	$ 754,565	$ 939,579	$ 843,089	$ 383,581	$ -	$ -	$ 2,920,814
3	Energy Efficient Lighting	$ 650,874	$ 1,136,390	$ 1,050,708	$ 577,938	$ -	$ -	$ 3,415,909
4	Multi-Family Energy Efficiency Program	$ 458,694	$ 653,898	$ 598,323	$ 295,671	$ -	$ -	$ 2,006,585
5	My Home Energy Report	$ 6,016,176	$ -	$ -	$ -	$ -	$ -	$ 6,016,176
6	Neighborhood Energy Saver	$ 42,581	$ 61,285	$ 54,279	$ 28,517	$ -	$ -	$ 186,662
7	Residential Energy Assessments	$ 210,303	$ 275,808	$ 246,877	$ 117,628	$ -	$ -	$ 850,616
8	Residential New Construction	$ 369,740	$ 519,463	$ 468,424	$ 233,640	$ -	$ -	$ 1,591,267
9	Residential Smart $aver®	$ 235,241	$ 284,755	$ 250,445	$ 112,910	$ -	$ -	$ 883,352
10	Total Lost Revenues	$ 8,813,332	$ 3,953,304	$ 3,583,875	$ 1,778,164	$ -	$ -	$ 18,128,675
11	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	-
12	Net Lost Residential Revenues	**$ 8,813,332**	**$ 3,953,304**	**$ 3,583,875**	**$ 1,778,164**	**$ -**	**$ -**	**$ 18,128,675**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
13	Business Energy Report	$ 577	$ -	$ -	$ -	$ -	$ -	$ 577
14	Energy Efficient Lighting	$ 140,093	$ 316,570	$ 328,825	$ 165,951	$ -	$ -	$ 951,440
15	EnergyWise for Business	$ 29,965	$ 45,234	$ 46,985	$ 16,026	$ -	$ -	$ 138,210
16	Small Business Energy Saver	$ 1,045,486	$ 1,803,999	$ 1,873,837	$ 767,913	$ -	$ -	$ 5,491,235
17	Smart $aver(R) Non Residential Performance Incentive Pro	$ 8,952	$ 20,325	$ 21,112	$ 12,355	$ -	$ -	$ 62,744
18	Smart $aver® Non Residential Prescriptive	$ 2,202,094	$ 3,875,364	$ 4,024,915	$ 1,714,272	$ -	$ -	$ 11,816,646
19	Smart $aver® Non-Residential - Custom	$ 203,962	$ 452,557	$ 470,076	$ 236,533	$ -	$ -	$ 1,363,128
20	Total Lost Revenues	$ 3,631,129	$ 6,514,049	$ 6,765,752	$ 2,913,049	$ -	$ -	$ 19,823,979
21	Found Non-Residential Revenues	$ (72,644)	$ (106,296)	$ (106,296)	$ (32,792)	$ -	$ -	$ (318,028)
22	Net Lost Non-Residential Revenues	**$ 3,558,485**	**$ 6,407,753**	**$ 6,659,456**	**$ 2,880,258**	**$ -**	**$ -**	**$ 19,505,951**

	DSDR	2017	2018	2019	2020	2021	2022	Total
23	DSDR	$ 65,125	$ 2,329	$ -	$ -	$ -	$ -	$ 67,453

Vintage 2018

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program		$ 68,911	$ 129,318	$ 87,537	$ -	$ -	$ 285,766
3	Energy Efficient Appliances and Devices		$ 440,027	$ 850,555	$ 575,751	$ -	$ -	$ 1,866,332
4	Energy Efficient Lighting		$ 642,900	$ 1,381,621	$ 935,237	$ -	$ -	$ 2,959,758
5	Multi-Family Energy Efficiency Program		$ 445,045	$ 881,489	$ 596,691	$ -	$ -	$ 1,923,225
6	My Home Energy Report		$ 7,718,873	$ -	$ -	$ -	$ -	$ 7,718,873
7	Neighborhood Energy Saver		$ 38,712	$ 87,336	$ 59,119	$ -	$ -	$ 185,168
8	Residential Energy Assessments		$ 236,716	$ 433,062	$ 293,145	$ -	$ -	$ 962,923
9	Residential New Construction		$ 440,096	$ 911,175	$ 616,786	$ -	$ -	$ 1,968,058
10	Residential Smart $aver®		$ 224,364	$ 443,734	$ 300,369	$ -	$ -	$ 968,468
11	Total Lost Revenues	$ -	$ 10,255,643	$ 5,118,292	$ 3,464,637	$ -	$ -	$ 18,838,571
12	Found Residential Revenues		$ (4,903)	$ (8,353)	$ (5,569)	$ -	$ -	(18,824)
13	Net Lost Residential Revenues	**$ -**	**$ 10,250,740**	**$ 5,109,939**	**$ 3,459,068**	**$ -**	**$ -**	**$ 18,819,748**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting		$ 130,325	$ 276,105	$ 184,656	$ -	$ -	$ 591,085
15	EnergyWise for Business		$ 681	$ 1,590	$ 1,063	$ -	$ -	$ 3,334
16	Small Business Energy Saver		$ 864,421	$ 1,675,520	$ 1,120,571	$ -	$ -	$ 3,660,511
17	Smart $aver(R) Non Residential Performance Incentive Program		$ 25,808	$ 68,527	$ 45,830	$ -	$ -	$ 140,165
18	Smart $aver® Non Residential Prescriptive		$ 2,156,131	$ 3,539,467	$ 2,367,160	$ -	$ -	$ 8,062,758
19	Smart Saver® Non-Residential - Custom		$ 345,367	$ 534,452	$ 357,436	$ -	$ -	$ 1,237,255
20	Total Lost Revenues	$ -	$ 3,522,733	$ 6,095,660	$ 4,076,716	$ -	$ -	$ 13,695,108
21	Found Non- Residential Revenues		$ (31,247)	$ (55,439)	$ (36,959)	$ -	$ -	$ (92,398)
22	Net Lost Non-Residential Revenues	**$ -**	**$ 3,491,486**	**$ 6,040,221**	**$ 4,039,757**	**$ -**	**$ -**	**$ 13,602,711**

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

Vintage 2019

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program			$ 112,171	$ 134,338	$ 29,017	$ 23,094	$ 298,619
2	Energy Efficient Appliances and Devices			$ 529,158	$ 868,744	$ 368,074	$ 257,520	$ 2,023,496
3	Energy Efficient Lighting			$ 1,044,587	$ 1,411,674	$ 494,928	$ 320,586	$ 3,271,775
4	Multi-Family Energy Efficiency Program			$ 423,542	$ 555,710	$ 178,992	$ 121,400	$ 1,279,644
5	My Home Energy Report			$ 9,095,458	$ -	$ -	$ -	$ 9,095,458
6	Neighborhood Energy Saver			$ 82,557	$ 109,512	$ 38,662	$ 24,244	$ 254,975
7	Residential Energy Assessments			$ 244,084	$ 341,865	$ 124,996	$ 83,414	$ 794,359
8	Residential New Construction			$ 523,723	$ 815,936	$ 323,848	$ 226,074	$ 1,889,582
9	Residential Smart $aver®			$ 210,486	$ 324,420	$ 134,868	$ 88,545	$ 758,319
10	Weatherization Pilot			$ 3,751	$ 6,561	$ 2,765	$ 1,905	$ 14,981
11	Total Lost Revenues	$ -	$ -	$ 12,269,515	$ 4,568,759	$ 1,696,149	$ 1,146,782	$ 19,681,206
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ 12,269,515**	**$ 4,568,759**	**$ 1,696,149**	**$ 1,146,782**	**$ 19,681,206**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting			$ 208,345	$ 277,493	$ 96,422	$ 61,721	$ 643,981
15	EnergyWise for Business			$ 21,449	$ 35,193	$ 14,888	$ 9,754	$ 81,284
16	Small Business Energy Saver			$ 813,467	$ 1,146,686	$ 397,843	$ 277,956	$ 2,635,952
17	Smart $aver(R) Non Residential Performance Incentive Program			$ 30,568	$ 50,425	$ 24,599	$ 15,731	$ 121,322
18	Smart $aver® Non Residential Prescriptive			$ 1,221,088	$ 1,648,321	$ 595,594	$ 389,547	$ 3,854,550
19	Smart $aver® Non-Residential - Custom			$ 221,885	$ 457,593	$ 209,748	$ 156,465	$ 1,045,690
20	Total Lost Revenues	$ -	$ -	$ 2,516,801	$ 3,615,711	$ 1,339,095	$ 911,173	$ 8,382,779
21	Found Non- Residential Revenues	$ -	$ -	$ (2,687)	$ (3,706)	$ (1,357)	$ (835)	$ (8,585)
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 2,514,114**	**$ 3,612,005**	**$ 1,337,737**	**$ 910,338**	**$ 8,374,194**

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

Vintage 2020

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program			$ -	$ 36,513	$ 61,432	$ 62,312	$ 160,257
2	Energy Efficient Appliances and Devices			$ -	$ 520,634	$ 887,602	$ 900,324	$ 2,308,560
3	Energy Efficient Lighting			$ -	$ 526,646	$ 883,147	$ 895,806	$ 2,305,599
4	Multi-Family Energy Efficiency Program			$ -	$ 136,010	$ 90,692	$ 91,992	$ 318,694
5	My Home Energy Report			$ -	$ 9,317,886	$ -	$ -	$ 9,317,886
6	Neighborhood Energy Saver			$ -	$ 12,247	$ 8,938	$ 9,066	$ 30,251
7	Residential Energy Assessments			$ -	$ 173,035	$ 356,326	$ 361,433	$ 890,794
8	Residential New Construction			$ -	$ 613,230	$ 1,074,029	$ 1,089,424	$ 2,776,683
9	Residential Smart $aver®			$ -	$ 201,538	$ 365,194	$ 370,429	$ 937,161
10	Weatherization Pilot			$ -	$ 2,892	$ 5,923	$ 6,008	$ 14,823
11	Total Lost Revenues	$ -	$ -	$ -	$ 11,540,630	$ 3,733,283	$ 3,786,795	$ 19,060,708
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ (12)	$ (12)	$ (25)
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 11,540,630**	**$ 3,733,271**	**$ 3,786,782**	**$ 19,060,684**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting			$ -	$ 103,565	$ 175,594	$ 175,945	$ 455,104
15	EnergyWise for Business			$ -	$ 14,795	$ 17,452	$ 17,487	$ 49,734
16	Small Business Energy Saver			$ -	$ 458,582	$ 676,224	$ 677,577	$ 1,812,383
17	Smart $aver(R) Non Residential Performance Incentive Program			$ -	$ 26,728	$ 152,846	$ 153,152	$ 332,727
18	Smart $aver® Non Residential Prescriptive			$ -	$ 917,203	$ 1,542,285	$ 1,545,372	$ 4,004,860
19	Smart $aver® Non-Residential - Custom			$ -	$ 260,424	$ 514,000	$ 515,029	$ 1,289,452
20	Total Lost Revenues	$ -	$ -	$ -	$ 1,781,297	$ 3,078,400	$ 3,084,562	$ 7,944,260
21	Found Non- Residential Revenues	$ -	$ -	$ -	$ (5,064)	$ (9,609)	$ (9,609)	$ (14,673)
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 1,776,234**	**$ 3,068,792**	**$ 3,074,953**	**$ 4,845,025**

Vintage 2021

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program			$ -	$ -	$ 119,914	$ 216,664	$ 336,578
2	Energy Efficient Appliances and Devices			$ -	$ -	$ 819,946	$ 1,536,419	$ 2,356,365
3	Energy Efficient Lighting			$ -	$ -	$ 245,134	$ 480,605	$ 725,739
4	Multi-Family Energy Efficiency Program			$ -	$ -	$ 513,447	$ 961,489	$ 1,474,937
5	My Home Energy Report			$ -	$ -	$ 9,430,353	$ -	$ 9,430,353
6	Neighborhood Energy Saver			$ -	$ -	$ 90,941	$ 170,298	$ 261,239
7	Residential Energy Assessments			$ -	$ -	$ 462,332	$ 865,770	$ 1,328,102
8	Residential New Construction			$ -	$ -	$ 588,687	$ 1,162,104	$ 1,750,792
9	Residential Smart $aver®			$ -	$ -	$ 151,993	$ 284,625	$ 436,618
10	Total Lost Revenues	$ -	$ -	$ -	$ -	$ 12,422,747	$ 5,677,975	$ 18,100,721
11	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ 12,422,747**	**$ 5,677,975**	**$ 18,100,721**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
13	Energy Efficient Lighting				$ -	$ 49,121	$ 95,135	$ 144,255
14	EnergyWise for Business				$ -	$ 1,239	$ 2,291	$ 3,530
15	Small Business Energy Saver				$ -	$ 811,359	$ 1,541,199	$ 2,352,558
16	Smart $aver(R) Non Residential Performance Incentive Program				$ -	$ 78,024	$ 144,332	$ 222,355
17	Smart $aver® Non Residential Prescriptive				$ -	$ 1,755,219	$ 3,246,890	$ 5,002,109
18	Smart $aver® Non-Residential - Custom				$ -	$ 396,339	$ 733,168	$ 1,129,508
19	Total Lost Revenues	$ -	$ -	$ -	$ -	$ 3,091,300	$ 5,763,015	$ 8,854,315
20	Found Non- Residential Revenues	$ -	$ -	$ -	$ -	$ (6,175)	$ (11,399)	$ (17,574)
21	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,085,125**	**$ 5,751,616**	**$ 8,836,741**

Vintage 2022

Line	Residential	2017	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program			$ -	$ -	$ -	$ 144,472	$ 144,472
2	Energy Efficient Appliances and Devices			$ -	$ -	$ -	$ 1,054,283	$ 1,054,283
3	Energy Efficient Lighting			$ -	$ -	$ -	$ 400,970	$ 400,970
4	Multi-Family Energy Efficiency Program			$ -	$ -	$ -	$ 363,882	$ 363,882
5	My Home Energy Report			$ -	$ -	$ -	$ 9,262,304	$ 9,262,304
6	Neighborhood Energy Saver			$ -	$ -	$ -	$ 118,763	$ 118,763
7	Residential Energy Assessments			$ -	$ -	$ -	$ 514,092	$ 514,092
8	Residential New Construction			$ -	$ -	$ -	$ 604,841	$ 604,841
9	Residential Smart $aver®			$ -	$ -	$ -	$ 198,059	$ 198,059
10	Weatherization Pilot			$ -	$ -	$ -	$ 5,688	$ 5,688
11	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ 12,667,355	$ 12,667,355
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 12,667,355**	**$ 12,667,355**

	Non-Residential	2017	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting				$ -	$ -	$ 79,364	$ 79,364
15	Small Business Energy Saver				$ -	$ -	$ 1,206,418	$ 1,206,418
16	Smart $aver(R) Non Residential Performance Incentive Program				$ -	$ -	$ 49,631	$ 49,631
17	Smart $aver® Non Residential Prescriptive				$ -	$ -	$ 1,659,749	$ 1,659,749
18	Smart $aver® Non-Residential - Custom				$ -	$ -	$ 407,424	$ 407,424
19	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ 3,402,586	$ 3,402,586
20	Found Non- Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ (317)	$ (317)
21	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,402,269**	**$ 3,402,269**

Duke Energy Progress
For the Period January 1, 2017 - December 31, 2019
Docket No. E-2, Sub 1273
North Carolina Net Lost Revenue
True Up for Vintages 2017 - 2019

Vintage 2017 as Filed Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ 75,158	$ 82,127	$ 71,730	$ 26,431	$ -	$ -	$ 255,446
3	Energy Efficient Lighting	$ 650,874	$ 1,136,390	$ 1,050,708	$ 540,193	$ -	$ -	$ 3,378,164
4	Home Energy Improvement Program	$ 235,241	$ 284,755	$ 250,445	$ 105,536	$ -	$ -	$ 875,978
5	Multi-Family	$ 458,694	$ 653,898	$ 598,323	$ 276,361	$ -	$ -	$ 1,987,275
6	My Home Energy Report	$ 6,016,176				$ -	$ -	$ 6,016,176
7	Neighborhood Energy Saver	$ 42,581	$ 61,285	$ 54,279	$ 26,654	$ -	$ -	$ 184,800
8	Residential Energy Assessments	$ 210,303	$ 275,808	$ 246,877	$ 109,946	$ -	$ -	$ 842,934
9	Residential New Construction	$ 369,740	$ 519,463	$ 468,424	$ 218,382	$ -	$ -	$ 1,576,008
10	Save Energy and Water Kit	$ 754,565	$ 939,579	$ 843,089	$ 358,530	$ -	$ -	$ 2,895,763
11	Lost Residential Revenues	**$ 8,813,332**	**$ 3,953,304**	**$ 3,583,875**	**$ 1,662,033**	**$ -**	**$ -**	**$ 18,012,544**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ 8,813,332**	**$ 3,953,304**	**$ 3,583,875**	**$ 1,662,033**	**$ -**	**$ -**	**$ 18,012,544**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Business Energy Report	$ 577	$ -	$ -	$ -	$ -	$ -	$ 577
15	Energy Efficiency for Business	$ 2,406,056	$ 4,327,920	$ 4,494,992	$ 1,871,445	$ -	$ -	$ 13,100,414
16	Energy Efficient Lighting	$ 140,093	$ 316,570	$ 328,825	$ 159,200	$ -	$ -	$ 944,689
17	Small Business Energy Saver	$ 1,045,486	$ 1,803,999	$ 1,873,837	$ 736,674	$ -	$ -	$ 5,459,996
18	Non-Res SmartSaver Performance	$ 8,952	$ 20,325	$ 21,112	$ 11,852	$ -	$ -	$ 62,241
19	EnergyWise for Business	$ 29,965	$ 45,234	$ 46,985	$ 15,374	$ -	$ -	$ 137,558
20	Net Lost Non-Residential Revenues	**$ 3,631,129**	**$ 6,514,049**	**$ 6,765,752**	**$ 2,794,545**	**$ -**	**$ -**	**$ 19,705,475**
21	Found Non- Residential Revenues	$ (72,644)	$ (106,296)	$ (106,296)	$ (32,792)	$ -	$ -	$ (318,028)
22	Net Lost Non-Residential Revenues	**$ 3,558,485**	**$ 6,407,753**	**$ 6,659,456**	**$ 2,761,753**	**$ -**	**$ -**	**$ 19,387,447**

	DSDR	2017(a)	2018	2019	2020	2021	2022	Total
23	DSDR	$ 65,125	$ 2,329	$ -				**$ 67,453**

Vintage 2018 as Filed Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ 68,911	$ 129,318	$ 81,820	$ -	$ -	$ 280,049
3	Energy Efficient Lighting	$ -	$ 642,900	$ 1,381,621	$ 874,157	$ -	$ -	$ 2,898,679
4	Home Energy Improvement Program	$ -	$ 224,364	$ 443,734	$ 280,752	$ -	$ -	$ 948,851
5	Multi-Family	$ -	$ 434,773	$ 846,931	$ 535,857	$ -	$ -	$ 1,817,561
6	My Home Energy Report	$ -	$ 7,718,873	$ -	$ -	$ -	$ -	$ 7,718,873
7	Neighborhood Energy Saver	$ -	$ 38,712	$ 87,336	$ 55,258	$ -	$ -	$ 181,307
8	Residential Energy Assessments	$ -	$ 236,716	$ 433,062	$ 274,000	$ -	$ -	$ 943,778
9	Residential New Construction	$ -	$ 440,096	$ 911,175	$ 576,504	$ -	$ -	$ 1,927,776
10	Save Energy and Water Kit	$ -	$ 440,027	$ 850,555	$ 538,149	$ -	$ -	$ 1,828,731
11	Lost Residential Revenues	**$ -**	**$ 10,245,371**	**$ 5,083,734**	**$ 3,216,498**	**$ -**	**$ -**	**$ 18,545,603**
12	Found Residential Revenues	$ -	$ (4,903)	$ (8,353)	$ (5,569)	$ -	$ -	$ (18,824)
13	Net Lost Residential Revenues	**$ -**	**$ 10,240,469**	**$ 5,075,381**	**$ 3,210,930**	**$ -**	**$ -**	**$ 18,526,779**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	$ -	$ 130,325	$ 276,105	$ 215,622	$ 62,040	$ -	$ 684,092
15	Non-Residential Smart $aver Prescriptive	$ -	$ 2,156,131	$ 3,539,467	$ 2,764,128	$ 573,019	$ -	$ 9,032,744
16	Non-Residential Smart $aver Custom	$ -	$ 345,367	$ 534,452	$ 417,377	$ 77,460	$ -	$ 1,374,656
17	Non-Res SmartSaver Performance	$ -	$ 25,808	$ 68,527	$ 53,516	$ 18,392	$ -	$ 166,243
18	Small Business Energy Saver	$ -	$ 864,421	$ 1,675,520	$ 1,308,488	$ 342,804	$ -	$ 4,191,233
19	EnergyWise for Business	$ -	$ 681	$ 1,590	$ 1,242	$ 389	$ -	$ 3,902
20	Net Lost Non-Residential Revenues	**$ -**	**$ 3,522,733**	**$ 6,095,660**	**$ 4,760,373**	**$ 1,074,103**	**$ -**	**$ 15,452,869**
21	Found Non- Residential Revenues	$ -	$ (31,247)	$ (55,439)	$ (44,987)	$ (10,510)		$ (142,182)
22	Net Lost Non-Residential Revenues	**$ -**	**$ 3,491,486**	**$ 6,040,221**	**$ 4,715,386**	**$ 1,063,593**	**$ -**	**$ 15,310,687**

	DSDR	2016(a)	2017(a)	2018	2019	2020	2021	Total
23	DSDR	$ -	$ -	$ -	$ -			**$ -**

Vintage 2019 as Filed Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program	$ -	$ -	$ 112,171	$ 141,064	$ 78,558	$ -	$ 331,792
2	Energy Efficient Appliances and Devices	$ -	$ -	$ 539,606	$ 883,980	$ 497,220	$ -	$ 1,920,806
3	Energy Efficient Lighting	$ -	$ -	$ 1,044,587	$ 1,409,874	$ 783,860	$ -	$ 3,238,322
4	Multi-Family Energy Efficiency Program	$ -	$ -	$ 412,299	$ 567,959	$ 313,221	$ -	$ 1,293,479
5	My Home Energy Report	$ -	$ -	$ 9,095,458	$ -	$ -	$ -	$ 9,095,458
6	Neighborhood Energy Saver	$ -	$ -	$ 82,557	$ 110,291	$ 64,012	$ -	$ 256,859
7	Residential Energy Assessments	$ -	$ -	$ 244,084	$ 337,845	$ 183,510	$ -	$ 765,439
8	Residential New Construction	$ -	$ -	$ 523,723	$ 800,957	$ 446,297	$ -	$ 1,770,977
9	Residential Smart $aver®	$ -	$ -	$ 210,486	$ 316,432	$ 177,059	$ -	$ 703,977
10	Weatherization Pilot	$ -	$ -	$ 3,751	$ 6,553	$ 4,110	$ -	$ 14,413
11	Lost Residential Revenues	**$ -**	**$ -**	**$ 12,268,722**	**$ 4,574,954**	**$ 2,547,846**	**$ -**	**$ 19,391,522**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ 12,268,722**	**$ 4,574,954**	**$ 2,547,846**	**$ -**	**$ 19,391,522**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	$ -	$ -	$ 208,344	$ 353,582	$ 372,818	$ -	$ 934,744
15	EnergyWise for Business	$ -	$ -	$ 1,295	$ 2,239	$ 2,361	$ -	$ 5,896
16	Small Business Energy Saver	$ -	$ -	$ 784,625	$ 1,385,267	$ 1,460,629	$ -	$ 3,630,521
17	Smart $aver(R) Non Residential Performance Incenti	$ -	$ -	$ 30,568	$ 60,896	$ 64,209	$ -	$ 155,672
18	Smart $aver® Non Residential Prescriptive	$ -	$ -	$ 1,357,017	$ 2,300,536	$ 2,425,690	$ -	$ 6,083,243
19	Smart Saver® Non-Residential - Custom	$ -	$ -	$ 221,885	$ 559,003	$ 589,414	$ -	$ 1,370,302
20	Total Lost Revenues	**$ -**	**$ -**	**$ 2,603,733**	**$ 4,661,524**	**$ 4,915,120**	**$ -**	**$ 12,180,377**
21	Found Non- Residential Revenues	$ -	$ -	$ (2,687)	$ (4,880)	$ (4,880)	$ -	$ (12,447)
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 2,601,047**	**$ 4,656,644**	**$ 4,910,240**	**$ -**	**$ 12,167,930**

Duke Energy Progress
For the Period January 1, 2017 - December 31, 201
Docket No. E-2, Sub 1273
North Carolina Net Lost Revenue
True Up for Vintages 2017 - 2019

Vintage 2017 True Up Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ 75,158	$ 82,127	$ 71,730	$ 28,278	$ -	$ -	$ 257,293
3	Energy Efficient Lighting	$ 650,874	$ 1,136,390	$ 1,050,708	$ 577,938	$ -	$ -	$ 3,415,909
4	Home Energy Improvement Program	$ 235,241	$ 284,755	$ 250,445	$ 112,910	$ -	$ -	$ 883,352
5	Multi-Family	$ 458,694	$ 653,898	$ 598,323	$ 295,671	$ -	$ -	$ 2,006,585
6	My Home Energy Report	$ 6,016,176	$ -	$ -	$ -	$ -	$ -	$ 6,016,176
7	Neighborhood Energy Saver	$ 42,581	$ 61,285	$ 54,279	$ 28,517	$ -	$ -	$ 186,662
8	Residential Energy Assessments	$ 210,303	$ 275,808	$ 246,877	$ 117,628	$ -	$ -	$ 850,616
9	Residential New Construction	$ 369,740	$ 519,463	$ 468,424	$ 233,640	$ -	$ -	$ 1,591,267
10	Save Energy and Water Kit	$ 754,565	$ 939,579	$ 843,089	$ 383,581	$ -	$ -	$ 2,920,814
11	Lost Residential Revenues	**$ 8,813,332**	**$ 3,953,304**	**$ 3,583,875**	**$ 1,778,164**	**$ -**	**$ -**	**$ 18,128,675**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ 8,813,332**	**$ 3,953,304**	**$ 3,583,875**	**$ 1,778,164**	**$ -**	**$ -**	**$ 18,128,675**
		-	-	-				

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Business Energy Report	$ 577	$ -	$ -	$ -	$ -	$ -	$ 577
15	Energy Efficiency for Business	$ 2,406,056	$ 4,327,920	$ 4,494,992	$ 1,950,805	$ -	$ -	$ 13,179,774
16	Energy Efficient Lighting	$ 140,093	$ 316,570	$ 328,825	$ 165,951	$ -	$ -	$ 951,440
17	Small Business Energy Saver	$ 1,045,486	$ 1,803,999	$ 1,873,837	$ 767,913	$ -	$ -	$ 5,491,235
18	Non-Res SmartSaver Performance	$ 8,952	$ 20,325	$ 21,112	$ 12,355	$ -	$ -	$ 62,744
19	EnergyWise for Business	$ 29,965	$ 45,234	$ 46,985	$ 16,026	$ -	$ -	$ 138,210
20	Net Lost Non-Residential Revenues	**$ 3,631,129**	**$ 6,514,049**	**$ 6,765,752**	**$ 2,913,049**	**$ -**	**$ -**	**$ 19,823,979**
21	Found Non- Residential Revenues	$ (72,644)	$ (106,296)	$ (106,296)	$ (32,792)	$ -	$ -	$ (318,028)
22	Net Lost Non-Residential Revenues	**$ 3,558,485**	**$ 6,407,753**	**$ 6,659,456**	**$ 2,880,258**	**$ -**	**$ -**	**$ 19,505,951**

	DSDR	2017(a)	2018	2019	2020	2021	2022	Total
23	DSDR	$ 65,125	$ 2,329	$ -	$ -	$ -	$ -	**$ 67,453**

Vintage 2018 True Up Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ 68,911	$ 129,318	$ 87,537	$ -	$ -	$ 285,766
3	Energy Efficient Lighting	$ -	$ 642,900	$ 1,381,621	$ 935,237	$ -	$ -	$ 2,959,758
4	Home Energy Improvement Program	$ -	$ 224,364	$ 443,734	$ 300,369	$ -	$ -	$ 968,468
5	Multi-Family	$ -	$ 445,045	$ 881,489	$ 596,691	$ -	$ -	$ 1,923,225
6	My Home Energy Report	$ -	$ 7,718,873	$ -	$ -	$ -	$ -	$ 7,718,873
7	Neighborhood Energy Saver	$ -	$ 38,712	$ 87,336	$ 59,119	$ -	$ -	$ 185,168
8	Residential Energy Assessments	$ -	$ 236,716	$ 433,062	$ 293,145	$ -	$ -	$ 962,923
9	Residential New Construction	$ -	$ 440,096	$ 911,175	$ 616,786	$ -	$ -	$ 1,968,058
10	Save Energy and Water Kit	$ -	$ 440,027	$ 850,555	$ 575,751	$ -	$ -	$ 1,866,332
11	Lost Residential Revenues	**$ -**	**$ 10,255,643**	**$ 5,118,292**	**$ 3,464,637**	**$ -**	**$ -**	**$ 18,838,571**
12	Found Residential Revenues	$ -	$ (4,903)	$ (8,353)	$ (5,569)	$ -		$ (18,824)
13	Net Lost Residential Revenues	**$ -**	**$ 10,250,740**	**$ 5,109,939**	**$ 3,459,068**	**$ -**	**$ -**	**$ 18,819,748**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	$ -	$ 130,325	$ 276,105	$ 184,656	$ -	$ -	$ 591,085
15	Non-Residential Smart $aver Prescriptive	$ -	$ 2,156,131	$ 3,539,467	$ 2,367,160	$ -	$ -	$ 8,062,758
16	Non-Residential Smart $aver Custom	$ -	$ 345,367	$ 534,452	$ 357,436	$ -	$ -	$ 1,237,255
17	Non-Res SmartSaver Performance	$ -	$ 25,808	$ 68,527	$ 45,830	$ -	$ -	$ 140,165
18	Small Business Energy Saver	$ -	$ 864,421	$ 1,675,520	$ 1,120,571	$ -	$ -	$ 3,660,511
19	EnergyWise for Business	$ -	$ 681	$ 1,590	$ 1,063	$ -	$ -	$ 3,334
20	Net Lost Non-Residential Revenues	**$ -**	**$ 3,522,733**	**$ 6,095,660**	**$ 4,076,716**	**$ -**	**$ -**	**$ 13,695,108**
21	Found Non- Residential Revenues	$ -	$ (31,247)	$ (55,439)	$ (36,959)	$ -	$ -	$ (123,644)
22	Net Lost Non-Residential Revenues	**$ -**	**$ 3,491,486**	**$ 6,040,221**	**$ 4,039,757**	**$ -**	**$ -**	**$ 13,571,464**

	DSDR	2016(a)	2017(a)	2018	2019	Total
23	DSDR	$ -	$ -	$ -	$ -	**$ -**

Vintage 2019 True Up Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program	$ -	$ -	$ 112,171	$ 134,338	$ 29,017	$ 23,094	$ 298,619
2	Energy Efficient Appliances and Devices	$ -	$ -	$ 529,158	$ 868,744	$ 368,074	$ 257,520	$ 2,023,496
3	Energy Efficient Lighting	$ -	$ -	$ 1,044,587	$ 1,411,674	$ 494,928	$ 320,586	$ 3,271,775
4	Multi-Family Energy Efficiency Program	$ -	$ -	$ 423,542	$ 555,710	$ 178,992	$ 121,400	$ 1,279,644
5	My Home Energy Report	$ -	$ -	$ 9,095,458	$ -	$ -	$ -	$ 9,095,458
6	Neighborhood Energy Saver	$ -	$ -	$ 82,557	$ 109,512	$ 38,662	$ 24,244	$ 254,975
7	Residential Energy Assessments	$ -	$ -	$ 244,084	$ 341,865	$ 124,996	$ 83,414	$ 794,359
8	Residential New Construction	$ -	$ -	$ 523,723	$ 815,936	$ 323,848	$ 226,074	$ 1,889,582
9	Residential Smart $aver®	$ -	$ -	$ 210,486	$ 324,420	$ 134,868	$ 88,545	$ 758,319
10	Weatherization Pilot	$ -	$ -	$ 3,751	$ 6,561	$ 2,765	$ 1,905	$ 14,981
11	Lost Residential Revenues	**$ -**	**$ -**	**$ 12,269,515**	**$ 4,568,759**	**$ 1,696,149**	**$ 1,146,782**	**$ 19,681,206**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ 12,269,515**	**$ 4,568,759**	**$ 1,696,149**	**$ 1,146,782**	**$ 19,681,206**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	$ -	$ -	$ 208,345	$ 277,493	$ 96,422	$ 61,721	$ 643,981
15	EnergyWise for Business	$ -	$ -	$ 21,449	$ 35,193	$ 14,888	$ 9,754	$ 81,284
16	Small Business Energy Saver	$ -	$ -	$ 813,467	$ 1,146,686	$ 397,843	$ 277,956	$ 2,635,952
17	Smart $aver(R) Non Residential Performance	$ -	$ -	$ 30,568	$ 50,425	$ 24,599	$ 15,731	$ 121,322
18	Smart $aver® Non Residential Prescriptive	$ -	$ -	$ 1,221,088	$ 1,648,321	$ 595,594	$ 389,547	$ 3,854,550
19	Smart Saver® Non-Residential - Custom	$ -	$ -	$ 221,885	$ 457,593	$ 209,748	$ 156,465	$ 1,045,690
20	Total Lost Revenues	**$ -**	**$ -**	**$ 2,516,801**	**$ 3,615,711**	**$ 1,339,095**	**$ 911,173**	**$ 8,382,779**
21	Found Non- Residential Revenues	$ -	$ -	$ (2,687)	$ (3,706)	$ (1,357)	$ (835)	$ (7,750)
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 2,514,114**	**$ 3,612,005**	**$ 1,337,737**	**$ 910,338**	**$ 8,375,030**

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Vintage 2017 Variance Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ -	$ -	$ 1,847	$ -	$ -	$ 1,847
3	Energy Efficient Lighting	$ -	$ -	$ -	$ 37,745	$ -	$ -	$ 37,745
4	Home Energy Improvement Program	$ -	$ -	$ 0	$ 7,374	$ -	$ -	$ 7,374
5	Multi-Family	$ -	$ -	$ -	$ 19,310	$ -	$ -	$ 19,310
6	My Home Energy Report	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Neighborhood Energy Saver	$ -	$ -	$ -	$ 1,862	$ -	$ -	$ 1,862
8	Residential Energy Assessments	$ -	$ -	$ -	$ 7,682	$ -	$ -	$ 7,682
9	Residential New Construction	$ -	$ -	$ -	$ 15,259	$ -	$ -	$ 15,259
10	Save Energy and Water Kit	$ -	$ -	$ -	$ 25,051	$ -	$ -	$ 25,051
11	Lost Residential Revenues	**$ -**	**$ -**	**$ 0**	**$ 116,131**	**$ -**	**$ -**	**$ 116,131**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ 0**	**$ 116,131**	**$ -**	**$ -**	**$ 116,131**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Business Energy Report	-	-	$ -	$ -	$ -	$ -	$ -
15	Energy Efficiency for Business	-	-	$ -	$ 79,360	$ -	$ -	$ 79,360
16	Energy Efficient Lighting	-	-	$ 0	$ 6,751	$ -	$ -	$ 6,751
17	Small Business Energy Saver	-	-	$ -	$ 31,239	$ -	$ -	$ 31,239
18	Non-Res SmartSaver Performance	-	-	$ -	$ 503	$ -	$ -	$ 503
19	EnergyWise for Business	-	-	$ -	$ 652	$ -	$ -	$ 652
20	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 0**	**$ 118,504**	**$ -**	**$ -**	**$ 118,504**
21	Found Non- Residential Revenues	-	-	-	$ -	$ -	$ -	$ -
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 0**	**$ 118,504**	**$ -**	**$ -**	**$ 118,504**

	DSDR	2017(a)	2018	2019	2020	2021	2022	Total
23	DSDR	-	-	-				$ -

Vintage 2018 Variance Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ -	$ -	$ 5,717	$ -	$ -	$ 5,717
3	Energy Efficient Lighting	$ -	$ -	$ -	$ 61,080	$ -	$ -	$ 61,080
4	Home Energy Improvement Program	$ -	$ -	$ -	$ 19,617	$ -	$ -	$ 19,617
5	Multi-Family	$ -	$ 10,272	$ 34,558	$ 60,834	$ -	$ -	$ 105,664
6	My Home Energy Report	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Neighborhood Energy Saver	$ -	$ -	$ -	$ 3,861	$ -	$ -	$ 3,861
8	Residential Energy Assessments	$ -	$ -	$ -	$ 19,145	$ -	$ -	$ 19,145
9	Residential New Construction	$ -	$ -	$ -	$ 40,282	$ -	$ -	$ 40,282
10	Save Energy and Water Kit	$ -	$ -	$ -	$ 37,602	$ -	$ -	$ 37,602
11	Lost Residential Revenues	**$ -**	**$ 10,272**	**$ 34,558**	**$ 248,138**	**$ -**	**$ -**	**$ 292,968**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ 10,272**	**$ 34,558**	**$ 248,138**	**$ -**	**$ -**	**$ 292,968**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	-	-	-	(30,966)	(62,040)	-	$ (93,006)
15	Non-Residential Smart $aver Prescriptive	-	-	-	(396,968)	(573,019)	-	$ (969,987)
16	Non-Residential Smart $aver Custom	-	-	-	(59,941)	(77,460)	-	$ (137,401)
17	Non-Res SmartSaver Performance	-	-	-	(7,686)	(18,392)	-	$ (26,077)
18	Small Business Energy Saver	-	-	-	(187,918)	(342,804)	-	$ (530,721)
19	EnergyWise for Business	-	-	-	(178)	(389)	-	$ (567)
20	Net Lost Non-Residential Revenues	**0**	**0**	**0**	**(683,658)**	**(1,074,103)**	**0**	**$ (1,757,761)**
21	Found Non- Residential Revenues	-	-	-	8,028	10,510	-	$ 18,538
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ (675,629)**	**$ (1,063,593)**	**$ -**	**$ (1,739,223)**

	DSDR	2016(a)	2017(a)	2018	2019	2020	2021	Total
23	DSDR	-	-	-	$ -			-

Vintage 2019 Variance Lost Revenue kWh $

Line	Residential	2017(a)	2018	2019	2020	2021	2022	Total
1	Energy Efficiency Education Program	$ -	$ -	$ -	$ (6,726)	$ (49,541)	$ 23,094	(33,174)
2	Energy Efficient Appliances and Devices	$ -	$ -	$ (10,449)	$ (15,236)	$ (129,147)	$ 257,520	102,689
3	Energy Efficient Lighting	$ -	$ -	$ (0)	$ 1,800	$ (288,933)	$ 320,586	33,453
4	Multi-Family Energy Efficiency Program	$ -	$ -	$ 11,242	$ (12,249)	$ (134,229)	$ 121,400	(13,835)
5	My Home Energy Report	$ -	$ -	$ -	$ -	$ -	$ -	-
6	Neighborhood Energy Saver	$ -	$ -	$ -	$ (779)	$ (25,350)	$ 24,244	(1,884)
7	Residential Energy Assessments	$ -	$ -	$ -	$ 4,020	$ (58,514)	$ 83,414	28,920
8	Residential New Construction	$ -	$ -	$ -	$ 14,979	$ (122,448)	$ 226,074	118,605
9	Residential Smart $aver®	$ -	$ -	$ -	$ 7,988	$ (42,191)	$ 88,545	54,341
10	Weatherization Pilot	$ -	$ -	$ -	$ 8	$ (1,345)	$ 1,905	568
11	Lost Residential Revenues	**$ -**	**$ -**	**$ 793**	**$ (6,195)**	**$ (851,697)**	**$ 1,146,782**	**$ 289,683**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ 793**	**$ (6,195)**	**$ (851,697)**	**$ 1,146,782**	**$ 289,683**

	Non-Residential	2017(a)	2018	2019	2020	2021	2022	Total
14	Energy Efficient Lighting	$ -	-	1	(76,089)	(276,396)	61,721	(290,763)
15	EnergyWise for Business	$ -	-	20,154	32,954	12,527	9,754	75,389
16	Small Business Energy Saver	$ -	-	28,842	(238,581)	(1,062,785)	277,956	(994,569)
17	Smart $aver(R) Non Residential Performance	$ -	-	-	(10,471)	(39,610)	15,731	(34,350)
18	Smart $aver® Non Residential Prescriptive	$ -	-	(135,929)	(652,215)	(1,830,096)	389,547	(2,228,693)
19	Smart Saver® Non-Residential - Custom	$ -	-	-	(101,411)	(379,667)	156,465	(324,612)
20	Total Lost Revenues	**$ -**	**$ -**	**$ (86,932)**	**$ (1,045,813)**	**$ (3,576,026)**	**$ 911,173**	**$ (3,797,598)**
21	Found Non- Residential Revenues	-	-	-	1,174	3,523	(835)	3,862.18
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ (86,932)**	**$ (1,044,639)**	**$ (3,572,503)**	**$ 910,338**	**$ (3,793,736)**

Evans Exhibit 3

Duke Energy Progress
Actual Program Costs for Vintage Years 2016 - 2020
Docket Number E-2, Sub 1273

			Carolinas System - 12 Months Ended 12/31/2016	Carolinas System - 12 Months Ended 12/31/2017	Carolinas System - 12 Months Ended 12/31/2018	Carolinas System - 12 Months Ended 12/31/2019	Carolinas System - 12 Months Ended 12/31/2020
1	Appliance Recycling Program		$ (137,009)	$ 5,586	$ -	$ -	$ -
2	Appliances and Devices		$ -	$ -	$ -	$ 2,160,799	$ 3,051,854
3	Residential Service – Smart $aver		$ 6,013,170	$ 6,961,463	$ 7,168,833	$ 6,411,758	$ 6,517,089
4	Energy Efficient Lighting		$ 15,552,184	$ 10,904,279	$ 8,752,062	$ 11,993,695	$ 5,385,332
5	Neighborhood Energy Saver		$ 2,052,535	$ 1,781,211	$ 1,845,739	$ 1,671,298	$ 401,046
6	Residential New Construction		$ 9,405,615	$ 11,671,724	$ 13,189,949	$ 15,113,951	$ 18,861,261
7	Residential Energy Efficient Benchmarking		$ -	$ -	$ -	$ -	$ -
8	Residential Home Advantage		$ -	$ -	$ -	$ -	$ -
9	Energy Education Program for Schools		$ 827,497	$ 835,991	$ 676,815	$ 747,483	$ 388,273
10	Multi-Family Energy Efficiency		$ 2,045,220	$ 2,514,413	$ 2,409,743	$ 2,156,484	$ 892,251
11	My Home Energy Report		$ 5,890,093	$ 6,753,153	$ 7,687,891	$ 6,299,307	$ 7,369,336
12	Residential Energy Assessments		$ 1,417,924	$ 1,863,486	$ 1,851,965	$ 2,113,798	$ 2,160,729
13	Save Energy and Water Kit		$ 674,538	$ 888,869	$ 825,279	$ -	$ -
14	Low Income Weatherization Pilot		$ -	$ -	$ -	$ 27,356	$ 51,370
15	Business Energy Report		$ 69,516	$ 20,330	$ -	$ -	$ -
16	Energy Efficiency for Business		$ 14,159,310	$ 21,749,807	$ 13,690,077	$ -	$ -
17	Energy Efficient Lighting		$ 1,889,694	$ 1,324,943	$ 1,063,434	$ 1,453,336	$ 610,362
18	Non-Residential Smart $aver Custom		$ -	$ -	$ -	$ 2,776,482	$ 3,514,807
19	Non-Residential Smart $aver - Prescriptive		$ -	$ -	$ -	$ 7,877,838	$ 7,863,953
20	Non-Residential Smart $aver Performance Incentive		$ -	$ 147,160	$ 201,559	$ 267,186	$ 386,339
21	Small Business Energy Saver		$ 9,336,274	$ 8,770,755	$ 8,858,213	$ 7,301,790	$ 5,004,816
22	EnergyWise Home		$ 13,633,666	$ 13,125,314	$ 14,619,512	$ 15,117,800	$ 14,221,860
23	EnergyWise for Business		$ 1,112,815	$ 1,390,549	$ 2,108,030	$ 2,412,880	$ 1,896,524
24	Commercial, Industrial, & Governmental Demand Response		$ 1,615,703	$ 1,523,514	$ 1,692,473	$ 1,715,824	$ 1,837,718
25	**Total Energy Efficiency & Demand Side Program Cos**	(Lines	**$ 85,558,746**	**$ 92,232,546**	**$ 86,641,573**	**$ 87,619,068**	**$ 80,414,918**
26	NC Allocation Factor for EE programs	Listeba	85.44%	85.51%	85.56%	85.63%	85.75%
27	NC Allocation Factor for DSM programs	Listeba	86.17%	86.16%	86.53%	86.69%	86.34%

			NC Allocated - 12 Months Ended 12/31/2016 (1)	NC Allocated - 12 Months Ended 12/31/2017 (1)	NC Allocated - 12 Months Ended 12/31/2018 (1)	NC Allocated - 12 Months Ended 12/31/2019 (1)	NC Allocated - 12 Months Ended 12/31/2020 (1)
28	Appliance Recycling Program	1 * Lin	$ (117,059)	$ 4,776.58	$ -	$ -	$ -
29	Appliances and Devices	2 * Lin	$ -	$ -	$ -	$ 1,850,371.47	$ 2,617,099.41
30	Residential Service – Smart $aver	3 * Lin	$ 5,137,557	$ 5,952,627.50	$ 6,133,715.68	$ 5,490,622.77	$ 5,588,691.49
31	Energy Efficient Lighting	4 * Lin	$ 13,287,540	$ 9,324,062.29	$ 7,488,339.94	$ 10,270,639.05	$ 4,618,160.26
32	Neighborhood Energy Saver	5 * Lin	$ 1,753,654	$ 1,523,082.68	$ 1,579,230.00	$ 1,431,193.32	$ 343,914.32
33	Residential New Construction	6 * Lin	$ 8,036,009	$ 9,980,291.02	$ 11,285,434.67	$ 12,942,627.79	$ 16,174,364.35
34	Residential Energy Efficient Benchmarking	7 * Lin	$ -	$ -	$ -	$ -	$ -
35	Residential Home Advantage	8 * Lin	$ -	$ -	$ -	$ -	$ -
36	Energy Education Program for Schools	9 * Lin	$ 707,000	$ 714,841.32	$ 579,088.78	$ 640,097.22	$ 332,960.83
37	Multi-Family Energy Efficiency	10 * Li	$ 1,747,403	$ 2,150,031.73	$ 2,061,796.67	$ 1,846,676.22	$ 765,144.36
38	My Home Energy Report	11 * Li	$ 5,032,403	$ 5,774,505.65	$ 6,577,826.06	$ 5,394,326.86	$ 6,319,531.14
39	Residential Energy Assessments	12 * Li	$ 1,211,452	$ 1,593,434.59	$ 1,584,557.04	$ 1,810,122.41	$ 1,852,920.50
40	Save Energy and Water Kit	13 * Li	$ 576,315	$ 760,056.35	$ 706,115.88	$ -	$ -
41	Weatherization - Electric	14 * Li	$ -	$ -	$ -	$ 23,426.11	$ 44,052.45
42	Business Energy Report	15 * Li	$ 59,393	$ 17,383.70	$ -	$ -	$ -
43	Energy Efficiency for Business	16 * Li	$ 12,097,491	$ 18,597,886.97	$ 11,713,348.28	$ -	$ -
44	Energy Efficient Lighting	17 * Li	$ 1,614,525	$ 1,132,935.88	$ 909,883.35	$ 1,244,545.00	$ 523,412.06
45	Non-Residential Smart $aver Custom	18 * Li	$ -	$ -	$ -	$ 2,377,603.24	$ 3,014,102.12
46	Non-Residential Smart $aver Prescriptive	19 * Li	$ -	$ -	$ -	$ 6,746,080.63	$ 6,743,686.79
47	Non-Residential Smart $aver Performance Incentive	20 * Li	$ -	$ 125,834.21	$ 172,455.95	$ 228,801.53	$ 331,302.53
48	Small Business Energy Saver	21 * Li	$ 7,976,765	$ 7,499,722.72	$ 7,579,163.64	$ 6,252,789.54	$ 4,291,850.84
49	EnergyWise Home	22 * Li	$ 11,747,963	$ 11,308,498.16	$ 12,650,326.09	$ 13,105,769.51	$ 12,279,063.40
50	EnergyWise for Business	23 * Li	$ 958,899	$ 1,198,068.36	$ 1,824,087.26	$ 2,091,749.23	$ 1,637,446.74
51	Commercial, Industrial, & Governmental Demand Res	24 * Li	$ 1,392,232	$ 1,312,628	$ 1,464,504	$ 1,487,465	$ 1,586,674
52	**Total Energy Efficiency & Demand Side Program Cos**	(Lines 2	**$ 73,219,542**	**$ 78,970,668**	**$ 74,309,873**	**$ 75,234,907**	**$ 69,064,377**

(1) NC Allocations are based on annual weighted average, which are employed in the allocation of Utility Cost Test (UCT) results for PPI determination. This differs from the allocation used in Miller Exhibit 2, which allocates actual costs by month.

Evans Exhibit 4
Duke Energy Progress, LLC
January - December 2020 Actuals
January 2021 - December 2022 Estimates
Docket Number E-2, Sub 1273
North Carolina Found Revenues

	Actual/Reported KWH					Estimated KWH		
	2016	2017	2018	2019	2020	2021	2022	Decision Tree Node
Economic Development	40,751,172	217,748,650	43,971,258	53,541,120	54,029,490	-	-	Box 5 - exclude
Lighting								
Residential	21,158	18,164	15,302	872	525	525	525	Box 6 - include
Non Residential (Regulated)	328,140	304,084	111,625	10,984	23,372	23,372	23,372	Box 6 - include
MV to LED Credit - Residential (Regulated)	(460,649)	(456,768)	(2,478)	(1,589)	(543)	(2,994)	(2,994)	Box 6 - include
MV to LED Credit - Non-Residential (Regulated)	(105,415)	(105,982)	(919)	(1,602)	(322)	(1,775)	(1,775)	Box 6 - include
Total KWH	40,534,406	217,508,148	44,094,788	53,549,785	54,052,522	19,128	19,128	
Total KWH Included	(216,766)	(240,502)	123,530	8,665	23,032	19,128	19,128	
Total KWH Included (net of Free Riders 15%)	(184,251)	(204,427)	105,001	7,365	19,577	16,259	16,259	
Annualized Found Revenue - Non Residential	$ 113,553	$ 106,296	$ 55,439	$ 4,880	$ 12,028	$ 11,399	$ 11,422	
Annualized Found Revenue - Residential	$ (279,063)	$ (297,693)	$ 8,353	$ (492)	$ (13)	$ (1,713)	$ (1,737)	

	2016	2017	2018	2019	2020	2021	2022
Vintage 2016 - Non Res	$ 68,561	$ 113,553	$ 69,282	$ 22,835	$ -	$ -	$ -
Vintage 2017 - Non Res		$ 72,644	$ 106,296	$ 106,296	$ 32,792	$ -	$ -
Vintage 2018 - Non Res			$ 31,247	$ 55,439	$ 36,959	$ -	$ -
Vintage 2019 - Non Res				$ 2,687	$ 3,706	$ 1,357	$ 835
Vintage 2020 - Non Res					$ 5,064	$ 9,609	$ 9,609
Vintage 2021 - Non Res						$ 6,175	$ 11,399
Vintage 2022 - Non Res							$ 317
Net Negative Found Revenues to Zero*	-	-	-	-	-	-	-
Subtotal - Non Res	**$ 68,561**	**$ 186,197**	**$ 206,825**	**$ 187,256**	**$ 78,520**	**$ 17,141**	**$ 22,160**
Vintage 2016 - Res	$ (150,940)	$ (279,063)	$ (76,403)	$ (20,187)	$ -	$ -	$ -
Vintage 2017 - Res		$ (160,772)	$ (199,283)	$ (173,386)	$ (78,746)	$ -	$ -
Vintage 2018 - Res			$ 4,903	$ 8,353	$ 5,569	$ -	$ -
Vintage 2019 - Res				$ (173)	$ (402)	$ (223)	$ (155)
Vintage 2020 - Res					$ (26)	$ 12	$ 12
Vintage 2021 - Res						$ (928)	$ (1,713)
Vintage 2022 - Res							$ (941)
Net Negative Found Revenues to Zero*	150,940	439,836	270,784	185,393	73,606	1,138	2,797
Subtotal - Residential	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Found Revenues	**$ 68,561**	**$ 186,197**	**$ 206,825**	**$ 187,256**	**$ 78,520**	**$ 17,141**	**$ 22,160**

* Eliminates the inclusion of total negative found revenues at the Residential level

I/A

Evans Exhibit 5

Duke Energy Progress
System Event Based Demand Response January 1, 2020 - December 31, 2020
Docket Number E-2, Sub 1273

Date	State	Program Name	Event Trigger	Customers Notified /Switches Dispatched	MW Reduction
6/4/2020	NC&SC	DSDR	DMS Testing	NA	107.8
7/15/2020	NC & SC	DEP EnergyWise Home	System Test	9,759/7,227	12.2
7/16/2020	NC&SC	DSDR	DMS Testing	NA	123.2
7/17/2020	NC and SC	DEP DRA	Tariff - Minimum Event	22 Customers / 87 Sites	25.4
7/17/2020	NC & SC	DEP EnergyWise Home	System Test	9,753/7,342	11.4
7/27/2020	NC & SC	DEP EnergyWise Home	System Test	10,958/8739	13.6
7/30/2020	NC&SC	DSDR	DMS Testing	NA	114.5
8/27/2020	NC&SC	DEP EnergyWise Home	System Test	12,625/9,502	15.0
8/27/2020	NC&SC	DSDR	DMS Testing	NA	167.5
9/3/2020	NC&SC	DEP EnergyWise Home	System Test	13,125/9,853	18.0
9/3/2020	NC&SC	DSDR	DMS Testing	NA	178.4
9/14/2020	NC&SC	DSDR	Capacity Needs	NA	157.9
11/19/2020	NC&SC	DSDR	Capacity Needs	NA	129.8
12/8/2020	NC&SC	DSDR	DMS Testing	NA	92.5
12/10/2020	NC&SC	DSDR	DMS Testing	NA	127.9
12/30/2020	NC&SC	DEP EnergyWise Home	Capacity	13,150/18,300	14.1

Energy Efficient Appliances and Devices

A. Description

The Energy Efficient Appliances and Devices program ("Program") offers a variety of measures to eligible Duke Energy Progress, LLC (the "Company") customers to facilitate a reduction in their energy consumption. The Program includes offers for lighting measures, smart thermostats, water measures and other energy efficient measures.

Online Savings Store-

The Duke Energy Savings Store ("Store") is an on-demand ordering platform enabling eligible customers to purchase a variety of energy efficient products for their home. The incentive levels vary by product, and the customer pays the difference. Various promotions run throughout the year, offering customer reduced prices as well as shipping promotions, ranging from free to a reduced flat rate price.

The maximum number of incented products are listed below with the associated limits (per account)

- LED lighting, 36 per account.
    - LED lighting product offering is comprised of - reflectors, globes, candelabra, 3-way, and dimmable bulbs. The incentive levels vary by bulb type.
- Smart thermostats, 2 total
- Water measures, 3 total
- Smart Strips, 4 total
- LED fixtures (direct wires, portable, & outdoor photocell), limit 8 total
- Small appliance, dehumidifiers & air purifiers, limit 2 each total

Customers may choose to order additional products without the Company's incentive.

Product pages include application photos, product images, product specifications, purchase limits, and program pricing. Customers may place items in their shopping carts to purchase at a later time. Customers can pay for their purchases with a credit card or by check.

Save Energy and Water Kit Program

The Save Energy and Water Kit Program ("SEWK") launched in November 2015. The Program is designed to increase the energy efficiency of residential customers by offering customers energy efficient water fixtures and insulating pipe tape for use within their homes.

The SEWK program is offered through a selective eligibility process, enabling eligible customers to request a kit and have it shipped directly to their homes. Customers owning and living in a single-family home with an electric water heater who have not received similar measures through another Company-offered energy efficiency program are eligible for the program. Kits are available in two sizes for homes with one or more full bathrooms and contain varying quantities of shower heads, bathroom aerators, kitchen aerator and insulating pipe tape. Program participants are eligible for one kit shipped free of charge to their home.

Customers are pre-screened based on the eligibility requirements. Marketing channels include both a direct mail business reply card (BRC) and direct email. Customers receiving the BRC may choose to return the BRC, navigate to a redemption website listed on the card, or call a toll-free number to take advantage of the offer. Customers receiving a direct email simply click on a redemption link to redeem the offer online. Upon receiving the order from the customer through one of the methods above, Energy Federation Inc. (EFI), the program vendor, will ship the pre-determined kit to the customer. Due to the unique eligibility requirements of this program, direct mail (BRCs) and direct email are the only two methods being used to solicit customers for participation.

The program has a website in place that customers can access to learn more about the program or to watch videos to aid in installing the kit measures.

Energy Efficient Appliances and Devices

Audience

The Program is available to customers residing in a single-family home with an electric water heater who have not received similar measures through another Company-offered energy efficiency program.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	23,788	18,784	-5,004
Savings (MW)	7.92	2.05	-5.87
Participants		338,776	
Program Expenses		$3,051,854	

D. Qualitative Analysis

Online Savings Store

Highlights
The Online Savings Store was launched in DEP in Q3 2019 and provides an ecommerce platform that allows customers to purchase a variety of energy efficient products, including LEDs, smart thermostats, smart strips and more, at any time—delivered to their home. In 2020, the program has delivered 94,427 bulbs; 7,313 smart thermostats; 1,943 smart strips; 118 water products, 199 LED fixtures, and 5 small appliances (dehumidifiers) to customers.

Issues
Educating and bringing awareness to the variety of products on the Store to eligible customers.

Potential Changes
The program continues to explore opportunity to facilitate ease of use shopping online as well as additional product offerings for consideration to enhance energy savings.

Save Energy and Water Kit

In 2020, the Program distributed over 234,000 water measures in over 24,000 kits to Duke Energy Progress customers in the Carolinas. These kits delivered approximately 49,488 bath aerators, 24,744 kitchen aerators, 36,819 showerheads, and 123,720 feet of pipe insulation.. Upgraded showerheads accounted for 16% of all showerheads shipped in 2020.

Issues

Potential Changes
The program will be enhancing the standard showerhead included in the kit in effort to increase installation rates and improve customer satisfaction in 2021. Additionally, the program continues to explore opportunities to consider new measures for replacement or upgrade.

E. Marketing Strategy

Online Savings Store

The marketing efforts for the store can include the following:

- bill messages
- bill inserts

- email campaigns
- direct mail
- and other digital media channels

Awareness and education will continue to be a focus in collateral messages to eligible customers, as well as highlighting great pricing and other promotional offerings such as free shipping.

Save Energy and Water Kit

The overall strategy of the program is to reach residential customers who have not adopted low flow water devices.

Both direct mail marketing in the form of BRCs and direct email are the current marketing channels being utilized by this program in the Carolinas. O Email solicitation and online ordering continue to grow. As a result, the paper and cost associated with traditional mail solicitations continues to decline.

F. Evaluation, Measurement and Verification

Future evaluations for the DEC Online Savings Store/Marketplace Program is tentatively scheduled for a final report date in the fourth quarter of 2021.

Save Energy & Water

The final evaluation was delivered in 2020 and a revised report to account for corrections to the showerheads was presented at the October 2020 Collaborative.

The next evaluation is scheduled to begin activities in mid-2021, with a final report scheduled for mid-2022.

Energy Efficiency Education Program

A. Description

The Energy Efficiency Education Program ('Program') is an energy efficiency program available to students in grades K-12 enrolled in public and private schools who reside in households served by Duke Energy Progress in North and South Carolina. The current curriculum administered by The National Theatre for Children ("NTC") provides performances in elementary, middle and high schools.

The Program provides principals and teachers with an innovative curriculum that educates students about energy, resources, the relationship between energy and resources, ways energy is wasted and ways they can be more energy efficient. The centerpiece of the curriculum is a live theatrical production focused on concepts such as energy, renewable fuels and energy efficiency and performed by two professional actors. Teachers receive supportive educational materials for their classrooms and assignments for students to take home. The workbooks, assignments, and activities meet state curriculum requirements.

School principals are the main point of contact for scheduling their school's performance. Once the principal confirms the performance date and time, all materials are scheduled for delivery two weeks prior to the performance. Materials include school posters, teacher guides, and classroom and family activity books.

Students are encouraged to compete a request form with their family (found in their classroom and family activity book, as well as online), to receive an Energy Efficiency Starter Kit. The kit contains specific energy efficiency measures to reduce home energy consumption. It is available at no cost to eligible Duke Energy customer households at participating schools.

In 2020, many of the aspects of the Energy Efficiency Education program were impacted as a result of the COVID-19 pandemic. All in-school performances ceased as of March 13, 2020. This resulted in the program pivoting and offering livestream performances so school and students could still participate. More details are provided below in section D.

Audience

Eligible participants include the Company's residential customers, with school-age children enrolled in public and private schools, who reside in households served by Duke Energy Progress.

B &C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/30/2020	Variation
Savings (MWH)	3,873	1,455	-2,418
Savings (MW)	0.46	0.17	-0.29
Participants		4,382	
Program Expenses		$388,273	

D. Qualitative Analysis

Highlights

The Company is supporting arts and theatre in schools while providing an important message about energy efficiency for students through an innovative delivery channel. Enhancing the message with a live theatrical production captivates the students' attention and reinforces the classroom curriculum materials provided.

Energy Efficiency Education Program

The spring semester of the 2019-2020 school year brought on unprecedented challenges related to the COVID-19 pandemic forcing schools to close and revert to virtual learning. As a result, live performances ceased on March 13, 2020. Overall, 23 scheduled schools representing close to 7,000 children had to have their performance cancelled. This also impacted the ability to the program administrator to continue outreach to additional schools that may have been interested in having a performance in the Spring months. Despite this, the program provided these schools with an educational video as well as the educational materials that could be accessed via the program website.

After the conclusion of the spring semester, the program began to develop a plan to continue to offer these educational performances via online livestream for all three levels of schooling for the Fall semester. Given the uncertainty around whether or not a school is remote learning or using a hybrid plan, the program would be able to offer time slots to schools to view a live host providing educational information and narrating between four different segments of the theatrical performance that's normally given in schools by professional acting troupes.

Consistent with past years, each performance had content that was appropriate with its educational level. Elementary schools were able to view livestream performances of "Space Station Conservation"; "The Conservation Crew" was made available to Middle schools and High Schools were able to watch "Your Plant, Your Future". Students and teachers also had access to a Q&A with the host and an e-learning package that includes games, quizzes and lesson plans for the class that reinforce concepts from the show.

In addition, students and teachers will still have the ability to request an Energy Efficient kit and download the program's educational gaming app, Kilowatt Krush.

Overall in 2020, a total of 196 schools participated in the program in the Company's DEP service territory, reaching approximately 64,572 students and spurring the distribution of 4,382 kits.

Once an eligible customer submits a completed energy efficiency, the Energy Efficiency Starter Kit is shipped for delivery within two to four weeks.

In order to help encourage student participation, NTC would reward schools $250 for every 100 Energy Efficient kit requests. Additionally, various rewards for teachers and participating families were offered to encourage additional kit requests.

Updates

The Company continues to enhance the Program by the following:

- Introducing new productions each school year to refresh and refocus the materials and scripts to keep participating schools engaged.
- Promoting the program through social media to encourage awareness, recognition and participation.
- Partnering with Duke Energy Account and District Managers to leverage existing relationships in the community to develop positive media stories while encouraging kit sign ups.
- Offering teacher satisfaction survey evaluations after the performances for all school levels. Survey data from January through December indicated 87% of teachers surveyed had an overall satisfaction of rating of at least 8 on a scale of 1 to 10.
- Enhancing the offering by providing educational materials for all student households, but particularly those that have already received the current Energy Efficiency Starter Kit as well as non-Duke Energy customer student households; both of which are ineligible for an EE Starter Kit.
- Inclusion of the Kilowatt Krush mobile gaming application that will allow users to learn about smart energy use and conservation through an engaging arcade of action-packed, energy themed games. Students build and customize virtual houses in the neighborhood of their choice while learning about energy efficiency and safety education.

E. Marketing Strategy

The National Theatre for Children is responsible for all marketing campaigns and outreach. The marketing channels may include but are not limited to the following:

- Direct mail (letters to school administrators)
- Email
- In-Person
- Program Website
- Events or assemblies
- Printed materials for classrooms
- Social media promotions

These marketing efforts engage students and their families in energy conservation behavior and provide energy saving opportunities through the Energy Efficiency Starter kits.

F. Evaluation, Measurement and Verification

An evaluation report covering an evaluation period of August 2017 through July 2018 was completed in 2019. Evaluation work is currently underway for the period covering August 2019 – July 2020. The final report is scheduled to be completed in the third quarter of 2021.

Energy Efficient Lighting

A. Description

The Energy Efficient Lighting Program partners with lighting manufacturers and retailers across North and South Carolina to provide marked-down prices at the register to DEP customers purchasing energy efficient lighting products. Participation continues to be high, and the success of this Program can be attributed to high customer interest in energy efficiency, increased knowledge of the benefits associated with energy efficient lighting, and effective promotion of the Program.

The Energy Efficient Lighting Program continues to incentivize customers to adopt a wide range of energy efficient lighting products, including LEDs and fixtures. Customer education is imperative to ensure customers are purchasing the right bulb for the application, to obtain high satisfaction with lighting products and to encourage subsequent purchases.

Audience

The Program is available to residential customers. Customers simply shop for their lighting needs at a wide variety of retail locations. Incentives are provided at the point of purchase.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/30/2020	Variation
Savings (MWH)	11,336	23,936	12,600
Savings (MW)	2.09	4.42	2.33
Participants		1,463,047	
Program Expenses		$5,995,694	

D. Qualitative Analysis

Highlights

In 2020, the Program incentivized a total of 1,463,047 measures, including 1,208,839 LEDs and 254,208 fixtures. The DEP Energy Efficiency Program had 15 lighting retail channels actively participating in 2020. While the top five retail channels account for 84% of the Program sales, all retail channels allow access to the Program for a diverse and geographically wide population of DEP customers. The Program is designed to reach 90% of customers within 30 miles of a participating retail location.

The Program continues to operate efficiently with 85% of overall Program costs going directly to customers in the form of incentives. Additionally, a total of 14% of the Program costs are spent on implementation and administration of the Program, including management fees. Therefore, only 1% is spent on marketing, labor and other costs.

Issues

Despite continued success in 2020, potential effects of the COVID-19 pandemic remain on the program's radar. Based on experiences in 2020, impacts included and could continue to include:

- temporary store closures or limited hours impacting opportunity for the program.
- depending on COVID conditions, in-field store visits (training of store staff, proper placement of POP) may be paused to limit exposure of field team in stores for not only their safety, but that of store patrons and staff.
- Continued suspension of in-store and community events promoting the program and its product offering.

The Program continues to monitor this closely while adhering to Duke Energy Customer Engagement Safety Protocols.

Potential Changes

The Program will continue to evaluate the market and adjust products and incentive levels as necessary, focusing on specialty applications and strategically targeting underserved customers through select channels and events.

E. Marketing Strategy

The Program continued marketing efforts in 2020 through the following:

- Point of Purchase materials at the participating retailer locations
- Duke Energy Progress and Program website
- General Awareness Email Campaigns
- Cross-Promotional Opportunities in via internal marketing channels (Other Programs, Residential Newsletters)

In general, marketing efforts are designed to create customer awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of Program participation.

As a result of the COVID-19 pandemic, the program has suspended its normal events at key retailers as well as community outreach events (national night out, cultural events, etc.) indefinitely. This decision will be evaluated on a regular basis with activities only resuming when appropriate conditions permit.

F. Evaluation, Measurement and Verification

No evaluation activities occurred in 2020. The evaluation for the DEP Retail Lighting Program are tentatively scheduled for a final report date in the fourth quarter of 2021.

EnergyWise Home Program

A. Description

EnergyWise Home ("Program") allows Duke Energy Progress, LLC ("Company") to:

Option 1- install load control switches at the customer's premise to remotely control the following
residential appliances:

- Central air conditioning or electric heat pumps
- Auxiliary strip heat on central electric heat pumps (Western Region only)
- Electric water heaters (Western Region only)

AND/OR

Option 2- enroll a customer's qualified smart thermostat

For each of the appliance options mentioned in item 1, Program participants receive an initial one-time bill credit of $25 following the successful installation and testing of load control device(s) and an annual bill credit of $25 in exchange for allowing the Company to control the listed appliances.

For each customer's premise that enrolls their qualified smart thermostat the Program participants receive a one-time initial e-gift card of $75 following the successful enrollment and an annual e-gift card of $25 in exchange for allowing the Company to control the enrolled thermostat(s).

Customers cannot be enrolled in both options for the same appliance.

Audience

The Program is available to all of the Company's residential customers residing in owner-occupied or leased, single-family, or multi-family residences. Water heater option is only available in the Western Region only.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	N/A	N/A	N/A
Savings (MW)	27.63	17.81	-9.82
Participants (258,673Devices)		15,862	
2020 Program Expenses		$14,221,860	

1. MW Savings at the generator include Summer MW for AC participants and Winter MW for Heat Strip and Water Heater Participants

D. Qualitative Analysis

Highlights

After receiving regulatory approval from both the North Carolina Utilities Commission and the South Carolina Public Service Commission late in 2008, the Company officially launched the Program in April of 2009. Comverge, which specializes in integrated demand response solutions, was awarded the contract for the load management system software and switch technology, and GoodCents was awarded the contract for enrollment, field implementation, and call center support.

EnergyWise Home Program

Smart Thermostat Introduction/Option

Winter-focused option was made available November 13, 2020, in North Carolina and a few weeks later in South Carolina as well.

E. Marketing Strategy

The Company continues to deploy Program marketing efforts through various channels that include but are not limited to the following:

- Door-to-door canvassing
- Outbound calling
- Duke Energy Progress website
- Email
- Direct mail (letters and postcards to qualifying customers)

Additional detailed program information is located at https://www.duke-energy.com/home/products/energywise-home

F. Evaluation, Measurement and Verification

EnergyWise Home completed a 2019 summer impact study using AMI data (for the first time) and traditional data loggers. The Final Evaluation Study was completed Summer 2020 and presented at the 2nd Quarter Carolinas Collaborative.

Guidehouse estimated impacts at the two cycling levels: 65% cycling impacts estimated at 1.12 kw; 100% cycling impacts estimated at 1.81 kW. Full capacity was estimated at 1.44 kW per participant at 65% cycling and 2.29 kW per participant at 100% cycling.

Evaluation activities are currently underway for the DEP EnergyWise Winter evaluation.

Income-Qualified Programs

A. **Description**

The purpose of Income-Qualified Programs (Program) for DEP is to assist low income customers with installing energy efficiency measures in their homes that will help reduce their energy cost. There are two offerings currently in the Program:

- Neighborhood Energy Saver (NES)
- Low-Income Weatherization Pay for Performance Pilot

Neighborhood Energy Savers

The purpose of Duke Energy Progress's ("DEP") Neighborhood Energy Saver program (the "Program") is to reduce energy usage through the direct installation of energy efficiency measures within the households of income-qualified residential customers. The Program utilizes Honeywell Building Solutions, which was awarded the contract through a competitive bid process, to (1) to identify appropriate energy conservation measures through an on-site energy assessment of the residence, (2) to install a comprehensive package of energy conservation measures at no cost to the customer, and (3) to provide one-on-one energy education. Program measures address end-uses in lighting, refrigeration, air infiltration and HVAC applications.

Program participants receive a free energy assessment of their homes followed by a recommendation of energy efficiency measures to be installed at no cost to the resident. A team of energy technicians install applicable measures and provide one-on-one energy education about each measure, emphasizing the benefit of each and recommending behavior changes to reduce and control energy usage. The goal is to serve a minimum of 4,500 households each year. NES participants may have the measures listed below installed in their homes based on the opportunities identified during the energy assessment.

1. Energy Efficient Bulbs - Up to 15 energy efficient bulbs (LEDs) to replace incandescent bulbs
2. Electric Water Heater Wrap and Insulation for Water Pipes
3. Electric Water Heater Temperature Check and Adjustment
4. Water Saving Faucet Aerators - Up to three faucet aerators
5. Water Saving Showerheads - Up to two showerheads
6. Wall Plate Thermometer
7. HVAC Winterization Kits – Up to three kits for wall/window air conditioning units will be provided along with education on the proper use, installation and value of the winterization kit as a method of stopping air infiltration.
8. HVAC Filters - A one-year supply of HVAC filters will be provided along with instructions on the proper method for installing a replacement filter.
9. Air Infiltration Reduction Measures - Weather stripping, door sweeps, caulk, foam sealant and clear patch tape will be installed to reduce or stop air infiltration around doors, windows, attic hatches and plumbing penetrations.

Pay for Performance

The Low-Income Weatherization Pay for Performance Pilot Program (Pilot) in Buncombe County North Carolina provides monetary incentives to local weatherization assistance providers and other non-profit organizations involved in weatherizing residential low-income households. Incentive payments is based on the kilowatt-hours (kWhs) saved from the additional Energy Efficiency (EE) measures installed. EE measures such as attic or wall insulation, air sealing, refrigerator replacement, lighting, or water measures could qualify for the incentives. The Pilot seeks to provide additional funding to weatherization assistance organizations that would allow them to extend EE more deeply into the projects they undertake. This is likely to include the deployment of additional EE measures that may or may not be covered by traditional weatherization assistance organizational funding, but it could also include weatherization of additional homes. The Pilot is proposed for a 36-month period and limited to dwellings in the Buncombe County area.

Income-Qualified Programs

Audience

Neighborhood Energy Savers

The Program is designed for individually metered residential homeowners and tenants within DEP. Implementation of the program is done in neighborhoods designated by DEP. Income-eligible neighborhoods must have at least 50% of households with income equal to or less than 200% of the poverty level set by the U.S. Department of Energy. Participants are only able to participate in the Program once.

Pay for Performance

Eligible participants will be selected by participating weatherization assistance and other non-profit organizations using current United States Department of Energy Low Income Home Energy Assistance Program grant requirements (must be less than 200% of the federal poverty guidelines, with the number of disabled, elderly, and minors in the household taken into consideration, as well as a high energy burden).

B & C. Impacts, Participants and Expenses

Neighborhood Energy Saver

2020 YTD Results	Annual Forecast	Actual at 12/30/2020	Variation
Savings (MWH)	2,280	505	-1,774
Savings (MW)	0.35	0.07	-0.28
Participants		617	
2020 Program Expenses		$ 401,046	

Weatherization - Electric

2020 YTD Results	Annual Forecast	Actual at 12/30/2020	Variation
Savings (MWH)	0	108	108
Savings (MW)	0.00	0.02	0.02
Participants		1,067	
2020 Program Expenses		$ 51,370	

D. Qualitative Analysis

Highlights

Neighborhood Energy Savers

After receiving regulatory approval from both the North Carolina Utilities Commission and the South Carolina Public Service Commission in the fall of 2009, the Program was officially launched by the Company in November 2009. The yearly goal has been to serve a minimum of 4,500 households. Honeywell Building Solutions was awarded the contract through a competitive bid process to administer the Program.

The Program started 2020 offering free walk-through energy assessments and installing measures in the homes of customers in an Erwin NC neighborhood. Work stopped in March 2020 due to the Covid-19 virus pandemic and the program is still waiting on authorization to resume. Work is anticipated to resume in the first quarter of 2021.

The program has been very successful and widely accepted by the eligible Duke Energy Progress

customers. Nearly 70 percent of the eligible customers in the neighborhoods where the program has been offered have participated.

Pay for Performance

The Program received North Carolina Utility Commission approval on November 27, 2018. Since receiving program approval two vendors have been participating in the program. Community Action Opportunity signed a contract on January 28, 2019 and Green Built Alliance did the same on April 24, 2019. Initial orientation and startup went very well with both vendors and both vendors are regularly submitting invoices for incentive payments. Both vendors stopped work in March 2020 due to the Covid-19 virus but resumed their field work in June 2020. Since returning to field operation the vendors have experienced minimal Covid-19 issues. The program has had good participation and both vendors see themselves increasing their level of participation in the future.

Since inception and through December 2020 the program has paid $38,288.36 in rebates; served 203 homes; and rebated 2,441 measures.

Issues

Neighborhood Energy Savers

The program continues to operate with minimal issues. The implementers are constantly striving to install the best quality measures and to use techniques that will motivate better customer behavior responses and participation.

Pay for Performance

The Program started off smoothly without any major issues. During the initial stages Green Built Alliance experienced challenges verifying client eligibility. Also, the measures they have been able to seek incentive payments for have been limited because of the skills of the mostly volunteer workforce they use. Otherwise there are no issues of concern.

Potential Changes

The NES Program received authorization to begin offering in 2020 some additional measures to income-qualified customers with high energy burdens in the designated NES neighborhoods. This addition to the program is ready to begin as soon as the program resumes its field operation and has an annual goal of 640 homes. Based on the opportunities identified during the energy assessment the customers could be eligible to receive the following measures:

1. Attic insulation
2. Duct Sealing
3. Air Sealing w/Blower Door
4. Floor/Belly Insulation in Mobile Homes
5. Smart Thermostat

E. Marketing Strategy

Neighborhood Energy Savers

Current methods of marketing the program have been very successful in driving participation. The Company will continue the following marketing strategies in 2018:

Direct mail (letters and postcards to qualifying customers)
Secure local support from community leaders and organizations

Income-Qualified Programs

Community outreach events
Publicized kickoff events
Door-to-door canvassing

These marketing efforts are designed to create customer awareness of the Program, educate customers on energy saving opportunities and emphasize the convenience of Program participation.

F. Evaluation, Measurement and Verification

No evaluation activities for Pay for Performance was conducted in 2020.

The previous evaluation for the Neighborhood Energy Saver portion of the Program was completed late in the fourth quarter of 2019. The next evaluation, which will cover the period July 2018 –June 2019, is scheduled to begin in the first quarter of 2021. The final report is scheduled for completion in the fourth quarter of 2021.

My Home Energy Report

A. Description

My Home Energy Report ("MyHER") helps Duke Energy Progress ("DEP") customers put their energy use in perspective with simple and easily understood graphics that compare customers' energy use with homes of similar size, age and heating source. The reports motivate customers to change their behaviors and reduce their consumption by presenting them with timely tips and program offers.

My Home Energy Report Interactive links customers to a portal where they can complete a home profile, set savings goals and track their progress, get answers to their personal energy questions from an energy expert, and share their energy saving tips with other customers. Customers can also see how much electricity they might use in the coming months based on their usage history.

Audience

Program participants are identified through demographic information and must reside in an individually metered, single-family residence served on a residential rate schedule and must have at least 13 months of electric usage with the Company. These customers receive up to 8 paper reports per year. Electronic versions of the report are distributed 12 times a year for customers who have enrolled in My Home Energy Report Interactive and/or who have a registered email address with the Company.

Customers who live in an individually metered, multi-family dwelling served on a residential rate schedule and who have at least 13 months of electric usage with the Company may also participate. Multi-family customers who have registered their email address with the Company receive 4 printed reports and 12 electronic reports throughout the year. Multi-family customers without a registered email address with the Company receive 6 printed reports throughout the year with a strong call to action to provide their email address to receive more energy efficiency tips and information through additional reports delivered.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	116,046	154,961	38,915
Savings (MW)	19.59	54.39	34.81
Participants		769,399	
Program Expenses		$7,369,336	

D. Qualitative Analysis

As of December 31, 2020, over 705,000 DEP single-family customers and 64,000 multifamily customers were receiving the MyHER, and over 67,500 DEP single-family customers and over 4,900 multifamily customers were enrolled in the MyHER Interactive portal.

Highlights

In 2020, the program continued the Pilot of new AMI usage charts on the eHERs which show customers the difference in average weekly usage by hour from one month to the next. Feedback continues to be positive.

E. Marketing Strategy

Since the MyHER paper report is an opt-out program, customers who meet the eligibility requirements automatically receive the report. Less than 0.03% of single-family customers and .11% of multi-family chose to opt out. The MyHER Interactive portal is an opt-in portal. Marketing for the portal includes email campaigns and messages in the paper report and on its envelope.

In 2020, the program continued its email and on-report marketing campaigns to further awareness of

the interactive portal. These campaigns resulted in an increase of over 14,700 customers enrolling in the interactive portal.

F. Evaluation, Measurement and Verification

The process and impact evaluation report, combined with DEC, was completed and presented to the Carolinas Collaborative in 2019.

An evaluation covering the period Jan 2020 – Dec 2020 will begin in Q1-2021 and is planned for completion in Q4-2021.

Residential Smart $aver® Energy Efficiency Program

A. Description

The purpose of this Program is to offer customers a variety of energy conservation measures that increase energy efficiency in existing residential dwellings. The Program utilizes a network of participating contractors to do the following: (1) to encourage the installation of high efficiency central air conditioning (AC) and heat pump systems with an optional add on measure such as Smart Thermostats, (2) to encourage attic insulation and sealing, (3) to encourage the installation of heat pump water heaters, and (4) to encourage high efficiency variable speed pool pumps.

Incentives are only applicable to measures installed by a contractor approved by Company.

Duke Energy contracts with a third-party vendor for application processing, incentive payment disbursement, and customer/contractor support.

Audience

The Program is available to customers whose premise is at least one year old, who are served on a residential rate, and who meet the service delivery qualifications.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	5,635	6,893	1,258
Savings (MW)	1.97	1.92	-0.05
Participants		22,411	
Program Expenses		$6,517,089	

D. Qualitative Analysis

Highlights

The Program's tiered incentive structure continues to receive a positive reaction from customers as well as Trade Allies. Reporting continues to show that the higher incentive amounts for greater SEER equipment has encouraged customers to have higher efficiency equipment installed properly and managed well.

The Referral Channel, which provides free, trusted referrals to customers who are trying to find reliable qualified contractors, has successfully generated 4801 Duke Energy Progress customer referrals in 2020. Despite COVID-related concerns during the first half of 2020 resulting in 50% reduction in referrals generated, referrals rebounded somewhat and ended the year with a 17% decrease from 2019. Customers were asked to rate their experience with the Referral Channel. The Referral Channel has remained steady with average star ratings 4.71 for 2020.

The Smart $aver ® incentive program has continued strong results during 2020. Duke Energy Progress participation increased 4% when compared to 2019.

Issues

The participation of the Trade Ally network is vital to the success of the Program. Our outreach team will continue to reach out and gain acceptance, however, the market uncertainty and COVID-related concerns remain the prevailing issue.

The program will continue to place emphasis on best practices and continue offering additional training to the Trade Allies and modifications to program requirements when needed to build support.

E. Marketing Strategy

Promotion of the rebate Program is targeted towards HVAC and home performance contractors as well as pool and plumbing contractors that install variable speed pumps and heat pump water heater technology.

Program information to educate customers about the Program and encourage participation and Trade Ally enrollment links are available on the Program's website. Increasing the overall awareness of the Program and the participation of Trade Allies ensures more customers are considering the benefits of the Program at the time of purchase. Point of Sale marketing materials have been placed in Lowe's and Home Depot stores that allow customers to download coupons and take advantage of instant rebates at time of purchase. The Midstream channel has also been used to promote Pool Pump rebates through one national distributor along with local pool retailers throughout NC/SC.

Various customer marketing campaigns during the first half of 2020 were halted, again due to COVID concerns, but restarted in July which drove referral participation back up. Our marketing leverages channels such as TV, radio, social media and email messaging in order to build awareness of the referral service. Other marketing efforts, such as paid search and co-branded special offer campaigns with eligible referral contractors, manufacturers, and national retailers, also aided in the rebound of referral generation in the last quarter of 2020.

F. Evaluation, Measurement and Verification

No evaluation activities were completed in 2020. The evaluation for the HVAC measures is scheduled for evaluation work to begin in mid-year 2022, with a completion date in mid-2023. The timeframe for a final report has been pushed out one year to allow additional participation in the referral component of the program.

Residential Energy Assessments

A. Description

The Home Energy House Call Program ("Program") is offered under the Energy Assessment Program where Duke Energy Progress, LLC ("Company") partners with several key vendors to administer the Program.

The Program provides a free in-home assessment performed by an energy specialist certified by the Building Performance Institute ("BPI"). The BPI-certified energy specialist completes a 60- to 90-minute walk through of a customer's home and analyzes energy usage to identify energy savings opportunities. The energy specialist discusses behavioral and equipment modifications that use less energy. The customer also receives a customized report identifying actions the customer can take to increase their home's efficiency. The following are examples of recommendations that might be included in the report:

Turn off vampire load equipment when not in use.
Use energy efficient lighting.
Use a programmable thermostat to manage heating and cooling usage.
Replace old equipment.
Add insulation and seal the home.

In addition to a customized report, customers receive an energy efficiency starter kit with a variety of measures that can be directly installed by the energy specialist. The kit includes measures such as energy efficient lighting, a shower head, faucet aerators, outlet/switch gaskets, weather stripping and a booklet of energy saving tips.

Additionally, bath aerators and pipe wrap are also available for free at the time of the assessment. New discounted measures may be purchased and installed during the assessment including LED specialty lighting (i.e. globes, candelabra and recessed), hand-held showerhead, smart thermostats and a blower door test.

Audience

Residential customers that own a single-family residence with central air, electric heat or an electric water heater and that have at least four months of billing history are eligible to participate in the Program.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	6,867	7,151	285
Savings (MW)	0.82	0.86	0.04
Participants		42,902	
Program Expenses		$2,160,729	

D. Qualitative Analysis Highlights

The Company continues with a multi-channel approach which includes Duke Energy website pages, website banners, online services banner, paid search campaigns, Facebook, email, bill inserts, bill messages, direct mail, and customer segmentation to reach customers with a high propensity to participate. Program staff explores other channels for marketing campaigns to reach the target audience and maximize both program performance as well as customer experience.

Vendors, partners and the team at Duke Energy collaborate regarding marketing initiatives, future scheduling, availability, routing, targeting, backlog, etc. to drive efficient operations as well as customer satisfaction

Through December 2020, the program conducted 5,926 assessments and installed 20,250 additional

LEDs.. The program additionally installed 6,421 feet of pipe insulation and 2,057 additional bathroom aerators. Beginning in August 2020, the program began offering new discounted measures, the program installed; 2,271 specialty LED globes, 1,809 recessed bulbs, 3,916 candelabra LEDs and 202 hand-held showerheads. Beginning in November 2020, 50 Smart Thermostats were installed to eligible customers. The program continues to focus on maximizing measures installed as well as cross promoting other Duke Energy programs and offerings.

Enhancements to the program in 2020 include a continuing focus on cross promotion of other programs and integration of in-field referrals for FindItDuke (FID),

Issues

The program was shut down in mid-March through late June due to the Covid pandemic in 2020. Duke worked collaboratively with the vendor to build safety protocols, procedures and use of Personal Protective Equipment (PPE) into the assessment process for the relaunch in June. Additionally, the program was shut down again during the holidays (December) to limit risks for customers and the vendor during the high Covid transmission period which impacted the overall performance of the program. Also, the program delayed the training and launch of the blower door measure in 2020, due to the Covid pandemic and additional time required in the home. The program continues to coordinate closely with the vendor to monitor incoming demand, to balance marketing and to ensure adequate appointment slots are available.

Potential Changes

- Continuing to optimize the online scheduling tool to enhance the customer experience
- Including townhomes/condos for audit eligibility
- Implementing post audit follow up with reminders of recommendations/referrals

Currently, Program implementers are evaluating the need for a plan to obtain customer feedback proactively and identify improvement or EM&V opportunities.

E. Marketing Strategy

The Program continued to use a multichannel marketing approach including targeted mailings to pre-qualified residential customers, bill inserts, online promotions and online video. For those who elect to receive offers electronically, email marketing is used to supplement direct mail. The Program management team continues to explore additional channels to drive awareness such as social, event marketing and other cross-promotional opportunities. The creative team continues to drive engagement and interest in the program based on online survey results and enrollment. In between larger initiatives, such as bill inserts, the program utilizes direct mail which can easily be modified based on demand. Core messaging is simple and focuses on key benefits (a free energy assessment from Duke Energy can help save energy and money while also increasing comfort) and three easy steps (You Call, We Come Over, You Save).

Home Energy House Call program information and an online assessment request form are available at www.duke-energy.com.

F. Evaluation, Measurement and Verification

To accommodate the additional measures now included in the energy assessment program and to work around the program suspension due to COVID, the evaluation timeframe has been pushed back to cover the period Sept 2020 – Aug 2021. The activities will begin in earnest in Fall 2021 with a final report scheduled for First Quarter 2023.

It is anticipated that the evaluation will consist of a billing analysis that will compare the consumption of program participants to future program participants. Engineering estimates for the kit measures will also be conducted to provide insight into the behavioral impacts achieved through the program and to provide impacts for the Additional Bulbs and other optional measures provided to program participants.

Participants surveys will be used to determine in-service rates and determine free ridership at the measure level.

The process evaluation will consist of participant surveys which will identify barriers to participation, improve program processes and assess overall participant satisfaction.

Residential New Construction

A. Description

The purpose of this Program is to incent new construction that falls within the 2018 North Carolina Residential Building Code to meet or exceed the 2018 North Carolina Energy Conservation Code High Efficiency Residential Option("HERO"). If a builder or developer constructing to the HERO standard elects to participate, the Program offers the homebuyer an incentive guaranteeing the heating and cooling consumption for the dwelling's total annual energy costs. Additionally, the Program incentivizes the installation of high-efficiency heating ventilating and air conditioning("HVAC") and heat pump water heating ("HPWH") equipment in new residential construction.

Audience

The Program is available to builders and developers installing high-efficiency HVAC and HPWH equipment in new single family, manufactured, and multi-family residential housing units that are served under any of the Company's residential rate schedules.

The program is also available to builders and developers of new single family and multi-family residential dwellings (projects of three or fewer stories) that comply with all requirements of the 2018 HERO standard and are served under any of the Company's residential schedules. Manufactured housing, multi- family residential housing projects over three stories in height, and any other dwellings which do not fall within the 2018 North Carolina Residential Building Code, are not eligible for any whole-house incentives.

The Program also supports the initial homeowner for any home constructed to meet or exceed the HERO standard when the builder or developer elects to extend a heating and cooling energy usage guarantee to the homeowner. At the sole option of the builder or developer, homeowners may be offered a Heating and Cooling Energy Usage Limited Guarantee for homes with a HERS Index Score verified by a certified HERS rater calculating the heating and cooling energy usage that the home should use during an average weather year.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	15,992	20,008	4,016
Savings (MW)	4.61	5.36	0.75
Participants		16,844,791	
2020 Program Expenses		$18,861,261	

D. Qualitative Analysis

Highlights

The Program move to a whole-house incentive structure which pays incentives to builders for HERO-compliant homes based solely on annual kWh savings continues to drive builders toward increasing savings. The Program requested approval from RESNET to offer 34 courses online for rater CEU's and was approved. The Program has provided on-site instruction to over 400 builders and trade allies.

Currently there are 580 builders and 28 approved raters registered in the Program. For 2020 the Program invoiced homes for 342 builders from 22 raters. ICF is responsible for the operational oversight of Home Energy Raters and builders or developers participating in the Program. For 2020 Program was able to complete 12 rater trainings, 2 Whole-home trainings, and performed 3 one-on-one builder walk thru on rough inspections.

Residential New Construction

Whole-House Requirement	Eligibility	Incentive
HERO	Meet 2018 NCECC HERO standards	$750
HERO plus HERS Score	Meet HERO standards and submit confirmed annual kWh savings from the Energy Summary Report.	$0.90/kWh
	Equipment Description	**Incentive**
Tier 1	AC or heat pump with SEER (Seasonal Energy Efficiency Ratio) of 14 or greater but less than 15. The HVAC system must meet the Quality Installation Standard of 90%. High Efficiency Heat Pumps: The unit(s) shall be a minimum SEER of 14 with ECM. High Efficiency Central AC: The unit(s) shall be a minimum SEER of 14 with ECM.	$250 per unit
QI	Quality Installation Standard (Optional for Tier 2).	$75 per unit
Tier 2	AC or heat pump with SEER of 15 or greater.	$300 per unit
Heat Pump Water Heater	ENERGY STAR qualified HPWH(s) with minimum Energy Factor of 2.0.	$350 per unit

Issues

With the uptick in townhome construction Program is working to increase trainings to educate builders on pathway to compliance. While the North Carolina building code has specific requirements for fire-rated assemblies, there are different approaches being used to meet these requirements, and the acceptance and interpretations of these assemblies differs among code officials by jurisdiction. To assist builders, Program staff will work with various resources to identify code compliant separation wall assemblies and accepted air sealing methods. This information will provide builders and raters recommendations that will not only meet the code but also increase compliance with program standards. Program is partnering with NCBPA to perform technical research in support of the Program's interests identifying townhome and multifamily assembly air sealing practices that meet or exceed minimum code and program requirements. BASF will provide technical support and research and development resources on an as-needed basis. Suppliers including Dow, Knauf Insulation and others will participate on an as-needed basis.

Potential Changes

The Program is considering modifying the incentives and eliminating non-cost-effective measures and measures that are no longer applicable. Those changes may include the following:

- Remove Quality Installation and Heat Pump Water Heater measures, as they are typically included when building to HERO standards and rarely implemented on a stand-alone basis.

Residential New Construction

E. Marketing Strategy

The Company drove awareness in 2019 through various marketing channels that include but are not limited to the following:

- Duke Energy Progress website
- Community outreach events/HBA Parade of Homes
- Social media promotions

These marketing efforts are designed to create customer awareness of builders participating in the Program and to educate customers on the quality, comfort and energy savings these homes offer. Please see Appendix for examples.

F. Evaluation, Measurement and Verification

Evaluation of the Program began in December for years 2018 thru 2020. It is anticipated that evaluation will be completed late in 2021 with a final report early 2022.

G. Appendix

Multifamily Energy Efficiency Program

A. Description

The Multifamily Energy Efficiency program ("Program") provides energy efficient lighting and water measures to reduce energy usage in multi-family properties. The Program allows Duke Energy Progress ("Company") to target multi-family apartment complexes with an alternative delivery channel. The measures are installed in permanent fixtures by Franklin Energy, the program administrator. Franklin Energy oversees all aspects of the Program including outreach, direct installations, and customer care.

The Program helps property managers save energy by offering energy efficient lighting and water products. The Program offers LED lighting measures including A-Lines, globes, candelabras, recessed, and track bulbs, and water measures such as bath and kitchen faucet aerators, water saving showerheads, and pipe wrap. Water measures are available to customers with electric water heating. These measures assist with reducing maintenance costs while improving tenant satisfaction by lowering energy bills.

The Program offers a direct install ("DI") service by Franklin Energy. Franklin Energy installs the lighting and water measures during scheduled visits. Crews carry tablets to keep track of which measures are installed in each apartment.

After the installation, Quality Assurance ("QA") inspections are conducted on 20 percent of the properties that completed installations in each month. The QA inspections are conducted by an independent third party. Any QA adjustments are provided to the Company to update participation records.

Audience

The target audience is property managers who have properties served on an individually metered residential rate schedule. To receive water measures, apartments must have electric water heating.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	14,539	2,817	-11,722
Savings (MW)	1.85	0.37	-1.48
Participants		69,966	
Program Expenses		$892,251	

D. Qualitative Analysis

Highlights

Through March 2020, the Program completed installations at 40properties., accounting for over 4,756 units. The Program installed 50,108 measures with lighting measures representing 72 percent of the total number of installations and 19,858 water measures representing 28 percent. Of the lighting measures, the program installed over 33,600 Alines, over 7,800 Candelabras, over 5,400 Globes, 1,700 Recessed and 1,400 Track LED bulbs. The water measures consisted of over 6K aerators, over 10K feet of pipe warp and over 3K Showerheads.

Issues

In early 2021, the Program is planning to add 1.25 GPM showerheads and discounted Smart Thermostats to the program.

New technology enhancements are being implemented to increase the accuracy of recording the measures installed and the bulb wattages removed, to increase efficiencies with scheduling units, and to improve the tracking of new opportunities from both the direct installers and energy advisors.

The program will continue to implement new Covid safety protocols and processes in preparation for

relaunch in 2021.

Potential Changes

Program Management continues to evaluate new energy efficient measures for addition to the program.

New technology enhancements are being implemented to increase accuracy of recording measures installed, bulb wattages removed, increase efficiencies with scheduling units, and improved tracking of new opportunities from both the direct installers and energy advisors.

E. Marketing Strategy

As program implementer, Franklin Energy is responsible for marketing and outreach to property managers in the Company's service territory. Marketing is primarily done through outbound calls and on-site visits to gauge initial interest in the program. The Program also uses local apartment association memberships to obtain access to contact information for local properties and to attend association trade shows and events to promote the program.

A Multi-Family Energy Efficiency public website landing page is available for property managers to learn more about the Program. A program brochure and a frequently asked question sheet are available for download.

Other ways a property manager may learn more about this Program are through the MyDuke Portal, an online tool used to pay the utility bills of vacant units at their property. The MyDuke Portal presents a promo link that directs the user to the Program website for more information.

Once enrolled, Franklin Energy provides property managers a variety of marketing tools to create awareness of the Program among their tenants. The tools include letters to each tenant informing them of what energy efficient measures are being installed and when the installations will take place. Tenants receive educational leave-behind brochures when the installation is complete.

Feedback from both property managers and tenants is important for the Program's continued success. Property managers are provided with leave-behind materials about the program which also includes survey for them to complete and return. For tenants, the educational leave-behind brochure includes a satisfaction survey to return to Duke Energy. Online versions of both the Program Manager and Tenant surveys are also available.

After the installation, window clings are placed in strategic areas throughout the property. Placement of the window clings at a minimum will be at the common areas entry and each residential building on site (to the extent applicable). Using the window clings ensures that the program and Duke Energy are recognized long after the installation has taken place.

F. Evaluation, Measurement and Verification

The combined DEC/DEP EM&V evaluation was completed in April 2020, covering the period from January 2017 - May 2018. The evaluation determined the net annual energy and demand associated with the program participants and found that reported gross savings were 21% higher than verified. The evaluation used a combination of surveys, on site data collection, a lighting logger study, and engineering analysis to determine the impacts for the program. The free ridership was estimated at 7% with very limited spillover, for an overall NTG of 93%.

G. Appendix

Tenant Post Installation Summary Report

Multifamily Energy Efficiency Program

DUKE ENERGY.

Thank You for Participating in the Duke Energy Multifamily Energy Efficiency Program!

Together with your neighbors, you helped Duke Energy provide and install energy-saving products in your home. Doing so is good for the environment AND your power bill!

As a result of your participation, the average unit could see energy savings of around **[$XXX]** every year.*

Our community could save **[XX]** kilowatt-hours annually, which is the environmental equivalent to planting **[XX]** trees or taking **[XX]** cars off the road!

Please take Duke Energy's survey by scanning this QR code:

SAMPLE

*Actual savings will vary by floor plan and usage

Program Brochure-

Updated to add Commercial Offerings partnership and new water measures

FAQ for Property Managers

What does the install process look like?
On your scheduled installation days, our team will arrive at 8:45 a.m. to begin working by 9 a.m. A member of your staff will need to accompany our installers and handle keys throughout the installation process. The time spent in each unit varies depending on the layout and products being replaced. We will leave a flyer for each resident explaining what was installed and a survey providing an opportunity to give us feedback. It's that simple and that fast!

How do we qualify?
Your property's electric utility must be Duke Energy to qualify. Additional qualifications depend on several factors such as metering, existing products, and method for water heating. To see which offerings your property qualifies for, you will need to schedule a complimentary energy assessment with one of our Energy Advisors by calling **888.297.1671** or emailing **dukeenergymultifamilyeep@franklinenergy.com**.

How much does it cost?
NOTHING! This program is part of many programs Duke Energy offers its customers from funds set aside to help reduce energy use. There are two parts to our program: residential (inside tenant units) and commercial (common areas). There are no limits on how many products we can install. Your Energy Advisor will go over your qualifications during the energy assessment.

What safety precautions should we know before installation?
As we are going through the units, if there are any unsecured pets or unattended minors, we will not be able to enter to perform the installation. During product installation, we ask that all small children be kept at a safe distance from the installers. The installers will provide further direction once on-site.

What is the next step?
Call **888.297.1671** or email **dukeenergymultifamilyeep@franklinenergy.com** to schedule an appointment for an energy assessment.

This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

Contact us today!

Phone
888.297.1671

Website
duke-energy.com/multifamily

Email
dukeenergymultifamilyeep@franklinenergy.com

Note that this program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

DUKE ENERGY.

Multifamily Energy Efficiency Program

It's what's on the inside that counts.
Our **FREE** energy-saving lightbulbs and water-saving devices can help your tenants save money.

DUKE ENERGY.
BUILDING A SMARTER ENERGY FUTURE®

Start saving now with the latest **FREE** energy-saving products.

Multifamily Energy Efficiency Program
If you are a Duke Energy customer, your tenants may receive the following energy-saving products – installed in each multifamily unit and qualifying common areas at no cost.

Standard, Globe, Candelabra, Recessed and Track LEDs

Use **up to 90% less energy** and **can save at least $80** over their lifetime in energy costs compared to traditional incandescent bulbs. A popular residential option, ENERGY STAR® light-emitting diodes, or LEDs, can be installed in bathrooms, track lights, ceiling fans, recessed lights and other high-usage permanent fixtures.

Exit Sign LEDs

Exit signs are necessary to keep us safe. We can help you save on operating and labor costs by replacing incandescent exit sign bulbs with LEDs.

Bathroom and Kitchen Faucet Aerators

Use **up to 55% less water** than traditional 2.2-gallons-per-minute (gpm) faucets, which can reduce water and sewer costs, as well as the amount of energy used to heat the water.*

Outer ring allows for adjustable flow

*If water is heated by electricity, savings are not guaranteed.

Water-saving Showerheads

Use **up to 40% less water** than traditional 2.5-gpm showerheads, which can reduce water and sewer costs, as well as the amount of energy used to heat the water.*

Outer ring allows for adjustable flow

Hot Water Pipe Wrap

Reduces water and energy use by preventing heat loss while hot water travels through your building's pipes.*

This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

DUKE ENERGY.

See what other property managers had to say.

You guys got top marks
"I received the satisfaction survey and filled it out. You guys got top marks. I received a lot of compliments about how friendly and professional you all were. Thank you again for all that you did!"
- Asheville Property Manager

They were so polite and professional
"I just wanted to let you know that your team did a wonderful job installing the energy-saving products. They were so polite and professional, which made the residents feel more at ease with the installation. I really appreciate all the hard work that went into making this project run so smoothly. We are now officially energy efficient!"
- Raleigh Property Manager

The program has been a huge success and very much appreciated
"The thing that stood out most for me is your willingness to contact all property managers in my district. You took control of the program and scheduled each property efficiently and effectively, resulting in less work for each property. The program has been a huge success and very much appreciated by the management company, properties and our residents. Thank you for your hard work!"
- Durham Property Management Company

Sorry We Missed You
Door post-it

DUKE ENERGY.
BUILDING A SMARTER ENERGY FUTURE®

Sorry We Missed You!

Today we stopped by to install your **free energy-saving products**, but

_____

_____

Don't worry—you can still get your products! Simply contact your property manager to find out how.

Learn more at **duke-energy.com/multifamily**. Note that this program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

Property Manager Direct Mail Piece

Sign up today!

Phone 888.297.1671 | **Website** duke-energy.com/multifamily
Email dukeenergymultifamilyeep@franklinenergy.com

DUKE ENERGY.
BUILDING A SMARTER ENERGY FUTURE®

Our **FREE** energy-saving lightbulbs and water-saving devices can help your tenants save money!

DUKE ENERGY.

Address
City, ST ZIP XXXXX

Use less energy, help your tenants save money and receive **FREE** products throughout your property by signing up for the Duke Energy Multifamily Energy Efficiency program. Your multifamily property can receive a **FREE** energy assessment, plus **FREE** energy-saving products installed in each unit and qualifying common areas – at no cost:

- Standard, globe, candelabra, recessed and track LEDs
- Bathroom and kitchen faucet aerators
- Exit-sign LEDs
- Showerheads
- Hot-water pipe wrap
- Comparable assessments could cost $1,000-$3,000

Scan me

Sign up today!

Phone 888.297.1671
Website duke-energy.com/multifamily
Email dukeenergymultifamilyeep@franklinenergy.com

Case Study

MULTIFAMILY ENERGY EFFICIENCY PROGRAM CASE STUDY

Here's What They're Saying About Us

"The Duke Energy Multifamily program has been instrumental in reducing the cost of living in Bell communities, enhancing our environmental stewardship and differentiating our NC/SC properties in the marketplace. We look forward to a continued partnership with Franklin Energy and Duke Energy."

– Wes Winterstein, Vice President, Ancillary Services, Bell Partners Inc.

ESTIMATED SAVINGS FOR RESIDENTS

Annual Electric Savings	Annual Electric Bill Savings
1,015 kWh	$107

Value and Savings for Bell Partners and Its Residents Through 2018

Annual Electric Savings	Value of Products and Energy Savings
2,771,664 kWh	$434,089

Going Green Makes a Difference

So far Bell Partners and Duke Energy have delivered energy savings equivalent to:	Cars Taken Off the Road	Trees Planted
	314	37,653

DUKE ENERGY AND BELL PARTNERS ARE GOING GREEN!

To date, Bell Partners and Duke Energy have collaborated to make nine communities more energy efficient by replacing standard lighting with LED bulbs, replacing inefficient faucets and showerheads with water-saving products, and insulating hot water heater pipes. The cost to Bell Partners and its residents? Nothing! In 2017 and 2018, Duke Energy provided and installed:

- $152,000 worth of energy-saving products
- Over 26,000 LED lights
- Nearly 5,600 water-saving faucet aerators
- Over 1,800 energy-saving showerheads
- Nearly 14,000 feet of pipe insulation

Bell Partners residents can save an average of $107 annually on their electric bill. The communities save ongoing O&M expenses. And with the help of Duke Energy, Bell Partners continues to be a leader in the green multifamily market.

DUKE ENERGY.

BUILDING A SMARTER ENERGY FUTURE®

BELL PARTNERS

APARTMENT INVESTMENT & MANAGEMENT

Small Business Energy Saver

A. Description

The purpose of the Duke Energy Progress ("Company") Small Business Energy Saver program ("Program") is to reduce energy usage through the direct installation of energy efficient measures within qualifying non-residential customer facilities. All aspects of the Program are administered by a single Company-authorized vendor. Program measures address major end-uses in lighting, refrigeration, and HVAC applications.

Program participants receive a free, no-obligation energy assessment of their facility followed by a recommendation of energy efficiency measures that could be installed in their facility along with the projected energy savings, costs of all materials and installation, and the amount of the up-front incentive the Company. The customer makes the final determination of which measures will be installed after receiving the results of the energy assessment. The vendor schedules the installation of the energy efficiency measure at a convenient time for the customer, and electrical subcontractors perform the installation.

The Program is designed as a pay-for-performance offering, meaning that the vendor administering the Program is only compensated for energy savings achieved through the installation of energy efficiency measures.

Audience

The Program is available to non-residential customers that are not opted-out of the Company's EE/DSM rider and have an average annual demand of 180 kW or less per active account.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	38,402	23,472	-14,930
Savings (MW)	6.64	3.90	-2.75
Participants		22,264,626	
Program Expenses		$5,004,816	

D. Qualitative Analysis

Highlights

Lime Energy is the Company-authorized vendor administering the Program in both DEC and DEP service areas.

In 2020, the Company and vendor experienced many difficulties as a result of the COVID-19 virus. In March the program was shut down due to the high-risk nature of sending employees from business to business to market the program and to complete the free energy audit. The Program could complete some customer requested work, but the Program was not allowed to complete any marketing. In June the program started a gradual reopening that continue through November when we were at 80% staff. The program was paused for one week following Thanksgiving and then shutdown for the year in mid-December.

Even with the shutdown, customers still showed interest in the Program. We experienced higher than plan participation per salesperson the Program could have in the field, but we also had customers unwilling to act due to the uncertainty of the market due to the impacts of COVID-19. As spread of the COVID-19 virus starts to slowdown and the vaccine distribution increases the uncertainty in the marketplace is resolved and customers will be willing to move forward with projects.

The Company continues to administer a customer satisfaction survey to Program participants since the Program's launch in DEC. Customers continue to give the Program high scores and generating a positive view of the Company.

Issues

While LED lighting measures are expected to remain the primary driver of kWh savings in the Program for the foreseeable future, the Company has been actively working with our vendor Lime Energy to implement initiatives focused on increasing refrigeration and HVAC measure adoption.

Potential Changes

In 2020, the Company filed changes to the Program to add a new option called SmartPath™ and to add process measures. SmartPath™ is an addition to the existing Small Business Energy Saver tariff that was approved in 2020 and planned to be launched in the first half of 2021. SmartPath™ is designed to minimize financial barriers to customer participation by allowing customers above 180 kW finance and implement energy efficiency upgrades with little to no upfront out of pocket costs.

The new process measures will allow the Program to provide measures that will have more of an impact on the Company's winter peak and will continue the Program efforts to extend projects beyond just lighting. As the Program continues to mature, the Company will continue to evaluate opportunities to add incentivized measures which fit the direct install program model and are suitable for the small business market.

E. Marketing Strategy

The Program is marketed primarily using the following channels:

- Lime Energy field representatives
- Direct mail (letters and postcards to qualifying customers)
- Duke Energy Progress website
- Email & Duke Energy Business E-Newsletters
- Social media and search engine marketing
- Direct marketing & outreach via Program administrator
- Outreach via Duke Energy Business Energy Advisors
- Community events

All marketing efforts are designed to create awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of participation for the target market.

F. Evaluation, Measurement and Verification

Evaluation activities commenced in late 2020, with an evaluation covering the period from January 2019 through June 2020. The evaluation will conduct virtual verification of measure installations and estimate energy and peak demand savings (both summer and winter) via engineering analysis. The evaluation will also assess the NTG ratio through the use of online customer surveys. In addition, the process evaluation will assess the strengths and weaknesses of current program processes and customer perceptions of the program. The evaluation is scheduled for completion mid-2021.

Non-Residential Smart $aver® Performance Incentive

A. Description

Duke Energy Progress, LLC's (the "Company") Non-Residential SmartSaver® Performance Incentives (the "Program") offers financial assistance to qualifying commercial, industrial and institutional customers to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The Program encourages the installation of new high efficiency equipment in new and existing nonresidential establishments as well as efficiency-related repair activities designed to maintain or enhance efficiency levels in currently installed equipment. The Program provides incentive payments to offset a portion of the higher cost of energy efficient installations that are not eligible under either the Smart $aver® Prescriptive or Custom programs. The types of projects covered by the Program include projects with some combination of unknown building conditions or system constraints, or uncertain operating, occupancy, or production schedules. The specific measures incentivized are stated in the agreement with the customer. The Program coordinates closely with the existing custom program team and shares resources for administrative review and payment processing. The Program requires pre-approval prior to project initiation. Only projects that demonstrate that they clearly reduce electrical consumption and/or demand are eligible for incentives.

The intent of the Program is to broaden participation in non-residential efficiency programs by being able to provide incentives for projects that previously were deemed too unpredictable to calculate an acceptably accurate savings amount, and therefore ineligible for incentives. This Program provides a platform to understand new technologies better.

The key difference between the Performance Incentive Program and the custom program is that the performance incentive customers get paid based on actual measure performance. A plan is developed to verify actual performance of the project upon completion and is the basis for the performance portion of the incentive.

The incentive is typically paid out on the following schedule, though the quantity & timing of payment installments may vary:

- Incentive #1: For the portion of savings that are expected to be achieved with a high degree of confidence, an initial incentive is paid once the installation is complete.
- Incentive #2: After actual performance is measured and verified, the performance-based part of the incentive is paid. The amount of the payout is tied directly to the savings achieved by the measures.

The Company contracts with Alternative Energy Systems Consulting, Inc. (AESC) to perform technical review of the applications. All other program implementation is performed by Duke Energy employees or direct contractors.

Audience

All of the Company's non-residential electric accounts billed on qualifying rate schedules are eligible, except accounts that are opted out of the rider.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	7,520	3,104	-4,416
Savings (MW)	0.86	0.22	-0.63
Participants		42	
Program Expenses		$386,339	

Non-Residential Smart $aver® Performance Incentive

D. Qualitative Analysis

Highlights

As new technologies are introduced and changes occur in the energy efficiency marketplace, performance incentives are the perfect tool to influence and reward customers who invest in energy efficiency. The Smart $aver Performance Incentives program was launched on January 1, 2017. Efforts to encourage internal resources, trade allies and vendors who sell energy efficient equipment to promote the Program and assist customers to participate are continuous and on-going. In addition, the Program is marketed closely with the Smart $aver Custom Program.

In DEP, the program is beginning to reap the fruits of its marketing efforts as program participation increases slightly.

The program experiences large fluctuations in performance due to long project lead times, long monitoring and verification times, and the timing and sizes of projects. With a compelling value proposition and internal resources and trade allies getting comfortable with this unique program offering, participation is expected to continue to be strong.

The program is now able to offer both top and bottom cycle CHP to customers.

Issues

Program management is monitoring a few areas.

- The preferred method for measurement and verification of performance is gathering, monitoring and analyzing customer billing history. However, energy savings are not significant enough at times to evaluate effectively through the review of billing information. If this is the case, sub-metering is required at the customer's expense and may be a hurdle due to the time and expense of monitoring and verifying savings.

- The Performance program cannot be offered to customers who are opted out of the EE Rider. Performance projects can easily carryover into multiple calendar years because of the monitoring and verification requirement, a situation which could make opting in more difficult to justify.

- Sometimes project M&V can span multiple years thus requiring a customer to be opted-in for multiple years. This is often not preferred and we are beginning to see customers forfeit a portion of their project incentive to opt-out of the rider.

- Customers may not participate because of the risk of measured energy savings being less than expected and resulting in a smaller incentive payout.

- The program is having difficulty in finding cost effective projects. Typical Performance project with uncertainty in savings have been controls related, where savings are determined based on the part-load characteristics of the measure or system optimization. These types of projects typically have the following characteristics which makes costs-effectiveness challenging:
  - High first costs
  - Little demand savings – low avoided costs
  - Low measure life

  The program will continue to evaluate projects on a case by case basis to ensure cost effective projects are incentivized.

Non-Residential Smart $aver® Performance Incentive

Potential Changes

The Company will continuously consider functional enhancements to enhance participation, processing speed, and program efficiency.

E. Marketing Strategy

The 2020 marketing strategy for the Smart $aver Performance Incentive Program aligned closely with the Custom Program. The goal is to educate non-residential customers about the technologies incentivized through both programs, as well as the benefits of installing energy-efficient equipment. These efforts utilize a multi-channel approach, which includes the following:

- Email
- Direct Mail (letters to qualifying customers)
- Duke Energy Progress website
- Webinars
- Small Business Group outreach events
- Paid advertising/mass media
- Industry Associations
- Large Account Managers
- Business Energy Advisors
- Trade Ally Outreach

These marketing efforts are designed to create awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of participating.

Non-residential customers are informed of programs via targeted marketing material and communications. Information about incentives is also distributed to trade allies, who in turn sell equipment and services to all sizes of non-residential customers. Large business or assigned accounts are targeted primarily through assigned Company account managers. Unassigned small to medium business customers are supported by the Company's business energy advisors. The business energy advisors follow up on customer leads to answer questions and steer customers who are not already working with a trade ally to the trade ally search tool. In addition, the business energy advisors contact customers with electrical costs between $60,000 and $250,000 to promote the Non-Residential Smart $aver Program.

The internal marketing channel is comprised of assigned Large Business Account Managers, Business Energy Advisors, and Local Government and Community Relations who all identify potential opportunities as well as distribute program collateral and informational material to customers and trade allies. In addition, the Economic and Business Development groups also provide a channel to customers who are new to the service territory.

F. Evaluation, Measurement and Verification

No evaluation activities occurred in 2020. Future evaluation timing will depend upon sufficient participation and may be included in future Smart $aver Non-Residential evaluations.

Non-Residential Smart $aver Program

A. Description

The Non-Residential Smart $aver Program ("Program") provides incentives to Duke Energy Progress, LLC's ("DEP" or the "Company") commercial and industrial customers to install high efficiency equipment in applications involving new construction and retrofits and to replace failed equipment.

Commercial and industrial customers can have significant energy consumption but may lack knowledge and understanding of the benefits of high efficiency alternatives. The Program provides financial incentives to reduce the cost differential between standard and high efficiency equipment so that customers see a quicker return on their investments into high efficiency equipment and so that the money they save on utility bills can be reinvested in their businesses. Incentives are determined based on the Company's modeling of cost effectiveness over the life of the measure. In addition, the Program encourages dealers and distributors (or market providers) to stock and provide these high efficiency alternatives to meet increased demand for the products.

The Program provides incentives through prescriptive measures, custom measures and assessment/ technical assistance.

Prescriptive Measures:
Customers receive incentive payments after they install certain high efficiency equipment from the list of pre-defined measures, including lighting; heating, ventilating and air conditioning equipment; and refrigeration measures and equipment. A list of eligible equipment and measures and specific incentive amounts are available at the Program website: https://www.duke-energy.com/business/products/smartsaver.

Custom Measures:
The Smart $aver Custom Program is designed for customers with electrical energy-saving projects involving more complicated or alternative technologies or measures not covered by the Non-Residential Smart $aver Prescriptive Program. The intent of the Program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the Company's technical or financial assistance.

Unlike the Non-Residential Smart $aver Prescriptive Program, the custom program requires pre-approval prior to the project initiation. Proposed energy efficiency measures may be eligible for customer incentives if they clearly reduce electrical consumption and/or demand.

The two approaches for applying for incentives for this Program are Classic Custom and Smart $aver Tools. Each approach has a method by which energy savings are calculated, but the documents required as part of the application process vary slightly between the two.
Currently the application forms listed below are located on the Company's website under the Smart $aver® Incentives (Business and Large Business tabs).

- Custom Application, offered in word and pdf format.
- Energy savings calculation support:
  - Classic Custom excel spreadsheet approach (> 700,000 kWh or no applicable Smart $aver Tool)
  - Lighting worksheet (excel)
  - Variable Speed Drive (VFD) worksheet (excel)
  - Compressed Air worksheet (excel)
  - Energy Management System (EMS) worksheet (excel)
  - General worksheet (excel), to be used for projects not addressed by or not easily submitted using one of the other worksheets
  - Smart $aver Tools approach (< 700,000 kWh)
  - HVAC & Energy Management Systems
  - Lighting (no project size limit)
  - Process VFDs
  - Compressed Air

Non-Residential Smart $aver Program

Energy Assessments and Design Assistance:
Incentives are available to assist customers with energy studies such as energy audits, retro commissioning, and system-specific energy audits for existing buildings and with design assistance such as energy modeling for new construction. Customers may use a contracted Duke Energy vendor to perform the work or they may select their own vendor. Additionally, the Program assists customers who identify measures that may qualify for Smart $aver Incentives with their applications. Pre-approval is required.

In 2019, the program again modified its approach to energy assessments by utilizing a "virtual" approach. Using energy modeling software called NEO from our vendor, Willdan, and collecting all building information remotely will allow the audit to be completed in 2-3 weeks for less cost. Each audit has a fixed cost of $5,000 which is covered 100% by the program. In 2020, the program was expanded to include buildings with process loads such as manufacturers. Program parameters are a focus on customers with a minimum demand of 180 kW with those below being serviced by Small Business Energy Saver®.

The Company contracts with AESC to perform technical reviews of applications. All other Program implementation and analysis is performed by Duke Energy employees or direct contractors.

Audience

This Program is designed for all of the Company's non-residential customers billed on an eligible Duke Energy Progress rate schedule.

B & C. Impacts, Participants and Expenses

Energy Efficiency for Business – Total Program

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	84,827.62	59,121	-25,706
Savings (MW)	12.85	10.72	-2.13
Participants		2,099,086	
Program Expenses		$11,378,760	

Custom Measures Only

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	21,077	12,768	-8,309
Savings (MW)	2.41	3.02	0.62
Participants		9,183	
Program Expenses		$3,514,807	

Prescriptive Measures

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	63,751	46,353	-17,397
Savings (MW)	10.44	7.70	-2.74
Participants		2,089,903	
Program Expenses		$7,863,953	

D. Qualitative Analysis

Highlights

The prescriptive, custom, and assessment/technical assistance programs continue to generate substantial savings and customer satisfaction by leveraging internal staff focused on providing solutions to participants. Prescriptive measures foster high-volume participation for common retrofit projects, while custom programs seek ways to provide in-depth technical expertise required to bring in larger and more unique projects.

Over the years, the Program has worked closely with Trade Allies (TAs), which are energy-efficiency equipment vendors, contractors, engineers, architects and energy services providers in the Carolinas registered with the Program, to promote incentives to our business customers at the critical point in time when customers are considering standard or high efficiency equipment options. The Smart $aver® outreach team builds and maintains relationships with TAs in and around Duke Energy's service territory. Existing relationships continue to be cultivated while recruiting new TAs remains a focus. Duke Energy's efforts to engage TAs include the following activities:

- Trade Ally Search tool located on the Smart $aver® website
- Inspections of a sample of all projects to ensure quality control
- TA co-marketing including information about the Smart $aver Program in the TAs marketing efforts
- Online application portal training and support
- Midstream channel support
- TA year-end awards
- TA quarterly newsletter
- Technology- and segment-specific marketing collateral
- TA discussion group (20 trade allies that give input on the Program)
- TA training
- Sponsorship of TA events
- Online collateral toolkit for access to marketing materials

The TA outreach team educates TAs on the Program rules and the Smart $aver Program expectations for TA conduct. The Company engages the TAs in promoting the Program as well as targeting TAs more effectively based on market opportunities.

The Program has developed multiple approaches to reaching a broad and diverse audience of business customers through incentive payment applications, paper and online options, and instant incentives offered through the midstream marketing channel and the online energy savings store. The Company continues to consider ways to expand participation through new channels that offer instant incentives thus reducing the price of energy efficient products at the time of purchase and reducing or eliminating the need for a separate incentive application. Several 2020 program trends are listed below:

- Customers continued to show interest in energy efficiency, however the program experienced a significant decline due to the negative effects that the COVID-19 pandemic had on business customers.
- Customers continued to utilize the midstream marketing channel by taking advantage of instant incentives through participating equipment distributors
- More applicants used the online application.
- Outreach continued to support Trade Allies working with the program, but largely pivoted to virtual and phone outreach instead of in-person meetings
- Marketing efforts were reduced due to the COVID-19 pandemic
- A dedicated team of representatives responded to customer questions via phone and email, providing high levels of customer service.

Customers have several options for participating in the Program. The following chart summarizes 22020 participating customers by Program channel:

Non-Residential Smart $aver Program

Prescriptive Program Option	Participating Customers*	% 2020 Repeat Customer
Paper and Online Application Form	369	70%
Midstream Marketing Channel	1,238	58%
Online Energy Savings Store	422	41%
Multifamily Free Channel**	23	83%

*May include multiple facilities/sites for one customer.
**The Multifamily Free Channel was suspended for the majority of 2020 due to COVID-19

During 2020, 854 applications, consisting of 2,269 measures, were paid for Duke Energy Progress prescriptive measures. Paid application volume was down 32% in 2020 vs. 2019. . 69% of 2020 applications were submitted via the online application portal. The average payment paid per application was $3,320. Duke Energy utilizes an internal database that allows the Program to self-administer applications and track data.

Many TAs participating in the application process reduce the customer's invoice by the amount of the Smart $aver® Prescriptive incentive and then receive reimbursement from DEP. Customers often prefer this approach rather than paying the full cost of equipment upfront and receiving an incentive check from DEP later.

The midstream marketing channel provides instant prescriptive incentives to eligible customers at a participating distributor's point of sale. Approved midstream distributors validate eligible customers and the lighting, HVAC, food service and IT products they selected to purchase through an online portal and use that information to show customers the reduced price of high efficiency equipment. Upon purchase, the distributor reduces the customer's invoice for the eligible equipment by the amount of the prescriptive incentive. Distributors then provide the sales information to DEP electronically for reimbursement. The incentives offered through the midstream channel are consistent with current Program incentive levels.

Energy Solutions provides the online portal for distributors to manage the paperless validation and incentive application. During 2020, approximately 49% of total Smart $aver Prescriptive incentives were paid through the midstream marketing channel. Duke Energy currently has 300 distributors signed up for the midstream channel, an increase of 10% from 2019.

The Duke Energy Business Savings Store on the Duke Energy website uses EFI, a the third-party that fulfills orders directly for the customers. The site gives customers the opportunity to take advantage of a limited number of prescriptive measure incentives by purchasing products from the on-line store at a purchase price reduced by the amount of the incentive. The discounts in the store are consistent with current incentive levels.

In order to grow the number of accounts participating in EE, particularly in market segments where knowledge of EE is limited, the Program is now collaborating with the Residential Multifamily Direct Install program to offer free low-cost measures to multifamily common areas as well as tenant spaces. Multifamily properties that are being approached by the Residential Multifamily program's vendor, Franklin Energy, are now eligible to add on limited quantities of common area measures. The common area must be on an eligible commercial rate to participate. Measures such as LED screw-in lamps, LED exit signs, low flow shower heads, faucet aerators and pipe insulation are now being installed where possible in multifamily common areas as well as in residential spaces. For those properties that accept the measures, Franklin Energy will directly install them in the common areas when they are on site for the residential installations. Franklin Energy tracks the measures installed by property, as well as total installations and reports this information to the Program team. This channel was suspended along with the Residential Multifamily Direct Install program for the majority of 2020 due to COVID-19.

Customers continue to identify energy efficiency opportunities eligible for incentives under this Program. In 2020, 99 new pre-approval applications were submitted of which 50 were new construction projects. Additionally, 47 projects were enrolled in new construction which precedes a Smart $aver Custom application.

Non-Residential Smart $aver Program

Smart $aver Custom Incentives program uses a flat rate incentive for both energy and demand savings.

Efforts to educate trade allies and vendors who sell energy efficient equipment have been very successful. In many cases, vendors will submit the paperwork for the customer, eliminating a barrier for customers that do not have the resources to devote to completing the application.

The Program launched a fast track option for 2017 which gives customers the ability to pay a fee to speed up their application processing time to seven business days. This fee is passed through to the vendor for its cost to expedite the application.

As new technologies are introduced and changes occur in the energy efficiency marketplace, performance incentives are the perfect tool to influence and reward customers who invest in energy efficiency. The Smart $aver Performance Incentives program was launched on January 1, 2017. Efforts to encourage internal resources, trade allies and vendors who sell energy efficient equipment to promote the Program and assist customers to participate are continuous and on-going. In addition, the Program is marketed closely with the Smart $aver Custom Program.

In 2020 the Smart $aver Performance Incentives program received 7 new applications.

The program experiences large fluctuations in performance due to long project lead times, long monitoring and verification times, and the timing and sizes of projects. With a compelling value proposition and internal resources and trade allies getting comfortable with this unique program offering, participation is expected to continue to be strong.

The program is now able to offer both top and bottom cycle CHP to customers.

The Program launched a new marketing channel in 2017 called New Construction Energy Efficiency Design Assistance (NCEEDA) to identify projects for customers currently underserved in the small and medium business market. This channel utilizes the vendor Willdan Energy Solutions to help find those opportunities, complete savings calculations as well as submit applications for the customer. As of January 24, 2020, 160 active and completed projects have enrolled in the DEP - NCEEDA offering, representing 21.8 million square feet of new construction along with 127 Smart $aver Custom project applications representing 38 million kilowatt hours of energy savings.

Issues

The primary issues that faced the program in 2020 were all related to responding and adapting to the new reality after the onset of the COVID-19 pandemic in late first quarter. Program participation experienced a sharp decline in April and slowly recovered through the remainder of the year. Fortunately, very few program activities require face-to-face contact, so the Smart $aver® team as able to continue processing incentive applications and administering the program while working from home.

Potential Changes

Standards continue to change and new, more efficient technologies continue to emerge in the market. DEP periodically reviews major changes to baselines, standards, and the market for equipment that qualifies for existing measures and explores opportunities to add measures to the approved Program for a broader suite of options.

DEP is also considering new and innovative ways to reach out to customer segments that have had a lower rate of prescriptive incentive applications and considering options to partner with other DEP EE programs to cover gaps in the market and ultimately, make it easier for customers to participate in Smart $aver incentives.

The Program team would like to drive deeper customer savings and increase participation in technologies beyond lighting. The Midstream distributor channel has proven to be efficient and customer friendly, influencing energy efficiency at the point of sale. Efforts are underway to build upon the success of the

Midstream channel by promoting a similar Upstream offer with manufacturers for existing food service and HVAC technologies only.

E. Marketing Strategy

Program marketing efforts were greatly reduced in 2020 in response to the COVID-19 pandemic and the need for Duke Energy marketing to focus first on more relevant and appropriate messaging to customers regarding pandemic-related assistance.

The marketing plan for 2021 includes direct marketing such as email and direct mail, online marketing, print marketing and supporting partnerships.

The internal marketing channel consists of assigned Large Business Account Managers, small and medium Business Energy Advisors, and Local Government and Community Relations, who all identify potential opportunities as well as distribute program informational material to customers and Trade Allies. Duke Energy has Business Energy Advisors in the Carolinas area to perform outreach to unassigned small and medium business customers. The Business Energy Advisors follow up on customer leads, assist with program questions, and steer customers who are not already working with a trade ally to the trade ally search tool. In addition, the Business Energy Advisors contact customers with revenue between $60,000 and $250,000 to promote the Smart $aver® programs. The Economic and Business Development groups also provide a channel to customers who are new to the service territory.

F. Evaluation, Measurement and Verification

Non-Residential Smart $aver Prescriptive Program

The combined DEC/DEP process and impact evaluation for the Non-Residential Smart $aver Prescriptive Incentive program for the period of March 2017 through December 2018 began the first quarter of 2019. The final report was completed in July 2020 and presented at the 4th Qtr 2020 Collaborative.

A process evaluation to determine free ridership and spillover was conducted. The process evaluation included interviews with program management. Main Channel Customer, Midstream Customer and Trade Ally surveys were conducted to assess program awareness, satisfaction and installation decisions. Program materials were also reviewed to fully understand the specifics of the program design.

The impact evaluation consisted of engineering desk reviews as well as on site metering for a subset of lighting measures. An online survey with Midstream lighting customers was performed to verify purchase and installation of lighting measures. Program supplied tracking databases, project documentation and Technical Reference Manuals from Ohio and neighboring states were also be used to estimate verified energy and demand savings for the Smart $aver Prescriptive program.

Non-Residential Smart $aver Custom Program

No evaluation activities occurred in 2019, however evaluation activities commenced in the first quarter of 2020. A final report, combined with DEP, is planned for the second quarter of 2021.

EnergyWise Business

A. Description

The Duke Energy Progress, LLC ('Company') EnergyWise Business ('Program') is an energy efficiency and demand response program for non-residential customers that allows the Company to reduce the operation of participants AC units to mitigate system capacity constraints and improve reliability of the power grid. The Program provides customers with options for how they would like to participate. In exchange for participation, the Company provides participants with an annual incentive applied directly to their bill.

Program participants can choose between a Wi-Fi thermostat or a load control switch which is professionally installed for free for each air conditioning or heat pump unit at the premise. In addition to choosing the equipment, the participants can also choose at what cycling level they would like to participate 30%, 50%, or 75%. During a conservation period, the Company sends a signal to the thermostat or switch to reduce the amount of time the unit is running by the percentage the participant selected. For participating at the 30% level, the customer receives a $50 annual bill credit for each unit, $85 for the 50% level, or $135 for the 75% level. Additionally, participants with a heat pump unit with electric resistance emergency/back up heat that choose the thermostat can also participate in a winter option which allows the Company to control the emergency/back up heat. For 100% control of the emergency/back up heat, the Company provides an additional $25 annual bill credit.

Participants choosing the thermostat have access to a portal that allows them to control their units from anywhere with internet access. They can set schedules, adjust temperature set points, and receive energy conservation tips and communications from the Company. In addition to the portal access, participants also receive notifications of upcoming conservation periods. These notifications allow participants to make adjustments to their schedules or notify their employees of the upcoming conservation period. Participants are allowed to override two conservation periods per year without penalty. They can activate an override before or during the conservation period.

Audience

The Program is available to existing non-residential customers that are not opted-out of the DSM Rider, have at least one air conditioner or heat pump that operates to maintain a conditioned space on weekdays during the calendar months of May through September, and are not served under Schedules LGS-RTP and SI, Riders NM, DRA, 57, 68 IPS, LLC or NFS. Also, customers must have an average minimum usage of 1,000 kWh during those same calendar months.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	55	548.6	494.0
Savings (MW)	8.25	5.06	-3.19
Participants (EE & DR)		5,915	
Program Expenses		$1,896,524	

D. Qualitative Analysis

Highlights

During 2020, the Program was significantly impacted by shutdowns due to COVID-19. The program was shut down completely from the end of March until June 15th, 2020. The program closed again for one week in November and the last two weeks of December. The shutdown time plus the removal of no longer active devices the result is the Program shrunk by 601 devices reducing the total installed devices in DEC to 5,802.

The door-to-door marketing (canvassing) used by the program was considered a high-risk activity. The program delayed restarting due to the risk. Once it was restarted, the Program used a phased approach to test safety protocols and use of PPE to keep everyone safe. The program only returned to

75% of the preCOVID levels

Issues

One factor that continues to impact the Program's overall performance is the high number of customers selecting to enroll in the 30% cycling option. 58% of customers are participating in this option. This is a slight improvement from the 60% participation in the 30% cycling option seen at the end of 2018. The original assumption when the Program was filed was that 50% of customers would select this option. Program staff worked with canvassers to improve their pitches to promote the higher cycling options, improving the current enrollment percentages and bringing them closer to the original assumptions. But, with the high percentage of customers participating in the 30% option in prior years, the overall percentage is slow to come down.

Potential Changes

With the program struggling with cost effectiveness, and the change in DEP from a summer peaking utility to winter peaking, the program is going to move to a maintenance mode. We have negotiated price reductions with our vendor that will improve the cost effectiveness and allow the program to maintain the current capacity levels.

E. Marketing Strategy

In 2019, the Program has continued to use a dedicated canvassing vendor for door-to-door marketing in Raleigh, the greater Raleigh region, and Wilmington. Additionally, the Program continues to see enrollments as a result of cross promotion efforts with the Small Business Energy Saver program and the Duke Energy Business Energy Advisors.

F. Evaluation, Measurement and Verification

The evaluation for the Smart Thermostat (EE) measure for the period of January 2018 – February 2019 was completed in February 2021. Impacts for the demand response portion (Summer 2021) for the program has subsequently begun with a final DR rpeort scheduled for 2nd Quarter 2022.

A. Description

Demand Response Automation ('Program') allows Duke Energy Progress, LLC ('Company') to install data acquisition and optional load control devices to remotely monitor and control the following electrical equipment:

HVAC
Lighting
Standby generation
Variable speed motors
Non-critical, interruptible operations

Program participants agree to reduce their total metered demand by the seasonal contracted kilowatt (kW) amount during the time specified in the event notification. Participants may reduce their demand using any method, including the use of other power sources. In return, these businesses receive valuable incentives as follows:

1. A one-time participation incentive of $50/kW for demonstrated demand reduction during initial summer event(s) on the program,
2. Monthly credits of $4.25/kW for the contracted amount of curtailable demand, and
3. Performance credits of $6/kW for demand reduced during each curtailment event.

Audience

The Program is available to commercial, industrial and governmental customers with a service base that is capable of contracting for a minimum of 50 kW in curtailable demand. Some exclusions apply based on rate schedules and participation in other riders.

B & C. Impacts, Participants and Expenses

2020 YTD Results	Annual Forecast	Actual at 12/31/2020	Variation
Savings (MWH)	N/A	N/A	N/A
Savings (MW)	7.36	1.93	-5.43
Participants		1,834	
Program Expenses		$1,837,718	

D. Qualitative Analysis

Highlights

CIG DRA added a net 1.9 MW (at the plant) of curtailable demand in 2020. Program growth in recent years has been limited by impacts of EPA regulations and by the aversion of industrial customers to the rider's minimum three annual curtailment events, particularly since larger customers interested in demand response programs also have an alternative through Rider LLC that does not have the DSM/EE Opt-In requirement. In early 2020, the Company sought and received approval from the NCUC and PSC to address these barriers through minor revisions to Rider DRA without negatively impacting cost-effectiveness of the Program. Specifically, DEP changed the required minimum number of annual summer events from three (3) to one (1), while simultaneously adjusting the monthly credit to maintain the current guaranteed annual incentive opportunity of $57.00/kW. Additionally, the required minimum contracted demand was reduced from 75kW to 50kW. These changes were effective February 25, 2020.

The Company dispatched the program one time in 2020, which occurred during the summer to meet the rider minimum.

Potential Changes

No changes currently being evaluated.

E. Marketing Strategy

The Company continues to market the Program directly through Large Account Management and has expanded efforts to reach eligible unassigned customers through various channels that include but are not limited to the following:

Direct mail (letters and postcards to qualifying customers)
Duke Energy Progress website
Email
Video
Promotion by the Medium Business Energy Advisors team
Additional detailed program information is located at www.duke-energy.com/dra.

F. Evaluation, Measurement and Verification

There were no evaluation activities in 2020. PY2021 evaluation activities will begin the first quarter of 2021 with a planned final report in the second quarter of 2022 with a planned impact and process evaluation.

Compliance Evans Exhibit 7

Duke Energy Progress
Estimate - January 1, 2022 - December 31, 2022
Docket Number E-2, Sub 1273
Projected Program/Portfolio Cost Effectiveness - Vintage 2022

Program	UCT	TRC	RIM	PCT
Residential Programs				
· Energy Education Program for Schools	1.46	1.50	0.60	8.95
· Energy Efficient Appliances & Devices	2.78	1.70	0.55	4.37
· Residential Smart $aver	1.01	0.49	0.43	1.38
· Neighborhood Energy Saver	0.85	0.90	0.48	2.61
· Weatherization Pilot	0.99	1.44	0.43	
· Residential New Construction	1.35	1.46	0.58	3.48
· Energy Efficient Lighting	2.18	3.68	0.66	9.47
· Multi-Family EE Products & Services	2.59	2.85	0.57	10.49
· My Home Energy Report	1.64	1.64	0.64	
· EnergyWise Home	3.77	26.74	3.77	
· Residential Energy Assessments	2.29	2.21	0.56	31.28
Residential Total	**1.77**	**1.69**	**0.60**	**5.22**
Non-Residential Programs				
· EnergyWise for Business	0.28	0.81	0.28	
· Smart $aver(R) Non Residential Performance Incentive Program	2.80	1.11	1.00	1.83
· Smart $aver® Non Residential Prescriptive	3.11	1.93	0.85	3.79
· Smart Saver® Non-Residential - Custom	2.29	1.12	0.94	1.98
· Small Business Energy Saver	2.48	1.46	0.85	2.76
· Commercial, Industrial, Governmental Energy Efficiency (CIG EE, EEB)	2.11	26.31	2.11	
Non-Residential Total	**2.48**	**1.66**	**0.86**	**3.18**
Overall Portfolio total	**2.07**	**1.68**	**0.71**	**4.09**

Evans Exhibit 8

Duke Energy Progress
Changes to DSM/EE Cost Recovery Vintage 2020 True Up January 1, 2020 - December 31, 2020
Changes from Prior Filing Due to Application of M&V and Participation
System kWh and kW Impacts Net Free Riders at the Plant
Docket Number E-2, Sub 1273

Residential Programs

	Filed in Docket E-2, Sub 1206		Filed in Docket E-2, Sub 1273		Overall Variance		E-2 Sub 1206	E-2 Sub 1273	Delta	Variance attributable to Participation		Variance attributable to Mix of Measures		Variance attributable to EM&V		Sum of Variances	
Program Name	kWh	kW	kWh	kW	kWh	kW	System Participation		Participation	kWh	kW	kWh	kW	kWh	kW	kWh	kW
Weatherization Pilot	-	-	107,608	21	107,608	21	-	1,067	1,067	-	-	107,608	21	-	-	107,608	21
Energy Efficiency Education Program	3,872,957	462	1,455,424	174	(2,417,532)	(289)	11,661	4,382	(7,279)	(2,417,532)	(289)	-	-	-	-	(2,417,532)	(289)
Energy Efficient Lighting	8,977,956	1,480	18,942,865	3,123	9,964,908	1,643	687,321	1,304,922	617,601	9,964,908	1,643	-	-	-	-	9,964,908	1,643
Residential Smart $aver®	5,634,699	1,971	6,893,070	1,925	1,258,371	(47)	14,286	22,411	8,125	1,258,375	(47)	-	-	(4)	0	1,258,371	(47)
Multi-Family Energy Efficiency Program	14,538,633	1,847	2,816,526	369	(11,722,107)	(1,479)	313,426	69,966	(243,460)	(11,403,988)	(1,435)	-	-	(318,119)	(44)	(11,722,107)	(1,479)
Neighborhood Energy Saver	2,279,725	348	505,268	67	(1,774,456)	(280)	5,049	617	(4,432)	(2,001,139)	(305)	-	-	226,683	25	(1,774,456)	(280)
Residential Energy Assessments	6,866,573	820	7,151,467	861	284,894	41	18,657	42,902	24,245	(160,046)	(14)	444,940	55	-	-	284,894	41
Residential New Construction	15,992,111	4,606	20,007,860	5,358	4,015,749	752	12,836,720	16,844,791	4,008,071	3,976,598	750	39,151	2	-	-	4,015,749	752
Energy Efficient Appliances and Devices	23,787,507	7,922	18,783,681	2,049	(5,003,826)	(5,873)	410,184	338,776	(71,408)	(11,507,625)	(3,848)	6,368,084	976	135,714	(3,001)	(5,003,826)	(5,874)
Residential Home Advantage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
My Home Energy Report	116,045,885	19,586	154,961,344	54,395	38,915,460	34,809	780,250	769,399	(10,851)	(657,374)	(243)	-	-	39,572,834	35,052	38,915,460	34,809
Power Manager	-	27,629	-	17,810	-	(9,819)	16,112	15,862	(250)	-	(2,477)	-	-	-	(7,342)	-	(9,819)
Residential Programs Total	197,996,045	66,671	231,625,113	86,150	33,629,069	19,479	15,093,666	19,415,095	4,321,429	(12,947,823)	(6,265)	6,959,784	1,054	39,617,108	24,691	33,629,069	19,479

Non-Residential Programs

	Filed in Docket E-2, Sub 1206		Filed in Docket E-2, Sub 1273		Overall Variance		E-2 Sub 1206	E-2 Sub 1273	Delta	Variance attributable to Participation		Variance attributable to Mix of Measures		Variance attributable to EM&V		Sum of Variances	
Program Name	kWh	kW	kWh	kW	kWh	kW	System Participation		Participation	kWh	kW	kWh	kW	kWh	kW	kWh	kW
Energy Efficient Lighting	2,357,624	611	4,993,362	1,294	4,992,751	683	83,286	158,125	74,839	2,635,739	683	-	-	-	-	2,635,739	683
Smart Saver® Non-Residential - Custom	21,077,008	2,406	12,768,124	3,024	(8,308,884)	618	15,844	9,183	(6,661)	-	-	(8,308,884)	618	-	-	(8,308,884)	618
Smart Saver® Non Residential Prescriptive	63,750,610	10,443	46,353,186	7,700	(17,397,424)	(2,743)	2,238,498	2,089,903	(148,595)	(15,385,257)	(2,324)	3,322,207	380	(5,334,374)	(799)	(17,397,424)	(2,743)
Smart Saver(R) Non Residential Performance Incent	7,520,191	858	3,104,355	223	(4,415,837)	(635)	7,227,548	42	(7,227,506)	-	-	(4,415,837)	(635)	-	-	(4,415,837)	(635)
Small Business Energy Saver	38,401,907	6,642	23,471,981	3,895	(14,929,926)	(2,747)	36,000,000	22,264,626	(13,735,374)	(14,929,926)	(2,747)	-	-	-	-	(14,929,926)	(2,747)
EnergyWise for Business	54,636	8,252	548,603	5,063	493,967	(3,188)	10,723	5,915	(4,807)	(31,972)	(3,286)	-	-	525,939	98	493,967	(3,188)
Commercial, Industrial, Governmental Energy Effici	-	7,357	-	1,928	-	(5,429)	7,000	1,834	(5,166)	-	(5,571)	-	-	-	142	-	(5,429)
Non-Residential Programs Total	133,161,976	36,570	91,239,612	23,128	(39,565,352)	(13,441)	45,582,898	24,529,628	(21,053,270)	(27,711,417)	(13,245)	(9,402,513)	363	(4,808,435)	(559)	(41,922,365)	(13,441)
Distribution System Demand Response																	
DSDR	46,476,232	293,836	32,097,809	205,053	(14,378,423)	(88,783)	-	-	-	N/A	N/A	-	-	-	-	N/A	N/A
Total Residential and Non-Residential Programs	377,634,253	397,076	354,962,533	314,331	(20,314,707)	(82,745)	60,676,564	43,944,723	(16,731,841)	(40,659,240)	(19,510)	(2,442,729)	1,416	34,808,673	24,132	(8,293,296)	6,038

NOTE - The actual per unit impacts are reflective of the following EM&V reports:

Program Name As Filed	Docket	Report Reference	Effective Date
Energy Efficient Appliances and Devices	E-2, Sub 1085	Save Energy and Water Kits 2018 – 2019 Evaluation Report	9/1/2019
Multifamily Energy Efficiency Program	E-2, Sub 1059	EM&V Report for the Duke Energy Multifamily Energy Efficiency Program	6/1/2018 (Water); 7/1/19 (Lighting)
Non-Residential Smart $aver Program	E-2, Sub 938	Duke Energy Carolinas and Duke Energy Progress Non-Residential Smart $aver Prescriptive Program Evaluation Report	8/1/2019
EnergyWise for Business	E-2, Sub 1086	2020 EM&V Interim Report for the EnergyWise Business Program	3/1/2019

Duke Energy Progress, LLC
List of Industrial and Commercial Customers Opted Out of Vintage 2020
Docket E-2, Sub 1273

	Number of Accounts
DSM RIDER OPT OUT YR 2020	**5,441**
EE RIDER OPT OUT YR 2020	**5,233**

Customer Bill Name	EE YR 20 (JAN 1 - DEC 31) RIDER OPT OUT	DSM YR 20 (JAN 1 - DEC 31) RIDER OPT OUT	GRAND TOTAL
1922 SKIBO CROSS CREEK LLC	1	1	2
333 VENTURES LLC	2	2	4
3700 GLENWOOD OWNER LLC	1	1	2
3C PACKAGING INC	1	1	2
5400 RALEIGH CRABTREE KKC	1	1	2
81ST REGIONAL SUPPT COMMAND	1	1	2
A STUCKI COMPANY	1	1	2
A&M 2610 WYCLIFF OWNER LLC	2	2	4
ABB MOTORS AND MECHANICAL INC	2	2	4
ACCUCHROME TOOL & MOLD INC	1	1	2
ACME-MCCRARY CORP	1	1	2
ADVANCED PLASTIC EXTRUSION LLC	3	3	6
ADVANCED PLASTIFORM INC		5	5
AG PROVISION LLC	3	3	6
AIR SYSTEM COMPONENTS INC	1	1	2
AJINOMOTO USA INC	3	3	6
ALBANY ROAD - 6501 WESTON LLC	1	1	2
ALCAMI CAROLINAS CORPORATION	4	5	9
ALIDADE GLENWOOD LLC	1	1	2
ALL TRUSS LLC	1	1	2
ALLEN HARIM FOODS LLC	1	1	2
ALPLA INC	1	1	2
AMCOR FLEXIBLES INC	1	1	2
AMCOR RIGID PLASTICS USA LLC	3	3	6
AMERICAN AIRLINES INC	1	1	2
AMERICAN GROWLER INC	2	2	4
AMERICAN SKIN COMPANY INC	1	1	2
AMERICAN WOOD FIBERS INC		1	1
AMERICHEM INC	3	3	6
AMERIQUAL ASEPTIC LLC	2	2	4
AMERISOURCEBERGEN DRUG CORPORA	1	0	1
ANSON COUNTY WATER DEPT	2	2	4
ANSON COUNTY WTR SYSTEM	2	2	4
ANSON MACHINE WORKS	4	4	8
ANSON WOOD PRODUCTS INC	4	4	8
APAC TENNESSEE INC	4	4	8
APEX OIL CO INC/TERMINALS DIVI	5	5	10
APEX TOOL GROUP LLC	2	2	4
ARAUCO NORTH AMERICA INC	7	7	14
ARCADIA FARMS LLC	2	2	4
ARCHER DANIELS MIDLAND CO	2	2	4
ARCLIN USA INC	6	6	12

ARDAGH GLASS INC	10	10	20
ARDEN CORPORATION	4	4	8
ASHEBORO CITY OF	4	4	8
ASHEBORO CITY SCHOOLS	10	22	32
ASHEBORO ELASTICS CORP	2	2	4
ASHEVILLE BUNCOMBE TECH	21	21	42
ASHEVILLE CITY OF	7	8	15
ASHEVILLE WASTE PAPER CO INC	5	5	10
ASTON PARK HEALTH CARE CENTER	1	1	2
AT & T MOBILITY	3	3	6
AT HOME STORES LLC	2	2	4
ATEX TECHNOLOGIES INC	2	2	4
ATLANTIC CORP OF WILM INC	7	9	16
ATLANTIC VENEER CORP	4	4	8
ATLAS PRECISION INC	1	1	2
AURIA TROY LLC	1	1	2
AUSTIN QUALITY FOODS INC	5	5	10
AUX KITCHEN LLC	1	1	2
AVL TECHNOLOGIES INC	7	7	14
AVL TECHNOLOGY PARK LLC	2	2	4
B V HEDRICK GRAVEL & SAND CO	9	9	18
BAILEY FARMS INC	1	1	2
BALCRANK CORPORATION	1	1	2
BALLY REFRIGERATED BOXES INC	2	2	4
BARNES FARMING CORPORATION	8	8	16
BARNHARDT MFG CO	2	2	4
BARTLETT MILLING CO	2	2	4
BASF AGR SOLUTIONS SEED US LLC	1	1	2
BASS FARMS INC	1	1	2
BB&T CORPORTATION	1	1	2
BB&T	5	5	10
BEAR CREEK ARSENAL INC	4	4	8
BELK INC	6	7	13
BELLSOUTH TELECOMMUNICATIONS	13	14	27
BELT CONCEPTS OF AMERICA	1	1	2
BILTMORE FARMS HOTEL GRP LLC	3	3	6
BILTMORE FOREST CNTRY CLUB INC	5	5	10
BJ'S WHOLESALE CLUB INC	8	8	16
BLACK CREEK RENEWABL ENERG LLC		1	1
BLACK MTN CENTER	6	6	12
BLUE RIDGE METALS CORP	3	3	6
BLUE RIDGE PAPER PRODUCTS INC	32	32	64
BOISE CASCADE WOOD PRDCTS LLC	1	1	2
BOLIVIA LUMBER CO LLC	2	2	4
BONSAL AMERICAN INC	3	3	6
BORG WARNER TURBO SYSTEMS INC	6	6	12
BORGWARNER THERMAL SYSTEMS INC	1	1	2
BP SOLUTIONS GROUP INC	2	2	4
BRIDGESTONE BANDAG LLC	7	7	14
BRIER CREEK OFF #6 LLC	1	1	2
BRIER CREEK OFFICE # 1 LLC	1	1	2
BRIER CREEK OFFICE # 2 LLC	1	1	2

BRIER CREEK OFFICE # 5 LLC	1	1	2
BRIER CREEK OFFICE #4 LLC	1	1	2
BRM PARTNERS II LLC	1	1	2
BRM PARTNERS LLC	1	1	2
BROMLEY PLASTICS CORPORATION	1	1	2
BROOKS HOWELL RETIREMENT HOME	3	3	6
BROOKWOOD FARMS INC	5	5	10
BRUNSWICK CO UTILITIES	1	1	2
BRUNSWICK CO	1	1	2
BRUNSWICK COUNTY SCHOOLS	43	50	93
BSH HOME APPLIANCES	6	9	15
BUNCOMBE CO BD OF EDUCATION		2	2
BUNCOMBE COUNTY		2	2
BURCAM CAPITAL II LLC	1	1	2
BURLINGTON INDUSTRIES LLC	2	2	4
CAMBRIDGE VILLAGE OF WIL LLC		5	5
CAMP DAVIS INDUSTRIAL PARK INC	6	6	12
CAMPBELL SOUP SUPPLY CO LLC	5	5	10
CAMPBELL UNIVERSITY INC	64	65	129
CAN AM SOUTH LLC	2	2	4
CANTON SAWMILL LLC	6	6	12
CAPE FEAR ACADEMY	2	2	4
CAPE FEAR COMMUNITY COLLEGE	36	36	72
CAPE FEAR COUNTRY CLUB	8	8	16
CAPE FEAR PUBLIC UTILITY AUTH	4	4	8
CAPEL INC	6	6	12
CAPITAL FUNDS INC	2	2	4
CAPITOL BROADCASTING CO	14	15	29
CAPITOL FUNDS INC	1	1	2
CARDINAL METALWORKS INC	2	2	4
CARLIE C OPERATION CENTER INC	15	8	23
CAROLINA APPAREL GROUP INC	1	1	2
CAROLINA BAY OF WILMINGTON LLC	5	5	10
CAROLINA BEACH TOWN OF	2	2	4
CAROLINA COUNTRY CLUB	3	3	6
CAROLINA CRATE & PALLET INC	3	3	6
CAROLINA DAIRY LLC	3	3	6
CAROLINA EGG CO INC	1	1	2
CAROLINA ELECTRONIC ASSEMBLERS	1	1	2
CAROLINA EYE ASSOCIATES PA	1	1	2
CAROLINA ICE INC	4	4	8
CAROLINA INNOVATIVE FOOD INGRE	3	3	6
CAROLINA METAL RECYCLERS INC	3	2	5
CAROLINA PRESERVE BY DEL WEBB	4	4	8
CAROLINAS HEALTHCARE SYSTEM	1	1	2
CARQUEST OF SRONCE	2	2	4
CARTERET CO BD OF ED	6	6	12
CARTERET COMMUNITY COLLEGE	16	16	32
CARTERET COUNTY FINANCE	1	1	2
CARTERET GENERAL HOSPITAL	18	18	36
CARY TOWN OF	24	24	48
CASCADES HOLDING US INC	7	7	14

CASE FARMS	15	15	30
CATALENT PHARMA SOLUTIONS LLC	16	20	36
CATERPILLAR INC	19	18	37
CECIL BUDD TIRE COMPANY LLC	1	1	2
CEGM MORRISVILLE LLC	1	1	2
CERTAINTEED CORPORATION	5	5	10
CERTAINTEED GYPSUM NC INC	3	3	6
CFVH - BLADEN HEALTHCARE	11	11	22
CHARTER COMMUNICATIONS INC	1	1	2
CHATHAM CO BOARD OF EDUCATION	23	23	46
CHATHAM CO	1	1	2
CHATHAM HOSPITAL INC	3	3	6
CHERRY HOSPITAL	19	19	38
CHROMA COLOR CORPORATION	3	1	4
CINCINNATI THERMAL SPRAY INC	1	1	2
CITRIX SYSTEMS INC	3		3
CITY OF HENDERSON	2	2	4
CITY OF RALEIGH PARKS REC DEPT	28	28	56
CL CARY LLC	3	3	6
CLIFFORD W ESTES CO INC	3	3	6
CLINTON CITY BD OF ED	8	8	16
CLINTON CITY OF	3	3	6
CM TUCKER LUMBER OF NC LLC	3	3	6
CMC CORPORATION	1	1	2
CMS FOOD SOLUTIONS INC	1	1	2
COAST LAMP MANUFACTORY	2	2	4
COASTAL CAR COMM COLL RES BLD	1	1	2
COASTAL CAROLINA COMM COLLEGE	13	13	26
COASTAL FEDERAL CREDIT UNION	1	1	2
COATINGS AND ADHESIVES CORP	7	7	14
COBB VANTRESS INC	1	1	2
COKER FEED MILL INC	1	1	2
COLUMBUS COUNTY SCHOOLS	11	11	22
COLUMBUS REG HEALTHCARE SYSTEM	3	3	6
COMFORT TECH INC	1	1	2
CONESTOGA WOOD SPECIALTIES	2	2	4
CONSOLIDATED METCO INC	5	5	10
COOPER INDUSTRIES INC	2	2	4
CORE-MARK DISTRIBUTORS INC	2	2	4
CORNELIA NIXON DAVIS INC	6	6	12
CORNING INC	4	4	8
CORTEK	4	4	8
COSTCO	4	4	8
COTTLE STRAWBERRY NURSERY INC	8	8	16
COTY US LLC	7	7	14
COUNCIL TOOL CO INC	5	5	10
COUNTRY CLUB OF LANDFALL	14	14	28
COUNTY OF WAYNE	1	1	2
COURTYARD BY MARRIOTT	2	2	4
COVIA HOLDINGS CORPORATION	6	6	12
CPI USA NORTH CAROLINA LLC	1	1	2
CRAVEN CO BD OF ED	15	19	34

CRAVEN CO JUSTICE CENTER	2	2	4
CRAVEN CO WOOD ENERGY LP		2	2
CRAWFORD KNITTING INC	1	1	2
CROP PRODUCTION SERVICES INC	1	1	2
CRUMPLER PLASTIC PIPE INC	8	8	16
CSX TRANSPORTATION	2	2	4
CTC FURNITURE DISTRIBUTORS INC	1	1	2
CUMBERLAND CNTY HOSPITAL SYS	1	1	2
CUMBERLAND CO BD ED	31	31	62
DAK AMERICAS LLC	8	8	16
DALIAH PLASTICS CORP	4	4	8
DAY INTERNATIONAL INC	3	3	6
DCI INC	2	2	4
DEERE & COMPANY	3	3	6
DEERFIELD EPISCOPAL RETIREMENT	18	19	37
DENNISON WYNDHAM V	1	1	2
DEPT OF HEALTH & HUMAN RESOURC	33	33	66
DESCO INDUSTRIES INC	4	4	8
DEVIL DOG MFG CO INC	1	2	3
DIRECT PACK EAST LLC	2	2	4
DLP CCMC LLC	1	1	2
DOMTAR PAPER COMPANY LLC	4	4	8
DRPFC I LLC	5	5	10
DUKE UNIV HEALTH SYSTEM INC	25	25	50
DUKE UNIVERSITY MARINE LAB	1	1	2
DUNN CITY OF	3	6	9
DUPLIN CO BD OF ED	10	10	20
DUPLIN GENERAL HOSP	3	3	6
DUPONT INDUSTRIAL BIOSCIENCES	15	15	30
DYNAPAR CORP	4	4	8
E CAROLINA METAL TREATING INC	3	3	6
EAGLE SPORTSWEAR LLC	2	3	5
EATON CORPORATION	21	21	42
EDELBROCK LLC	1	1	2
EDWARDS WOOD PROD INC ALAMANCE	4	4	8
EDWARDS WOOD PRODUCTS INC	16	16	32
ELASTIC THERAPY INC	3	1	4
ELECTRO SWITCH CORPORATION	1	1	2
ELEMENTIS CHROMIUM INC	4	4	8
ELKAY SOUTHERN PLANT 2	1	1	2
ELKINS SAWMILL INC	3	3	6
EMC CORPORATION	4	4	8
EMERGEORTHO PA	2	2	4
EMERSON AUTOMATION SOLUTIONS	3	3	6
ENERGIZER BATTERY MANUFACTURIN	9	9	18
ENTERPRISE PROPANE TERM & STOR	5	5	10
ENVIVA PELLETS HAMLET LLC	7	7	14
ENVIVA PELLETS SAMPSON LLC	1	1	2
ENVIVA PORT OF WILMINGTON LLC	4	4	8
EPC COLUMBIA INC		3	3
ERICO INC	6	6	12
EVERGREEN PACKAGING INC	4	4	8

EXTREME NETWORKS INC	1	1	2
F7 WEST LLC	4	4	8
FAYETTEVILLE TECH COMM COLL	2	2	4
FCC (NC) LLC	9	9	18
FENNER DRIVES	1	1	2
FIRST BAPTIST CH OF ASHE INC	1	1	2
FIRST CITIZENS BANK & TRUST CO	4	5	9
FIRST CITIZENS BANK	1	1	2
FIRSTHEALTH OF THE CAROLINAS	48	48	96
FLETCHER BUSINESS PARK LLC		1	1
FLETCHER HOSPITALITY LLC		1	1
FLEXENTIAL CORP	3	3	6
FLOCO FOODS INC	1	1	2
FLOWSERVE US INC	1	1	2
FLYING J INC	1	1	2
FOOD LION LLC	167	165	332
FORTRON INDUSTRIES LLC	1	1	2
FOUNTAIN POWER BOATS INC	5	5	10
FOUR SEASONS MNGMT SVCS INC	6	6	12
FRANKLIN BAKING COMPANY LLC	12	12	24
FRANKLIN COUNTY SCHOOLS	5	5	10
FRESH BUY INC	2	2	4
FRESH FOODS LLC	3	5	8
FRONTIER YARNS INC	20	20	40
FUJIFILM DIOSYNTH BIOTEC USA	6	8	14
FULCHER`S POINT PRIDE SEAFOOD	3	3	6
FUQUAY-VARINA TOWN OF	3	3	6
GALE FORCE SPORTS & ENTERTAIN	16	16	32
GALLOWAY RIDGE INC	17	17	34
GENERAL ELECTRIC CO	9	9	18
GENERAL INDUSTRIES INC	4	5	9
GENERAL PARTS DIST LLC	1	1	2
GENERAL SHALE BRICK INC	9	9	18
GENERAL TIMBER INC	4	4	8
GEORGIA PACIFIC WOOD PROD LLC	1	1	2
GEORGIA-PACIFIC CORP	2	2	4
GH CRESCENT GREEN INC	1	1	2
GIBRALTAR PACKAGING GROUP INC	4	4	8
GILDAN YARNS LLC	3	3	6
GIVENS ESTATES INC	12	12	24
GIVENS HIGHLAND FARMS LLC	15	16	31
GKN DRIVELINE N AMERICA INC	5	5	10
GLAXOSMITHKLINE	6	6	12
GLEN RAVEN MILLS INC	2	2	4
GLENAIRE INC		6	6
GLENWOOD ASSET MANAGEMENT LLC	1	1	2
GLENWOOD PLACE VENTURES LLC	1	1	2
GLOBAL PACKAGING INC	1	1	2
GODWIN MFG CO INC	14	14	28
GOLD BOND BUILDING PRODUCT LLC		2	2
GOLDSBORO CITY OF	3	3	6
GOLDSBORO HOUSING AUTHORITY	3	3	6

GOLDSBORO MILLING CO	14	14	28
GRANITE FALLS SWIM/ATHL CLUB	2	2	4
GREATER ASHEVILLE REG AIRPORT	1	1	2
GREDE II LLC	8	8	16
GREENE COUNTY MANAGER	1	1	2
GRIFOLS THERAPEUTICS LLC	37	37	74
H & H FURNITURE MFG INC	2	3	5
HAM PRODUCE LLC	5	5	10
HANESBRANDS INC	2	2	4
HANSON AGGREGATES SE LLC	33	33	66
HAPPY JACK INC	1	1	2
HARDEN ROAD ASSOCIATES	1	1	2
HARGER LIGHTNING & GROUNDING	1	1	2
HARNETT CO BD OF ED	27	27	54
HARNETT CO PUBLIC UTIL	9	9	18
HARNETT CO SHERIFF OFFICE	1	1	2
HARNETT HEALTH SYSTEM INC	19	19	38
HARRIS PRINTING CO INC	3	3	6
HARRIS TEETER INC	21	28	49
HASTY PLYWOOD CO	3	3	6
HAVELOCK CITY OF	1	1	2
HAYWOOD COUNTY LOCAL GOV	1	1	2
HAYWOOD REGIONAL MEDICAL CNTR	5	6	11
HCL AMERICA INC	1	1	2
HEATMASTERS LLC	3	3	6
HERAEUS QUARTZTECH AMERICA LLC	1	1	2
HEXION INC D/I/P	1	1	2
HIGHWOODS JOINT VENTURE	1	1	2
HIGHWOODS REALTY LP	19	19	38
HJH ASSOCIATES	1	1	2
HOG SLAT INC	7	7	14
HOLLY SPRINGS TOWN OF	1	1	2
HOME CARE PRODUCTS LLC	1	1	2
HOME DEPOT USA INC	2	2	4
HOOD PACKAGING CORPORATION	2	2	4
HOPE COMMUNITY CHURH OF NC INC	1	2	3
HORNWOOD INC	3	3	6
HOUSE OF RAEFORD FARMS INC	17	17	34
HOUSING AUTH CITY OF RALEIGH	2	2	4
HP ASHEVILLE LLC		1	1
HUGHES FURNITURE INDUSTRIE INC	2	2	4
HULSING HOTELS INC	12	12	24
HUVEPHARMA INC	2	2	4
HYDRO TUBE ENTERPRISES INC	1	1	2
IMMEDION LLC	5	2	7
INGERSOLL-RAND	1	1	2
INGLES MARKETS INC	117	118	235
INN ON BILTMORE ESTATE INC	1	1	2
INNOVATIVE LAMINATIONS CO	1	1	2
INTERNATIONAL BROADCAST BUREAU	1	1	2
INTERNATIONAL PAPER COMPANY	12	12	24
J & D WOOD INC	3	3	6

J A MCNEILL & SONS	1	1	2
J C HOWARD FARMS LLC	8	8	16
J P TAYLOR COMPANY LLC	4	4	8
J&J SNACK FOODS HANDHELDS CORP	3	3	6
JACKSONVILLE CITY OF	4	4	8
JACOB HOLM IND AMERICA INC	4	4	8
JOHNSON BROTHERS OF NC INC	2	2	4
JOHNSTON CO BOARD OF EDUCATION	72	76	148
JOHNSTON CO PUBLIC UTILITIES	2	2	4
JOHNSTON MEM HOSPITAL AUTH	1	1	2
JORDAN LUMBER & SUPPLY INC	22	22	44
JOVC FOOD CORP INC		1	1
KAYSER-ROTH CORPORATION	8	8	16
KENNAMETAL INC	2	2	4
KESSLER ASHEVILLE LLC	1	1	2
K-FLEX USA LLC	10	10	20
KING CHARLES INDUSTRIES LLC	2	2	4
KINGS HOLDINGS 4 LLC	4	4	8
KINGSLAND REALTY LLC	1	1	2
KLAUSSNER FURN IND INC	9	24	33
KOOPMAN DAIRIES INC	4	4	8
KORDSA INC	4	4	8
KRYOCAL LLC	3	3	6
LAKE JUNALUSKA ASSEMBLY INC	51	50	101
LAKE PARTNERS LLC	2	2	4
LANCER INC	5	5	10
LAURINBURG-MAXTON AIRPORT	12	14	26
LAZAR INDUSTRIES LLC	4	4	8
LEAR CORPORATION	8	8	16
LEE BRICK & TILE COMPANY	9	9	18
LEE COUNTY GENERAL SERVICES	1	2	3
LEE IRON & METAL CO	5	3	8
LENOIR CO BD OF EDUCATION	10	10	20
LEWIS SAUSAGE CO INC	1	1	2
LIBERTY COMMONS WARREN CO LLC	1	1	2
LIBERTY HEALTHCARE SERVICES	2	2	4
LIDL US OPERATIONS LLC	5	5	10
LIFEWAY CHRISTIAN RESOURCES OF	11	11	22
LINAMAR NORTH CAROLINA INC	4	4	8
LINPRINT CO	1	1	2
LIVE OAK BANKING COMPANY		1	1
LOCAL GOVERNMENT FED CREDIT UN	1	1	2
LONERIDER BREWING COMPANY	1	1	2
LORD CORPORATION	5	5	10
LOUISBURG COLLEGE INC	12	12	24
LOUISE WELLS CAMERON ART MUSEU	4	4	8
LOUISIANA PACIFIC CORP	5	5	10
LOW & BONAR INC	1	1	2
LOWER CAPE FEAR WATER & SEWER	1		1
LOWES COMPANIES INC	34	34	68
LOWES FOODS LLC	27	27	54
LOWES HOME CENTERS LLC	1	1	2

LTF CLUB OPERATIONS CO INC		1	1
LUMBERTON CELLULOSE LLC	6	6	12
M ADLER'S SON INC	1	1	2
MAGNETI MARELLI USA INC	7	7	14
MANHATTAN AMERICAN TERRAZO	1	1	2
MANUFACTURING METHODS LLC		1	1
MARS PETCARE US INC	10	10	20
MARTIN MARIETTA MATERIALS INC	63	63	126
MAS US HOLDINGS INC	2	2	4
MAY FURNITURE INC	3	3	6
MCDOWELL LUMBER CO INC	11	11	22
MCGILL ENVIRONMENTAL SYS OF NC	1	1	2
MCLAMBS ABATTOIR AND MEATS INC	1	1	2
MCMURRAY FABRICS INC	7	7	14
MEASUREMENTS GROUP INC	4	4	8
MEDICAL ACTION INDUSTRIES INC	1	1	2
MEDICAL SPECIALTIES INC	1	1	2
MEMORIAL MISSION HOSPITAL INC	1	1	2
MEREDITH COLLEGE	6	6	12
MERITOR HEAVY VEHICLE SYS LLC	2	2	4
MERTEK SOLUTIONS INC	3	3	6
MESTEK INC		3	3
METAL-CAD & STEEL FRAMING	1	1	2
METCHEM LLC	1	1	2
METHODIST UNIVERSITY	48	48	96
METROPOLITAN LIFE INS CO	2	3	5
METROPOLITAN SEWAGE DISTRICT	5	5	10
MHG ASHEVILLE ACH LLC	1	1	2
MHG ASHEVILLE AL LP	1	1	2
MICRO LAND GROUP LLC	1	1	2
MICROSPACE COMM CORP	1	1	2
MILKCO INC		4	4
MINE SAFETY APPL CO INC	1	1	2
MISSION HEALTH SYSTEM INC	21	21	42
MISSION ST JOSEPH HEALTH SYS	1	1	2
MISSION ST JOSEPH HOSPITAL	1	1	2
MITCHELL CO BD OF ED	3	3	6
MMIC-TL INC PARTNERS LLC	1	1	2
MOEN INC	8	8	16
MONTGOMERY COUNTY OF	2	2	4
MOORE COUNTY SCHOOLS	19	19	38
MOORE COUNTY	1	3	4
MOUNTAIRE FARMS INC	45	39	84
MT OLIVE PICKLE CO	18	18	36
MULE CITY SPEC FEED INC	2	2	4
MURPHY BROWN LLC	1	1	2
N C TELEVISION INC	1	1	2
N RALEIGH CHRISTIAN ACADEMY	1	3	4
NASH COMMUNITY COLLEGE	6	6	12
NASH COUNTY MANAGERS OFFICE	1	1	2
NASH COUNTY	1	1	2
NASH ROCKY MOUNT BD OF ED	26	26	52

NATIONAL SPINNING CO INC	7	7	14
NATIONAL WIPER ALLIANCE INC	1	1	2
NATURAL BLEND VEG DEHYDR LLC	1	1	2
NATURES WAY FARMS INC	1	1	2
NC AQUARIUM	2	3	5
NC DEPT OF AGRICULTURE	3	3	6
NC DEPT OF MENTL HEALTH	1	1	2
NC DEPT OF PUBLIC SAFETY	60	59	119
NC ELECTRIC MEMBERSHIP CORP		1	1
NC FARM BUREAU FEDERATION	1	1	2
NC NATIONAL GUARD	2	2	4
NC PORT EXPANSION FUND 1	1	1	2
NC RENEWABLE PWR LUMBERTON LLC	5	5	10
NC STATE FAIRGROUNDS	6	6	12
NC STATE PORTS AUTH	13	14	27
NC STATE PORTS AUTHORITY	34	34	68
NC STATE UNIVERSITY	133	133	266
NC STATE VETERANS HOME	2	2	4
NC WILDLIFE COMMISSION	1	1	2
NESBITT ASHEVILLE VENTURE LLC	2	2	4
NEW BELGIUM BREWING CO INC	3	3	6
NEW GENERATION YARN CORP	1	1	2
NEW HANOVER CO BD OF ED	62	71	133
NEW HANOVER REGIONAL MED CTR	33	33	66
NG PURVIS FARMS INC	3	3	6
NHC PROPERTY MANAGEMENT		2	2
NOBLE OIL SERVICES	5	5	10
NOMACO INC	4	4	8
NORCRAFT COMPANIES LP	3	3	6
NORTH CAROLINA MFG CO INC	1	1	2
NORTH HILLS TOWER II LLC	3	3	6
NORTH STATE TECH SOLUTIONS	2	2	4
NORTHEAST FOODS INC	1		1
NOVIPAX LLC	4	4	8
NOVO NORDISK PHARMACEUTICAL	14	14	28
NOVOZYMES NORTH AMERICA INC	6	6	12
NYPRO ASHEVILLE INC	3	3	6
OBERLIN INVESTORS LLC	1	1	2
OFFICE OF INFOR TECH SVCS	5	5	10
OLIVER RUBBER COMPANY	2	2	4
OMNI GROVE PARK LLC	21	21	42
ONSLOW CO BD OF COMM	8	8	16
ONSLOW CO BD OF EDUC	26	26	52
ONSLOW MEMORIAL HOSPITAL AUTH	2	2	4
ONSLOW WATER AND SEWER AUTH	5	5	10
ORACLE AMERICA INC	3	3	6
OWENS & MINOR	1	1	2
OXFORD CITY OF		1	1
P G & C INC	1	2	3
P&A INDUSTRIAL FABRCATIONS LLC		2	2
P/W OF NASHVILLE INC	2	2	4
PACON MANUFACTURING CORP	5	5	10

PACTIV LLC	1	1	2
PAK A SAK FOOD STORES	1	1	2
PALLET EXPRESS INC	4	5	9
PALZIV NORTH AMERICA INC	1	1	2
PAPA JOHNS USA INC		1	1
PARADIGM ANALYTICAL	1	1	2
PARK COMMUNICATIONS LLC	3	3	6
PARK N SHOP FOOD MART INC	4	4	8
PARKDALE AMERICA LLC	4	4	8
PARKS FAMILY MEATS LLC	1	1	2
PARRISH & RONE INC	1	1	2
PCS PHOSPHATE CO INC	5	5	10
PENDER CO BD OF ED	11	21	32
PENDER MEMORIAL HOSPITAL INC	7	7	14
PENICK VILLAGE INC	13	13	26
PENTAIR WATER POOL AND SPA INC	11	11	22
PEPSI BOTTLING VENTURES LLC	13	13	26
PERDUE FARMS INC	28	28	56
PERSON CO BD OF ED	2	2	4
PETROLEUM TANK CO	2	2	4
PFIZER INC	46	52	98
PHOENIX LTD PARTNERSHIP	1	1	2
PIEDMONT NATURAL GAS CO	1	1	2
PIEDMONT NATURAL GAS	2	2	4
PILGRIMS PRIDE CORPORATION	16	16	32
PILKINGTON	2	2	4
PINEHURST COUNTRY CLUB LLC	1	1	2
PINEHURST LLC	87	88	175
PINEHURST MEDICAL CLINIC	2	2	4
PINEHURST SURGICAL CLINIC PA		1	1
PIONEER HI BRED INC	4	4	8
PLASTEK IND INC (PA) NC	6	6	12
PLASTICARD PRODUCTS INC	2	2	4
POLYMER GROUP INC	8	8	16
POLYZEN INC	1	1	2
POP 150 FAYETTEVILLE LLC	3	3	6
PORT CITY COMMUNITY CHURCH	3	3	6
PPD DEVELOPMENT L.P.	4	4	8
PR II DRP WADE III OWNER LLC	1	1	2
PR II DRP WADE IV OWNER LLC	1	1	2
PR II WADE PARK LLC	3	3	6
PRAXAIR INC	3	3	6
PRECISION HYDRAULIC CYL INC	12	12	24
PRECISIONAIRE INC	3	3	6
PREMIERE FIBERS LLC	8	8	16
PRESTAGE AGENERGY OF NC LLC	1	2	3
PRESTAGE FARMS INC	35	35	70
PRESTIGE FABRICATORS INC	1	3	4
PRESTON TAYLOR FOOD INC	2	2	4
PRINTLOGIC LLC	3	3	6
PRO PALLET SOUTH INC	1	1	2
PROTO LABS INC		1	1

PSNC ENERGY	1	1	2
PUBLIC SCHOOLS OF ROBESON CO	31	31	62
PUBLIX NORTH CAROLINA LP	21	21	42
QUALITY CHEMICAL LABORATRS LLC	2	2	4
QUALITY TEXTILE SERVICES INC	1	1	2
RAEFORD CITY OF	1	1	2
RAILROAD FRICTION PRODUCT CORP	5	5	10
RALEIGH 1 LP	6	6	12
RALEIGH CITY OF	16	16	32
RALEIGH DURHAM OFFICE PARTNERS	4	4	8
RALEIGH FITNESS & WELLNESS	1	1	2
RALEIGH HOTEL OPERATOR INC	1	1	2
RANDOLPH COUNTY	10	10	20
RANDOLPH HOSPITAL INC D/I/P	2	19	21
RAVEN ANTENNA SYSTEMS INC	1	1	2
RC CREATIONS LLC	2	2	4
RD AMERICA LLC	1	1	2
RDU AIRPORT AUTHORITY	8	8	16
RED HAT INC	2	2	4
RED WOLF COMPANY LLC		1	1
REDDY ICE CORP	6	2	8
REGAL CINEMAS	1	1	2
REGAL ENTERAINMENT GROUP	2	1	3
REICH LLC	2	2	4
RELIANCE PACKAGING LLC	7	8	15
RESINART EAST INC	1	1	2
REVLON CONSUMER PRODUCTS CORP	3	3	6
REX HEALTH CARE INC	18	18	36
REX MOB PARTNERS LLC	1	1	2
RICHMOND COUNTY BOARD OF COMM	2	2	4
RICHMOND COUNTY SCHOOLS	9	9	18
RICHMOND COUNTY	1	1	2
ROBESON CO HEALTH SERVICE	1	1	2
ROBESON CO WATER PLANT	6	6	12
ROBESON COUNTY DSS	1	1	2
ROCKINGHAM CITY OF	9	9	18
RODECO CO	2	2	4
ROYAL TEXTILE MILLS INC	1	1	2
RSE INDEPENDENCE LLC	19	19	38
RV MANAGEMENT SERVICES LLC		2	2
S B SMITH & SON INC	4	4	8
S T & F PRECISION INC	1	1	2
S T WOOTEN CORPORATION	18	18	36
SAAB BARRACUDA LLC	6	6	12
SAGE & EVANS INC	1	1	2
SAGENT PHARMACEUTICALS INC	2	2	4
SAINT JOSEPH OF THE PINES INC	21	21	42
SAMPSON CO HEALTH	1	1	2
SAMPSON CO LAW ENFORCEMENT	1	1	2
SAMPSON REGIONAL MEDICAL CTR	3	3	6
SANDERSON FARMS INC	12	12	24
SANDHILLS COMM COLLEGE		12	12

SANFORD CITY OF	5	5	10
SANFORD LEE CO BD OF ED	23	42	65
SANFORD MILLING CO INC	2	2	4
SAPONA MFG CO INC	2	2	4
SAS INSTITUTE INC	55	54	109
SCHINDLER ELEVATOR CORP	2	2	4
SCOTLAND CONTAINER INC	2	2	4
SCOTLAND MANUFACTURING	1	1	2
SEPARATION TECHNOLOGIES LLC	2	2	4
SEQIRUS INC	2	2	4
SFM LLC		1	1
SHAW UNIVERSITY	9	9	18
SIBELCO NORTH AMERICA INCORPOR	45	45	90
SIEMENS MEDICAL SOLUTIONS	3	3	6
SILAR LABORATORIES INC	1	1	2
SILER CITY TOWN OF	2	2	4
SILVER LINE PLASTICS CORP	10	10	20
SINCLAIR BROADCAST GROUP INC	1	1	2
SIX FORKS OFFICE LLC		1	1
SMITHFIELD FRESH MEATS	14	14	28
SMOKY MOUNTAIN MACHINING INC	3	3	6
SNEEDEN NORMAN E	2	2	4
SONOCO PRODUCTS CO	1	1	2
SOUTH RIVER EMC COMM ASST CORP	1	1	2
SOUTHCO INC OF NC	1	1	2
SOUTHEASTERN CONTAINER INC	1	1	2
SOUTHEASTERN REGIONAL MED CTR	4	4	8
SOUTHERN CONCRETE MATERIAL INC	14	14	28
SOUTHERN FABRICATORS INC	4	4	8
SOUTHERN PINES TOWN OF	3	3	6
SOUTHERN PRODUCTS & SILICA CO	6	6	12
SOUTHERN STATES CHEMICAL INC	3	3	6
SOUTHERN VENEER SPEC PROD LLC	8	8	16
SPANSET INC	1	1	2
SPECTRUM PROP MANAGEMENT CO	1	1	2
SPIRIT AEROSYSTEMS INC	2	2	4
SPORTS FACTORY LLC	2	2	4
SPRING LAKE TOWN OF		1	1
SPUNTECH INDUSTRIES INC	2	2	4
SPX FLOW TECHNOLOGY SYSTEMS	1	1	2
ST ANDREWS PRESBYTERIAN COLL	5	5	10
ST. DAVIDS SCHOOL	6	6	12
STAN JOHNSON & ASSOCIATES LLC	6	6	12
STANADYNE INC	3	3	6
STARPET INC	7	7	14
STATIC CONTROL COMP INC	5	5	10
STEEL & PIPE CORP	1	2	3
STEPAN COMPANY		1	1
STEVEN ROBERTS ORIGINAL	2	2	4
STI POLYMER INC	1	1	2
STORM CLOUDS BREWING LLC	1	1	2
SUMITOMO ELECTRIC LIGHTWAVE CO	1	1	2

SUMMIT HOTEL TRS 123 LLC	1	1	2
SUN LIFE ASSURANCE CO OF CANAD	1	1	2
SUNBRIDGE REGENCY NC LLC	2	2	4
SUNRISE SENIOR LIVING	1	1	2
SUPERIOR MODULAR PRODUCT INC	1	1	2
SUPERIOR PLASTICS EXTRUSION	1	1	2
SUPERTEX INC	4	4	8
SURGERY CENTER OF PINEHURST	1	1	2
SURGICAL CARE AFFILIATES	1	1	2
SURTRONICS	3	3	6
SVT VENTURES LP	1	1	2
SYRACUSE PLASTIC OF NC INC	1	1	2
TALBERT BUILDING SUPPLY INC	1	1	2
TARGET STORES	4	18	22
TAYLOR DEVELOPMENT GROUP LLC	2	2	4
TE CONNECTIVITY CORPORATION	4	4	8
TECHNIMARK LLC	5	5	10
TESLA INC	1	1	2
THE ATRIUM AT BLUE RIDGE LLC	1	1	2
THE BILTMORE COMPANY	3	3	6
THE CHEESECAKE FACTORY	1	1	2
THE CHEMOURS COMPANY FC LLC	12	12	24
THE COUNTRY CLUB OF NC INC	1	1	2
THE CYPRESS OF RALEIGH	9	9	18
THE HARRELSON BUILDING INC		1	1
THE MARTIN BROWER COMPANY LLC	1	1	2
THE NEWS REPORTER CO INC	1	1	2
THE PORK COMPANY	1	1	2
THE QUARTZ CORP USA	19	19	38
THE SEFA GROUP INC	2	2	4
THE SUMMIT LAKE BOONE LLC	1	1	2
THE THREE RING BREWING CO LLC		2	2
THE UMSTEAD	1	1	2
THERMAL METAL TREATING INC	1	1	2
THERMOFISHER SCI ASHEVILLE LLC	1	1	2
TIERPOINT LLC	4	4	8
TIME WARNER CABLE SE LLC	3	3	6
TIPPER TIE INC	4	4	8
TOP TOBACCO LP	3	3	6
TOWN SQUARE WEST LLC	7	7	14
TRAM LUMBER LLC	3	3	6
TRAMWAY VENEERS INC	1	1	2
TRANS CAROLINA PRODUCTS LLC	1	1	2
TREEHOUSE FOODS INC	6	6	12
TRIANGLE AQUATIC CENTER	1	1	2
TRIANGLE BRICK CO	7	7	14
TRINITY MANUFACTURING INC	7	7	14
TROTTERS SEWING COMPANY INC		1	1
TROY LUMBER CO	18	18	36
TROY POLYMER INC	1	1	2
TUCSON CARY LLC	1	1	2
TURN BULL LUMBER COMPANY	1	1	2

TYSON FOODS INC	4	4	8
U S REIF 4700 FALLS NC LLC	1	1	2
UCHIYAMA MANUF AMERICA LLC	3	3	6
UNC AT ASHEVILLE	8	8	16
UNC HEALTH CARE SYSTEM	2	3	5
UNC INSTITUTE OF MARINE SCI	3	3	6
UNC PUBLIC TV OF NC	1	1	2
UNCW	22	26	48
UNILEVER MANUFACTURING US INC	7	7	14
UNILIN NORTH AMERICA LLC	3	3	6
UNILIN US MDF	12	12	24
UNISON ENGINE COMPONENTS INC	5	5	10
UNITED PARCEL SERVICE INC	1	1	2
UNITED STATES COLD STORAGE INC	8	8	16
UNIV OF NC HOSPITALS	1	1	2
UNIVERSAL HEALTHCARE N RAL INC	1	1	2
UNIVERSAL LEAF NORTH AMERICA	6	6	12
UNIVERSITY OF NC AT PEMBROKE	15	15	30
UNIVERSITY RESEARCH UNIT	1	1	2
URETHANE INNOVATORS INC		1	1
US ARMY FORT BRAGG	9	9	18
US ARMY	1	1	2
US DEPT OF AIR FORCE	3	3	6
US FLUE CURED TOBACCO GROWERS	1	1	2
US MARINE CORP	3	3	6
US MARINE CORPS	6	6	12
US POST OFFICE	3	3	6
US REIF REGENCY I	1	1	2
US VETERANS ADMIN HOSPITAL	3	3	6
USS NC BATTLESHIP COMM	2	2	4
UWHARRIE FRAME MFG LLC	2	2	4
UWHARRIE LUMBER CO	3	3	6
VALLEY PROTEINS INC	17	17	34
VANDERBILT MINERALS LLC	4	4	8
VANGUARD CULINARY GROUP LTD	1	1	2
VENEER TECHNOLOGIES INC	6	6	12
VESCOM AMERICA INC	4	4	8
VICTAULIC CO OF AMERICA	2	2	4
VILLARI BROS FOODS LLC	1	1	2
VINVENTIONS USA LLC	3	3	6
VONDREHLE CORP	9	9	18
VULCAN CONST MATERIALS LP	27	19	46
W N WILDER CO INC	1	1	2
WADE MANUFACTURING COMPANY	8	8	16
WAKE CO HOSP SYSTEM INC	4	4	8
WAKE COUNTY BOARD OF EDUCATION	220	220	440
WAKE COUNTY GENERAL SERVICES	21	21	42
WAKE STONE CORP	21	21	42
WAKE TECHNICAL COMM COLLEGE	32	32	64
WAKEFIELD REX INVESTORS MOBLLC	1	1	2
WAKEMED FACILITIES SVC	2	2	4
WAKEMED PROPERTY SERVICES	15	15	30

WAKEMED	6	6	12
WAL MART PDC #6091	4	4	8
WALLACE TOWN OF	1	1	2
WALMART STORES INC	80	80	160
WALNUT CREEK AMPHITHEATER	1	1	2
WARP TECHNOLOGIES INC	2	2	4
WARREN CO BD OF ED	4	4	8
WAYCO HAM COMPANY	2	2	4
WAYNE CO PUBLIC SCHOOLS	1	1	2
WAYNE COMMUNITY COLLEGE	1	1	2
WAYNE COUNTY	4	4	8
WAYNE MEMORIAL HOSPITAL INC	11	11	22
WAYNESVILLE TOWN OF	1	1	2
WEGMANS FOOD MARKETS INC	1	1	2
WELLS FARGO BANK NA	2	2	4
WEST FRASER INC	11	11	22
WESTERN NC HEALTHCARE INNO III	1	1	2
WESTERN NC HEALTHCARE INNO LLC	1	1	2
WEYERHAEUSER NR COMPANY	6	6	12
WHITEVILLE FABRICS LLC	4	4	8
WHOLE FOODS MARKET GROUP INC	6	6	12
WILLIAM BARNET & SON INC	5	5	10
WILLIAMS PROPERTY GROUP INC	1	1	2
WILMINGTON CITY OF	1	1	2
WILMINGTON HEALTH PLLC	4	4	8
WILMINGTON HOTEL ASSOC CORP	2	2	4
WILMINGTON INTL AIRPORT	20	20	40
WILMINGTON MACHINERY INC	1	1	2
WILSONART INTERNATIONAL	6	6	12
WINDSTREAM COMMS LLC	2	2	4
WIRTHWEIN NEW BERN CORP	3	3	6
WRDC LLC	1	1	2
WRIGHT MACHINE & TOOL CO INC	1	1	2
WRIGHTSVILLE BEACH BREWERY LLC	1	1	2
YALE INDUSTRIAL PRODUCTS INC	1	1	2
YAMCO LLC	1	1	2
YMCA OF THE TRIANGLE AREA	5	5	10
YMCA OF WESTERN NORTH CAROLINA		1	1
Grand Total	**5,233**	**5,441**	**10,674**

Duke Energy Progress, LLC
List of Industrial and Commercial Customers Opted Into Vintage 2020
Docket E-2, Sub 1273

	Number of Accounts	
Customer Bill Name	**EE YR 20 (JAN 1 - DEC 31)**	**DSM YR 20 (JAN 1 - DEC 31)**
ASHEBORO CITY SCHOOLS	10	
ATLANTIC CORP OF WILM INC	2	
CAROLINA METAL RECYCLERS INC		1
FIRST CITIZENS BANK & TRUST CO	1	
FOOD LION LLC	1	
HOME DEPOT USA INC	1	
MOUNTAIRE FARMS		5
NEW HANOVER CO BD OF ED	1	
NHC PROPERTY MANAGEMENT	1	
RED WOLF COMPANY, LLC	1	
TARGET STORES	4	
WILMINGTON CITY OF	1	
Grand Total	**23**	**6**

EM&V Activities

Planned Evaluation, Measurement and Verification (EM&V) Activities through the rate period (Dec. 31, 2022)

Evaluation is a term adopted by Duke Energy Progress (DEP) and refers generally to the systematic process of gathering information on program activities, quantifying energy and demand impacts, and reporting overall effectiveness of program efforts. Within evaluation, the activity of measurement and verification (M&V) refers to the collection and analysis of data at a participating facility/project. Together this is referred to as "EM&V."

Refer to the accompanying Evans Exhibit 11 chart for a schedule of process and impact evaluation analysis and reports that are currently scheduled.

Energy Efficiency Portfolio Evaluation

DEP has contracted with independent, third-party evaluation consultants to provide the appropriate EM&V support, including the development and implementation of an evaluation plan designed to measure the energy and demand impacts of the residential and non-residential energy efficiency programs.

Typical EM&V activities:

- Develop evaluation action plan
- Process evaluation interviews
- Collect program data
- Verify measure installation and performance through surveys and/or on-site visits
- Program database review
- Impact data analysis
- Reporting

The process evaluation provides unbiased information on past program performance, current implementation strategies and opportunities for future program improvements. Typically, the data collection for process evaluation consists of surveys with program management, implementation vendor(s), program partner(s), and participants; and, in some cases, non-participants. A statistically representative sample of participants will be selected for the analysis.

The impact evaluation provides energy and demand savings resulting from the program. Impact analysis may involve engineering analysis (formulas/algorithms), billing or AMI consumption analysis, statistically adjusted engineering methods, and/or building simulation models, depending on the program and the nature of the impacts. Data collection may involve surveys and/or site visits. A statistically representative sample of participants is selected for the analysis. Duke Energy Progress intends to follow industry-accepted methodologies for all measurement and

verification activities, consistent with International Performance Measurement Verification Protocol (IPMVP) Options A, C or D depending on the measure.

The field of evaluation is constantly learning from ongoing data collection and analysis, and best practices for evaluation, measurement and verification continually evolve. As updated best practices are identified in the industry, DEP will consider these and revise evaluation plans as appropriate to provide accurate and cost-effective evaluation.

Demand Response Program Evaluation

DEP has contracted with independent, third-party evaluation consultants to provide an independent review of the evaluation plan designed to measure the demand impacts of the residential and non-residential demand response programs and the final results of that evaluation.

Typical EM&V activities:

- Collect program data
- Process evaluation interviews
- Verify operability and performance through on-site visits
- Collect interval data
- Program database review
- Benchmarking research
- Dispatch optimization modeling
- Impact data analysis
- Reporting

The process evaluation provides unbiased information on past program performance, current implementation strategies and opportunities for future improvements. Typically, the data collection for process evaluation consists of surveys with program management, implementation vendor(s), program partner(s), and participants; and, in some cases, non-participants. A statistically representative sample of participants will be selected for the analysis.

The impact evaluation provides demand savings resulting from the program. Impact analysis for EnergyWise involves a simulation model to calculate the duty cycle reduction, and then an overall load reduction. Impact analysis for CIG-DR involves statistical modeling of an M&V baseline load shape for a customer, then modeling the event period baseline load shape and comparing to the actual load curve of the customer during the event period.

The field of evaluation is constantly learning from ongoing data collection and analysis, and best practices for evaluation, measurement and verification continually evolve. As updated best practices are identified in the industry, DEP will consider these and revise evaluation plans as appropriate to provide accurate and cost-effective evaluation.

DEP DSM/EE Programs - Anticipated EM&V Schedule

DEP DSM/EE Programs - Anticipated EM&V Schedule
As of June 3, 2021

Program Name	NC Docket	SC Docket	Short name	2021 2nd Quarter	2021 3rd Quarter	2021 4th Quarter	2022 1st Quarter	2022 2nd Quarter	2022 3rd Quarter	2022 4th Quarter	Notes
Commercial Demand Response	Docket No. E-2, Sub 953	Docket 2010-41-E	CIG DR	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP			Impact/process report due April 2022
Distribution System Demand Response	Docket No. E-2, Sub 926	Docket 2009-190-E	DSDR								
Nonresidential Smart $aver EE Products & Assessment (Prescriptive)	Docket No. E-2, Sub 938	Docket 2009-190-E	EEB		PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP		
Nonresidential Smart $aver EE Products & Assessment (Custom)	Docket No. E-2, Sub 938	Docket 2009-190-E	EEB	PROC/IMP	REP						
EnergyWise	Docket No. E-2, Sub 927	Docket 2009-190-E	EW	$IMP_{(S)}$ $PROC/IMP_{(W)}$	$IMP_{(S)}$ $REP_{(W)}$	IMP(S) IMP(W)	$REP_{(S)}$	$IMP_{(W)}$	$REP_{(W)}$		Summer 2021 report completed Feb 2022; Winter 2021/2022 completed Sep 2022
EnergyWise for Business	Docket No. E-2, Sub 1086	Docket 2015-163-E	EWB		PROC/IMP	PROC/IMP	PROC/IMP	$REP_{(DR)}$			Evaluation (2020) broken into two components; EE 1Q-2021 and DR 2Q-2022
Energy Efficiency Education	Docket No. E-2, Sub 1060	Docket 2014-420-E	K12	PROC/IMP	REP						
Residential Energy Assessment	Docket No. E-2, Sub 1094	Docket 2016-82-E	REA	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP	Combined DEC/DEP evaluation in late 2022/early 2023; timing delayed due to COVID-19 and delay in Smart T'stat launch
Lighting (Retail)	Docket No. E-2, Sub 950	Docket 2010-41-E	EEL				PROC/IMP	PROC/IMP	REP		Evaluation focused on hard-to-reach retailers; due to COVID, sample frame pushed out past 12/31/2021
Online Savings Store	Docket No. E-2, Sub 950	Docket 2010-41-E	OSS	PROC/IMP	PROC/IMP	REP					With timing revision for Retail Lighting, this will be standalone evaluation; timing is preliminary
Multi-Family Energy Efficiency	Docket No. E-2, Sub 1059	Docket 2014-419-E	MF	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP			Will be combined DEC/DEP evaluation; evaluation schedule extended
My Home Energy Report	Docket No. E-2, Sub 989	Docket 2011-180-E	MyHER	PROC/IMP	PROC/IMP	REP					Final report planned for Q4-2021
Neighborhood Energy Saver	Docket No. E-2, Sub 952	Docket 2009-190-E	NES	PROC/IMP	PROC/IMP	REP					Evaluation to be combined with DEC evaluation
Residential New Construction	Docket No. E-2, Sub 1021	Docket 2015-237-E	RNC	PROC/IMP	PROC/IMP	REP					
Residential Save Energy & Water Kit	Docket No. E-2 Sub 1085	Docket 2015-322-E	SEW		PROC/IMP	PROC/IMP	REP				Final report planned for Feb 2022
Small Business Energy Saver	Docket No. E-2, Sub 1022	Docket 2015-163-E	SBES	REP							Final report planned for Jun 2021
Residential HVAC	Docket E-2, Sub 936		HVAC				PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	final report planned for Q2-2023 (based on discussions w NCPS, pushed back evaluation timing one year)

LEGEND	
PROC	Process surveys/interviews (customers, etc.) for purposes of report that follows
IMP	Impact data collection (onsites, billing, etc.) & analysis for purposes of reporting
REP	Evaluation, Measurement & Verification Report

NOTE: THESE DATES ARE SUBJECT TO CHANGE

Evans Exhibit 12

Duke Energy Progress, LLC
Docket Number E-2, Sub 1273
Actual Program and Avoided Costs, January 1, 2015 - December 31, 2020

		2015		2016		2017		2018		2019		2020	
Market	Program	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs
Residential	Appliance Recycling Program	$ 1,220,465	$ 1,508,567	$ (137,009)	$ 76,177	$ 5,586	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Residential	Appliances and Devices	-	-	-	-	-	-	-	-	2,160,799	10,419,429	3,051,854	8,646,551
Residential	Energy Education Program for Schools	703,689	1,576,241	827,497	1,693,087	835,991	1,376,442	676,815	1,261,493	747,483	1,039,694	388,273	456,210
Residential	Energy Efficient Lighting	16,392,094	47,462,180	17,441,878	44,883,085	12,229,222	39,549,493	9,815,496	33,768,459	13,447,031	35,415,070	5,995,694	20,092,826
Residential	EnergyWise	5,205,545	32,617,641	6,887,758	70,854,171	6,502,032	62,410,503	5,817,271	55,969,845	5,806,874	53,221,850	1,110,200	8,817,400
Residential	Low Income Weatherization Pilot	-	-	-	-	-	-	-	-	27,356	75,533	51,370	61,168
Residential	Multi-Family	2,615,745	9,816,135	2,045,220	7,155,924	2,514,413	10,163,052	2,409,743	8,510,661	2,156,484	5,977,179	892,251	1,389,245
Residential	My Home Energy Report	5,808,941	5,791,217	5,890,093	7,524,461	6,753,153	6,972,509	7,687,891	9,855,291	6,299,307	11,676,738	7,369,336	10,897,311
Residential	Neighborhood Energy Saver	1,586,061	1,134,613	2,052,535	1,167,680	1,781,211	1,117,743	1,845,739	1,682,598	1,671,298	1,438,897	401,046	196,865
Residential	Residential Energy Assessments	-	-	1,417,924	4,853,362	1,863,486	5,512,365	1,851,965	5,373,630	2,113,798	4,344,111	2,160,729	4,050,428
Residential	Home Energy Improvement Program	5,298,232	6,858,804	6,013,170	6,991,688	6,961,463	6,313,442	7,168,833	6,300,631	6,411,758	5,417,341	6,517,089	5,453,175
Residential	Residential New Construction	7,447,258	12,081,218	9,405,615	19,280,066	11,671,724	21,481,837	13,189,949	22,773,890	15,113,951	19,396,567	18,861,261	22,840,461
Residential	Save Energy and Water Kit	-	-	674,538	13,873,513	888,869	17,187,186	825,279	10,207,890	-	-	-	-
Non-Residential	Business Energy Report	74,374	-	69,516	309,365	20,330	737	-	-	-	-	-	-
Non-Residential	Commercial, Industrial, & Governmental Demand R	569,444	1,025,439	-	(10,684,733)	1,393,650	3,551,967	1,154,642	1,413,457	1,811,347	4,394,068	1,352,902	2,964,614
Non-Residential	EnergyWise for Business	65,456	-	1,112,815	164,696	1,390,549	858,655	2,108,030	151,899	2,412,880	923,654	1,896,524	686,030
Non-Residential	Energy Efficiency for Business	6,226,453	29,902,372	14,159,310	47,824,935	21,749,807	77,891,372	-	-	-	-	-	-
Non-Residential	Non-Residential Smart $aver Prescriptive	-	-	-	-	-	-	11,515,913	65,320,575	7,877,838	31,482,596	7,863,953	28,517,362
Non-Residential	Non-Residential Smart $aver Custom	-	-	-	-	-	-	2,174,163	8,907,939	2,776,482	9,658,177	3,514,807	9,481,018
Non-Residential	Non-Res SmartSaver Performance	-	-	-	-	147,160	335,899	201,559	810,508	267,186	606,333	386,339	1,239,947
Non-Residential	Small Business Energy Saver	9,780,196	25,239,036	9,336,274	32,988,897	8,770,755	26,945,514	8,858,213	22,343,579	7,301,790	17,456,367	5,004,816	10,837,185
		$ 62,993,952	$ 175,013,463	$ 77,197,134	$ 248,956,374	$ 85,479,401	$ 281,668,716	$ 77,301,500	$ 254,652,345	$ 78,403,665	$ 212,943,604	$ 66,818,443	$ 136,627,796

Costs as Filed in	Docket Number
2015	E-2, Sub 1174
2016	E-2, Sub 1206
2017	E-2, Sub 1206
2018	E-2, Sub 1273
2019	E-2, Sub 1273
2020	E-2, Sub 1273

I/A

Save Energy and Water Kits 2018 – 2019 Evaluation Report

Submitted to Duke Energy Carolinas and Progress by Nexant in partnership with Opinion Dynamics

April 23rd, 2020

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1 Executive Summary

1.1 Program Summary

The Save Energy and Water Kit Program (SEWKP) is a Duke Energy offering that provides free energy saving and water efficiency kits to pre-selected households in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) jurisdictions. The kits include aerators for kitchen and bathroom sink faucets, showerheads, and insulating water heater pipe tape.

1.2 Evaluation Objectives and Results

This report presents the results and findings of evaluation activities for DEC and DEP SEWKP conducted by the evaluation team, collectively Nexant Inc. and our subcontracting partner Opinion Dynamics, for the program year of September 2018 – August 2019.

1.2.1 Impact Evaluation

The evaluation team conducted the evaluation as detailed in this report to estimate energy and demand savings attributable to the programs. The evaluation was divided into two research areas - to determine gross savings and net savings (or impacts). Gross impacts are energy and demand savings estimated at a participant's home that are the direct result of the homeowner's installation of the measures included in the SEWKP kit. Net impacts reflect the degree to which the gross savings are a result of the program efforts and funds.

Table 1-1, Table 1-2, and Table 1-3 present the summarized findings of the impact evaluation for the DEC jurisdiction. All totals in Table 1-1, excluding the population, are weighted averages based on the 2018-2019 evaluation sample and represent expected savings from the average participant.

Table 1-1: DEC Energy Savings per Kit

Kit Size	Population	Reported Energy (kWh)	Energy Realization Rate	Gross Verified Energy (kWh)
Small	26,364	333	104%	347
Medium	17,750	564	87%	489
Program Total	**44,114**	**426**	**95%**	**404**

Table 1-2: DEC Demand Savings per Kit

Kit Size	Summer Demand (kW)			Winter Demand (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Small	0.114	26%	0.030	0.073	112%	0.082
Medium	0.188	22%	0.042	0.129	97%	0.125
Program Total	**0.144**	**24%**	**0.035**	**0.096**	**104%**	**0.099**

Table 1-3: DEC Program Level Savings

Measurement	Population	Reported	Realization Rate	Gross Verified
Energy (kWh)	44,114	18,797,312	95%	17,834,056
Summer Demand (kW)		6,342	24%	1,541
Winter Demand (kW)		4,217	104%	4,371

The portion of gross verified savings by measure type are presented in Figure 1-1. Per unit energy and demand savings by measure and the program net to gross ratio, with free ridership and spillover components, are presented in Table 1-4.

Figure 1-1: DEC Portion of Program Verified Savings by Measure

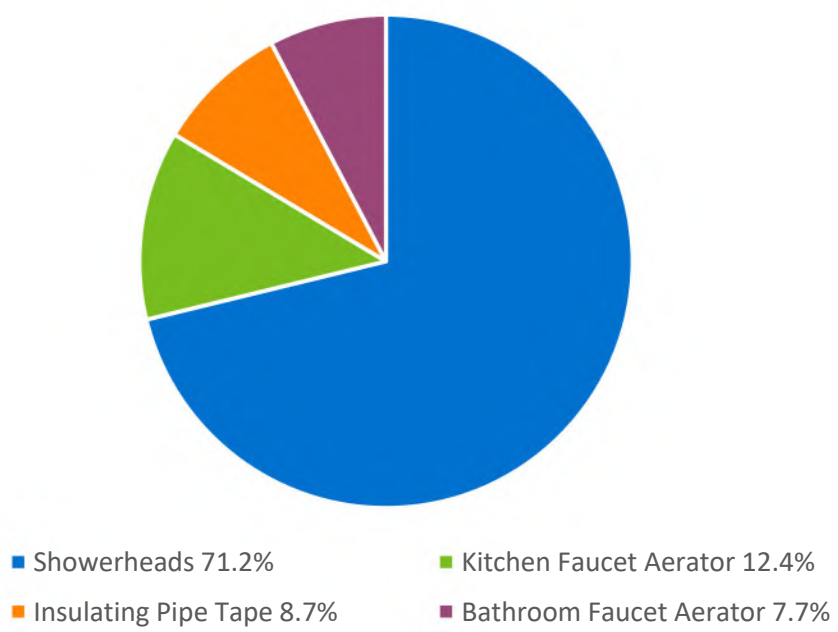


Table 1-4: DEC Verified Impacts by Measure

Measure	Energy Savings per unit (kWh)	Summer Demand Savings per unit (kW)	Winter Demand Savings per unit (kW)	Free Ridership	Spillover	Net to Gross Ratio
Low-flow Showerhead	205.3	0.0174	0.0625	9.2%	18.2%	109.0%
Low-flow Kitchen Aerator	50.2	0.0035	0.0040			
Low-flow Bathroom Aerator	15.5	0.0015	0.0017			
Insulating Pipe Tape*	7.0	0.0008	0.0008			

* Savings for pipe tape is a per linear foot measurement

Table 1-5, Table 1-6, and Table 1-7 present the summarized findings of the impact evaluation for the DEP jurisdiction.

Table 1-5: DEP Energy Savings per Kit

Kit Size	Population	Reported Energy (kWh)	Energy Realization Rate	Gross Verified Energy (kWh)
Small	14,479	428	88%	376
Medium	11,633	738	72%	533
Program Total	**26,112**	**566**	**79%**	**446**

Table 1-6: DEP Demand Savings per Kit

Kit Size	Summer Demand (kW)			Winter Demand (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Small	0.143	23%	0.033	0.107	82%	0.087
Medium	0.242	19%	0.046	0.191	71%	0.135
Program Total	**0.187**	**21%**	**0.038**	**0.144**	**75%**	**0.108**

Table 1-7: DEP Program Level Savings

Measurement	Population	Reported	Realization Rate	Gross Verified
Energy (kWh)	26,112	14,785,941	79%	11,647,379
Summer Demand (kW)		4,886	21%	1,004
Winter Demand (kW)		3,761	75%	2,833

The portion of gross verified savings by measure type are presented in Figure 1-2. Per unit energy and demand savings by measure and program net to gross ratio, with free ridership and spillover components, are presented in Table 1-8.

Figure 1-2: DEP Portion of Program Verified Savings by Measure

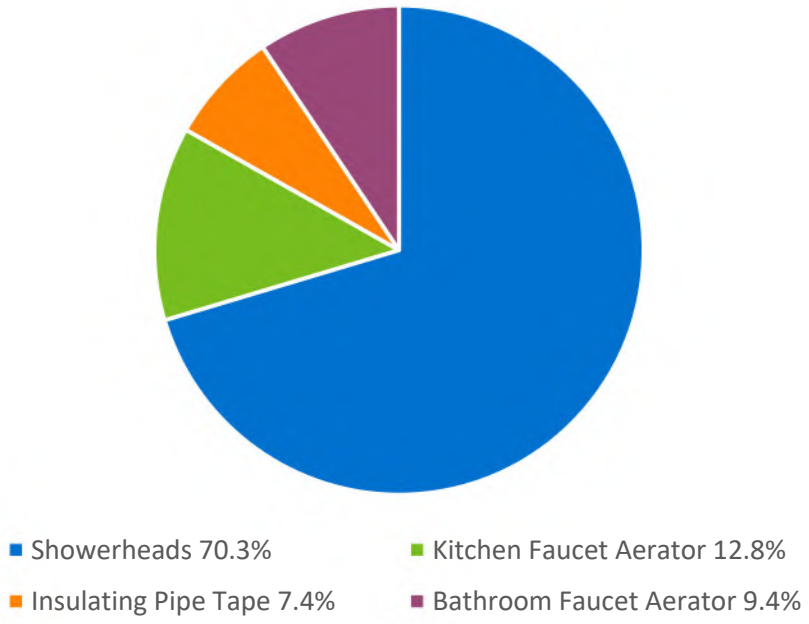


Table 1-8: DEP Verified Impacts by Measure

Measure	Energy Savings per unit (kWh)	Summer Demand Savings per unit (kW)	Winter Demand Savings per unit (kW)	Free Ridership	Spillover	Net to Gross Ratio
Low-flow Showerhead	217.1	0.0184	0.0661	7.8%	25.7%	117.9%
Low-flow Kitchen Aerator	57.3	0.0040	0.0045			
Low-flow Bathroom Aerator	20.9	0.0020	0.0023			
Insulating Pipe Tape*	6.9	0.0008	0.0008			

* Savings for pipe tape is a per linear foot measurement

1.2.2 Process Evaluation

The process evaluation assessed opportunities for improving the program's design and delivery in the DEC and DEP service territories. It specifically documented participant experiences by exploring participating household feedback and the extent to which the kits effectively motivate households to save energy.

The evaluation team conducted telephone and web surveys with households that received a kit (DEC n=320; DEP n=343). The team also conducted in-depth interviews with the Duke Program Team and kit provider staff.

Program Successes

The 2018-2019 DEP/DEC SEWKP evaluation found successes in the following areas:

Most participants are satisfied with kit items and report high satisfaction with the overall program. Less than 10% of participants in each jurisdiction reported dissatisfaction with any specific measure they installed, and the vast majority reported they were highly satisfied with the overall program (83% DEC; 86% DEP).

Kit instructions are perceived as highly helpful among SEWKP participants. Eighty-five percent of participants in each jurisdiction said they read the instructional insert from their kit that offers detailed instructions on self-installing the measures, and most of them said the instructions were very helpful (81% DEC; 84% DEP). These paper instructions are likely sufficient for most participants, as most reported high satisfaction and very few took advantage of the toll-free hotline.

The updated propensity model scoring used to select households is effective in identifying homes with electric water heaters. Customers with electric water heaters are able to realize electric savings from water-saving equipment. Thanks at least in part to propensity model updates, the percentage of participants with electric water heaters increased in both jurisdictions from less than 80% in 2017 to nearly 90% in 2019.

The program influenced households to install kit measures. Most participating households installed at least one measure from the kit (79% DEC; 83% DEP), and the vast majority of measures, once installed, remained installed (92% DEC; 91% DEP). Participants were highly influenced by the program to install kit measures, as demonstrated by low free ridership rates. In addition, more than one-third of participants in each jurisdiction reported purchasing and installing additional energy efficiency measures since receiving their kit (37% DEC; 35% DEP).

Program Challenges

The 2018-2019 DEC and DEP SEWKP evaluations found some challenges in the following areas:

Insulating pipe tape is the least popular measure. Pipe tape was the least installed measure type, with just over one-third of participants (36%) reportedly installing it in each jurisdiction.

Low water pressure is a significant contributor to dissatisfaction and uninstalls. Complaints of excessively low water pressure was the primary driver of dissatisfaction and uninstallation among a relatively small number of participants who were dissatisfied with or uninstalled any items.

Increased penetration and saturation of measures included in the kits could contribute to lower installation rates in the future. Among participants who had yet to install at least one measure and had no immediate plans to do so, more than 20% in each jurisdiction indicated they already had at least one of the efficient measures installed.

1.3 Evaluation Conclusions and Recommendations

The evaluation findings led to the following conclusions and recommendations for the program.

Conclusion 1: The program model is highly successful: it leverages low-cost measures to foster energy savings that would not have happened otherwise. Duke Energy's easy process for requesting and receiving a kit with free energy and water-saving items motivated thousands of customers to request and install energy saving measures in their home during the evaluation period. Most participants installed at least one measure from the kit, relatively few measures get uninstalled, and many participants reported installing additional energy saving items since receiving the kit. The majority of participants said they would not have installed any of the items on their own, as represented by low free ridership rates, and the program is reaching a diverse range of customers in terms of household characteristics and demographics.

> **Recommendation**: Continue using SEWKP to encourage Duke Energy customers to save energy and water.

Conclusion 2: The water saving measures' low flow water pressure results in some minor dissatisfaction and uninstallation issues. Complaints of excessively low water pressure was the primary driver of water-saving measure dissatisfaction and uninstallation. However, only a minority of participants were dissatisfied with or uninstalled any items.

> **Recommendation**: Monitor how showerhead upgrades affect satisfaction and uninstallation rates going forward.

Conclusion 3: Recent program improvements have been largely successful. Updates to the propensity model contributed to an increase in the percentage of participants that have electric water heaters from less than 80% in 2017 to nearly 90% in 2019 (from 70% to 88% for the DEC program and from 79% to 89% for the DEP program). The new instructional materials provided with the kits also appear to denote a significant improvement from the prior instructions. Recent participants rated the instructions as considerably more helpful than participants in the last evaluated program year: the percentage of customers who rated instructions as "very helpful" increased since 2017 (from 70% to 81% among DEC participants and 80% to 84% among DEP participants).

Conclusion 4: Increased penetration and saturation of measures included in the kits may limit installation rates going forward. Among participants who had yet to install measures and had no immediate plans to do so, more than 20% indicated they already had at least one of the efficient measures installed. For insulating pipe tape, more than 30% of those without plans to install the measure reported they already had some installed (34% for DEC and 32% for DEP). These rates were nearly as high for showerheads, for which 32% of DEC respondents and 25% of DEP respondents with no plans to install indicated that they already an efficient one installed.

Recommendation: Monitor installation rates going forward and consider excluding measures that show high rates of prior ownership.

2 Introduction and Program Description

2.1 Program Description

2.1.1 Overview

The Save Energy and Water Kit Program (SEWKP) is a Duke Energy program that provides free energy and water efficiency kits to pre-selected households in Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) territories. The kits include low-flow aerators for kitchen and bathroom sink faucets, low-flow showerheads, and insulating water heater pipe tape.

2.1.2 Energy Efficiency Kit Measures

Table 2-1 lists the kit's contents included in the evaluation scope. There are two kit sizes, which dictate the number of showerheads the participant receives. In addition to the measures below, the kit includes plumbing tape, a rubber gasket opener to remove old aerators and showerheads, and an instructional insert that has detailed installation instructions. Duke Energy has additional installation instruction information available on their website.

Table 2-1: Kit Measures and Quantity

Measures	Small Kit	Medium Kit
Low-flow Showerhead (1.5 gpm)	1	2
Low-flow Bathroom Faucet Aerator (1.0 gpm)	2	2
Low-flow Kitchen Faucet Aerator (1.0 gpm)	1	1
Insulating Pipe Tape (up to 10' of coverage)	1	1

2.2 Program Implementation

2.2.1 Participant Identification and Recruitment

Every month Duke Energy's internal analytics department identifies households to recruit into the program. They look through customer accounts for single family electric-only accounts that have not participated in SEWKP or any other programs with similar measures (specifically, the Energy Efficiency Education in Schools and Home Energy House Call programs). Pre-selected households are then assigned either a small or medium kit based on household square footage. Next, Duke Energy approaches these customers through either emails, if the pre-selected customer has an email address on file, or business reply cards (BRC). Simultaneously, Duke Energy sends the implementer – Energy Federation, Inc. (EFI) – a list of pre-selected accounts that received an offer to participate in the SEWKP that month. Email messages provide a link for the customer to join the program and households that receive the BRC simply detach the reply

form and put it back in the mail (postage is pre-paid). Alternatively, customers may also call a toll free number, provided on the email or BRC, to confirm eligibility and request their free kit. EFI then ships the appropriate kit (small or medium) to registered households.

2.2.2 Participation

For the defined evaluation period of September 1st, 2018 through August 31st, 2019, the program recorded a total of 49,353 kit recipients in DEC and 10.6% of our sample stated they did not remember receiving the kit. The program population was reduced by 10.6% to 44,114 for the evaluated estimate of kit participants. For DEP the program reported 27,939 kit recipients with 6.5% of our sample stated they did not remember receiving the kit; leading to an evaluated estimate of 26,112 DEP participants.

2.3 Key Research Objectives

Over-arching project goals will follow the definition of impact evaluation established in the "Model Energy-Efficiency Program Impact Evaluation Guide – A Resource of the National Action Plan for Energy Efficiency," November 2007:

> *"Evaluation is the process of determining and documenting the results, benefits, and lessons learned from an energy-efficiency program. Evaluation results can be used in planning future programs and determining the value and potential of a portfolio of energy-efficiency programs in an integrated resource planning process. It can also be used in retrospectively determining the performance (and resulting payments, incentives, or penalties) of contractors and administrators responsible for implementing efficiency programs".*

Evaluation has two key objectives:

1) To document and measure the effects of a program and determine whether it met its goals with respect to being a reliable energy resource.
2) To help understand why those effects occurred and identify ways to improve the program.

2.3.1 Impact

As part of evaluation planning, the evaluation team outlined the following activities to assess the impacts of the DEC-DEP SEWKP:

- Quantify accurate and supportable energy (kWh) and demand (kW) savings for energy efficient measures implemented in participants' homes;
- Assess the rate of free riders from the participants' perspective and determine spillover effects;
- Benchmark verified measure-level energy impacts to applicable technical reference manual(s) and other Duke-similar programs in other jurisdictions.

2.3.2 Process

The process evaluation assessed opportunities for improving the design and delivery of the program in both DEC and DEP service territories. It specifically documented participant experiences by investigating participant responses to the energy efficiency kits and the extent to which the kits effectively motivate households to save energy and water.

The evaluation team assessed several elements of the program delivery and customer experience, including:

Motivation:

- What motivated participants to request and install the measures in the kit?
- In what ways, if any, did the program motivate participants to adopt new energy and water saving behaviors?

Program experience and satisfaction:

- How satisfied are participants with the overall program experience and kit items in terms of ease of use and measure quality?

Challenges and opportunities for improvement:

- Are there any inefficiencies or challenges with the delivery of the program?
- Are there any measures that have particularly low installation rates? If so, why?
- Are there any measures that have particularly high uninstallation rates? If so, why?

Participant household characteristics:

- What are demographic characteristics of those who received the kits?

2.4 Evaluation Overview

The evaluation team divided its approach into key tasks to meet the goals outlined:

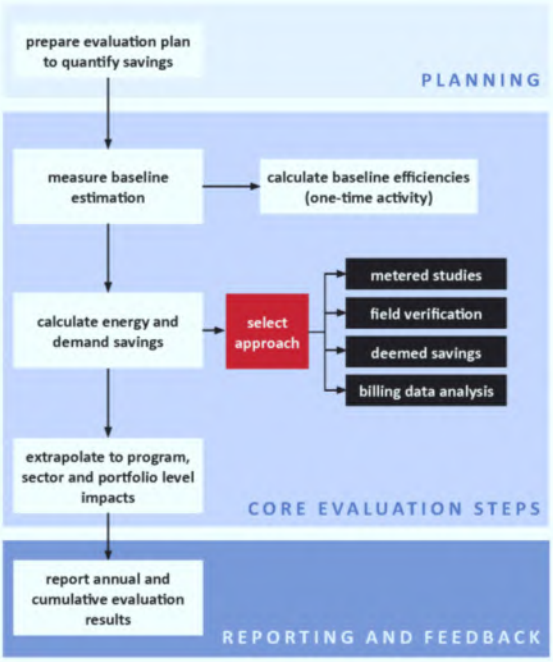
- Task 1 – Develop and manage evaluation work plan to describe the processes that will be followed to complete the evaluation tasks outlined in this project;
- Task 2 – Conduct a process review to determine how successfully the programs are being delivered to participants and to identify opportunities for improvement;
- Task 3 – Verify gross and net energy and peak demand savings resulting from SEWKP through verification activities of a sample of 2018-2019 program participants.

2.4.1 Impact Evaluation

The primary determinants of impact evaluation costs are the sample size and the level of rigor employed in collecting the data used in the impact analysis. The accuracy of the study findings is in turn dependent on these parameters. Techniques that we used to conduct our evaluation, measurement, and verification (EM&V) activities, and to meet the goals for this evaluation, included telephone and web-based surveys with program participants, best practice review, and interviews with implementation and program staff.

Figure 2-1 demonstrates the principal evaluation team steps organized through planning, core evaluation activities, and final reporting.

Figure 2-1: Impact Evaluation Process



The evaluation is generally comprised of the following steps, which are described in further detail throughout this report:

- **Participant Surveys:** The file review for all sampled and reviewed program participation concluded with a telephone and/or web-based survey with the participants. Table 2-2 below summarizes the number of surveys completed. The samples were drawn to meet a 90% confidence and 10% precision level based upon the expected and actual significance (or magnitude) of program participation, the level of certainty of savings, and the variety of measures.
- **Calculate Impacts:** Data collected via surveys enabled the evaluation team to calculate gross verified energy and demand savings for each measure.
- **Estimate Net Savings**: Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and incentives. The evaluation team estimated free-ridership and spillover based on self-report methods through surveys with program participants. The ratio of net verified savings to gross verified savings is the net-to-gross ratio as an adjustment factor to the reported savings.

2.4.2 Process Evaluation

Process evaluation examines and documents:

- Program operations
- Stakeholder satisfaction

- Opportunities to improve the efficiency and effectiveness of program delivery

To satisfy the EM&V objectives for this research effort, the evaluation team reviewed program documents and conducted telephone and web surveys with participating households who received a kit. The team also held in-depth interviews (IDI) with utility and implementation staff. Table 2-2 provides a summary of the activities the evaluation team conducted as part of the DEC (Table 2-2) and DEP (Table 2-3) SEWKP process and impact evaluations.

Table 2-2: DEC SEWKP Summary of Evaluation Activities

Target Group	Population	Sample	Confidence /Precision	Method
Impact Activities				
DEC Participants	49,353	320	90% ± 4.6%	Telephone/Web Survey
Process Activities				
DEC Participants	49,353	320	90% ± 4.6%	Telephone/Web Survey
Duke Energy Program Staff	n/a	1	n/a	Telephone IDI
Implementer Staff: EFI	n/a	1	n/a	Telephone IDI

Table 2-3: DEP SEWKP Summary of Evaluation Activities

Target Group	Population	Sample	Confidence /Precision	Method
Impact Activities				
DEP Participants	27,939	343	90% ± 4.5%	Telephone/Web Survey
Process Activities				
DEP Participants	27,939	343	90% ± 4.5 %	Telephone/Web Survey
Duke Energy Program Staff	n/a	1	n/a	Telephone IDI
Implementer Staff: EFI	n/a	1	n/a	Telephone IDI

3 Impact Evaluation

3.1 Methodology

The evaluation team's impact analysis focused on the energy and demand savings attributable to the SEWKP for the period of September 2018 through August 2019. The evaluation was divided into two research areas: to determine gross savings and net savings (or impacts). Gross impacts are energy and demand savings estimated at a participant's home that are the direct result of the homeowner's installation of a measure included in the program-provided energy saving kit. Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and funds. The evaluation team verified energy and demand savings attributable to the program by conducting the following impact evaluation activities:

- Review of DEC and DEP participant database.
- Completion of telephone and web-based surveys to verify key inputs into savings calculations.
- Estimation of gross verified savings using primary data collected from participants.
- Comparison of the gross-reported savings to program-evaluated results to determine kit-level realization rates.
- Application of attribution survey data to estimate net-to-gross ratios and net-verified savings at the program level.

3.2 Sampling Plan and Achievement

To provide representative results and meet program evaluation goals, a sampling plan was created to guide all evaluation activity. A random sample was created to target 90/10 confidence and precision at the program level assuming a coefficient of variation (C_v) equal to 0.5.

After reviewing the program database, we identified populations of 49,353 (DEC) and 27,939 (DEP) participants within our defined evaluation period. Based on this population, the evaluation team established sub-sample frames for phone and web-based survey administration. Customers who were flagged as "do not contact" in the participation database were excluded from the sample frame. As illustrated in Table 3-1 below, we completed 320 (DEC) and 343 (DEP) surveys among program participants between October 14th and 28th, 2019. This sample size resulted in a precision of ±4.6 (DEC) and ±4.5 (DEP) at a 90% confidence interval.

Table 3-1: DEC-DEP Impact Sampling

Jurisdiction	Survey Mode	Sample Frame	Sampled Participants	Achieved Precision at 90% Confidence
Carolinas	Phone	1,499	70	90% ± 4.6%
	Web-based	2,000	250	
	Total	**3,499**	**320**	
Progress	Phone	1,591	70	90% ± 4.5%
	Web-based	2,000	273	
	Total	**3,591**	**343**	

3.3 Description of Analysis

3.3.1 Telephone and web-based surveys

The evaluation team performed telephone and web-based surveys to gather key pieces of information used in the savings calculations. Results of the completed surveys were used to inform our program-wide assumptions as detailed in Table 3-2.

Table 3-2: Participant Data Collected and Used for Analysis

Measure	Data Collected	Assumption
Showerhead Bathroom Faucet Aerator Kitchen Faucet Aerator	Units Installed	In-Service Rate
	Units Later Removed	
	Hot Water Fuel Type	% Electric DHW
	Frequency of Showers	Hot Water Consumption
	Duration of Showers	
Insulating Pipe Tape	Pipe Tape Used	In-Service Rate
	Pipe Tape Removed	
	Hot Water Fuel Type	% Electric DHW
	Length of Insulated Pipe	Pipe Length

3.3.2 In-Service Rate

The in-service rate (ISR) represents the ratio of equipment installed and operable to the total pieces of equipment distributed and eligible for installation. For example, if 15 telephone surveys were completed for customers receiving 1 bathroom aerator each, and five customers reported to still have the aerator installed and operable, the ISR for this measure would be five out of 15 or 33%. In some instances equipment was installed, but may have been removed later due to homeowner preferences. In these cases the equipment is no longer operable and therefore contributes negatively to the ISR. In-service rates for each measure from all eligible survey respondents are detailed in Table 3-3.

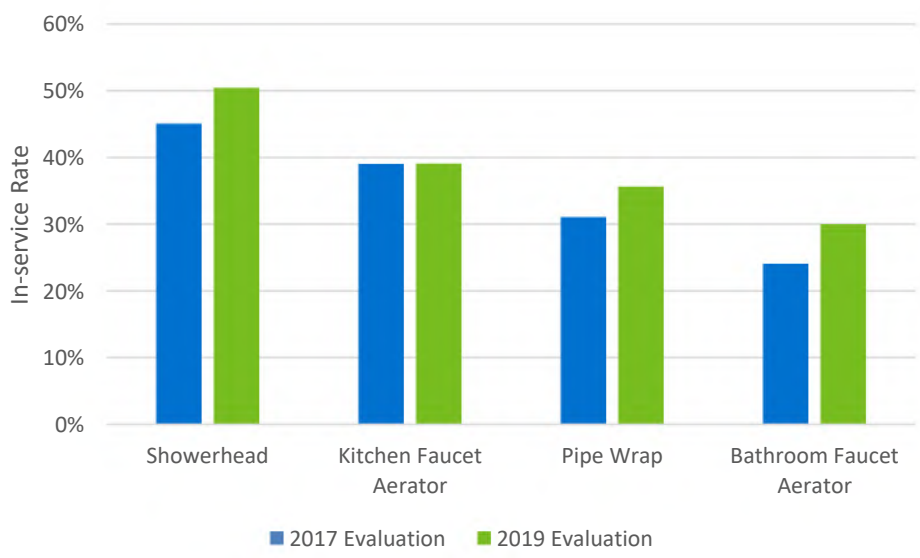
Table 3-3: DEC-DEP SEWKP Sample In-Service Rates

Jurisdiction	Measure	Distributed	Installed	Removed	ISR
Carolinas	Showerhead	436	244	24	50%
	Kitchen Faucet Aerator	320	142	17	39%
	Insulating Pipe Tape*	320	115	1	36%
	Bathroom Faucet Aerator	640	202	10	30%
Progress	Showerhead	481	278	31	51%
	Kitchen Faucet Aerator	343	159	15	42%
	Bathroom Faucet Aerator	686	270	11	38%
	Insulating Pipe Tape*	343	124	4	35%

*Quantity of pipe tape packages

In-service rates for all measures in the Carolinas jurisdiction (Figure 3-1) are greater than, or in-line with, the verified rates from the previous evaluation.[1]

Figure 3-1: DEC Equipment In-Service Rates

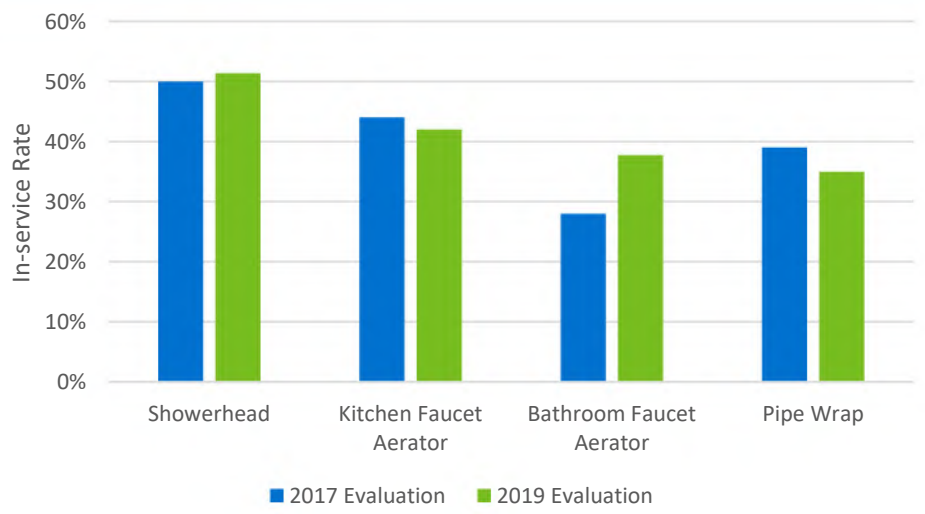


For the Progress jurisdiction (Figure 3-2) in-service rates for bathroom faucet aerators increased by 10% driven by a program change that reduced the number of bathroom faucet aerators provided through the medium kit from four to two. This evaluation (along with the previous 2016-2017 evaluation) has shown measure level in-service rates go down as the number of identical kit measures increases. Removing these items with low in-service rates increased the per unit

[1] Save Energy and Water Kits 2016 Program Year Evaluation Report, November 29th, 2017

savings attributed to bathroom faucet aerators. All other measure have similar in-service rates to the 2017 evaluation.

Figure 3-2: DEP Equipment In-Service Rates



3.3.3 Kit Measure Savings

The next section of the evaluation report provides a summary of the algorithms used to estimate energy and demand savings for each of the kit items. Input parameters were provided by program participant responses in the surveys. For more technical inputs the evaluation applied deemed values provided by the Mid-Atlantic TRM v9.

Demand savings coincident factors (CF) for the summer and winter seasons were estimated to align with peak demand periods[2] for each jurisdiction using the study on residential domestic hot water use referenced by the Mid-Atlantic TRM[3]. This method takes into account the average hot water use by fixture type (showerhead, faucet aerator) during the peak period along with the probability of the evaluated daily hours of use occurring at the same time.

3.3.3.1 Showerheads

The Save Energy and Water Kit contained either one or two low-flow showerheads, with the quantity depending on the size of the kit received. Small kit participants received one showerhead; those qualifying for a medium kit received two showerheads. The equations below outline the algorithms utilized to estimate savings accrued by the showerhead measure with parameters defined in Table 3-4.

[2] Both the Carolinas and Progress jurisdictions define their demand peaks as July, 4pm to 5pm (Summer) and January, 7am to 8am (Winter)

[3] Aquacraft, DeOreo and Mayer, *The End Uses of Hot Water in Single Family Homes from Flow Trace Analysis*

Equation 3-1: Showerhead Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{\Delta GPM \times HOU \times \Delta T \times 8.3 \frac{BTU}{gal \cdot °F}}{3{,}412 \frac{BTU}{kWh} \times RE}$$

$$HOU = \frac{T_{shower} \times N_{persons} \times Showers_{per\ person} \times 365 \frac{days}{year}}{Showers_{per\ home}}$$

Equation 3-2: Showerhead Demand Savings Algorithm

$$\Delta kW = CF \times \frac{\Delta kWh}{HOU}$$

Table 3-4: Inputs for Showerhead Savings Calculations

Input	Units	Showerhead Savings Input		Source
		DEC	DEP	
ISR, showerhead 1	n/a	56%	57%	Participant survey responses
ISR, showerhead 2	n/a	34%	37%	Participant survey responses
ELEC	n/a	88%	89%	Participant survey responses
ΔGPM	gpm	1.0		Baseline, Mid-Atlantic TRM v9 Retrofit, product specification sheet
T_{shower}	minutes/shower	9.1	9.8	Participant survey responses
$N_{persons}$	people/home	2.60	2.71	Participant survey responses
$Showers_{per\ person}$	showers/person/day	0.66	0.64	Participant survey responses
$Showers_{per\ home}$	showers/home	1.34	1.42	Participant survey responses
ΔT	°F	44.1°		Mid-Atlantic TRM v9
RE	n/a	98%		Mid-Atlantic TRM v9
CF, summer	n/a	0.0060	0.0062	Mid-Atlantic TRM v9, adjusted
CF, winter	n/a	0.0216	0.0222	Mid-Atlantic TRM v9, adjusted

The number of showerheads provided to each participant is dependent on the size of the kit received; with small kits providing a single showerhead and medium kits providing two. Since the evaluation demonstrated that equipment in-service rates drop as additional items are provided (i.e. a second showerhead) it is important to show the difference in estimated savings between the first and second showerhead provided to a participant. Savings for each showerhead, as shown in Table 3-5, are calculated at the jurisdiction level using all the same measure inputs from Table 3-4 expect for the in-service rate. This single change accounts for the full difference in energy and demand savings for the measure. Weighted averages presented here align with previous per unit savings shown in Table 1-4 and Table 1-8 and represent the average savings for each showerhead provided through the program.

Table 3-5: Showerhead Savings, per unit

Jurisdiction	Item	Program Population	Verified Savings, per unit		
			Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
DEC	Showerhead 1	44,114	231	0.020	0.070
	Showerhead 2	17,750	142	0.012	0.043
	Weighted Avg		205	0.017	0.063
DEP	Showerhead 1	26,112	244	0.021	0.074
	Showerhead 2	11,633	158	0.013	0.048
	Weighted Avg		217	0.018	0.066

3.3.3.2 Faucet Aerators

The Save Energy and Water Kit contained one kitchen faucet aerator and two bathroom faucet aerators. The equations below outline the algorithms utilized to estimate savings accrued by the faucet aerator measures with parameters defined in Table 3-6 and Table 3-8.

Equation 3-3: Faucet Aerator Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{(GPM_{base} \times Throttle_{base} - GPM_{low} \times Throttle_{low}) \times HOU \times 8.3 \frac{BTU}{gal \cdot °F} \times \Delta T}{3{,}412 \frac{BTU}{kWh} \times RE}$$

$$HOU = T_{faucet} \times N_{persons} \times 365 \frac{days}{year} \times DR$$

Equation 3-4: Faucet Aerator Demand Savings Algorithm

$$\Delta kW = CF \times \frac{\Delta kWh}{HOU}$$

Table 3-6: Inputs for Kitchen Faucet Aerator Measures Savings Calculations

Measurement	Units	Kitchen Aerator Savings Input		Source
		DEC	DEP	
ISR	n/a	39%	42%	Participant survey responses
ELEC	n/a	88%	89%	Participant survey responses

Measurement	Units	Kitchen Aerator Savings Input		Source
		DEC	DEP	
GPM_{base}	gpm	2.2		Mid-Atlantic TRM v9
GPM_{low}	gpm	1.0		Product specification sheet
$Throttle_{base}$	n/a	83%		Mid-Atlantic TRM v9
$Throttle_{low}$	n/a	95%		Mid-Atlantic TRM v9
T_{faucet}	minutes/day	4.5		Mid-Atlantic TRM v9
$N_{persons}$	persons/home	2.54	2.67	Participant survey responses
DR	n/a	50%		Mid-Atlantic TRM v9
ΔT	°F	32.1		Mid-Atlantic TRM v9
RE	n/a	98%		Mid-Atlantic TRM v9
CF, summer	n/a	0.0048	0.0051	Mid-Atlantic TRM v9, adjusted
CF, winter	n/a	0.0055	0.0058	Mid-Atlantic TRM v9, adjusted

Table 3-7: Kitchen Faucet Aerator Savings, per unit

Jurisdiction	Item	Verified Savings, per unit		
		Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
DEC	Kitchen Aerator	50	0.003	0.004
DEP	Kitchen Aerator	57	0.004	0.005

Table 3-8: Inputs for Bathroom Faucet Aerator Measures Savings Calculations

Measurement	Units	Bathroom Aerator Savings Input		Source
		DEC	DEP	
ISR, bath aerator 1	n/a	42%	48%	Participant survey responses
ISR, bath aerator 2	n/a	18%	27%	Participant survey responses
ELEC	n/a	88%	89%	Participant survey responses
GPM_{base}	gpm	2.2		Mid-Atlantic TRM v9
GPM_{low}	gpm	1.0		Product specification sheet
$Throttle_{base}$	n/a	83%		Mid-Atlantic TRM v9
$Throttle_{low}$	n/a	95%		Mid-Atlantic TRM v9
T_{faucet}	minutes/day	1.6		Mid-Atlantic TRM v9
$N_{persons}$	persons/home	2.63	2.78	Participant survey responses
DR	n/a	70%		Mid-Atlantic TRM v9
ΔT	°F	25.1°		Mid-Atlantic TRM v9

Measurement	Units	Bathroom Aerator Savings Input		Source
		DEC	DEP	
RE	n/a	98%		Mid-Atlantic TRM v9
CF, summer	n/a	0.0025	0.0026	Mid-Atlantic TRM v9, adjusted
CF, winter	n/a	0.0028	0.0030	Mid-Atlantic TRM v9, adjusted

Both kits (small and medium) include two bathroom aerators. It is important to show the difference in estimated savings between the first and second bathroom faucet aerator in a kit so savings for each bathroom aerator (Table 3-9) are calculated at the jurisdiction level using all the same measure inputs fromTable 3-8, with in-service rate as the only exception. Weighted averages presented here align with previous per unit savings shown in Table 1-4 and Table 1-8 and represent the average savings for each bathroom faucet provided through the program.

Table 3-9: Bathroom Faucet Aerator Savings, per unit

Jurisdiction	Item	Verified Savings, per unit		
		Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
DEC	Bathroom Aerator 1	21.7	0.0021	0.0024
	Bathroom Aerator 2	9.4	0.0009	0.0010
	Average Per Unit Savings	15.5	0.0015	0.0017
DEP	Bathroom Aerator 1	26.6	0.0026	0.0029
	Bathroom Aerator 2	15.2	0.0015	0.0017
	Average Per Unit Savings	20.9	0.0020	0.0023

3.3.3.3 Insulating Pipe Tape

All participants received a 15 foot roll of insulating pipe tape with their kit. To estimate the impacts resulting from the installation of the pipe tape measure, the evaluation team used the algorithms presented below.

Equation 3-5: Insulating Pipe Tape Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{\left(\frac{1}{R_{ex}} - \frac{1}{R_{new}}\right) \times L \times C \times \Delta T \times 8{,}760}{\eta DHW \times 3{,}413}$$

Equation 3-6: Insulating Pipe Tape Demand Savings Algorithm

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Table 3-10: Inputs for Insulating Pipe Tape Savings Calculations

Input	Units	Pipe Tape Savings Input		Source
		DEC	DEP	
ISR	n/a	36%	35%	Participant survey responses
ELEC	n/a	88%	89%	Participant survey responses
R_{ex}	n/a	1.00		Mid-Atlantic TRM v9
R_{new}	n/a	3.00		Product specification sheet
L	linear feet	5.01	4.78	Participant survey responses*
C	feet	0.20		Average outer diameter of 0.5” and 0.75” pipe
ΔT	°F	65°		Mid-Atlantic TRM v9
ηDHW	n/a	98%		Mid-Atlantic TRM v9

*Participant-provided estimated lengths of hot water pipe covered by the pipe tape was used to estimate verified savings.

Table 3-11: Insulating Pipe Tape Savings, per linear foot

Jurisdiction	Item	Verified Savings		
		Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
DEC	Pipe Tape	7.0	0.0008	0.0008
DEP	Pipe Tape	6.9	0.0008	0.0008

3.4 Billing Regression Analysis

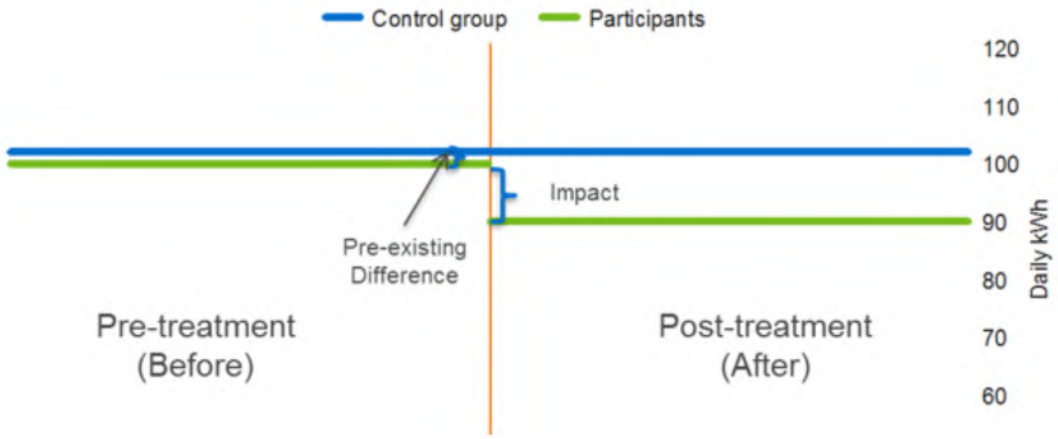
In addition to engineering analysis, the evaluation team attempted to estimate energy savings by analyzing energy use patterns before and after participation in the SEWKP – commonly referred to as billing analysis. After a thorough investigation, which is described in more detail below, we concluded that, absent a randomized control trial, billing analysis was unable to reliably detect energy savings associated with the kit effort. When the percent change in household energy use is small the only reliable way to estimate energy savings using billing analysis is through a randomized control trial with large treatment and control groups and pre- and post-data. Thus, the evaluation team’s recommendation is to rely on the engineering analysis and findings as the source of the verified gross and net savings for the program. Below we discuss how we attempted to complete a billing analysis and how we ultimately determined such an analysis was not feasible.

To estimate energy savings with billing data, it is necessary to estimate what energy consumption would have occurred in the absence of SEWKP – the counterfactual or baseline. To infer that the program led to energy savings, it is necessary to systematically eliminate plausible alternative explanations for differences in electricity use patterns.

The basic framework for the analysis is illustrated in Figure 3-3 and relies on both a control group and pre- and post-enrollment billing data. The analysis is implemented in two parts via weather-normalized pre-post and difference-in-differences (DID) techniques. The former utilizes observed weather patterns to assess changes in normalized electric consumption during the pre-treatment and post-treatment periods, while the latter compares program participants to a matched comparison group, and removes any pre-existing differences between the treatment and control groups. If the program's kit lead to reductions in consumption, we should observe:

- A change in consumption for households that participated in the SEWKP
- No similar change in consumption for the control group
- The timing of the change should coincide with the receipt of kits

Figure 3-3: Framework for Billing Analysis with Comparison Groups



While the SEWKP did not have a randomly assigned control group, the evaluation team did develop a comparison group to use in its analysis. However, there were several key challenges to producing reliable energy savings estimates using billing analysis. The two challenges that could not be addressed despite the use of a comparison group were the small effect size and selection bias. On a percentage basis, the expected energy savings from each kit were less than 2% of annual household energy consumption, and therefore it proved difficult to isolate the impacts of the program from other potential explanations, including random chance. Second, households that signed up for the kit self-selected from their peers. Despite using a comparison group, it could only account for observable characteristics like pre-treatment energy use patterns. As a result, while the participant and comparison group may have had similar energy use patterns in the pre-treatment period, their energy use trajectories absent program participation were not necessarily the same due to differences in the household use patterns.

From a practical standpoint, the use of billing analysis as the primary evaluation approach poses a number of possible challenges.

- Effect size - on a percentage basis, expected impacts from the program are small (0.5% to 1.5%) and thus difficult to distinguish from the inherent “noise” in the billing data;
- Timing of intervention - changes in the mix of participants and/or the timing of individual measure installations can be confused with natural changes in energy use;
- Self-selection - customers who enroll in SEWKP are inherently different than customers who do not:
  - They likely have different water use technology, household occupancy, and/or water consumption needs that can yield different responses to program intervention(s);
  - In order to be effective, the kits rely on customers to correctly install the individual fixtures themselves

In order to assess if the billing analysis produced reliable results, we implemented a series of placebo pressure tests. The approach consisted of simulating fake enrollments prior to actual participation in the program and assessing if the models detected an effect when using data from the false “pre” period to estimate the counterfactual for the false “post” period. Because enrollment dates were fictitious and actual post periods were excluded, we knew impacts were actually zero and any estimated impacts were due to modeling error. The evaluation team used two years of pre-treatment data for the placebo tests and each participant’s enrollment date was simulated to have occurred between three to nine months prior to actual participation, in increments of one month. The placebo tests were implemented using both a fixed-effects pre-post panel regression model (using only treatment group data) and a DID panel regression that made use of the matched comparison group.

Figure 3-4 shows the results from the pre-post placebo tests. Rather than produce zero impacts, the models estimated that the simulated enrollments led to changes in energy use when in fact no intervention had taken place. Moreover, the models incorrectly concluded that the erroneous impacts were statistically significant in several instances – an example of false precision. The pre-post model without a comparison group consistently estimated changes in energy consumption when impacts were in fact zero. The DID (Figure 3-5) that made use of the comparison group had less variable results, but it estimated energy increases in the range of roughly 1% to 1.5% when no intervention had taken place. Hence, neither method produced reliable energy savings estimates.

Figure 3-4: Placebo Pressure Test Results (Pre-Post)

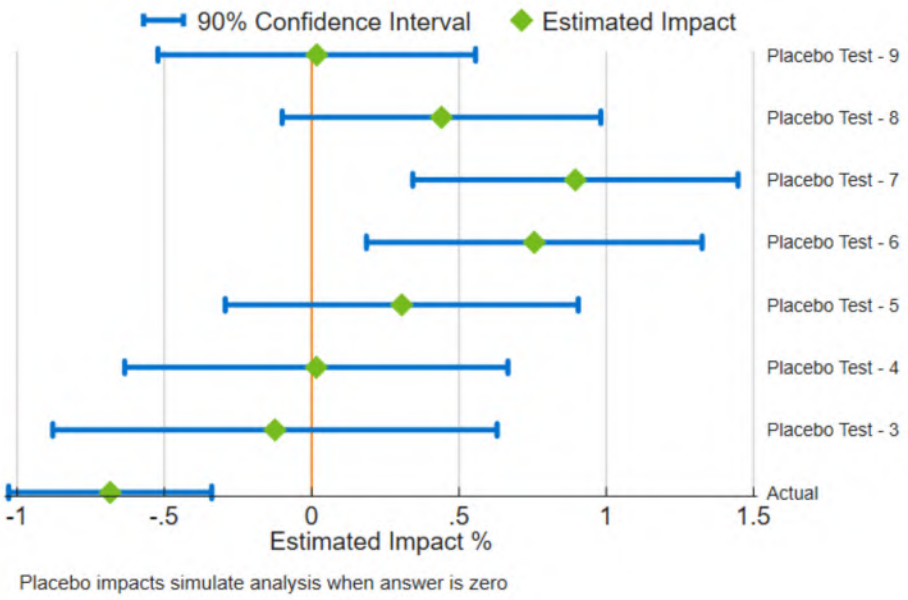
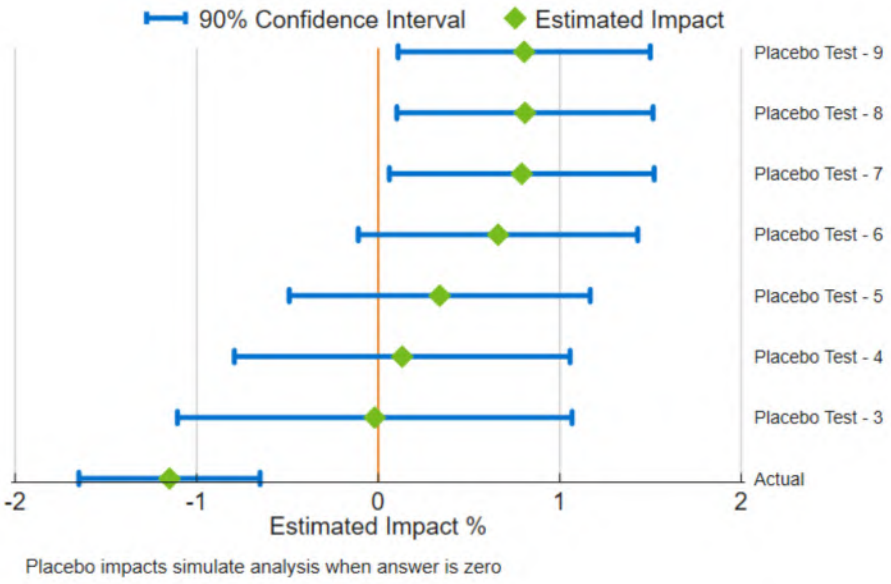


Figure 3-5: Placebo Pressure Test Results (Difference-in-Differences)



When the percent change in household energy use is small, as it is with the SEWKP, the only reliable way to estimate energy savings using billing analysis is through a randomized control trial (RCT) using large treatment and control groups combined with pre- and post-enrollment billing data. The most critical component of a well-designed RCT is to guarantee there are no differences between the treatment and control groups, other than the treatment of the program. This is a critical step to ensure that the analysis is able to accurately estimate the counterfactual

– or what would have happened absent the treatment. If inherent differences exist between the treatment group and control group, any changes in the post-treatment period could be due to these differences, rather than the treatment itself. In order to verify that effects are purely the result of the treatment intervention, the two groups must be ostensibly identical in every way except for the intervention.

Guaranteeing homogeneity between treatment and control groups is not achievable with an opt-in enrollment method. The fact that one group of customers chose to enroll in the program while the other did not implies that some intrinsic difference between them does exist. These differences may include:

- Behavioral preferences or predispositions for energy and water efficiency measures
- Information about the program that is not accessible to non-enrollees
- Higher energy needs and therefore a greater incentive to curb their consumption

Any of these characteristics are likely to contribute to consumption responses or patterns that cannot be attributable to the program intervention. A well-designed RCT includes randomly selected customers in the treatment and control groups, thereby ensuring that the analysis avoids adverse effects of selection bias and/or lurking confounding variables. Due to these variables, RCTs are impracticable for opt-in programs.

After a thorough investigation, we concluded that, absent a RCT, billing analysis was unable to reliably detect energy savings resulting from participation in the program. We consider the Pre-Post and Difference-in-Differences methodologies to provide complementary analyses; although a few of the Pre-Post placebo tests indicate statistically significant changes in energy usage the comparison group (DID) results indicate a greater level of uncertainty. The statistically significant treatment results from the pre-post analysis (101 kWh) is equivalent to 0.68% of total home energy consumption and is far too small to be considered definitive when conservative thresholds for billing analysis are set at 5% of consumption. Neither the Pre-Post or DID approach provides conclusive evidence of savings from the Program, thus calling into question the results from either analysis.

Low levels of savings compared to consumption will remain a consistent issue for the SEWKP and will continue to inhibit the accuracy of results provided through a billing analysis. The evaluation team's conclusion is not that there were no energy savings generated by the SEWKP, but rather that billing analysis was not the correct tool for estimating the small percentage of energy savings attributable to the program. Thus, the evaluation team's recommendation is to rely on the engineering analysis, which is supported by a regionally specific Technical Reference Manual and participant defined inputs that inform their use of the kit measures, and findings as the source of our verified gross and net savings for the programs.

3.5 Targeted and Achieved Confidence and Precision

We developed the SEWKP evaluation plan with the goal of achieving a target of 10% relative precision at the 90% confidence interval across both jurisdictions at the program level. Due to a high response rate from the web-based surveys, the evaluation team was able to surpass this target and achieve a high level of statistical precision. The final sample yielded a relative precision of ±4.6% for DEC and ±4.5% for DEP at the 90% confidence level (Table 3-12).

Table 3-12: Targeted and Achieved Confidence and Precision

Jurisdiction	Targeted Confidence/Precision	Achieved Confidence/Precision
DEC	90% ± 10%	90% ± 4.6%
DEP		90% ± 4.5%

3.6 Results

Measure-level and kit-level energy savings values for DEC and DEP Save Energy and Water Kit Programs are detailed in the following charts and tables.

3.6.1 Duke Energy Carolinas

Participant survey responses in DEC led to energy savings adjustments with a program realization rate of 95%. Two of the four measures verified energy savings above the program reported values.

Figure 3-6: DEC Gross Verified Energy Savings

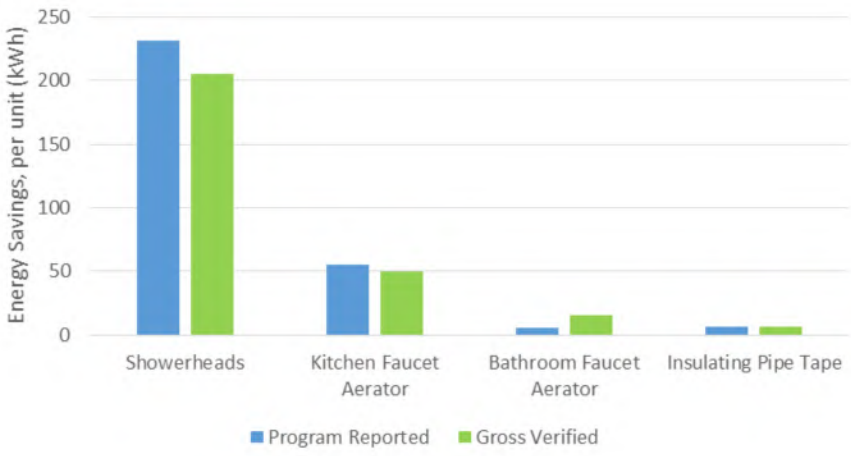


Table 3-13: DEC Measure-Level Reported and Verified Gross Energy Savings

Measure	Reported Energy Savings, per unit (kWh)	Realization Rate	Verified Energy Savings, per unit (kWh)
Low-flow Showerhead	231.4	89%	205.3
Low-flow Kitchen Aerator	55.2	91%	50.2
Low-flow Bathroom Aerator	5.7	272%	15.5
Insulating Pipe Tape*	7.0	100%	7.0

* Savings for pipe tape is a per linear foot measurement

Measure-level demand savings are detailed in Table 3-14.

Table 3-14: DEC Measure-Level Reported and Verified Demand Gross Savings

Measure	Summer Demand, per unit (kW)			Winter Demand, per unit (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Low-flow Showerhead	0.0740	24%	0.0174	0.0556	113%	0.0625
Low-flow Kitchen Aerator	0.0300	12%	0.0035	0.0133	30%	0.0040
Low-flow Bathroom Aerator	0.0030	50%	0.0015	0.0014	125%	0.0017
Insulating Pipe Tape*	0.0008	100%	0.0008	0.0017	48%	0.0008

* Savings for pipe tape is a per linear foot measurement

The impact evaluation for the 2018-2019 DEC SEWKP program resulted in a program energy realization rate of 95% and demand realization rates of 24% (summer) and 104% (winter) as presented in Table 3-15 and Table 3-16.

Table 3-15: DEC Energy Savings per Kit

Kit Size	Population	Reported Energy (kWh)	Energy Realization Rate	Gross Verified Energy (kWh)
Small	26,364	333	104%	347
Medium	17,750	564	87%	489
Program Total	**44,114**	**426**	**95%**	**404**

Table 3-16: DEC Demand Savings per Kit

Kit Size	Summer Demand (kW)			Winter Demand (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Small	0.114	26%	0.030	0.073	112%	0.082
Medium	0.188	22%	0.042	0.129	97%	0.125
Program Total	**0.144**	**24%**	**0.035**	**0.096**	**104%**	**0.099**

Table 3-17 presents the reported and verified energy and demand savings for the 2018-2019 program year.

Table 3-17: DEC Program Level Savings

Measurement	Population	Reported	Realization Rate	Gross Verified
Energy (kWh)	44,114	18,797,312	95%	17,834,056
Summer Demand (kW)		6,342.5	24%	1,541.5
Winter Demand (kW)		4,216.8	104%	4,371.2

3.6.2 Duke Energy Progress

Participant survey responses in DEP led to energy savings adjustments with a program realization rate of 79%.

Figure 3-7: DEP Gross Verified Energy Savings

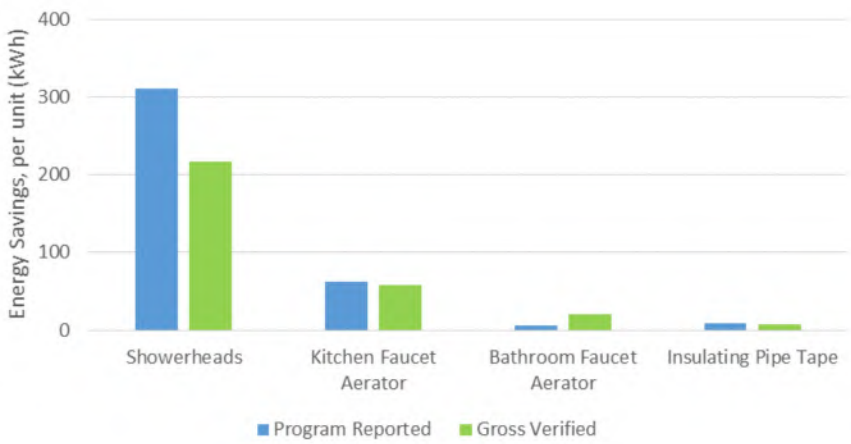


Table 3-18: DEP Measure-Level Reported and Verified Gross Energy Savings

Measure	Reported Energy Savings, per unit (kWh)	Realization Rate	Verified Energy Savings, per unit (kWh)
Low-flow Showerhead	310.1	70%	217.1
Low-flow Kitchen Aerator	62.2	92%	57.3
Low-flow Bathroom Aerator	5.9	354%	20.9
Insulating Pipe Tape*	8.8	79%	6.9

* Savings for pipe tape is a per linear foot measurement

Measure-level and kit-level demand savings are detailed in Table 3-19.

Table 3-19: DEP Measure-Level Reported and Verified Demand Gross Savings

Measure	Summer Demand, per unit (kW)			Winter Demand, per unit (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Low-flow Showerhead	0.0990	19%	0.0184	0.0841	79%	0.0661
Low-flow Kitchen Aerator	0.0330	12%	0.0040	0.0169	27%	0.0045
Low-flow Bathroom Aerator	0.0030	68%	0.0020	0.0016	144%	0.0023
Insulating Pipe Tape*	0.0010	79%	0.0008	0.0024	33%	0.0008

* Savings for pipe tape is a per linear foot measurement

The impact evaluation for the 2018-2019 DEP SEWKP program resulted in a program energy realization rate of 79% and demand realization rates of 21% (summer) and 75% (winter) as presented in Table 3-20 and Table 3-21.

Table 3-20: DEP Energy Savings per Kit

Kit Size	Population	Reported Energy (kWh)	Energy Realization Rate	Gross Verified Energy (kWh)
Small	14,479	428	88%	376
Medium	11,633	738	72%	533
Program Total	**26,112**	**566**	**79%**	**446**

Table 3-21: DEP Demand Savings per Kit

Kit Size	Summer Demand (kW)			Winter Demand (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Small	0.143	23%	0.033	0.107	82%	0.087
Medium	0.242	19%	0.046	0.191	71%	0.135
Program Total	**0.187**	**21%**	**0.038**	**0.144**	**75%**	**0.108**

Table 3-22 presents the reported and verified energy and demand savings for the 2018-2019 program year.

Table 3-22: DEP Program Level Savings

Measurement	Population	Reported	Realization Rate	Gross Verified
Energy (kWh)	26,112	14,785,941	79%	11,647,379
Summer Demand (kW)		4,885.7	21%	1,004.2
Winter Demand (kW)		3,760.8	75%	2,833.0

4 Net-to-Gross Methodology and Results

The evaluation team used participant survey data to calculate a net-to-gross (NTG) ratio for SEWKP. NTG reflects the effects of free ridership (FR) and spillover (SO) on gross savings. Free ridership refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (U.S. DOE, 2014).[4] Spillover refers to the program-induced adoption of additional energy-saving measures by participants who did not receive financial incentives or technical assistance for the additional measures installed (U.S. DOE, 2014). The evaluation team used the following formula to calculate the NTG ratio:

$$NTG = 1 - FR + SO$$

4.1 Free Ridership

Free ridership estimates how much the program influenced participants to install the energy-saving items included in the energy efficiency kit. Free ridership ranges from 0 to 1, with 0 being no free ridership and 1 being total free ridership.

The evaluation team used participant survey data to estimate free ridership. The survey used several questions to identify items that a given participant installed and did not later uninstall: respondents were only asked free ridership questions about items that remained installed by the date of the survey.

The evaluation team's methodology for calculating free ridership consists of two components, free ridership change (FRC) and free ridership influence (FRI), both of which range from 0 to .5 in value.

$$FR = FRC + FRI$$

4.1.1 Free Ridership Change

FRC reflects what participants reported they would have done if the program had not provided the items in the kit. For each respondent, the survey assessed FRC for each measure that the respondent installed and did not later uninstall.

Specifically, the survey asked respondents which, if any, of the currently installed items they would have purchased and installed on their own within the next year if Duke Energy had not provided them. For respondents who installed more than one of a given measure (bathroom

[4] The U.S. Department of Energy (DOE) (2014). *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 23: Estimating Net Savings: Common Practices*

aerators or showerheads) that indicated they would have installed either of the multi-count measures on their own, we asked them a follow up question that determined how many of the number installed through the program that they would have installed on their own.

For each measure, the evaluation team assigned one of the FRC values shown in the Table 4-1, based on the respondents' responses. FRC values range from 0.0 to 0.5.

Table 4-1: Free Ridership Change Values

What Respondent Would Have Done Absent the Program*	FRC Value
Would ***not*** have purchased and installed the item within the next year	0.00
Would have purchased and installed the item within the next year	$\frac{\text{Count respondent said would install on their own}}{\text{Count respondent installed through program}}$

*Survey response to: If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?

4.1.2 Free Ridership Influence

FRI assesses how much influence the program had on a participant's decision to install (and keep installed) the items in the kit. The survey asked respondents to rate how much influence four program-related factors had on their respective decisions to install the measures, using a scale from 0 ("not at all influential") to 10 ("extremely influential"). The program-related factors included:

- The fact that the items were free
- The fact that the items were mailed to their home
- Information provided by Duke Energy about how the items would save energy and water
- Other information or advertisements from Duke Energy, including its website

Asking respondents to separately rate the influence of each of the four above items had on the decision to install each measure would have been overly burdensome. Therefore, while the survey assessed FRC for each measure type, it assessed collective FRI for all measures.

FRI is based on the highest-rated item in the FRI battery. The evaluation team assigned the following FRI scores, based on that rating (Table 4-2).

Table 4-2: Free Ridership Influence Values

Highest Influence Rating	FRI Value
0	0.50
1	0.45
2	0.40
3	0.35

Highest Influence Rating	FRI Value
4	0.30
5	0.25
6	0.20
7	0.15
8	0.10
9	0.05
10	0.00

4.1.3 Total Free Ridership

The evaluation team calculated total free ridership by measure by calculating

- First, measure-specific FR scores for each respondent by summing each respondent's measure-specific FRC score with their FRI score.
- Second, a measure-specific average FR score across all respondents, weighted by the number of units installed by each respondent.

The evaluation team then estimated overall program-level free ridership by calculating a savings-weighted mean of the measure-specific FR scores. Table 4-3 presents the measure-specific and overall FR estimates.

Table 4-3: Measure-Specific Free Ridership Scores

End-use	Measure-Specific Free Ridership	
	Carolinas	Progress
Showerhead	9.5%	8.2%
Kitchen Faucet Aerator	9.6%	8.1%
Bathroom Faucet Aerator	6.3%	4.8%
Insulating Pipe Tape	8.3%	7.6%
Overall	**9.2%**	**7.8%**

4.2 Spillover

Spillover estimates energy savings from additional energy improvements made by participants who are influenced by the program to do so and is used to adjust gross savings. The evaluation team used participant survey data to estimate spillover. The survey asked respondents to indicate what energy-saving measures they had implemented since participating in the program. The evaluation team then asked participants to rate the influence the program had on their decision to purchase these additional energy-saving measures on a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential."

The evaluation team converted the ratings to a percentage representing the program-attributable percentage of the measure savings, from 0% to 100%. The team then applied the

program-attributable percentage to the savings associated with each reported spillover measure to calculate the participant measure spillover (PMSO) for that measure. We defined the per-unit energy savings for the reported spillover measures based on previous Duke Energy Smart$aver evaluations, ENERGY STAR® calculators, and algorithms and parameter assumptions listed in the Mid-Atlantic TRM v9.

Since Duke Energy offered program incentives for a variety of energy-saving measures throughout the evaluation period, we compared the list of customers reporting measures as spillover against participation records for other Duke Energy programs that offered the measure. To avoid double-counting savings for measures already claimed by another Duke Energy offering, we excluded savings from measures that appeared in another program's tracking data from our estimation of spillover savings.

Participant measure spillover is calculated as follows:

$$PMSO = Deemed\ Measure\ Savings * Program\ Attributable\ Percentage$$

The evaluation team summed all PMSO savings values for each jurisdiction (Table 4-4 and Table 4-5).

Table 4-4: DEC Sample PMSO, by Measure by Category

Measure Category	Total kWh for Category	Percent Share of kWh
LEDs	5,532	24%
Duct Sealing	4,553	20%
Appliance	3,850	17%
HVAC	3,632	16%
Insulation	2,108	9%
Windows	1,695	7%
Water Heater	1,616	7%
CFLs	167	1%
Total	**23,153**	**100%**

Table 4-5: DEP Sample PMSO, by Measure by Category

Measure Category	Total kWh for Category	Percent Share of kWh
LEDs	19,868	51%
ENERGY STAR Home	5,157	13%
HVAC	4,678	12%
Appliance	3,293	8%
Duct Sealing	1,680	4%
Water Heater	1,385	4%
CFLs	980	3%
Windows	945	2%
Insulation	754	2%
Total	**38,740**	**100%**

The evaluation team then calculated gross program savings associated with sampled participants by summing the products of each measure's average per household savings and the total sample size (Table 4-6 and Table 4-7).

Table 4-6: DEC Sample Gross Program Savings (n=131)

Measure	Average per Household Savings (kWh)	Verified Sample Savings(kWh)
Showerhead	282	90,329
Kitchen Faucet Aerator	50	16,077
Bathroom Faucet Aerator	31	9,930
Insulating Pipe Tape	35	11,225
Total	**399**	**127,561**

Table 4-7: DEP Sample Gross Program Savings (n=114)

Measure	Average per Household Savings (kWh)	Verified Sample Savings (kWh)
Showerhead	307	105,290
Kitchen Faucet Aerator	57	19,658
Bathroom Faucet Aerator	42	14,324
Insulating Pipe Tape	33	11,392
Total	**439**	**150,664**

The evaluation team then divided the summed jurisdictional PMSO values by the sample's gross program savings to calculate an estimated spillover percentage for the program:

$$Program\ SO = \frac{\sum PMSO}{\sum Sample\ Gross\ Program\ Savings}$$

$$DEC\ SO = \frac{23{,}153}{127{,}561} = 18.2\%$$

$$DEP\ SO = \frac{38{,}740}{150{,}664} = 25.7\%$$

These calculations produced a spillover estimate of 18.2% for the DEC program and 25.7% for the DEP program. Lower spillover in the Carolinas territory is partially due to Duke Energy's Free LED Program that allows many participants to install new LED lamps in their home at no cost. Since these free LEDs are provided by Duke Energy they are excluded from any spillover estimates.

4.3 Net-to-Gross

Inserting the FR and SO estimates into the NTG formula (NTG = 1 – FR + SO) produces an NTG value of 109% for the DEC program and 118% for the DEP program (Table 4-8). The evaluation team applied this NTG ratio to program-wide verified gross savings to calculate SEWKP kit net savings for the jurisdiction (Table 4-9 and Table 4-10).

Table 4-8: Net-to-Gross Results

Jurisdiction	Free Ridership	Spillover	NTG
Carolinas	9.2%	18.2%	**109.0%**
Progress	7.8%	25.7%	**117.9%**

Table 4-9: DEC Program Level Savings

Measurement	Population	Gross Verified	Net-to-Gross Ratio	Net Verified
Energy (kWh)	44,114	17,834,056	109.0%	19,434,623
Summer Demand (kW)		1,541.5		1,679.8
Winter Demand (kW)		4,371.2		4,763.5

Table 4-10: DEP Program Level Savings

Measurement	Population	Gross Verified	Net-to-Gross Ratio	Net Verified
Energy (kWh)	26,112	11,647,379	117.9%	13,729,595
Summer Demand (kW)		1,004.2		1,183.8
Winter Demand (kW)		2,833.0		3,339.5

5 Process Evaluation

5.1 Summary of Data Collection Activities

The process evaluation is based on interviews and surveys with program staff, implementer staff, and households who received a kit during the program year (Table 5-1).

Table 5-1: Summary of Process Evaluation Data Collection Activities

Target Group	Method	Sample Size	Population	Confidence / Precision
Duke Energy program staff	Phone in-depth interview	1	n/a	n/a
Implementation staff: EFI	Phone in-depth interview	1	n/a	n/a
DEC participants	Mixed mode (web/phone) survey	320	49,353	90% ± 4.6%
DEP participants	Mixed mode (web/phone) survey	343	27,939	90% ± 4.5%

5.2 DEC Process Evaluation Findings

Installation Rates

Most kit recipients (79%) installed at least one measure, installing an average of two measures from the kit. A majority of kit recipients (63%) initially installed at least one of the showerheads, and slightly less than half initially installed at least one of the bathroom faucet aerators (46%) or kitchen faucet aerators (44%) with a smaller proportion reporting installing pipe tape (36%). Of the respondents who received a medium-sized kit, 36% installed both showerheads.[5] Regardless of kit size received, participants installed an average of one bathroom aerator and one showerhead.

Of the respondents who installed at least one item from the kit, 15% said they later uninstalled at least one of the measures, but no participants uninstalled everything they had installed. In total, 8% of all installed measure types were later uninstalled. Showerheads and kitchen faucet aerators had the highest uninstallation rates, with 12% of respondents who initially installed each later uninstalling them. In most cases, respondents said they uninstalled these water saving measures because they did not like how they worked, later elaborating that the water pressure provided was insufficient to their preferences.

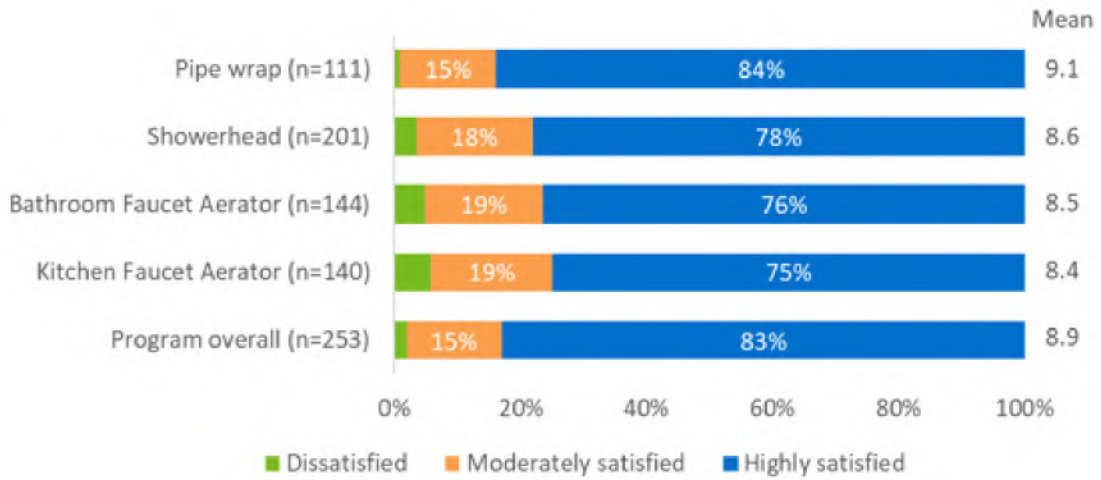
Fifteen percent of respondents reported installing all measure types. Of the respondents who did not install all measure types, 74% said they plan to install at least one of the items they had not yet installed. Respondents who indicated they don't plan to install one or more of the measures typically said they would not install the remaining items because they had not "gotten around to it" (27%), they already had the item (24%), or their current one is still working (17%).

[5] 66% of medium kit recipients installed at least one showerhead, 55% of whom installed both that came with the kit.

Measure Satisfaction

Nearly all kit recipients reported moderate to high satisfaction with the items they installed from their kit (Figure 5-1). To best gauge the experience with the measures, we asked respondents to rate their satisfaction with all measures they installed, including those they later uninstalled. Respondents were most satisfied with the pipe tape and were least satisfied with the kitchen faucet aerator. Open-ended comments revealed that those customers who were dissatisfied with water-saving measures most often pointed to low water pressure as the reason for dissatisfaction.

Figure 5-1: DEC Participant Satisfaction with Installed Measures*



* Respondents rated their satisfaction with the measures on a scale ranging from 0 ("very dissatisfied") to 10 ("very satisfied"). Dissatisfied indicates 0-4 ratings, moderately satisfied indicates 5-7 ratings, and highly satisfied indicates 8-10 ratings.

Kit Instructional Materials

In addition to energy-saving measures, the Save Energy and Water Kit includes a detailed instructional booklet that provides information on how to install the provided measures. The vast majority of respondents (85%) said they read the booklet, and most of them (81%) found it highly helpful. Duke Energy also offers a customer care hotline that participants can call for additional assistance, but just 1% of respondents took advantage of the service.

Additional Energy Saving Actions

More than one-third of participants (37%) reported purchasing and installing additional energy efficiency measures since receiving their kit (Table 5-2). Participants most commonly reported purchasing LEDs (24%), efficient appliances (16%), or air sealing (14%), and 83% of those who installed additional energy-saving measures said the program at least partially influenced their decision.

Table 5-2: Additional Energy Saving Measures Purchased by DEC Participants

	Percent of Respondents Reporting Purchases After Receiving the Kit	Percent Reporting at Least Some DEC Program Influence on Purchase
At least one measure	37%	31%
LEDs	24%	21%
Efficient appliances	16%	13%
Air sealing	14%	13%
Insulation	8%	7%
CFLs	6%	6%
Efficient heating or cooling equipment	6%	5%
Efficient water heater	6%	4%
Duct sealing	4%	4%
Efficient windows	4%	3%
Other	5%	3%

*Multiple Responses Allowed; n=320

5.3 DEP Process Evaluation Findings

Installation Rates

The majority (83%) of kit recipients installed at least one measure, installing an average of two measures from the kit. Most kit recipients initially installed at least one of the showerheads (65%), and slightly more than half initially installed at least one of the bathroom faucet aerators (53%). Slightly less than half installed kitchen faucet aerators (46%), and a smaller proportion reporting installing pipe tape (36%). Of the respondents who received a medium-sized kit, 39% installed both showerheads.[6] Regardless of kit size received, participants installed an average of one bathroom aerator and one showerhead.

Of the respondents who installed at least one item from the kit, 15% said they later uninstalled at least one of the measures, just one of whom uninstalled everything they had installed. In total, 9% of all installed measure types were later uninstalled. Showerheads and kitchen faucet aerators had the highest uninstallation rates, with 13% of those who installed showerheads and 9% of those who installed kitchen aerators later uninstalling them. In most cases, respondents said they uninstalled these water saving measures because they did not like how they worked, later elaborating that the water pressure provided was insufficient to their preferences.

About one-tenth (13%) of respondents reported installing all measure types. Of the respondents who did not install all measure types, 78% said they plan to install at least one of the items they had not yet installed. Respondents who indicated they don't plan to install one or more of the

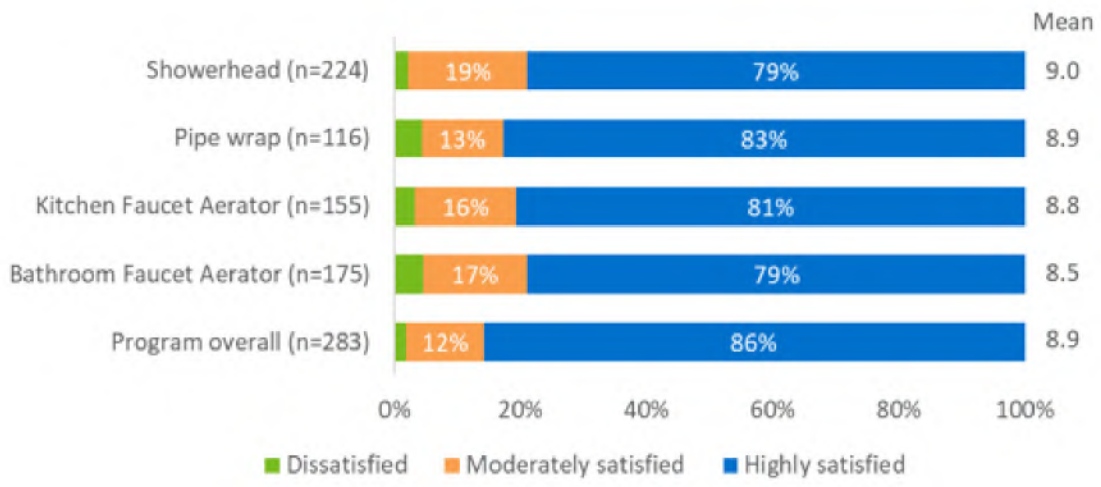
[6] 70% of medium kit recipients installed at least one showerhead, 56% of which installed both that came with the kit.

measures typically said they would not install the remaining items because they had not "gotten around to it" (24%), already had the item (22%), or their current one is still working (21%).

Measure Satisfaction

Nearly all kit recipients reported moderate to high satisfaction with the items they installed from their kit (Figure 5-2). To best gauge the experience with the measures, we asked respondents to rate their satisfaction with all measures they installed, including those they later uninstalled. Respondents reported similar levels of satisfaction with all four measures. Open-ended comments revealed that the few customers who were dissatisfied with water-saving measures mostly pointed to low water pressure as the source of dissatisfaction.

Figure 5-2: DEP Participant Satisfaction with Installed Measures*



* Respondents rated their satisfaction with the measures on a 0 ("very dissatisfied") to 10 ("very satisfied") scale. Dissatisfied indicates 0-4 ratings, moderately satisfied indicates 5-7 ratings, and highly satisfied indicates 8-10 ratings.

Instructional Materials in the Kit

In addition to energy-saving measures, the Save Energy and Water Kit includes a detailed instructional booklet that provides information on how to install the provided measures. The vast majority of respondents (85%) said they read the booklet, and most of them (84%) reported they found it highly helpful. Duke Energy also offers a customer care hotline that participants can call for additional assistance, but just 1% of respondents took advantage of the service.

Additional Energy Saving Actions

Over one-third of participants (35%) reported purchasing and installing additional energy efficiency measures since receiving their kit (Table 5-3). Participants most commonly reported purchasing LEDs (25%), efficient appliances (13%), or air sealing (12%), and 78% of those who installed additional energy-saving measures said the program at least partially influenced their decision.

Table 5-3: Additional Energy Saving Measures Purchased by DEP Participants*

	Count of Respondents Reporting Purchases After Receiving the Kit	Count Reporting at Least Some DEP Program Influence on Purchase
At least one measure	35%	27%
LEDs	25%	20%
Efficient appliances	13%	10%
Air sealing	12%	10%
Insulation	7%	5%
Efficient heating or cooling equipment	7%	4%
Energy efficient water heater	4%	3%
Efficient windows	4%	2%
CFLs	3%	3%
Duct sealing or insulation	3%	2%
Moved into ENERGY STAR home	1%	1%
Other	5%	4%

*Multiple Responses Allowed; n=343

6 Conclusions and Recommendations

The evaluation findings led to the following conclusions and recommendations for the program.

Conclusion 1: The program model is highly successful: it leverages low-cost measures to foster energy savings that would not have happened otherwise. Duke Energy's easy process for requesting and receiving a kit with free energy and water-saving items motivated thousands of customers to request and install energy saving measures in their home during the evaluation period. Most participants installed at least one measure from the kit, relatively few measures get uninstalled, and many participants reported installing additional energy saving items since receiving the kit. The majority of participants said they would not have installed any of the items on their own, as represented by low free ridership rates, and the program is reaching a diverse range of customers in terms of household characteristics and demographics.

> **Recommendation**: Continue using SEWKP to encourage Duke Energy customers to save energy and water.

Conclusion 2: The water saving measures' low flow water pressure results in some minor dissatisfaction and uninstallation issues. Complaints of excessively low water pressure was the primary driver of water-saving measure dissatisfaction and uninstallation. However, only a minority of participants were dissatisfied with or uninstalled any items.

> **Recommendation**: Monitor how showerhead upgrades affect satisfaction and uninstallation rates going forward.

Conclusion 3: Recent program improvements have been largely successful. Updates to the propensity model contributed to an increase in the percentage of participants that have electric water heaters from less than 80% in 2017 to nearly 90% in 2019 (from 70% to 88% for the DEC program and from 79% to 89% for the DEP program). The new instructional materials provided with the kits also appear to denote a significant improvement from the prior instructions. Recent participants rated the instructions as considerably more helpful than participants in the last evaluated program year: the percentage of customers who rated instructions as "very helpful" increased since 2017 (from 70% to 81% among DEC participants and 80% to 84% among DEP participants).

Conclusion 4: Increased penetration and saturation of measures included in the kits may limit installation rates going forward. Among participants who had yet to install measures and had no immediate plans to do so, more than 20% indicated they already had at least one of the efficient measures installed. For pipe tape, more than 30% of those without plans to install the measure reported they already had some installed (34% for DEC and 32% for DEP). These rates were nearly as high for showerheads, for which 32% of DEC respondents and 25% of DEP respondents with no plans to install indicated that they already an efficient one installed.

Recommendation: Monitor installation rates going forward and consider excluding measures that show high rates of prior ownership.

Appendix A Summary Form

Save Energy and Water Kit Program

Completed EMV Fact Sheet

Description of program

The Duke Energy Save Energy and Water Kit Program (SEWKP) is an energy efficiency program that offers energy efficient water fixtures and water pipe insulation to residential customers. The program is designed to reach customers who have not adopted energy efficient water devices. The kits are provided to residents through a Direct Mail Campaign, allowing eligible customers to request to have the items shipped directly to their homes, free of charge.

Date	April 23, 2020
Region(s)	Carolinas and Progress
Evaluation Period	September 1st, 2018 – August 31st, 2019
Annual Gross MWh Savings	DEC: 17,834 DEP: 11,647
Per Kit Gross kWh Savings	DEC: 404 DEP: 446
Annual Gross MW Savings	DEC: 1.54 (summer), 4.37 (winter) DEP: 1.00 (summer), 2.83 (winter)
Net-to-Gross Ratio	DEC: 109.0% DEP: 117.9%
Process Evaluation	Yes
Previous Evaluation(s)	2016

Evaluation Methodology

Impact Evaluation Activities

- Telephone/web surveys (DEC n=320, DEP n=343) and analysis of 4 unique measures

Impact Evaluation Findings

- Realization rates:
  - DEC: 95% (energy); 24% (summer demand); 104% for (winter demand)
  - DEP: 79% (energy); 21% (summer demand); 75% for (winter demand)
- Net-to-gross ratio: 109.0% (DEC), 117.9% (DEP)

Process Evaluation Activities

- Telephone/web surveys (DEC n=320, DEP n=343)
- 1 interview with program staff
- 1 interview with implementation staff

Process Evaluation Findings

- The SEWKP influences participants to install kit measures and adopt new behaviors.
- Participants are generally satisfied with kit items and report high satisfaction with overall program.
- Kit size assignment algorithm is fairly accurate.
- Low water pressure is the leading contributor to dissatisfaction with water-saving items among a relatively small number of participants.
- The toll-free customer care hotline is used by a very small number of SEWKP participants

Appendix B Measure Impact Results

Table B-1: DEC Per Unit Verified Impacts by Measure – Key Measure Parameters

Measure Category	Gross Energy Savings (kWh)	Gross Summer Demand (kW)	Gross Winter Demand (kW)	Realization Rate (Energy)	Free Ridership	Spillover	Net to Gross Ratio	M&V Factor (Energy) (RR x NTG)	Measure Life
Low-flow Showerhead (1.5 gpm)	205.3	0.0174	0.0625	88.7%	9.5%	18.2%	109.0%	96.7%	10
Kitchen Faucet Aerator (1.0 gpm)	50.2	0.0035	0.0040	91.0%	9.6%			99.2%	10
Bathroom Faucet Aerator (1.0 gpm)	15.5	0.0015	0.0017	272.2%	6.3%			296.6%	10
Insulating Pipe Tape*	7.0	0.0008	0.0008	100.2%	8.3%			109.2%	15

* Per linear foot

Table B-2: DEP Per Unit Verified Impacts by Measure – Key Measure Parameters

Measure Category	Gross Energy Savings (kWh)	Gross Summer Demand (kW)	Gross Winter Demand (kW)	Realization Rate (Energy)	Free Ridership	Spillover	Net to Gross Ratio	M&V Factor (Energy) (RR x NTG)	Measure Life
Low-flow Showerhead (1.5 gpm)	217.1	0.0184	0.0661	70.0%	8.2%	25.7%	117.9%	82.6%	10
Kitchen Faucet Aerator (1.0 gpm)	57.3	0.0040	0.0045	92.1%	8.1%			108.7%	10
Bathroom Faucet Aerator (1.0 gpm)	20.9	0.0020	0.0023	353.9%	4.8%			417.6%	10
Insulating Pipe Tape*	6.9	0.0008	0.0008	75.5%	7.6%			89.1%	15

* Per linear foot

Appendix C Program Performance Metrics

This appendix provides key program performance metrics, or PPIs. See Chapter 5 for the underlying results and more detailed findings.

Figure C-1: DEC Program Experience PPIs

	Participants	
	%	n
Program experience & satisfaction PPIs		
Overall satisfaction with program	83%	253
Usefulness of kit instructions	81%	272
Satisfaction with kit measures		
Showerhead	78%	201
Kitchen faucet aerator	75%	140
Bathroom faucet aerator	76%	144
Pipe wrap	84%	111
Program influence on behavior PPIs		
Installed at least one kit measure	79%	320
Most common measure installed: *showerhead*	63%	320
Respondents reporting program attributable spillover	19%	320
Challenges and opportunities for improvement PPIs		
Measure with lowest installation rate: pipewrap	36%	320
Measure with highest uninstallation rate: kitchen faucet aerator	12%	142
Measure with highest dissatisfaction: kitchen faucet aerator	6%	142

Figure C-2: DEC Participant Demographics

Ownership Status	
Own	85%
Rent	11%

Household Size	
One to two	58%
Three	16%
Four	12%
Five +	10%

Education	
High school or less	18%
Some college	31%
Bachelor's degree	25%
Graduate degree	20%

Income	
<$30k	17%
$30k to <$60k	24%
$60k to <$75k	15%
$75k to <$100k	11%
$100k+	11%

Age	
18 to 34	13%
35 to 44	15%
45 to 64	34%
65 and older	19%

Note: Refusals and "don't know" responses are not shown.

Figure C-3: DEC Participant Household Characteristics

Housing Type	
Detached	78%
Attached	5%
Mobile	12%
Apartment or condo	1%
Duplex or triplex	3%

Water Heater Fuel Type	
Electric	87%
Natural Gas	11%
Other	1%

Home Square Feet		
	Small Kit	Medium Kit
Less than 1,000	17%	1%
1,000-1,499	34%	24%
1,500-1,999	23%	34%
2,000-2,999	15%	28%
3,000+	2%	8%

Number of Showers		
	Small Kit	Medium Kit
1	35%	12%
2	57%	69%
3	6%	16%
4+	0%	3%

Number of Kitchen Faucets		
	Small Kit	Medium Kit
1	93%	89%
2	4%	11%
3+	2%	0%

Number of Bathroom Faucets		
	Small Kit	Medium Kit
1-2	67%	47%
3-4	28%	41%
5+	4%	11%

Figure C-4: DEP Program Experience PPIs

	Participants	
	%	n
Program experience & satisfaction PPIs		
Overall satisfaction with program	86%	283
Usefulness of kit instructions	84%	291
Satisfaction with kit measures		
Showerhead	79%	224
Kitchen faucet aerator	81%	155
Bathroom faucet aerator	79%	175
Pipe wrap	83%	116
Program influence on behavior PPIs		
Installed at least one kit measure	83%	343
Most common measure installed: *showerhead*	65%	343
Respondents reporting program attributable spillover	21%	343
Challenges and opportunities for improvement PPIs		
Measure with lowest installation rate: pipewrap	36%	343
Measure with highest uninstallation rate: showerhead	16%	224
Measure with highest dissatisfaction: bathroom faucet aerator	4%	181

Figure C-5: DEP Participant Demographics

Ownership Status	
Own	88%
Rent	9%

Household Size	
One to two	54%
Three	17%
Four	16%
Five +	8%

Education	
High school or less	13%
Some college	31%
Bachelor's degree	28%
Graduate degree	19%

Income	
<$30k	15%
$30k to <$60k	25%
$60k to <$75k	11%
$75k to <$100k	12%
$100k+	11%

Age	
18 to 34	11%
35 to 44	17%
45 to 64	31%
65 and older	15%

Note: Refusals and "don't know" responses are not shown.

Figure C-6: DEP Participant Household Characteristics

Housing Type	
Detached	77%
Attached	6%
Mobile	12%
Apartment or condo	1%
Duplex or triplex	2%

Water Heater Fuel Type	
Electric	88%
Natural Gas	9%
Other	2%

Home Square Feet		
	Small Kit	Medium Kit
Less than 1,000	13%	1%
1,000-1,499	31%	32%
1,500-1,999	22%	24%
2,000-2,999	19%	29%
3,000+	3%	8%

Number of Showers		
	Small Kit	Medium Kit
1	23%	6%
2	64%	79%
3	10%	12%
4+	2%	3%

Number of Kitchen Faucets		
	Small Kit	Medium Kit
1	91%	92%
2	6%	4%
3+	2%	3%

Number of Bathroom Faucets		
	Small Kit	Medium Kit
1-2	54%	36%
3-4	39%	54%
5+	6%	9%

Note: Refusals and “don’t know” responses are not shown.

Appendix D Instruments

D.1 Program Staff In-Depth Interview Guide

Introduction

Today, we'll be discussing your role in the SEWKP or water kit program. We would like to learn about your experiences in administering this program.

Your comments are confidential. If I ask you about areas you don't know about, please feel free to tell me that and we will move on. Also, if you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

I would like to record this interview for my note-taking purposes. Do I have your permission?

Roles & Responsibilities

Q1. Please describe your position at Duke Energy and your role in the water kit program.

Q2. How long have you been in this role?

Program Delivery

Next, I'd like to learn more about how this program was delivered since your involvement. If the program implementation is different in 2017, please let me know.

Q3. How is Duke Energy targeting households to participate in this program? Does this vary by jurisdiction?

[*IF NEEDED*:]

1. What marketing and outreach activities did Duke Energy conduct in the 2016 program year? [*Interviewer: we know they market the program through direct-mail campaign. Probe to inquire if they market the program in any other way.*]
2. In 2016, what proportion requested a kit among those targeted by the direct mail campaign? Are you satisfied with this response rate? If not, why not?
3. In terms of marketing, what is planned for 2017? [*If not mentioned:* Do you all plan to have a customer facing website for the program? If yes, when and what would it entail? If not, why not?]

Q4. What feedback, if any, did you receive from kit recipients on why they decided to request a kit?

Q5. Please describe the kit distribution process, including the responsibilities of your vendors: Relationship 1 (R1) and EFI.

[*IF NEEDED*:]

1. Can the kit form be submitted online? If not, is Duke considering this option?
2. Who checks whether customers who submitted the kit form are eligible for the program? What is the eligibility criteria?
3. How do you identify customers who have an electric water heating? [*Interviewer: Prior evaluation states that customers with electric water heating are eligible for this program.*]
4. Who tracks kit processing and distribution?
5. How are kits customized? [*IF NEEDED:*] Can you describe what is included in the small, medium, and large kit? (Confirm kit contents as seen below)

Kit 1 (small)	bath aerator	2
	kitchen aerator	1
	shower head	1
	pipe tape	5
Kit 2 (medium)	bath aerator	4
	kitchen aerator	1
	shower head	2
	pipe tape	5
Kit 3 (large)	bath aerator	5
	kitchen aerator	1
	shower head	3
	pipe tape	5

6. [*If not mentioned*] Are large kits still offered to customers? (If so, does this vary by jurisdiction?)
7. Prior to January 2016, documentation shows the kitchen aerator to have 1.0 GPM, but according to a Duke staff person, the aerator is now rated at 1.5 GPM. Can you please confirm the current GPM for kitchen aerators, and when that changed over (if at all)?
8. What energy saving educational materials are included in the kit?

Q6. What type of feedback have you received from kit recipients about the measures in the kit? [*IF ANY ISSUES REPORTED:*] How have you addressed those issues?

Program Goals

Q7. In 2016 and 2017 program year, what were/are Duke Energy targets in terms of:

1. Number of water kits distributed in Carolinas, Progress, Ohio, Indiana, and Kentucky
2. Number of kits distributed by customer segments – if applicable

3. Cost of distributing the kits [*Probe: Does this vary by jurisdiction?*]
4. Anything else?

Q8. How were those targets set, and by whom?

Q9. Compared to the previous program years, have these targets been the same or have they changed? [*If changed:*] Why have they changed?

Q10. Were/are you on track to meet 2016/2017 targets? [*If not on track, probe why not on track and how far behind are they in meeting their targets.*]

1. Number of water kits distributed in each jurisdiction
2. Number of kits distributed by customer segments – if applicable
3. Cost of distributing the kits
4. Anything else?

Q11. How about savings targets? Are you on track to meet the savings targets in Carolinas, Progress, Ohio, Indiana, and Kentucky? If not, why not?

Q12. Does the program have any process or non-impact goals? *(Probe: low-income, renter, or non-English speaking population targeting, increased kit recipient knowledge of how to save energy, etc.)*

[*IF YES:*]

1. How are these goals established?
2. How are they measured?

Communication

Q13. Can you describe how your vendors communicate about the program with Duke Energy? Who do you communicate with, how often, and what about? Does this vary by jurisdiction?

Q14. How often do you or vendors have to resolve an issue with kits? What types of issues come up?

Data Tracking of Kits

Let's talk about the kits a little bit.

Q15. Were there any changes to the items in the small, medium, or large kit during 2016 and 2017 program year? Any changes for 2018 program year? Are these changes for all jurisdictions?

Q16. We heard that customers must complete a short survey/form to receive a kit. Would it be possible to receive/see this survey data?

Q17. From the moment a customer requests a kit, how long does it take to receive a kit? Is this time frame typical in terms of how long it takes to receive a kit? [*IF NOT TYPICAL, PROBE to get more information on this topic.*] Does it vary by jurisdiction?

Q18. Can you tell us how your vendor reports the number of kits sent out to customers to Duke Energy? Is there information on kit distribution that you need but are not getting? What?

We are almost done. I have a few more questions.

Tape Up

Q19. What would you say are the greatest strengths of this program?

Q20. What would you say is the biggest challenge in administering this program?

Q21. How can this program be improved?

Q22. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q23. What would you like to learn from the program evaluation?

Those are all of my questions. Thank you very much for your time.

D.2 Implementer Staff In-Depth Interview Guide

Introduction

[*Note: Opinion Dynamics staff will schedule calls ahead of time through email contact.*]

[*If needed:*] We are conducting an evaluation of Duke Energy Save Energy and Water Kit Program (SEWKP). Because your organization is involved with this program, we would like to get your perspective on how the program works to help guide us in our efforts.

I would like to record this interview for my note-taking purposes. Do I have your permission?

Roles & Responsibilities

Q1. Can you describe your role in the SEWKP or water kit program?

Q2. Can you describe your program processes? (From receipt of kit forms to notifying EFI to send kits)

Q3. We have been told that your organization processes kit submission forms for Duke Energy water kit program. Do you provide any other services to Duke Energy?

1. Do you provide these services in all jurisdictions where this program is offered: Progress, Carolinas, Ohio, Indiana, and Kentucky?

Program Goals

Q4. In jurisdictions where you are providing services to Duke Energy, do you know what are Duke Energy targets in terms of:

1. Number of water kits distributed
2. Cost of the kits
3. Education goals
4. Anything else?

Q5. Do you know if Duke Energy is on track to achieve those targets? If so, how do you know?

Data Tracking of Kits and Eligibility

Q6. Based on what we heard, households must complete a short survey/form to receive a kit. Do you track the information that is on the survey form in a database? If so, what exactly do you track?

1. Do you track the same information for each jurisdiction?

2. How do you report this information to Duke Energy?
3. [*If not addressed:*] Do you maintain a dashboard that tracks number of kits and possibly other information. If so, can you send us a screen shot of that dashboard so we can see what is tracked on that dashboard?
4. Could you provide us with one of the forms so we can see what participants are filling out?

Q7. Can you describe to us who is eligible to receive the kit – that is, eligibility criteria? Do eligibility criteria vary by jurisdiction?

Q8. Can you tell us what proportion of households who sent in a kit survey form were ineligible to receive a kit in 2016 in each jurisdiction? What are the most common reasons as to why customers are ineligible? Do you think the proportion of ineligible applications will increase in 2017? If so, why?

Q9. From the moment households request a kit, do you know how long it takes to receive a kit? Is this time frame typical in terms of how long it takes to receive a kit? [*IF NOT TYPICAL, PROBE to get more information on this topic.*]

Q10. What challenges have you encountered with processing of the kit forms? [*Probe about missing information or other errors.*] [*If challenges:*] What could be done to address these challenges? Any suggestions on how to change the form? Are some of these challenges more prevalent in certain jurisdictions? If so, why?

Q11. How many forms, on average, do you process per week or annually?

Q12. [*If not addressed:*] What demographic data do you collect from households that request the kits? Which demographic segments are more likely to request the kits? Does this vary by jurisdiction?

Communication

Q13. Can you describe how you communicate with Duke Energy about the kit form submissions or anything else? Who do you communicate with, how often, and what about?

Q14. Have there been any challenges in your interactions with Duke Energy? If so, what were they? How did you address them? Were they resolved? If not, what do you think might resolve them?

Tape Up

I have only a couple of more questions left.

Q15. What would you say is the biggest challenge in processing kit submission forms and distributing kits? What could be done to improve this process?

Q16. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Those are all of my questions. Thank you very much for your time.

D.3 Participant Survey

Introduction/ Screening

[ASK FOR PHONE SURVEY]
Q1. Hi, I'm _____, calling on behalf of Duke Energy. We are calling about the Save Energy and Water Kit you got from Duke Energy. This kit included faucet aerators, one or two showerheads, and pipe wrap that can help you save water and energy in your home. Do you recall receiving this kit?
1. Yes
2. No
98. Don't know
[IF NEEDED: Can I speak with someone who may know something about this kit?]
[IF NO KNOWLEDGEABLE CONTACT, THANK AND TERMINATE]

[ASK FOR WEB SURVEY]
Q2. We are conducting surveys about the Save Energy and Water Kit you got from Duke Energy. This kit included faucet aerators, one or two showerheads, and pipe wrap that can help you save water and energy in your home. Do you recall receiving this kit?
1. Yes
2. No [TERMINATE]
3. Don't know [TERMINATE]

Motivation and Collateral

Q3. [deleted]

Q4. Did you read the included instructions on how to install the items that came in the kit?
1. Yes
2. No
98. Don't remember

[ASK IF Q3=1]
Q5. [ASK IF 4=1] On a scale from 0 to 10, where 0 is not at all helpful and 10 is very helpful, how helpful were the instructions on how to install the items that came in the kit?
0. Not at all helpful
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Very helpful
98. Don't know

[ASK IF Q5<7]
Q6. What might have made the instructions more helpful?
[RECORD VERBATIM ANSWER]

Q7. [deleted]
Q8. [deleted]
Q9. [deleted]

Assessing Measure Installation

[DISPLAY IF KIT_SIZE=SMALL:] We'd like to ask you about the energy and water saving items included in your kit. The kit contained a showerhead, faucet aerators for the bathroom and kitchen, and pipe wrap.

[DISPLAY IF KIT_SIZE=MEDIUM:] We'd like to ask you about the energy and water saving items included in your kit. The kit contained two showerheads, faucet aerators for the bathroom and kitchen, and pipe wrap.

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later? [Interviewer: Throughout interview, remind respondent as needed to report whether someone else in the home installed or uninstalled any items]
1. Yes
2. No [SKIP TO Q23]
98. Don't know [TERMINATE]

[ASK IF Q10=1]
Q11. Which of the items did you install, even if they were taken out later? [MULTIPLE RESPONSE]
[Interviewer: Record each response, then prompt with the list items.]
1. Showerhead
2. Kitchen faucet aerator
3. Bathroom faucet aerator
4. Pipe wrap
98. I don't remember which items were installed [TERMINATE]

[ASK IF Q11=1 AND KIT_SIZE=MEDIUM]
Q12. Your kit contained two showerheads. Did you install one or both of the showerheads in the kit, even if one or both were taken out later?
1. I installed both
2. I only installed one showerhead
98. Don't know

[ASK IF Q11=3]
Q13. How many of the bathroom faucet aerators from the kit did you install in your home, even if one or more were taken out later?
1. One
2. Two
98. Don't know

[ASK IF Q11=4]
Q14. Did you install all of the pipe insulation that was included with the kit?
1. Yes
2. No
98. Don't know

[ASK IF Q11=4]
Q15. About how many feet of the hot water pipe exiting your water heater did you wrap with the insulation that came in the kit? Please go over to your water heater if you need to check.
1. About three feet or less
2. About four to five feet
3. About six feet or more
98. Don't know

[ASK IF Q11=1,2,3,4]
Q16. Overall, how satisfied are you with the item(s) you installed? [0-10 SCALE FOR EACH; 98=DK]
[DISPLAY IF MODE=PHONE: Please use a 0 to 10 scale, where 0 is very dissatisfied and 10 is very satisfied. How satisfied are you with...]
1. [SHOW IF Q11=1] Showerhead
2. [SHOW IF Q11=2] Kitchen faucet aerator
3. [SHOW IF Q11=3] Bathroom faucet aerator
4. [SHOW IF Q11=4] Pipe wrap

[ASK IF Q16_1<7 OR Q16_2<7 OR Q16_3<7 OR Q16_4<7]
Q16a. Can you please explain any dissatisfaction you had with the following measures?
[SHOW LIST OF Q16 ITEMS THAT WERE RATED LESS THAN 7]
[OPEN END: RECORD VERBATIM]

Q17. Overall, how satisfied are you with Duke Energy's Save Energy and Water Kit Program?
[DISPLAY IF MODE=PHONE: IF NEEDED: Please use that same 0 to 10 scale, where 0 is very dissatisfied and 10 is very satisfied.]
0. Very dissatisfied
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Very satisfied
98. Don't know

[ASK IF ANY PART OF Q11=1]
Q18. Have you (or anyone in your home) removed any of the items from the kit that you had previously installed?
1. Yes
2. No
98. Don't know

[ASK IF Q18=1]
Q19. Which of the items did you remove? [MULTIPLE RESPONSE]
Q19_1. [DISPLAY IF Q11_1=1] Showerhead[s]
Q19_2. [DISPLAY IF Q11_2=1] Kitchen faucet aerator
Q19_3. [DISPLAY IF Q11_3=1] Bathroom faucet aerator[s]
Q19_4. [DISPLAY IF Q11_4=1] Pipe wrap

Q19_7. Don’t know [EXCLUSIVE ANSWER]

[ASK IF Q19=1 AND Q12=1]
Q20. Did you remove one or both of the showerheads you had previously installed?
1. I uninstalled both
2. I only uninstalled one of the showerheads
98. Don't know

[ASK IF Q19=3 AND Q13=2]
Q21. How many bathroom faucet aerators did you remove?
1. One
2. Two
98. Don't know

[CALCULATE SHOWER:
IF Q12=1, THEN SHOWER=2;
IF Q12=2 OR (Q11_1=1 AND KIT_SIZE=SMALL), THEN SHOWER=1;
ELSE SHOWER=0]

[CALCULATE KITCH:
IF Q11_2=1, THEN KITCH=1, ELSE KITCH=0]

[CALCULATE BATH:
IF Q13=2, THEN BATH=2;
IF Q13=1, THEN BATH=1;
ELSE BATH=0]

[CALCULATE PIPE:
IF Q11_4=1, THEN PIPE=1, ELSE PIPE=0]

[CALCULATE SHOWER1:
IF SHOWER=1 AND Q19_1=1, THEN SHOWER1=0;
IF Q19_1=1 AND (Q20=1 OR Q20=98), THEN SHOWER1=0;
IF Q19_1=1 AND Q20=2, THEN SHOWER1=1;
ELSE SHOWER1=SHOWER]

[CALCULATE KITCH1:
IF Q19_2=1, THEN KITCH1=0;
ELSE KITCH1=KITCH]

[CALCULATE BATH1:
IF BATH=1 AND Q19_3=1, THEN BATH1=0;
IF Q19_3=1 AND (Q21=2 OR Q21=98), THEN BATH1=0;
IF Q19_3=1 AND Q21=1, THEN BATH1=1;
ELSE BATH1=BATH]

[CALCULATE PIPE1:
IF Q19_4=1, THEN PIPE1=0;
ELSE PIPE1=PIPE]

CALCULATE CALCTOTAL1:
[SHOWER1 + BATH1 + KITCHEN1 + PIPE1]

[ASK IF Q19=1,2,3,4—REPEAT FOR EACH SELECTED ITEM]
Q22. Why was the [Q19 SELECTION] removed? [MULTIPLE RESPONSE]
1. It was broken
2. I didn't like how it worked
3. I didn't like how it looked, or
4. Some other reason (please specify): [OPEN END]
98. Don't know

[ASK IF Q10=2 OR Q11_1=0 OR Q11_2=0 OR Q11_3=0 OR Q11_4=0]
Q23. You said you haven't installed the following items. Which of the following do you plan to install in the next three months? [MULTIPLE RESPONSE]
1. [SHOW IF Q10=2 OR Q11_1=0] Showerhead
2. [SHOW IF Q10=2 OR Q11_2=0] Kitchen faucet aerator
3. [SHOW IF Q10=2 OR Q11_3=0] Bathroom faucet aerator
4. [SHOW IF Q10=2 OR Q11_4=0] Pipe wrap
96. I'm not planning to install any of these in the next three months [EXCLUSIVE ANSWER]
98. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q23_1=0 OR ((Q10=2 OR Q11_1=0) AND Q23_96=1)]
Q24_1. What's preventing you from installing the showerhead(s)?
[Interviewer: do not read response options, code responses]
1. Didn't know what that was
2. Tried it, didn't fit
3. Tried it, didn't work as intended (please specify): [OPEN-END]
4. Haven't gotten around to it
5. Current one is still working
6. Takes too much time to install or too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
10. [SHOW FOR Q24_1] Already have efficient showerhead
96. Other (please specify): [OPEN END]
98. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q23_2=0 OR ((Q10=2 OR Q11_2=0) AND Q23_96=1)]
Q24_2. What's preventing you from installing the showerhead(s)?
[Interviewer: do not read response options, code responses]
1. Didn't know what that was
2. Tried it, didn't fit
3. Tried it, didn't work as intended (please specify): [OPEN END]
4. Haven't gotten around to it
5. Current one is still working
6. Takes too much time to install or too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
11. [SHOW FOR Q24_2] Already have efficient kitchen faucet aerator
96. Other (please specify): [OPEN END]
98. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q23_3=0 OR ((Q10=2 OR Q11_3=0) AND Q23_96=1)]
Q24_3. What's preventing you from installing the showerhead(s)?

[Interviewer: do not read response options, code responses]
1. Didn't know what that was
2. Tried it, didn't fit
3. Tried it, didn't work as intended (please specify): [OPEN END]
4. Haven't gotten around to it
5. Current one is still working
6. Takes too much time to install or too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
12. [SHOW FOR Q24_3] Already have efficient bathroom faucet aerators
96. Other (please specify): [OPEN END]
98. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q23_4=0 OR ((Q10=2 OR Q11_4=0) AND Q23_96=1)]
Q24_4. What's preventing you from installing the showerhead(s)?
[Interviewer: do not read response options, code responses]
1. Didn't know what that was
3. Tried it, didn't work as intended (please specify): [OPEN END]
4. Haven't gotten around to it
6. Takes too much time to install or too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
13. Already have pipe wrap on my hot water pipe
96. Other (please specify): [OPEN END]
98. Don't know [EXCLUSIVE ANSWER]

Q24a. Customers that need additional assistance with their items can call a toll-free customer care hotline. Did you call the customer care hotline to seek assistance in installing any of your items?
1. Yes
2. No
98. Don't know

[ASK IF Q24A=1]
Q24b. Did you call the customer care hotline to seek assistance in installing your kitchen faucet aerator?
1. Yes
2. No
98. Don't know

[ASK IF Q24B=1]
Q24c. Did the customer care hotline offer to send you an adapter for the kitchen faucet aerator?
1. Yes
2. No
98. Don't know

[ASK IF Q24A=1]
Q24d. Did you call the customer care hotline to seek assistance in installing your bathroom faucet aerator?
1. Yes

2. No
98. Don't know

[ASK IF Q24D=1]
Q24e. Did the customer care hotline offer to send you an adapter for the bathroom faucet aerator?
1. Yes
2. No
98. Don't know

Q25. [deleted]
Q26. [deleted]
Q27. [deleted]
Q28. [deleted]

[ASK IF SHOWER1 > 0]
Q29. On average, what is the typical shower length in your household?
1. One minute or less
2. Two to four minutes
3. Five to eight minutes
4. Nine to twelve minutes
5. Thirteen to fifteen minutes
6. Sixteen to twenty minutes
7. Twenty-one to thirty minutes
8. More than thirty minutes
98. Don’t know

[ASK IF SHOWER1 > 0]
Q30. [DISPLAY IF SHOWER1=2] Thinking of the efficient showerhead you installed that gets the most usage, on average, how many showers per day are taken in this shower? [DISPLAY IF SHOWER1=1] Thinking of the efficient showerhead currently installed in your home, on average, how many showers per day are taken in this shower?
1. Less than one
2. One
3. Two
4. Three
5. Four
6. Five
7. Six
8. Seven
9. Eight or more
98. Don’t know

[ASK IF SHOWER1=2]
Q31. Thinking of the other efficient showerhead you installed, on average, how many showers per day are taken in this shower?
1. Less than one
2. One
3. Two
4. Three
5. Four
6. Five
7. Six

8. Seven
9. Eight or more
98. Don't know

Q32. [This question was moved to demographics section – but not renumbered for programming purposes]

NTG

[SKIP TO Q40 IF CALCTOTAL1=0]

Q33. If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?
1. Yes
2. No
4. Don't know

[ASK IF Q33=1]
Q34. What items would you have purchased and installed within the next year? [MULTIPLE RESPONSES]
Q34_1. [IF SHOWER1 > 0] Energy-efficient showerhead[s]
Q34_2. [IF KITCH1 > 0] Energy-efficient kitchen faucet aerator
Q34_3. [IF BATH1 > 0] Energy-efficient bathroom faucet aerator[s]
Q34_4. [IF PIPEWRAP1 > 0] Pipe wrap
Q34_7. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q34_1=1 AND SHOWER1=2]
Q35. If you had not received them in your free kit, how many energy-efficient showerheads would you have purchased and installed within the next year?
1. One
2. Two
98. Don't know

[ASK Q36 IF Q34_3=1 AND BATH1=2]
Q36. If you had not received them in your free kit, how many energy-efficient bathroom aerators would you have purchased and installed within the next year?
1. One
2. Two
98. Don't know

Q37. Now, thinking about the energy and water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how influential were the following factors on your decision to install the items from the kit? How influential was… [0-10 SCALE FOR EACH; 98=DK]
1. The fact that the items were free
2. The fact that the items were mailed to your house
3. Information provided by Duke Energy about how the items would save energy and water
0. Other information or advertisements from Duke Energy, including its website

Q38. [DELETED]
Q39. [DELETED]

Q40. Since receiving your kit from Duke Energy, have you purchased and installed any other products or made any improvements to your home to help save energy?
1. Yes
2. No
98. Don't know

[ASK Q41 IF Q40=1]
Q41. What products have you purchased and installed to help save energy in your home? [MULTIPLE RESPONSE]
[INTERVIEWER: Do not read list. After each response, ask, “Anything else?”]
4. Bought energy efficient appliances
5. Moved into an ENERGY STAR home
6. Bought efficient heating or cooling equipment
7. Bought efficient windows
8. Added insulation
9. Sealed air leaks in windows, walls, or doors
10. Sealed or insulated ducts
11. Bought LEDs
12. Bought CFLs
13. Installed an energy efficient water heater
15. Other (please specify): [OPEN END]
96. None – no other actions taken [EXCLUSIVE ANSWER]
98. Don't know [EXCLUSIVE ANSWER]

[ASK IF Q41=5]
Q42. Is Duke Energy still your gas or electricity utility?
1. Yes
2. No
98. Don’t know

Q43. [DELETED]
Q44. [DELETED]
Q45. [DELETED]

[ASK IF Q41=4,5,6,7,8,9,10,11,12,13,15—REPEAT FOR EACH SELECTED ITEM]
Q46. On a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential”, how much influence did the Duke Energy Save Energy and Water Kit Program have on your decision to… [0-10 SCALE FOR EACH; 98=DK]
4. [IF Q41=4] Buy energy efficient appliances
5. [IF Q41=5] Move into an ENERGY STAR home
6. [IF Q41=6] Buy efficient heating or cooling equipment
7. [IF Q41=7] Buy efficient windows
8. [IF Q41=8] Add insulation
9. [IF Q41=9] Seal air leaks in windows, walls, or doors
10. [IF Q41=10] Seal or insulate ducts
11. [IF Q41=11] Buy LEDs
12. [IF Q41=12] Buy CFLs
13. [IF Q41=13] Install an energy efficient water heater
15. [IF Q41=15] [Q41_15 OPEN END RESPONSE]

[ASK IF Q41=4 AND 46_4 > 0]
Q47. What kinds of appliance(s) did you buy? [MULTIPLE RESPONSE]
[Do not read list]

1. Refrigerator
2. Stand-alone Freezer
3. Dishwasher
4. Clothes washer
5. Clothes dryer
6. Oven
7. Microwave
0. Other (please specify): [OPEN END]
98. Don't know

[ASK IF Q47=1,2,3,4,5,7,0—REPEAT FOR EACH SELECTED ITEM]
Q48. Was the [INSERT Q47 RESPONSE] an ENERGY STAR or high-efficiency model?
1. Yes
2. No
98. Don't know
99. Refused

[ASK IF Q47=5]
Q49. Does the new clothes dryer use natural gas?
1. Yes - it uses natural gas
2. No – does not use natural gas
98. Don't know

[ASK IF Q41=6 AND Q46_6 > 0]
Q50. What type of heating or cooling equipment did you buy?
[MULTIPLE RESPONSE] [Do not read list]
4. Central air conditioner
5. Window/room air conditioner unit
6. Wall air conditioner unit
7. Air source heat pump
8. Geothermal heat pump
9. Boiler
10. Furnace
11. Wi-Fi thermostat
12. Other (please specify): [OPEN END]
98. Don't know

[ASK IF Q50=9 OR 10]
Q51. Does the new [INSERT Q50 RESPONSE] use natural gas?
1. Yes – it uses natural gas
2. No – does not use natural gas
98. Don't know

[ASK IF Q50=4,5,6,7,8,9,10,12—REPEAT FOR EACH SELECTED ITEM]
Q52. Was the [INSERT Q50 RESPONSE] an ENERGY STAR or high-efficiency model?
1. Yes - it is an ENERGY STAR or high-efficiency model
2. No - it is not an ENERGY STAR or high-efficiency model
98. I don't know if it is an ENERGY STAR or high-efficiency model

[ASK IF Q41=7 AND Q46_7 > 0]
Q53. Do you know how many windows you installed??
1. Yes (please specify how many you installed in the box below)
[NUMERIC RESPONSE 1 – 100]

2. No

[ASK IF Q41=8 AND Q46_8 > 0]
Q54. Please let us know what spaces you added insulation to. Also, let us know the proportion of each space for which you added insulation (for example, if you added insulation that covered your entire attic space, you would type in 100%).
1. Attic [NUMERIC RESPONSE 0 – 100]%
2. Walls [NUMERIC RESPONSE 0 - 100]%
3. Below the floor [NUMERIC RESPONSE 0 – 100]%

[ASK IF Q41= 11 AND Q46_11 > 0]
Q55. Do you know how many LEDs you installed at your property?
1. Yes (please specify how many you installed in the box below) [NUMERIC RESPONSE 1 – 100]
2. No

[ASK IF Q41=12 AND Q46_12 > 0]
Q56. Do you know how many CFLs you installed at your property?
1. Yes (please specify how many you installed in the box below) [NUMERIC RESPONSE 1 – 100]
2. No

[ASK IF Q41=13 AND Q46_13 > 0]
Q57. Does the new water heater use natural gas?
1. Yes – it uses natural gas
2. No – does not use natural gas
98. Don’t know

[ASK IF Q41= 13. AND Q46_13 > 0]
Q58. Which of the following water heaters did you purchase?
1. A traditional water heater with a large tank that holds the hot water
2. A tankless water heater that provides hot water on demand
3. A solar water heater
0. Other (please specify): [OPEN END]
98. Don’t know

[ASK IF Q41= 13 AND Q46_13 > 0]
Q59. Is the new water heater an ENERGY STAR model?
1. Yes
2. No
98. Don't know

Demographics

Q60. Which of the following types of housing units would you say best describes your home?
1. Single-family detached house
2. Single-family attached home (such as a townhouse or condo)
3. Duplex, triplex or four-plex
4 Apartment or condominium with 5 units or more
5. Manufactured or mobile home
0. Other (please specify): [OPEN END]
98. Don't know

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.
1. One
2. Two
3. Three
4. Four
5. Five or more
98. Don't know

Q62. How many bathroom sink faucets are in your home? (Keep in mind that some bathrooms may have multiple bathroom sink faucets in them)
1. One
2. Two
3. Three
4. Four
5. Five
6. Six
7. Seven
8. Eight or more
98. Don't know

Q63. How many kitchen faucets are in your home?
1. One
2. Two
3. Three
4. Four or more
98. Don't know

[ASK IF Q63=2,3,4]
Q63a. You mentioned that you have more than one kitchen faucet. Where is/are your other kitchen faucet(s) located in your home?
[OPEN-ENDED: RECORD VERBATIM RESPONSE]

Q32. What fuel type does your water heater use?
1. Electric
2. Natural Gas
3. Other (please specify): [OPEN END]
4. Don't know

Q64. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?
1. Less than 500 square feet
2. 500 to under 1,000 square feet
3. 1,000 to under 1,500 square feet
4. 1,500 to under 2,000 square feet
5. 2,000 to under 2,500 square feet
6. 2,500 to under 3,000 square feet
7. Greater than 3,000 square feet
98. Don't know
99. Prefer not to say

Q65. Do you or members of your household own your home, or do you rent it?
1. Own / buying

2. Rent / lease
3. Occupy rent-free
98. Don't know
99. Prefer not to say

Q66. Including yourself, how many people currently live in your home year-round?
1. I live by myself
2. Two people
3. Three people
4. Four people
5. Five people
6. Six people
7. Seven people
8. Eight or more people
98. Don't know
99. Prefer not to say

Q67. What was your total annual household income for 2018, before taxes?
1. Under $20,000
2. 20 to under $30,000
3. 30 to under $40,000
4. 40 to under $50,000
5. 50 to under $60,000
6. 60 to under $75,000
7. 75 to under $100,000
8. 100 to under $150,000
9. 150 to under $200,000
10. $200,000 or more
98. Don't know
99. Prefer not to say

Q68. What is the highest level of education achieved among those living in your household?
1. Less than high school
2. Some high school
3. High school graduate or equivalent (such as GED)
4. Trade or technical school
5. Some college (including Associate degree)
6. College degree (Bachelor’s degree)
7. Some graduate school
8. Graduate degree, professional degree
9. Doctorate
98. Don't know
99. Prefer not to say

Q69. Finally, what is your year of birth?
[Scroll box with years 1900-2011; 9998=Prefer not to say]

Appendix E DEC Participant Survey Results

This section reports the results from each question in the DEC participant survey. Since the results reported in this appendix represent the "raw" data (that is, none of the open-ended responses have been coded and none of the scale questions have been binned), some values may be different from those reported in the Process Evaluation Findings chapter (particularly: percentages in tables with "Other" categories and scale response questions). Only respondents who completed the survey are included in the following results.

Q1. [Read if mode = phone] Hi, I'm _____ , calling on behalf of Duke Energy. We are calling about the Save Energy and Water Kit you got from Duke Energy.

This kit included faucet aerators, one or two showerheads, and pipe tape that can help you save water and energy in your home. Do you recall receiving this kit?

Response Option	Percent (n=35)
Yes	100%
No	0%
Don't know	0%

Q2. [Display if mode = web] We are conducting surveys about the Save Energy and Water Kit you got from Duke Energy. This kit included faucet aerators, one or two showerheads, and pipe tape that can help you save water and energy in your home.

Do you recall receiving this kit?

Response Option	Percent (n=285)
Yes	100%
No	0
Don't know	0

Q3. DELETED

Q4. Did you read the included instructions on how to install the items that came in the kit?

Response Option	Percent (n=320)
Yes	85%
No	10%
Don't remember	5%

Q5. [Ask if Q4 = YES] On a scale from 0 to 10, where 0 is not at all helpful and 10 is very helpful, how helpful were the instructions on how to install the items that came in the kit?

Response Option	Percent (n=272)
0- Not at all helpful	0%
1	0%
2	0%
3	0%
4	0%

5	3%
6	5%
7	9%
8	15%
9	18%
10 - Very helpful	48%
Don't Know	2%

Q6. [Ask if Q5<7] What might have made the instructions more helpful?

Verbatim Response	Count (n=22)
They were fine	1
They said everything very well	1
There were no washers that were talked about in the instructions just teflon tape and no directions to use the tape.	1
step-by-step diagram for the show head installation	1
Specific use case or online video tutorials for individuals that are less likely to apply the items in the kit in the correct manner.	1
sheesh	1
Nothing, I know how to install	1
Nothing that remember. They went helpful to me because I already knew how to use the things that came.	1
Nothing	3
not sure	1
Na	1
More thoroughness	1
More diagrams	1
More details	1
Little more detail or more pics	1
Did not understand at all how to install would have had to call a plumber	1
Clear talk	1
Better pictures	1
Basic pin points	1
A little more simplified.	1

Q7. DELETED

Q8. DELETED

Q9. DELETED

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later?

Response Option	Percent (n=320)
Yes	79%
No	21%
Don't Know	0%

Q11. [Ask if Q10 = YES] Which of the items did you install, even if they were taken out later?

Response Option	Percent (n=254)*
Showerhead	80%
Kitchen faucet aerator	56%
Bathroom faucet aerator	58%
Pipe tape	45%
I don't remember	0%

*Multiple responses were allowed for this question

Q12. [Ask if Q11 = SHOWERHEAD AND KIT_SIZE= MEDIUM] Your kit contained two showerheads. Did you install one or both of the showerheads in the kit, even if one or both were taken out later?

Response Option	Percent (n=77)
I installed both	55%
I only installed one showerhead	46%
Don't know	0%

Q13. [Ask if Q11 = BATHROOM FAUCET AERATOR] How many of the bathroom faucet aerators from the kit did you install in your home, even if one or more were taken out later?

Response Option	Percent (n=146)
One	56%
Two	41%
Don't know	3%

Q14. [Ask if Q11 = PIPEWRAP] Did you install all of the pipe insulation that was included with the kit?

Response Option	Percent (n=116)
Yes	74%
No	21%
Don't know	5%

Q15. [Ask if Q14 is displayed] About how many feet of the pipe extruding from your water heater did you tape with the insulation **that came in the kit**? Please go over to your water heater if you need to check.

Response Option	Percent(n=116)
About three feet or less	39%
About four to five feet	24%
About six feet or more	10%
Don't know	27%

Q16. [Ask if any part of Q11 = YES] Overall, how satisfied are you with the item[s] you installed?

Showerhead

Response Option	Percent (n=202)
0 - Very dissatisfied	2%
1	1%
2	1%
3	1%
4	1%
5	4%
6	3%
7	11%
8	13%
9	11%
10 - Very satisfied	54%
Don't know	1%

Kitchen Faucet Aerator

Response Option	Percent (n=142)
0 – Very dissatisfied	2%
1	0%
2	4%
3	0%
4	0%
5	5%
6	3%
7	11%
8	13%
9	11%
10 - Very satisfied	50%
Don't know	1%

Bathroom Faucet Aerator

Response Option	Percent (n= 146)
0 – Very dissatisfied	2%
1	0%
2	1%
3	2%
4	1%
5	4%
6	3%
7	11%
8	16%
9	11%
10 - Very satisfied	49%
Don't know	1%

Pipe Tape

Response Option	Percent (n= 116)
0 – Very dissatisfied	0%
1	0%
2	0%
3	1%
4	0%
5	3%
6	2%
7	10%
8	10%
9	11%
10 - Very satisfied	59%
Don't know	4%

Q16a. Can you please explain any dissatisfaction you had with [DISPLAY ALL ITEMS IN Q16 THAT ARE <7]?

Showerhead

Verbatim Response	Count (n=21)
Was smaller than I prefer	1
Very low pressure decreases the enjoyment of a shower	1
They didn't make any difference	1
sheesh	1
Reduced pressure	1
Pressure changes during shower	1
Options	1
Not very strong pressure.	1
None	1
No water pressure at all. How are you supposed to shower with that??	1
no dissatisfaction	1
It reduced the pressure to the point of making the experience unenjoyable.	1
It had very little water pressure.	1
it does not fit my hand held device	1
It does not allow enough water flow.	1
I ordered the upgraded shower head with hose The hose is too short to comfortably spray yourself off I have stand very close and barely more to keep from tugging on the hose The head seems to high It cannot be adjusted to hang lower Also the material the	1
Even for my kids it was to reduced amount of flow to adequately rinse off.	1
Does not fit well with shower wand.	1
difficult to put own; also have two bathrooms, one that's not being used	1
Didn't have any	1
Did not let enough water through, Limited the flow	1

Kitchen Faucet Aerator

Verbatim Response	Count (n=19)
Worked OK but not excited about it.	1
Water didn't have enough pressure while use the filter, I guess wasn't good enough.	1
Takes forever for the water to heat up due to decreased flow.	1
sheesh	1
Reduced pressure	1
none	1
It's ok looks cheap I like products that look good and last a long time	1
It would not work as it should, and did not fit the faucet exactly.	1
It would make the water come at a good flow, got molded, would fall often	1
It seemed much louder than the original.	1
It has a continuous spray and sometimes I would like it to not have a continuous spray, just a regular spray	1
It doesn't do very well when you have sediment in your pipe lines (currently working on having the sediment taken care of)	1
I like to have a water filter on my sink	1
Hard to change from normal to shower flow	1
Didn’t make a difference	1
Did not let enough water through, Limited the flow	1
Did not fit spigot	1
Did not fit our delta faucet	1
Broke	1

Bathroom Faucet Aerator

Verbatim Response	Count (n=18)
Would not screw on straight, constant leak	1
Would not connect to faucet correctly.	1
Takes forever for the water to heat up.	1
same as the other	1
same as the kitchen filter problems in the kit	1
Reduced pressure	1
Not enough water coming out for me	1
None	1
n/a	1
Lose water pressure	1
It works fine	1
I didn't notice any difference	1
Flow too restrictive. I know it has to be, but it just wasn't sufficient	1

Fair	1
Drastically reduces the water pressure	1
Didn't make a difference	1
Did not let enough water through, Limited the flow	1
Broke	1

Pipe tape

Verbatim Response	Count (n=7)
Not enough provided	1
None	2
It deteriorated after two years.	1
I used that type wrap before and can't say it is much good.	1
DIDNT STICK	1
All good	1

Q17. Overall, how satisfied are you with Duke Energy's Save Energy and Water Kit Program?

Response Options	Percent (n=254)
0 - Very dissatisfied	1%
1	0%
2	1%
3	1%
4	3%
5	4%
6	8%
7	11%
8	15%
9	57%
10 - Very satisfied	0%
Don't know	1%

Q18. [Ask if any part of Q11 = YES] Have you (or anyone in your home) uninstalled any of the items from the kit that you had previously installed?

Response Option	Percent (n=254)
Yes	15%
No	82%
Don't know	4%

Q19. [Ask if Q18 = YES] Which of the items did you uninstall?

Response Option	Count (n= 37)*
Showerhead	24
Kitchen faucet aerator	17
Bathroom faucet aerator	9
Pipe tape	1

Don't know	1

*Multiple responses were allowed for this question

Q20. [Ask if Q19 = SHOWERHEAD and Q12 = INSTALLED BOTH] Did you uninstall one or both of the showerheads you had previously installed?

Response Option	Percent (n=2)
I uninstalled both	0%
I only uninstalled one of the showerheads	100%
Don't know	0%

Q21. [Ask if Q19 = BATHROOM FAUCET AERATOR and Q13 = 2-4] How many bathroom faucet aerators did you uninstall?

Response Option	Percent (n=2)
One	50%
Two	50%
Don't know	0%

Q22. [Ask if any item of Q19 is selected] Why were those items uninstalled?

Showerhead

Response Option	Percent (n=26)*
It was broken	0%
Didn't like how it worked	50%
Didn't like how it looked	4%
Other	46%
Don't know	8%

*Multiple responses were allowed for this question

Verbatim "Other" Responses	Count (n=12)
Too small	1
the well water had calcium build up on it	1
The flow is more reduced than I like (I have very long, thick hair). I am trying another low flow for another 30 days before deciding which to leave on.	1
Remodel to complete system	1
NO WATER PRESSURE	1
It did not remove	1
It got clogged up.	1
it does not fit my hand held	1
It did not fit very well	1
I got one that is larger	1
Hard water caused deposits to clog	1
Didn't make a difference	1

Kitchen faucet aerator

Response Options	Percent (n=17)*
It was broken	6%
Didn't like how it worked	53%
Didn't like how it looked	12%
Other	24%
Don't know	6%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=5)
the well water had calcium build up on it	1
new faucet and it would not fit	1
It made the water flow loud.	1
Didn't make difference	1
Didn't fit	1

Bathroom faucet aerator

Response Options	Percent (n=9)*
It was broken	0%
Didn't like how it worked	89%
Didn't like how it looked	0%
Other	11%
Don't know	0%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=2)
My water has rust (iron) particles that embed in the aerator and close it off.	1
Didn't make difference	1

Pipe tape

Response Options	Percent (n=1)*
It was broken	100%
Didn't like how it worked	0%
Didn't like how it looked	0%
Other	0%
Don't know	0%

*Multiple responses were allowed for this question

Q23. [Ask if any items not selected in Q11 or Q10 = NO] You said you haven't installed the following items. Which of the following do you plan to install in the next three months?

Response Option	Percent (n=256)*
Showerhead	29%
Kitchen faucet aerator	32%

Bathroom faucet aerator	34%
Pipe tape	31%
I'm not planning on installing any of these in the next three months	26%
Don't know	27%

*Multiple responses were allowed for this question

Q24. [Ask if any 1-6 options were not selected in Q23 or option "none" was selected] What's preventing you from installing those items?

Showerhead

Response Option	Percent (n=72)*
Already have an efficient showerhead	32%
Current one is still working	40%
Tried it, didn't fit	4%
Too difficult to install it, don't know how to do it	6%
Takes too much time to install it / No time / Too busy	0%
Tried it, didn't work as intended (please explain in the box below)	0%
Don't have the items any longer (threw away, gave away)	0%
Haven't gotten around to it	11%
Don't have the tools I need	1%
Didn't know what that was	0%
Other	13%
Don't know	1%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=9)
We have a shower head that is removable. We won't be switching to any other kinds.	1
We have a rainshower shower head and LOVE it. The sink part doesn't work with our fancy faucet in the kitchen.	1
We don't have a shower.	1
Too narrow, my wife likes the wide showerheads because they water isn't as harsh.	1
Need one with hose so I can wash my dogs	1
Need movable shower head with handheld option.	1
I have installed	1
End up taking longer showers so it seems I actually use more water with this type.	1
don't have help	1

Kitchen faucet aerator

Response Option	Percent (n=111)*
Tried it, didn't fit	18%
Current one is still working	23%
Already have an efficient kitchen faucet aerator	20%

Haven't gotten around to it	22%
Didn't know what that was	5%
Tried it, didn't work as intended (please explain in the box below)	1%
Too difficult to install it, don't know how to do it	3%
Takes too much time to install it / No time / Too busy	1%
Don't have the items any longer (threw away, gave away)	0%
Don't have the tools I need	0%
Other	6%
Don't know	8%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=16)
No applicable to my installation.	1
need a new kitchen faucet	1
it was the wrong thread It was male I needed female	1
I'll have to read the instructions again.	1
I have a water purification system	1
I don't know if it will work on the faucets I have in my kitchen & bath	1
I didn't receive that	1
Have portable dishwasher that has specific connection on sink.	1
Have an extender attached with spray features doesn't fit	1
Have a combo sprayer style kitchen faucet, so this will not fit on our existing fixture.	1
Don't have one	1
don't know if I need it	1
Does not fit with my faucet type.	1
didn't get tape	1
Buying a new faucet soon.	1
Bought a new system for kitchen	1

Bathroom Faucet Aerator

Response Option	Percent (n=105)*
Tried it, didn't fit	16%
Haven't gotten around to it	31%
Current one is still working	16%
Already have an efficient bathroom faucet aerator	12%
Didn't know what that was	5%
Takes too much time to install it / No time / Too busy	0%
Don't have the items any longer (threw away, gave away)	0%
Too difficult to install it, don't know how to do it	6%
Tried it, didn't work as intended (please explain in the box below)	1%
Don't have the tools I need	2%
Other	5%
Don't know	8%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=11)
Will not fit the Moen bathroom fixtures we have, aerator thread pattern doesn't match-up.	1
Need one in the 1/2 bath. haven't gotten to it yet	1
It does not match my current style or color	1
I've been sick, still under Dr's care and need somebody to do it for me	1
I'm not sure if it will work with my faucet	1
I needed the female threads not the male	1
I didn't get it in my box	1
Going to remodel soon	1
Faucet is decorative and this does not look right	1
Don't have one	1
don't know if I need it	1

Pipe Tape

Response Option	Percent (n=130)*
Haven't gotten around to it	37%
Already have pipe tape on my hot water pipe	34%
Didn't know what that was	11%
Too difficult to install it, don't know how to do it	6%
Takes too much time to install it / No time / Too busy	2%
Don't have the items any longer (threw away, gave away)	0%
Tried it, didn't work as intended (please explain in the box below)	1%
Don't have the tools I need	2%
Other	6%
Don't know	9%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=16)
There isn't enough tape to wrap enough pipe to make it worthwhile	1
Physically unable to get to pipes.	1
no need for it the crawl space is insulated and sealed up good	1
Nice	1
Need to replace water heater soon. Waiting to get new one.	1
My aerators don't need to be replace yet.	1
I hurt too much to crawl around under the house.	1
I don't know if I need the pipe wrap we haven't had cold weather, extreme enough to burst pipes	1
I didn't receive pipe wrap	1
I already have pipe wrap	1
Haven't needed it yet, already have the foam slip on kind	1
Don't have access to these pipes in our apartment.	1

Don't need pipe wrap	1
DON'T KNOW WHAT TO DO WITH IT	1
Didn't know. What it was for but know now and will wrap my hot water pipe	1
Didn't get around to it.	1

Q24a. Customers that need additional assistance with their items can call a toll-free customer care hotline. Did you call the customer care hotline to seek assistance in installing any of your items?

Response Option	Percent (n=320)
Yes	1%
No	98%
Don't know	1%

Q24b. [ASK IF Q24a = 1] Did you call the customer care hotline to seek assistance in installing your kitchen faucet aerator?

Response Option	Percent (n=2)
Yes	0%
No	100%
Don't know	0%

Q24c. [ASK IF Q24b = 1] Did the customer care hotline offer to send you an adapter for the kitchen faucet aerator?

[No valid responses]

Q24d. [ASK IF Q24a = 1] Did you call the customer care hotline to seek assistance in installing your bathroom faucet aerator?

Response Option	Percent (n=2)
Yes	0%
No	100%
Don't know	0%

Q24e. [ASK IF Q24d = 1] Did the customer care hotline offer to send you an adapter for the bathroom faucet aerator?

[No valid responses]

Q25. DELETED

Q26. DELETED

Q27. DELETED

Q28. DELETED

Q29. [Ask if Q11 = SHOWERHEAD and at least one showerhead is still installed] On average, what is the typical shower length in your household?

Response Option	Percent (n=180)
One minute or less	1%
Two to four minutes	9%
Five to eight minutes	37%
Nine to twelve minutes	32%
Thirteen to fifteen minutes	12%
Sixteen to twenty minutes	5%
Twenty-one to thirty minutes	2%
More than thirty minutes	1%
Don't know	1%

Q30. [DISPLAY IF TWO SHOWERHEADS STILL INSTALLED: Thinking of the efficient showerhead you installed that gets the most usage…]

[DISPLAY IF ONE SHOWERHEAD STILL INSTALLED: Thinking of the efficient showerhead currently installed in your home…]

On average, how many showers per day are taken in this shower?

Response Option	Percent (n=180)
Less than one	4%
One	38%
Two	42%
Three	10%
Four	3%
Six	1%
Seven	1%
Eight or more	1%
Don't know	4%

Q31. [Ask if two showerheads still installed] Thinking of the other efficient showerhead you installed…

On average, how many showers per day are taken in this shower?

Response Option	Percent (n=40)
Less than one	28%
One	38%
Two	23%
Three	5%
Four	3%
Five	0%
Six	0%
Seven	0%

Eight or more	3%
Don't know	3%

Q32. What fuel type does your water heater use?

Response Option	Percent (n=320)
Electric	86%
Natural gas	11%
Other (please specify in the box below)	1%
Don't know	2%

Q33. [Ask if any item was selected in Q11 and it's not the case that all parts of Q19 are selected (that is, they installed anything and did not uninstall everything they installed)] If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?

Response Option	Percent (n=243)
Yes	22%
No	52%
Don't know	26%

Q34. [Ask if Q33 = YES] What items would you have purchased and installed within the next year?

Response Option	Count (n=54)*
Showerhead	30
Kitchen faucet aerator	21
Bathroom faucet aerator	14
Pipe tape	15
Don't know	5

*Multiple responses were allowed for this question

Q35. [Ask if Q34 = SHOWERHEAD and two showerheads are still installed] If you had not received them in your free kit, how many energy-efficient showerheads would you have purchased and installed within the next year?

Response Option	Percent (n=9)
One	33%
Two	67%
Don't know	0%

Q36. [Ask if Q34 = BATHROOM FAUCET AERATOR and if more than one bathroom aerator is still installed] If you had not received them in your free kit, how many energy-efficient bathroom aerators would you have purchased and installed within the next year?

Response Option	Percent (n=9)
One	33%
Two	67%
Don't know	0%

Q37. [If Q33 was displayed] Now, thinking about the energy and water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how influential were the following factors on your decision to install the items from the kit? *How influential was…*

The fact that the items were free

Response Option	Percent (n=243)
0- Not at all influential	2%
1	0%
2	0%
3	0%
4	1%
5	3%
6	3%
7	2%
8	8%
9	13%
10 - Extremely influential	69%
Don't know	0%

The fact that the items were mailed to your home

Response Option	Percent (n=243)
0- Not at all influential	1%
1	0%
2	0%
3	0%
4	0%
5	1%
6	2%
7	4%
8	7%
9	14%
10 - Extremely influential	70%
Don't know	1%

Information provided by Duke Energy about how the items would save energy and water

Response Option	Percent (n=243)
0- Not at all influential	2%
1	0%
2	0%
3	0%
4	0%
5	6%
6	5%
7	5%
8	9%
9	13%

10 - Extremely influential	58%
Don't know	1%

Other information or advertisements from Duke Energy, including its website

Response Option	Percent (n=243)
0- Not at all influential	9%
1	1%
2	2%
3	3%
4	5%
5	8%
6	3%
7	5%
8	11%
9	14%
10 - Extremely influential	32%
Don't know	%

Q38. DELETED

Q39. DELETED

Q40. Since receiving your kit from Duke Energy, have you purchased and installed any other **products** or made any improvements to your home to help save energy?

Response Option	Percent (n=320)
Yes	37%
No	58%
Don't know	5%

Q41. [If Q40 = YES] What **products** have you purchased and installed to help save energy in your home?

Response Option	Percent (n=118)*
Bought energy efficient appliances	42%
Moved into an ENERGY STAR home	0%
Bought efficient heating or cooling equipment	16%
Bought efficient windows	10%
Added insulation	23%
Sealed air leaks in windows, walls, or doors	38%
Sealed or insulated ducts	11%
Bought LEDs	66%
Bought CFLs	16%
Installed an energy efficient water heater	15%
None – no other actions taken	0%
Other	13%
Don't know	0%

*Multiple responses were allowed for this question

Verbatim Other Responses	Count (n=15)
water filtration system	1
smart thermostat	1
smart thermostat	1
Programmable thermostat	1
new thermostat	1
New roof	1
Nest thermostat	1
More pipe wrap in the garage to the hot water tap out there.	1
Installed new kitchen faucet.	1
Installed a metal roof	1
Got Led bulbs from Duke Energy	1
gas stove	1
Fixed the leaking water pipe	1
bought more insulation for the water heater pipe	1
Bought 2 nest thermostats	1

Q42. [If Q41 = MOVED INTO AN ENERGY STAR HOME] Is Duke Energy still your gas or electricity utility?

Response Option	Count (n=320)
Yes	0
Not asked	320

Q43. DELETED

Q44. DELETED

Q45. DELETED

Q46. [Ask if any item in Q41 was selected] On a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential”, how much influence did the Duke Energy Save Energy and Water Kit Program have on your decision to…

	0	1	2	3	4	5	6	7	8	9	10	Don’t Know	Total (n)
Buy energy efficient appliances	14%	2%	0%	6%	4%	6%	4%	14%	4%	8%	36%	2%	50
Move into an ENERGY STAR home	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0
Buy efficient heating or cooling equipment	16%	0%	0%	5%	5%	5%	0%	16%	0%	11%	42%	0%	19
Buy efficient windows	25%	0%	0%	8%	8%	0%	8%	8%	8%	8%	25%	0%	12

Add insulation	19%	4%	0%	7%	0%	4%	4%	4%	15%	15%	30%	0%	27
Seal air leaks	11%	2%	0%	0%	2%	4%	2%	9%	11%	20%	38%	0%	45
Seal ducts	8%	0%	0%	8%	0%	0%	0%	8%	15%	15%	46%	0%	13
Buy LEDs	15%	1%	0%	5%	1%	9%	5%	5%	8%	12%	37%	1%	78
Buy CFLs	5%	0%	0%	5%	0%	21%	5%	11%	5%	5%	42%	0%	19
Install an energy efficient water heater	28%	6%	0%	6%	11%	0%	6%	0%	0%	6%	28%	11%	18
Other	27%	0%	0%	7%	0%	7%	7%	7%	7%	0%	40%	0%	4

Q47. [Ask if Q41 = BOUGHT ENERGY EFFICIENT APPLIANCES and Q46_BUY ENERGY EFFICIENT APPLIANCES <> 0] What kinds of appliance(s) did you buy?

Response Option	Percent (n=43)*
Refrigerator	58%
Stand-alone freezer	9%
Dishwasher	30%
Clothes washer	37%
Clothes dryer	33%
Oven	26%
Microwave	21%
Other	7%
Don't know	2%

*Multiple responses were allowed for this question

Q48. [Ask if Q47 <> DON'T KNOW OR REFUSED] Was the [INSERT Q47 RESPONSE] an ENERGY STAR or high-efficiency model?

Response Option	Microwave	Refrigerator	Stand-alone Freezer	Dishwasher	Clothes washer	Clothes dryer	Oven	Other
Yes	8	22	4	13	12	11	0	3
No	0	1	0	0	1	0	0	0
Don't know	1	2	0	0	3	3	0	0
Total	9	25	4	13	16	14	0	3

Q49. [Ask if Q47 = CLOTHES DRYER] Does the new clothes dryer use natural gas?

Response Option	Percent (n=14)
Yes	7%
No	93%
Don't know	0%

Q50. [Ask if Q41 = BOUGHT EFFICIENT HEATING OR COOLING EQUIPMENT and Q46_BUY EFFICIENT HEATING OR COOLING EQUIPMENT > 0] What type of heating or cooling equipment did you buy?

Response Option	Percent (n=16)*

Central air conditioner	38%
Window/room air conditioner unit	13%
Wall air conditioner unit	0%
Air source heat pump	44%
Geothermal heat pump	0%
Boiler	0%
Furnace	6%
Wi-Fi thermostat	19%
Other	13%
Don't know	0%

*Multiple responses were allowed for this question

Q51. [Ask if Q50 = BOILER OR FURNACE] Does the new [INSERT Q50 RESPONSE] use natural gas?

Response Option	Percent (n=1)
Yes	100%
No	0%
Don't know	0%
Refused	0%

Q52. [Ask if Q50 <> WIFI-ENABLED THERMOSTAT, DON'T KNOW, OR REFUSED] Was the [INSERT Q50 RESPONSE] an ENERGY STAR or high-efficiency model?

Response Option	Other	Central air conditioner	Window / room air conditioner unit	Wall air conditioner unit	Air source heat pump	Geothermal heat pump	Boiler	Furnace
Yes	5	2	1	0	7	0	0	1
No	0	0	0	0	0	0	0	0
Don't know	1	0	1	0	0	0	0	0
Total	6	2	2	0	7	0	0	1

Q53. [Ask if Q41= BOUGHT EFFICIENT WINDOWS and Q46_BUY EFFICIENT WINDOWS >0] Do you know how many windows you installed?

Response Option	Percent (n=320)
Yes	3%
No	0%
Don't know	0%
Not asked	97%

Please specify how many you installed:

Verbatim Response	Percent (n=9)
7	22%
10	11%
13	22%

14	11%
18	11%
19	11%
20	11%

Q54. [Ask if Q41 = ADDED INSULATION and Q46_ADD INSULATION > 0] Please let us know what spaces you added insulation to. Also, let us know the proportion of each space you added insulation to (for example, if you added insulation that covered your entire attic space, you would type in 100%).

Response Option	Percent (n=22)*
Attic	64%
Walls	18%
Below the floor	64%

*Multiple responses were allowed for this question

Attic

Verbatim Response	Count (n=14)
40	2
50	5
60	1
80	1
90	1
100	4

Walls

Verbatim Response	Count (n=4)
50	3
100	1

Below the floor

Verbatim Response	Count (n=14)
10	1
30	1
50	4
75	1
100	7

Q55. [Ask if Q41 = BOUGHT LEDS and Q46_BUY LEDS > 0] Do you know how many LEDs you installed at your property?

Response Option	Percent (n=66)
Yes	83%

No	17%

[Please specify how many you installed in the box below:]

Verbatim Response	Count (n=55)
2	2
3	2
4	2
5	7
6	4
7	1
8	5
9	1
10	8
12	8
14	2
15	2
16	2
20	4
24	1
25	1
27	1
31	1
40	1

Q56. [Ask if Q41 = BOUGHT CFLS and Q46_BUY CFLS > 0] Do you know how many CFLs you installed at your property?

Response Option	Percent (n=18)
Yes	89%
No	11%

[Please specify how many you installed in the box below:]

Verbatim Response	Count (n=16)
2	1
3	2
4	3
5	2
6	1
7	2
9	1
10	1
12	1
15	1
20	1

Q57. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Does the new water heater use natural gas?

Response Option	Percent (n=13)
Yes	0%
No	100%
Don't know	0%

Q58. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Which of the following water heaters did you purchase?

Response Option	Percent (n=13)
A traditional water heater with a large tank that holds the hot water	77%
A tankless water heater that provides hot water on demand	15%
A solar water heater	0%
Other	8%
Don't know	0%

Q59. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Is the new water heater an ENERGY STAR model?

Response Option	Percent (n=13)
Yes	85%
No	0%
Don't know	15%

Q60. Which of the following types of housing units would you say best describes your home? It is . . .?

Response Option	Percent (n=320)
Single-family detached house	78%
Single-family attached home (such as a townhouse or condo)	5%
Duplex, triplex or four-plex	1%
Apartment or condo with 5 units or more	3%
Manufactured or mobile home	12%
Other	1%
Don't know	1%

Verbatim Other Response	Count (n=3)
Single family home with separate guest house	1
New construction	1
A house 4 bedrooms	1

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.

Response Option	Percent (n=320)
One	27%
Two	62%
Three	10%

Four	1%
Five or more	0%
Don't know	1%

Q62. How many bathroom sink faucets are in your home? (Keep in mind that some bathrooms may have multiple bathroom sink faucets in them)

Response Option	Percent (n=320)
One	18%
Two	43%
Three	22%
Four	12%
Five	4%
Six	1%
Seven	1%
Eight or more	0%
Don't know	0%

Q63. How many kitchen faucets are in your home?

Response Option	Percent (n=320)
One	92%
Two	7%
Three	1%
Four or more	1%
Don't know	0%

Q63a. You mentioned that you have more than one kitchen faucet. Where is/are your other kitchen faucet(s) located in your home?

Verbatim Response	Frequency (n=28)
Laundry room	9
Basement/ lower level	9
Kitchen	2
Other	3
Misread question- only one kitchen faucet	5

Q64. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

Response Option	Percent (n=320)
Less than 500 square feet	0%
500 to under 1,000 square feet	11%
1,000 to under 1,500 square feet	28%
1,500 to under 2,000 square feet	27%
2,000 to under 2,500 square feet	14%
2,500 to under 3,000 square feet	6%
Greater than 3,000 square feet	4%
Prefer not to say	1%

Don't know	9%

Q65. Do you or members of your household own your home, or do you rent it?

Response Option	Percent (n=320)
Own / buying	85%
Rent / lease	11%
Occupy rent-free	1%
Prefer not to say	3%
Don't know	0%

Q66. Including yourself, how many people currently live in your home year-round?

Response Option	Percent (n=320)
I live by myself	17%
Two people	41%
Three people	16%
Four people	12%
Five people	6%
Six people	3%
Seven people	0%
Eight or more people	1%
Prefer not to say	4%
Don't know	0%

Q67. What was your total annual household income for 2016, before taxes?

Response Option	Percent (n=320)
Under $20,000	7%
$20,000 to under $30,000	9%
$30,000 to under $40,000	8%
$40,000 to under $50,000	11%
$50,000 to under $60,000	4%
$60,000 to under $75,000	15%
$75,000 to under $100,000	11%
$100,000 to under $150,000	7%
$150,000 to under $200,000	3%
$200,000 or more	1%
Prefer not to say	22%
Don't know	1%

Q68. What is the highest level of education achieved among those living in your household?

Response Option	Percent (n=320)
Less than high school	2%
Some high school	1%
High school graduate or equivalent (such as GED)	15%
Trade or technical school	4%
Some college (including Associate degree)	27%

College degree (Bachelor's degree)	22%
Some graduate school	3%
Graduate degree, professional degree	18%
Doctorate	2%
Prefer not to say	7%
Don't know	0%

Q69. Finally, what is your year of birth?

Response Option	Frequency (n=320)
18-24	2
25-34	39
35-44	49
45-54	54
55-64	53
65+	60
Prefer not to say	62

Appendix F DEP Participant Survey Results

This section reports the results from each question in the DEP participant survey. Since the results reported in this appendix represent the "raw" data (that is, none of the open-ended responses have been coded and none of the scale questions have been binned), some values may be different from those reported in the Process Evaluation Findings chapter (particularly: percentages in tables with "Other" categories and scale response questions). Only respondents who completed the survey are included in the following results.

Q1. [Read if mode = phone] Hi, I'm _____ , calling on behalf of Duke Energy. We are calling about the Save Energy and Water Kit you got from Duke Energy.

This kit included faucet aerators, one or two showerheads, and pipe tape that can help you save water and energy in your home. Do you recall receiving this kit?

Response Option	Percent (n=35)
Yes	100%
No	0%
Don't know	0%

Q2. [Display if mode = web] We are conducting surveys about the Save Energy and Water Kit you got from Duke Energy. This kit included faucet aerators, one or two showerheads, and pipe tape that can help you save water and energy in your home.

Do you recall receiving this kit?

Response Option	Percent (n=308)
Yes	100%
No	0%
Don't know	0%

Q3. DELETED

Q4. Did you read the included instructions on how to install the items that came in the kit?

Response Option	Percent (n=343)
Yes	85%
No	11%
Don't remember	4%

Q5. [Ask if Q4 = YES] On a scale from 0 to 10, where 0 is not at all helpful and 10 is very helpful, how helpful were the instructions on how to install the items that came in the kit?

Response Option	Percent (n=291)
1- Not at all helpful	0%
1	0%
2	0%
3	0%
4	0%
5	3%
6	2%
7	8%
8	16%
9	17%
10 - Very helpful	51%
Don't Know	1%

Q6. [Ask if Q5<7] What might have made the instructions more helpful?

Verbatim Response	Count (n=20)
We already knew how to install	1
Very clear details, with pictures and diagrams. Most I understood, but some items, such as the pipe wrap, I wasn't sure I would do right so didn't try. I am waiting for a friend to help me.	1
Tools that are actually needed	1
To give Troubleshooting tips. I couldn't get the shower faucet to attach...,	1
They may have help people without construction knowledge	1
The instructions were fine, it was the quality of the product that was sub-par.	1
Simple	1
Nothing really.	1
Nothing	1
N/A	1
More tools	1
More precise	1
More pictures	1
more photos	1
I didn't really need instructions.	1
easier way to attach them	1
Don't have good response	1
details	1
Clearer	1
?	1

Q7. DELETED

Q8. DELETED

Q9. DELETED

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later?

Response Option	Percent (n=343)
Yes	83%
No	17%
Don't Know	0%

Q11. [Ask if Q10 = YES] Which of the items did you install, even if they were taken out later?

Response Option	Percent (n=285)*
Showerhead	79%
Bathroom faucet aerator	56%
Kitchen faucet aerator	64%
Pipe tape	44%
I don't remember	0%

*Multiple responses were allowed for this question

Q12. [Ask if Q11 = SHOWERHEAD AND KIT_SIZE= MEDIUM] Your kit contained two showerheads. Did you install one or both of the showerheads in the kit, even if one or both were taken out later?

Response Option	Percent (n=97)
I installed both	56%
I only installed one showerhead	44%
Don't know	0%

Q13. [Ask if Q11 = BATHROOM FAUCET AERATOR] How many of the bathroom faucet aerators from the kit did you install in your home, even if one or more were taken out later?

Response Option	Percent (n=181)
One	45%
Two	52%
Don't know	3%

Q14. [Ask if Q11 = PIPEWRAP] Did you install all of the pipe insulation that was included with the kit?

Response Option	Percent (n=125)
Yes	77%
No	18%
Don't know	5%

Q15. [Ask if Q14 is displayed] About how many feet of the pipe extruding from your water heater did you tape with the insulation **that came in the kit**? Please go over to your water heater if you need to check.

Response Option	Percent (n=240)
About three feet or less	41%
About four to five feet	23%
About six feet or more	8%
Don't know	28%

Q16. [Ask if any part of Q11 = YES] Overall, how satisfied are you with the item[s] you installed?

Showerhead

Response Option	Percent (n=224)
0 - Very dissatisfied	0%
1	1%
2	0%
3	1%
4	1%
5	5%
6	5%
7	7%
8	11%
9	11%
10 - Very satisfied	57%
Don't know	0%

Kitchen Faucet Aerator

Response Option	Percent (n= 159)
0 – Very dissatisfied	0%
1	1%
2	0%
3	2%
4	1%
5	3%
6	4%
7	8%
8	11%
9	11%
10 - Very satisfied	57%
Don't know	3%

Bathroom Faucet Aerator

Response Option	Percent (n= 181)
0 – Very dissatisfied	1%
1	2%
2	0%

3	2%
4	2%
5	5%
6	3%
7	6%
8	12%
9	13%
10 - Very satisfied	51%
Don't know	3%

Pipe Tape

Response Option	Percent (n= 124)
0 – Very dissatisfied	0%
1	0%
2	1%
3	3%
4	2%
5	0%
6	3%
7	7%
8	10%
9	15%
10 - Very satisfied	53%
Don't know	7%

Q16a. Can you please explain any dissatisfaction you had with [DISPLAY ALL ITEMS IN Q16 THAT ARE <7]?

Showerhead

Verbatim Response	Count (n=32)
Truthfully the one I have already had better settings as far as adjusting the type of flow from the shower head and has a light to let you know when the temperature is correct. I really loved the original shower heads we had so they are now back on.	1
Too little water to take a shower in.	1
They reduced the water flow at first, but I can no longer see a reduction.	1
The water pressure coming out of the showerhead	1
The shower head was nice, we just prefer a shower head with a corded handset. That makes cleaning or washing the dog easier.	1
Style	1
Showering was not as enjoyable with the lower pressure.	1
Reduced water stream too much	1
pressure seems to be variable from time to time	1
Pressure	1

On aa well they didn't perform well I purchased another online word much better	1
not really adjustable	1
Not enough water pressure	1
Not adjustable enough	1
NONE	1
No water pressure	1
Need more pressure	1
My water pressure was not very strong during the use of the showerhead	1
My husband thinks the water pressure is too low with this shower head. It doesn't bother me. I prefer to shower at the YMCA anyway.	1
My husband didn't like it because he said the flow was not strong enough.	1
it's to slow of a flow	1
It was to small	1
It made for a miserable shower.	1
It didn't match my current faucet set up.	1
I prefer a handheld	1
I like more options with my shower head	1
Flimsy	1
Don't remember	1
Doesn't spray very hard	1
Didn't fit	1
Did not like the water pressure.	1
Can be better products	1

Kitchen Faucet Aerator

Verbatim Response	Count (n=18)
Worked ok	1
Too small	1
There wasn't enough water pressure. It made the water pressure very low in the sink.	1
Not adjustable enough	1
No water pressure	1
N/A	1
LOVE IT	1
It works fine, but restricted water flow presser when trying to rinse things off	1
It served its purpose of lowering water which is why I disliked it	1
It didn't seem to fit very well on our faucet.	1
I needed more pressure coming out	1
has very low pressure	1
Had to replace kitchen faucets not due to the aerator, it limits the water too much.	1
Don't remember	1

Didn't last long	1
Didn't like pressure	1
Couldn't get a correct fit even with the tape and wateoulhoot	1
Can be better	1

Bathroom Faucet Aerator

Verbatim Response	Count (n=26)
Worked ok	1
too big	1
The water pressure was reduced so much it makes it difficult to wash hands and brush teeth. It seems we use as lot more water this way.	1
The water pressure was really was really low	1
same as kitchen. both faucets ended up being replaced but not do to the aerator.	1
poor water flow	1
One seems to be working OK, but the other restricts water flow too much. Thinking about replacing it.	1
Not really sure I could tell the difference since it was installed with the new head	1
None	3
No water pressure	1
Neutral. Not dissatisfied.	1
Less pressure	1
Its ok for washing hands but if I have to fill up a cup or anything it takes too long	1
It was okay	1
It leaked and you couldn't get enough water to do anything with it.	1
It actually leaks a bit around the seal.	1
I wasn't dissatisfied just took some getting used to	1
I realize its purpose, but it needs more flow	1
Don't remember	1
Didn't like pressure	1
Didn't fit	1
Cheaply made	1
Cheap, there are better ones	1
Cheap feeling and were very tall. They were about twice the height as the original.	1

Pipe Tape

Verbatim Response	Count (n=11)
Unhappy with the way it looks	1
There was not enough	1
Really need long lengths of foam pipe wrap. I have long runs of piping underneath of my home.	1
Not enough	1
Need more. Not enough in Kit.	1
It was good but the stuff you can buy at Lowe's is better	1

It did not adhere very well, even to clean pipe.	1
Don't remember	1
Didn't use	1
Averange	1
adhesive didn't stick very well	1

Q17. Overall, how satisfied are you with Duke Energy's Save Energy and Water Kit Program?

Response Options	Percent (n=285)
0 - Very dissatisfied	1%
1	0%
2	0%
3	0%
4	1%
5	3%
6	2%
7	7%
8	13%
9	14%
10 - Very satisfied	58%
Don't know	1%

Q18. [Ask if any part of Q11 = YES] Have you (or anyone in your home) uninstalled any of the items from the kit that you had previously installed?

Response Option	Percent (n=285)
Yes	15%
No	82%
Don't know	3%

Q19. [Ask if Q18 = YES] Which of the items did you uninstall?

Response Option	Count (n=45)*
Showerhead	9
Kitchen faucet aerator	4
Bathroom faucet aerator	4
Pipe tape	1
Don't know	0

*Multiple responses were allowed for this question

Q20. [Ask if Q19 = SHOWERHEAD and Q12 = INSTALLED BOTH] Did you uninstall one or both of the showerheads you had previously installed?

Response Option	Percent (n=3)
I uninstalled both	67%
I only uninstalled one of the showerheads	33%
Don't know	0%

Q21. [Ask if Q19 = BATHROOM FAUCET AERATOR and Q13 = 2-4] How many bathroom faucet aerators did you uninstall?

[No valid responses]

Q22. [Ask if any item of Q19 is selected] Why were those items uninstalled?

Showerhead

Response Option	Percent (n=32)*
It was broken	7%
Didn't like how it worked	50%
Didn't like how it looked	10%
Other	37%
Don't know	3%

*Multiple responses were allowed for this question

Verbatim "Other" Responses	Count (n=11)
the flow was to slow	1
the cord wasn't long enough	1
Not enough pressure	1
Moved	1
Lower water flow	1
It was smaller than the one I had on the shower	1
It leaked really bad	1
It didn't fit right with the faucet.	1
I wanted the handset with hose. I will be installing this shower head at our vacation home.	1
i removed both shower heads and installed both	1
I felt like it didn't put out the same amount of water as the old one	1

Kitchen faucet aerator

Response Options	Percent (n=18)*
It was broken	13%
Didn't like how it worked	53%
Didn't like how it looked	13%
Other	40%
Don't know	0%

*Multiple responses were allowed for this question

Verbatim "Other" Responses	Count (n=6)
Water would shoot out sides, couldn't get good long term fit. Was able to temporarily get a seal and was still	1
replaced faucets	1

Our water pressure is already bad and this device made it worse	1
Installed a kegan water filtration system.	1
I didn't remove it	1
Because we install a water filter	1

Bathroom faucet aerator

Response Options	Percent (n=10)*
It was broken	8%
Didn't like how it worked	33%
Didn't like how it looked	8%
Other	25%
Don't know	8%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=6)
Replaced the lavatory and faucet with a new one.	1
replaced faucets	1
Lower water flow	1
It kealed	1
I removed one bathroom aerator and replace on	1
I didn't remove it	1

Pipe Tape

Response Options	Percent (n=4)*
It was broken	0%
Didn't like how it worked	0%
Didn't like how it looked	%
Other	100%
Don't know	0%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=4)
Needs to have foam wrap. Also concerned if the pipe may start sweating or not due to condinsation	1
It wasn't removed	1
insulation	1
I wrapped my pipes with it	1

Q23. [Ask if any items not selected in Q11 or Q10 = NO] You said you haven't installed the following items. Which of the following do you plan to install in the next three months?

Response Option	Percent (total n=288)*
Showerhead	33%
Kitchen faucet aerator	26%

Bathroom faucet aerator	25%
Pipe tape	32%
I'm not planning on installing any of these in the next three months	22%
Don't know	33%

*Multiple responses were allowed for this question

Q24. [Ask if any 1-6 options were not selected in Q23 or option "none" was selected] What's preventing you from installing those items?

Showerhead

Response Option	Percent (n=73)*
Already have an efficient showerhead	25%
Current one is still working	36%
Too difficult to install it, don't know how to do it	4%
Tried it, didn't fit	12%
Takes too much time to install it / No time / Too busy	0%
Tried it, didn't work as intended (please explain in the box below)	1%
Don't have the items any longer (threw away, gave away)	1%
Haven't gotten around to it	15%
Don't have the tools I need	1%
Didn't know what that was	0%
Other	86%
Don't know	1%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=14)
we like ours better	1
the water pressure	1
seems cheap	1
Quality isn't as good as what we currently have.	1
Not very attractive	1
Like the pull down one I have	1
it hideous	1
i have new shower heads currently	1
I have a dual head shower nozzle that I like better. It has colors to reflect safe temperatures so I don't have to worry about my son burning himself.	1
Have been ill with extended illness.	1
Have a multi head that is detachable for washing the dog.	1
Didn't like the style, color of the showerheads. Wasn't sure what the kit would actually look like. Should have realized they'd be plain chrome.	1
because I tried the aerators and I felt the shower would have too little water pressure	1
All I received was the shower head	1

Kitchen faucet aerator

Response Option	Percent (n=129)*
Tried it, didn't fit	21%
Current one is still working	26%
Already have an efficient kitchen faucet aerator	22%
Haven't gotten around to it	16%
Too difficult to install it, don't know how to do it	2%
Tried it, didn't work as intended (please explain in the box below)	2%
Didn't know what that was	5%
Takes too much time to install it / No time / Too busy	1%
Don't have the items any longer (threw away, gave away)	2%
Don't have the tools I need	2%
Other	6%
Don't know	2%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=7)
Would not fit	1
Wont fit the faucet I have	1
the aerator is not threaded the same. I would have to replace the whole faucet.	1
only have 1 shower	1
my husband passed away so I have no one to install them.	1
my home just got rem	1
My faucet does not support this type of aerator	1
make flow too low	1
Landlord has not installed yet	1
it's not compatible with our kitchen faucet	1
I only received the one for the bathroom, there wasn't a one for the kitchen	1
I no longer live at the residence.	1
I like the faucet I have and you aerator doesn't work with it	1
I like my faucet and it isn't compatible	1
I have a water filter that prevents me from using the kitchen faucet aerator.	1
I don't think it fit ours. We have faucet that pulls down to turn into the sprayer.	1
I am replacing the entire shower and waiting to do it all at once.	1
I already have a water filter and the aerator wont fit	1
Have an attachment for my water filter	1
Have a Pur water filter installed, will not fit because of that. Will use when sink is replaced.	1
getting to it	1
Gave this item away.	1
Gave it to a friend at work.	1
Doesn't match	1

Does not fit on current sink faucet.	1
does not fit my spray head	1
Did not get that item	1
Current kitchen faucet is the type that has retractable hose and faucet.	1
couldn't remove the other one	1
Also ugly.	1

Bathroom Faucet Aerator

Response Option	Percent(n=114)*
Tried it, didn't fit	18%
Current one is still working	32%
Already have an efficient bathroom faucet aerator	7%
Haven't gotten around to it	24%
Too difficult to install it, don't know how to do it	3%
Takes too much time to install it / No time / Too busy	0%
Don't have the items any longer (threw away, gave away)	3%
Don't have the tools I need	4%
Tried it, didn't work as intended (please explain in the box below)	2%
Didn't know what that was	4%
Other	4%
Don't know	4%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=17)
Won't work with my current bathroom faucet.	1
we were having renovations done on the bathrooms, the whole house.	1
the aerator is not threaded the same. I would have to replace the whole faucet.	1
my husband passed away so I have no one to install them.	1
make flow too low	1
Landlord hasn't installed yet	1
I no longer live at the residence.	1
I just installed new fixtures,	1
getting tpo ti	1
Gave this item away	1
Gave it to a friend at work.	1
Faucet does not support this type of aerator	1
Don't want to lose water pressure	1
doesn't match	1
Did not get one	1
Did not get item	1
Been installed	1

Pipe Tape

Response Option	Percent (n=63)*
Already have pipetape	32%
Haven't gotten around to it	35%
Too difficult to install it, don't know how to do it	9%
Didn't know what that was	8%
Tried it, didn't work as intended (please explain in the box below)	0%
Takes too much time to install it / No time / Too busy	5%
Don't have the tools I need	1%
Don't have the items any longer (threw away, gave away)	1%
Other	2%
Don't know	2%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=3)
Using	1
unable to access pipes	1
too small. didn't fit all the way around.	1
They didn't fit my pipes	1
The piping is to hard to reach.	1
Replaced to tankless water heater	1
not enouph to wrap	1
No pipes eased to cold.	1
no need for the pipe wrap	1
My pipes are not exposed. Home is on a slab.	1
my husband passed away so I have no one to install them.	1
Kit didn't include it	1
Im not sure we got the pipe wrap or I just don't remember it	1
I no longer live at the residence.	1
I don't have any piping exposed requiring pipe wrap. I wish it came with a water heater wrap	1
I don't remember getting the pipe wrap, I have to look for it and I will install it. I was disappointed with the aerators and did not look in the box much	1
I didn't see a pipe wrap in the box	1
I didn't receive pipe wrap.	1
Have read that it's not really very efficient	1
Hard to get to	1
Gave it to a friend at work.	1
Don't think it's needed, but will check.	1
DIDNT RECIEVE IT	1
Didn't have it in my kit.	1
did not get item	1
Did not get it	1
Can't get under the house	1

can't access pipe	1

Q24a. Customers that need additional assistance with their items can call a toll-free customer care hotline. Did you call the customer care hotline to seek assistance in installing any of your items?

Response Option	Percent (n=343)
Yes	2%
No	98%
Don't know	1%

Q24b. [ASK IF Q24a = 1] Did you call the customer care hotline to seek assistance in installing your kitchen faucet aerator?

Response Option	Percent (n=5)
Yes	40%
No	60%
Don't know	0%

Q24c. [ASK IF Q24b = 1] Did the customer care hotline offer to send you an adapter for the kitchen faucet aerator?

Response Option	Percent (n=2)
Yes	100%
No	0%
Don't know	0%

Q24d. [ASK IF Q24a = 1] Did you call the customer care hotline to seek assistance in installing your bathroom faucet aerator?

Response Option	Percent (n=5)
Yes	60%
No	40%
Don't know	0%

Q24e. [ASK IF Q24d = 1] Did the customer care hotline offer to send you an adapter for the bathroom faucet aerator?

Response Option	Percent (n=3)
Yes	0%
No	67%
Don't know	33%

Q25. DELETED

Q26. DELETED

Q27. DELETED

Q28. DELETED

Q29. [Ask if Q11 = SHOWERHEAD and at least one showerhead is still installed] On average, what is the typical shower length in your household?

Response Option	Percent (n=196)
Two to four minutes	5%
Five to eight minutes	48%
Nine to twelve minutes	24%
Thirteen to fifteen minutes	10%
Sixteen to twenty minutes	9%
Twenty-one to thirty minutes	2%
Don't know	2%

Q30. [DISPLAY IF TWO SHOWERHEADS STILL INSTALLED: Thinking of the efficient showerhead you installed that gets the most usage…]

[DISPLAY IF ONE SHOWERHEAD STILL INSTALLED: Thinking of the efficient showerhead currently installed in your home…]

On average, how many showers per day are taken in this shower?

Response Option	Percent (n=196)
Less than one	8%
One	31%
Two	37%
Three	13%
Four	6%
Five	3%
Six	91%
Don't know	1%

Q31. [Ask if two showerheads still installed] Thinking of the other efficient showerhead you installed…

On average, how many showers per day are taken in this shower?

Response Option	Percent (n=51)
Less than one	22%
One	43%
Two	22%
Three	10%
Four	4%
Five	0%
Six	0%

Seven	0%
Eight or more	0%
Don't know	0%

Q32. What fuel type does your water heater use?

Response Option	Percent (n=343)
Electric	88%
Natural gas	9%
Other (please specify in the box below)	2%
Don't know	1%

Verbatim "Other" Response	Count (n=6)
Propane and heating oil	1
Propane	5

Q33. [Ask if any item was selected in Q11 and it's not the case that all parts of Q19=selected (that is, they installed anything and did not uninstall everything they installed)] If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?

Response Option	Percent (n=270)
Yes	22%
No	57%
Don't know	22%

Q34. [Ask if Q33 = YES] What items would you have purchased and installed within the next year?

Response Option	Count (n=58)*
Showerhead	31
Kitchen faucet aerator	19
Bathroom faucet aerator	15
Pipe tape	16
Don't know	5

*Multiple responses were allowed for this question

Q35. [Ask if Q34 = SHOWERHEAD and two showerheads are still installed] If you had not received them in your free kit, how many energy-efficient showerheads would you have purchased and installed within the next year?

Response Option	Percent (n=10)
One	30%
Two	60%
Don't know	10%

Q36. [Ask if Q34 = BATHROOM FAUCET AERATOR and if more than one bathroom aerator is still installed] If you had not received them in your free kit, how many energy-efficient bathroom aerators would you have purchased and installed within the next year?

Response Option	Percent (n=9)
One	11%
Two	78%
Don't know	11%

Q37. [If Q33 was displayed] Now, thinking about the energy and water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how influential were the following factors on your decision to install the items from the kit? *How influential was…*

The fact that the items were free

Response Option	Percent (n=270)
1- Not at all influential	1%
1	0%
2	1%
3	0%
4	2%
5	2%
6	3%
7	2%
8	8%
9	11%
10 - Extremely influential	69%
Don't know	1%

The fact that the items were mailed to your home

Response Option	Percent (n=270)
0- Not at all influential	2%
1	1%
2	0%
3	0%
4	1%
5	1%
6	2%
7	2%
8	7%
9	10%
10 - Extremely influential	74%
Don't know	1%

Information provided by Duke Energy about how the items would save energy and water

Response Option	Percent (n=270)
0- Not at all influential	1%
1	0%
2	1%
3	0%
4	1%
5	3%
6	2%

7	9%
8	10%
9	16%
10 - Extremely influential	56%
Don't know	1%

Other information or advertisements from Duke Energy, including its website

Response Option	Percent (n=270)
0- Not at all influential	11%
1	2%
2	3%
3	2%
4	3%
5	10%
6	4%
7	7%
8	7%
9	13%
10 - Extremely influential	33%
Don't know	6%

Q38. DELETED

Q39. DELETED

Q40. Since receiving your kit from Duke Energy, have you purchased and installed any other **products** or made any improvements to your home to help save energy?

Response Option	Percent (n=343)
Yes	35%
No	62%
Don't know	3%

Q41. [If Q40 = YES] What **products** have you purchased and installed to help save energy in your home?

Response Option	Percent (n=120)*
Bought energy efficient appliances	38%
Moved into an ENERGY STAR home	3%
Bought efficient heating or cooling equipment	19%
Bought efficient windows	11%
Added insulation	19%
Sealed air leaks in windows, walls, or doors	35%
Sealed or insulated ducts	8%
Bought LEDs	71%
Bought CFLs	8%
Installed an energy efficient water heater	11%

None – no other actions taken	2%
Other	15%
Don't know	1%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=18)
use powerstrips on all electronics and turn them off when the units are not in use	1
Solar outdoor light	1
pool pump	1
new window	1
New roof installation	1
new roof and calked the windows	1
new doors	1
Installed storm door	1
Installed some new lightbulbs.	1
Installed screen doors	1
Installed insulated siding	1
I had someone come to my home and do an energy evaluation once a long time ago. i also bought a cover to seal the attic.	1
EchoBee thermostat,	1
Changed to a hand held shower head. It works great!	1
Bought curtains	1
Bought 2 new toilets that use 1.1-1.6 gallons of water and a new efficient water heater	1
Blanket for water heater.	1
Added weather stripping to the door	1

Q42. [If Q41 = MOVED INTO AN ENERGY STAR HOME] Is Duke Energy still your gas or electricity utility?

Response Option	Percent (n=3)
Yes	100%
No	0%
Don't know	0%

Q43. DELETED

Q44. DELETED

Q45. DELETED

Q46. [Ask if any item in Q41 was selected] On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did the Duke Energy Save Energy and Water Kit Program have on your decision to…

Response Option	0	1	2	3	4	5	6	7	8	9	10	Don't Know	Total (n)
Buy energy efficient appliances	28%	4%	0%	0%	2%	11%	2%	7%	11%	11%	24%	0%	46
Move into an ENERGY STAR home	0%	0%	0%	33%	0%	0%	0%	0%	33%	33%	0%	0%	3
Buy efficient heating or cooling equipment	39%	0%	0%	0%	0%	8%	0%	8%	13%	4%	22%	4%	23
Buy efficient windows	39%	0%	0%	8%	0%	8%	0%	0%	8%	8%	23%	8%	13
Add insulation	22%	0%	0%	0%	13%	0%	4%	9%	4%	13%	30%	4%	23
Seal air leaks	17%	0%	0%	2%	2%	2%	5%	5%	12%	17%	33%	5%	42
Seal ducts	22%	11%	0%	0%	0%	0%	0%	0%	0%	11%	44%	11%	9
Buy LEDs	19%	1%	1%	0%	2%	11%	4%	7%	6%	13%	33%	4%	85
Buy CFLs	10%	0%	0%	0%	0%	0%	0%	10%	10%	30%	30%	10%	10
Install an energy efficient water heater	15%	0%	0%	0%	0%	15%	8%	15%	15%	8%	23%	0%	13
Other	28%	6%	0%	0%	0%	22%	0%	0%	6%	0%	28%	11%	18

Q47. [Ask if Q41 = BOUGHT ENERGY EFFICIENT APPLIANCES and Q46_BUY ENERGY EFFICIENT APPLIANCES <> 0] What kinds of appliance(s) did you buy?

Response Option	Percent (n33)*
Refrigerator	61%
Stand-alone freezer	6%
Dishwasher	42%
Clothes washer	42%
Clothes dryer	39%
Oven	21%
Microwave	27%
Other	3%
Don't know	0%

*Multiple responses were allowed for this question

Q48. [Ask if Q47 <> DON'T KNOW OR REFUSED] Was the [INSERT Q47 RESPONSE] an ENERGY STAR or high-efficiency model?

Response Option	Microwave	Refrigerator	Stand-alone Freezer	Dishwasher	Clothes washer	Clothes dryer	Other
Yes	8	19	2	12	12	12	1
No	0	0	0	1	0	0	0
Don't know	1	0	0	0	1	1	0
Total	9	19	2	13	13	13	1

Q49. [Ask if Q47 = CLOTHES DRYER] Does the new clothes dryer use natural gas?

Response Option	Percent (n=3)
Yes	8%
No	92%
Don't know	0%

Q50. [Ask if Q41 = BOUGHT EFFICIENT HEATING OR COOLING EQUIPMENT and Q46_BUY EFFICIENT HEATING OR COOLING EQUIPMENT > 0] What type of heating or cooling equipment did you buy?

Response Option	Percent (n=14)*
Central air conditioner	57%
Window/room air conditioner unit	0%
Wall air conditioner unit	7%
Air source heat pump	29%
Geothermal heat pump	7%
Boiler	0%
Furnace	7%
Wifi thermostat	29%
Other	7%
Don't know	0%

*Multiple responses were allowed for this question

Verbatim "Other" Response	Count (n=1)
fans and heaters	1

Q51. [Ask if Q50 = BOILER OR FURNACE] Does the new [INSERT Q50 RESPONSE] use natural gas?

Response Option	Percent (n=1)
Yes	0%
No	0%
Don't know	100%

Q52. [Ask if Q50 <> WIFI-ENABLED THERMOSTAT, DON'T KNOW, OR REFUSED] Was the [INSERT Q50 RESPONSE] an ENERGY STAR or high-efficiency model?

Response Option	Other	Central air conditioner	Window / room air conditioner unit	Wall air conditioner unit	Air source heat pump	Geothermal heat pump	Boiler	Furnace
Yes	1	5	0	0	4	1	0	1
No	0	0	0	1	0	0	0	0
Don't know	0	3	0	0	0	0	0	0
Total	1	8	0	1	4	1	0	1

Q53. [Ask if Q41= BOUGHT EFFICIENT WINDOWS and Q46_BUY EFFICIENT WINDOWS >0] Do you know how many windows you installed?

Response Option	Percent (n=8)
Yes	75%
No	25%
Don't know	0%
Not asked	100%

Please specify how many you installed:

Verbatim Response	Percent (n=6)
9	13%
10	25%
13	25%
15	13%

Q54. [Ask if Q41 = ADDED INSULATION and Q46_ADD INSULATION > 0] Please let us know what spaces you added insulation to. Also, let us know the proportion of each space you added insulation to (for example, if you added insulation that covered your entire attic space, you would type in 100%).

Response Option	Percent (n=18)*
Attic	33%
Walls	33%
Below the floor	44%

*Multiple responses were allowed for this question

Attic

Verbatim Response	Count (n=6)
100	3
50	1
30	1
25	1

Walls

Verbatim Response	Count (n=6)
100	1
75	1
50	1
30	1
15	1
14	1

Below the floor

Verbatim Response	Count (n=8)
100	4
25	1
20	2
10	1

Q55. [Ask if Q41 = BOUGHT LEDS and Q46_BUY LEDS > 0] Do you know how many LEDs you installed at your property?

Response Option	Percent (n=69)
Yes	77%
No	23%

[Please specify how many you installed in the box below:]

Verbatim Response	Count (n=53)
2	1
3	2
4	3
5	5
6	5
7	1
8	2
10	8
11	1
12	3
15	6
16	1
18	1
20	5
25	5
30	2
35	1
56	1

Q56. [Ask if Q41 = BOUGHT CFLS and Q46_BUY CFLS > 0] Do you know how many CFLs you installed at your property?

Response Option	Percent (n=9)
Yes	67%
No	33%

[Please specify how many you installed in the box below:]

Verbatim Response	Count (n=6)
2	1
3	2
4	1
10	2
15	1

Q57. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Does the new water heater use natural gas?

Response Option	Percent (n=4)
Yes	18%
No	82%
Don't know	0%

Q58. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Which of the following water heaters did you purchase?

Response Option	Percent (n=11)
A traditional water heater with a large tank that holds the hot water	73%
A tankless water heater that provides hot water on demand	18%
A solar water heater	0%
Other	9%
Don’t know	0%

Q59. [Ask if Q41 = INSTALLED AN ENERGY EFFICIENT WATER HEATER and Q46_INSTALL AN ENERGY EFFICIENT WATER HEATER > 0] Is the new water heater an ENERGY STAR model?

Response Option	Percent (n=11)
Yes	91%
No	9%
Don't know	0%

Q60. Which of the following types of housing units would you say best describes your home? It is . . .?

Response Option	Percent (n=343)
Single-family detached house	77%
Single-family attached home (such as a townhouse or condo)	6%
Duplex, triplex or four-plex	1%
Apartment or condo with 5 units or more	2%
Manufactured or mobile home	12%
Other	1%
Don't know	1%

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.

Response Option	Percent (n=343)
One	16%
Two	70%
Three	11%
Four	2%
Five or more	1%
Don’t know	1%

Q62. How many bathroom sink faucets are in your home? (Keep in mind that some bathrooms may have multiple bathroom sink faucets in them)

Response Option	Percent (n=343)
One	9%
Two	38%
Three	30%
Four	15%
Five	4%
Six	2%
Seven	0%
Eight or more	1%
Don’t know	1%

Q63. How many kitchen faucets are in your home?

Response Option	Percent (n=343)
One	92%
Two	5%
Three	2%
Four or more	1%
Don’t know	1%

Q63a. You mentioned that you have more than one kitchen faucet. Where is/are your other kitchen faucet(s) located in your home?

Response Option	Frequency (n=27)
Laundry room	11%
Basement/lower level	19%
Kitchen	33%
Other	22%
Misread question-only one kitchen faucet	22%

Q64. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

Response Option	Percent (n=343)
Less than 500 square feet	1%
500 to under 1,000 square feet	7%
1,000 to under 1,500 square feet	31%
1,500 to under 2,000 square feet	23%
2,000 to under 2,500 square feet	16%
2,500 to under 3,000 square feet	7%
Greater than 3,000 square feet	5%
Prefer not to say	1%
Don't know	9%

Q65. Do you or members of your household own your home, or do you rent it?

Response Option	Percent (n=343)
Own / buying	88%
Rent / lease	9%
Occupy rent-free	0%
Prefer not to say	3%
Don't know	1%

Q66. Including yourself, how many people currently live in your home year-round?

Response Option	Percent (n=343)
I live by myself	18%
Two people	36%
Three people	17%
Four people	16%
Five people	5%
Six people	2%
Seven people	0%
Eight or more people	1%
Prefer not to say	4%
Don't know	1%

Q67. What was your total annual household income for 2016, before taxes?

Response Option	Percent (n=343)

Under $20,000	7%
$20,000 to under $30,000	8%
$30,000 to under $40,000	8%
$40,000 to under $50,000	10%
$50,000 to under $60,000	8%
$60,000 to under $75,000	11%
$75,000 to under $100,000	12%
$100,000 to under $150,000	7%
$150,000 to under $200,000	2%
$200,000 or more	3%
Prefer not to say	23%
Don't know	2%

Q68. What is the highest level of education achieved among those living in your household?

Response Option	Percent (n=343)
Less than high school	0%
Some high school	0%
High school graduate or equivalent (such as GED)	12%
Trade or technical school	8%
Some college (including Associate degree)	23%
College degree (Bachelor's degree)	25%
Some graduate school	3%
Graduate degree, professional degree	16%
Doctorate	4%
Prefer not to say	9%
Don't know	1%

Q69. Finally, what is your year of birth?

Response Option	Frequency (n=343)
18-24	1
25-34	39
35-44	58
45-54	52
55-64	54
65+	53
Prefer not to say	86

Appendix G Participant Demographics by State

	DEC				DEP			
Home type	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
Single-family detached	76%	176	83%	72	77%	229	78%	35
Single-family attached	5%	12	3%	3	7%	21	2%	1
Duplex, triplex, four-plex	2%	4	0%	0	1%	4	0%	0
Apartment or condo 5 units or more	3%	6	2%	2	2%	6	0%	0
Manufactured or mobile home	14%	32	8%	7	11%	33	18%	8
Other	1%	2	1%	1	1%	2	2%	1
Don't know	0%	1	2%	2	1%	3	0%	0
Home size	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
Less than 500 square feet	0%	1	0%	0	1%	2	4%	2
500 to under 1,000 square feet	12%	28	8%	7	8%	23	4%	2
1,000 to under 1,500 square feet	31%	71	23%	20	31%	93	31%%	14
1,500 to under 2,000 square feet	28%	64	25%	22	24%	71	18%	8
2,000 to under 2,500 square feet	14%	32	14%	12	16%	48	18%	8
2,500 to under 3,000 square feet	5%	11	10%	9	7%	21	4%	2
Greater than 3,000 square feet	3%	7	7%	6	5%	15	4%	2
Don't know	8%	18	12%	10	7%	22	16%	7
Prefer not to say	0%	1	1%	1	1%	3	0%	0
Ownership Status	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
Own / buying	85%	197	86%	75	87%	259	96%	43
Rent / lease	12%	28	9%	8	0%	27	4%	2
Occupy rent-free	1%	2	0%	0	0%	1	0%	0
Don't know	0%	0	1%	1	1%	2	0%	0
Prefer not to say	3%	6	3%	3	3%	9	0%	0
Water Heater Fuel Type	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
Electric	86%	201	87%	76	87%	260	93%	42
Natural Gas	12%	27	9%	8	9%	28	7%	3
Other	0%	1	1%	1	2%	6	0%	0
Don't know	2%	4	2%	2	1%	4	0%	0
Household Size	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
I live by myself	19%	44	12%	10	18%	53	18%	8
Two people	37%	87	52%	45	36%	107	38%	17
Three people	18%	41	13%	11	18%	53	13%	6
Four people	12%	29	9%	8	16%	47	20%	9
Five people	5%	11	9%	8	5%	15	4%	2
Six people	3%	8	2%	2	2%	5	2%	1
Seven people	0%	1	0%	0	0%	1	0%	0
Eight or more people	1%	2	0%	0	0%	1	2%	1
Don't know	0%	0	1%	1	1%	2	0%	0
Prefer not to say	4%	10	2%	2	5%	14	2%	1

Household Income	NC (%)	NC (n)	SC (%)	SC (n)	NC (%)	NC (n)	SC (%)	SC (n)
Under $20,000	9%	20	3%	3	6%	18	13%	6
20 to under $30,000	8%	19	13%	11	7%	20	13%	6
30 to under $40,000	9%	21	7%	6	8%	24	4%	2
40 to under $50,000	12%	27	10%	9	10%	29	13%	6
50 to under $60,000	5%	12	2%	2	8%	24	4%	2
60 to under $75,000	14%	32	17%	15	12%	35	9%	4
75 to under $100,000	9%	21	16%	14	11%	34	16%	7
100 to under $150,000	8%	19	5%	4	8%	23	2%	1
150 to under $200,000	2%	5	3%	3	2%	6	0%	0
$200,000 or more	1%	2	1%	1	3%	9	0%	0
Don't know	1%	3	1%	1	2%	6	2%	1
Prefer not to say	22%	52	21%	18	24%	70	22%	10
Education Level	**NC (%)**	**NC (n)**	**SC (%)**	**SC (n)**	**NC (%)**	**NC (n)**	**SC (%)**	**SC (n)**
Less than high school	2%	4	1%	1	0%	0	2%	1
Some high school	1%	3	1%	1	0%	0	2%	1
High school graduate or equivalent (such as GED)	15%	35	14%	12	11%	33	20%	9
Trade or technical school	5%	11	3%	3	6%	18	18%	8
Some college (including Associate degree)	26%	61	28%	24	25%	75	11%	5
College degree (Bachelor's degree)	21%	48	26%	23	26%	76	20%	9
Some graduate school	3%	8	1%	1	2%	7	4%	2
Graduate degree, professional degree	18%	42	16%	14	16%	48	11%	5
Doctorate	2%	5	2%	2	4%	11	2%	1
Don't know	0%	0	1%	1	1%	2	0%	0
Prefer not to say	7%	16	6%	5	9%	28	9%	4
Age	**NC (%)**	**NC (n)**	**SC (%)**	**SC (n)**	**NC (%)**	**NC (n)**	**SC (%)**	**SC (n)**
18-24	1%	2	0%	0	0%	1	0%	0
25-34	12%	29	17%	15	11%	34	11%	5
35-44	16%	38	11%	10	17%	52	13%	6
45-54	18%	43	15%	13	16%	49	7%	3
55-64	17%	40	14%	12	13%	40	31%	14
65+	16%	38	21%	18	14%	42	24%	11
Prefer not to say	18%	43	22%	19	27%	80	13%	6

Appendix H Participant Responses by State

Measurement	Carolinas		Progress	
	NC	SC	NC	SC
Survey Responses	233	87	297	45
Small Kit	155	49	167	24
Medium Kit	78	38	116	13
Average Occupants per Home	2.61	2.58	2.60	2.73
Electric Water Heater %	88%	89%	88%	93%
Showerheads				
Provided	311	125	422	59
Installed	179	65	241	37
Installed %	58%	52%	57%	63%
Removed %	5%	6%	7%	5%
In-service Rate	52%	46%	50%	58%
Shower per Day (per person)	0.65	0.69	0.63	0.71
Minutes per Shower	8.93	9.66	9.76	9.85
Showerheads per Home	1.33	1.36	1.42	1.38
Kitchen Faucet Aerator				
Provided	233	87	297	45
Installed	100	42	135	24
Installed %	43%	48%	45%	53%
Removed %	11%	14%	10%	4%
In-service Rate	38%	41%	41%	51%
Bathroom Faucet Aerator				
Provided	466	174	594	90
Installed	139	63	230	40
Installed %	30%	36%	39%	44%
Removed %	5%	5%	5%	0%
In-service Rate	28%	34%	37%	44%
Pipe Wrap				
Provided	233	87	297	45
Installed	88	27	106	18
Installed %	38%	31%	36%	40%
Removed %	1%	0%	3%	6%
In-service Rate	37%	31%	35%	38%
Length Installed	5.10	4.70	4.68	5.39

EM&V Report for the Duke Energy Multifamily Energy Efficiency Program

Prepared for:

Duke Energy Progress, Duke Energy Carolinas

April 16, 2020

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DISCLAIMER

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1. EVALUATION SUMMARY

1.1 Program Summary

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- **Lighting measures:** LED bulbs installed in permanent fixtures. Program measures include A-line, globe, candelabra, recessed and track lighting products installed onsite at the tenant's premise.
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap

For this evaluation cycle, Navigant Consulting, Inc., n/k/a Guidehouse Inc. ("Navigant")[1] assessed lighting and water measures installed through the program in both the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) jurisdictions. This evaluation includes program participation for the following dates:

- Water measures: January 1, 2017 through May 1, 2018
- Lighting measures: January 1, 2017 through June 30, 2019

Franklin Energy is the implementation contractor for the program. Customers (i.e., property managers) have the option to choose self-installation or direct installation through Franklin Energy. All installation was completed through the direct install pathway during the period covered by this evaluation. Duke Energy also informed Navigant that third-party quality control inspections are completed on 20 percent of properties in any given month. Within a selected property, the quantity of units to inspect is based on property size as defined by the number of housing units.

1.2 Evaluation Objectives and Program-Level Findings

Duke Energy selected Navigant to provide independent Evaluation, Measurement, and Verification (EM&V) for the Multifamily Energy Efficiency Program in the DEP and DEC jurisdictions. EM&V is a term used to describe the process of evaluating a program to assess the impacts as well as the program structure and delivery. For this EM&V effort, the evaluation approach and objectives can be described as follows:

- **Impact evaluation:** To quantify the net and gross energy and coincident demand savings associated with program activity at both the measure level and program level

[1] On October 11, 2019, Guidehouse LLP completed its previously announced acquisition of Navigant Consulting Inc. In the months ahead, we will be working to integrate the Guidehouse and Navigant businesses. In furtherance of that effort, we recently renamed Navigant Consulting Inc. as Guidehouse Inc.

- **Process evaluation:** To assess program delivery and customer satisfaction

By performing both components of the EM&V effort, Navigant provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner.

As in previous evaluations, Navigant found that Duke Energy is successfully delivering the Multifamily Energy Efficiency Program to customers, participant satisfaction is generally favorable, and the reported measure installations are accurate.

For the evaluation period covered by this report, there were a total of 37,094 housing units at 323 participating properties in the DEP jurisdiction. There were 60,913 housing units at 500 properties in the DEC jurisdiction. The program-level evaluation findings are presented in Table 1 though Table 4. For the DEP jurisdiction, Navigant found the realization rate for gross energy savings to be 79 percent, meaning that total verified gross energy savings were found to be somewhat lower than claimed in the tracking database provided by Duke Energy. For DEC, the realization rate for gross energy savings was 85 percent. Navigant found the net-to-gross (NTG) ratio to be 0.93, meaning that for every 100 kWh of reported energy savings, 93 kWh can be attributed directly to the program. These findings will be discussed in greater detail throughout this report.

Table 1. Program Claimed and Evaluated Gross Energy Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Energy Impacts (MWh)	28,504	22,376	79%
DEC Gross Energy Impacts (MWh)	36,780	31,266	85%

Source: Navigant analysis, values subject to rounding.

Table 2. Program Claimed and Evaluated Gross Peak Demand Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Summer Peak Demand Impacts (MW)	4.15	3.08	74%
DEP Gross Winter Peak Demand Impacts (MW)	2.73	3.68	135%
DEC Gross Summer Peak Demand Impacts (MW)	3.85	4.22	109%
DEC Gross Winter Peak Demand Impacts (MW)	5.60	5.31	95%

Source: Navigant analysis, values subject to rounding.

Table 3. Program Net Energy Impacts

	MWh
DEP Net Energy Impacts	20,792
DEC Net Energy Impacts	29,053

Source: Navigant analysis, values subject to rounding.

Table 4. Program Net Peak Demand Impacts

	MW
DEP Net Summer Peak Demand Impacts	2.86
DEP Net Winter Peak Demand Impacts	3.42
DEC Net Summer Peak Demand Impacts	3.92
DEC Net Winter Peak Demand Impacts	4.93

Source: Navigant analysis, values subject to rounding.

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Navigant performed an engineering review of measure savings algorithms, field verification to assess installed quantities and characteristics, a metering study to record lighting hours of use and coincidence factors, as well as surveys with tenants and property managers to assess satisfaction and decision-making processes.[2] Navigant conducted an initial lighting logger study in the summer of 2018 to estimate hours of use and coincidence factors for lighting measures. A follow-up logger study was conducted between July of 2019 and February of 2020 to explore further sampling dimensions, extend the duration of the logger study, and perform logging of the track and recessed measure offerings which were not included in the 2018 study. This report includes results from the second logger study. The evaluated parameters are summarized in Table 5. For field verification, the expected sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 9.2 percent.

[2] A billing analysis was also considered, but Navigant determined that the engineering-based approach was appropriate for the evaluation objectives due to the frequency of tenant turnover at multifamily facilities and the small impact of energy savings from program measures relative to annual facility energy consumption.

Table 5. Evaluated Parameters

Evaluated Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	1. LED wattage 2. LED operating hours 3. Aerator flow rates (gpm) 4. Showerhead flow rates (gpm) 5. Water temperature (F) 6. Pipe wrap length (ft) 7. Baseline characteristics
In-Service Rates	The percentage of program measures in use as compared to reported	1. LED, aerator, and showerhead quantities 2. Pipe wrap length
Satisfaction	Customer satisfaction	1. Satisfaction with program 2. Satisfaction with contractor 3. Satisfaction with program measures
Free Ridership	Fraction of reported savings that would have occurred anyway, even in the absence of the program	
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	

Source: Navigant

This evaluation covers program participation from January 1, 2017 through May 1, 2018 for water measures, and from January 1, 2017 through June 30, 2019 for lighting measures. This is the first evaluation of this program in DEP and DEC since LEDs were introduced as a measure offering.[3] Table 6 shows the start and end dates of Navigant's sample period for evaluation activities.

Table 6. EM&V Sample Period Start and End Dates

Activity	Start Date	End Date
Field Verification[4]	June 4, 2018 July 30, 2019	June 20, 2018 September 19, 2019
Lighting Logger Study	July 30, 2019	February 14, 2020
Tenant Phone Surveys	August 2, 2018	August 14, 2018
Property Manager Interviews	August 13, 2018	August 30, 2018

Source: Navigant

[3] LEDs were introduced in the program at the very end of 2016, and new track and recessed lighting measures were introduced in early 2018.

[4] Navigant conducted field verification during both the 2018 and 2019 lighting logger studies, and this report contains field verification findings from both studies.

1.4 Evaluation Considerations and Recommendations

Navigant developed a series of recommendations during the EM&V effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

1. Navigant recommends that Duke Energy should adopt the ex post, per-unit energy and demand impacts from this evaluation and use them going forward.
2. Duke Energy should consider whether additional marketing material can be distributed to tenants during participation in this program, to educate participants about other Duke Energy program offerings and services.
3. Duke Energy should consider whether smart thermostats or other HVAC-related measures would be reasonable offerings for this program.

2. PROGRAM DESCRIPTION

2.1 Design

The Multifamily Energy Efficiency Program is designed to provide energy efficiency to a sector that is often underserved or difficult to reach via traditional, incentive-based energy efficiency programs. This market can be difficult to penetrate because multifamily housing units are often tenant-occupied rather than owner-occupied, meaning that the benefits of performing energy efficiency upgrades may be realized by the tenant whereas the incremental costs are absorbed by the owner.

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment at no cost to multifamily housing property owners. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- **Lighting measures:** LED bulbs installed in permanent fixtures. Program measures include A-line, globe, candelabra, recessed and track lighting products installed onsite at the tenant's premise.
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap.

2.2 Implementation

Franklin Energy is the implementation contractor for the program. To recruit participants, Franklin Energy conducts onsite visits, in combination with internet searches, and SalesGenie[5] lists, to identify properties, property managers, or property management companies that it believes are likely to participate. Franklin Energy then sends an outreach team of energy advisors to coordinate with property managers and explain the program delivery and benefits. This is considered an Energy Assessment. This is the time for energy advisors to determine the type of measures along with associated quantities that can be installed. One potential delay in committing to the program is the need for the property manager to get approval to participate from their corporate office.

Once a property has been fully assessed and a service agreement has been signed, the project is handed over to a different group at Franklin Energy to schedule the installations. The installation crew performs the work as scheduled, while displaying Duke Energy branded clothing, badges, and vehicle decals as directed. The installation crews record the quantities and locations of installed measures for each housing unit via a tablet device, which are entered into a tracking database.

When energy efficient program measures are installed, Franklin Energy removes the existing or baseline equipment and generally disposes of it onsite. If the property management previously requested to keep

[5] SalesGenie is a business and consumer lead generation tool that sales and marketing professionals can use to search for targeted leads, get contact names and phone numbers, and view detailed information. The tool also provides marketing and data solutions designed to help businesses reach their intended audiences more effectively.

the existing equipment, Franklin Energy will package it up and leave it behind with property management or maintenance personnel. Franklin Energy records the baseline characteristics (e.g. lamp type wattage, aerator flow rates) for a sample of measures removed and makes that information available to Duke Energy and Navigant for evaluation purposes.

There can be logistical complications associated with performing these types of retrofits at multifamily housing properties. Franklin Energy indicated that some units may be skipped at a property due to safety issues, lack of access to equipment, pet barriers, or refusal from tenants.

Franklin Energy stated that they have internal and external forms of quality control (QC) to ensure consistent measure installation. On the internal side, a Franklin Energy supervisor may accompany installation crews to ensure quality work. On the external side, a third-party inspector, High Performance Building Solutions, conducts inspections on a least five percent of participating housing units each year. The QC inspections are required to happen within 22 business days of installation. If a property is selected for a QC inspection, at least 20 percent of the units at the property are targeted for inspection.

During each month of QC inspections, Franklin Energy is provided with a discrepancy report that indicates when measures were missing, installed incorrectly, or if there were missed opportunities. Franklin Energy attempts to address the discrepancies, and subsequently updates the tracking data to reflect the QC findings. The tracking data is ultimately provided to Duke Energy, and subsequently to Navigant for EM&V.

3. KEY RESEARCH OBJECTIVES

As outlined in the Statement of Work, the key research objectives were to conduct impact and process evaluations, as well as a net-to-gross (NTG) analysis.

The primary purpose of the evaluation, measurement, and verification (EM&V) assessment is to estimate net annual energy and demand impacts associated with participation during the following dates:

- Water measures: January 1, 2017 through May 1, 2018.
- Lighting measures: January 1, 2017 through June 30, 2019

Secondary objectives include the following:

- Estimate net and gross impacts by measure
- Perform detailed review of deemed savings estimates for each measure, and provide updates if necessary
- Assess the installed quantities and efficiency characteristics of program measures
- Evaluate the strengths and weaknesses of current program processes and customer perceptions of the program offering and delivery
- Recommend improvements to program rules and processes that support greater savings, enhanced cost-effectiveness, and improved customer satisfaction
- Update measure life assumptions, if applicable

Key impact and process research questions to be explored include:

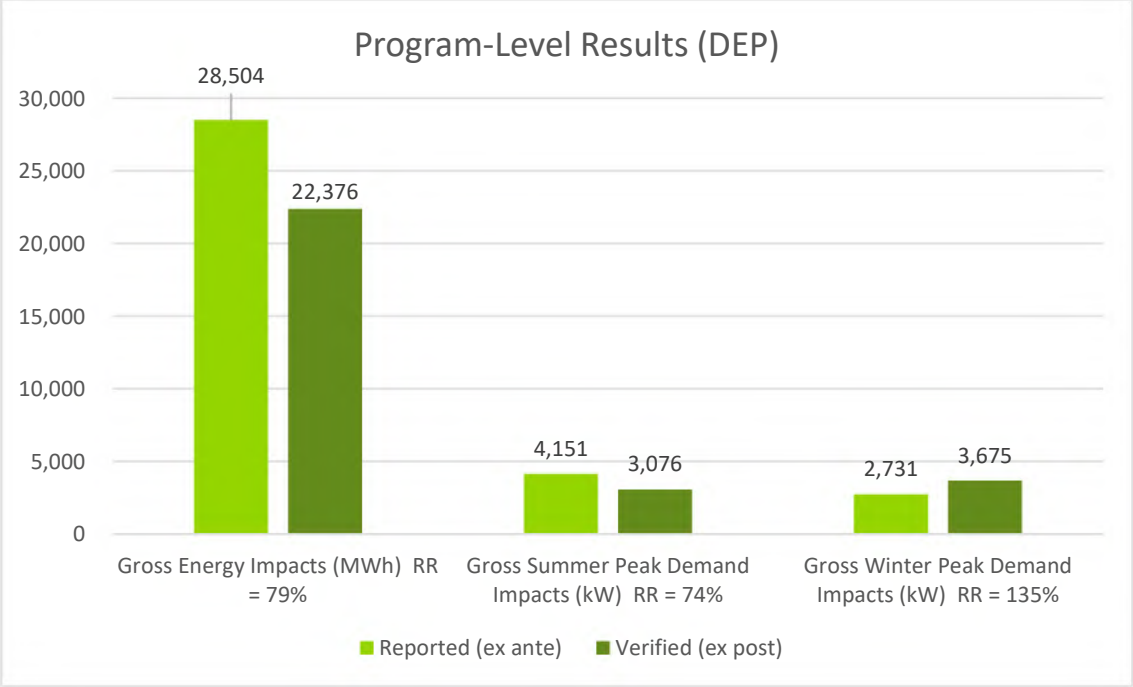
- Is the program achieving targeted energy and demand savings at the measure level?
- How do customers learn about the program, and can participation be increased?
- How is the persistence of savings impacted by participant removal of measures installed through the program?
- Are there opportunities for additional measure offerings through the program?
- Provide the effect on baseline lamp wattage from EISA, including some discussion on the projected degradation of baseline lamp wattage in future years.

4. IMPACT EVALUATION

4.1 Impact Results

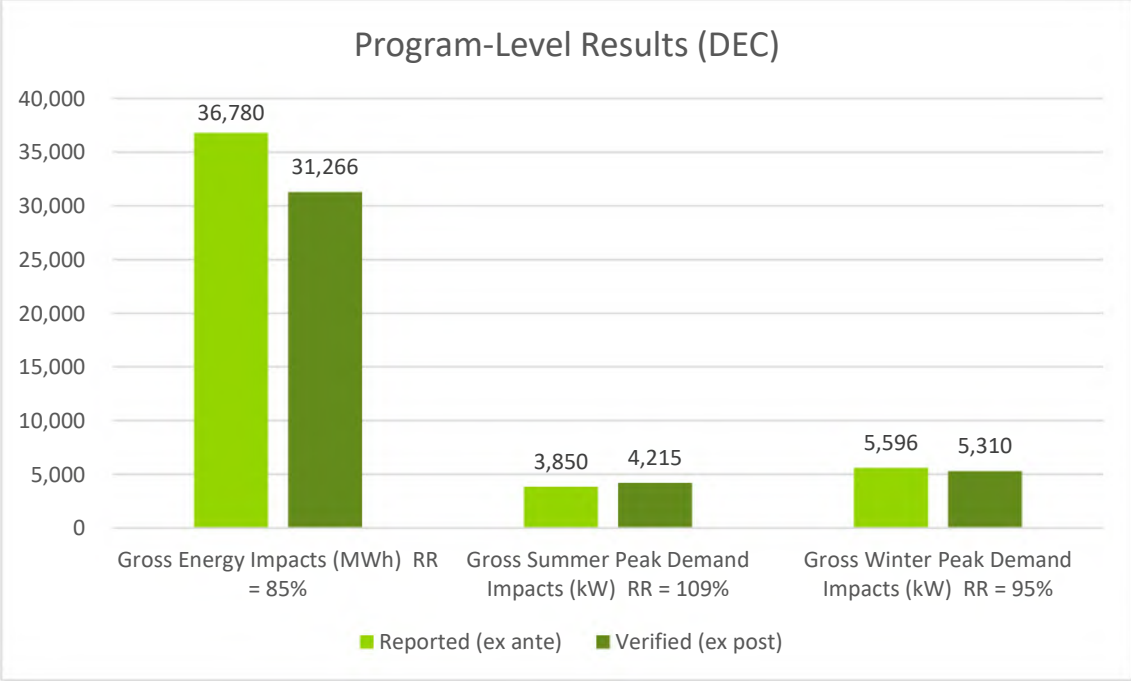
Figure 1 shows the program-level results for gross energy and demand savings for DEP, and Figure 2 shows the corresponding results for DEC. Table 7 shows a more complete list of program-level findings. The evaluation team calculated the results in Table 7 by multiplying the measure quantities found in the tracking database by the verified energy and demand savings estimated during the EM&V process for each measure. The net impacts were found by multiplying the gross impacts by the NTG ratio of 0.93. The NTG methodology and results are discussed in detail in Section 5 of this report.

Figure 1. Reported and Verified Program-Level Impacts (DEP)



Source: Navigant

Figure 2. Reported and Verified Program-Level Impacts (DEC)



Source: Navigant

Table 7. Summary of Program Impacts

	Energy (MWh)	Summer Coincident Demand (MW)	Winter Coincident Demand (MW)
DEP Verified Gross Impacts	22,376	3.08	3.68
DEP Verified Net Impacts	20,792	2.86	3.42
DEC Verified Gross Impacts	31,266	4.22	5.31
DEC Verified Net Impacts	29,053	3.92	4.93

Source: Navigant analysis, values subject to rounding.

At the measure level, there were considerable differences between ex ante and ex post impacts. This is because LEDs had not been previously evaluated for this program, and because many factors that affect the ex post calculations for water measures are different than they were during the previous evaluation cycles, which are the source for ex ante water impacts. The driving factors for these differences include:

- The lighting logger study to measure operating hours and coincidence factors for LED measures
- The availability of baseline flow rate data for water measures, and baseline wattage data for LED measures

- Significant changes to the impact algorithms for water measures in the 2018 Mid-Atlantic Technical Reference Manual

A summary of each measure's contribution to program energy savings and realization rate between reported savings and verified savings is shown in Table 8 for DEP, and Table 9 for DEC.

Table 8. Distribution of Program Gross Energy Savings by Measure (DEP)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	322,430	11,607	41%	8,914	77%
Candelabra LED	57,928	1,495	5%	810	54%
Globe LED	77,612	3,126	11%	2,551	82%
Recessed LED	19,807	1,335	5%	891	67%
Track LED	19,692	569	2%	474	83%
Bathroom Faucet Aerator	20,138	796	3%	1,109	139%
Kitchen Faucet Aerator	11,700	1,011	4%	1,341	133%
Low Flow Showerhead	17,966	4,254	15%	5,050	119%
Water Htr Pipe Wrap (ft)	64,330	4,312	15%	1,235	29%
Total	611,603	28,504	100%	22,376	79%

Source: Navigant analysis, values subject to rounding.

Table 9. Distribution of Program Gross Energy Savings by Measure (DEC)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	397,706	14,744	40%	10,996	75%
Candelabra LED	82,201	2,124	6%	1,149	54%
Globe LED	128,715	5,193	14%	4,230	81%
Recessed LED	31,214	2,107	6%	1,405	67%
Track LED	32,470	637	2%	782	123%
Bathroom Faucet Aerator	27,178	1,173	3%	1,497	128%
Kitchen Faucet Aerator	15,737	1,431	4%	1,804	126%
Low Flow Showerhead	28,281	6,562	18%	7,950	121%
Water Htr Pipe Wrap (ft)	75,722	2,808	8%	1,454	52%
Total	819,224	36,780	100%	31,266	85%

Source: Navigant analysis, values subject to rounding.

The results for gross summer coincident demand by measure for DEP and DEC are shown in Table 10 and Table 11, respectively.

Table 10. Distribution of Summer Coincident Demand Savings by Measure (DEP)

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	1,967	47%	1,478	75%
Candelabra LED	255	6%	168	66%
Globe LED	536	13%	324	61%
Recessed LED	228	5%	158	69%
Track LED	83	2%	66	80%
Bathroom Faucet Aerator	105	3%	146	140%
Kitchen Faucet Aerator	133	3%	177	133%
Low Flow Showerhead	350	8%	417	119%
Water Htr Pipe Wrap (ft)	495	12%	141	28%
Total	4,151	100%	3,076	74%

Source: Navigant analysis, values subject to rounding.

Table 11. Distribution of Summer Coincident Demand Savings by Measure (DEC)

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	1,511	39%	1,824	121%
Candelabra LED	263	7%	239	91%
Globe LED	631	16%	538	85%
Recessed LED	256	7%	248	97%
Track LED	78	2%	109	140%
Bathroom Faucet Aerator	155	4%	198	128%
Kitchen Faucet Aerator	189	5%	238	126%
Low Flow Showerhead	540	14%	656	121%
Water Htr Pipe Wrap (ft)	227	6%	166	73%
Total	3,850	100%	4,215	109%

Source: Navigant analysis, values subject to rounding.

The results for gross winter coincident demand by measure for DEP and DEC are shown in Table 12 and Table 13, respectively.

Table 12. Distribution of Winter Coincident Demand Savings by Measure (DEP)

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	419	15%	1,110	265%
Candelabra LED	52	2%	61	116%
Globe LED	109	4%	346	319%
Recessed LED	48	2%	59	125%
Track LED	28	1%	46	168%
Bathroom Faucet Aerator	91	3%	129	143%
Kitchen Faucet Aerator	116	4%	156	135%
Low Flow Showerhead	1,374	50%	1,627	118%
Water Htr Pipe Wrap (ft)	495	18%	141	28%
Total	2,731	100%	3,675	135%

Source: Navigant analysis, values subject to rounding.

Table 13. Distribution of Winter Coincident Demand Savings by Measure (DEC)

Measure	Total Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	1,750	31%	1,369	78%
Candelabra LED	255	5%	86	34%
Globe LED	618	11%	574	93%
Recessed LED	250	4%	93	37%
Track LED	75	1%	76	102%
Bathroom Faucet Aerator	136	2%	174	128%
Kitchen Faucet Aerator	165	3%	210	127%
Low Flow Showerhead	2,121	38%	2,561	121%
Water Htr Pipe Wrap (ft)	227	4%	166	73%
Total	5,596	100%	5,310	95%

Source: Navigant analysis, values subject to rounding.

4.2 Impact Evaluation Methodology

Navigant's methodology for evaluating the gross and net energy and demand impacts of the program included the following components:

1. Detailed review of deemed savings estimates including engineering algorithms, key input parameters, and supporting assumptions.

2. Onsite field verification to assess measure characteristics and in-service rates (ISRs)
3. Lighting logger study to measure LED hours of use and coincidence factors
4. Net-to-gross (NTG) analysis
5. Incorporating supplemental impact findings from tenant surveys

4.2.1 Detailed Review of Ex Ante Deemed Savings

Navigant reviewed the ex-ante savings and supporting documentation used to estimate ex ante program impacts. Duke Energy provided Navigant with a spreadsheet containing the deemed savings estimates for LED and water measures, as well as some of the inputs used to develop those estimates. The deemed savings for LED measures are shown in Table 14 below.

Table 14. Ex Ante Savings Estimates for LED Measures

Measure	Jurisdiction	Annual Gross Energy Savings (kWh)	Winter Coincident Demand Impacts (kW)	Summer Coincident Demand Impacts (kW)	Annual Non-Coincident Demand Impacts (kW)
Candelabra (per lamp)	DEP	25.8000	0.0009	0.0044	0.0054
	DEC	25.8450	0.0031	0.0032	0.0038
Globe (per lamp)	DEP	40.2743	0.0014	0.0069	0.0084
	DEC	40.3444	0.0048	0.0049	0.0059
A-Line (per lamp)	DEP	35.9995	0.0013	0.0061	0.0075
	DEC	37.0734	0.0044	0.0038	0.0054
Recessed (per lamp)	DEP	67.3990	0.0024	0.0115	0.0141
	DEC	67.5163	0.0080	0.0082	0.0100
Track (per lamp)	DEP	28.8845	0.0014	0.0042	0.0060
	DEC	19.6282	0.0023	0.0024	0.0029

Source: Duke Energy

Duke Energy also provided Navigant with the wattages of LED products, and the average baseline lamp wattages from the sample recorded by Franklin Energy, as shown in Table 15.

Table 15. Baseline and Efficient Wattage Values for LEDs

Measure	Baseline Lamp Wattage	Efficient (LED) Lamp Wattage
Candelabra (per lamp)	35	5
Globe (per lamp)	41	6
A-Line (per lamp)	61	9
Recessed (per lamp)	65	11
Track (per lamp)	40	6

Source: Duke Energy, values subject to rounding

Because this evaluation was the first for this program since Duke Energy began offering LEDs, the deemed savings values were sourced from Duke Energy's assumptions carried over from other program offerings or modeling. Navigant performed a high-level review of the deemed savings by using algorithms from the 2018 Mid-Atlantic Technical Reference Manual[6] for energy savings and summer coincident demand savings. Navigant modified the summer demand saving equation to develop a winter demand savings equation since the Mid-Atlantic TRM does not provide one.

Equation 1. Energy Savings Algorithm for LEDs

$$kWh\ savings = \left[\frac{(Watts_{base} - Watts_{EE})}{1000}\right] \times ISR \times HOU \times (WHFe_{Heat} + (WHFe_{Cool} - 1))$$

Equation 2. Summer Coincident Demand Savings Algorithm for LEDs

$$summer\ kW\ savings = \left[\frac{Watts_{base} - Watts_{EE}}{1000}\right] \times ISR \times CF_{summer}\ x\ WHF_d$$

Equation 3. Winter Coincident Demand Savings Algorithm for LEDs

$$winter\ kW\ savings^{7} = \left[\frac{Watts_{base} - Watts_{EE}}{1000}\right] \times ISR \times CF_{winter}\ x\ ((1 - WHF_d - 1) * \%electric)$$

Where the parameters are defined as:

$Watts_{base}$ = wattage of baseline lamp removed
$Watts_{EE}$ = wattage of LED lamp installed
ISR = in-service rate
HOU = annual operating hours

[6] https://neep.org/mid-atlantic-technical-reference-manual-v8-may-2018

[7] To calculate winter coincident demand savings, Navigant assumed that the WHF_d subtracted from savings by the same proportion that it added to savings in the summer equation. We also assumed that 55% of participants have electric heating in their homes, which is based on the data from the EIA's Residential Energy Consumption Survey for the Southern Atlantic region (found at https://www.eia.gov/consumption/residential/data/2015/).

$WHFe_{Cool}$ = waste heat factor for energy to account for cooling savings from reduced waste heat from efficient lighting
$WHFe_{Heat}$ = waste heat factor for energy to account for electric heating savings from reducing waste heat from efficient lighting
WHFd = waste heat factor for demand to account for cooling savings from efficient lighting
CF_{summer} = summer coincidence factor
CF_{winter} = winter coincidence factor
%electric = percentage of homes with electric heating

Navigant's review of the LED ex ante savings found that the estimates were reasonable, but that the ex post values were likely to differ because the measures had not been evaluated before.

Duke Energy also provided Navigant with the deemed savings estimates for water measures shown in Table 16. The values for the DEP jurisdiction match those from Navigant's previous 2016 EM&V report for this program, and the values for the DEC jurisdiction match those from Navigant's 2015 EM&V report for this program. Navigant also expected all ex post values to differ from these previous evaluations because Duke Energy provided Navigant with data for baseline water measure flow rates from the sample collected by Franklin Energy, and Navigant updated several impact calculation parameters (discussed in Section 4.3.2).

Table 16. Ex Ante Savings Estimates for Water Measures

Measure	Jurisdiction	Annual energy savings (kWh)	Annual Winter Coincident demand savings (kW)	Annual Summer Coincident demand savings (kW)	Annual Non-Coincident demand savings (kW)
Faucet Aerators MF Direct 1.0 GPM - bath (per aerator)	DEC	43.1615	0.0050	0.0057	0.1183
	DEP	39.5210	0.0045	0.0052	0.1083
Faucet Aerators MF Direct 1.0 GPM – kitchen (per aerator)	DEC	90.9189	0.0105	0.0120	0.2491
	DEP	86.4016	0.0099	0.0114	0.2367
LF Showerhead MF Direct 1.5 GPM (per showerhead)	DEC	232.0200	0.0750	0.0191	0.6357
	DEP	236.7797	0.0765	0.0195	0.6487
Pipe Wrap MF Direct (per linear foot)	DEC	37.0873	0.0030	0.0030	0.0100
	DEP	67.0275	0.0077	0.0077	0.0077

Source: Duke Energy

4.2.2 Onsite Field Verification

Navigant performed onsite field verification at 229 housing units across 28 participating properties during the 2018 and 2019 field studies. The field verification for lighting measures includes a sample from customers who participated in the program between January 2017 through June 2019. The field

verification for water measures includes a sample from participants between January 2017 and May of 2018.

Of this total field sample, 108 housing units were located at 12 properties in DEP, and 121 housing units were located at 16 properties in DEC. Field verification efforts were designed to assess the measure characteristics as reported in the tracking data and to assess measure parameters that can be used to verify inputs and assumptions used to estimate energy and demand savings for individual measures. Table 17 shows a summary of the parameters assessed by Navigant during field verification, and Table 18 shows the field verification sample.

Table 17. Parameters Evaluated During Field Verification

	LEDs	Faucet Aerators	Water-saving Showerheads	Hot Water Pipe Wrap
Installed quantity	x	x	x	x
Installed wattage	x			
Flow rates (gpm)		x	x	
Water heating system characteristics		x	x	x
Water Temperatures		x	x	x
Pipe length				x
Measure location	x	x	x	x
Baseline information (where available)	x	x	x	x

Table 18. Field Verification Sample

Program Measure	Number of Housing Units in Sample[a]	Number of Measures Reported in Sample
A-Line LED	212	1,945
Candelabra LED	83	330
Globe LED	90	554
Recessed LED	44	148
Track LED	45	182
Bathroom Faucet Aerators	88	135
Kitchen Faucet Aerators	90	90
Showerheads	83	115
Pipe Wrap	66	390 ft

a. Totals exceed 229 because many sites had multiple measures

Source: Navigant analysis

A summary of findings from field verification is included in Section 4.3.

4.2.3 Lighting Logger Study

Navigant conducted a lighting logger study in the summer of 2018 to measure the operating hours and coincidence factors for LED measures. A follow-up logger study was conducted between July of 2019 and February of 2020 to explore further sampling dimensions, extend the duration of the logger study, and perform logging of the track and recessed measure offerings which were not included in the 2018 study. This report includes results from the second logger study.

Navigant deployed 341 data loggers across 110 participant homes. Most data loggers remained in place from late July or August 2019 until February 2020, and a small portion of the loggers were in place from September 2019 until February 2020. For the subset of loggers deployed for less than six months, Navigant used a sinusoidal modeling method to annualize the logger data to account for seasonality. The remainder of this subsection describes the methodology for conducting the lighting logger study.

Sampling and Deployment

Navigant deployed data loggers to be representative of program activity across measure type, space type, housing unit floorplan, and between DEP and DEC. Table 19 shows the number of loggers deployed at field sites for each jurisdiction. Of the 341 total loggers deployed, 284 were deployed in North Carolina and 57 were deployed in South Carolina. Table 20 shows a comparison of sample disposition for logger deployment by lamp type as compared with overall program characteristics. Table 21 shows a comparison between the sample and population distribution by space type, and Table 22 shows a similar comparison by housing unit floorplan. The small differences between sample and population distributions are due to logistical considerations of the field study based on the random selection of tenant homes at each property in the field study. Navigant also attempted to achieve a sufficient number of loggers for each lamp type despite the relevant proportion of the population total.

Table 19. Number of Data Loggers Deployed at Sites for Each Jurisdiction

Location	Number of Sites	Number of Data Loggers
DEP	56	128
DEC	54	213
Total	110	341

Source: Navigant analysis, values subject to rounding

Table 20. Distribution of Logger Deployment by Measure and Jurisdiction

Measure	DEP/DEC Combined Population		DEP/DEC Field Metering Sample	
	DEP	DEC	DEP	DEC
A-Line	28%	34%	18%	35%
Candelabra	5%	7%	4%	14%
Globe	7%	11%	2%	2%
Recessed	2%	3%	5%	7%
Track	2%	3%	8%	5%

Source: Navigant analysis, values subject to rounding

Table 21. Distribution of Logger Deployment by Space Type

Space Type	Population Distribution	Logger Sample Distribution
Bedroom	11%	16%
Bathroom	38%	22%
Living Room	6%	8%
Dining Room	8%	6%
Other	3%	6%
Master BR	5%	8%
Hall	10%	12%
Kitchen	5%	11%
Unspecified	13%	13%
Total	100%	100%

Source: Navigant analysis, values subject to rounding

Table 22. Distribution of Logger Deployment by Floorplan

Housing Unit Floorplan	Population Distribution	Logger Sample Distribution
2-bedroom, 2-bathroom	35%	37%
1-bedroom, 1-bathroom	34%	46%
2-bedroom, 1-bathroom	12%	2%
3-bedroom, 2-bathroom	8%	7%
Other	11%	8%
Total	100%	100%

Source: Navigant analysis, values subject to rounding

Data QC and Cleaning

Upon retrieving the data loggers, Navigant performed a thorough visual and analytical QC of all data. Data from each logger was plotted and analyzed to identify instances of excessive lamp flickering, malfunctioning logger devices, loggers being affected by daylight, and battery failure. From the original 341 loggers, Navigant recovered 299 loggers from the field. The remaining loggers had been discarded or taken by tenants or maintenance staff at some point during the six-month duration of the study. Navigant removed all data that did not pass the QC analysis, which resulted in a final total of 285 loggers with usable data. The 14 loggers removed from the analysis experienced a mix of logger failure and flickering.

Binning Annualization to Calculate Annual Operating Hours

The majority of loggers were deployed in the field for a full six months, allowing them to capture seasonal trends in lighting usage for the summer, fall and winter months. For these loggers, Navigant used a

binning approach to extrapolate the six months of data to annual estimates for hours of use and coincidence factors. For each logger, the logging and non-logging periods were divided into bins representing weekday, weekend/holiday, daytime, and nighttime. The hourly usage for the non-logging period was determined by using the average hourly usage during the logging period for each bin. Finally, the winter and summer coincidence factors for each logger were calculated using extrapolated and actual hourly usage during the winter and summer peak periods, respectively.

Sinusoidal Annualization to Calculate Annual Operating Hours

Fifty-two data loggers were in the field from the middle of September of 2019 through the middle of February 2020, or about five months. For these 52 loggers, Navigant used a sinusoidal method to account for seasonal changes in lighting usage and extrapolate results from the metering period to a full year. Navigant used the following equation to determine each logger's daily HOU for the non-logging period.

Equation 4. Sinusoidal Annualization Equation

$$HOU_d = c_1 + c_2 \sin(\theta_d)$$

Where,

HOU_d = Daily Hours of use for non-logging period

c_1 and c_2 = Extrapolation coefficients determined using the logged hours of use and the scaling factors from the U.S. DOE Residential Lighting End-Use Consumption Study[8]

θ_d = Angle for each day (d), such that $\sin(\theta_d)$ is 0 at the spring and fall equinox and $\pi/2$ at the summer and winter solstice.

We calculated the extrapolation coefficients by using the daily average HOU measured during the month of December and the scaled daily average HOU for the month of June, as shown in the following equations.

Equation 5. Extrapolation Coefficients

$$c_1 = (HOU_{June\ Scaled} + HOU_{December\ Logged}) / 2$$
$$c_2 = (HOU_{December\ Logged} - HOU_{June\ Scaled}) / 2$$

Where,

$HOU_{December\ Logged}$ = Average daily HOU logged during the month of December for each logger

$HOU_{June\ Scaled}$ = Average daily HOU for June, which is calculated by taking the measured HOU in December and applying the scaling factor from the U.S. DOE Residential Lighting End-Use Consumption Study, as shown in Equation 6.

Equation 6. Seasonal Scaling Equation

$$HOU_{June\ Scaled} = HOU_{December\ Logged} * (HOU_{June\ DOE} / HOU_{December\ DOE})$$

[8] https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/2012_residential-lighting-study.pdf

Where,

$HOU_{December\ DOE}$ = Average daily HOU for the month of December sourced from U.S. DOE Residential Lighting End-Use Consumption Study

$HOU_{June\ DOE}$ = Average daily HOU for the month of June sourced from U.S. DOE Residential Lighting End-Use Consumption Study

4.2.4 Tenant Surveys

Navigant incorporated supplemental findings from 150 tenant phone surveys to inform the impact analysis where applicable. The findings from the tenant surveys will be addressed later in this report.

4.3 Impact Evaluation Findings

The impact evaluation findings for lighting measures and water measures are discussed separately.

4.3.1 LED Lighting Measures

Table 23 shows a summary of Navigant's ex-post, verified findings for LEDs. To calculate verified energy and demand impacts, Navigant applied the parameters from Table 23 to the algorithms from Equation 1, Equation 2, and Equation 3.

Table 23. Summary of LED findings

Evaluation Parameter	Source	A-Line	Candelabra	Globe	Recessed	Track
In-Service Rate	Navigant field verification	0.95	0.94	0.97	0.90	0.91
Baseline Lamp Wattage	Duke Energy	61	35	41	65	40
Efficient Lamp Wattage	Navigant field verification	9	5	6	8	7
Daily Operating Hours	Navigant metering study	1.6	1.4	2.7	2.4	2.2
Summer Coincidence Factor	Navigant metering study	0.08	0.09	0.10	0.13	0.09
Winter Coincidence Factor	Navigant metering study	0.08	0.04	0.15	0.07	0.09
$WHFe_{Cool}$	2018 Mid-Atlantic TRM	1.09	1.09	1.09	1.09	1.09
$WHFe_{Heat}$	2018 Mid-Atlantic TRM	0.9	0.9	0.9	0.9	0.9
WHFd	2018 Mid-Atlantic TRM	1.2	1.2	1.2	1.2	1.2
Gross Energy Savings Per Lamp (kWh)		27.6	14.0	32.9	45.0	24.1
Gross Summer Coincident Demand Savings Per Lamp (kW)		0.0046	0.0029	0.0042	0.0080	0.0034
Gross Winter Coincident Demand Savings Per Lamp (kW)		0.0034	0.0010	0.0045	0.0030	0.0024

Source: Navigant analysis, values subject to rounding

4.3.1.1 In-Service Rate

At the 224 housing units inspected by Navigant that had LEDs, there were a total of 3,159 reported program LEDs in the tracking database. During the inspections, Navigant found 2,920 of the program LEDs. Additionally, during phone surveys with tenants, Navigant interviewed customers representing an

additional 1,823 LEDs.[9] Navigant used a weighted average to combine the ISR from field verification with the ISR from phone surveys to calculate a final ISR.[10]

4.3.1.2 Wattage

Duke Energy provided Navigant with wattage data from lamps removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites. Since this program is a direct install program, we used this data for the baseline wattage in the impact calculations. Wattage for the efficient lamps was obtained from field verification and aligned very closely with reported values from Duke Energy's tracking data.

4.3.1.3 Waste Heat and Coincidence Factors

We used the waste heat factors from the 2018 Mid-Atlantic TRM, and calculated the coincidence factors as described in Section 4.2.3.

4.3.1.4 Lighting Hours of Use

Navigant calculated the operating hours for LEDs using data from the metering study and the methods described in Section 4.2.3. The study was designed to achieve statistically significant results at the tenant site level, and the final precision was found to be ±15.6% at the 90% confidence level. Navigant did calculate operating hours at the lamp type and space type to understand how customers are using their LED measures in more detail. Table 24 shows the metering study results for LED operation hours by lamp type.

Table 24. Metered Hours of Use by Lamp Type

LED Measure	Annual HOU	Daily HOU
A-Line	572	1.6
Candelabra	502	1.4
Globe	983	2.7
Track	806	2.2
Recessed	893	2.4
Weighted Average	664	1.8

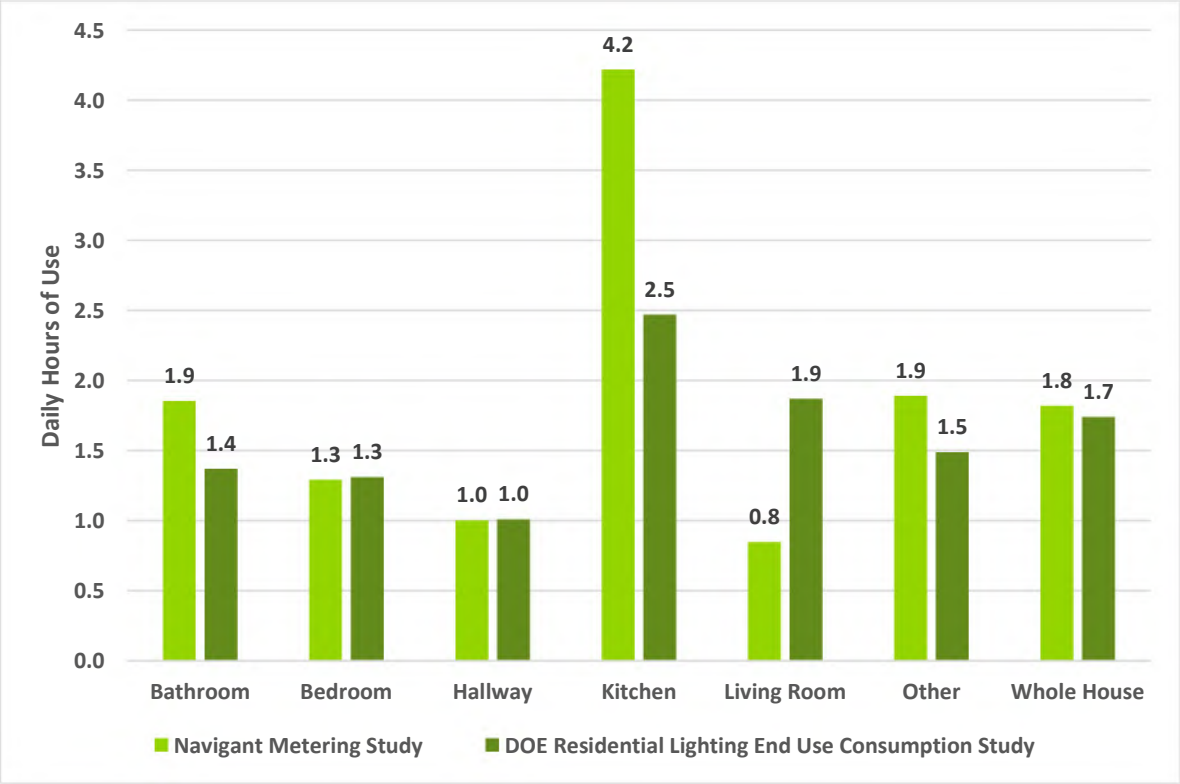
Source: Navigant analysis, values subject to rounding

[9] Six of the phone survey respondents indicated they had removed a total of 11 LEDs.

[10] The weighted results reflect a total of 4,732 verified LEDs out of a sample of 4,982. Navigant used the same approach to calculate ISRs during our 2016 evaluation of this program in DEP and DEC. We believe that combining the results from field and phone verification effectively increases the sample size, and helps to control for the time period covered by this evaluation by incorporating participant input and field observations.

Figure 3 provides the metering study results by space type, along with a comparison to results for the multifamily housing segment from the DOE Lighting End Use Consumption Study.[11] For the most part, Navigant's results followed similar trends to those in the DOE study, especially at the whole household level which represents the weighted hours of use for a typical lamp in the home. The most significant differences were in the kitchen and living room spaces.

Figure 3. Metered Hours of Use by Space Type

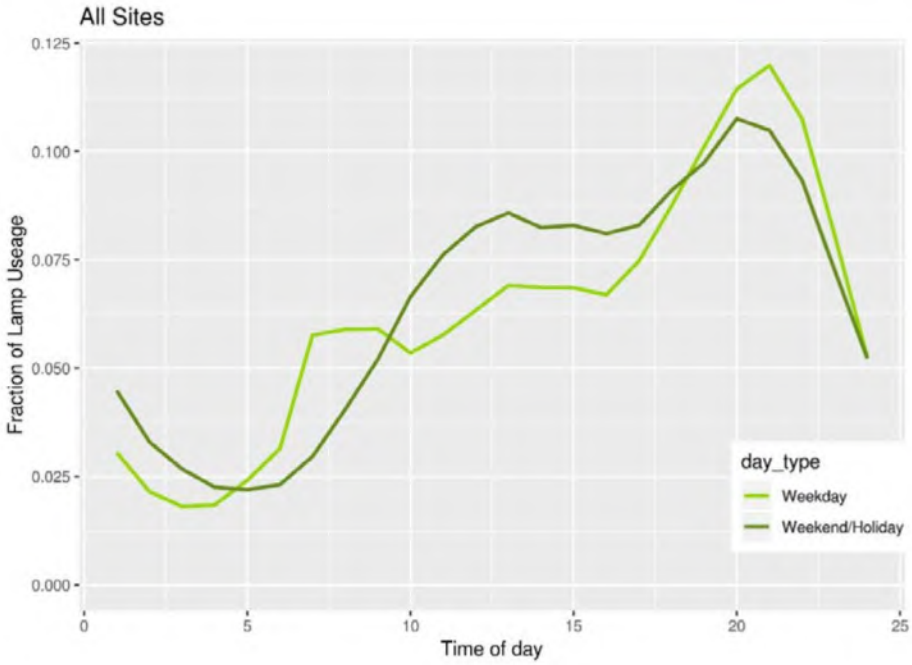


Source: Navigant analysis, values subject to rounding

Navigant also created diurnal (daily) load shapes with the lighting logger data to visualize how program participants use LEDs. Figure 4, Figure 5, Figure 6, and Figure 7 provide graphical results for the load shapes for some of the metered space types.

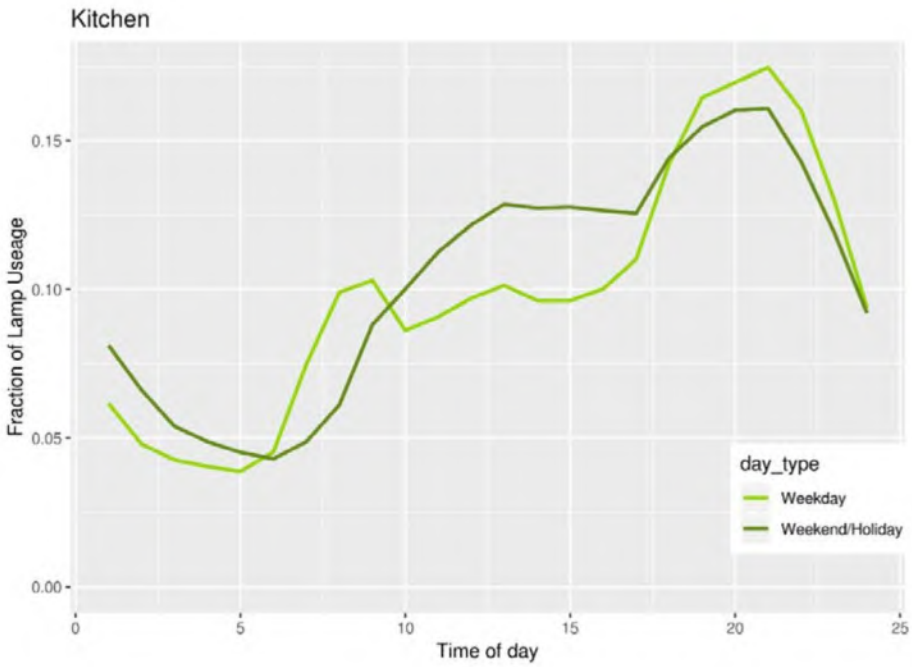
[11] https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/2012_residential-lighting-study.pdf

Figure 4. Aggregate LED Load Shape at Site Level



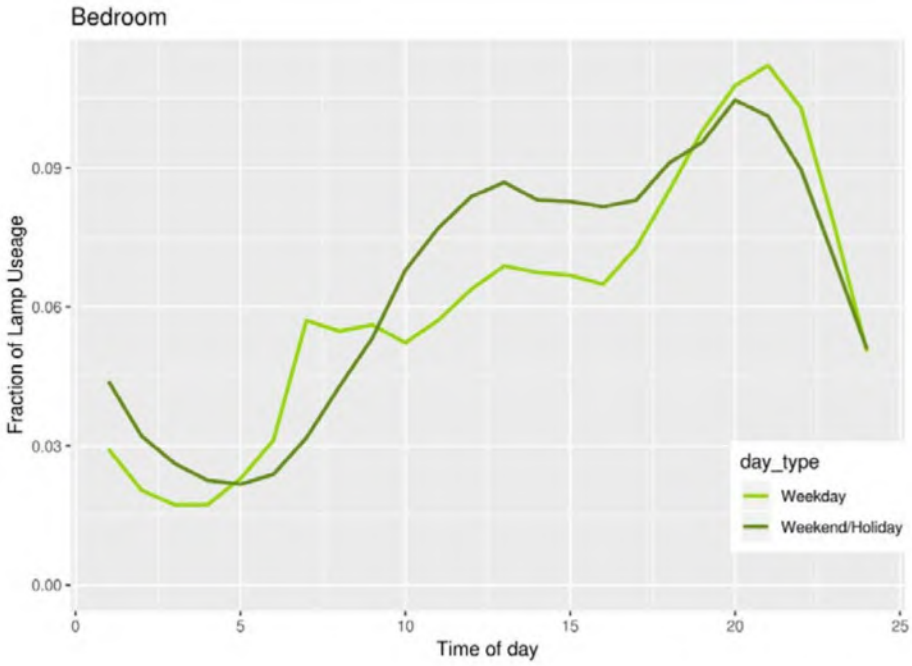
Source: Navigant analysis

Figure 5. LED Load Shape for Kitchen Spaces



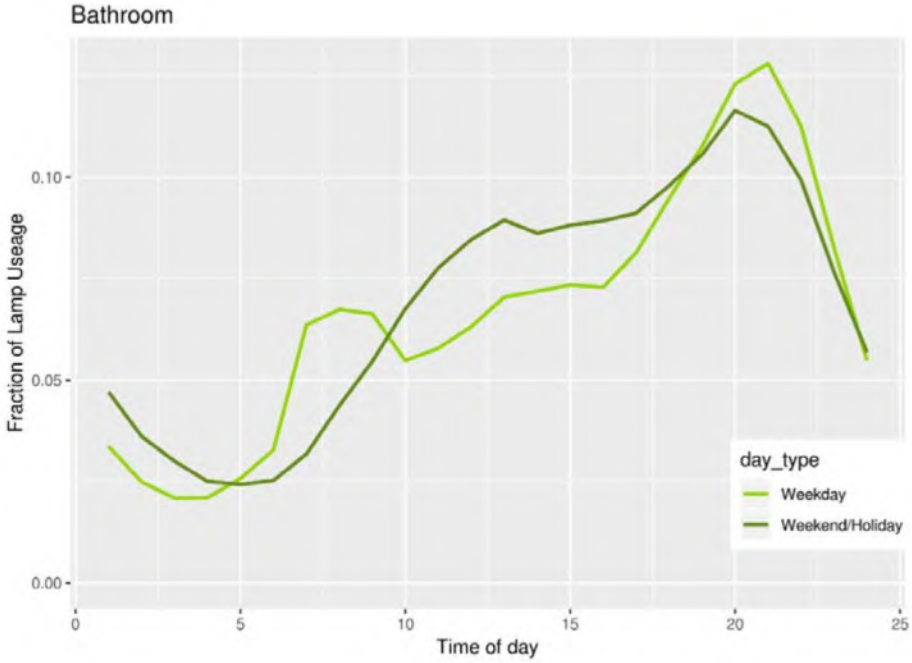
Source: Navigant analysis

Figure 6. LED Load Shape for Bedroom Spaces



Source: Navigant analysis

Figure 7. LED Load Shape for Bathroom Spaces



Source: Navigant analysis

4.3.1.5 Effect of Baseline Wattage Requirements for EISA

The EISA backstop was predicted to take effect in 2020, but is currently on hold. If the backstop does go into effect, the baseline wattage for lighting measures will continue to decrease. If Duke Energy continues to collect information about the wattage of lamps removed during the retrofit process, Navigant believes it is reasonable to use those values in future evaluations as necessary. In the absence of baseline data, it will be reasonable to incorporate EISA standards into baseline wattage values.

4.3.2 Water Flow Regulation Measures

For field verification of program water measures, Navigant collected information to validate the efficiency characteristics of the equipment. This included verifying the reported number of measures and measuring actual flow rates of the retrofit equipment.

4.3.2.1 In-Service Rate

The ISRs for water measures are shown in Table 25. These were calculated using a weighted average of results from the onsite field verification inspections and the tenant phone surveys.

Table 25. In-Service Rates for Water Measures

Measure	ISR
Kitchen aerators	0.83
Bathroom aerators	0.96
Showerheads	0.92
Pipe wrap	0.91

Source: Navigant analysis, values subject to rounding

4.3.2.2 Energy Savings

To calculate verified savings for aerators and showerheads, Navigant used the algorithms from the 2018 Mid-Atlantic Technical Reference Manual, shown in Equation 7, Equation 8, and Equation 9.[12] Navigant subsequently applied inputs collected during field verification or assumptions as listed below in Table 26. The resulting estimates for impacts of aerators and showerheads are presented in Table 27.

Equation 7. Algorithm for Estimating Energy Savings for Faucet Aerators

$$kWh\ savings\ for\ faucet\ aerators\ = ISR \times \left[\frac{((GPM_{base} \times Throttle_{base}) - (GPM_{low} \times Throttle_{low})) \times Time_{faucet} \times \#peopole \times 365\frac{days}{yr} \times DR \times (T_{ft} - T_{in}) \times 8.3\frac{Btu}{gal \cdot °F}}{\#_{faucets} \times 3412\frac{Btu}{kWh} \times DHW\ Recovery\ Efficiency}\right]$$

[12] The impact equations for water measures in the 2018 Mid-Atlantic TRM were updated from those in the 2016 version, which contributed to the realization rates for water measures in this evaluation since the deemed values were based on Navigant's previous evaluation which leveraged several inputs from the 2016 Mid-Atlantic TRM. Navigant believes it is most appropriate to use the latest TRM.

Equation 8. Algorithm for Estimating Energy Savings for Low Flow Showerheads

$$kWh\ savings\ for\ low\ flow\ showerheads = ISR \times \left[\frac{((GPM_{base} - GPM_{low}) \times Time_{shower} \times \#\ people \times Showers_{person} \times 365\frac{days}{yr} \times (T_{sh} - T_{in}) \times 8.3\frac{Btu}{gal \cdot °F}}{\#_{showerheads} \times 3412\frac{Btu}{kWh} \times DHW\ Recovery\ Efficiency}\right]$$

Equation 9. Algorithm for Estimating Coincident Demand Savings for Aerators and Showerheads

$$\Delta kW_{peak} = \Delta\, kWh/Hours \times CF$$

Table 26. Input Parameters and Assumptions for Aerator Savings Calculations

Input	Definition	Value	Source
ISR	In-service rate	Refer to Table 25	Navigant field verification and phone surveys
GPM_{base}	Baseline flow rate	Bathroom Aerators 2.12 Kitchen Aerator 2.17 Shower 2.76	Data Provided by Duke Energy from Franklin Energy Sample
GPM_{low}	Retrofit flow rate	Bathroom Aerators 0.84 Kitchen Aerator 0.73 Shower 1.5	Navigant field verification[a]
Throttle	Throttle factor	Base 0.83 Low 0.95[a]	2018 Mid-Atlantic TRM
$Time_{faucet}$	Avg hot water use per day per person (minutes)	Kitchen 4.5 Bath 1.6 Shower 7.8	2018 Mid-Atlantic TRM
#People	Number of people per household	2.07	EIA RECs Study
$Showers_{person}$	Number of showers per person per day	0.6	2018 Mid-Atlantic TRM
DR	Percent of water going down drain	Kitchen 50% Bath 70%	2018 Mid-Atlantic TRM
T_{ft} or T_{Sh}	Temp of water flowing from faucets (F) Temp of water flowing from showerheads (F)	Kitchen 97 Bath 96[b] 105	Navigant field verification 2018 Mid-Atlantic TRM
T_{in}	Temp of water entering water heater (F)	66	Navigant field verification
#faucets/showers	Number of faucets in home	Kitchen 1 Bathroom 1.53 Shower 1.39	Navigant field verification

Input	Definition	Value	Source
DWH Recovery Efficiency	Recovery efficiency of water heater	0.98	2018 Mid-Atlantic TRM
CF (aerators)	Coincidence Factor	Summer 0.003 Winter 0.002	2018 Mid-Atlantic TRM & Navigant Calculation using data from Building America Benchmark
CF (showerheads)	Coincidence Factor	Summer 0.005 Winter 0.019	2018 Mid-Atlantic TRM & Navigant Calculation using data from Building America Benchmark
Hours	Hours of use per year	Kitchen 18.25 Bath 18.25 Shower 47.45	2018 Mid-Atlantic TRM & Navigant Calculation

a. *Navigant measured flow rates during onsite field verification. For faucet aerators, we used the measured flow rates to calculate impacts instead of multiplying the nameplate flowrate by the throttling factor since primary data was available. For showerheads, we used the nameplate flow rate since the equation does not include a throttling factor.*

b. *For faucet aerators, Navigant assumed that customers use water at a temperature equal to the average of the hot and cold temperatures measured during field verification.*

Table 27. Verified Estimates of per Unit Impacts for Aerators and Showerheads[13]

Measure	Kitchen aerator (1.0 GPM)	Bathroom aerator (1.0 GPM)	Low flow showerhead (1.5 GPM)
Gross Energy Savings Per Device (kWh)	115	55	281
Gross Summer Coincident Demand Savings Per Device (kW)	0.015	0.007	0.023
Gross Winter Coincident Demand Savings Per Device (kW)	0.013	0.006	0.091

Source: Navigant analysis, values subject to rounding

4.3.3 Water Heater Pipe Wrap

During field verification, Navigant found that some of the water heater pipe wrap was installed on the cold water inlet pipe to the water heater. Industry standards are to install pipe wrap on all hot water pipes, and only the first three feet of the cold water pipe because savings are minimal from insulating

[13] The program may offer aerators and showerheads at other flow rates in the future. However, the tracking data indicated that 100 percent of the water measures installed during the period covered by this evaluation cycle were the flow rates shown in Table 25, so a verified savings are shown here for only those measures. A full list of savings is shown in Section 9 and can be used for planning purposes.

cold water pipes.[14] Therefore, when calculating the ISR, Navigant did not count savings from pipe wrap of greater than three feet installed on cold water pipes.

To estimate impacts from the pipe wrap measure, Navigant used algorithms from the 2018 Mid-Atlantic TRM shown in Equation 10 and Equation 11 below.[15] The ex-post impacts are shown in Table 28.

Equation 10. Energy savings for water heater pipe wrap

$$\Delta kWh = ISR \times \left(\frac{1}{R_e} - \frac{1}{R_n}\right) \times (L \times C) \times \Delta T \times 8760 \div nDHW \div 3413$$

Equation 11. Demand savings from water heater pipe wrap

$$\Delta kW = \Delta kWh \div 8760$$

The following list defines the parameters used in the equations above:

ISR = in-service rate
R_e = R-value of existing, uninsulated pipe (R = 1)
R_n = insulation R-value of pipe wrap plus R-value of uninsulated pipe (R = 4)
L = length of pipe (per foot)
C = circumference of pipe (Navigant assumed average of 0.5” and 0.75” diameter pipe)
ΔT = temperature difference between water in pipe and ambient air (65F)
nDHW = heat recovery efficiency (0.98)
3,413 = conversion from Btu to kWh

Table 28. Verified Impacts for Water Heater Pipe Wrap

Measure	Water Heater Pipe Wrap (per foot)
Gross Energy Savings Per Foot (kWh)	19
Gross Summer Coincident Demand Savings Per Foot (kW)	0.0022
Gross Winter Coincident Demand Savings Per Foot (kW)	0.0022

Source: Navigant analysis, values subject to rounding

[14] http://www.energy.gov/energysaver/projects/savings-project-insulate-hot-water-pipes-energy-savings

[15] http://www.neep.org/mid-atlantic-technical-reference-manual-v6

5. NET-TO-GROSS ANALYSIS

Navigant conducted an NTG analysis to estimate the share of program savings that can be attributed to participation in or influence from the program. Table 29 shows the results of Navigant's NTG analysis. Navigant anticipated low free ridership and spillover given that the program is structured to offer energy efficient equipment at no cost to multifamily housing units, which are typically not owner-occupied. The results shown here are in line with expectations and very similar to our previous evaluations of this program. Navigant chose to present a program-level NTG ratio rather than measure level due to the difficulty in estimating spillover by measure. Navigant believes it is more appropriate to present the NTG ratio in aggregate.

Table 29. NTG Results

Estimated Free Ridership	7.2%
Estimated Spillover	0.15%
Estimated NTG	0.93

Source: Navigant analysis, values subject to rounding

5.1 Overview of Net-to-Gross Methodology

As indicated in the evaluation plan, Navigant used a survey-based, self-report methodology to estimate free ridership and spillover for the Multifamily Energy Efficiency Program. A self-report approach is outlined in the Universal Methods Protocol (UMP), and Navigant has previously used this method to estimate a NTG ratio for several other Duke Energy programs in the Carolinas. Navigant primarily targeted property managers for the NTG surveys, because they are the decision makers for participation in the program.[16] Navigant also incorporated supplemental data gathered during tenant phone surveys into the analysis.

5.1.1 Definitions of Free Ridership, Spillover, and NTG Ratio

The methodology for assessing the energy savings attributable to a program is based on a NTG ratio. The NTG ratio has two main components: free ridership and spillover.

Free ridership is the share of the gross savings that is due to actions participants would have taken anyway (i.e., actions that were not induced by the program). This is meant to account for naturally occurring adoption of energy efficiency measures. The Multifamily Energy Efficiency Program and most other Duke Energy programs cover a wide range of energy efficiency measures and are designed to advance the overall energy efficiency market. However, it is likely that, for various reasons, some participants would have wanted to install some high-efficiency measures even if they had not participated in the program or been influenced by the program in any way.

[16] Navigant recognizes that some property managers may have been instructed to participate by higher-level decision makers at the corporate level. Although we do not think this was the case very often, we do think that the local property managers were still privy to the decision making process.

Spillover captures program savings that go beyond the measures installed through the program. Also called market effects, the term spillover is often used because it reflects savings that extend beyond the bounds of the program records. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

The overall NTG ratio accounts for both the net savings at participating projects and spillover savings that result from the program but are not included in the program's accounting of energy savings. When the NTG ratio is multiplied by the estimated gross program savings, the result is an estimate of energy savings that are attributable to the program (i.e., savings that would not have occurred without the program). The NTG formula is shown in Equation 12:

Equation 12. Net-to-Gross Formula

$$NTG = 1 - \text{free ridership} + \text{spillover}$$

The underlying concept inherent in the application of the NTG formula is that only savings caused by the program should be included in the final net program savings estimate but that this estimate should include all savings caused by the program.

5.1.2 Estimating Free Ridership

Data to assess free ridership was gathered through the self-report method using a series of survey questions asked to the property managers at participating properties. The survey assessed free ridership using both direct questions, which aimed to obtain respondent estimates of the appropriate free ridership rate that should be applied to them, and supporting or influencing questions, which could be used to verify whether the direct responses were consistent with participants' views of the program's influence.

Each respondent to the survey provided perspectives on the measures that they had installed through the program. The core set of questions addressed the following three categories:

- **Likelihood:** To estimate the likelihood that they would have incorporated measures "of the same high level of efficiency," if not for the assistance of the program. In cases where respondents indicated that they might have incorporated some but not all of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free ridership estimates.
- **Prior planning:** To further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the energy efficient measure prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency measures prior to participation then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency measures. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the equipment and an installer.

- **Program importance:** To clarify the role that program components (e.g., information, incentives) played in decision-making and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the influence of the program.

Free ridership scores were calculated for each of the three categories.[17] Navigant then calculated a weighted average from each respondent based on their share of sample energy savings, and divided by 10 to convert the scores into a free ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked when they would have installed the equipment without the program. Respondents who indicated that they would not have installed the equipment for at least two years were not considered free riders and received a timing multiplier of 0.[18] If they would have installed at the same time as they did, they received a timing multiplier of 1; within one year, a multiplier of 0.67; and between one and two years, a multiplier of 0.33. Participants were also asked when they learned about the financial incentive; if they learned about it after the equipment was installed then they received a timing multiplier of 1.

5.1.3 Estimating Spillover

The basic method for assessing participant spillover was an approach that asked a set of questions to determine the following:

- **Whether spillover exists at all.** These were yes-or-no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records and did not receive any rebates from Duke Energy.
- **The savings that could be attributed to the influence of the program.** Participants were asked to list the extra measures they installed, and the evaluation team assigned a savings value. See below for the method of assigning savings.

[17] Scores were calculated by the following formulas:

- Likelihood: The likelihood score is 0 for those that "definitely would NOT have installed the same energy efficient measure" and 1 for those that "definitely WOULD have installed the same energy efficient measure." For those that "MAY HAVE installed the same energy efficient measure," the likelihood score is their answer to the following question: "On a scale of 0 to 10, where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed the same energy efficient measure, can you tell me the likelihood that you would have installed the same energy efficient measure?" If more than one measure was installed in the project, then this score was also multiplied by the respondent's answer to what share they would have done.
- Prior Planning: If participants stated they had considered installing the measure prior to program participation, then the prior planning score is the average of their answers to the following two questions: "On a scale of 0 to 10, where 0 means you 'Had not yet planned for equipment and installation' and 10 means you 'Had identified and selected specific equipment and the contractor to install it,' please tell me how far along your plans were" and "On a scale of 0 to 10, where 0 means 'Had not yet budgeted or considered payment' and 10 means 'Already had sufficient funds budgeted and approved for purchase,' please tell me how far along your budget had been planned and approved."
- Program Importance: This score was calculated by taking the maximum importance on a 0 to 10 scale of the four program importance questions and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

[18] Navigant believes a two-year horizon is appropriate for assessing free ridership as it likely reduces certain types of bias and it becomes difficult for respondents to predict behavior beyond that horizon.

- **Program attribution**. Estimates were derived from a question asking the program importance on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they were assigned a 0 score for spillover. If they said yes, then Navigant estimated the energy spillover savings on a case-by-case basis. It is important to note that although free ridership questions were only asked of property managers, Navigant surveyed both property managers and tenants for spillover.[19]

5.1.4 Combining Results Across Respondents

The evaluation team determined free ridership estimates for each of the following:

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above.
- The program as a whole, by taking a weighted average of the individual results based on each respondent's share of reported energy savings.

[19] The reason for not assessing free ridership at the tenant level is because tenants generally participated in the program via their property managers rather than personal choice. It is possible that tenants would have installed the same measures themselves, but Navigant does not believe they should be considered free riders to the program because the timing of those installations would have been difficult to evaluate and tenants would still have the ability to install CFLs in non-retrofitted fixtures. If a tenant already had equivalent measures in place, it is unlikely that the implementer would have replaced them with program measures.

5.2 Results for Free Ridership, Spillover, and Net-to-Gross

5.2.1 Review of Data Collection Efforts for Attribution Analysis

Surveys were conducted with decision makers to provide the information to estimate free ridership, and thus, NTG ratios. Navigant completed surveys with 24 property managers. This sample represents about 11 percent of the total reported energy savings, as shown in Table 30.

Table 30. Property Manager Sample Representation

	Program Total Reported Energy Savings (MWh)	Sample Total Energy Savings (MWh)	% of Program
LEDs	20,159	2,053	10%
Bathroom faucet aerators	1,969	237	12%
Kitchen faucet aerators	2,442	294	12%
Showerheads	10,816	1,250	12%
Pipe wrap (ft)	7,120	700	10%
Energy Savings (MWh)	42,505	4,534	11%

Source: Navigant analysis, values subject to rounding

5.2.2 Free Ridership Results

As described above, surveyed participants responded to a series of questions intended to elicit explicit estimates of free ridership, as well as ratings of program influence. Estimates are based on questions regarding the likelihood, scope, and timing of the investments in energy efficiency if the respondent had not participated in the program. For the Multifamily Energy Efficiency Program, free ridership was estimated at 7.2 percent, which is similar to previous evaluations of this program.

Navigant developed the free ridership estimate presented above based on responses to a variety of questions that related to survey respondents' intentions prior to participating in the program and to the influence of the program itself. Below are summaries by scoring component.

Prior Planning: Fourteen of the respondents indicated they had some level of prior plans for installing some of the energy efficient measures, but only 6 of those indicated their plans were somewhat developed. The other 10 respondents indicated that they did not have plans.

Program Importance: Respondents stated that the program was very important in having the measures installed. Several property managers noted that their decision to participate was influenced by helping their tenants save energy and money.

Likelihood: Respondents were asked in the absence of the program, if they would have had at least some of the work done. Five respondents stated they "definitely would not have" installed some measures in the absence of the program, and 14 said they "may have". Respondents who said they may have installed some measures without the program indicated they would have only installed, on average, less than half of the measures they did install. Furthermore, those same respondents indicated there was only about a 60 percent change they would have installed those additional measures. Taken together, these findings indicate relatively low free ridership.

Timing: Twelve respondents stated they would have done the installation within two years or less in the absence of the program. But those same respondents indicated that there was about a 70 percent chance that less than half of the work would have been completed in the absence of the program.

In summary, respondents indicated that the program was very important in their decisions to have the energy efficient measures installed. Some indicated that they did have some prior plans to install the measures, and the free ridership estimates account for those responses.

5.2.3 Spillover Results

Four of the 24 surveyed property managers indicated that the program influenced him/her to install additional, non-incentivized energy efficiency measures at the property. The additional measures included a small number of LEDs in outdoor or common spaces and weather stripping. In addition to the three property managers reporting spillover, six tenants reported installing a small number of LEDs and household appliances as a result of participating in the program.

Navigant estimated spillover from the equipment reported by property managers and tenants by applying simple engineering equations along with the self-reported measure quantities and characteristics. Navigant calculated the total spillover to be 0.15 percent.

5.2.4 NTG Results

The NTG ratio was calculated as written in Equation 13:

Equation 13. Net-to-Gross Ratio

$$NTG = 1 - free\ ridership + spillover = 1 - 0.072 + 0.00147 = 0.929$$

This suggests that for every one kWh reduced from program measures, about 0.93 kWh of savings can be directly attributed to the program.

6. PROCESS EVALUATION

Navigant conducted a process evaluation of the Multifamily Energy Efficiency Program to assess program delivery and customer satisfaction. The process findings summarized in this section are based on the results of customer surveys with 150 program participants, detailed surveys with 24 property managers, interviews with the Duke Energy Program Manager and key implementation staff from Franklin Energy, and a high-level review of the program documents and functionality. The property manager interviews and tenant surveys were also used to inform the NTG analysis.

6.1 Key Findings

- The program appears to be effectively addressing many key challenges that are inherent to delivering energy efficiency programs to non-owner-occupied multifamily housing facilities.
- About half of the property managers learned about this program through outreach by a program representative. This onsite marketing approach seems to be a successful way of gaining participants. Most tenants learned of this program through their property managers, but about 20 percent of tenants reported learning about the program through a bill stuffer or email from Duke Energy. The latter group may be confusing the bill and email outreach with other Duke Energy outreach, since no specific bill or email promotion is carried out for this program.
- Property managers indicated they chose to participate in the program to provide a service and save money for their tenants and owners as well as to capitalize on the free installation to save on internal labor costs. Over 80 percent of surveyed property managers indicated they were “very likely” to recommend the program to other property managers.
- 43 percent of DEP tenants and 54 percent of DEC tenants reported that they noticed savings on their energy bills since the installation of the measures.
- A majority of program participants were satisfied with the program. On a scale of 0 to 10, where 0 indicates “not satisfied at all” and 10 indicates “extremely satisfied”:
    - About 84 percent of DEC participants and 74 percent of DEP participants indicated 8-10 for satisfaction with the overall program
    - About 86 percent of DEC participants and 88 percent of DEP participants indicated 8-10 for satisfaction with the installer’s quality of work
    - About 74 percent of DEC participants and 83 percent of DEP participants indicated 8-10 for satisfaction with Duke Energy
- High satisfaction ratings by tenants were often associated with money savings as the primary benefit. Low satisfaction ratings were often associated with complaints about the equipment.
- Tenant satisfaction was higher for LEDs than for showerheads and aerators. Respondents were generally happy with the brightness and quality of light provided by the LEDs.
- During the tenant phone surveys, several participants expressed dissatisfaction with the low water pressure in their showers and sinks. Additionally, several property managers indicated that they had received tenant complaints about low water pressure.

6.2 Documentation Review

Navigant requested program documentation and tracking data to conduct a complete review of current processes. The program tracking data was sufficient to identify the measure characteristics and quantities of installed measures for each tenant at the participating properties.

6.3 Interviews with Duke Energy Program Manager and Franklin Energy Implementation Staff

Interview with Duke Energy's Program Manager
Navigant interviewed Duke Energy's Program Manager to discuss program goals and any relevant changes to delivery or offerings since the previous evaluation. This interview revealed that Duke Energy prioritizes a culture of safety at all levels of program operation, strategic partnerships and engagement to reach additional customers, and maintaining overall satisfaction by program participants. Overall Duke Energy is pleased with the program's performance and constantly seeking creating ways to improve delivery and continue meeting customer needs. Duke Energy acknowledges that EISA lighting regulations will affect the program's future, and is actively considering non-lighting measures that may be good options for program measures.

The program is making strategic changes to recruitment, regulation, measure offerings and customer interface technology. Duke Energy is focused on increasing relationships with property management companies to streamline scheduling and to reach more customers. The program also introduced specially bulbs, BR30s and MR16s, in March 2018. The utility has changed participation requirement to allow properties with as low as four housing units to be eligible for the program in DEP and DEC; this regulation approval has increased participation. Finally, a new software tool named Clipboard will provide property managers a 1-page summary report of the financial and energy savings estimates from participating in this program. Currently, the testing phases of the summary report offering have resulted in positive feedback from property managers who were on the fence about participating.

Duke Energy is satisfied with Franklin Energy's management of the program. Some areas of strength include a strong customer pipeline, program management, scheduling resources, data and quality control, and a strong measure mix offering.

Interview with Franklin Energy Implementation Staff
Navigant also interviewed program implementation staff from Franklin Energy. Franklin Energy has developed a program logic model and detailed program plan that clarifies program operations. The program logic model details the customer influence process and the proactive way that program staff recruits, engages and educates, and specifies procedures for following up with the property managers. The primary implementation steps include the process of outreach, scheduling, measure installation, quality control, and continuous improvement.

Franklin Energy reported an increase in participation because of the new measure offerings and is working with Duke Energy to introduce additional measure offerings. Franklin Energy continues to provide critical customer feedback to Duke Energy. Finally, Franklin Energy is coordinating to offer enhanced program delivery by incorporating tablet devices into their operations. They have received positive feedback from program participants after changing from paper-based to tablet-based

documentation. They also have enhanced program tracking with electronic recording during installations; this resulted in a quick data entry, upload and quality control process, where issues can be resolved swiftly.

6.4 Property Manager Interviews

The evaluation team conducted interviews with property managers from the participating properties to assess decision-making (which will ultimately feed into the NTG analysis) and overall satisfaction with the program. The evaluation team interviewed 24 property managers representing over 80,000 measures or 11% of the program reported energy savings.

Overall, property managers indicated that their experience with the program was very favorable. Some key findings from the property manager interviews are listed below:

- On a scale of 0 to 10, where 10 indicates “very satisfied” and 0 indicates “not satisfied at all”, the average rating from property managers was 7.8.
- Property managers expressed high satisfaction with the free program measures and free installation by an external contractor. Property managers noted the contractor’s quality of work as “professional” and “efficient.” Other respondents indicated there were some small issues related to insufficient materials to complete retrofits at all housing units at the property.
- About 80 percent of property managers are very likely to recommend this program to other property managers. Provided are a subset of property manager responses on how the program influenced their decision to install the energy efficient measures:
    - “It was painless, and I didn’t have to do much other than send a notice to my tenants”
    - “The main thing was to save money for residents”
    - The program provided “benefits to residents, allowed upgrades to equipment, saves money, and updated the property”
- Several property managers indicated their maintenance staff had to replace some of the program showerheads due to tenant complaints about low water pressures.
- One property manager indicated that installation staff left muddy footprints in tenant homes.
- General suggestions for program improvement from property managers and maintenance staff included: adding exterior or common space lighting, improving the quality of aerator devices, improving the installation logistics such as material needs.

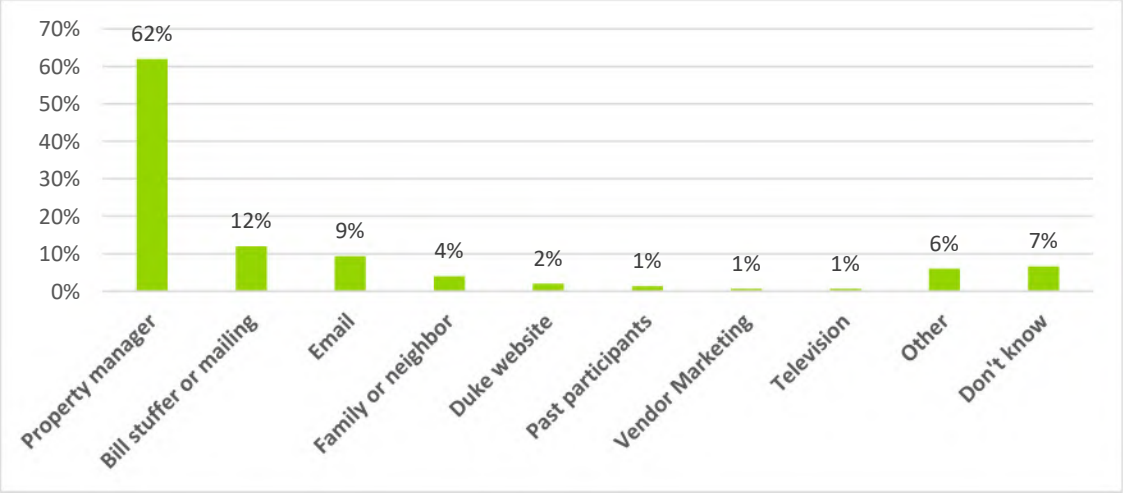
6.5 Overall Marketing and Outreach

Customer outreach is a key driver to program participation. Navigant recognizes the importance of marketing and outreach with regards to continued participation and satisfaction, so several questions in the tenant survey and property manager interviews were included to address this.

Figure 8 and Figure 9 show how tenants and property managers learned about the program, respectively. Tenant participants were asked to indicate all of the sources through which they learned about the program, and about 62 percent indicated they had learned about the program through property managers as would be expected given the program model. Tenants also indicated having received

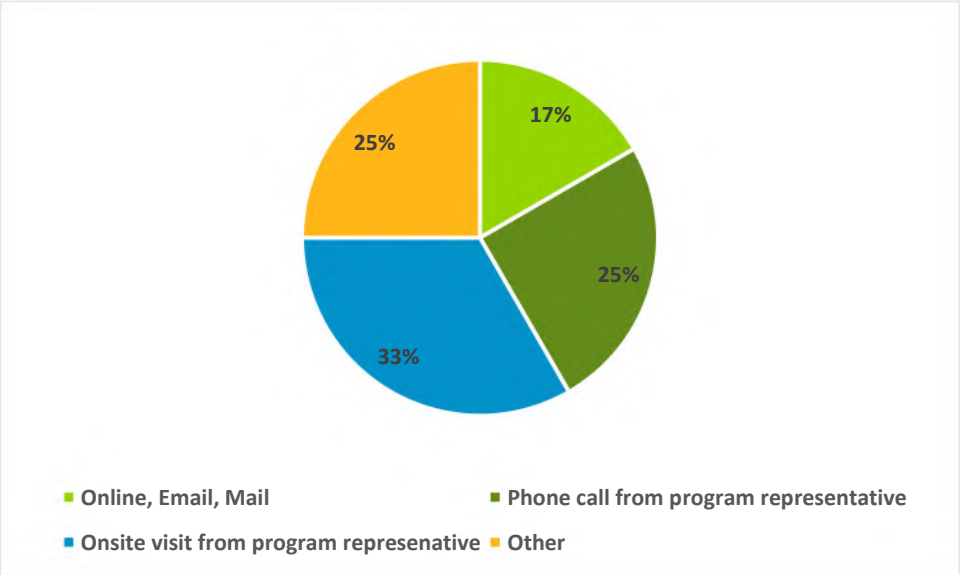
notice via a Duke Energy mailing, bill stuffer or email.[20] Property managers indicated that they were approached in-person by a program representative or received a mail or email with program details.

Figure 8. How Tenants Learned About the Program (n=150)



Source: Navigant analysis, values subject to rounding

Figure 9. How Property Managers Learned About the Program (n=24)



Source: Navigant analysis, values subject to rounding

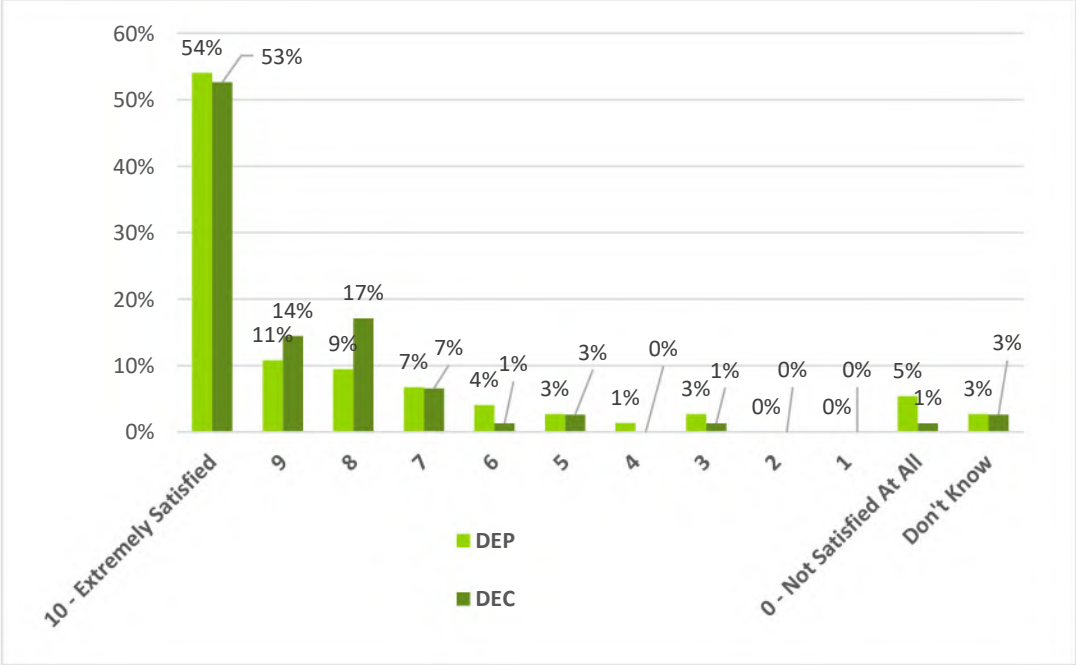
[20] Duke Energy does not promote this program through bill stuffers or emails, so it is possible that tenants were confusing this with notification received via paper or email from property managers.

6.6 Tenant Surveys

Navigant conducted phone surveys with 150 residential tenants to assess program satisfaction. The surveys contained a number of questions to assess satisfaction with program participation, satisfaction with new equipment, as well as questions to assess measure baseline and any measures removed by the tenant after participation.

Customer satisfaction with the program is high. On a scale of 0 to 10, where 0 indicates "not satisfied at all" and 10 indicates "extremely satisfied," about two-thirds of tenants rated satisfaction with the program as an 8-10 as shown in Figure 10. The average overall tenant satisfaction rating with the program was 8.62. Participants who ranked their overall satisfaction low did so because they disliked the products or did not notice any monetary savings.

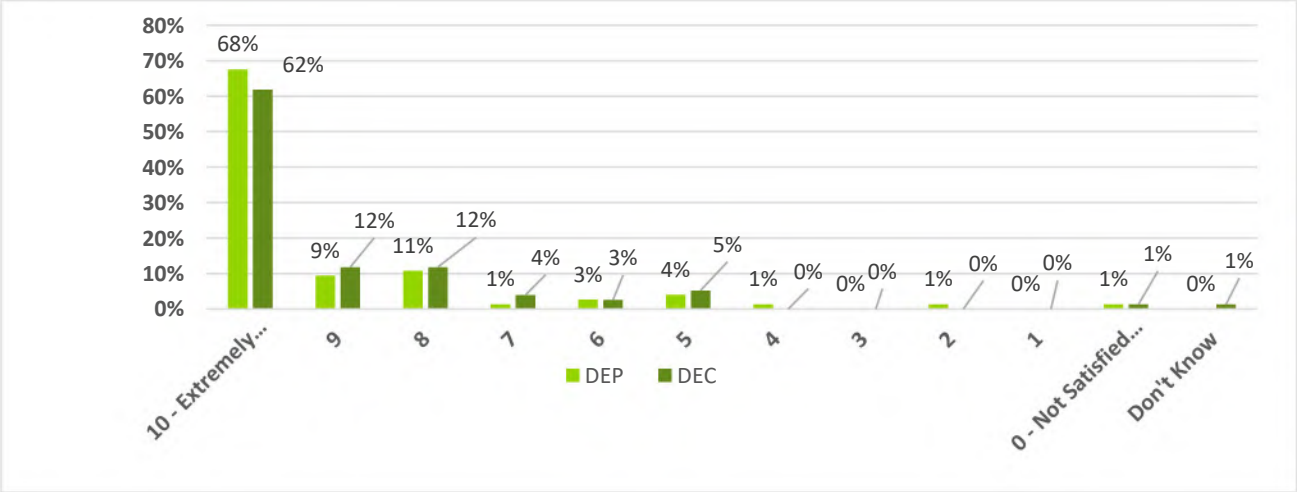
Figure 10. Tenant Satisfaction with Overall Program Experience (n=150)



Source: Navigant analysis, values subject to rounding

Customer satisfaction with the contractor quality of work was also high, as shown by Figure 11.

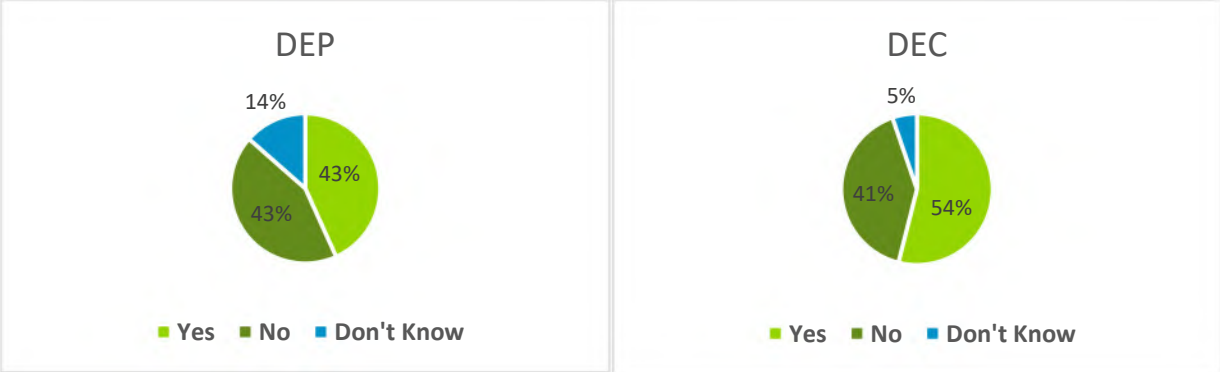
Figure 11. Tenant Satisfaction with Contractor's Quality of Work (n=150)



Source: Navigant analysis, values subject to rounding

As shown in Figure 12, 43 percent of DEP participants and 54 percent of DEC participants noticed a decrease in their energy bills after the new measures were installed.

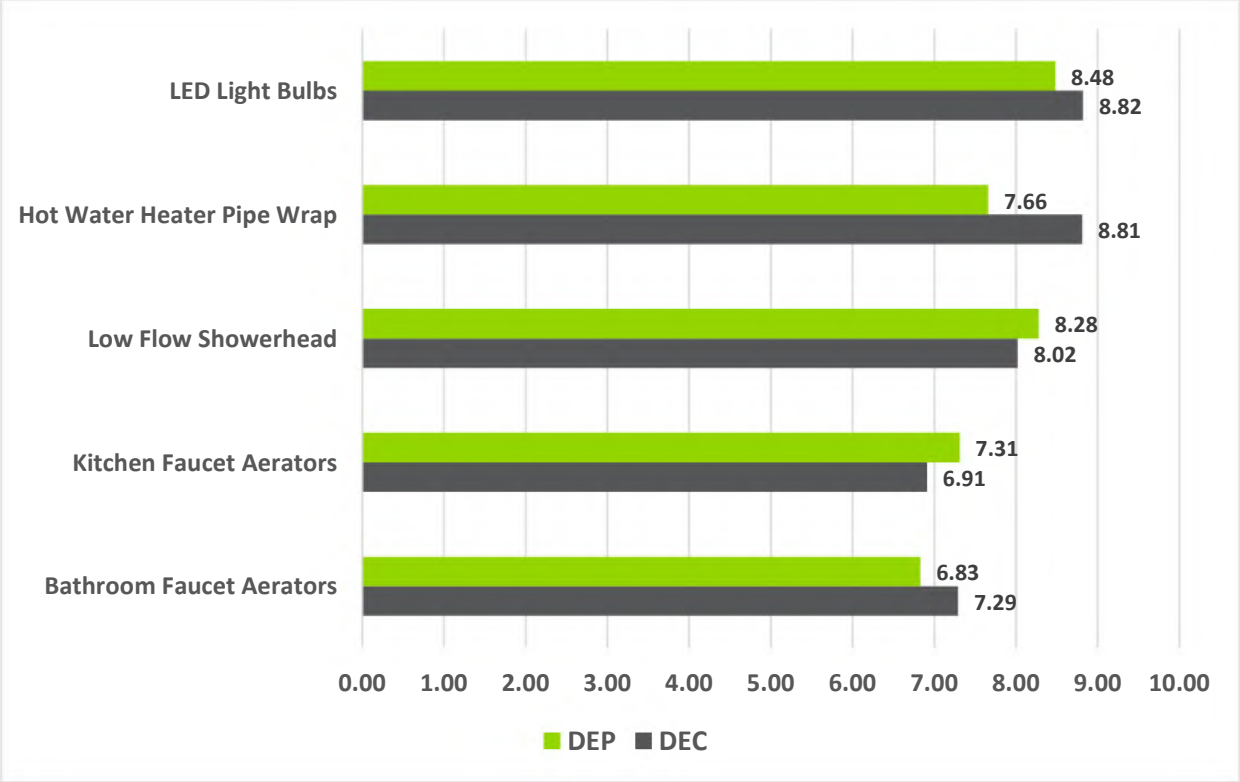
Figure 12. Participants Who Noticed a Decrease in Their Energy Bill After Installing Program Measures (N=150)



Source: Navigant analysis, values subject to rounding

While a majority of participants were satisfied with the new measures, some were not. Navigant asked the participants to rate their satisfaction for each measure installed at their home. Average satisfaction ratings ranged from as high as 8.82 of 10 for LEDs in DEC, to as low as 6.83 out of 10 for bathroom faucet aerators in DEP, as shown in Figure 13.

Figure 13. Tenant Satisfaction Rating for Each Measure (n=150)



Source: Navigant analysis, values subject to rounding

A small percentage of tenants reported they removed some of their program measures. Six respondents reported removing a total of 11 LEDs, mostly due to burnout or dissatisfaction with lighting quality. Two respondents removed a total of three bathroom aerators, and 9 respondents removed one kitchen aerator each. One person reported removing two program showerheads. Participants indicated they removed bathroom faucet areators and showerheads because of poor water pressure and excess water spray.

6.6.1.1 Participant Suggestions

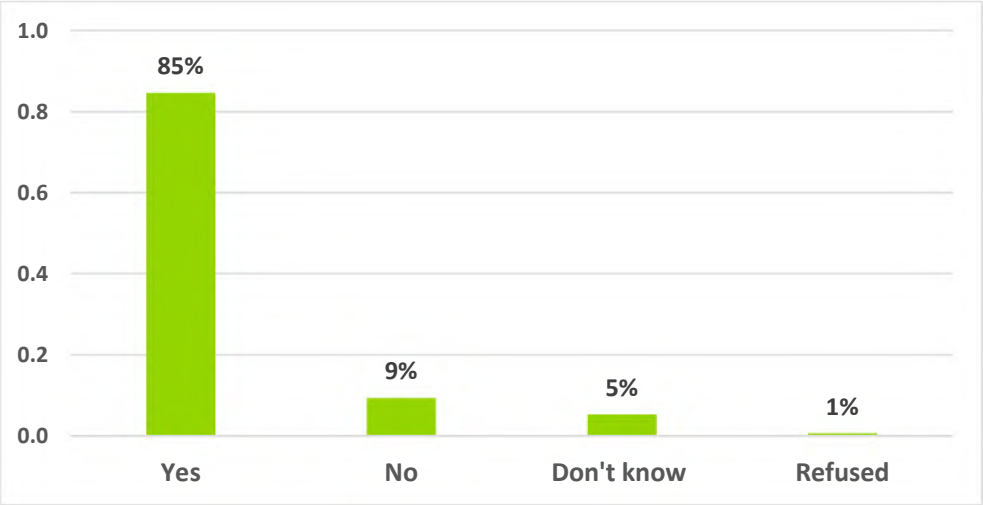
Navigant also included a question in the tenant satisfaction survey that allowed respondents to offer suggestions for improving the program. About 20 percent of respondents offered suggestions, which were as follows:

- Several respondents asked for a better quality of equipment, especially the showerheads, and aerators
- Several participants asked for better notification of installation date and time
- One respondent requested offering HVAC and thermostat measures

6.6.1.2 Participant Familiarity with Duke Energy

Navigant asked participant tenants a series of questions about their familiarity with Duke Energy's efficiency program offerings, as well as their preference for additional program offerings. As shown in Figure 14, 85 percent of respondents said they consider Duke Energy a resource for energy efficiency information. However, as shown in Figure 15, a nearly equivalent percentage of respondents were not able to specifically name other Duke Energy efficiency programs when asked without prompts.

Figure 14. Participants Who Consider Duke Energy a Resource for Energy Efficiency Information (n=150)



Source: Navigant analysis, values subject to rounding

Figure 15. Participants Who Could Name Other Duke Energy Solutions/Programs to Help Them Save Energy and Money (n=150)

Source: Navigant analysis, values subject to rounding

Navigant also asked participants about their preferences related to other technologies such as smart thermostats, solar and electric vehicles. Responses showed that:

- 20% of respondents currently have a smart thermostat (16% were unsure)
- Of the respondents who do not have a smart thermostat, about half are interesting in getting one
- Nearly 60% of respondents say they would like to see solar PV installed at their property
- Less than 3% of respondents currently own an EV, and about 4% are aware of EV charging stations at their properties

7. SUMMARY FORM

Multifamily Energy Efficiency Program

Completed EMV Fact Sheet

Description of program

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. Typically, measures are installed directly by the implementation contractor rather than tenants or onsite maintenance staff.

The program consists of lighting and water measures.

- **Lighting measures:** Light Emitting Diode (LED) bulbs installed in permanent fixtures
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, hot water pipe wrap

Date:	April 16, 2020
Region:	Duke Energy Progress Duke Energy Carolinas
Evaluation Period	1/1/17 – 5/1/18
Annual kWh Savings	DEP 22,376,274 DEC 31,266,195
Per Participant kWh Savings	DEP 797 DEC 711
Net-to-Gross Ratio	0.93

Evaluation Methods

The evaluation team used engineering analysis ,onsite field inspections, and a lighting logger study as the primary basis for estimating program impacts. Additionally, telephone surveys were conducted with tenants and multifamily housing units to assess customer satisfaction and spillover. Detailed interviews were conducted with property managers to assess their decision-making process, and ultimately to estimate a net-to-gross ratio.

Impact Evaluation Details

- **Field inspections were conducted at 229 housing units.** The evaluation team inspected program equipment at 229 housing units to assess measure quantities and characteristics to be compared with the program tracking database.
- **341 lighting loggers were deployed**. The evaluation team deployed 341 lighting loggers to measure operating hours for two months. Results were extrapolated to annual estimates using a sinusoidal modeling method. The weighted average of lamp usage across all program lamp and space types was 1.8 hours per day.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 83% for kitchen aerators to 95% for globe LED lamps.
- **Participants achieved an average of 797 kWh of energy savings per year in DEP, and 711 kWh in DEC.** Differences were driven by the mix and quantity of measures installed between the jurisdictions.

8. CONCLUSIONS AND RECOMMENDATIONS

Navigant developed a series of recommendations during the EM&V effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to support future EM&V activities and possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

1. Navigant recommends that Duke Energy should adopt the ex post, per-unit energy and demand impacts from this evaluation and use them going forward.
2. Duke Energy should consider whether additional marketing material can be distributed to tenants during participation in this program, to educate participants about other Duke Energy program offerings and services. Nearly 90 percent of tenants surveyed were not able to identify other Duke Energy efficiency programs or offerings without being prompted.
3. Duke Energy should consider whether smart thermostats or other HVAC-related measures would be reasonable offerings for this program. About half of survey respondents who did not have a smart thermostat indicated they would like to get one.

9. MEASURE-LEVEL INPUTS FOR DUKE ENERGY ANALYTICS

Navigant used the findings from field verification, surveys, and review of Duke Energy's deemed savings to estimate an updated set of deemed savings for Duke Energy to use for tracking program activity. Table 31 provides the measure-level inputs that can be used by Duke Energy Analytics for estimates of future program savings.

Table 31. Gross Measure-Level Impacts

Measure*	Unit Basis for Impacts	Annual Energy Savings Per Unit (kWh)	Annual Summer Coincident Demand Savings Per Unit (kW)	Annual Winter Coincident Demand Savings Per Unit (kW)
Faucet Aerators MF Direct 0.5 GPM - bath	Per Aerator	75.11	0.0099	0.0087
Faucet Aerators MF Direct 1.0 GPM - bath	Per Aerator	55.09	0.0073	0.0064
Faucet Aerators MF Direct 1.0 GPM - kitchen	Per Aerator	114.61	0.0151	0.0133
LF Showerhead MF Direct 0.5 GPM	Per Showerhead	505.00	0.0417	0.1627
LF Showerhead MF Direct 1.0 GPM	Per Showerhead	393.04	0.0324	0.1266
LF Showerhead MF Direct 1.5 GPM	Per Showerhead	281.09	0.0232	0.0906
Pipe Wrap MF Direct	Per Linear Foot	19.20	0.0022	0.0022
A-line LED Direct	Per Lamp	27.65	0.0046	0.0034
Globe LED Direct	Per Lamp	32.87	0.0042	0.0045
Candelabra LED Direct	Per Lamp	13.98	0.0029	0.0010
Track LED Direct	Per Lamp	24.08	0.0034	0.0024
Recessed LED Direct	Per Lamp	45.01	0.0080	0.0030

Source: Navigant analysis, values subject to rounding

**Duke Energy does not currently offer faucet aerators at the 0.5 gpm flow rate, nor showerheads at the 1.0 and 0.5 gpm flow rates. The values in this table are presented for planning purposes only.*

APPENDIX A. DETAILED SURVEY RESULTS

This appendix contains additional results from the property manager interviews and tenant surveys. It is meant as a supplement to other sections of the report.

A.1 Property Manager Interviews

Navigant conducted in-depth interviews with 24 property managers. This section presents details of the interviews. The responses to each question shown are paraphrased to maintain confidentiality and summarize the key points.

Table 32. How did you learn about the Duke Energy Multifamily Energy Efficiency Program?

Respondent(s)	Response
2,6,7,9,14-17,20	Duke Energy phone call, mail or email
1,3,19,22	Corporate company mandated
4,6,8,10,11,14,16,18,20,21,23	Approached by a program representative
12	Through a family friend or neighbor
5	Don't know

Source: Navigant analysis

Table 33. What were the primary reasons to participate in the program?

Respondent(s)	Response
7,8,19	To save energy
1,18	Corporate mandated
2,3,4,5,13,15,17,20,21,23,24	To save money
6,9,10,16	To improve tenant satisfaction
11	Duke Advertising
12,22	Modernize, Replace old equipment
14	Don't Know

Source: Navigant analysis

Table 34. On a scale of 0 to 10, with 0 being "not satisfied at all" and 10 being "extremely satisfied", how satisfied are you with your overall program experience?

Respondent(s)	Response
2,3,6,23	10
7,9,15,19	9
1,4,8,13,14,16,18,22	8
10,12,21,24	7
11,17	6
5	5
20	3

Source: Navigant analysis

Table 35. On a scale of 0 to 10, with 0 being "not satisfied at all" and 10 being "extremely satisfied", how satisfied are you with the tenant notification and program materials?

Respondent(s)	Response
1-3,6,8-10,15,16,20,23,24	10
11,17,19,21	9
4,12,13,18,22	8
14	7
5,7	Don't Know

Source: Navigant analysis

Table 36. On a scale of 0 to 10, with 0 being "not satisfied at all" and 10 being "extremely satisfied", how satisfied would you say your tenants are with the new energy efficient equipment?

Respondent(s)	Response
1-3,6,19,23	10
9,11,13,15	9
8,12,22	8
16,18,24	7 – low pressure from water fixtures*
10,14	6 – Aerator low flow pressure received bad feedback*
4,5,7,17	5 – water measures had multiple complaints, two properties reinstalled old showerheads; aerators didn't receive good feedback either*
20	2 –showerheads didn't have adequate pressure, so the old showerheads were reinstalled*
21	Don't Know
*Indicates feedback for lower satisfaction applied only to water measures and respondents were satisfied with LEDs	

Source: Navigant analysis

Table 37. On a scale of 0 to 10, with 0 being "not likely at all" and 10 being "very likely", how likely are you to recommend the Multifamily Energy Efficiency Program to other property managers?

Respondent(s)	Response
1-3,6-9,12,15,16,19,23	10
13,22,24	9
4,14	8
10,11,18	7
5	4
21	3
17,20	0 – feedback noted that property manager felt the installer was unprepared for 10 ft. ceiling, they didn't replace all of the lights, and had bad communication; program was unorganized and they had to replace many of the aerators and showerheads.

Source: Navigant analysis

Table 38. Prior to participating in the program, had you considered installing the same energy efficient equipment at your facility?

Respondent(s)	Response
3,4,13,17,19-21	No
2,5,7,9-12,14,-16,18,22-24	Yes
1,6,8	Don't Know

Source: Navigant analysis

Table 39. Did your experience with the program influence you to incorporate any additional energy efficiency equipment for which you did not receive a Duke Energy program rebate?

Respondent(s)	Response
2-4,6,10,11,13-15,17-24	No
7,12,16	Yes, installing LEDs
9	Yes, weather-stripping
1,5,8	Don't Know

Source: Navigant analysis

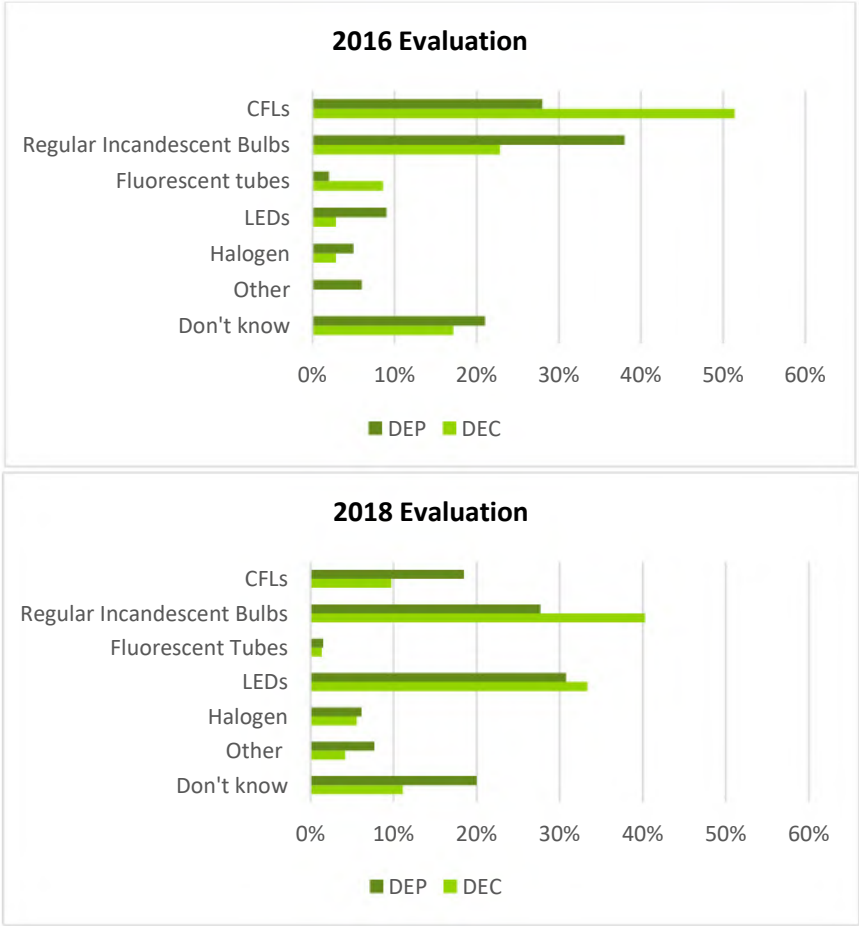
A.2 Tenant Satisfaction Surveys

Satisfaction surveys were conducted with 150 program participants. Many of the results are presented in Section 6.6 of the main report, and this section serves as a supplement.

Figure 16 shows the types of light bulbs that tenants reported as being installed in the non-retrofitted fixtures in their homes. We have included a comparison to the same question from the 2016 evaluation of this program, and the responses indicate that non-program LEDs are more prevalent in multifamily homes than they were in 2016. Key takeaways include:

- In 2018, about one-third of respondents indicated they have LEDs in fixtures that were not retrofitted through the program, as compared to less than 10 percent in 2016.
- In 2018, fewer respondents indicated that their non-retrofitted fixtures CFLs.
- Estimates for other lamp types were relatively consistent between 2016 and 2018

Figure 16. Comparison of 2016 and 2018 Results for Type of Bulbs Reported by Tenants to be in Non-Retrofitted Fixtures



Source: Navigant analysis

As noted earlier, overall tenant satisfaction with the program was very high for DEP and DEC jurisdictions, with an average rating of 8.6 on a scale of 0 to 10 with 10 as very satisfied. However, nine of the 150 tenants reported a satisfaction of five or less with the program for the following reasons:

- No noticeable money savings (n=4)
- Dislike products (n=1)
- Unspecified reason (n=4)

Tenants also reported a few suggestions for improving the program:

- Improve the kitchen faucet aerator (n=8)
- Improve tenant notification about installation times (n=7)
- Improve low flow showerhead (n=5)
- Improve the quality of LEDs (n=4)
- Improve the quality of products (n=3)
- Don’t mandate participation (n=1)
- Change all light bulbs in home (n=1)
- Add protective UV film to doors (n=1)

APPENDIX B. TENANT SURVEY GUIDE

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
TENANT SATISFACTION SURVEY

This survey guide is targeted at residents that are recipients of energy efficient equipment through Duke Energy's Multifamily Energy Efficiency Program (MEEP). The goal of the tenant satisfaction surveys includes informing, updating and improving the MEEP Program. Recruiting calls for tenant surveys will be made between 10:00am-8:30pm EST on weekdays, and 10:00am-5:00pm EST on Saturdays. No calls on Sundays.

Company: _____ Telephone: _____
Name: _____ Cell phone: _____
Title: _____ Fax: _____
City: _____ State: _____ Zip: _____
Interview date: _____ Time: _____

[PROGRAMMER: INSERTS FOR "MEASURE(S)": (add MEASURE_NAME_# to sample)
IF LED_LIGHT_BULBS_1 ≥ 1, [INSERT MEASURE(S)] = "LED LIGHT BULBS"
IF BATHROOM_FAUCET_AERATORS_2 ≥ 1, [INSERT MEASURE(S)] = "BATHROOM FAUCET AERATORS"
IF KITCHEN_FAUCET_AERATORS_3 ≥ 1, [INSERT MEASURE(S)] = "KITCHEN FAUCET AERATORS"
IF HOT_WATER_HEATER_PIPE_WRAP_4 ≥ 1, [INSERT MEASURE(S)] = "HOT WATER HEATER PIPE WRAP"
IF LOW_FLOW_SHOWERHEADS_5 ≥ 1, [INSERT MEASURE(S)] = "LOW FLOW SHOWERHEAD"

INTRO **[IF COMPLEX_NAME = 2 USE THIS INTRO.] (individual - add "2"to sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the light bulbs and other energy saving equipment that your landlord or property manager installed in your home. Is this the **[INSERT CONTACT_NAME FROM SAMPLE]** residence? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

INTRO 2 **[IF COMPLEX_NAME = 1 USE THIS INTRO.] (complex – add to "1"sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the light bulbs and other energy saving equipment that your landlord or property manager installed in your home. Do you reside at a property managed by **[INSERT CONTACT_NAME FROM SAMPLE]**? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

SC1. Safety is always first at Duke Energy. Are you able to safely take this call right now?
1. Yes **[CONTINUE]**
2. No **[SCHEDULE A CALLBACK]**
99. Refused **[THANK AND TERMINATE]**

[FOR TERMINATIONS]: I thank you for your time.

[IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 10-12 MINUTES."]

S1. I am calling for your opinion on your experience with the energy efficiency program. We will keep all of your responses confidential. For quality purposes, this call may be monitored and recorded. I just need to ask a few screening questions before we get started. Our records show that your household received new energy efficient lighting and/or water-saving equipment this year or in 2017. Your landlord or property manager most likely organized your participation in this program, and a work crew or maintenance staff person would have installed **[INSERT MEASURE(S)]** in your home.

Do you recall these **[INSERT MEASURE(S)]** being installed in your home?

1. Yes, respondent recalls the program
2. No **[THANK AND TERMINATE]**

98. Don't know **[ASK S3]**
99. Refused **[ASK S3]**

[FOR TERMINATIONS]: I have been asked to conduct interviews with people who had these items installed during 2017 or 2018. Since you did not, these are all the questions I have at this time. Thank you.

[IF S1 = 98 OR 99, CONTINUE. OTHERWISE SKIP TO M1.]

S3. Is there anyone available who might know? (IF NOT AVAILABLE, SCHEDULE A CALL BACK).

1. Yes **[REPEAT S1 WITH NEW RESPONDENT TO CONFIRM MEASURES INSTALLED.]**
2. No

99. Refused

[IF S3 = 2 OR 99, THANK AND TERMINATE]

[FOR TERMINATIONS]: I thank you for your time.

==========

MEEP NTG Survey: Res

Notes for Client:

- Scoring and multipliers are for FR (not NTGR).
- Text in brackets {} serve as a placeholder and will be concluded with the survey firm

==========

Measures

M1. The following survey pertains to the energy efficiency improvements you had completed in your home: **[INSERT MEASURE(S)]** This survey contains questions relating to your overall satisfaction with the Multifamily Energy Efficiency Program as well as questions relating to your decision to participate in the program.

Did you live at this residence, prior to the installation of these efficient items in your home?

1. Yes
2. No
98. Don't know

[IF LED_LIGHT_BULBS_1 ≥ 1, ASK. OTHERWISE, SKIP TO M3.]

M2. How many LED light bulbs were installed in your home with the program by the maintenance staff? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

1. _____[ENTER A NUMBER 1 TO 90]

[IF LOW_FLOW_SHOWERHEAD_5 ≥ 1, ASK. OTHERWISE, SKIP TO M4.]

M3. How many low flow showerheads were installed in your home with the program by the maintenance staff? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

1. _____[ENTER A NUMBER 1 TO 90]

[IF BATHROOM_FAUCET_AERATORS_2 ≥ 1, ASK. OTHERWISE, SKIP TO M4a.]

M4. How many bathroom faucet aerators were installed in your home with the program by the maintenance staff? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

1. _____[ENTER A NUMBER 1 TO 90]

[IF KITCHEN_FAUCET_AERATORS_3 ≥ 1, ASK. OTHERWISE, SKIP TO M5.]

M4a. How many kitchen faucet aerators were installed in your home with the program by the maintenance staff? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

1. _____[ENTER A NUMBER 1 TO 90]

[IF HOT_WATER_HEATER_PIPE_WRAP_4 ≥ 1, ASK. OTHERWISE, SKIP TO M6.]

M5. Was insulated pipe wrap installed on your hot water heater pipes with the program by the maintenance staff?

1. Yes
2. No
98. Don't know

M6. Have you removed any of the **[INSERT MEASURE(S)]** installed by your property manager?

1. Yes
2. No
98. Don't know

[TURN OFF QM6A.]

[IF M6 = 2 OR 98, SKIP TO M8. OTHERWISE CONTINUE.]

M6aa. As I read the following measures, please tell me which ones you removed. Did you remove…(READ LIST. RECORD ALL MENTIONS)?

1. LED light bulbs
2. Bathroom faucet aerators
3. Kitchen faucet aerators
4. Hot water heater pipe wrap
5. Low flow showerhead
6. (DO NOT READ) None were removed

[IF M6aa = 6, SKIP TO M8. OTHERWISE CONTINUE.]

M6ab. Please tell me the quantity of items you removed for each of the following. How many (READ LIST) did you remove? (INTERVIEWER: RECORD-QUANTITY FOR EACH. USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

Measure Description	Quantity
[IF M6aa = 1, 2, 3, 4, OR 5, INSERT MEASURES BELOW.]	
M6ab_1. LED light bulbs	_____
M6ab_2. Bathroom faucet aerators	_____
M6ab_3. Kitchen faucet aerators	_____
M6ab_4. Hot water heater pipe wrap	_____
M6ab_5. Low flow showerheads	_____

[IF M6A_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M8.]

M7a. You told me you removed LED light bulbs. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

[IF M6B_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M8.]

M7b. You also told me you removed bathroom faucet aerators. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

[IF M6C_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M8.]

M7c. You also told me you removed kitchen faucet aerators. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

[IF M6D_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M8.]

M7d. You also told me you removed hot water heater pipe wrap. Why did you remove those items?

(RECORD VERBATIM.)

_____**[OPEN-END]**

[IF M6E_2 GT "0", CONTINUE. OTHERWISE, SKIP TO M8.]

M7e. You also told me you removed low flow showerheads. Why did you remove those items? (RECORD VERBATIM.)

_____**[OPEN-END]**

[IF LED_LIGHT_BULBS_1 ≥ 1, ASK. OTHERWISE, SKIP TO IS1.]

M8. Of the lights used most frequently in your home, were the LED light bulbs installed in those fixtures?

1. Yes
2. No

[IF M8 = 1 "YES", SKIP TO M9. OTHERWISE CONTINUE.]

M8a. What types of light bulbs are in the lights you use the most in your home? (RECORD VERBATIM.)

_____**[OPEN-END]**

M9. Using your best estimate, about how many hours per day, on average, would you say you use your LED light bulbs in the following space types? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) (USE "97" IF RESPONDENT DOES NOT HAVE THAT SPACE TYPE.)

1. ____Bedrooms [ENTER A NUMBER 0 TO 24]

2. ____Bathrooms [ENTER A NUMBER 0 TO 24]
3. ____Kitchen [ENTER A NUMBER 0 TO 24]
4. ____Family or dining room [ENTER A NUMBER 0 TO 24]
5. ____Hallways [ENTER A NUMBER 0 TO 24]
6. ____Other [ENTER A NUMBER 0 TO 24]

M9a0. **[IF ANY RESPONSE TO M9 = 0, ASK M9a0. OTHERWISE SKIP TO M9a.]**

You indicated that one or more of your LEDs is used for 0 hours per day on average. Can you tell me why that is? (DO NOT READ LIST. RECORD ONE ANSWER ONLY.)

1. I don’t use the space/room very often.
2. No lights are needed for that space/room.
3. I use other lights in that space/room instead of the LEDs.
4. Other (Please Specify)

M9a. To the best of your knowledge, what was the most common type and wattage of bulb removed when the LEDs were installed? (INTERVIEWER: RECORD BULB TYPE AND WATTAGE.)

(USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) (NOTE: COMMON TYPES OF BULBS INCLUDE: REGULAR/INCANDESCENT, HALOGEN, CFLs, AND LEDS. COMMON WATTAGES INCLUDE: 13, 43, 60, 75, OR 100.)

Type of Bulb	Wattage
1. _____	2._____

M10. What types of light bulbs do you have in the other lights in your home? (READ LIST IF NECESSARY.

RECORD ALL MENTIONS.)

1. Regular Incandescent Bulbs (NOTE: Traditional light bulbs that look like an upside down pear. These are no longer being produced.)
2. Halogen (NOTE: Usually found in outside or recessed lighting.)
3. LEDs (NOTE: LEDs last longer than CFLs.)
5. Compact Fluorescent Bulbs or CFLs (NOTE: These look like a spiral or "twisty.")
4. Other (Please Specify)
98. Don't know (DO NOT READ)

Spillover (INSIDE SPILLOVER)

IS1. As a result of your experience with the program, did you purchase additional energy efficiency equipment for your home or adopt any energy efficient behavior for which you did not receive a rebate/discount from any other Duke Energy program?

1. Yes **[CONTINUE]**
2. No
98. Don't know

[IF IS1 = 2 OR 98, SKIP TO PS1.]

IS2a. Please tell me the types of additional energy efficient items and the quantity you had installed

where you did not receive a program rebate. (INTERVIEWER: RECORD MEASURE DESCRIPTION

AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?) (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) (ONLY THE FIRST LINE IS REQUIRED. ENTER AS MANY MEASURES AS THE RESPONDENT HAD INSTALLED AND LEAVE THE REST BLANK.)

Measure Description	Quantity

IS2a. 1._____ 2._____
IS2b. 3._____ 4._____
IS2c. 5._____ 6._____
IS2d. 7._____ 8._____
IS2e. 9._____ 10._____

IS3. Please briefly describe how the program has influenced your decisions to incorporate additional energy efficient items in your home that were not part of a program rebate. (RECORD VERBATIM.)
_____**[OPEN-END]**

IS4. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was your participation in the program in your decision to install additional energy efficiency measures?

Not at all important										Extremely important	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

PARTICIPATION and SATISFACTION

Thank you for your time and patience; there are only a few more questions and they relate to your satisfaction with the program.

PS1. How did you first hear about Duke Energy's Multifamily Energy Efficiency Program? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Through property manager
2. Duke Energy bill stuffer or mailing
3. Duke Energy website
4. Duke Energy email
10. Social media such as Facebook, Linkedin, etc.
5. Marketing by trade ally, vendor or contactor
6. Through family, friend, or neighbor
7. Participation in other Duke Energy Programs
8. Past Program participants
9. Other (Please Specify)
98. Don't know
99. Refused

PS2. What was the main reason you decided to accept the installation of **[INSERT MEASURE(S)]** through the program? (DO NOT READ LIST. RECORD ONE REASON ONLY. PROBE ONLY IF NECESSARY.)

1. Existing equipment was old

2. Existing equipment was no longer working
3. Existing equipment needed major repairs
4. To save energy
5. To lower energy bill, save money on bills
6. Environmental reasons
7. The installation was free
8. Recommended by a family or friend
9. Contacted by vendor
10. Duke Energy advertising
11. Advertising other than Duke Energy
12. Remodeling
13. Federal tax credit
14. Contractor recommended it
15. Property Manager mandated the installation
16. Other (Please Specify)
98. Don't know
99. Refused

[PS13/PS13A RELOCATED TO AFTER PS12A]

PS3. On a scale of 0 to 10, with 0 being "Not at all satisfied", and 10 being "Extremely satisfied", how satisfied are you with your new **[INSERT MEASURE(S)]? [REPEAT FOR EACH MEASURE INSTALLED BY PARTICIPANT.]**

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS3 < 5, ASK PS4]

PS4. Why do you say that? (RECORD VERBATIM.)

_____**[OPEN-END]**

[LOOP PS3/PS4 WILL BE ASKED MULTIPLE TIMES, BASED ON NUMBER OF MEASURES INSTALLED AT PS4.]

PS5a. **[IF LED_LIGHT_BULBS_1 ≥ 1, ASK. OTHERWISE, SKIP TO PS8.]**
In your own words, can you tell me about your experience so far with the LED Light Bulbs? This can include your opinion on quality of lighting, brightness, color, or any other observations that you have? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS7. Have you noticed any savings on your electric bill since the installation of your new **[INSERT MEASURE(S)]**?

1. Yes
2. No
98. Don't know
99. Refused

[IF PS7 = 1 ASK PS8, OTHERWISE SKIP TO PS9.]

PS8. How satisfied are you with any savings you noticed on your electric bill since the installation of your new energy efficient items on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

PS9. We understand that the new energy efficient items may have been installed by your property manager, maintenance personnel, or a contractor company. How would you rate your satisfaction with your installer's "quality of work" on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS9 < 5, ASK PS9A]

PS9a. Why aren't you satisfied? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS10. On a scale of 0 to 10, where 0 is "Not at all likely" and 10 is "Very likely", how likely are you to

purchase additional LEDs in the future?

Not at all likely										Very likely	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS10 < 5, ASK PS10A]

PS10a. Why do you say that? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS11. Using a scale from 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied are you with the Duke Energy Multifamily Energy Efficiency Program?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[ASK IF PS11 = 0-10]

PS11a. Why do you give it that rating? (RECORD VERBATIM.)

_____**[OPEN-END]**

PS12. Do you have any suggestions to improve the Multifamily Energy Efficiency Program?

1. Yes
2. No
98. Don't know
99. Refused

[IF PS12 = 1, ASK PS12A.]

PS12a. What are those suggestions? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)

_____**[OPEN-END]**

PS13. How would you rate your overall satisfaction with Duke Energy on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS13 < 5, ASK PS13A.]

PS13a. Why do you say that? (RECORD VERBATIM.)

_____**[OPEN-END]**

[NEW QUESTIONS – PS14-PS20A]

PS14. Do you consider Duke Energy as a resource for energy efficiency information?

1. Yes
2. No
98. Don't know
99. Refused

PS15. Have you heard of any other Duke Energy solutions or programs to help you save energy and money in your apartment? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Equipment incentives through the Smart Saver Energy Home Rebate Program, including HVAC, Water Heater, Insulation, Ductwork, Pool & Drives, and Refrigeration
2. Outdoor Lighting Solutions
3. Duke Online Savings Store for lighting measures
4. Lighting discounts at local retail stores
5. Refrigeration and Appliance Replacement
6. Heating and Cooling system replacement
7. Duke Free LED Program
8. Other (Please Specify)
9. No **[EXCLUSIVE]**
98. Don't Know
99. Refused

[PS16 REMOVED]

~~PS16. Do you find Duke Energy's solutions or programs helpful in saving energy and money in your apartment?~~

~~1. Yes~~
~~2. No~~
~~98. Don't know~~
~~99. Refused~~

[NEW QUESTION]

PS16O. Of the energy efficiency solutions or programs offered by Duke Energy, which ones would be the most useful to you? (READ LIST. RECORD ALL MENTIONS.)

1. Equipment incentives through the Smart Saver Energy Home Rebate Program, including HVAC, Water Heater, Insulation, Ductwork, Pool & Drives, and Refrigeration
2. Outdoor Lighting Solutions
3. Duke Online Savings Store for lighting measures
4. Lighting discounts at local retail stores
5. Refrigeration and Appliance Replacement
6. Heating and Cooling system replacement
7. Duke Free LED Program
8. None **[EXCLUSIVE]**
98. Don't Know (DO NOT READ)
99. Refused (DO NOT READ)

[ASK IF PS16O NE 98 OR 99]

PS16a. Why do you say these programs would be useful to you? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)

_____**[OPEN-END]**

PS17. Do you currently have a smart thermostat at your home?

1. Yes
2. No
98. Don't know
99. Refused

[IF PS17 = 2, ASK PS17A.]

PS17a. Would you be interested in a smart thermostat?

1. Yes
2. No
98. Don't know
99. Refused

PS18. Do you currently own an electric vehicle?

1. Yes
2. No
98. Don't know
99. Refused

[IF PS18 = 2, ASK PS18A.]

PS18a. Would you consider purchasing an electric vehicle in the next 1 to 3 years?

1. Yes
2. No
98. Don't know
99. Refused

PS19. Does your housing property have charging stations for electric vehicles?

1. Yes
2. No
98. Don't know
99. Refused

PS20. Does your housing property have solar panels?

1. Yes
2. No
98. Don't know
99. Refused

[IF PS20 = 2, ASK PS20A.]

PS20a. Would you like to see your housing property have solar panels installed?

1. Yes
2. No
98. Don't know
99. Refused

CLOSING: This completes the survey. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

APPENDIX C. PROPERTY MANAGER SURVEY GUIDE

This survey guide is targeted at property managers of Duke Energy's Multifamily Energy Efficiency Program (MEEP). The goal of property manager surveys includes informing, updating and improving the MEEP Program. This survey guide walks the interviewer through the phone call, which are to be made between 10:00am-8:30pm EST on weekdays, and 10:00am-5:00pm EST on Saturdays. No calls on Sundays. Navigant interviewer will introduce himself/herself and inform the customer about the purpose of the interview.

Company: _____ Telephone: _____
Name: _____ Cell phone: _____
Title: _____ Fax: _____
City: _____ State: _____ Zip: _____
Interview date: _____ Time: _____

S1. According to our records, your property participated in Duke Energy's Multifamily Energy Efficiency Program this year or during 2017 and received free installation of **lighting and/or water efficiency measures**. Is that correct?
Yes
98. No [Terminate]
99. Don't know
100. Refused

[*FOR TERMINATIONS]*: This study is for people who participated in Duke Energy's Multifamily Energy Efficiency Program this year or during 2017. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2. Are you the primary person who was involved in making the decision to receive the installation for the **lighting and/or water efficiency measures?**
1. Yes [Move to M1]
2. No [Continue]
3. Don't know [Continue]
98. Refused

S2a. I understand that the decision to install the **lighting and/or water efficiency measures** may have been driven by someone other than yourself. However, if you had some involvement in the process of the installation of the measures through the program your input will be helpful. Are you somewhat familiar with the program participation and installation process?
1. Yes [Continue]
2. No [Terminate]
3. Don't know [Terminate]
98. Refused

S2b. Can you direct me to the person who was involved in the decision making?

1. Yes [Gather correct contact information]
2. No [Terminate]
3. Don't know [Terminate]
4. Refused [Reassure participant prior to Terminating]

Survey Introduction

My questions are about the **lighting and/or water efficiency measures**[21] installed at [Insert Property] through the Duke Energy Multifamily Energy Efficiency Program this year or in 2017: I will ask about your satisfaction with the program as well as questions relating to your decision to participate in the program. Finally, I am also interested in hearing about any decisions to pursue efficiency projects at other properties your company manages.

Participation and Satisfaction

The first set of questions relate to your satisfaction with the program.

PS0. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how satisfied are you with your overall experience with the program? (INTERVIEWER: USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS0a. What is the reason for your rating? (RECORD VERBATIM)

PS1. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how satisfied are you with the program enrollment, lead time and communications involved with the program? If this does not apply to you, please say "Does Not Apply" (INTERVIEWER: USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS1a. [if PS1 response is 4 or less] What is the reason for your rating? (RECORD VERBATIM)

[21] If respondents participated prior to the introduction of LEDs into the program (October 2016), Navigant will inform the respondent that the questions only pertain to water measures.

PS1b. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how satisfied are you with the tenant notification and program materials from the program? (INTERVIEWER: USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS1c. [if PS1b response is 4 or less] What is the reason for your rating? (RECORD VERBATIM)

_____

PS2. On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how

satisfied would you say your tenants are with the new **lighting and water efficiency measures**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS2a. What is the reason for your rating? *(RECORD VERBATIM)*

_____

PS3. (ASK ONLY IF PARTICIPANT RECEIVED LEDs) The LED lighting equipment that your facility received is a relatively new offering of the program. Can you tell me about any feedback that you have received from your tenants about their experience with the LED lights? (RECORD VERBATIM)

PS4. (ASK ONLY IF PARTICIPANT RECEIVED LEDs) As the property manager, can you explain any differences that you have noticed in the quality of lighting from the LED lamps in the tenant spaces?

PS5. (ASK ONLY IF PARTICIPANT RECEIVED LEDs) As the property manager, can you explain any differences that you have noticed in reactions from prospective tenants to the quality of lighting as they are considering moving into your property?

PS6. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how satisfied are you with the program equipment options? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS6a. Why do you say that? (RECORD VERBATIM)

_____

PS7. Are there other equipment options, you think the program should include? (RECORD VERBATIM)

PS8. If you are responsible for any of the energy bills at your facility, have you noticed an increase, decrease or no change in the energy bills at your property since participating in the program?

1. Increase
2. Decrease
3. No Change
98. Don't Know
99. Refused

PS9. How would you rate your satisfaction with the installation team's "quality of work", on a scale of 0 to 10, with 0 meaning "not at all satisfied" and 10 meaning "extremely satisfied"? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS9a. Why do you say that? (RECORD VERBATIM)

_____

PS10. On a scale of 0 to 10, where 0 is "not at all likely" and 10 is "very likely", how likely are you to

recommend the Duke Energy Multifamily Energy Efficiency Program to other property managers? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS10a. Why do you say that? (RECORD VERBATIM)

_____

Awareness Questions

The next set of questions relate to your program awareness, prior planning, and decision making.

A1. How did you first learn about the Duke Energy Multifamily Energy Efficiency Program?
[DO NOT READ LIST. RECORD ALL MENTIONS.]

5. Duke Energy bill stuffer
6. Duke Energy mailing
7. Duke Energy website
8. Duke Energy email
9. Duke Energy phone call
10. On-site visit from Duke Energy program staff
11. Marketing by trade ally, vendor or contactor
12. Through family, friend, or neighbor
13. Participation in other Duke Energy Programs
14. Past program participants
15. Other [SPECIFY] _____
98. Don't know
99. Refused

A2. What was the primary reason for your decision to participate in the program?
[DO NOT READ LIST. RECORD ONLY ONE MENTION.]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke
8. Previous experience with other Duke programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation

14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Advertising
18. Advertising other than Duke
19. Federal tax credit
20. No other reasons
21. Other [SPECIFY] _____
98. Don't know
99. Refused

A3. Are there any other reasons you decided to install **lighting and water efficiency measures**? [DO NOT READ LIST. RECORD ALL MENTIONS]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke
8. Previous experience with other Duke programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation
14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Advertising
18. Advertising other than Duke.
19. Federal tax credit
20. No other reasons
21. Other [SPECIFY] _____
98. Don't know
99. Refused

Prior Plans

P1. Prior to participating in the Duke Energy program, <u>had you considered installing</u> the **lighting and water efficiency measures** at the property?

3. Yes [Continue]
4. No [Move to IC1]
98. Don't know

P1a. Please describe the plans you had to install the **lighting and water efficiency measures** prior to participating in the Duke Energy program.
[Record PM Response verbatim]:_____

P2. Thinking about before you decided to participate in the Duke Energy program. On a scale of 0 to 10, where 0 means you "had not yet started to plan for equipment or installation" and 10 means you "had identified and selected specific equipment and the contractor to install it", please tell me how far along you were in your plans to install the measures. (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Had not Yet planned for Equipment and Installation										Identified and selected specific equipment and the contractor to install it	Don't know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

Role of Contractor

P3a. Did an equipment vendor or contractor help you with selecting the **lighting and water efficiency measures**?

1. Yes [Move to P3c].
2. No [Continue]

98. Don't Know

P3b. If no, who selected the energy efficient measures?
[Record PM Response verbatim]:_____
[Move to IC1 when finished]

P3c. If yes, on a scale of 0 to 10, where 0 is "not at all important" and 10 is "extremely important," how important was the recommendation from an equipment vendor or contractor in your decision to install the **lighting and water efficiency measures**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

Importance: Categories

IC1. On a scale of 0 to 10, where 0 means "not at all important" and 10 means "extremely important", please tell me how important the Duke Energy program's free installation was in your decision to install the **lighting and water efficiency measures**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

IC2. On a scale of 0 to 10, where 0 means "not at all important" and 10 means "extremely important", please tell me how important the Duke Energy program's advertising and information was in your decision to install the **lighting and water efficiency measures**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

Own

O1. Please tell me in your own words how the program influenced your decision to install the **lighting and water efficiency measures**. (RECORD VERATIM)

_____

Likelihood

L1. Given everything you've just told me, what is the likelihood that you would have installed the same **lighting and water efficiency measures** without the Duke Energy program and its financial and technical assistance? Would you say you … [READ LIST]?

1. Definitely would NOT have installed the same **lighting and water efficiency measures without the Duke Energy program**
2. MAY HAVE installed the same **lighting and water efficiency measures**, even without the Duke Energy program
3. Definitely WOULD have installed the same **lighting and water efficiency measures,** even without the Duke Energy program

98. (DO NOT READ) Don't know

L1a. [If Option 2 was chosen] You indicated you may have installed the same energy efficient [INSERT MEASURES DENOTED ABOVE] , even without the Duke Energy program. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY

WOULD have installed", can you tell me the likelihood that you would have installed the same **measures** without the program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L2. Thinking about the quantity of measures you installed through the program, what is the likelihood that you would have installed the same quantity of the same **lighting and water efficiency measures** without the program's financial and technical assistance? Would you say you …[READ LIST]

1. Definitely would NOT have installed the same quantity of the same **lighting and water efficiency measures** without the Duke Energy program
2. MAY HAVE installed the same quantity of the same energy efficient **lighting and water efficiency measures**, even without the Duke Energy program
3. Definitely WOULD have installed the same quantity of the same energy efficient **lighting and water efficiency measures**, even without the Duke Energy program

98. (DO NOT READ) Don't know

L2a. [If Option 2 was chosen] You indicated you may have installed the same quantity of the same measures even without the Duke Energy program. Using a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same quantity of the same **lighting and water efficiency measures without the program**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3. [For all participants] Is there a chance you would have had at least some of the work done without the program?

1. Yes [Continue]
2. No [Skip to IS1]

98. Don't know

L3a. Could you estimate the percentage of the work that you might have had done without the program? _____%

L3b. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", what is the likelihood you might have installed [INSERT

L3A ANSWER] percent of the **lighting and water efficiency measures** without the Duke Energy program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L4c. You mentioned you might have done some work without the program, please describe what you might have had done. (RECORD VERBATIM)

_____

[Continue to T1]

L5. Without the program, about when would you have installed the **lighting and water efficiency measures**?

Would it have been…(READ LIST)?

1. At the same time as you did
2. Within 1 year of the time you did
3. Between 1 and 2 years within the time you did
4. Sometime after 2 years within the time you did
5. Would have never installed without the program

Spillover

Thank you for your time and patience; the final set of questions relate to your additional improvements made because of the program.

IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at your property?

1. Yes [Continue]
2. No [Skip to IS5]
98. Don't know

IS2. Please tell me the types of additional energy efficient equipment and the quantity you had installed where you did not receive a program rebate. [INTERVIEWER: RECORD MEASURE DESCRIPTION AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?]

Measure Description	Quantity
1._____	_____
2._____	_____

3._____ _____
4._____ _____
5._____ _____
6._____ _____

IS3. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at your property that were not part of a program rebate. (RECORD VERBATIM)

IS4. On a scale of 0 to 10, where 0 is "not at all important" and 10 is "extremely important," how important was your participation in the program in your decision to install the additional energy efficiency equipment? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

IS5. Did your company mandate that this property to participate in this program?

1. Yes
2. No
98. Don't know
99. Refused

IS6. Aside from the primary property that participated in the program, did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at any other properties managed by your company?

1. Yes
2. No
98. Don't know

IS7. To your knowledge, did your company mandate other owned properties, aside from this property, to participate in this program or install energy efficiency measures?

1. Yes
2. No
98. Don't know
99. Refused

IS8. Is there anything you would suggest to improve Multifamily Energy Efficiency Program? (RECORD VERBATIM)

_____

CLOSING:

This completes the survey. Your responses are very important to DUKE ENERGY and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

I/A

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Duke Energy Carolinas and Duke Energy Progress

Non-Residential Smart $aver® Prescriptive Program Evaluation Report – Final

July 16, 2020

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1. Evaluation Summary

1.1 Program Summary

The Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) Smart $aver® Program provides incentives for electric commercial and industrial customers to purchase and install high-efficiency lighting products, HVAC systems, pumps and drives, as well as qualifying process, food service, and information technology. Incentives are available for new construction and retrofits and replacements. Prescriptive incentives under the program are limited to 75% or less of the customer cost. The program has three delivery channels:

- The **main channel** for the program is application-based and primarily delivered through trade allies.
- The **midstream channel** allows distributors to provide incentives directly to prequalified customers on applicable equipment and receive reimbursement for those incentives from Duke Energy.
- The **Business Savings Store** on the Duke Energy website offers customers a limited number of qualified products for which they can receive an instant discount.

All three channels offer the same incentive levels. The evaluation period for this program is from March 1, 2017 to December 31, 2018.

1.2 Evaluation Objectives

The majority of ex ante savings were realized through the main channel (50% DEC, 54% DEP) and the midstream channel (48% DEC, 46% DEP). As a result, the focus of this evaluation is on those two channels. While the scope of this evaluation did not include research specific to the Business Savings Store, our deemed savings review considered all measures incented through the program, irrespective of delivery channel. In addition, we applied results from our research for the main channel and the midstream channel to Business Savings Store projects.

Our evaluation addressed the following key objectives:

Gross Impact Evaluation

- Update deemed savings values through review of measure assumptions and calculations.
  - Develop updated per-unit savings values for reviewed measures.
  - Document causes of differences between ex ante and ex post (evaluated) savings estimates.
- Verify program-tracked hours of use (HOU) for a sample of lighting projects through on-site metering.
  - Develop a population-level HOU adjustment factor for key lighting technologies for incorporation into updated deemed-savings values.
- Assess differences, if any, in self-reported lighting HOU between applications completed by customers versus trade allies.
- Verify installed quantities and measure characteristics for a sample of main channel projects through desk reviews.
  - Develop project-specific realization rates.

  - Document causes of differences between tracked and verified information.
  - Develop a population-level quantity adjustment factor by technology.
- Verify installed quantities for a sample of midstream lighting projects through the participant survey.
  - Develop project-specific realization rates.
  - Develop a population-level quantity adjustment factor.
- Estimate verified gross energy and peak demand savings (both summer and winter), by technology, via engineering analysis, based on the deemed savings and quantity adjustment factors.
- Develop overall gross realization rates for each technology.

Net-to-Gross Analysis

- Estimate free-ridership (FR) for main channel and midstream channel projects, including separate estimates for main channel lighting and non-lighting.
- Estimate participant spillover (PSO) for main channel and midstream channel participants.
- Estimate trade ally spillover (TA SO) for the main channel.
- Develop Net-to-Gross Ratios (NTGRs) for lighting and non-lighting projects, providing separate estimates by channel as well as aggregated estimates.

Process Evaluation

- Identify barriers to program participation and how these barriers can be addressed.
- Identify program strengths and opportunities for improvements.
- Assess participant and trade ally satisfaction with program processes.
- Assess trade allies' perception of the status of the lighting market.
- Provide a high-level assessment of remaining opportunities for energy efficiency upgrades of lighting and non-lighting measures.

1.3 Key Findings

During the evaluation period, non-residential customers completed close to 19,000 projects through the DEC Smart $aver® Program and close to 7,000 projects through the DEP Smart $aver® Program. The DEC projects generated approximately 482 GWh of ex post gross energy savings, 86 MW of ex post gross summer peak demand savings, and 84 MW of ex post gross winter peak demand savings. The DEP projects generated approximately 177 GWh of ex post gross energy savings, 31 MW of ex post gross summer peak demand savings, and 30 MW of ex post gross winter peak demand savings.

The main channel accounted for the majority of ex post gross energy savings in both service territories (51% DEC, 54% DEP). The midstream channel gained a lot of traction during the evaluation period and almost equaled the main channel in contribution to savings (48% DEC, 46% DEP). A relatively small share of savings was generated through the Business Savings Store (2% DEC, 1% DEP; see Table 1-1).

In both jurisdictions, lighting accounted for the vast majority of program projects and savings.

Table 1-1. Summary of Ex Post Gross Energy Savings

Delivery Channel	DEC		DEP	
	MWh	Percent [a]	MWh	Percent [a]
Main Channel	243,946	51%	95,034	54%
Midstream Channel	230,286	48%	81,129	46%
Business Savings Store	7,814	2%	967	1%
TOTAL	**482,047**	**100%**	**177,131**	**100%**

[a] Individual values do not sum to totals due to independent rounding.

Gross Impact Findings

Our gross impact analysis found overall gross realization rates (RRs) for energy and demand savings close to 100%, ranging from 96% to 102%, for both DEC and DEP. These results were driven by the following:

- Our deemed savings review made small adjustments to lighting projects and somewhat larger adjustments to projects in the pumps and drives category.
- The light logger study resulted in HOU estimates for LED tube and LED panel measures that are 16% higher than data in the program-tracking database.
- The database comparison of HOU reported by trade allies and customers, respectively, found close alignment between the two sources in the aggregate but variations at the measure-group level.
- Our desk reviews of main channel projects found relatively few data tracking issues with respect to the quantities of installed measures, adjusting the quantities for only 11 of the 136 sampled projects. One food service project had a quantity adjustment that significantly affected the overall RR for that end-use.
- In-service rates for midstream participants were also high, at 99% for DEC and 97% for DEP.

Table 1-2 and Table 1-3 summarize the overall gross energy and demand impacts, respectively, for DEC and DEP.

Table 1-2. Overall Gross Energy Impacts

Technology	DEC			DEP		
	Ex Ante kWh	Realization Rate	Ex Post kWh	Ex Ante kWh	Realization Rate	Ex Post kWh
Lighting	473,196,869	97%	459,722,955	175,849,149	96%	168,509,214
Pumps and Drives	9,621,917	100%	9,604,616	1,468,036	115%	1,694,655
HVAC	8,438,190	100%	8,415,298	4,762,444	100%	4,752,610
Food Service	3,464,138	81%	2,816,818	1,038,041	81%	844,294
Process	1,455,989	100%	1,455,950	143	100%	143
IT	31,499	98%	31,027	1,329,977	100%	1,329,694
TOTAL	**496,208,603**	**97%**	**482,046,663**	**184,447,789**	**96%**	**177,130,609**

Table 1-3. Overall Gross Demand Impacts

Technology	DEC			DEP		
	Ex Ante kW	Realization Rate	Ex Post kW	Ex Ante kW	Realization Rate	Ex Post kW
Summer Demand Impacts						
Lighting	83,501	97%	81,372	29,960	97%	28,977
Pumps and Drives	1,427	100%	1,425	171	136%	232
HVAC	2,447	100%	2,447	1,225	100%	1,225
Food Service	300	72%	216	79	72%	57
Process	260	100%	260	0	N/A	0
IT	0	N/A	0	128	100%	128
TOTAL	**87,934**	**97%**	**85,719**	**31,563**	**97%**	**30,618**
Winter Demand Impacts						
Lighting	79,375	102%	80,656	28,173	102%	28,703
Pumps and Drives	1,481	100%	1,478	151	139%	211
HVAC	1,121	100%	1,120	799	100%	799
Food Service	288	71%	204	77	71%	55
Process	276	100%	276	0	100%	0
IT	0	N/A	0	0	N/A	0
TOTAL	**82,540**	**101%**	**83,734**	**29,201**	**102%**	**29,768**

Net Impact Findings

We estimate the program-level NTGR to be 88.4% for DEC and 79.5% for DEP. For all three analysis groups (main channel lighting, main channel non-lighting, and midstream lighting), the DEC NTGRs are higher than the corresponding DEP NTGRs. For both jurisdictions, the lighting NTGRs (both main channel and midstream) are higher than the non-lighting NTGRs.

Table 1-4 presents the individual net-to-gross (NTG) components (i.e., FR, PSO, and TA SO) and the resulting NTGRs by jurisdiction and channel/technology group (i.e., lighting and non-lighting). The NTGR is calculated as 1 – FR + PSO + TA SO.

Table 1-4. Summary of NTG Results

	Free-Ridership	Participant SO	Trade Ally SO	NTGR [a]
DEC				
Main Channel Lighting	18.1%	0.04%	7.0%	88.9%
Main Channel Non-Lighting	26.7%			80.3%
Midstream Lighting	11.5%	0.10%	-	88.6%
TOTAL DEC	**15.3%**	**0.07%**	**3.6%**	**88.4%**
DEP				
Main Channel Lighting	31.2%	0.04%	7.0%	75.8%
Main Channel Non-Lighting	34.5%			72.5%
Midstream Lighting	15.9%	0.10%	-	84.2%
TOTAL DEP	**24.3%**	**0.06%**	**3.8%**	**79.5%**

[a] NTGR = 1 – FR + PSO + TA SO

Table 1-5 and Table 1-6 summarize ex post gross and net savings for the evaluation period for DEC and DEP, respectively.

Table 1-5. Summary of DEC Ex Post Gross and Net Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Main Channel	**243,946,395**	**44,453**	**42,831**	**0.88**	**215,112,095**	**39,161**	**37,820**
Lighting	*223,443,824*	*40,278*	*39,829*	*0.89*	*198,641,559*	*35,807*	*35,408*
Pumps and Drives	*9,604,616*	*1,425*	*1,478*	*0.80*	*7,715,772*	*1,145*	*1,188*
HVAC	*6,659,752*	*2,278*	*1,050*	*0.80*	*5,350,045*	*1,830*	*844*
Food Service	*2,784,828*	*213*	*202*	*0.80*	*2,237,164*	*171*	*162*
Process	*1,453,375*	*260*	*272*	*0.80*	*1,167,554*	*209*	*218*
IT	-	-	-	*0.80*	-	-	-
Midstream Channel	***230,286,322***	**40,071**	**39,616**	**0.89**	***204,029,075***	**35,502**	**35,099**
Lighting	*230,076,090*	*39,876*	*39,615*	*0.89*	*203,842,814*	*35,329*	*35,098*
Non-Lighting	*210,232*	*196*	*2*	*0.89*	*186,261*	*173*	*1*
Business Savings Store	***7,813,947***	**1,194**	**1,286**	**0.89**	***6,923,001***	**1,058**	**1,140**
TOTAL DEC	**482,046,663**	**85,719**	**83,734**	**0.88**	**426,064,171**	**75,722**	**74,059**

Table 1-6. Summary of DEP Ex Post Gross and Net Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Main Channel	95,034,465	16,442	15,678	0.76	71,780,071	12,413	11,852
Lighting	*86,819,822*	*14,852*	*14,628*	*0.76*	*65,821,580*	*11,260*	*11,090*
Pumps and Drives	*1,694,655*	*232*	*211*	*0.73*	*1,229,218*	*168*	*153*
HVAC	*4,366,481*	*1,174*	*785*	*0.73*	*3,167,227*	*851*	*569*
Food Service	*832,522*	*56*	*54*	*0.73*	*603,870*	*41*	*39*
Process	*143*	*-*	*0.3*	*0.73*	*104*	*-*	*0.2*
IT	*1,320,842*	*128*	*-*	*0.73*	*958,073*	*93*	*-*
Midstream Channel	*81,128,776*	14,066	13,956	0.84	*68,303,128*	11,842	11,750
Lighting	*81,053,594*	*14,003*	*13,955*	*0.84*	*68,239,832*	*11,790*	*11,749*
Non-Lighting	*75,182*	*62*	*1*	*0.84*	*63,296*	*52*	*1*
Business Savings Store	*967,368*	111	134	0.84	*814,437*	93	113
TOTAL DEP	177,130,609	30,618	29,768	0.80	140,897,636	24,348	23,714

Process Findings

The process evaluation for the **main channel** focused on program processes (including the new pre-qualification option), customer and trade ally satisfaction with the program, opportunities for program improvement, the status of the commercial lighting market, and remaining opportunities for lighting and non-lighting upgrades. For the **midstream channel**, the process evaluation was limited to an assessment of participant satisfaction. The following are key findings:

Sources of Information

- Contractors and trade allies continue to be a key source of information for main channel participants. Participants most often first learn about the program from a trade ally or contractor (55% DEC, 53% DEP), and about three-quarters receive equipment selection support from a contractor or vendor. For close to half of participants, the contractor or vendor is the most influential party in identifying the installed equipment.
- Midstream participants are generally aware of the discount at the time they purchase the equipment (91% DEC, 89% DEP), and almost all of them are aware that Duke Energy provided the discount. Participants aware of the discount most often learn about it from their distributor (69% DEC, 74% DEP).

Pre-Qualification Option

- Two-thirds of trade allies (66%) are aware of the pre-qualification option and 36% have used it. Trade allies see the certainty of knowing that the equipment will qualify and what the incentive amount will be as the main benefits of the pre-qualification option. Notably, responses suggest that some trade allies believe that the incentive is “set aside” or “guaranteed.”

- Awareness of the pre-qualification option is significantly lower among participating customers (29% DEC, 35% DEP). In addition to providing certainty about equipment eligibility and incentive levels, the pre-qualification option helps some participants secure internal budget approval.
- The likelihood of future use is higher among participants (91% DEC, 96% DEP) compared to trade allies (75%). The main reason for not planning on using the option is already being familiar with qualifying equipment and incentive levels and therefore not needing to pre-qualify applications.

Satisfaction

- Main channel participants are generally satisfied with their program experience and with most program components. All program components included in the survey received a mean rating of 7.6 or higher (on a scale of 0 to 10 [1]), and the program overall was rated an average of 8.2 and 8.4 by DEC and DEP participants, respectively. DEC participants are least satisfied with the application process and eligible measures, while DEP participants are least satisfied with incentive levels.
- Main channel trade allies are slightly less satisfied with the program than main channel participants, giving mean satisfaction ratings between 7.0 and 8.6. The mean rating for the program overall was 8.0, with 69% of trade allies being "satisfied."[2] Trade allies expressed the lowest satisfaction with incentive levels (mean rating of 7.0), often pointing to decreasing lighting incentives over time, which they believe has had an adverse effect on the number and scope of LED projects.
- Midstream participants have a more streamlined program experience (compared to main channel participants) and are generally very satisfied with it (giving mean ratings ranging from 8.8 to 9.4).

Remaining Opportunities for Energy Efficiency Upgrades

- Smart $aver® lighting projects generally address the majority of interior lighting in participants' facilities (on average 89% DEC, 74% DEP), leaving little opportunity for future upgrades. More than one-third of lighting projects addressed all interior lighting, while only 12% of projects addressed 50% or less.
- Among participants who completed non-lighting projects, linear LEDs (38%) and nonlinear LEDs (34%) are the lighting types most commonly present at their facilities. Only 11% of participants with non-lighting projects have no LEDs or CFLs at their facilities but 59% have at least some inefficient lighting technologies (including incandescent/halogen bulbs, HID lighting, or T8/T10/T12 linear fluorescent lighting), suggesting some remaining opportunities among this group of participants.
- Reduced cost (31%), increased selection (16%), and quality improvements (14%) for LEDs are most often identified by participating trade allies as key developments in the non-residential lighting market. However, many trade allies believe that utility incentives are still needed to support customer adoption of LEDs, noting adverse consequences of recent incentive reductions on their LED sales. Close to half of interviewed trade allies consider the program incentive very influential on LED selection and on project timing.
- Among participating customers, heating, cooling, and information technology are the most common non-lighting types of energy-using equipment, and they are also the most likely to have undergone energy-efficient upgrades in the past five years. Nevertheless, a large share of facilities with these equipment types have not recently made upgrades—or have made standard-efficiency upgrades—and might therefore present opportunities for future program participation.

[1] A rating of 0 means "extremely dissatisfied;" a rating of 10 means "extremely satisfied."
[2] "Satisfied" is defined as a rating of 8 or higher on the 0 to 10 satisfaction scale.

- Trade allies and participants most often identify upfront cost as the key barrier to energy-efficient upgrades to non-lighting equipment. Both groups most commonly identify awareness and knowledge as the key barrier to program participation but also note other barriers, including incentive levels, the equipment eligible for incentives, and the required paperwork.
- Trade allies most commonly identify HVAC equipment and motors/VFDs as types of non-lighting products with the most potential for increased program uptake, matching their areas of expertise.

1.4 Evaluation Recommendations

Based on our impact and process research, we identified the following opportunities for program improvement.

Recommendation 1: Continue to Improve Data Collection and Tracking Processes

Our review and processing of program-tracking data revealed a few issues that, if addressed, would allow program staff to better track program activity and potentially also improve future realization rates. In particular, areas that can be improved include the following:

- **Perform additional quality assurance steps on the data entered into the program-tracking database.** While our impact analysis generally found few data tracking issues, each of the last two evaluations of this program found a major discrepancy in the quantity tracked for one food service project, which significantly impacted the RR for that end-use. While it is impossible to ensure perfect data entry for a program of this size, additional checks could catch these impactful errors. In specific, the program may wish to generate statistics on the incentive amount per unit of quantity for each type of measure to identify outlier values. In addition, single records that account for unusually large shares of savings for non-lighting end-uses can provide useful flags for potential data entry errors. Similarly, a small share of annual HOU values in the program-tracking data (36 of 22,208, or 0.2%) were outside the range of valid values (i.e., above 8,760 hours), in some cases significantly. If used for any analytical purposes, such invalid values could be caught with a simple check on maximum values.
- **Ensure that customer contact information is collected for each project.** This evaluation was the first one for the Smart $aver® Prescriptive Program to use an online survey with program participants. Fielding of the main channel survey was difficult as 10% of projects listed a trade ally or billing service as the primary contact and did not include an email address for the participating customer. To allow for important evaluation activities, including the assessment of FR and PSO, the program should ensure that valid contact information for participating customers is collected.

Recommendation 2: Continue to Promote the Pre-Qualification Option

The pre-qualification option is a popular new feature of the program that is known to a majority of trade allies; however, the feature remains unknown to many customers: Only about a third of participating customers knew of its existence but many of them expressed an interest in taking advantage of it. Featuring information about the pre-qualification option in future marketing to customers could help promote participation and further improve customers' experience with the program. In addition, some trade allies appeared to think that if they used the pre-qualification option, incentives are reserved or guaranteed. The program may wish to more clearly communicate to trade allies that pre-qualification does not mean that incentives are reserved, especially if the program should ever be in a situation of potentially exhausting its incentive budgets.

Recommendation 3: Continue to Develop Tools to Streamline the Application Process

A somewhat cumbersome and sometimes unclear application process continues to be a source of participant and trade ally dissatisfaction. In fact, a few interviewed trade allies noted that they now only use the midstream channel (which has a simpler participation process) or sometimes forgo participation in the program altogether. The program should continue to develop tools to streamline this process, which could include more guidance on required steps (e.g., a workflow sheet) and better functionality of the online portal (e.g., lookup or pre-fill functions).

Recommendation 4: Reduce Uncertainties around Incentive Levels

Trade allies who were less than satisfied with incentive levels often pointed to decreasing lighting incentives over time, which they believe has had an adverse effect on the number and scope of their LED projects. This is due not only to the incentive amount covering less of the incremental cost but also to the uncertainty it introduces for planning projects. While periodic adjustments to incentives are inevitable and needed to optimize program performance, the program may wish to consider approaches that reduce uncertainty among trade allies and customers. For example, the program could establish and circulate a policy of incentive adjustments that occur at specific times, e.g., on January 31st of every year (and avoid, if at all possible, additional unscheduled adjustments). This would allow trade allies and customers to plan for project completion prior to the selected date if they want to be certain of the incentive amount. Another option would be to provide advanced notification of upcoming adjustments to registered trade allies, which would not only reduce uncertainty for this group but might also motivate more contractors to join the trade ally network.

Recommendation 5: Continue Marketing and Education around Non-Lighting Technologies

Both trade allies and participants identified awareness and knowledge as the most significant barrier to increasing the number of non-lighting projects completed through the program. Program staff should continue to provide information on non-lighting technologies and assist trade allies with promoting this part of the program. Recommendations provided by trade allies included more in-person outreach by trade ally representatives to discuss non-lighting opportunities, case studies and other tools to help determine and communicate potential energy savings from non-lighting measures, and incentivized energy audits for customers to showcase ways to save energy besides lighting.

2. Program Description

This section describes key elements of program design, implementation, and performance. The evaluation period addressed in this report is March 1, 2017 to December 31, 2018.

2.1 Program Design

The Duke Energy Carolinas and Duke Energy Progress Smart $aver® Prescriptive Program provides per-unit incentives for electric commercial and industrial customers to purchase and install qualifying high-efficiency equipment in six technology categories: lighting, HVAC equipment, pumps and drives, food service equipment, process equipment, and information technology equipment. Incentives are available for new construction, retrofits of existing equipment, and replacements of failed equipment. Prescriptive incentives under the program cannot exceed 75% of the customer's equipment cost.

The program has three delivery channels:

1. The **main channel** for the program is application-based and primarily delivered through trade allies.
2. The **midstream channel** allows distributors to provide incentives directly to prequalified customers on applicable equipment and receive reimbursement for those incentives from Duke Energy.
3. The **Business Savings Store** on the Duke Energy website offers customers a limited number of qualified products for which they can receive an instant discount.

All three channels offer the same incentive levels.

The program made a few design changes during the evaluation period, including (1) the addition of new measures, including additional LED measures; (2) a reduction in incentive levels for many types of LEDs; (3) the introduction of a new pre-approval option, which allows customers and trade allies to receive confirmation about a product's eligibility and the expected incentive level;[3] and (4) a modification to the program's 90-day "grace period" to no longer allow customers/trade allies to make a new installation after the effective date of new incentives and still claim old incentive levels if inside the 90-day window.

2.2 Program Implementation

Duke Energy staff implement the Smart $aver® Prescriptive Program with contractor support for specific program components. The program is also offered in other Duke Energy territories, and most program staff share responsibilities across the territories. In the DEC and DEP territories, the program is managed by two program staff, with support from Duke Energy marketing staff, a trade ally outreach team, a team of Business Energy Advisors (BEAs), and operational support for processing applications. In addition, Large Business Account Managers and Local Government and Community Relations staff assist with outreach efforts.

The program is marketed to commercial and industrial customers through targeted outreach and communications by the program. Marketing approaches during the evaluation period primarily included email and online marketing. Additional outreach is conducted by Large Business Account Managers, BEAs, and Local Government and Community Relations staff.

[3] See Section 6.3.2 for a more detailed description of this option.

The trade ally outreach team is specifically tasked with marketing the program to trade allies, who in turn are encouraged to promote the program to their customers. The trade ally outreach team manages existing trade ally relationships, recruits new trade allies, and educates trade allies about the program offerings and changes in the program as they occur. The program also offers a co-marketing campaign for trade allies that provides reimbursement for up to 50% of their marketing costs (up to $2,000).

2.3 Program Performance

Based on the program-tracking database, the program completed 18,908 projects in DEC territory and 6,870 projects in DEP territory.[4] These projects were completed by over 8,800 unique DEC customers and over 3,000 unique DEP customers.[5] They accounted for approximately 482 GWh and 177 GWh of ex post gross savings for DEC and DEP, respectively.

Close to half (49%) of all DEC projects were completed through the midstream channel, compared to 42% through the main channel and 9% through the Business Savings Store. In DEP territory, equal shares (48%) of projects were completed through the main and midstream channels, and 4% went through the Business Savings Store.

Table 2-1 summarizes these results, by jurisdiction.

Table 2-1. Summary of Projects, Customers, and Ex Post Gross Savings

Delivery Channel	Projects		Number of Unique Customers [a]	Ex Post Gross Savings	
	Number	Percent		MWh	Percent
DEC					
Main Channel	7,880	42%	4,124	243,946	51%
Midstream Channel	9,246	49%	4,157	230,286	48%
Business Savings Store	1,782	9%	1,186	7,814	2%
TOTAL DEC	**18,908**	**100%**	**8,852**	482,047	100%
DEP					
Main Channel	3,292	48%	1,548	95,034	54%
Midstream Channel	3,311	48%	1,487	81,129	46%
Business Savings Store	267	4%	211	967	1%
TOTAL DEP	**6,870**	**100%**	**3,058**	177,131	100%

[a] Note that some customers participated in more than one delivery channel. As a result, the sum of unique customers across delivery channels does not add to the DEC and DEP totals.

[4] The program-tracking database tracks measures but not projects. For evaluation purposes, we defined a unique project as one or more measures of the same technology installed by the same customer (based on account number and name), at the same location, at the same time.

[5] Unique customers are defined at the company level, rather than the location level (i.e., a company that participated at more than one locations is only counted once).

3. Overview of Evaluation Activities

To address the objectives outlined in Section 1.2, the evaluation team performed a range of data collection and analytic activities, including:

- Program staff interviews (n=2)
- Program material review
- Program-tracking database review
- Main channel participant survey (n=170)
- Midstream channel participant survey (n=148)
- Trade ally survey (n=146)
- Engineering desk reviews (n=136)
- Deemed savings review of select measures (n=47)
- Lighting logger on-site visits (n=37)

3.1 Program Staff Interviews

We conducted an in-depth interview with the two Smart $aver® Prescriptive Program managers in November 2018. The purpose of the interview was to collect information on the Smart $aver® Prescriptive Program, including changes in program design and implementation since the last evaluation and the program's goals, successes, and challenges during the evaluation period.

3.2 Program Material Review

The evaluation team reviewed the prior evaluation report for the DEC and DEP Non-Residential Prescriptive Program[6] as well as summary documentation describing the program design and implementation approach, application templates, the 2018 marketing plan, and documentation of incentivized technologies. In support of the gross impact evaluation, we also reviewed a number of technical reference manuals (TRMs) and a variety of secondary materials documenting Duke Energy's ex ante deemed savings assumptions. The full list of these materials is included in the Deemed Savings Review Memorandum, provided in the Appendix.

3.3 Program-Tracking Database Review

We received a data extract from the program-tracking database that contained the data needed in support of our evaluation. Our team of energy data scientists and engineers cleaned these data and created two evaluation datasets (one at the measure level and one at the project level) that reflect program activity during the evaluation period and that could be used for the gross impact analysis and for survey sampling. Key data-cleaning activities included verification of installation dates, removal of duplicate and otherwise ineligible records (e.g., zero savings), development of project IDs, development of ex ante savings (by multiplying per-

[6] Duke Energy Carolinas/Duke Energy Progress Non-Residential Prescriptive Program Evaluation Report (March 25, 2018; Opinion Dynamics)

unit savings by measure quantities), and cleaning of customer and trade ally contact information for sampling purposes.

3.4 Main Channel Participant Survey

We fielded an online survey with a stratified random sample of participants in the main channel. The survey was fielded in October and November 2019. The survey was designed to collect information on FR and PSO for main channel projects (in support of the net impact analysis) and on program processes, such as awareness and prior use of the pre-qualification option, as well as barriers to future participation and program satisfaction.

Sample Design

The survey sample was designed to allow for the development of statistically significant FR estimates (targeting 10% relative precision at 90% confidence) by jurisdiction and for lighting and non-lighting projects. We further stratified the sample in all four groups based on project savings. While the sampling unit for this survey was the unique customer contact, the FR questions had to be asked about a specific project completed by that customer. Because many customers had completed more than one project during the evaluation period, our sampling approach prioritized projects in strata with fewer available sample points, i.e., projects with larger savings and non-lighting projects.

We completed a total of 170 interviews with customers who participated in the program's main delivery channel, 103 with DEC participants and 67 with DEP participants. The average length of the interviews was approximately 17 minutes; the response rate was 7.4%. Table 3-1 summarizes the population and number of survey completes, by jurisdiction and technology.

Table 3-1. Sampling Approach for Main Channel Participant Survey

Technology	DEC		DEP	
	# of Projects in Population (Main Channel)	# of Completes	# of Projects in Population (Main Channel)	# of Completes
Lighting	6,745	59	2,667	55
Non-Lighting	1,135	44	625	12
Pumps and Drives	*53*	*4*	*16*	*1*
HVAC	*595*	*33*	*268*	*8*
Food Service	*446*	*3*	*273*	*3*
Process	*41*	*4*	*1*	-
IT	-	-	*67*	-
TOTAL	**7,880**	**103**	**3,292**	**67**

It should be noted that some respondents did not complete the entire survey but completed all questions in the NTG module. These partial respondents were included in the FR and PSO analyses. As such, the NTG analyses are based on a different number of respondents than shown in Table 3-1.

3.5 Midstream Channel Participant Survey

We fielded an online survey with a stratified random sample of participants in the midstream channel. While the midstream channel includes non-lighting measures, the vast majority of midstream savings is associated with lighting measures. As such, our survey only included participants who made lighting purchases.

The objective of this survey was to verify the purchase and installation of the incented lighting products (in support of the gross impact analysis) and to collect information on FR and PSO for midstream channel projects (in support of the net impact analysis). Process questions were limited to participant satisfaction.

Sample Design

The survey sample was designed to allow for the development of statistically significant in-service rate (ISR) and FR estimates (targeting 10% relative precision at 90% confidence) by jurisdiction. We stratified the sample for each jurisdiction based on savings. While the sampling unit for this survey was the unique customer contact, the ISR and FR questions had to be asked about a specific purchase made by that customer. Because many customers had made more than one purchase during the evaluation period, our sampling approach prioritized purchases in strata with fewer available sample points, i.e., purchases with larger savings.

A total of 148 midstream channel participants completed the survey. The average length of the interviews was approximately 21 minutes; the response rate was 10.5%. Table 3-2 summarizes the population and number of midstream channel participant survey completes by jurisdiction.

Table 3-2. Sampling Approach for Midstream Channel Participant Survey

Jurisdiction	Population (Lighting Purchases)	Survey Completes
DEC	9,228	75
DEP	3,298	73
TOTAL	**12,526**	**148**

It should be noted that some respondents did not complete the entire survey but completed all questions in the ISR module and/or the NTG module. These partial respondents were included in the ISR and/or the NTG analyses. As such, the ISR and NTG analyses are based on a different number of respondents than shown in Table 3-2.

3.6 Trade Ally Survey

We conducted an online survey with trade allies who had completed at least one project through the DEC and/or DEP Smart $aver® Prescriptive Program during the evaluation period. The goals of this survey were to support estimation of TA SO attributable to the Smart $aver® Prescriptive Program and to explore various process topics, such as contractor experience, satisfaction with, and awareness of program processes; drivers of the LED market; and barriers to installation of efficient non-lighting equipment.

Sample Design

We sent an email invitation to each company that served as a trade ally for at least one project incentivized by the Smart $aver® Prescriptive Program during the evaluation period, i.e., we attempted a census of participating trade ally companies. As such, our data collection approach was not sample-based, and the

concept of sampling precision does not apply. To promote participation in the survey, we offered an incentive of $50 to every trade ally who completed the survey.

Overall, 146 trade allies completed the survey, including 109 that primarily serve DEC customers, 31 that primarily serve DEP customers, and 6 that supported the same number of projects in both jurisdictions. The response rate was 18.9%.

3.7 Engineering Desk Reviews

To verify measure quantities reported in the program-tracking database, our engineering team performed 136 desk reviews of main channel projects (84 for DEC and 52 for DEP projects), sampling by technology. The desk reviews consisted of a thorough examination of all available program documentation for the projects, including applications, invoices, and specification sheets.

To select projects for desk reviews, we used a stratified random sampling approach, stratifying by technology and project savings (see Table 3-3). We targeted 10% relative precision at 90% confidence for the resulting quantity adjustments, by technology.

Table 3-3. Summary of Desk Reviews

Technology	Number of Projects	
	Population (Main Channel)	Desk Reviews
Lighting	9,412	62
HVAC	863	30
Food Service	719	18
Pumps and Drives	69	12
Process	42	8
IT	67	6
TOTAL	11,172	136

3.8 Deemed Savings Review

To assess ex ante per-unit savings values, our engineering team performed a deemed savings review of select measures across all delivery channels. Because of the large number of unique measures incented during the evaluation period (a total of 275), we first identified measures that accounted for the largest share of program savings, i.e., measures that individually accounted for at least 0.5% of total ex ante program savings, as well as closely related measures (e.g., the same type of lighting but with a different wattage or number of lamps). Per Duke Energy's request, we then excluded from this list measures that were discontinued in 2019. In total, we reviewed 47 individual measures, which accounted for approximately 86% of total program energy savings.

For each of these 47 measures, we reviewed existing program documents, program-tracking data, assumptions, TRMs, and other resources, as applicable, to determine the appropriateness of the per-unit savings values. In addition, we incorporated results from the lighting HOU logger study into the deemed savings estimates for key lighting measures (see Section 3.9). We then updated the per-unit savings for several measures, based on the review of materials.

3.9 Lighting Hours of Use Logging

To verify program-tracked HOU for incented lighting equipment, Opinion Dynamics conducted on-site metering visits for a sample of lighting projects and developed annual HOU estimates for logged lighting equipment.

Opinion Dynamics conducted on-site metering visits for a sample of 37 lighting projects, a subset of lighting projects sampled for desk reviews. Deployment visits took place between June 24 and June 28, 2019. During these visits, we confirmed the installation of the energy-efficient lighting measures and deployed a total of 157 loggers (between 1 and 12 loggers per site). Between August 5 and August 7, 2019, we retrieved 153 of the 157 deployed loggers.

4. Gross Impact Evaluation

4.1 Methodology

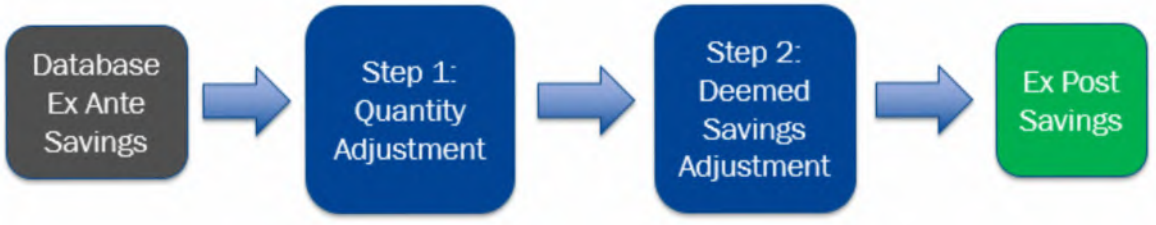
Our gross impact evaluation included five main evaluation activities (1) a program-tracking database review, (2) engineering desk reviews to verify measure quantities for main channel projects, (3) a survey-based ISR analysis to verify measure quantities for midstream channel purchases, (4) a review of Duke Energy's ex ante (deemed) savings assumptions, and (5) a lighting HOU logging study to verify program-tracked lighting HOU values.

The evaluation team used these activities to develop ex post (verified) gross savings and realization rates at the technology level, by delivery channel and jurisdiction. The methodology consisted of two general steps:

- Step 1: Quantity Adjustment
  - For the main channel, the quantity adjustment was based on a sample of 136 engineering desk reviews. We developed technology-specific quantity adjustment factors, which we applied to the main channel measure quantities in the program-tracking database. The sample included both DEC and DEP projects but did not target specific quota for each jurisdiction. We therefore developed quantity adjustments by technology but not by jurisdiction.
  - For the midstream channel and the Business Savings Store, the quantity adjustment was based on responses from the midstream participant survey. We developed ISRs by jurisdiction, but not by technology.
- Step 2: Deemed Savings Adjustment
  - Based on the deemed savings review, we developed updated per-unit savings values for 47 reviewed measures, across all three delivery channels. For measures not part of the deemed savings review, ex post per unit savings were set to equal ex ante savings.
  - The deemed savings review included development of evaluation period-specific lighting HOU values, by key lighting technologies, based on the program-tracking database. For LED tube and panel measures, we further adjusted the program-tracked HOU estimates based on results from the lighting HOU logging study.

To develop ex post gross savings, we applied the quantity adjustments and deemed savings adjustments to ex ante savings. Figure 4-1 depicts this process.

Figure 4-1. Gross Impact Evaluation Approach



The following subsections provide more detail on the gross impact evaluation activities.

4.1.1 Program-Tracking Database Review

The first step in the gross impact evaluation was to perform a review of the program-tracking database. This review consisted of several steps. First, we verified dates of installation, identified duplicate records, and checked for any other parameters that may disqualify measures (e.g., not achieving the minimum efficiency level). Second, we calculated ex ante savings for each database record by multiplying per-unit database savings by measure quantities. Third, we developed unique project identifiers to support sampling.

The database review resulted in a clean dataset that reflects the eligible population of program projects with complete data required to estimate savings, including measure- and project-level ex ante savings. We used this dataset to select measures for the deemed savings review, to select projects for the engineering desk reviews and light logger study, and to develop ex ante gross impacts by technology, delivery channel, and jurisdiction.

4.1.2 Main Channel Quantity Adjustment

The purpose of the desk reviews was to compare measure quantities included in the program-tracking database with those identified in project documentation. We performed desk reviews for a sample of 136 main channel projects, sampling by technology (see Section 3.7). We reviewed all available project documentation for sampled projects, including the project application; any supplied calculations, invoices, specification sheets, and inspection forms; and any other project-specific data made available to our team. For all sampled projects, we compared measure types and quantities listed on project documents with measure types and quantities listed in the program-tracking database to ensure consistency and to check for any errors. If inconsistencies were found, quantities listed on project documents superseded those in the tracking database for use in calculating ex post savings. Based on results from the desk reviews, we developed technology-level quantity adjustment factors to apply to main channel projects.

4.1.3 Midstream and Business Savings Store Quantity Adjustment

As part of the midstream channel participant survey, we asked customers to verify receipt, installation, and continued operation of lighting measures recorded in the program-tracking database. We calculated the quantity adjustment as the number of lamps or fixtures installed and operational at the time of the survey divided by the number of lamps or fixtures in the program-tracking database (by respondent and type of lighting measure). We then aggregated measure-level ISRs to the respondent level, weighting by savings. We further aggregated respondent-level ISRs to the program level, by jurisdiction, applying savings and stratum weights to reflect our sampling strategy (see Section 3.5 above). We used these ISRs as the quantity adjustments for both midstream channel and Business Savings Store purchases.[7]

4.1.4 Deemed Savings Adjustment

The purpose of the deemed savings review was to update per-unit savings assumptions for key measures incented through the Non-Residential Prescriptive Program. Because of the large number of unique measures incented during the evaluation period (a total of 275), we focused our efforts on the measures that accounted

[7] Due to the small contribution of the Business Savings Store to overall program savings, we did not conduct research specific to this delivery channel. We applied ISR results from the midstream channel to Business Savings Store purchases due to similarities in the delivery mechanism: Both channels rely on customer purchases and independent installation, while the main channel is largely contractor-driven.

for the largest share of program savings, including savings from all three delivery channels. The review excluded measures that were discontinued in 2019.

Table 4-1 presents the number of measures incented through the program, as well as those selected for review, by technology. As shown, the deemed savings review included 47 measures that accounted for 86% of total ex ante program savings. For the measures not covered by the deemed savings review (accounting for the remaining 14% of total ex ante savings), we maintained existing per-unit ex ante assumptions.

Table 4-1. Summary of Measures Reviewed

	Total		Included in Deemed Savings Review			
	# Measures	MWh (Ex Ante)	# Measures	% Measures	MWh (Ex Ante)	% MWh
Lighting	117	649,046	46	39%	577,422	89%
Pumps and Drives	14	11,090	1	7%	8,194	74%
HVAC	81	13,201	-	0%	-	0%
Food Service	50	4,502	-	0%	-	0%
Process	11	1,456	-	0%	-	0%
IT	2	1,361	-	0%	-	0%
TOTAL	**275**	**680,656**	**47**	**17%**	**585,616**	**86%**

For the selected measures, we reviewed all program-supplied documentation of ex ante assumptions. We leveraged a variety of TRMs, including the Mid-Atlantic TRM and Michigan Master Measure Database as well as previous program evaluations and research.

For lighting measures, the deemed savings review included development of evaluation period-specific HOU estimates, by lighting category, based on the program-tracking database. In addition, for LED tube and panel measures only, we applied an HOU adjustment based on results from the lighting HOU logger study (described in Section 4.1.5).

The full, measure-level deemed savings review, including the supporting spreadsheet, can be found in the Appendix.

4.1.5 Lighting HOU Verification

HOU are a key input required to estimate the savings from lighting projects. The program collects facility-specific HOU estimates as part of the incentive application and includes these in the program-tracking database. In this evaluation (as well as the prior one), Opinion Dynamics used the program-tracked HOU data to develop weighted average HOU estimates for major categories of lighting equipment and used these estimates to update deemed savings values for relevant lighting measures.

Given the large contribution of lighting measures to overall DEC and DEP Smart $aver® Prescriptive Program savings, North Carolina Public Staff, as part of their review of the last evaluation of this program, recommended that Duke Energy verify program-tracked lighting HOU values through a light logger study. In response to this recommendation, Opinion Dynamics worked with Duke Energy to incorporate such a light logger study into the scope of this evaluation.

In a related activity, to further investigate self-reported HOU in the program-tracking database, Opinion Dynamics compared trade ally-provided HOU values with customer-provided HOU values for lighting categories included in the deemed savings review. The goal of this analysis was to determine if there are systematic

differences between the two sources of this data. The analysis focused on measure categories included in the deemed savings review since the self-reported HOU values for those measures directly impact ex post savings.

It should be noted that for each record, the program-tracking data contains an HOU value reported by either the trade ally or the customer. This analysis therefore compares trade ally and customer reported HOU for different sets of projects (albeit for the same measure groups and therefore for the same functional applications). As such, this analysis does not control for any factors that may systematically differ between trade ally-implemented projects and customer-implemented projects (within the same measure group).

Light Logger Study Methodology

The lighting HOU logging study was conducted between June and August 2019. It included on-site metering visits for a sample of 37 lighting projects, a subset of the desk review projects. Deployment visits took place between June 24 and June 28, 2019. During these visits, we confirmed the installation of the energy-efficient lighting measures and deployed a total of 157 loggers (between 1 and 12 loggers per site). Between August 5 and August 7, 2019, we retrieved 153 of the 157 deployed loggers.

Opinion Dynamics performed a series of data cleaning steps on the retrieved loggers, including (1) identification and removal of corrupted/failed loggers; (2) analysis of unexpected/suspicious usage patterns; (3) logger date "trimming;" and (4) analysis of logger flickering. Based on the cleaning steps, we excluded 41 of the 153 deployed loggers (27%) from further analysis.

We calculated annual HOU by first summing, for each logger, the average time the light was on, per day, during the logging period. We then multiplied the result by 365 days. We paid particular attention to two special cases to ensure that the hours recorded during the logging period could be extrapolated to the full year: (1) different operating hours during the week of July 4th, and (2) seasonality of facility operating schedules.

We developed a program-level HOU realization rate through a series of aggregation and weighting steps (described in detail in the Appendix). Given the number of sample points for different types of lighting technologies, we developed two estimates of the program-level HOU realization rate.

- The first estimate included all lighting technologies that were represented in the light logger study: LED tube lighting, LED panel lighting, LED case lighting, LED downlights, LED highbay lighting, and LED reflector lamps.
- The second estimate included only LED tube lighting and LED panel lighting. We developed this second estimate since most loggers (87 out of 95) and site/measure-level sample points (42 out of 50) were associated with these two lighting technologies.

Opinion Dynamics selected the second estimate for use in this evaluation. We feel that it is a better estimate, given that the vast majority of loggers were associated with these two technologies. The HOU realization rate was applied as an adjustment to annual HOU values for LED tube lighting and LED panel lighting, as part of the deemed savings review.

A detailed description of the methodology and results of the lighting HOU study can be found in the Appendix.

4.2 Gross Impact Results

Table 4-2 summarizes the overall gross energy impacts for DEC and DEP (including savings from all three delivery channels) resulting from the two-step adjustment approach described above. The overall realization

rates are slightly less than 100%, driven by small downward adjustments to both quantities and per-unit savings values for lighting projects. We describe these adjustments in more detail below.

Table 4-2. Overall Gross Energy Impacts

Technology	DEC			DEP		
	Ex Ante kWh	Realization Rate	Ex Post kWh	Ex Ante kWh	Realization Rate	Ex Post kWh
Lighting	473,196,869	97%	459,722,955	175,849,149	96%	168,509,214
Pumps and Drives	9,621,917	100%	9,604,616	1,468,036	115%	1,694,655
HVAC	8,438,190	100%	8,415,298	4,762,444	100%	4,752,610
Food Service[a]	3,464,138	81%	2,816,818	1,038,041	81%	844,294
Process	1,455,989	100%	1,455,950	143	100%	143
IT	31,499	98%	31,027	1,329,977	100%	1,329,694
TOTAL	496,208,603	97%	482,046,663	184,447,789	96%	177,130,609

[a] The realization rates for food service projects were driven by one project with a large quantity adjustment due to a data entry error. The realization rates without this error would have been 100%, which may be a better planning value to use.

Table 4-3 summarizes the overall gross demand impacts for DEC and DEP (including savings from all three delivery channels) resulting from the two-step adjustment approach described above.

- The overall summer demand realization rates are slightly less than 100% for both jurisdictions, with both quantity and deemed savings adjustments contributing to the discrepancy.
- The overall winter demand realization rates, on the other hand, are slightly higher than 100%, mainly due to deemed savings adjustments for lighting measures.

We describe these adjustments in more detail below.

Table 4-3. Overall Gross Demand Impacts

Technology	DEC			DEP		
	Ex Ante kW	Realization Rate	Ex Post kW	Ex Ante kW	Realization Rate	Ex Post kW
Summer Demand Impacts						
Lighting	83,501	97%	81,372	29,960	97%	28,977
Pumps and Drives	1,427	100%	1,425	171	136%	232
HVAC	2,447	100%	2,447	1,225	100%	1,225
Food Service[a]	300	72%	216	79	72%	57
Process	260	100%	260	0	N/A	0
IT	0	N/A	0	128	100%	128
TOTAL	**87,934**	**97%**	**85,719**	**31,563**	**97%**	**30,618**
Winter Demand Impacts						
Lighting	79,375	102%	80,656	28,173	102%	28,703
Pumps and Drives	1,481	100%	1,478	151	139%	211
HVAC	1,121	100%	1,120	799	100%	799
Food Service[a]	288	71%	204	77	71%	55
Process	276	100%	276	0	100%	0
IT	0	N/A	0	0	N/A	0
TOTAL	**82,540**	**101%**	**83,734**	**29,201**	**102%**	**29,768**

[a] The realization rates for food service projects were driven by one project with a large quantity adjustment due to a data entry error. The realization rates without this error would have been 100%, which may be a better planning value to use.

4.2.1 Main Channel Quantity Adjustment

Based on our desk reviews, we adjusted the quantities for 11 of the 136 sampled main channel projects. Of the 11 adjustments, 10 were relatively minor and often resulted from differences due to rounding. One large (based on ex ante savings) food service project, however, had a quantity adjustment that significantly impacted the overall realization rate for that technology. This project had a measure (ECM refrigerated case motors) with a tracked quantity of 130, but project documents showed a quantity of 35 motors with a horsepower (HP) of 0.0323 each. Since the quantity unit for this measure is per horsepower, the ex post quantity was updated to 1.13 HP.

Table 4-4 summarizes the quantity adjustments made for the 11 projects.

Table 4-4. Summary of Main Channel Project with Quantity Adjustments

Sample Project #	Measure	Technology	Unit of Measure	Quantity	
				Database (ex ante)	Desk Review (ex post)
#1	Exterior HID Lighting	Lighting	Fixture	475	4
#2	LED Flood Lighting	Lighting	Fixture	15	5
#3	VFD HVAC Fan	Pumps & Drives	Horsepower	8	7.5
#4	VFD HVAC Fan	Pumps & Drives	Horsepower	8	7.5
	VFD HVAC Fan	Pumps & Drives	Horsepower	8	7.5
#5	VFD HVAC Fan	Pumps & Drives	Horsepower	8	7.5

Sample Project #	Measure	Technology	Unit of Measure	Quantity	
				Database (ex ante)	Desk Review (ex post)
#6	VFD HVAC Fan	Pumps & Drives	Horsepower	1	0.5
	VFD HVAC Fan	Pumps & Drives	Horsepower	1	0.75
	VFD HVAC Fan	Pumps & Drives	Horsepower	8	7.5
#7	HVAC DX AC 65-135kBtuh 12.2 EER (Tier 2)	HVAC	Ton	9	9.4
	HVAC DX AC less than 65kBtuh 15 SEER (Tier 2)	HVAC	Ton	6	6.2
#8	HVAC DX AC 240-760kBtuh 10.8 EER (Tier 2)	HVAC	Ton	115	120
#9	HVAC DX AC 65-135kBtuh 12.2 EER (Tier 2)	HVAC	Ton	8	7.5
#10	Water-Cooled Chiller	HVAC	Ton	164	163.6
#11	ECM Refrigerated Case Motors	Food Service	Horsepower	130	1.129

The quantity adjustments for the 11 projects resulted in realization rates different from 100% for lighting, pumps and drives, HVAC, and food service technologies. We did not make any adjustments to the other technologies because we did not find any discrepancies in our sample for those technologies. Table 4-5 summarizes these results.

We achieved a relative precision, at 90% confidence, of ±3% for lighting projects, better than ±1% for pumps and drives and HVAC projects, and ±9% for food service projects. Because we found no discrepancies for the other technologies, the relative precision is ±0%.

Table 4-5. Main Channel Quantity Adjustments

Technology	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Lighting	98.1%	100.0%	100.0%
Pumps and Drives	99.8%	99.8%	99.8%
HVAC	100.1%	100.1%	100.0%
Food Service	81.2%	71.7%	70.7%
Process	100.0%	100.0%	100.0%
IT	100.0%	100.0%	N/A

4.2.2 Midstream and Business Savings Store Quantity Adjustment

The midstream participant survey found high ISRs for both DEC and DEP respondents (98.5% and 96.9%, respectively). The relative precision of these estimates, at 90% confidence, is 2.3% and 3.7%, respectively. Table 4-6 summarizes these results.

As noted above, these quantity adjustments were applied to the midstream channel as well as the Business Savings Store.

Table 4-6. Midstream and Business Savings Store Quantity Adjustments

Jurisdiction	n	ISR	Relative Precision (90% Confidence)
DEC	77	98.5%	2.3%
DEP	72	96.9%	3.7%

4.2.3 Deemed Savings Adjustment

The deemed savings review resulted in modifications to per-unit savings values for select measures within the lighting and the pumps and drives technology categories.[8] For reviewed measures, we multiplied revised per-unit savings values by ex ante quantities, at the measure-level, to calculate deemed savings-adjusted gross savings. We then developed deemed savings adjustments by dividing these adjusted gross savings by ex ante savings. For all measures that were not included in the deemed savings review, ex post per unit values were set to equal ex ante values.

The deemed savings review resulted in the following adjustments:

- Lighting
  - We incorporated measure-specific weighted average HOU estimates from the program-tracking database.
  - For LED tube and panel measures, an HOU realization of 1.163, based on the lighting HOU logger study (see Section 4.2.4), was applied to the HOU value from the program-tracking database.
  - For lighting measures not included in the prior deemed savings review, we made the following additional adjustments:
    - We applied waste heat and coincidence factors consistent with values used in the previous DEC-DEP deemed savings review.
    - We cross-checked and updated any wattage assumptions to ensure consistency between the previous evaluations for the DEC/DEP, DEI, and DEO Smart $aver® Prescriptive Programs.
- Pumps and drives
  - For the one pumps and drives measure reviewed (VFD HVAC Fan), we made no adjustment to the DEC values. The DEP values were aligned with the DEC values.

Table 4-7 summarizes the results of the deemed savings review, by jurisdiction and technology. The full, measure-level deemed savings review, including the supporting spreadsheet, can be found in the Appendix.

[8] The deemed savings review did not include measures within the HVAC, food service, process, or information technology categories.

Table 4-7. Deemed Savings Adjustments

Technology	DEC			DEP		
	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Lighting	99%	98%	102%	98%	98%	103%
Pumps and Drives	100%	100%	100%	116%	136%	140%
HVAC	100%	100%	100%	100%	100%	100%
Food Service	100%	100%	100%	100%	100%	100%
Process	100%	100%	100%	100%	N/A	100%
IT	100%	N/A	N/A	100%	100%	N/A
TOTAL	**99%**	**98%**	**102%**	**98%**	**99%**	**104%**

4.2.4 Lighting HOU Verification

The lighting HOU verification resulted in two key findings:

- The light logger study resulted in HOU estimates for LED tube and LED panel measures that are 16% higher than data in the program-tracking database.
- The database comparison of HOU reported by trade allies and customers, respectively, found close alignment between the two sources in the aggregate but variations at the measure-group level.

Results from both analyses are described below.

Light Logger Study

Based on the results of the light logger study, we developed two estimates of the program-level HOU RR:

- The first estimate includes all lighting technologies that were represented in the light logger study: LED tube lighting, LED panel lighting, LED case lighting, LED downlights, LED highbay lighting, and LED reflector lamps.
- The second estimate includes only LED tube lighting and LED panel lighting. We developed this second estimate since most loggers (87 out of 95) and site/measure-level sample points (42 out of 50) were associated with these two lighting technologies.

Table 4-8 summarizes the results and precision estimates for both approaches. Notably, both approaches yielded almost identical results – HOU RRs of 1.147 and 1.163, respectively – as well as fairly similar precision levels.

Table 4-8. HOU Realization Rates and Precision Estimates

	n	HOU RR	Relative Precision at...		
			90%	85%	80%
All Logged Lighting Technologies	50	1.147	0.17	0.15	0.13
LED Tube and Panel Lighting	42	1.163	0.19	0.16	0.15

Opinion Dynamics selected the second estimate – the HOU realization rate of 1.163, based on LED tube and panel lighting only – for application in this evaluation. Despite slightly lower precision levels, we feel that it is

more appropriate to use this estimate, given that the vast majority of loggers were associated with these two technologies.

As described above, the HOU realization rate was applied as an adjustment to annual HOU values as part of the deemed savings review. It should be noted that this adjustment was applied to a subset of lighting measures incented during the evaluation period:

- Given that the HOU realization rate is based on LED tube and LED panel lighting only, it was only applied to these two measure types.
- Since the HOU RR was incorporated into ex post deemed savings values, it was only applied to LED tube and lighting measures that were part of the deemed savings review for this evaluation.[9]

Overall, the HOU RR of 1.16 was applied to 33% of program-incented lighting savings during the evaluation period. If we had used the estimate for all logged lighting technologies (RR of 1.15), we would have applied it to a broader set of lighting measures, accounting for 65% of program lighting savings. The selected approach therefore represents a more conservative assumption, despite the slightly higher RR.

Comparison of Trade Ally and Customer-Reported HOU

The comparison of HOU values reported by trade allies versus those reported by customers showed very close alignment in the aggregate: Across all 10 lighting measure categories included in the deemed savings review (accounting for 94% of total main channel lighting savings), the weighted HOU difference was less than 1%. For each lighting category, however, there were differences:

- For four of the ten measure categories, the average estimates were within 5% of each other.
- For another four categories, trade ally estimates exceeded customer estimates by more than 5%.
- For two categories, customer estimates exceeded trade ally estimates by more than 5%.

Table 4-9 summarizes these results.

[9] Several LED tube measures were discontinued in 2019 and were therefore excluded from the deemed savings review.

Table 4-9. Comparison of Trade Ally and Customer-Reported HOU

Measure Category	Weighted Average HOU[A]		% Difference
	Trade Allies	Customers	
LED Panel Lighting	4,394	3,526	25%
LED Downlight	4,864	3,936	24%
LED Lamps	4,550	4,117	11%
Occupancy Sensors per Watt	5,711	5,198	10%
LED Canopy Lighting	4,209	4,047	4%
Exterior HID Lighting	4,084	3,956	3%
LED Lowbay Lighting	4,303	4,337	-1%
LED Tube Lighting	4,168	4,373	-5%
Garage HID Lighting	6,439	6,997	-8%
LED Highbay Lighting	3,431	4,177	-18%
TOTAL	**4,080**	**4,108**	**<1%**

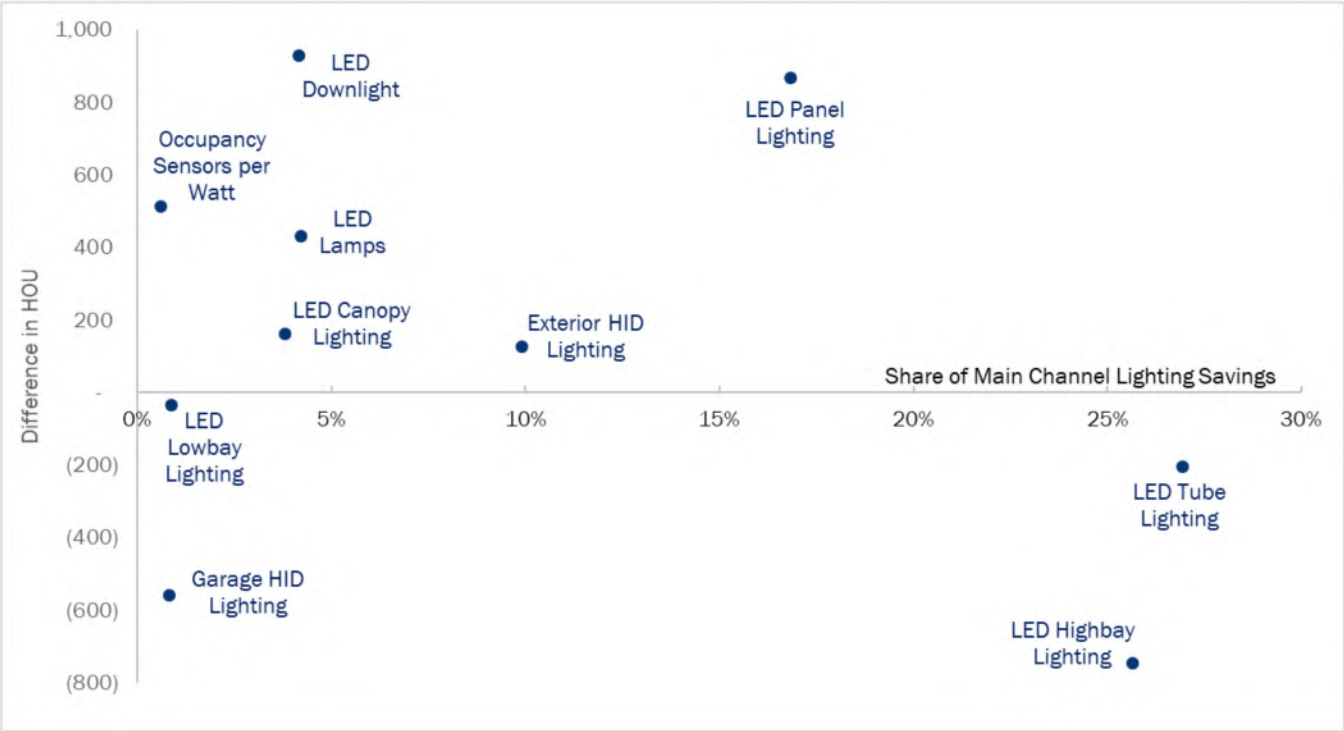
[A] Within each measure category, HOU estimates were weighted by measure quantity; across the categories, the average HOU estimates were weighted by kWh savings.

Figure 4-2 presents these results graphically:

- The y-axis shows the absolute difference (in hours) between trade ally-reported values and customer-reported values: Points above the x-axis reflect measure categories for which trade allies provided a higher estimate than customers; points below the x-axis reflect measure categories with higher customer estimates.
- The x-axis represents the share of main channel lighting savings that each measure category accounts for: The further to the right, the greater the share of savings from that category.

Mapping differences in HOU estimates against the share of savings helps explain the results: Even though trade allies provided higher estimates for the majority of measure categories, the overall HOU estimates closely align because customer-provided values are higher for the two measures with the highest savings: LED tube lighting and LED highbay lighting.

Figure 4-2. Differences in Trade Ally and Customer Provided HOU Estimates Relative to Savings



5. Net-to-Gross Analysis

5.1 Methodology

Our NTG analysis included consideration of FR, PSO, and TA SO. We developed estimates of FR and PSO based on the online surveys with participants in the main and midstream channels and estimates of TA SO based on the online survey with main channel trade allies. The NTGR was calculated as follows, separately for DEC and DEP and for the main channel and the midstream channel:

$$NTGR = 1 - FR + PSO + TA\ SO$$

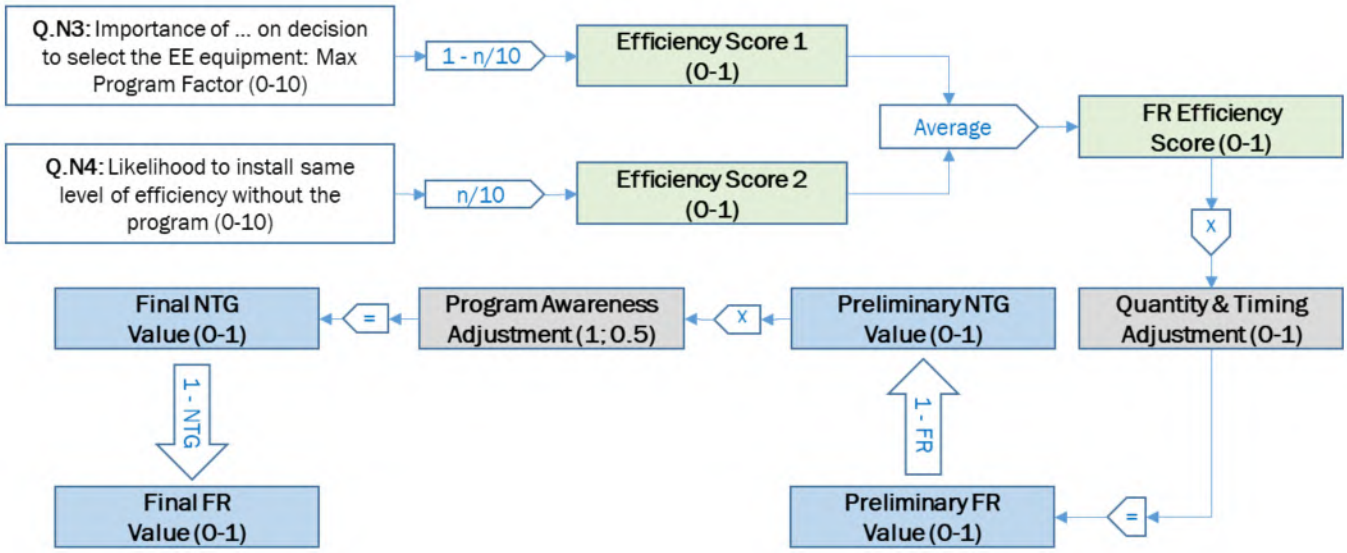
5.1.1 Free-Ridership

Free-riders are program participants who would have completed the same energy efficiency upgrade without the program. FR scores represent the percentage of savings that would have been achieved in the absence of the program. FR scores can range from 0% (not a free-rider; the participant would not have completed the project without the program) to 100% (a full free-rider; the participant would have completed the project without the program). FR scores between 0% and 100% represent partial free-riders, i.e., participants who were to some degree influenced by the program to complete the energy efficiency upgrade.

FR survey questions focused on the importance of various program factors on the decision to install energy-efficient equipment, as well as on the likelihood of making the same upgrades in the absence of the program (the counterfactual). These questions were used to determine program influence on levels of efficiency and on measure quantity (where applicable) and project timing. We developed two measurements of program influence on levels of efficiency and used consistency checks in cases where inconsistent responses were given. Responses about measure quantity and project timing were used to adjust the efficiency-based FR rate, allowing the program to receive credit in cases where the program influenced project size and timing rather than, or in addition to, the level of efficiency. A second adjustment, the Program Awareness Adjustment, was applied in cases where participants reported having learned about the program after they selected the equipment for which they received an incentive. This adjustment was applicable to the main channel only and, if applied, reduced a respondent's program attribution (1 – FR) by 50%.

Figure 5-1 presents a diagram of the FR algorithm used for this evaluation, including references to question numbers. A more detailed description of the algorithm can be found in the Appendix.

Figure 5-1. Overview of Free-Ridership Algorithm



We developed separate FR estimates for six analysis groups: DEC main channel lighting, DEC main channel non-lighting, DEP main channel lighting, DEP main channel non-lighting, DEC midstream lighting, and DEP midstream lighting. We explored the possibility of developing separate FR estimates for the various non-lighting technologies incented through the main channel (i.e., HVAC equipment; process equipment; pumps and drives; food service equipment; and information technology). However, due to the small number of unique customers who completed non-lighting projects, we did not obtain enough responses to develop rigorous FR estimates at the technology level (despite an attempted census of these projects).

We developed FR estimates for the six analysis groups as follows:

- We first developed a FR estimate for each survey respondent, using the algorithm depicted above.
- We then aggregated respondent-level FR estimates to the stratum level, weighting the sampled projects within each stratum by their ex post gross savings. In cases of low numbers of responses within an analysis group, we combined two or more of the size strata.
- For each analysis group, we developed a FR value by applying ex post savings weights to reflect the relative contribution of each stratum to the group's overall savings.

In addition, we rolled up FR results to the channel level (across lighting and non-lighting projects) and to the lighting level (across the two delivery channels), by jurisdiction. We developed these aggregate values by applying ex post savings weights to reflect the relative contribution of each analysis group to the aggregated values.

5.1.2 Participant Spillover

PSO refers to additional energy efficiency upgrades participants made at the time of or after their participation in the Smart $aver® Prescriptive Program that were influenced by the program but for which they did not receive a program incentive. PSO was estimated separately for the main and midstream channels and is expressed as a percentage of delivery channel savings.

To determine if a survey respondent is eligible for PSO savings, we asked a series of questions about additional energy efficiency installations that they made without receiving an incentive and the degree to which the program influenced their decision to install the efficient equipment. The survey included two program influence questions:

SP2a. How much did your experience with the Smart $aver Incentive Program or interactions with Duke Energy staff influence your decision to make efficiency improvements without an incentive?

This question was asked on a scale of 0 to 10, where 0 means "No Influence" and 10 means "Greatly Influenced."

SP2b. If you had NOT participated in the Smart $aver Incentive Program, how likely is it that <COMPANY> would still have made the additional energy efficient improvements?

This question was asked on a scale of 0 to 10, where 0 means "Definitely would not have made improvements" and 10 means "Definitely would have made improvements."

To supplement these numeric responses, we asked open-ended questions about how the program influenced the decision to make the energy efficiency installations and why the participant made the installations without a program incentive. A respondent's additional energy efficiency installations were deemed eligible for PSO if two conditions were met: (1) the Program Influence Factor (see below) was greater than 7.0 and (2) the open-ended responses did not contradict that the installations were eligible for PSO.

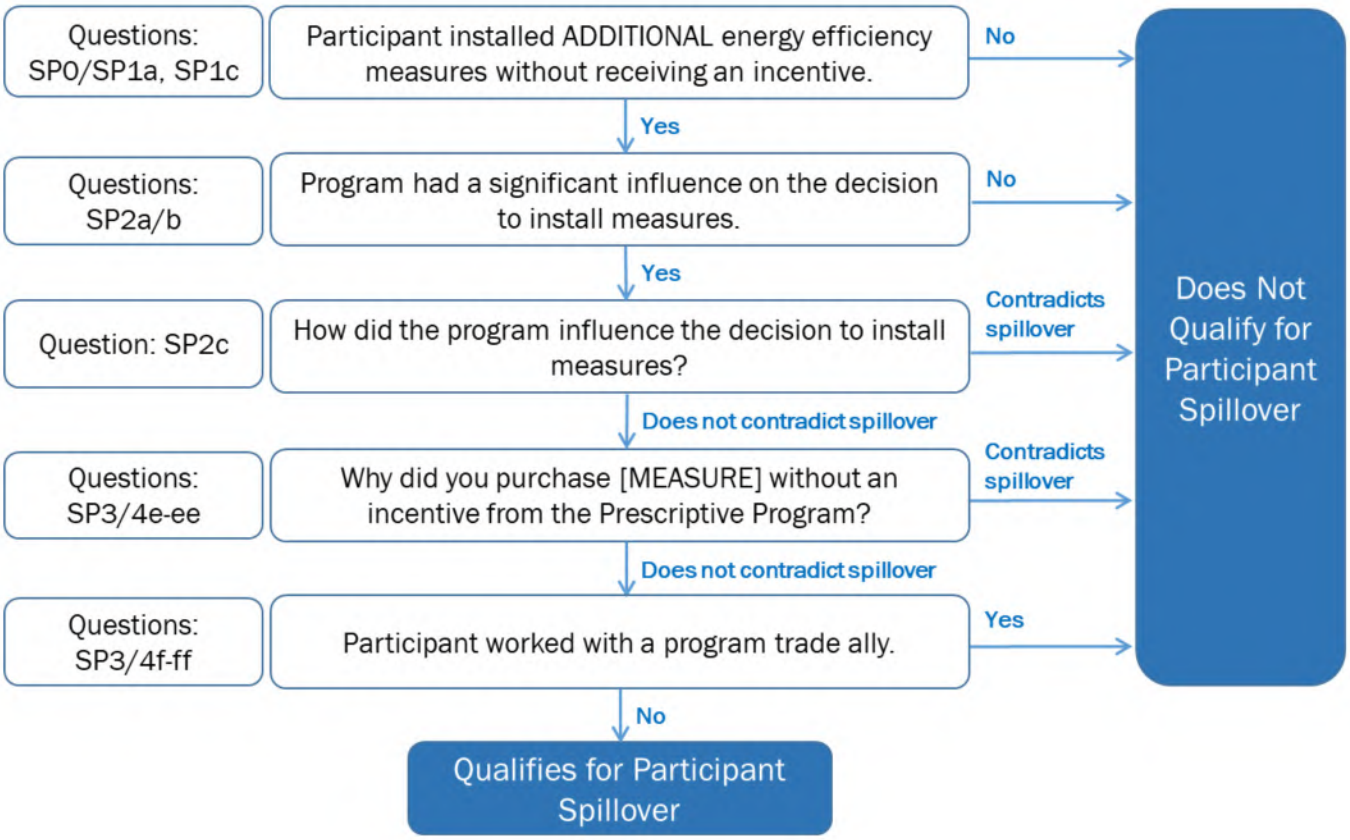
The Program Influence Factor was calculated as follows:

$$\textit{Program Influence Factor} = (\textit{SP2a Response} + (10 - \textit{SP2b Response})) \div 2$$

In addition, we applied a third PSO eligibility condition: that the participant did not work with a participating trade ally. This condition was necessary because this evaluation also estimated TA SO. When estimating spillover (SO) from multiple sources, it is important to avoid double-counting. In the case of this evaluation, double-counting could occur if participants and trade allies report SO from the same projects. We avoided such double-counting by determining if the participant's SO project was completed by a trade ally who is in the sample frame for the TA survey (i.e., the trade ally completed at least one project through the Smart $aver® Prescriptive Program during the evaluation period). If so, the SO reported by the participant was excluded from the PSO estimate as it was captured through the TA SO analysis (see next section).

Figure 5-2 presents a diagram of the PSO eligibility determination methodology used for this evaluation, including references to question numbers.

Figure 5-2. Participant Eligibility for Spillover - Methodology



The survey also included a few follow-up questions about SO-eligible measures, including the type of equipment and, for lighting measures only, information on the quantity of measures installed, whether they were installed in a conditioned space, and the type of lighting they replaced.

For participants with qualifying installations, we conducted follow-up interviews to collect more-detailed information for each additional measure, such as baseline and efficient wattages or the age of the equipment. We then used the program's deemed savings values to develop SO savings for each measure. In two cases, we were not able to reach a participant with qualifying installations for a follow-up interview[10] and were not able to estimate SO savings with the desired degree of confidence. Following discussion with Duke Energy evaluation staff, we made the conservative decision to set SO savings for these two participants to zero.

We developed a "PSO Rate," separately for the main channel and the midstream channel, which is calculated using the following formula:

$$PSO\ Rate = \frac{SO\ in\ Sample}{Ex\ Post\ Gross\ Impacts\ in\ Sample}$$

[10] Our outreach included several attempts via phone and email over a 4-week period. We used contact information available in the program-tracking database, provided in the online survey, as well as additional contact information received from Duke Energy.

5.1.3 Trade Ally Spillover

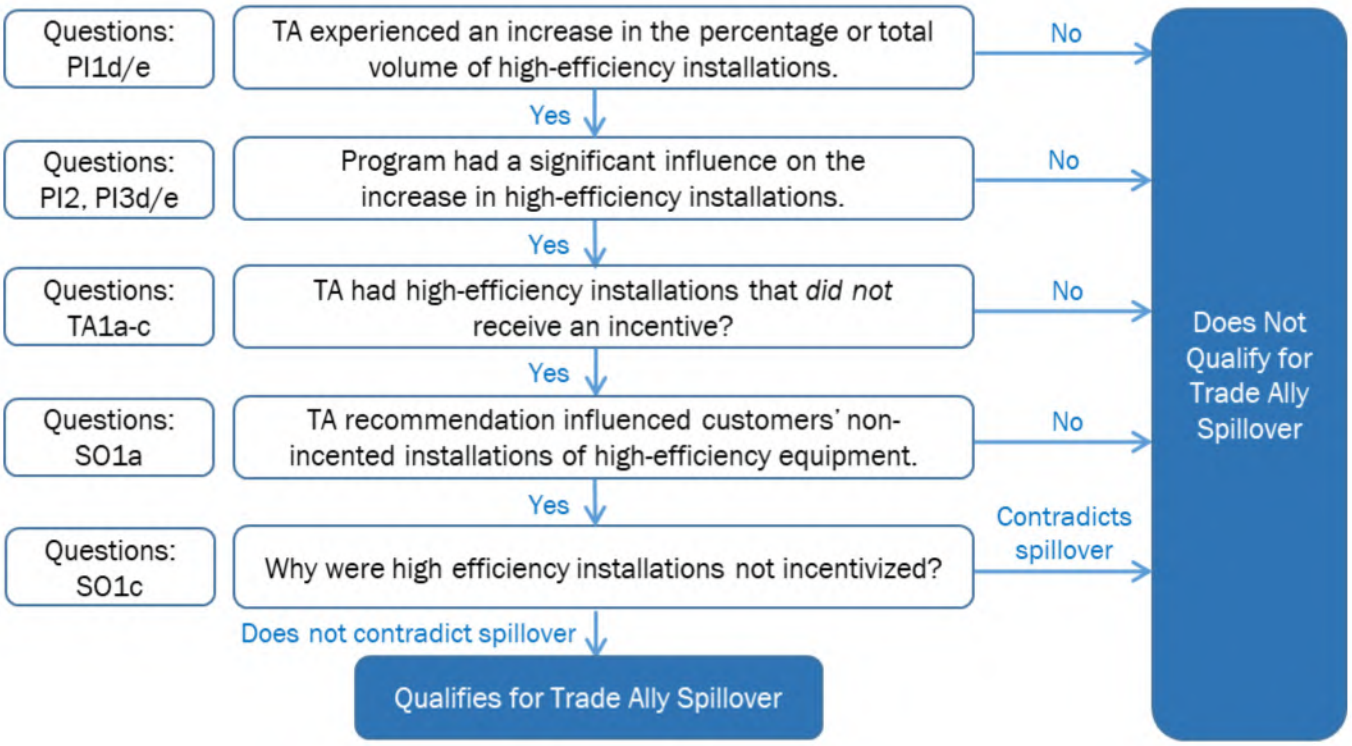
TA SO refers to non-incented energy efficiency upgrades made by customers who were influenced by a participating main channel trade ally who was in turn influenced by the Smart $aver® Prescriptive Program. TA SO is estimated at the program level and is expressed as a percentage of program savings. This section presents a high-level overview of the TA SO methodology.

To determine if a trade ally was eligible for SO savings, the online survey asked a series of SO-related questions. We considered a trade ally eligible for SO if the following conditions were met:

- Since working with the Smart $aver® Prescriptive Program, either the trade ally's percentage of high-efficiency installations increased or the trade ally's total volume of high-efficiency installations increased.
- The trade ally rated the importance of the Smart $aver® Prescriptive Program on at least one of these increases an 8, 9, or 10 (on a scale of 0 to 10).
- The trade ally reported having installed at least some high-efficiency equipment without an incentive from the Smart $aver® Prescriptive Program during the evaluation period.
- The trade ally gave a rating of 8, 9, or 10 (on a scale of 0 to 10) for the importance of their recommendation on installations of high-efficiency equipment that did not receive an incentive from the Smart $aver® Prescriptive Program.
- The trade ally's open-ended response about why customers with high-efficiency installations did not receive an incentive from the program did not contradict that non-incented, high-efficiency installations qualified as SO.

Figure 5-3 presents a diagram of the TA SO eligibility determination methodology used for this evaluation, including references to question numbers.

Figure 5-3. Trade Ally Eligibility for Spillover - Methodology



For each respondent who met these qualifying conditions, we determined SO savings from the non-incented, high-efficiency installations through:

- Survey questions about:
  - The respective shares of the trade ally's total high-efficiency installations that did and did not receive a program incentive;
  - The level of increase in the percentage or total volume of high-efficiency installations, and whether factors other than the program contributed to the increase; and
  - For trade allies who could not report the respective shares of total high-efficiency installations that did and did not receive a program incentive: The size of non-incented, high-efficiency installations relative to those that did receive an incentive (resulting in a "Size Adjustment" factor).
- Program-tracking data on the savings associated with the Smart $aver® Prescriptive Program projects for that respondent.

For respondents who met the five main qualifying conditions outlined above, SO savings were considered to be equal to a portion of the savings of their non-incented, high-efficiency installations. SO for each qualifying trade ally respondent (i) is calculated using the following equation. Data inputs to this formula are further described in the Appendix.

$$TA\ SO\ Respondent_i = \left(\frac{Savings\ from\ Program\ Database_i}{\%\ Efficient\ Installations\ that\ Received\ Incentive_i} - Savings\ from\ Program\ Database_i \right) * Attribution\ Factor_i * Size\ Adjustment_i$$

To extrapolate savings to the program, we developed a "Respondent SO Ratio" by dividing the sum of the estimated SO savings by total program savings associated with all survey respondents. We then applied this Respondent SO Ratio to program savings associated with all trade allies (whether a survey respondent or not) to derive the overall SO estimate (in MWh). Finally, we estimated the "Program-level SO Ratio" by dividing the overall SO estimate (in MWh) by total program ex post savings (in MWh). This final step is necessary to normalize the SO rate to the entire Smart $aver® Prescriptive Program, taking into account that some customers complete projects without a trade ally.

Since many trade allies completed projects in both DEC's and DEP's service territory, we conducted the TA SO analysis across both jurisdictions.

A more detailed description of the TA SO algorithm can be found in the Appendix.

5.2 Net-to-Gross Results

We estimate the program-level NTGR to be 88.4% for DEC and 79.5% for DEP. For all three analysis groups (main channel lighting, main channel non-lighting, and midstream lighting) the DEC NTGRs are higher than the equivalent DEP NTGRs. For both jurisdictions, the lighting NTGRs (for both channels) are higher than the non-lighting NTGRs.

Table 5-1 presents the individual NTG components (i.e., FR, PSO, and TA SO) and the resulting NTGRs by jurisdiction and channel/technology group (i.e., lighting and non-lighting). The NTGR is calculated as 1 – FR + PSO + TA SO.

Table 5-1. Summary of DEC and DEP NTG Results

	Free-Ridership	Participant SO	Trade Ally SO	NTGR [a]
DEC				
Main Channel Lighting	18.1%	0.04%	7.0%	88.9%
Main Channel Non-Lighting	26.7%			80.3%
Midstream Lighting	11.5%	0.10%	-	88.6%
TOTAL DEC	**15.3%**	**0.07%**	**3.6%**	**88.4%**
DEP				
Main Channel Lighting	31.2%	0.04%	7.0%	75.8%
Main Channel Non-Lighting	34.5%			72.5%
Midstream Lighting	15.9%	0.10%	-	84.2%
TOTAL DEP	**24.3%**	**0.06%**	**3.8%**	**79.5%**

[a] NTGR = 1 – FR + PSO + TA SO

In addition to the results presented in Table 5-1, we rolled-up NTG results to the channel level (across lighting and non-lighting projects) and to the lighting level (across the two delivery channels), by jurisdiction. These results are shown in Table 5-2.

Table 5-2. Summary of Channel- and Technology-Level NTG Results

	Free-Ridership	Participant SO	Trade Ally SO	NTGR [a]
DEC				
Main Channel	18.9%	0.04%	7.0%	88.2%
Lighting	14.8%	0.07%	3.5%	88.7%
DEP				
Main Channel	31.5%	0.04%	7.0%	75.5%
Lighting	23.8%	0.07%	3.6%	79.9%

[a] NTGR = 1 – FR + PSO + TA SO

5.2.1 Free-Ridership

A total of 172 main channel participants and 140 midstream participants provided valid responses to the FR questions in the participant surveys and were included in the FR analysis. Using the algorithm summarized in Section 5.1.1, we estimate program-level FR to be 15.3% for DEC and 24.3% for DEP. For all three analysis groups (main channel lighting, main channel non-lighting, and midstream lighting) the DEC FR estimates are lower than the equivalent DEP estimates. For both jurisdictions, the lighting FR estimates (for both channels) are lower than the non-lighting ones.

Relative precision levels for all FR estimates are 6.2% or better at 90% confidence. It should be noted that we attempted a census for main channel non-lighting projects. As such, the concept of relative precision does not apply to these analysis groups.

Table 5-3 summarizes the FR estimates for the six analysis groups as well as DEC and DEP totals, including precision levels.

Table 5-3. Summary of DEC and DEP FR Estimates

Project Type	n	Free-Ridership	NTGR (1-FR)	Relative Precision (90% Conf.)
DEC				
Main Channel Lighting	58	18.1%	81.9%	5.0%
Main Channel Non-Lighting	49	26.7%	73.3%	n/a
Midstream Lighting	75	11.5%	88.5%	2.1%
TOTAL DEC	**182**	**15.3%**	**84.7%**	**2.5%**
DEP				
Main Channel Lighting	52	31.2%	68.8%	6.2%
Main Channel Non-Lighting	13	34.5%	65.5%	n/a
Midstream Lighting	65	15.9%	84.1%	5.1%
TOTAL DEP	**130**	**24.3%**	**75.7%**	**3.8%**

Participants' free-ridership related survey responses show the following:

- **Efficiency:** Interviewed participants generally reported a high degree of program influence on the efficiency level of their projects, resulting in savings-weighted Efficiency FR Scores ranging from 0.19

(DEC midstream) to 0.35 (DEP main channel non-lighting). Program influence on efficiency was higher for:

- DEC participants compared to DEP participants;
- Lighting projects compared to non-lighting projects; and
- The midstream channel compared to the main channel.

- **Quantity:** The program had a significant influence on the scope of many incented projects, in particular lighting projects. Respondents with lighting projects reported that between 43% (DEP midstream and main channel) and 58% (DEC midstream) of the efficient lighting would not have been installed at the same time without the program. Notably, the share of non-lighting measures that would not have been installed at the same time without the program is much smaller than the share of lighting measures (33% DEC; 8% DEP), suggesting that customers have more flexibility in the scope of lighting projects and that the program was successful in encouraging them to make additional upgrades.
- **Timing:** Responses to the timing questions show trends similar to the quantity questions: Participants reported that the program was responsible for a greater acceleration of lighting projects compared to non-lighting projects. The resulting timing adjustment factors, applied to the quantity that participants would not have installed at the same time without the program, range from 0.44 (DEC midstream) to 0.60 (DEP main channel) for lighting projects compared to 0.71 (DEC) to 0.95 (DEP) for non-lighting projects.[11]
- **Quantity and Timing Adjustment:** Combining the responses to the quantity and timing questions resulted in overall Quantity and Timing Adjustments ranging from 0.60 (DEC midstream) to 0.98 (DEP main channel non-lighting), meaning that the program can claim credit for 40% (1 − 0.60 = 0.40) of DEC midstream savings but only 2% (1 – 0.98 = 0.02) of DEP main channel non-lighting savings that would be considered free-rider savings based on efficiency alone.
- **Program Awareness:** Few participants reported having learned about the program *after* they selected the equipment for which they received an incentive. For these participants, we reduced the Preliminary NTGR by 50%, resulting in adjustments of between 0.98 (DEC main channel non-lighting and DEP main channel lighting) and 1.00 (DEC main channel lighting). Note that for the midstream channel, we set the Program Awareness Adjustment to 1.0, i.e., no adjustments, since the concept of program awareness does not apply.

The following two figures summarize FR results for DEC and DEP participants, respectively, using the diagram presented in Figure 5-1.

[11] A higher factor means a lower adjustments, i.e., less program influence on the timing of the project.

Figure 5-4. Free-Ridership Results – DEC

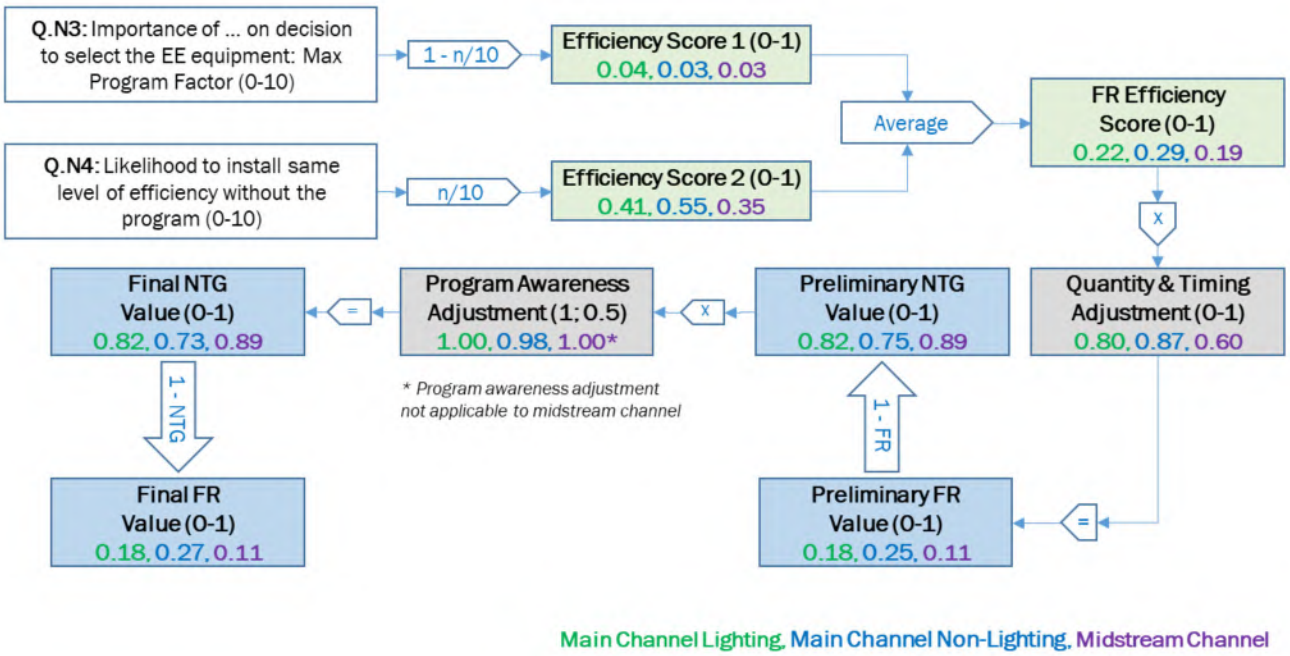
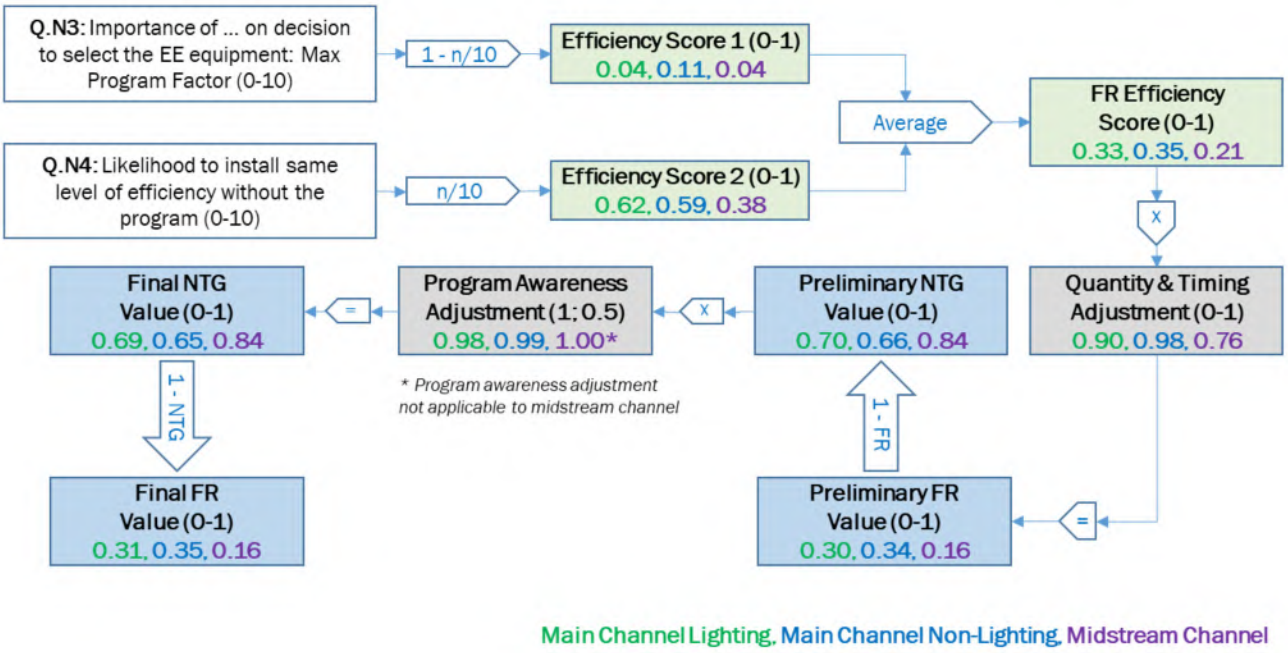


Figure 5-5. Free-Ridership Results – DEP

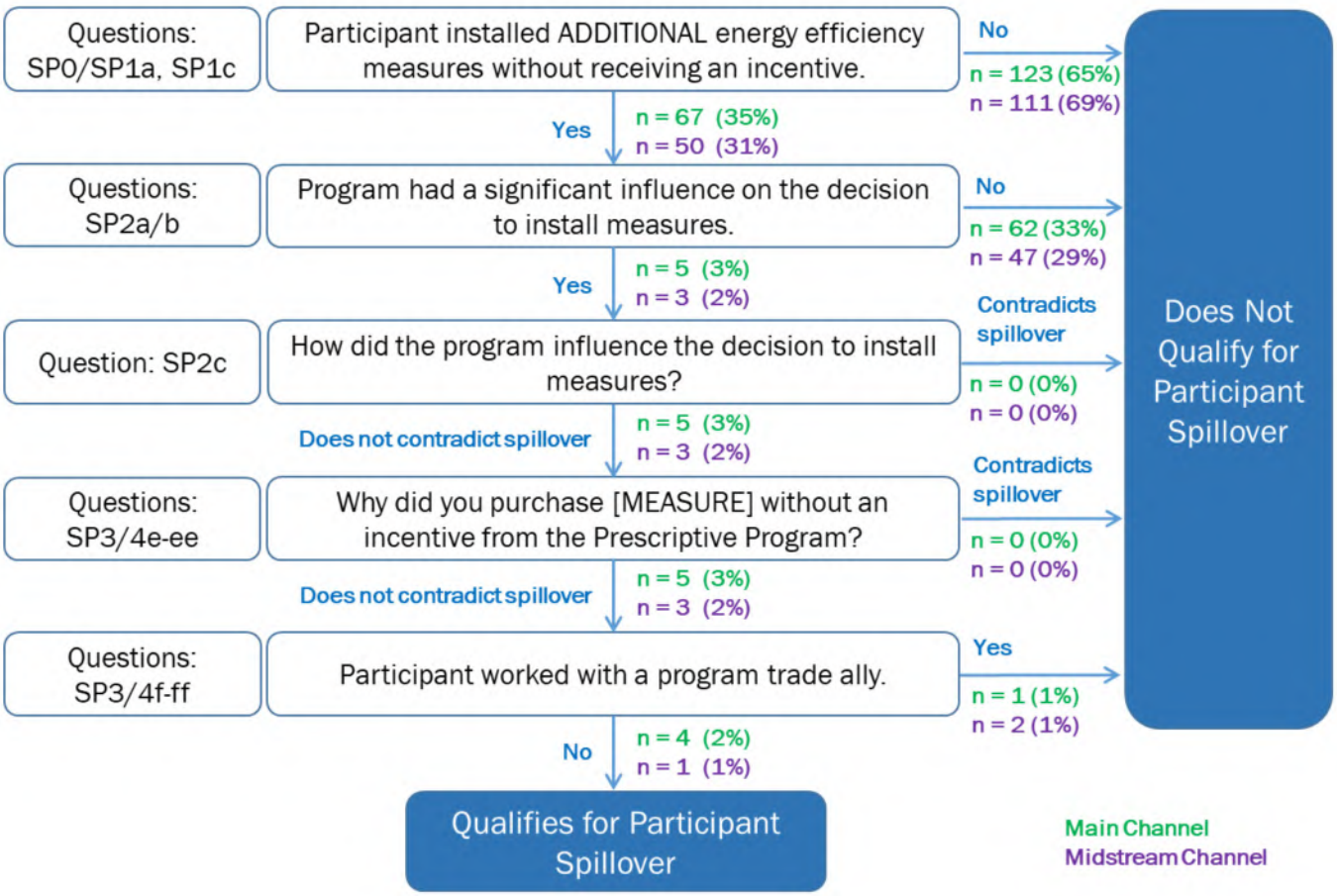


5.2.2 Participant Spillover

A total of 190 main channel participants and 161 midstream participants completed the SO questions in the participant surveys and were included in the PSO analysis. Most of these participants did not install any additional energy efficiency measures without receiving an incentive (65% main channel and 69% midstream channel) or did install additional measures but were not influenced by the program (33% main channel and 29% midstream channel). Four main channel respondents (2%) and one midstream channel survey respondent (1%) qualified for PSO.

Figure 5-6 summarizes the analysis of PSO eligibility, using the diagram presented in Figure 5-2.

Figure 5-6. Participant Eligibility for Spillover - Results



Of the four main channel respondents with PSO, two did not provide sufficient information in the survey to quantify PSO and could not be reached for a follow-up interview. Following discussion with Duke Energy evaluation staff, we made the conservative decision to set PSO savings for these two participants to zero. The other two main channel respondents and the one midstream channel respondent who qualified for PSO installed the lighting measures summarized in Table 5-4. We used the measure types and quantities reported by the respondents and the program's ex post deemed savings values for these measures to determine PSO savings.

Table 5-4. Summary of Measure-Level Participant Spillover

Participant	Measure	Quantity	Analysis Summary	kWh Per-unit	Total kWh
Main Channel					
#1	Linear LEDs	16	Deemed savings value for 4ft 1-LED tube replacing T8	77	1,233
#2	LEDs	16	Deemed savings value for 4ft 1-LED tube replacing T8	77	1,233
	Outside Lights	4	Deemed savings value for exterior HID replacement (up to 175W retrofit)	347	1,389
#3	LEDs	Unknown	Could not reach respondent for follow-up questions. Made conservative assumption of zero PSO savings.	n/a	0
#4	Unknown Process Equipment	Unknown	Could not reach respondent for follow-up questions. Made conservative assumption of zero PSO savings.	n/a	0
TOTAL MAIN CHANNEL					3,855
Midstream Channel					
#1	LEDs	15	Deemed savings value for 2x4 LED panels replacing T8	219	3,288
	Occupancy sensors	9	Deemed savings value for occupancy sensor per watt (@40 watts)	1.436	517
	Linear LEDs	24	Deemed savings value for 4ft 1-LED tube replacing T8	77	1,849
TOTAL MIDSTREAM CHANNEL					5,654

To determine the PSO Rate for each channel, we divided the channel's PSO savings by the total ex post gross savings of the sampled projects completed by the survey respondents. This calculation yielded a PSO rate of 0.04% for the main channel and of 0.10% for the midstream channel.

$$\text{PSO Rate–Main Channel} = \frac{\text{PSO in Main Channel Sample}}{\text{Ex Post Gross Impacts in Main Channel Sample}} = \frac{3{,}855\ kWh}{10{,}553{,}552\ kWh} = 0.04\%$$

$$\text{PSO Rate–Midstream Channel} = \frac{\text{PSO in Midstream Channel Sample}}{\text{Ex Post Gross Impacts in Midstream Channel Sample}} = \frac{5{,}654\ kWh}{5{,}935{,}688\ kWh} = 0.10\%$$

5.2.3 Trade Ally Spillover

A total of 146 main channel trade allies completed the SO section of the online survey. Three-quarters of responding trade allies (75%) reported increases in either the percentage or the total volume of their high-

efficiency installations and two-fifths (40%) attribute these increases to the program.[12] Trade allies most often credit the program incentive for the increases in energy-efficient installations, pointing specifically to reduced upfront costs and payback periods and a better return on investment (ROI). However, trade allies also pointed to market factors unrelated to the program that contributed to increases in high-efficiency sales, such as longer term energy savings and product quality and performance.

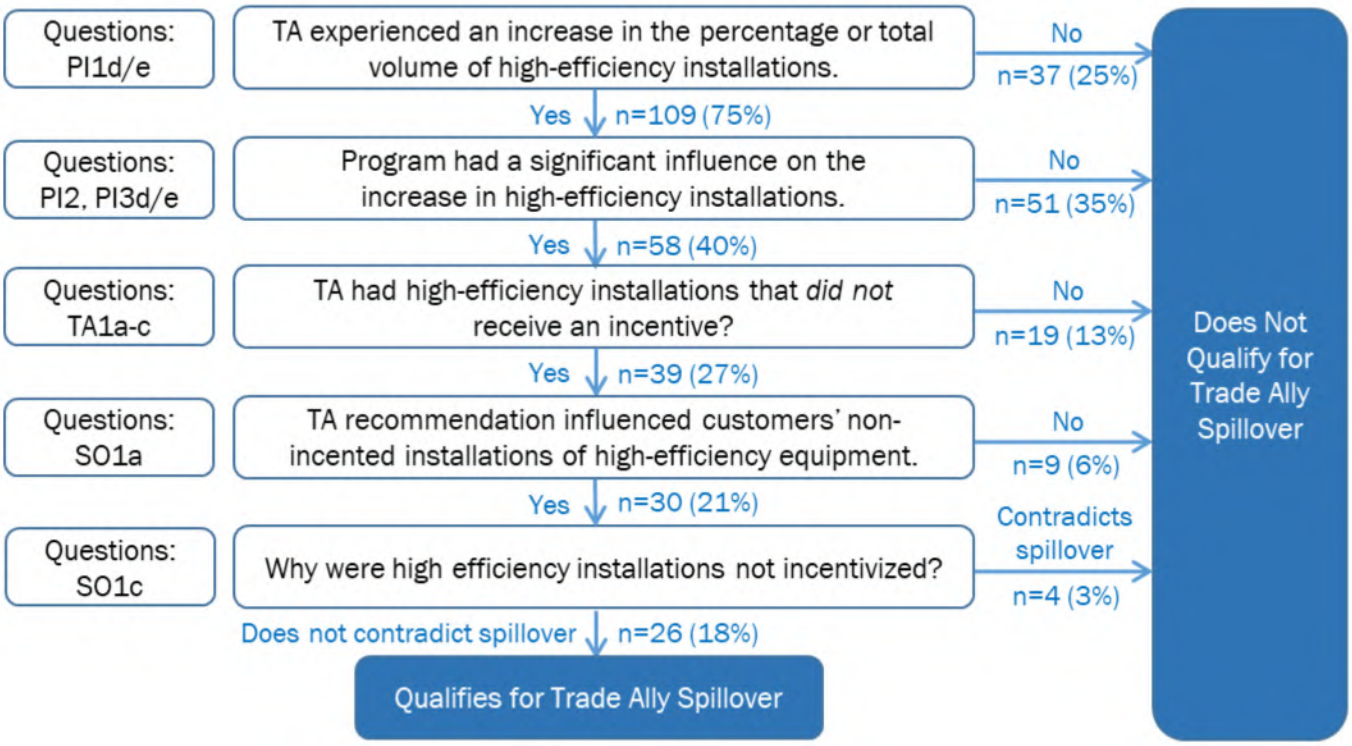
Close to three-quarters of trade allies (72%) reported having had at least one high-efficiency project that did not receive a program incentive during the evaluation period. On average, trade allies reported that 15% of their installations during the evaluation period were standard efficiency, while 64% were high efficiency and received an incentive and 21% were high efficiency and did not receive an incentive. On average, trade allies estimated that non-incented, high-efficiency installations were smaller, about 66% the size of those that received an incentive from the Smart $aver® Prescriptive Program.

Trade allies also reported that it was not too common for projects that receive an incentive from Duke Energy to also include high efficiency equipment that is not included in the incentive application (37% slightly common and 30% not at all common). When this does happen, the most common reason is that the non-incented products are not eligible for incentives through the Smart $aver® Prescriptive Program.

Overall, 18% of responding trade allies qualified for TA SO. Those who did not qualify experienced no increase in their energy-efficient installations (25%); were not influenced by the program (35%); did not have any non-incented, high-efficiency installations (13%); did not think that their recommendations influenced their customers' choice of non-incented, high-efficiency equipment (6%); or provided an open-ended response that contradicted the presence of SO (3%). Figure 5-7 summarizes these TA SO eligibility results.

[12] The Appendix contains additional details on trade ally responses to survey questions about changes to their business practices since becoming a trade ally and the program's influence on these changes.

Figure 5-7. Trade Ally Eligibility for Spillover – Results



Trade allies who qualified for SO most often indicated that the high-efficiency installations were completed without an incentive because the equipment did not qualify for program incentives, because the projects were too small to justify the paperwork, or because the customer had opted out of Duke Energy's energy efficiency programs. Non-incented high-efficiency equipment includes various types of LED lighting (sometimes not eligible for incentives or only eligible in a different category). A few trade allies also mentioned non-lighting equipment, such as solar, EC motor upgrades, compressors, and valves.

We estimated SO savings for each of the trade allies who qualified for SO (26 respondents, or 18%) using the trade ally's program savings from the program-tracking database as well as their survey responses on (1) the share of high-efficiency installations that received a program incentive; (2) the level of increase in the percentage or total volume of high-efficiency installations, and whether factors other than the program contributed to the increase; and (3) the relative size of incented and non-incented projects (for trade allies who could not report the respective shares of total high-efficiency installations that did and did not receive a program incentive). Respondent-level TA SO savings ranged from 272 kWh to just under 3,000 MWh.

Table 5-5 summarizes the results of the respondent-level TA SO savings.

Table 5-5. Summary of Respondent-Level Trade Ally Spillover

Trade Ally	Ex-Post Gross Program Savings (kWh)	Percent of High-Efficiency Installations That Received Incentive	Attribution Factor	Estimated SO Savings (kWh)
#1	2,977,872	50%	100%	2,977,872
#2	9,774,528	65%	25%	1,315,802
#3	696,053	65%	100%	374,798

Trade Ally	Ex-Post Gross Program Savings (kWh)	Percent of High-Efficiency Installations That Received Incentive	Attribution Factor	Estimated SO Savings (kWh)
#4	1,087,942	66%	50%	276,877
#5	65,795	10%	50%	296,076
#6	1,370,610	83%	100%	274,122
#7	84,348	13%	50%	274,131
#8	2,126,611	95%	100%	111,927
#9	605,824	75%	50%	100,971
#10	713,567	83%	50%	71,357
#11	520,023	89%	100%	65,003
#12	202,640	80%	100%	50,660
#13	212,224	67%	50%	53,056
#14	342,483	85%	50%	30,219
#15	630,999	95%	100%	33,210
#16	1,082,303	98%	100%	22,088
#17	234,180	93%	100%	18,014
#18	549,580	95%	50%	14,463
#19	70,455	66%	25%	8,965
#20	154,335	89%	25%	4,823
#21	8,822	66%	100%	4,490
#22	23,697	80%	50%	2,962
#23	9,676	74%	100%	3,456
#24	7,148	89%	100%	893
#25	22,063	93%	50%	788
#26	3,342	75%	25%	272
Total				**6,387,294**

The SO savings from these trade allies (accounting for 6,387 MWh) were used to extrapolate SO savings for the population of participating trade allies. Using the methodology described in Section 5.1.3, we estimated a Respondent SO Ratio of 7.7% and a Program-level SO Ratio of 7.0%.

5.3 Net Impact Results

Table 5-6 and Table 5-7 present the ex post net impacts for DEC and DEP, respectively, that result from applying the evaluation NTGRs to ex post gross savings.

The DEC program realized net energy savings of approximately 426 GWh during the evaluation period. The main channel contributed 215 GWh to this total while the midstream channel contributed 204 GWh and the Business Savings Store contributed 7 GWh.

Table 5-6. Summary of DEC Net Program Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Main Channel	**243,946,395**	**44,453**	**42,831**	**0.88**	**215,112,095**	**39,161**	**37,820**
Lighting	*223,443,824*	*40,278*	*39,829*	*0.89*	*198,641,559*	*35,807*	*35,408*
Pumps and Drives	*9,604,616*	*1,425*	*1,478*	*0.80*	*7,715,772*	*1,145*	*1,188*
HVAC	*6,659,752*	*2,278*	*1,050*	*0.80*	*5,350,045*	*1,830*	*844*
Food Service	*2,784,828*	*213*	*202*	*0.80*	*2,237,164*	*171*	*162*
Process	*1,453,375*	*260*	*272*	*0.80*	*1,167,554*	*209*	*218*
IT	-	-	-	*0.80*	-	-	-
Midstream Channel	**230,286,322**	**40,071**	**39,616**	**0.89**	**204,029,075**	**35,502**	**35,099**
Lighting	*230,076,090*	*39,876*	*39,615*	*0.89*	*203,842,814*	*35,329*	*35,098*
Non-Lighting	*210,232*	*196*	*2*	*0.89*	*186,261*	*173*	*1*
Business Savings Store	**7,813,947**	**1,194**	**1,286**	**0.89**	**6,923,001**	**1,058**	**1,140**
TOTAL DEC	**482,046,663**	**85,719**	**83,734**	**0.88**	**426,064,171**	**75,722**	**74,059**

The DEP program realized net energy savings of approximately 141 GWh during the evaluation period. The main channel contributed 72 GWh to this total while the midstream channel contributed 68 GWh and the Business Savings Store contributed less than 1 GWh.

Table 5-7. Summary of DEP Net Program Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Main Channel	**95,034,465**	**16,442**	**15,678**	**0.76**	**71,780,071**	**12,413**	**11,852**
Lighting	*86,819,822*	*14,852*	*14,628*	*0.76*	*65,821,580*	*11,260*	*11,090*
Pumps and Drives	*1,694,655*	*232*	*211*	*0.73*	*1,229,218*	*168*	*153*
HVAC	*4,366,481*	*1,174*	*785*	*0.73*	*3,167,227*	*851*	*569*
Food Service	*832,522*	*56*	*54*	*0.73*	*603,870*	*41*	*39*
Process	*143*	-	*0.3*	*0.73*	*104*	-	*0.2*
IT	*1,320,842*	*128*	-	*0.73*	*958,073*	*93*	-
Midstream Channel	**81,128,776**	**14,066**	**13,956**	**0.84**	**68,303,128**	**11,842**	**11,750**
Lighting	*81,053,594*	*14,003*	*13,955*	*0.84*	*68,239,832*	*11,790*	*11,749*
Non-Lighting	*75,182*	*62*	*1*	*0.84*	*63,296*	*52*	*1*
Business Savings Store	**967,368**	**111**	**134**	**0.84**	**814,437**	**93**	**113**
TOTAL DEP	**177,130,609**	**30,618**	**29,768**	**0.80**	**140,897,636**	**24,348**	**23,714**

6. Process Evaluation

The process evaluation for the **main channel** focused on program processes, customer and trade ally satisfaction with the program, program strengths and weaknesses, and opportunities for program improvement. Our research focused on areas of change, e.g., the new pre-approval process, as well as areas of interest identified by program staff, e.g., the status of the commercial lighting market and remaining opportunities for lighting and non-lighting upgrades.

For the **midstream channel**, the process evaluation was limited to an assessment of participant satisfaction.

6.1 Researchable Questions

The process evaluation explored the following questions:

- How effective are the program implementation practices?
- Are participants and trade allies satisfied with their program experiences?
- What is the level of awareness and interest in the new pre-qualification option? How satisfied are customers and trade allies with this process? Is it effective in increasing the reach of the program?
- What are the strengths, weaknesses, and opportunities for program improvement?
- What are key barriers to the installation of energy-efficient equipment and program participation? How can the program increase the share of savings from non-lighting measures?
- What is the status of the non-residential lighting market (from the point of view of participating trade allies)?
- What are remaining opportunities for energy efficiency upgrades for lighting and non-lighting measures?

6.2 Methodology

The process evaluation relied primarily on an analysis of responses to the surveys with main channel participants, midstream participants, and participating main channel trade allies. These survey efforts are described in more detail in Section 3, including sample design, the number of completed interviews, and response rates. To support the process evaluation, we also developed participant survey weights, developed cross-tabulations of survey responses, and conducted significance testing for all three surveys, as described below.

Participant Survey Weights

The sample designs of both participant surveys were based on the needs of the impact analysis and oversampled projects with larger savings and, for the main channel survey only, projects with non-lighting technologies. To ensure that aggregated responses to process questions are representative of the population, we developed process weights, which reflect each stratum's percentage of projects in the population divided by its percentage of projects in the sample.

Table 6-1 summarizes the process weights for the main channel participant survey.

Table 6-1. Main Channel Participant Survey Process Weights

Stratum	Population (n=11,172)	Survey Completes (n=170)	Weight
DEC Lighting Large	2%	8%	0.24
DEC Lighting Medium	20%	12%	1.73
DEC Lighting Small	38%	15%	2.50
DEC Non-Lighting Large	<1%	1%	0.21
DEC Non-Lighting Medium	1%	7%	0.19
DEC Non-Lighting Small	9%	18%	0.49
DEP Lighting Large	1%	4%	0.30
DEP Lighting Medium	8%	12%	0.66
DEP Lighting Small	15%	16%	0.94
DEP Non-Lighting Large	<1%	3%	0.10
DEP Non-Lighting Medium	1%	2%	0.50
DEP Non-Lighting Small	4%	3%	1.46

Table 6-2 summarizes the process weights for the midstream participant survey.

Table 6-2. Midstream Channel Participant Survey Process Weights

Stratum	Population (n=12,526)	Survey Completes (n=147)	Weight
DEC Lighting Large	1%	4%	0.35
DEC Lighting Medium	18%	25%	0.73
DEC Lighting Small	54%	22%	2.48
DEP Lighting Large	1%	2%	0.40
DEP Lighting Medium	6%	16%	0.39
DEP Lighting Small	19%	31%	0.62

Cross-Tabulation of Survey Results

For each of the three surveys, we developed detailed survey results tables showing weighted response frequencies for all process-related survey questions and cross-tabulations of responses for subgroups of interest. These survey results can be found in the Appendix.

We used the following subgroups for cross-tabulations:

Main Channel Participant Survey:

- Jurisdiction: DEC participants versus DEP participants
- Type of project: Lighting projects versus non-lighting projects
- Size of projects: Small projects versus medium/large projects

Midstream Participant Survey:

- Jurisdiction: DEC participants versus DEP participants
- Size of company: Fewer than 50 employees versus 50 or more employees
- Size of projects: Small projects versus medium/large projects

Trade Ally Survey:

- Type of projects: Only lighting projects versus one or more non-lighting projects
- Number of projects: Fewer than 5 projects versus 5 or more projects completed during the evaluation period
- Jurisdiction: Predominantly DEC versus predominantly DEP
- Company's geographic reach: Local companies versus regional/national companies

It should be noted that the survey results tables included in the Appendix include both valid and non-valid responses (generally "unsure" responses). In contrast, most of the process analyses presented in this report consider only valid responses. As a result, percentages shown in the survey tables may not always align with the results presented in the subsections below. In addition, all results shown in the results tables for the participant surveys, including the number of respondents, are weighted. While process results in this report are weighted as well, the underlying number of responses ("n") is on an unweighted basis, so again may not match numbers in the survey results tables.

Significance Testing

We conducted significance testing to determine if differences in responses between the subgroups included in the cross-tabulations are statistically significant. We compared (1) percentages, using the Independent Z-Test for Percentages; and (2) means, using the Independent T-Test for Means (unequal variances). Throughout this section, we report differences in responses only if they are statistically significant at a 90% confidence level. The detailed survey results in the Appendix identify statistically significant differences between all subgroups and for all questions.

6.3 Key Findings – Main Channel

Below, we present key findings related to this evaluation's researchable questions.

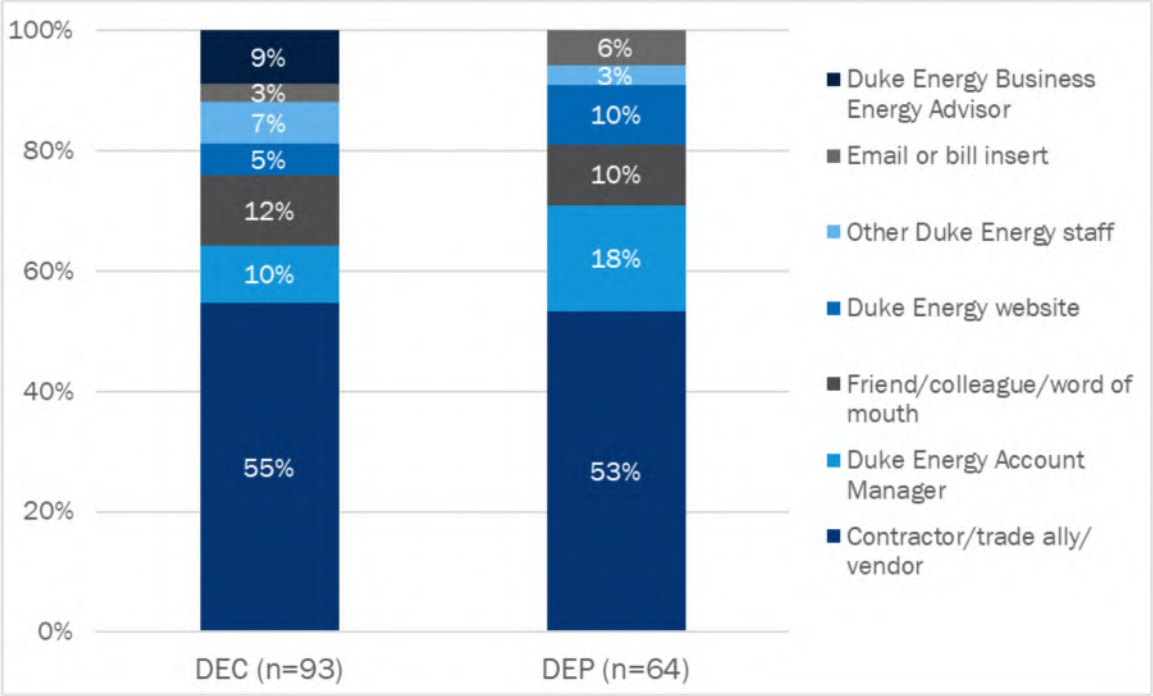
6.3.1 Sources of Program Information

The Smart $aver® Prescriptive Program relies on Duke Energy staff—including program staff, BEAs, and Large Business Account Managers—and trade allies working together to drive customer awareness and participation in the program. Main channel trade allies play a particularly important role in promoting the program as they are in direct contact with customers at the time of equipment replacement/installation.

The main channel participant survey included questions about program awareness and sources of program information, and responses confirmed the importance of trade allies in driving program awareness: Over half of respondents (55% DEC, 53% DEP) first heard about the program from a contractor, trade ally, or vendor. Other important sources of program awareness were Duke Energy staff (including Account Managers, BEAs,

and other staff; 25% DEC , 21% DEP), word of mouth (12% DEC, 10% DEP), and the Duke Energy website (5% DEC, 10% DEP). Figure 6-1 summarizes these results.

Figure 6-1. Participant Sources of Program Information



Most respondents also reported working with a contractor or vendor to assist with the selection of equipment (79% DEC, 75% DEP). Almost half (44% DEC, 49% DEP) of respondents said the contractor or vendor was the most influential in identifying the installed equipment, followed by the respondents themselves (40% DEC, 35% DEP).

6.3.2 Pre-Qualification Option

During the evaluation period, the Smart $aver® Prescriptive Program introduced an option for trade allies and customers to pre-qualify their incentive applications. Under this option, trade allies or customers can submit an incentive application for review by program staff to (1) ensure that the product they plan to install is eligible and (2) receive documentation of the incentive level. If approved, the application is pre-qualified for 90 days.[13]

To explore customer and trade ally views of this new pre-qualification option, the main channel participant and trade ally surveys included short modules on this topic, including questions about awareness and prior use, benefits and satisfaction, and the likelihood of future use.

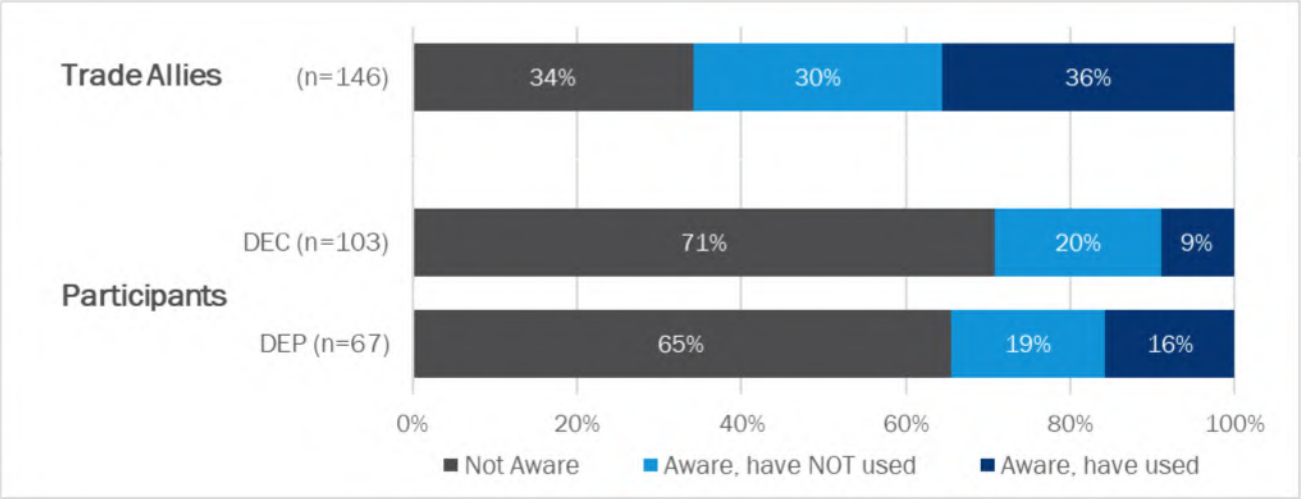
Awareness and Prior Use

Not surprisingly, awareness of the pre-qualification option is higher among trade allies (66%) than among participating customers (29% DEC, 35% DEP). Trade allies are also more likely to have taken advantage of the

[13] Unlike in the Midwest, the pre-qualification in DEC and DEP service territory does not include a "reservation" (or guarantee) of incentive funds.

pre-qualification option than customers. Figure 6-2 shows trade ally and customer awareness and prior use of the pre-qualification offering.

Figure 6-2. Awareness and Prior Use of the Pre-Qualification Option



Benefits and Satisfaction

Among trade allies who have used the pre-qualification option, 54% reported that it had an impact on the *number* of projects completed, while 37% reported that it had an impact on the *type* of projects completed. Trade allies see the certainty of knowing that the equipment will qualify and what the incentive amount will be as the main benefits of the pre-qualification option. Several interviewed trade allies also noted that the pre-qualification option saves time and speeds up the application and rebate process. Notably, several responses suggest that trade allies believe that the incentive is "set aside" or "guaranteed." The program may wish to more clearly communicate to trade allies that pre-qualification does not mean that incentives are reserved, especially if the program should ever be in a situation of potentially exhausting its incentive budgets.

Trade ally satisfaction with the pre-qualification option is high, with a mean rating of 8.2 on a scale of 0 to 10 (where 0 means "extremely dissatisfied" and 10 means "extremely satisfied"). Only 8% of trade allies who have used the pre-qualification option reported having experienced an issue with it. The only issue noted by more than one interviewed trade ally was related to having to provide the customer's account number:

> *"Hard to find customers using their address. Not the biggest deal as you can just ask for their account number. Would make life easier if the search functionality was more intuitive."*

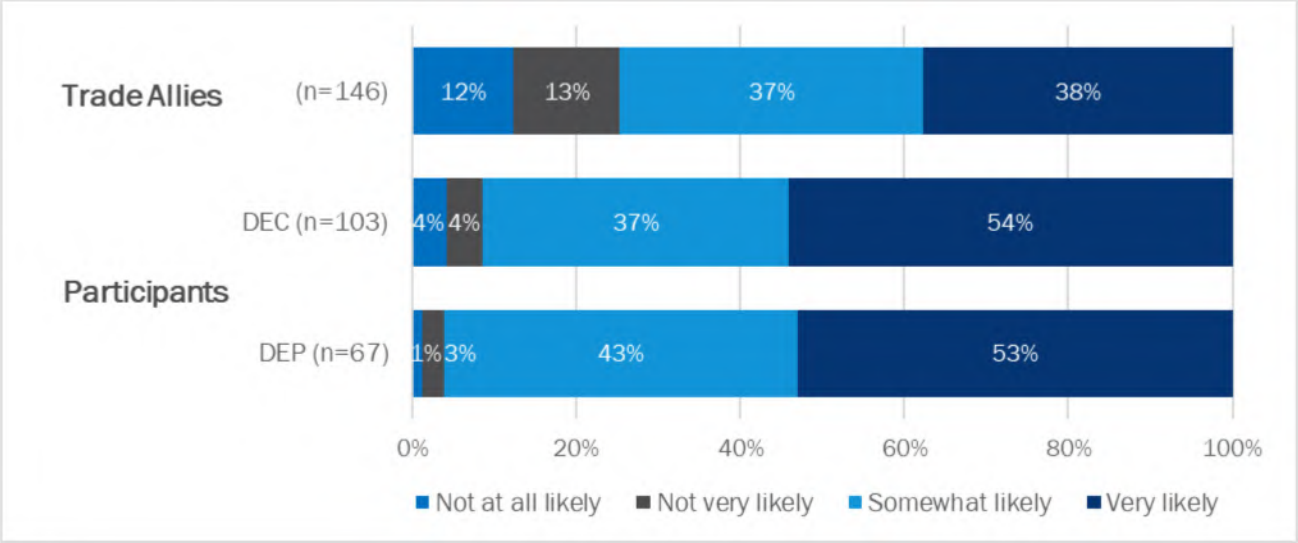
Among participants who have used the pre-qualifying option, 81% reported an impact on the type of equipment installed, 52% on the quantity of equipment installed, and 39% on the ability to complete the project. Similar to trade allies, participants see the certainty of knowing that the equipment will qualify and what the incentive amount will be as the main benefits of the pre-qualification option. Several interviewed participants noted that this can be helpful to secure budget approval for their projects.

Participant satisfaction with the pre-qualification option is very high, with a mean rating of 9.0 on a scale of 0 to 10, and only 4% of participants who have used the pre-qualification option reported having experienced an issue with it.

Likelihood of Future Use

Once aware of the pre-qualification option's availability, most interviewed participants (91% DEC, 96% DEP) reported being somewhat or very likely to use it in the future (see Figure 6-3). While still high, the likelihood among trade allies to use the option in the future is somewhat lower compared to customers (75%). Those not likely to use the option going forward most often noted that they are familiar with qualifying equipment and incentive levels and therefore do not find it necessary to pre-qualify their applications. Others noted that going through the pre-approval process can delay project timelines.

Figure 6-3. Likelihood of Using the Pre-Qualification Option for Future Projects



6.3.3 Program Satisfaction

The participant and trade ally surveys explored satisfaction with the Smart $aver® Prescriptive Program overall, as well as with individual program components. All satisfaction questions asked respondents to rate their satisfaction on a scale of 0 to 10, where 0 means "extremely dissatisfied" and 10 means "extremely satisfied." Consistent with Duke Energy's practices, we categorized numeric responses as follows:

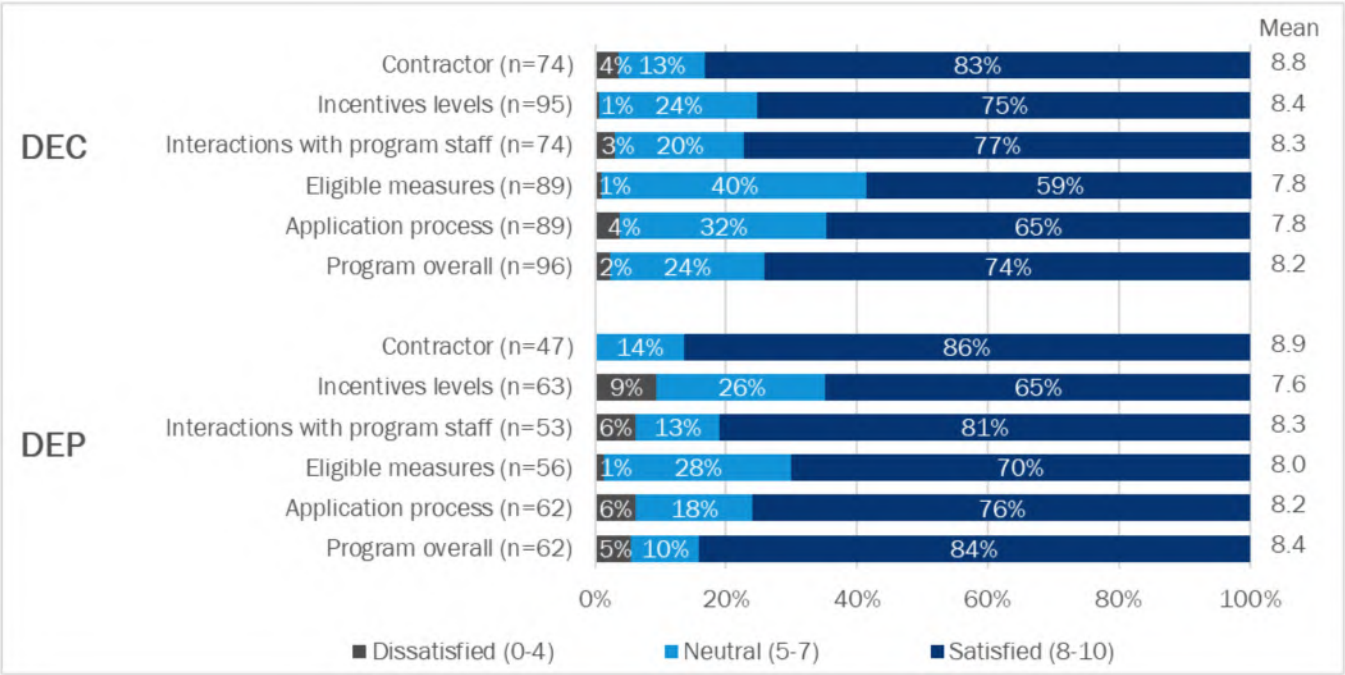
- 0 to 4 = "Dissatisfied"
- 5 to 7 = "Neutral"
- 8 to 10 = "Satisfied"

Participant Satisfaction

Participants in the main channel are generally very satisfied with their program experience and with most program components. All program components included in the survey received a mean rating of 7.6 or higher, and the program overall was rated an average of 8.2 by DEC participants and 8.4 by DEP participants. Both DEC and DEP participants are most satisfied with contractors who installed the equipment (mean satisfaction rating of 8.8 DEC and 8.9 DEP). DEC participants are least satisfied with the application process and eligible measures (mean rating of 7.8), while DEP participants are least satisfied with incentive levels (mean rating of 7.6).

Figure 6-4 summarizes main channel participant responses to the satisfaction questions.

Figure 6-4. Main Channel Participant Satisfaction with Program Components



Additional findings related to main channel participant satisfaction include:

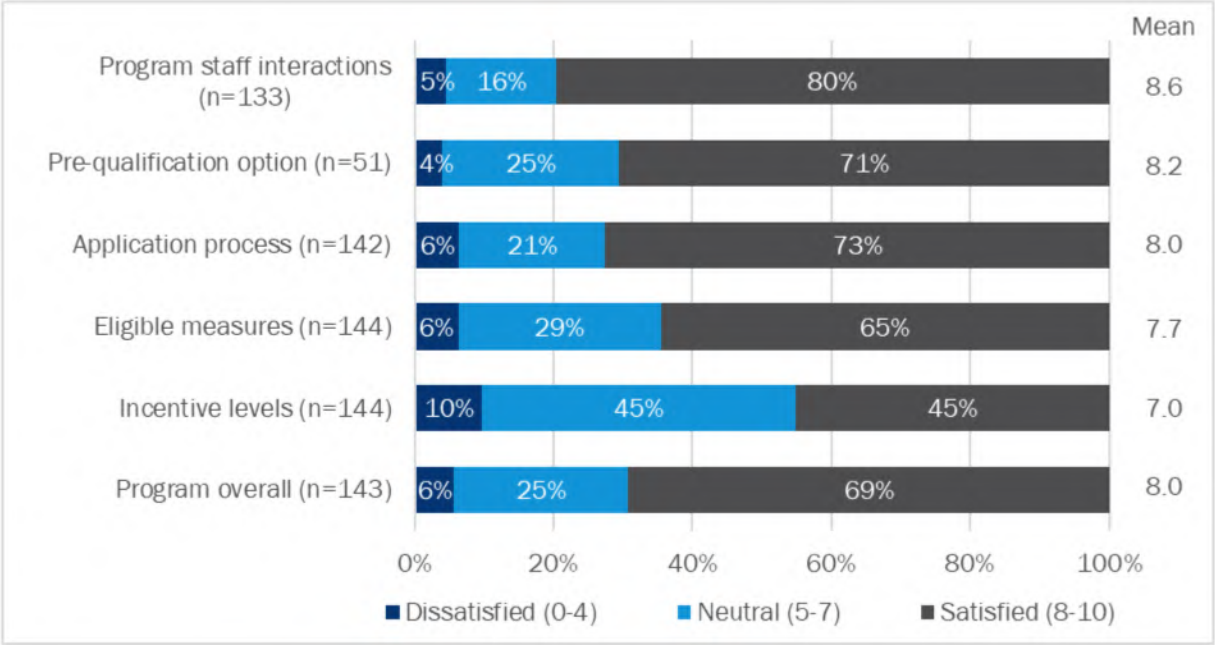
- **Application process:** The main source of reduced satisfaction was that the application process is complicated and tedious and requires a lot of detailed information. Several respondents noted a lack of clarity of what was required, and one suggested that a workflow sheet might be helpful.
- **Eligible measures:** The most common suggestion among less-than-satisfied participants was that the list of eligible measures is too specific and therefore too limited. In addition, a few respondents offered measure categories they felt could benefit from additional eligible measures, including new construction, exterior lighting, and HVAC.
- **Incentive levels:** Most participants who were less than satisfied with incentive levels did not name specific measures for which they would like to see higher incentive levels. One interviewed participant suggested a more direct correlation between efficiency levels and incentive levels, while another noted that incentives sometimes are not enough to cover the cost of the vendor to complete the application.

Trade Ally Satisfaction

In general, trade allies are satisfied with the program but gave satisfaction ratings slightly lower than those given by main channel participants. Mean trade ally satisfaction ratings for program components range from 7.0 to 8.6, with trade allies expressing particularly high satisfaction with program staff interactions. Trade allies expressed lower satisfaction with incentive levels (mean rating of 7.0). The mean rating for the program overall was 8.0, with 69% of trade allies providing a "satisfied" rating.

Figure 6-5 summarizes responses to the trade ally satisfaction questions.

Figure 6-5. Trade Ally Satisfaction with Program Components



Additional findings related to trade ally satisfaction include:

- **Application process:** Similar to participants, the main complaint voiced by less-than-satisfied trade allies is that the application process can be time consuming, lengthy, and difficult to navigate and that better educational materials would be helpful. Several interviewed trade allies noted that as a result of this process, they now go through the midstream channel or sometimes skip the program altogether. A few trade allies also noted that due to confusions in the process, their customers missed out on some rebates or the trade ally had to absorb the cost.
- **Eligible measures:** There was no consensus among less-than-satisfied trade allies as to what additional measures the program should offer, suggesting that there are no obvious gaps in the program. A few specific recommendations included options for 8-foot fixtures, a wider range of DLC-approved fixtures, and more clarity on what lights are eligible, e.g., basing eligibility on wattages rather than listing specific makes and models.
- **Incentive levels:** Trade allies who were less than satisfied with incentive levels often pointed to decreasing lighting incentive levels over time, which they believe has had an adverse effect on the number and scope of LED projects. This is due not only to the incentive amount covering less of the incremental cost (they believe the reduction in incentives has outpaced the reduction in LED prices)

but also to the uncertainty it introduces for longer-term planning. Some trade allies also suggested better alignment of incentive levels with energy savings, e.g., higher incentives for DLC premium fixtures.

- **Program staff interactions:** While program staff interactions received generally high satisfaction ratings, several trade allies mentioned that program staff can be hard to reach and that responses are sometimes delayed. A few trade allies mentioned the need of a more direct line and/or assigned program representatives, which they thought would help in getting better and more consistent information.

6.3.4 Remaining Opportunities for Energy Efficiency Upgrades

As part of this evaluation, Duke Energy was interested in exploring remaining opportunities for energy efficiency upgrades among their customers. While a rigorous examination of remaining opportunities was outside the scope of this study, Opinion Dynamics added to the main channel participant and trade ally surveys questions to explore this topic. The subsections below present the results of this investigation for lighting and non-lighting equipment, respectively.

It should be noted that the results in this section represent a high-level and somewhat limited view of broader program opportunities. Customers often struggle to accurately self-report details about their energy-using equipment, such as efficiency levels. In addition, the surveys only included *participating* customers and trade allies, who may not be representative of their respective populations in terms of their equipment and their views on energy efficiency. The results in this section should be interpreted with these limitations in mind. To obtain a more rigorous picture of remaining opportunities, Duke Energy should consider conducting baseline research with the general population of customers and trade allies (rather than just participants) that also includes on-site visits (to collect reliable information on equipment characteristics).

Lighting Opportunities

Over the past few years, lighting projects have dominated the DEC and DEP Smart $aver® Prescriptive Program. As the lighting market evolves and LED lighting becomes more commonplace, Duke Energy seeks to better understand trends in the lighting market, the role of the Smart $aver® Program in customer decision-making, and remaining opportunities. To explore these topics, the main channel participant and trade ally surveys included questions about the following:

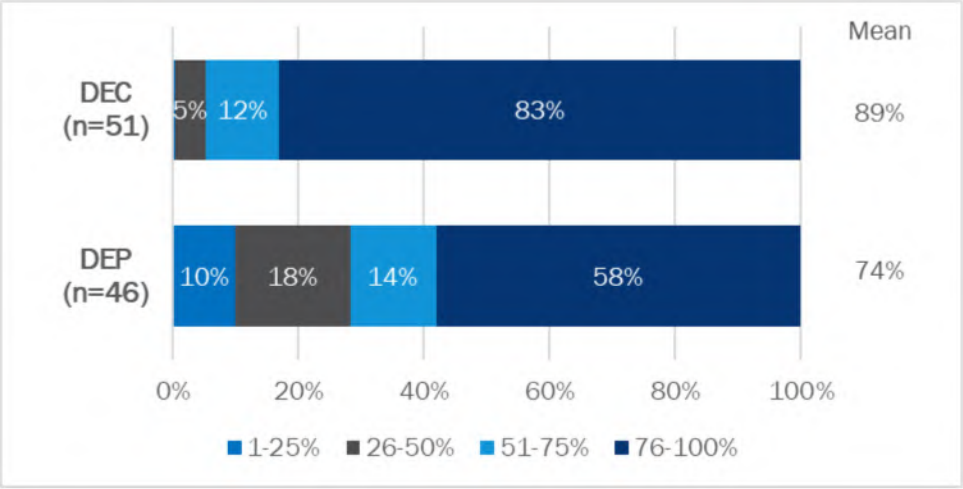
- Share of facility's lighting equipment updated through Smart $aver® lighting projects and type of lighting equipment not replaced (asked of main channel participants with lighting projects);
- Lighting equipment present at facilities (asked of main channel participants with non-lighting projects); and
- Lighting Market Trends and Drivers of LED Sales (asked of main channel trade allies who identified lighting as an area of expertise).

Scope of Lighting Projects and Equipment Not Replaced

On average, lighting projects completed through the program addressed 85% of interior lighting in participants' facilities (89% DEC, 74% DEP). More than one-third of lighting projects addressed 100% of interior lighting

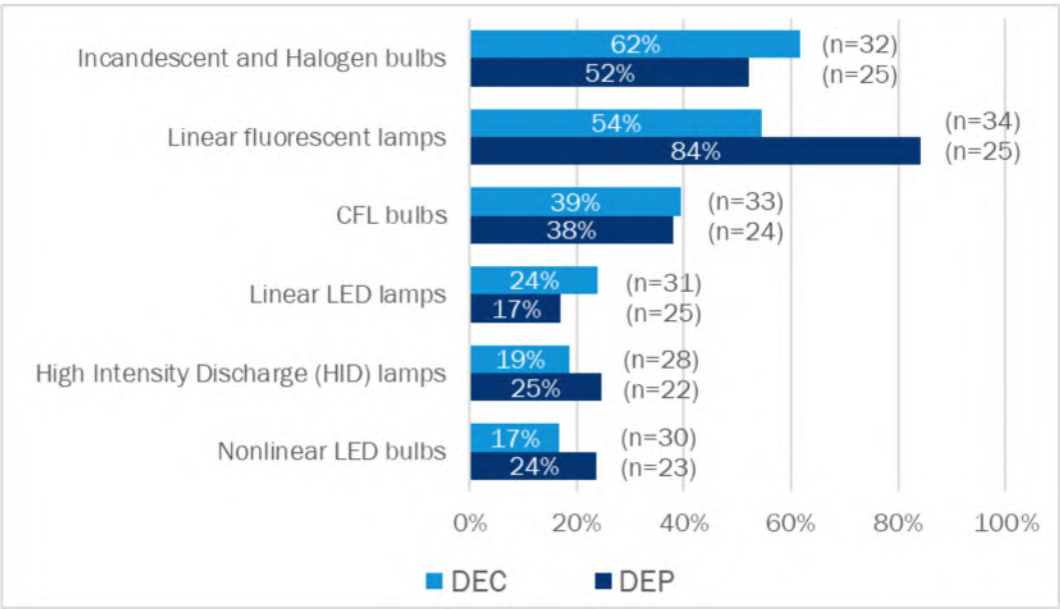
(36% DEC, 38% DEP), while only 12% of projects addressed 50% or less of interior lighting (5% DEC, 28% DEP).[14] Figure 6-6 summarizes these results.

Figure 6-6. Share of Interior Lighting Updated through Program



Most participants who did not update all of their interior lighting equipment through the program still have incandescent/halogen bulbs (62% DEC, 52% DEP) and linear fluorescents lamps (54% DEC, 84% DEP) present at their facilities. Of participants with remaining linear fluorescent lamps, most have T8 lamps (70% DEC, 63% DEP) and about half have T12 lamps (49% DEC, 46% DEP). It should be noted that some of the equipment that was not updated as part of the Smart $aver® project is already efficient equipment (linear and non-linear LEDs and CFLs). Figure 6 7 summarizes these results.

Figure 6-7. Percentage of Projects Where Lighting Not Updated by Type



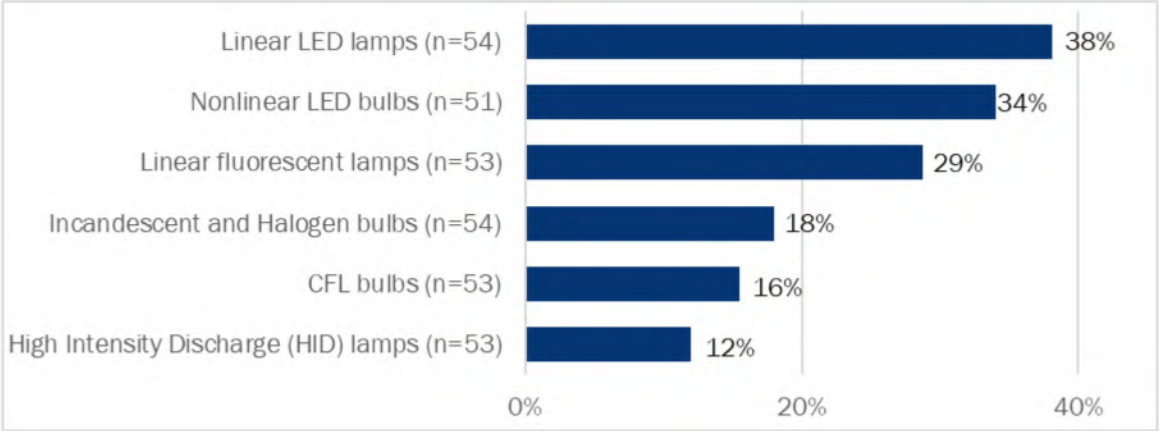
[14] Note that these results exclude lighting projects that only included exterior lighting measures.

Combined, these results suggest limited remaining opportunities for additional interior lighting projects among these participants.

Lighting Equipment Present at Facilities with Non-Lighting Projects

Among participants who completed non-lighting projects, linear LEDs (38%) and nonlinear LEDs (34%) are the bulb types most commonly present at their facilities. In contrast, less efficient technologies are present less frequently, incandescent and halogen bulbs at 18% of facilities and HID lamps at 12% of facilities (see Figure 6-8). Overall, only 11% of participants with non-lighting projects have no LEDs or CFLs at their facilities but 59% have at least some inefficient lighting technologies, including incandescent/halogen bulbs, HID lighting, or T8/T10/T12 linear fluorescent lighting, suggesting some remaining opportunities among this group of participants.

Figure 6-8. Penetration of Lighting Equipment Among Non-Lighting Participant Facilities



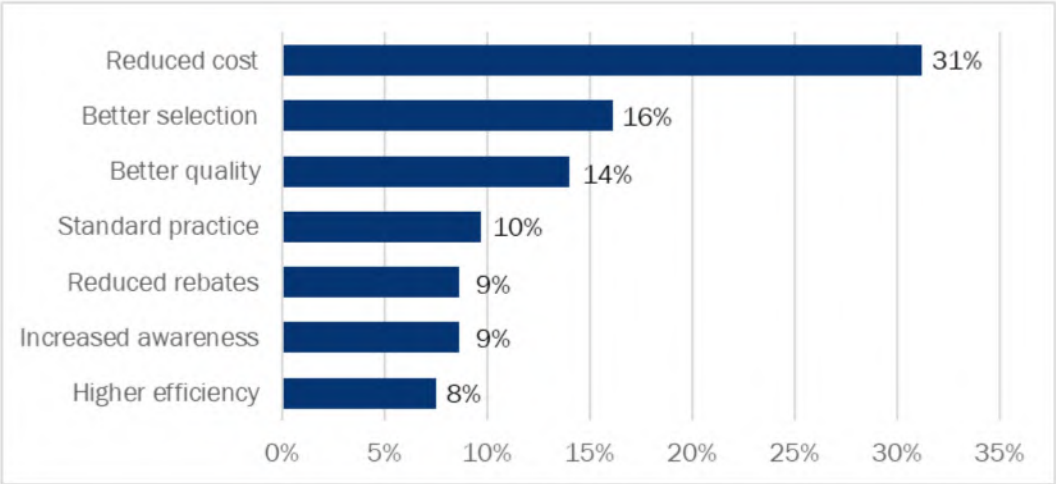
Lighting Market Trends and Drivers of LED Sales

To further explore remaining lighting opportunities, our trade ally survey included a series of questions about recent changes in the lighting market as well as the influence of the Smart $aver® Program on LED sales.

Trade allies most frequently identified reduced cost as the most important change in the lighting market over the past year (31%). In addition, increased selection (16%) – including greater varieties of styles, colors, and fixture sizes, and the integration of controls – and improvements in quality (14%) were frequently mentioned market changes. Interestingly, a number of interviewed trade allies mentioned reduced utility rebates as a recent change in the lighting market, and some noted adverse consequences on their sales. In the words of one interviewed trade ally:

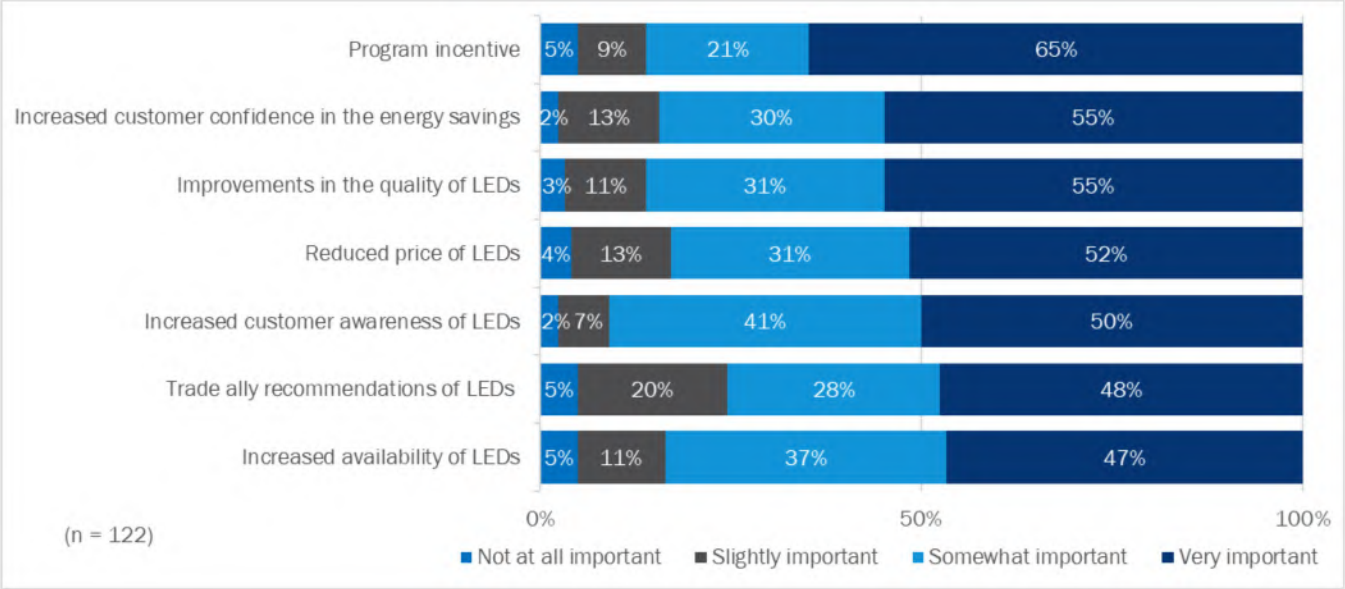
"Lots of utilities are starting to no longer reward LEDs stating that they are now the baseline for most projects but I don't agree with this action. A significant majority of the commercial market has still not converted to LEDs and many that were the early takers of LEDs 10 years ago are already looking to replace the fixtures because of the huge advances in LED drivers and optics."

Figure 6-9. Recent Changes in Lighting Market



When asked about factors contributing to the significant increase in the number of LEDs incented through the Smart $aver® Prescriptive Program, trade allies stressed the importance of the program incentive, with 65% considering it very important. However, trade allies also attributed high importance to other, market-based factors, including increased customer confidence in energy savings (55%), quality improvements (55%), price reductions (52%), and increases in customer awareness (50%; see Figure 6-10).

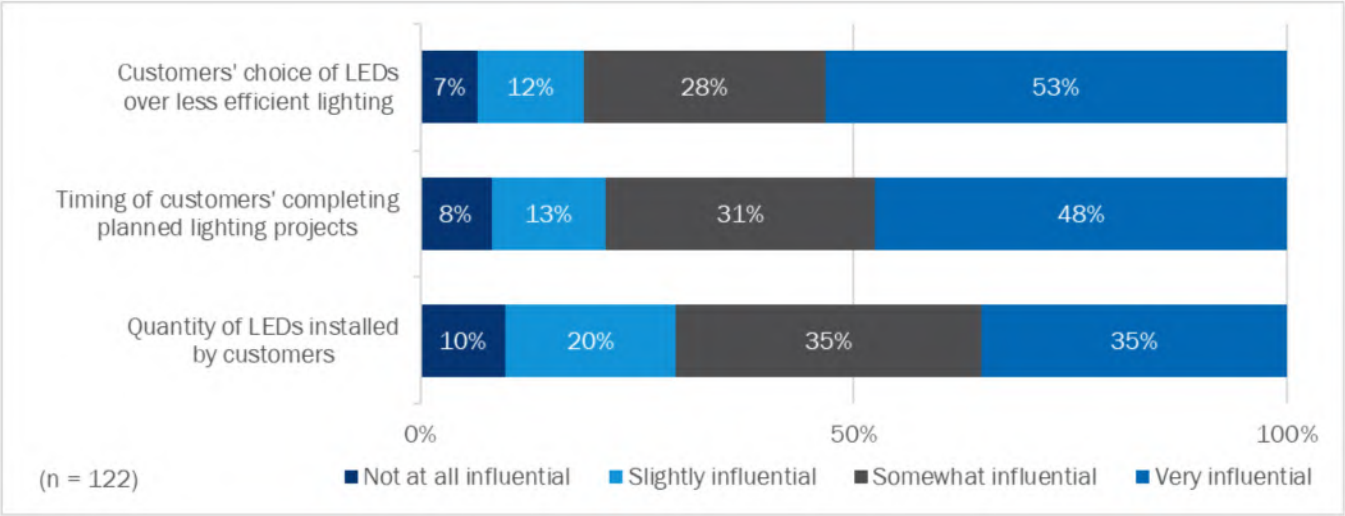
Figure 6-10. Key Factors Contributing to the Increase in LEDs Incented through the Smart $aver® Program



Trade allies also provided their perception of the influence of program LED incentives on customer projects in terms of the selected equipment as well as the timing and quantity of their lighting projects. Overall, trade allies believe that the program incentive has the highest influence on equipment selection, i.e., many customers would not select LEDs in the absence of the incentive (53% consider it very influential), followed by project timing, i.e., the incentive accelerates projects (48%). Trade allies attribute less of an influence on the size of LED projects (35%; see Figure 6-11).

These findings are consistent with free-ridership results based on participant self-report (see Section 5.2.1), which show a high program influence on lighting savings with equipment selection and project timing being key drivers of program attribution.

Figure 6-11. Influence of Program Incentives on Customer Projects



Non-Lighting Opportunities

Given the heavy reliance of the DEC and DEP Smart $aver® Prescriptive Program on savings from lighting projects, Duke Energy is interested in exploring opportunities to increase the contribution of non-lighting equipment to program savings. This evaluation included investigation of two related topics:

- Energy-using non-lighting equipment present at participants' facilities, including recent replacements/upgrades to this equipment and the efficiency level of those upgrades (asked of main channel participants); and
- Barriers to making energy-efficient improvements and participation in the Smart $aver® Program (asked of main channel participants and trade allies who identified at least one non-lighting technology as an area of expertise).

Energy-Using Non-Lighting Equipment and Recent Upgrades

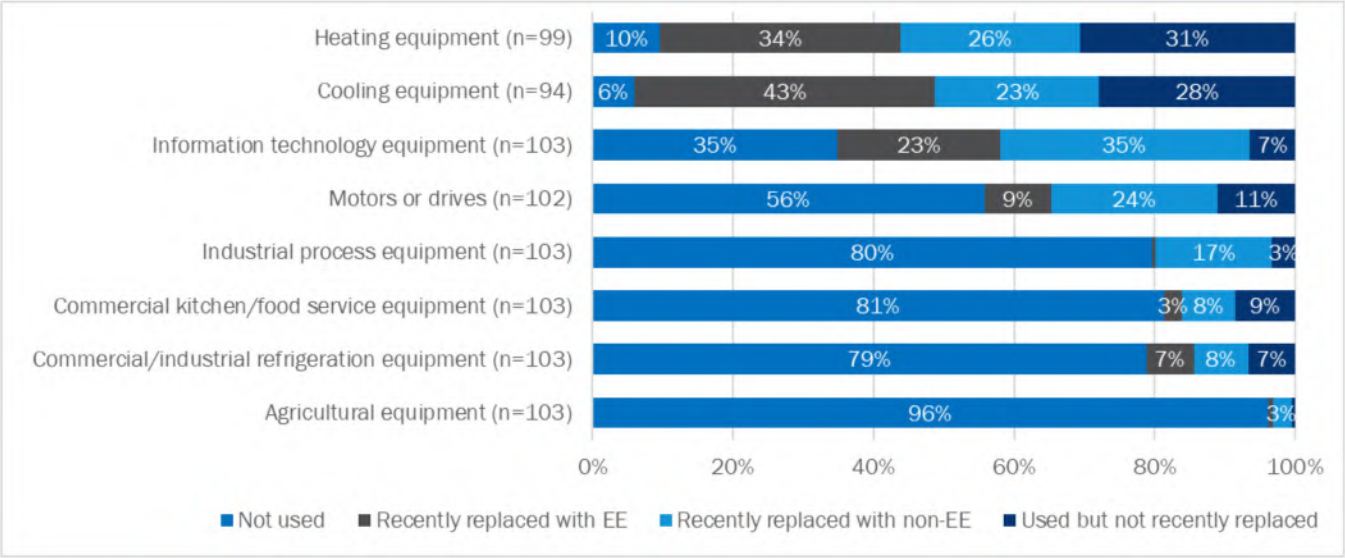
The most commonly used energy-using equipment at participating customers' facilities (other than lighting) includes heating (90% DEC, 77% DEP), cooling (94% DEC, 82% DEP), and information technology (65% DEC, 56% DEP). These three equipment types are also the most likely to have undergone energy-efficient upgrades

in the past five years.[15] Nevertheless, a large share of facilities with these equipment types have not recently made upgrades—or have made upgrades, but with standard-efficiency equipment—and might therefore present opportunities for future program participation.

While opportunities for other types of equipment appear more limited, it is difficult to draw definite conclusions from these results. As noted above, this analysis was limited to program participants (albeit for a different end-use) who may not be representative of other, non-participating customers in their equipment usage and replacement behaviors. For some equipment types, e.g., process equipment, it is also impossible to ascertain, based on a self-report survey, if existing equipment could be replaced or upgraded with program-eligible options. And finally, there is uncertainty about actual efficiency levels of recently replaced equipment, as customers often compare efficiency levels of their new equipment to that of their replaced equipment, which can lead to over-reporting of efficiency levels.

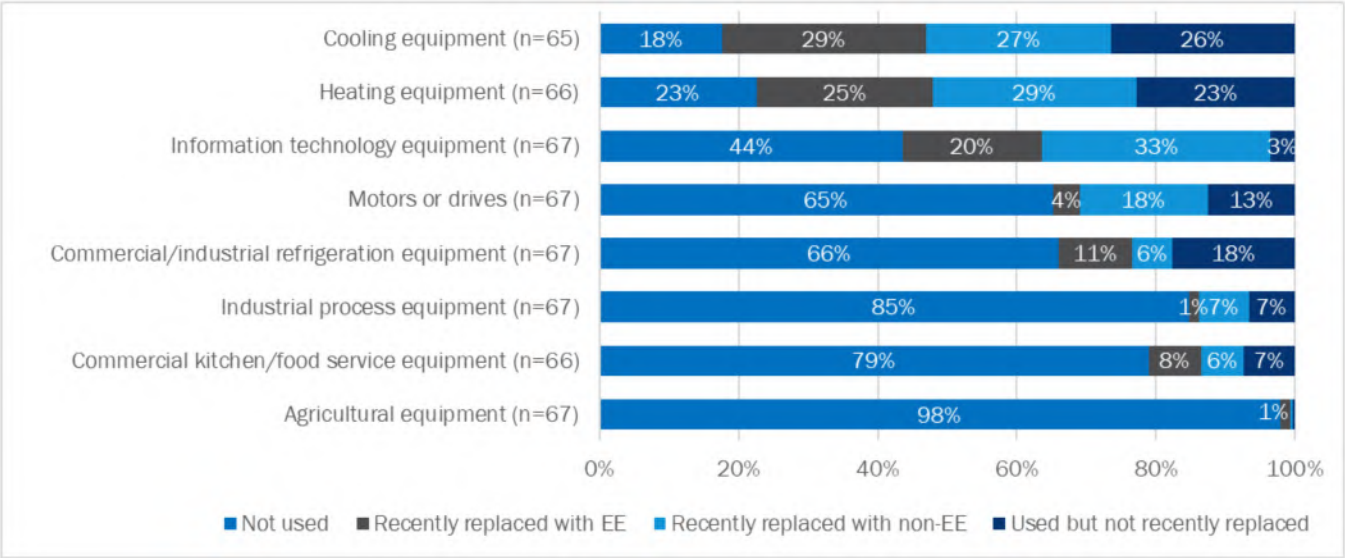
Figure 6-12 and Figure 6-13 summarize these results for DEC and DEP participants, respectively.

Figure 6-12. Opportunities for Non-Lighting Improvements – DEC



[15] In order to reduce potential biases, the numbers presented for each end-use *exclude* participants who received a program incentive for that end-use. For example, participants who received an incentive for cooling equipment are not included in the results for the cooling end-use as they, by definition, recently made energy-efficient upgrades.

Figure 6-13. Opportunities for Non-Lighting Improvements – DEP



Barriers to Energy Efficiency and Program Participation

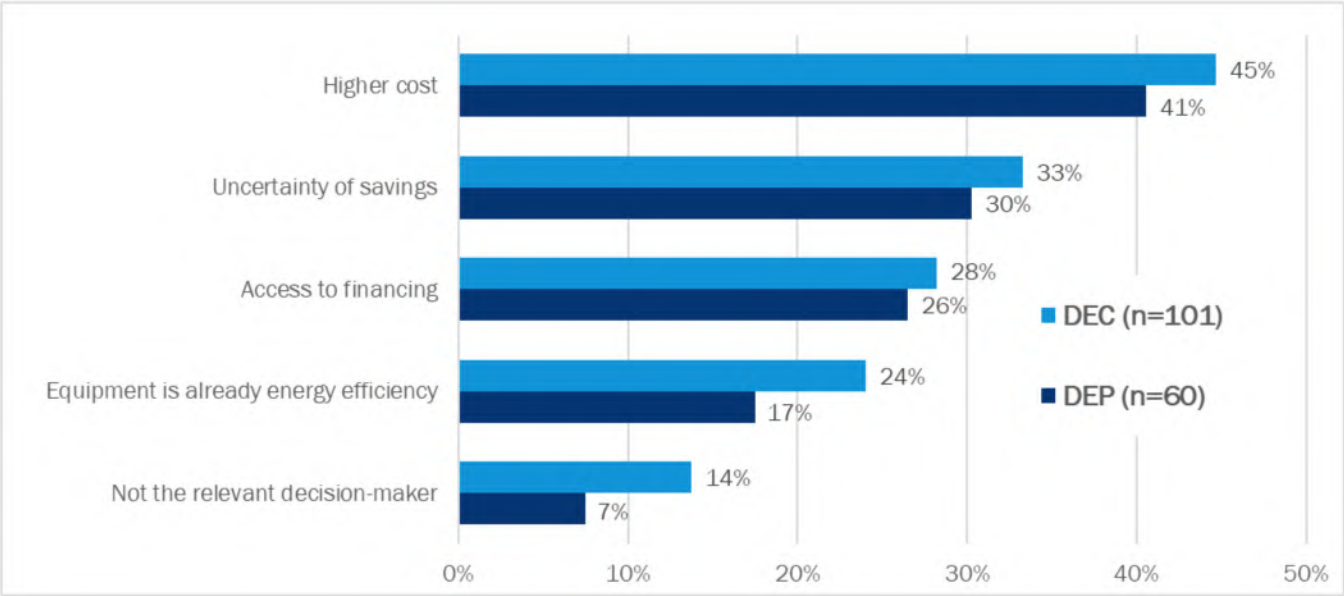
To further explore opportunities to increase non-lighting program participation, the main channel participant and trade ally surveys solicited feedback on barriers to customer adoption of energy-efficient non-lighting equipment, barriers to program participation, and actions Duke Energy could take to reduce those barriers. In addition, the trade ally survey asked trade allies to identify non-lighting measures that they believe have the most potential for increased program uptake.

Not surprisingly, both participants (45% DEC, 41% DEP) and trade allies (51%) pointed to upfront costs as a leading factor preventing the installation of energy-efficient non-lighting equipment. Uncertainty about likely energy savings and access to financing also ranked high for participants, while smaller shares of trade allies pointed to the complexity of some energy-efficient technologies, e.g., HVAC equipment, and lack of knowledge. Close to one-third of trade allies (32%) but smaller shares of participants (17% DEC, 11% DEP) did not see any barriers to installing energy-efficient non-lighting equipment.[16]

Figure 6-14 summarizes the top 5 barriers reported by main channel participants.

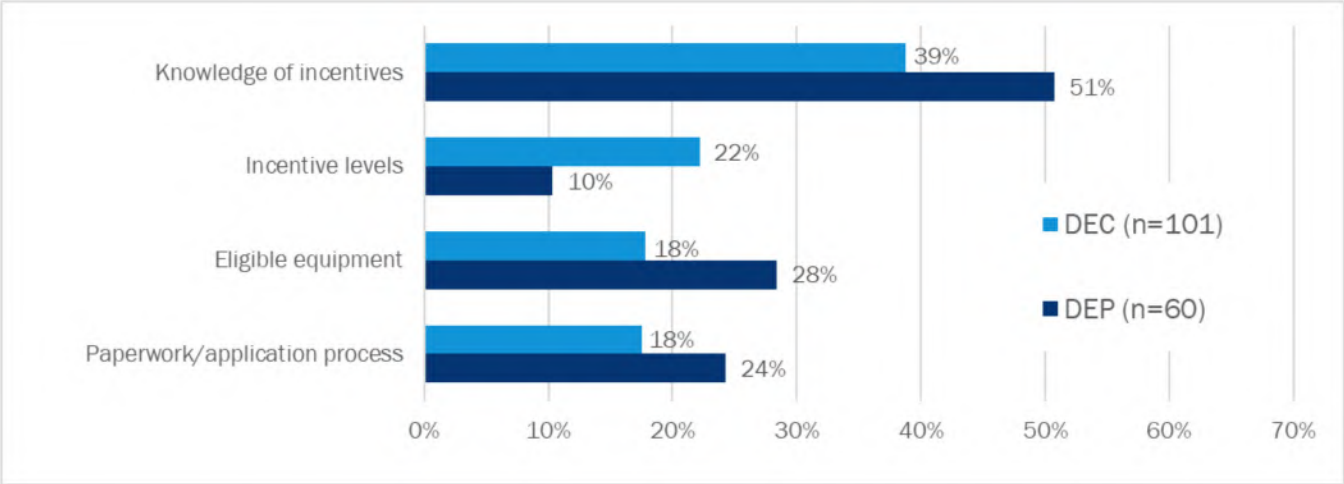
[16] Note that questions about barriers were prompted for participants but unprompted for trade allies.

Figure 6-14. Top 5 Customer Barriers to Making Energy-Efficient Non-Lighting Improvements



Trade allies and participants also agreed that awareness/knowledge of the program and available incentives is the most significant barrier to program participation (51% DEP participants, 39% DEC participants, and 16% trade allies). Smaller shares of participants also mentioned incentive levels, the equipment eligible for incentives, and the required paperwork as barriers (see Figure 6-15). Similarly, the program's application requirements (13%) and equipment cost (10%; suggesting that the incentive is not high enough to overcome the incremental cost barrier) were barriers noted by trade allies. Notably, 43% of interviewed trade allies with a non-lighting area of expertise did not see any barriers to non-lighting program participation, compared to 37% of DEC participants and 25% of DEP participants.[17]

Figure 6-15. Customer Barriers to Program Participation



[17] Note that questions about barriers were prompted for participants but unprompted for trade allies.

Consistent with the barriers identified by both trade allies and participants, the most common recommendations for increasing the uptake of energy-efficient non-lighting equipment were to increase both awareness and knowledge through more marketing and education, to provide higher incentives, and to simplify the application process. More specific suggestions provided by trade allies and participants included:

Trade Allies

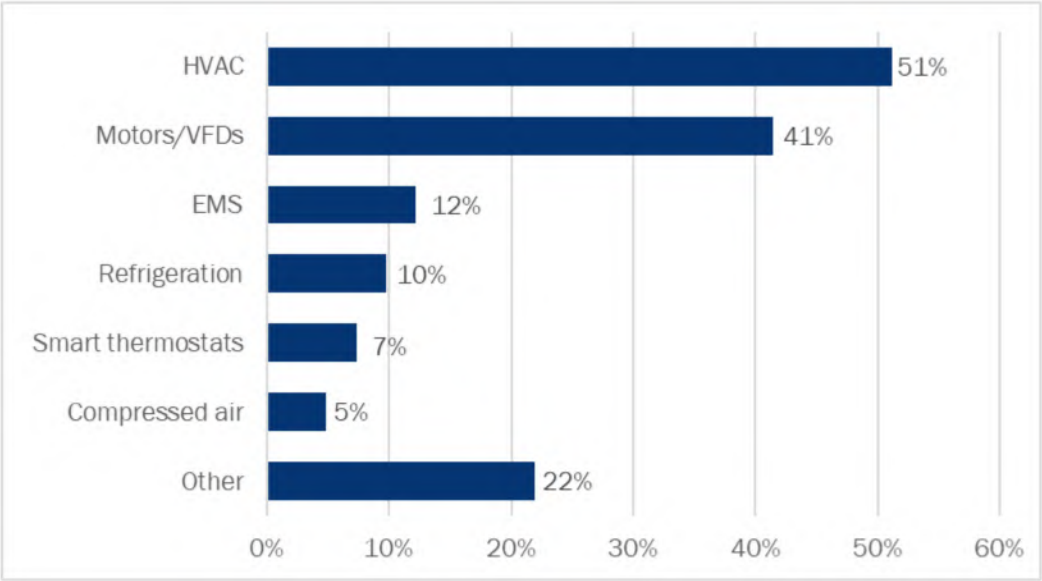
- *"I think if we had not just an email yearly but if a rep came by to discuss what we can key in on with our customers we would be more intuned to the opportunities and more likely to push them hard during the year."*
- *"Provide more education and training to trade allies. Provide case studies and best use cases of new products. Incentivize detailed energy audits for customers to showcase other ways to save energy besides lighting."*
- *"Make a simple but comprehensive list of 'if you did this, you could save this, and it would cost you this.'"*
- *"Provide calculation tools that make the determination of energy savings easier."*
- *"Review and re-publish new efficiency tiers to more accurately reflect actual higher-efficiency equipment capabilities."*

Participants

- *"We have done 4 lighting projects in which the contractors assisted with the Smart Saver, but have not used it for anything else, mostly because of the limited equipment and limited knowledge. Duke should really work on improving connections with smaller manufacturers and communicating the information more frequently, more effectively (newsletter, mailed materials, etc.)."*
- *"Assist in finding information on the different equipment that qualifies. Where do I go to find detailed info? How do compare an HVAC unit from a vendor quote to a unit that has a rebate?"*
- *"Work closely with a wide variety of companies to have a true understanding of their required equipment."*
- *"Have Duke Energy account manager reach out to City Staff on a more regular basis AND/OR have Duke Energy host bi-annual lunch & learns with select City Staff to present more info on Smart Saver Incentives. The latter will be a huge help."*
- *"Contact all businesses with newly approved building permits to ensure they are aware of the programs."*
- *"Keep all landlords informed. Create incentives for landlords to collaborate with leasing companies like ours and share the investment and savings."*

Finally, when asked about the types of non-lighting products with the most potential for increased uptake through the Smart $aver® Prescriptive Program, trade allies most often mentioned HVAC equipment (51%, including rooftop units and chillers) and motors/VFDs (41%; see Figure 6-16). Not surprisingly, these responses are correlated with the trade allies' self-reported equipment areas of expertise (61% HVAC, 48% motors/pumps/VFDs).

Figure 6-16. Non-Lighting Equipment with Potential for Increased Program Uptake



One interviewed trade ally noted the following about the potential for more HVAC projects:

"If HVAC incentives were higher, they might actually encourage the selection of very efficient units. Even if the timing of HVAC projects is generally non-discretionary, their effectiveness could be. Unfortunately, $30/ton is not going to push efficiency very hard in the right direction."

6.4 Key Findings – Midstream Channel

The midstream channel is a relatively new addition to the Smart $aver® Prescriptive Program. It launched in the DEC and DEP service territories in 2015 but was initially slow to gain traction. As such, it accounted for a relatively small fraction of program savings at the time of the last evaluation of this program (covering the period of August 2015 to February 2017 for DEC and March 2016 to February 2017 for DEP) and was not specifically targeted by evaluation activities. However, in 2017 and 2018, the midstream channel began gaining in popularity and started to see significant increases in participation. During the current evaluation period, the midstream channel accounted for 48% of DEC and 46% of DEP ex post gross energy savings. Given this significant contribution, this evaluation included a midstream participant survey to assess free-ridership, participant spillover, and limited process topics, including participant satisfaction.

6.4.1 Midstream Participation

During 2017 and 2018, the midstream channel focused heavily on lighting equipment. A total of 81 unique distributors participated in the program during the evaluation period, 74 selling discounted lighting equipment and 8 selling discounted non-lighting equipment (including HVAC and food service products). Many of these distributors were active in both service territories.

Overall, the 81 distributors accounted for over 12,500 "projects" – defined as one or more measures of the same technology purchased by the same customer (based on account number and name), at the same time, for the same location. Of these projects, 99.8% involved lighting equipment. Notably, the five most active distributors accounted for 44% of all midstream projects during the evaluation period.

Table 6-3 summarizes participation in the midstream channel during the evaluation period.

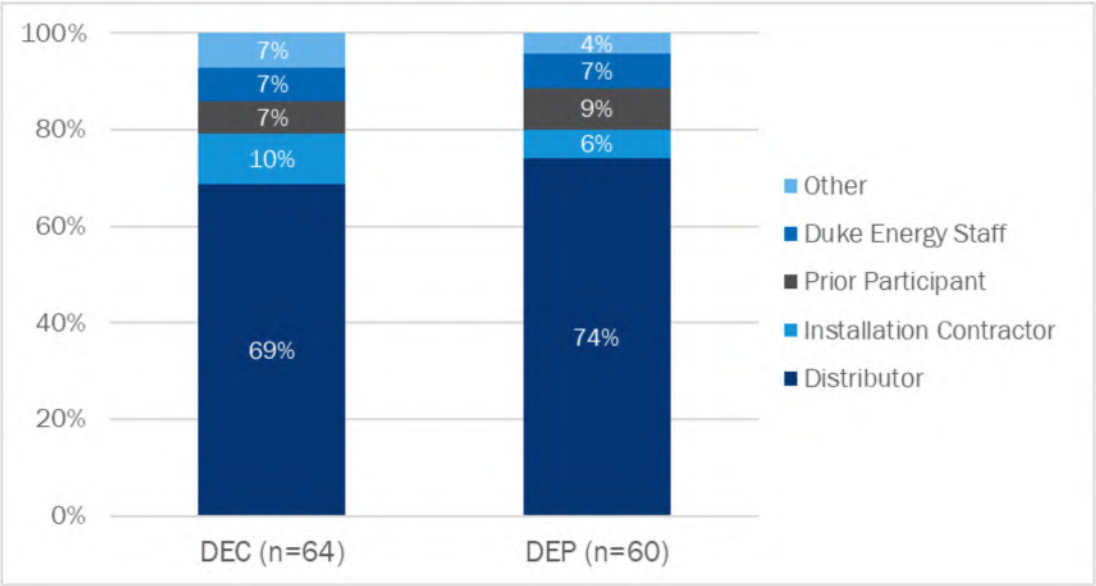
Table 6-3. Participation in the Midstream Channel

	TOTAL	DEC	DEP
Total Distributors	**81**	**75**	**58**
Lighting	*74*	*69*	*55*
Non-Lighting	*8*	*7*	*4*
Total Projects	**12,557**	**9,246**	**3,311**
Lighting	*12,526*	*9,228*	*3,298*
Non-Lighting	*31*	*18*	*13*

6.4.2 Participant Awareness and Equipment Selection

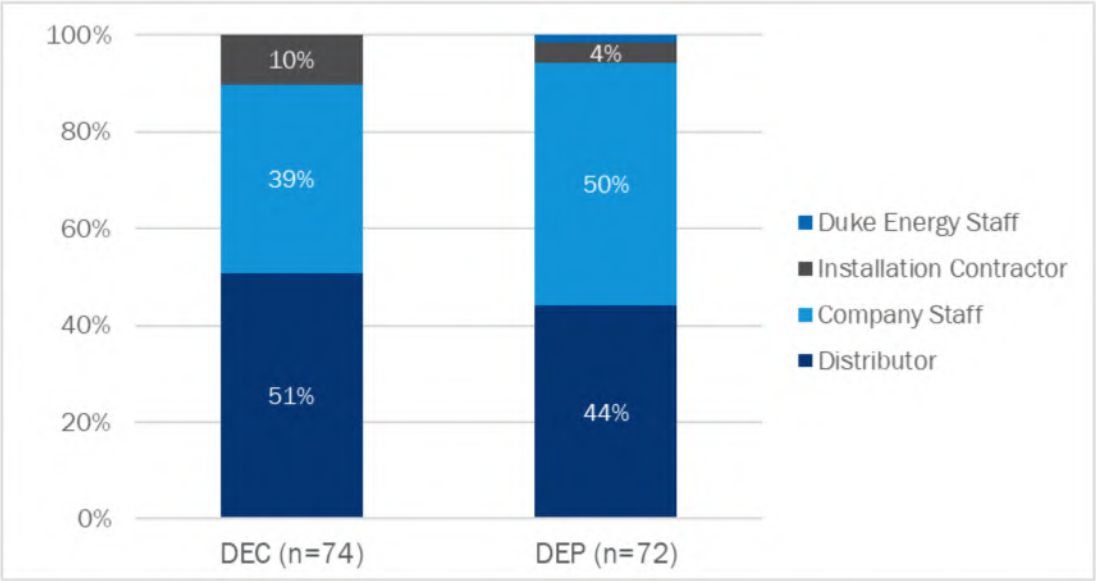
The vast majority of both DEC and DEP midstream respondents was aware of the discount at the time they purchased the equipment (91% DEC, 89% DEP), and almost all of them (97% DEC, 98% DEP) were aware that Duke Energy provided the discount. Participants aware of the discount most often learned about it from their distributor (69% DEC, 74% DEP; see Figure 6-17).

Figure 6-17. Participant Sources of Information about Discount



In addition to informing customers about the discount, distributors also play a key role in the equipment selection process. Based on survey responses, distributors helped most participants (92% DEC, 89% DEP) with the selection of their equipment. Distributors were the most influential party in the selection of the specific types of purchased equipment for 51% of DEC participants and 44% of DEP participants (see Figure 6-18).

Figure 6-18. Most Influential in Equipment Selection

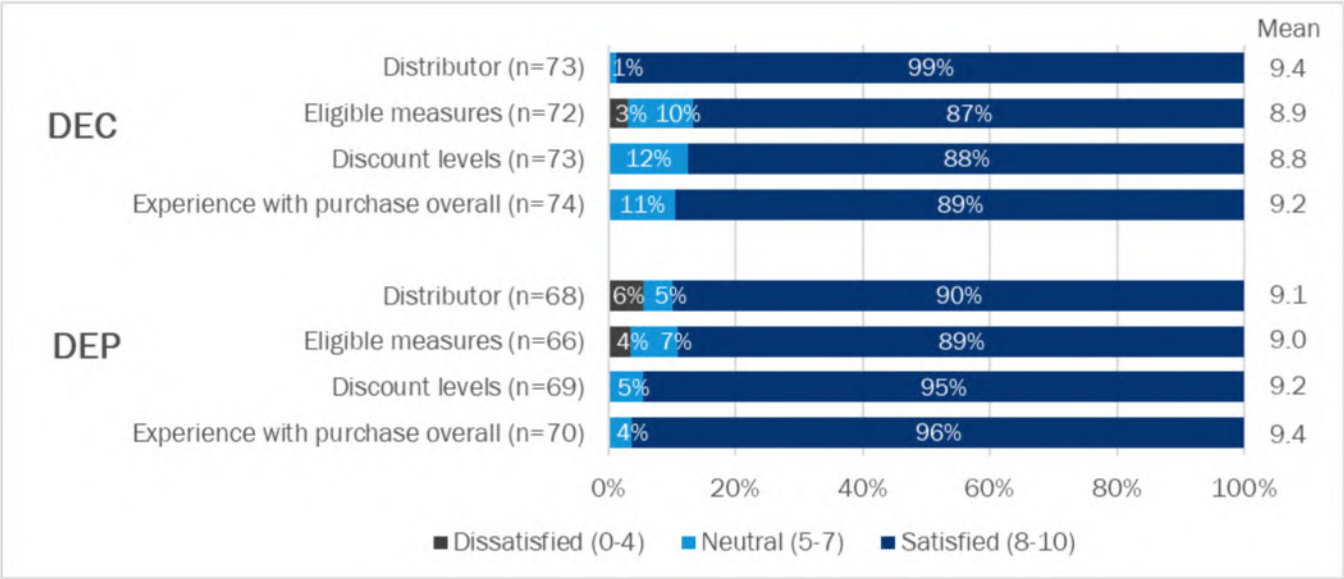


6.4.3 Participant Satisfaction

Midstream channel participants have a more limited exposure to the program and are subject to fewer program processes compared to main channel participants. Survey questions about participant satisfaction therefore focused on those program components applicable to this delivery channel. Similar to the main channel surveys, satisfaction questions in the midstream participant survey were asked on a scale of 0 to 10, where 0 means “extremely dissatisfied” and 10 means “extremely satisfied.”

Overwhelmingly, both DEC and DEP midstream participants expressed high satisfaction levels, giving mean ratings ranging from 8.8 to 9.4 (see Figure 6-19).

Figure 6-19. Midstream Participant Satisfaction with Program Components



While satisfaction by midstream participants was generally high, many respondents noted a general desire for more eligible measures and higher discounts. In addition, some respondents provided more specific comments and suggestions for improvement:

- Several respondents noted that more continuity in eligible measures and incentive levels would be helpful as frequent changes introduce uncertainty.
- Recommendations around eligible lighting measures included discounts for new equipment, not just the retrofit of existing fixtures, as well as offering a discount on all lamp lengths, including 8-foot lamps.
- A few respondents were unaware of the requirement to recycle the old lamps, noting that this introduced unexpected costs and hassle.

7. Summary Form

Duke Energy Carolinas/Duke Energy Progress Non-Residential Smart $aver® Prescriptive Program

Completed EM&V Fact Sheet

Program Description

The Duke Energy Carolinas/Progress Non-Residential Smart $aver® Prescriptive Program provides incentives to commercial and industrial customers for a range of measures, including lighting, HVAC systems, pumps and drives, process equipment, food service products, and information technology equipment. The program works with trade allies to promote the program and drive participation. The program also offers two alternative channels where customers can purchase a subset of products offered through the main channel at comparable incentive levels either directly from distributors as part of the midstream channel or through the online Business Savings Store.

Date	July 16, 2020
Region(s)	Duke Energy Carolinas (DEC) Duke Energy Progress (DEP)
Evaluation Period	March 1, 2017– December 31, 2018
Annual kWh Savings (ex post net)	DEC: 426,064 MWh DEP: 140,898 MWh
Coincident kW Impact (ex post net)	DEC: 75.7 MW (Summer), 74.1 MW (Winter) DEP: 24.3 MW (Summer), 23.7 MW (Winter)
Measure Life	Not Evaluated
Net-to-Gross Ratio	DEC: 88.4% DEP: 79.5%
Process Evaluation	Yes
Previous Evaluation(s)	DEC/DEP Smart $aver® Prescriptive Program, March 25, 2018

Evaluation Methodology

In support of the **gross impact evaluation**, we first reviewed program-tracking data and developed a comprehensive database of program measures and ex ante savings. We then reviewed and adjusted, where warranted, ex ante per-unit "deemed" savings for a sample of measures. The deemed savings updates incorporated results from a light logger study to verify the hours of operation for key lighting measures. To verify measure installations, we conducted desk reviews for main channel projects and a survey with midstream channel participants. Finally, we estimated ex post gross energy and demand savings, by delivery channel and technology, based on the quantity and per-unit deemed savings adjustments.

The **net impact evaluation** relied on participant and trade ally surveys to quantify free-ridership, participant spillover, and trade ally spillover. We estimated overall net-to-gross ratios for the two jurisdictions, as well as by delivery channel and for lighting and non-lighting projects. These net-to-gross ratios were multiplied by the ex post gross savings to determine net program impacts.

We also conducted a **process evaluation** that focused on program processes, customer and trade ally satisfaction with the program, program strengths and weaknesses, and opportunities for program improvement. It also included areas of interest identified by program staff, e.g., the status of the commercial lighting market and remaining opportunities for lighting and non-lighting upgrades.

8. DSMore Table

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the gross and net impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

[Provided as a separate file]

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I/A

2020 EM&V Interim Report for the EnergyWise Business Program

February 5, 2021

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Evaluation Summary

Guidehouse conducted an impact evaluation to estimate energy impacts contributed by participants that received the thermostat between January 2018 and February 2019, using monthly energy consumption data. This report contains only the results of the energy impact analysis. Upon completion of the Summer 2021 DR season, Guidehouse will estimate demand response impacts on event days, using participant and non-participant advanced metering infrastructure (AMI) interval data.

Table 1 summarizes the estimated annual energy impacts for participants who installed a thermostat. Guidehouse found that on average, DEC participants saved 1,026 kWh per thermostat and DEP participants saved 423 kWh per thermostat.

Table 1: Per Device and Program Total Energy Impacts

Energy Provider	Devices	Impact per Device (kWh / Device)	Program Impact (MWh)	Margin of Error (90% CI)
DEC	5,304	1,026	5,440	±1,488
DEP	2,653	423	1,122	±724

Source: Guidehouse analysis. Values subject to rounding.

The EnergyWise® Business ("EnergyWise Business") program in the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) territories, provides small and medium business customers that consume an average of at least 1,000 kWh per month and have one or more central air conditioning or heat pump units at their facility, with an opportunity to earn bill credits by allowing DEP and DEC to periodically cycle their HVAC equipment during conservation periods (i.e. curtailment or demand response – DR – events).

In the summer, participating devices may be controlled by DEP and DEC from May through September for up to four hours per event. Events typically occur between 1pm and 7pm on non-holiday weekdays. During the curtailment events, the HVAC compressors are typically cycled in 30-minute intervals for the duration of the event. Participants may opt out of up to two events per season. Additional opt-outs may result in the forfeiture of the annual bill credit. Participants who have electric heat pumps with electric resistance auxiliary heat strips can also participate in the winter DR season for an additional $25 bill credit. For the winter 2020/2021 season, events are expected to occur in the morning from 6:30am to 8:30am, around the peak demand hour of 7-8am.

Participants may elect to have curtailment dispatched via thermostat or switch. Participants equipped with the thermostat (the majority) can access the EnergyWise Business portal using a smartphone, tablet, or computer. The portal allows users to monitor and modify their facility HVAC runtimes, change the temperature setpoints, and program customized cooling and heating schedules. The purpose of the portal is to facilitate the adoption of energy efficiency behaviors by participants, specifically the practice of adjusting HVAC setpoints to reduce space heating and cooling energy consumption. The portal includes tips to help participants optimize energy use, including tutorials and preset features for energy efficiency, away times, and vacations.

Evaluation Methods

Guidehouse's impact evaluation approach for this report focuses on energy impacts. Demand impacts will be established after the summer 2021 DR season.

Energy Efficiency Impact Evaluation Approach

Guidehouse assessed the suitability of using a matched comparison group (MCG) to estimate savings, but concluded that such an approach was unsuitable for this evaluation due to evidence of divergent energy consumption behavior after the time period used to select the MCG. As a result, Guidehouse proceeded by using a within-subjects regression approach, using participants only.

Guidehouse estimated annual per participant savings by applying a regression analysis to participant consumption data observed in the period from March 1, 2019 through February 29, 2020 (the "Post-Install Period"). Only participants that enrolled in the period from January 1, 2018 through February 28, 2019 (the "Install Period" or the evaluation sample period) were included in the estimation data. Program impacts were calculated by multiplying estimated annual per participant impacts by the number of participants that enrolled during the Install Period. The impacts per thermostat were calculated by dividing the per participant results by the average number of thermostats at each participant site.

Findings and Conclusions

The principal EM&V findings and conclusions regarding the estimated energy impacts are as follows:

- **Participants are estimated to have reduced an average of 1,026 kWh per device in DEC and 423 kWh per device in DEP for the post-installation period.** The post-installation period was March 2019 through February 2020, and applies to the evaluation sample of participants who enrolled between January 2018 through February 2019. More savings were realized in summer months compared with winter, which reflects the fact that only some participants use electric heating (approximately 20%). Guidehouse has developed hypotheses for the difference in savings between DEC and DEP participants, which may be used to guide future evaluation and program implementation.

- **Guidehouse concluded that selecting a suitable non-participant comparison group was not possible with the data available for estimating energy impacts.** Guidehouse observed evidence of differing evolution of consumption patterns between participants and selected matches from the pre- to post-installation periods, which suggests that the consumption behavior of selected matches may not evolve in similar ways as participants as would be assumed when using a comparison group. This result suggests that an MCG comprised of non-participants is unsuitable for estimating energy efficiency impacts for small and medium-sized businesses in this program.

Based on the impact findings above, Guidehouse recommends that Duke Energy consider the following recommendations:

- **Consider customer targeting or outreach activities to increase energy savings.** Targeting more customers with electric heat could increase winter energy savings. Guidehouse understands that future program data will have more accurate tracking of HVAC equipment types, which would facilitate such targeting efforts. Duke Energy may wish to consider increasing outreach encouraging participants to adopt more energy efficient setpoints. Although program technicians assist participants with initial thermostat setup, it is unclear how the settings persist over time. Following up with participants to encourage them to optimize these settings may increase the amount of energy savings achieved in the program.

- **Consider using future process evaluations to better understand differences in savings estimated in DEP and DEC service territories.** Consistent with the findings of the prior evaluation conducted by another evaluator, Guidehouse estimated that average savings per participant were lower for DEP participants than for DEC participants. Participants interviews or surveys may be used to better understand the factors that cause DEP participants to exhibit lower savings. For example, surveying DEC and DEP participants may show differences in willingness to use temperature setbacks or capability of reducing HVAC consumption based on business operation considerations.

1. Introduction

The EnergyWise® Business ("EnergyWise Business") program in the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) territories, provides small and medium business customers that consume an average of at least 1,000 kWh per month and have one or more central air conditioning or heat pump units at their facility, with an opportunity to earn bill credits by allowing DEP and DEC to periodically cycle their HVAC equipment during conservation periods (i.e. curtailment or demand response events).

Upon enrollment, eligible participants select to receive either a "smart" Wi-Fi communicating thermostat[1] capable of remote set-point adjustment, or a switch device to allow DEP and DEC to cycle the participant's HVAC during DR events. The switch device may be either Wi-Fi connected or cellular. Participants may select one of three options for participating:

- 30% Cycling - Participants receive an annual bill credit of $50 per device controlled for the summer season.
- 50% Cycling - Participants receive an annual bill credit of $85 per device controlled for the summer season.
- 75% Cycling - Participants receive an annual bill credit of $135 per device controlled for the summer season.

In the summer, participating devices may be controlled by DEP and DEC from May through September, for up to four hours per event. Events typically occur between 1pm and 7pm on non-holiday weekdays. During the curtailment events, the HVAC compressors are cycled in 30-minute intervals for the duration of the event. Participants may opt out of up to two events per season Additional opt-outs may result in the forfeiture of the annual bill credit. Participants with electric heat pumps or electric resistance heating can also participate in the winter DR season for an additional $25 bill credit. For the winter 2020/2021 season, events are expected to occur in the morning from 6:30am to 8:30am, around the peak demand hour of 7-8am.

Participants with the thermostat can access the EnergyWise Business portal using a smartphone, tablet, or computer. The portal allows users to monitor and modify their facility HVAC runtimes, change the temperature setpoints, and program customized cooling and heating schedules. The purpose of the portal is to facilitate the adoption of energy efficiency behaviors by participants, specifically the practice of adjusting HVAC setpoints to reduce space heating and cooling energy consumption. The portal includes tips to help participants optimize energy use, including tutorials and preset features for energy efficiency, away times, and vacations.

[1] Note that this is not an "adaptive" thermostat.

1.1 Objectives of the Evaluation

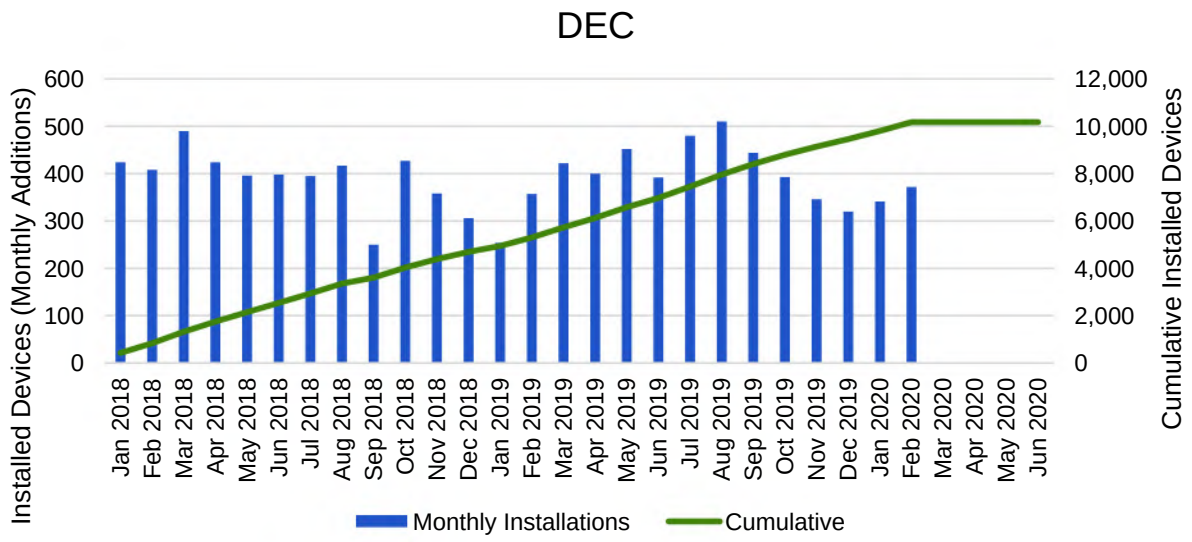
The key objectives for the impact analysis conducted as part of this evaluation, as identified in Guidehouse's evaluation plan, include:

- **Energy Efficiency Impacts:** estimate the annual energy efficiency impacts for participants who have a thermostat and enrolled in the program between January 2018 and February 2019.

1.2 Reported Program Participation

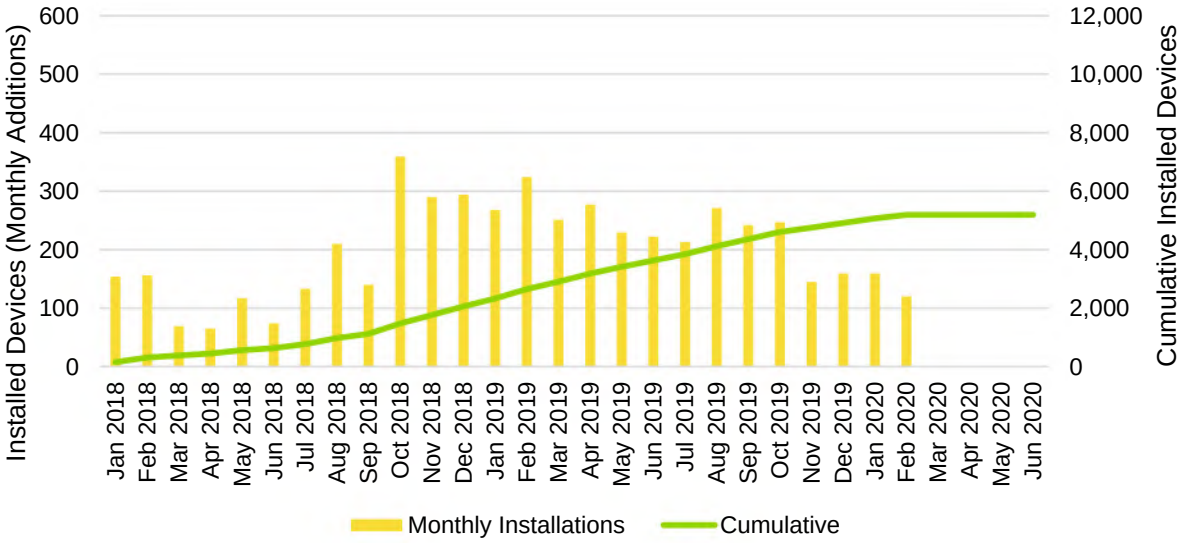
Figure 1-1 and Figure 1-2 illustrate installations between January 2018 and February 2020 for DEC and DEP, to show trends in participation over time outside of the evaluation sample period. In this time period, Duke Energy installed 10,176 and 5,188 devices in DEC and DEP territories respectively. From this population, the energy impacts in the report include a sample of participants who enrolled between January 2018 and February 2019, to allow sufficient post-installation consumption data to accrue for analysis.

Figure 1-1: Installations between January 2018 and February 2020 – DEC



Source: Guidehouse analysis

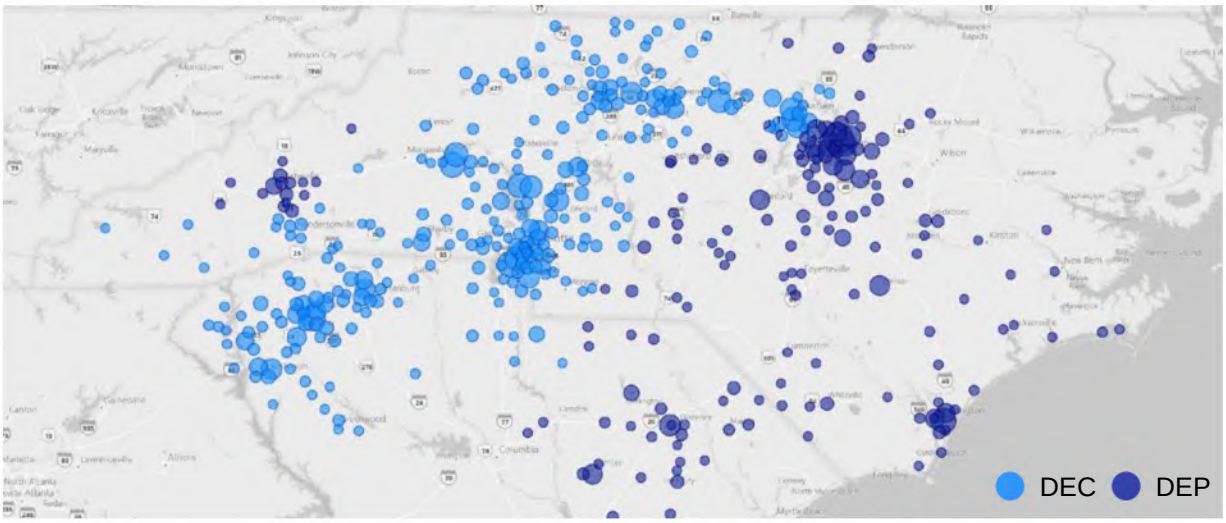
Figure 1-2: Installations between January 2018 and February 2020 – DEP



Source: Guidehouse analysis

Figure 1-3 shows the geographic distribution of participants. Most installations occurred around cities including Charlotte and Raleigh, although participation was achieved throughout the service territories.

Figure 1-3. Geographic Distribution of Participants



Source: Guidehouse Analysis
Size of Circle is Proportional to the Number of Installations

2. Evaluation Methods

This chapter of the evaluation report provides a description of the approaches used to conduct the evaluation. Additional technical details related to the impact approaches may be found in Appendix A.

2.1 Energy Efficiency Impact Methodology

Guidehouse estimated thermostat energy savings impacts using a within-subjects regression analysis applied to participant monthly consumption data, weather data, and data flags identifying the period after which each participant's thermostat was installed. This analysis also controlled for participation in other Duke Energy programs during the same time period, effectively netting out the impacts from other energy efficiency programs such as the Small Business Energy Saver.

A "within-subjects" regression approach is one which includes only participants and implicitly uses observed participant consumption prior to program enrollment to develop an estimate of participant baseline consumption in the program period and the estimated impact of the program on participant consumption in the post-installation period. A detailed description of the regression model specification is included in Appendix A.2.

Guidehouse also performed an experimental analysis comparing participant consumption patterns with those of a large pool of non-participants in pre-program period to select an MCG (non-participants with consumption patterns very similar to those of participants). As discussed below in Section 2.1.3, and in greater detail in Appendix A, Guidehouse's exploratory analysis identified that such an approach appears to be inappropriate for an evaluation of energy efficiency impacts for the small to medium businesses in this program.

2.1.1 Data Sources

For the energy efficiency evaluation, Guidehouse used the following data provided by Duke Energy:

- Monthly consumption data, for DEC and DEP participants and non-participants:
    - DEC: Calendarized monthly billing data for the period of January 2016 through February 2020 for 5,850 participants and 97,571 eligible non-participants[2]
    - DEP: Calendarized monthly billing data for the period of March 2017 through February 2020 for 2,898 participants and 66,899 non-participants. DEP billing consumption data was not available prior to March 2017.
- Customer cross-sectional data, including -

[2] Non-participant data were used only in exploratory analysis. All impacts reported in this evaluation are estimated based only on participant consumption data.

- Standard Industry Classification (SIC) Code
- HVAC equipment type (participants only)
- HVAC system capacity in tons of refrigeration (participants only)
- Program device type – switch or thermostat (participants only)
- Participant enrollment and drop-out dates

- List of participants that participated in other DEP or DEC EE programs, including measures and installation dates.

Guidehouse collected hourly dry-bulb temperature data for the period of January 2016 through February 2020 from twelve weather stations across the Carolinas and developed a weighted average hourly time series for the analysis based on the number of participants closest to each station. This single time series was then used in subsequent modeling to estimate energy efficiency impacts. The stations and corresponding weights are listed in Table 2-1.

Table 2-1. Weather Stations and Weighting Used for Analysis

Weather Station	Weight
Raleigh-Durham Airport	27.4%
Charlotte/Douglas Airport	22.3%
Piedmont Triad Airport	9.1%
Hickory Regional Airport	8.6%
Greenville Downtown Airport	8.3%
Florence Regional Airport	7.0%
Greenville-Spartanburg Airport	4.8%
Asheville Regional Airport	4.1%
Occonee County Airport	3.4%
Anderson Regional Airport	3.1%
Wilmington International Airport	1.7%
Craven County Airport	0.2%

Source; Guidehouse Analysis

2.1.2 Analysis Period, Participant Sample, and Data Cleaning

Guidehouse has divided the participant consumption data into three different periods for analysis:

- **Pre-Install Period (January – December 2017):** the year prior to thermostats being installed for all participants in the estimation sample. No participant included in the analysis had enrolled in the program during this period.
- **Install Period (January 2018 – February 2019):** the year during which participants in the estimation sample installed thermostats. All participants included in the analysis enrolled in the program during this period.
- **Post-Install Period (March 2019 – February 2020):** the year during which all participants in the estimation sample have a thermostat installed. All participants included in the analysis had enrolled in the program prior to this period.

Guidehouse performed data cleaning on the provided monthly consumption data, including checking for:

- Very large consumption (>2,500 kWh per day in a month)
- Negative consumption
- At least 8 months of data in the pre- and post-install periods. This requirement was chosen to balance data completeness while maximizing the number of participants that could be included in analysis, and is consistent with other Guidehouse evaluations.

Table 2-2 summarizes the number of participant accounts that were able to be included in the analysis after the data cleaning process.

Table 2-2. Summary of Accounts Included in Data Cleaning Process

Description	Accounts (DEC)	Accounts (DEP)
All accounts that installed thermostats between January 2018 and February 2019	3,080	1,519
Accounts with any billing data	3,033	1,498
Accounts in the sample after cleaning (i.e. had at least 8 months of billing data in both the pre- and post-periods)*	1,929	1,019
Remaining accounts after removing customers that changed consumption from pre- to post-period by more than 100%**	1,893	1,008

Source: Guidehouse Analysis
** Essentially all (>99%) accounts dropped in data cleaning were due to a lack of sufficient data in either the pre- or post-period.*
*** Guidehouse investigated trimming the sample of customers that exhibited very large changes in energy usage to mitigate potential bias, as discussed in Appendix A.1.*

2.1.3 Assessment of a Matched Comparison Group

Guidehouse assessed the suitability of estimating impacts using a lagged dependent variable (LDV) approach[3] supported by an MCG developed from eligible non-participants. In this process, each participant is assigned a "match." This is the non-participant whose pre-installation period consumption most closely resembles the given participant. In general, this approach is also commonly referred to as quasi-experimental design and is generally the preferred evaluation method in absence of true experimental design (e.g. a randomized control trial, or RCT).

The purpose of selecting an MCG is to find a group of customers for whom energy usage patterns would be expected to follow a parallel trend over time to that of the participants in absence of the program treatment. The treatment in this case is the installation of a thermostat.

The key assumption of selecting an MCG is that the relative difference between participant and MCG consumption is consistent over time in absence of the treatment, conditional on the independent variables included in the regression equation. In the residential sector, this assumption is generally regarded as unproblematic due to the homogenous nature of residential consumption patterns. However, the heterogeneity of small businesses means that the key assumption that underlies this approach may be too restrictive and not reflect the realities of small business. In other words, two businesses that exhibit similar usage patterns in the period in which they are matched may not evolve in similar ways over time. This may be due to differences in business types or to administrative details related to the data themselves. For example, if the electricity account holder is a landlord, the business may change entirely between the pre-program and the program period without any indication.

To assess the suitability of an MCG approach for this evaluation, Guidehouse selected matches for both DEC and DEP participants. Each participant was assigned the non-participant from the same SIC division[4] that had the most similar monthly consumption pattern during the pre-installation period. Guidehouse's exploratory analysis found that participant and comparison group consumption patterns outside of the pre-program matching period diverged materially from each other in a manner inconsistent with what might typically be expected of the program treatment.

Specifically, when using an MCG, savings estimates changed substantially in response to the incremental removal of participants and matches from the estimation set. Conversely, estimated savings using participants only (a within-subjects approach) were robust to the same sub-setting – the regression parameter values were insensitive to the sample used. This result suggests the presence of some non-program effect impacting the relative difference between participant and match consumption over time. Absent any observable data to control for this effect, it will result in omitted variable bias in the model, and inaccurate estimates of savings.

Therefore, Guidehouse concluded that an MCG was not appropriate for this analysis using the data available. Guidehouse proceeded with the analysis using a within-subject approach which considers participants only and compares consumption before and after installation of the

[3] The LDV approach is a special case of the difference-in-differences approach.

[4] Standard industry classification division denotes the broad industry category the small business belongs to. See https://www.naics.com/sic-codes-counts-division/.

thermostat. For a more detailed description of the methods used for selecting and assessing the suitability of a matched control group, see Appendix A.1

2.1.4 Estimating Ex-Post Impacts

Guidehouse employed a within-subject regression analysis to estimate impacts. This approach uses a model that implicitly compares the energy consumption of participants before and after installation of the program thermostat. This type of model is also known as a “pre-post” model. The model estimated for this analysis controls for the effects of weather (cooling and heating degree days), month of year, and participation in other DEP or DEC EE programs (such as Small Business Energy Saver). The treatment effect was modeled to be weather-dependent, on both cooling and heating degree days – savings, that is, are assumed to be a function of temperature.

In this model, any changes in consumption over time that are not explicitly controlled for by the independent variables are attributed to the treatment. As described in Section 2.1.3, Guidehouse employs within-subject models only in the absence of true experimental design (e.g., an RCT) and when matched controls are either not available or inappropriate.

The regression model provides ex-post (i.e., historical) impact estimates for the post-installation period described in Section 2.1.2, March 2019 through February 2020. These are obtained by applying the estimated treatment parameters to the observed weather in this period. For additional details regarding the regression model used for this analysis, see Appendix A.2.

3. Impact Findings

This chapter provides a detailed summary of the impact findings, and is divided into three sections:

- **Energy Efficiency Impacts.** This section summarizes the estimated energy efficiency impacts.
- **Differences in Savings between DEC and DEP.** This section discusses the differences in estimated savings for the two service territories.
- **Net-to-Gross.** This section describes the assumptions informing the net-to-gross ratio applied in this evaluation.

3.1 Energy Efficiency Impacts

Table 3-1 shows the ex-post energy efficiency impacts for the period from March 2019 through February 2020 for those participants who enrolled between January 2018 and February 2019. The program achieved an estimated 5,440 MWh and 1,122 MWh of savings for DEC and DEP participants respectively over the post-install period.

Table 3-1. Ex-Post EE Impacts – Program Total Mar 2019 through Feb 2020

Energy Provider	Devices	Program Impact (MWh)	Margin of Error (90% CI)	Relative Precision (+/-)
DEC	5,304	5,440	±1,488	±27%
DEP	2,653	1,122	±724	±65%

Source: Guidehouse analysis of DEC and DEP data, values subject to rounding.

Figure 3-1 and Table 3-2 show per participant EE savings in each season of the post-install period. Overall, the program delivered 1,743 kWh (DEC) and 724 kWh (DEP) of energy savings per participant over the entire post-install period. This amounts to about 3.9% of facility consumption in DEC and 1.8% in DEP. Statistically significant savings were estimated in both summer and winter seasons, but more savings accrued in the summer – 1,094 kWh (DEC) and 455 kWh (DEP) per participant. The higher savings during the summer months is consistent with Guidehouse's analysis of program tracking data that indicates that approximately 20% of participants have heat pumps installed.

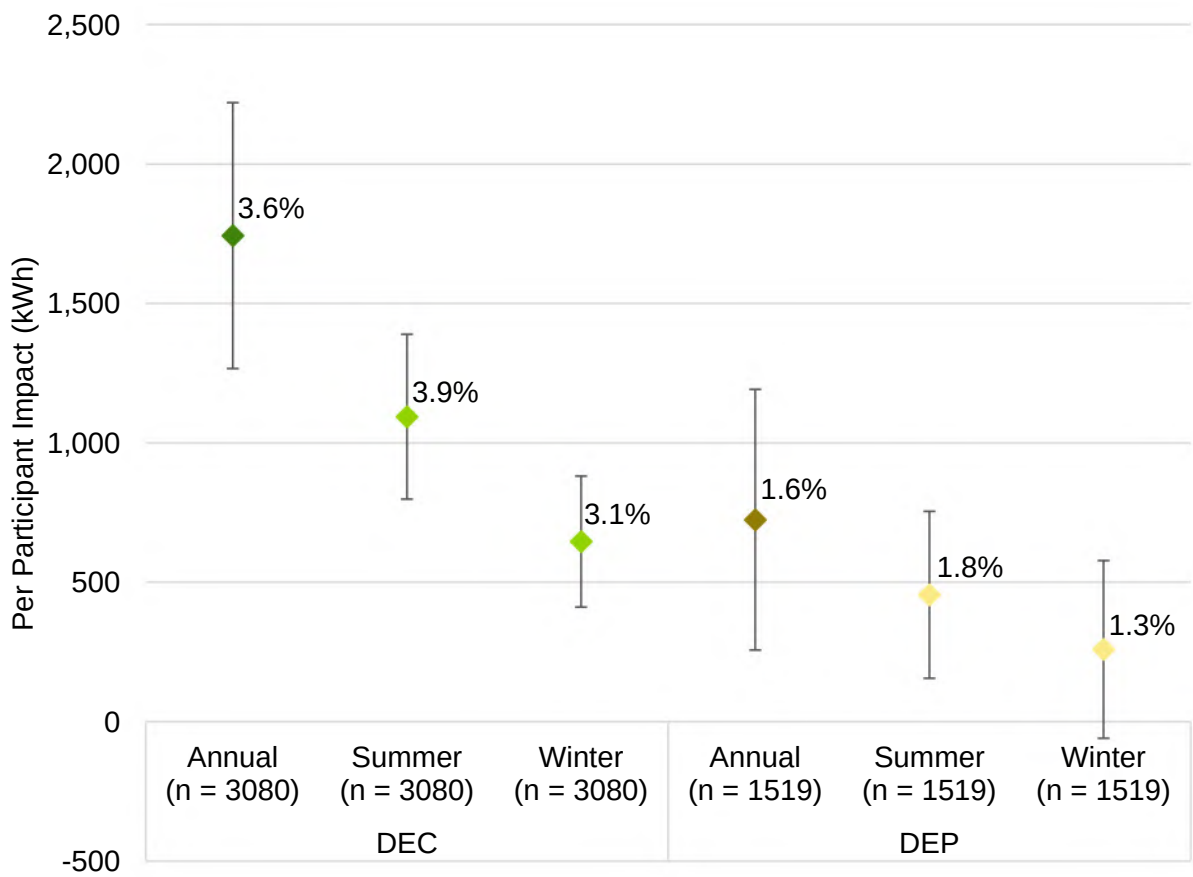
Table 3-2. Ex-Post EE Impacts – per Participant by Season

Energy Provider	Season	Impact (kWh / Participant)	Margin of Error (90% CI)	Savings (% Facility)
DEC	Summer	1,094	±296	3.9%
	Winter	646	±235	3.1%
	Annual	**1,743**	**±477**	**3.6%**
DEP	Summer	455	±299	1.8%
	Winter	259	±319	1.3%
	Annual	**724**	**±468**	**1.6%**

* Summer (May – Oct) and Winter (Nov – Apr) may not add up exactly to Annual impacts due to rounding and the fact that they are estimated separately from annual impacts.

Source: Guidehouse analysis of DEC and DEP data, values subject to rounding.

Figure 3-1. Ex-Post EE Impacts – Per Participant by Season



**percentages indicate savings as a percent of total facility consumption, and bars indicate margin of error.*
Source: Guidehouse analysis of DEC and DEP data.

Similarly, Table 3-3 and Figure 3-2 show per device energy savings in each season of the post-install period. Overall, the program delivered 1,026 kWh (DEC) and 423 kWh (DEP) of energy savings per device over the entire post-install period. Savings were observed for both summer and winter seasons, but more savings accrued in the summer – 644 kWh (DEC) and 266 kWh (DEP) per device.

Table 3-3. Ex-Post EE Impacts – per Device by Season

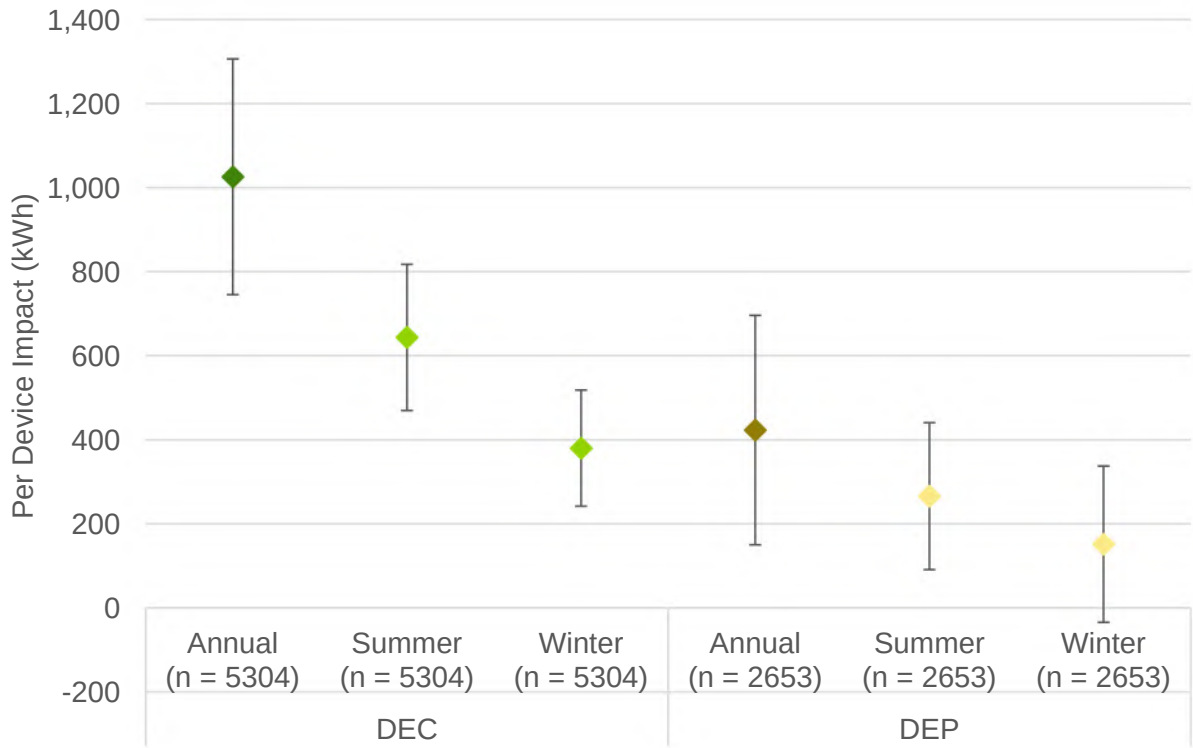
Energy Provider	Season	Impact (kWh / Device**)	Margin of Error (90% CI)
DEC	Summer	644	±174
	Winter	380	±138
	Annual	1,026	±281
DEP	Summer	266	±175
	Winter	152	±186
	Annual	423	±273

* Summer (May – Oct) and Winter (Nov – Apr) may not add up exactly to Annual impacts due to rounding and the fact that they are estimated separately from annual impacts.

*** Per device impacts are based on an average of 1.71 devices per participant (DEC) and 1.75 devices per participant (DEP).*

Source: Guidehouse analysis of DEC and DEP data, values subject to rounding.

Figure 3-2. Ex-Post EE Impacts – Per Device by Season



**Bars indicate margin of error.*
Source: Guidehouse analysis of DEC and DEP data.

3.2 Differences in Savings between DEC and DEP

Guidehouse estimated materially higher savings for DEC participants (1,026 kWh / device) than DEP participants (423 kWh / device). This difference (603 kWh / device) is consistent with the findings of the prior evaluation completed by another evaluator, which found DEC impacts to be 503 kWh higher per device in DEC than DEP. Guidehouse has developed and explored several hypotheses that may explain the difference in achieved savings:

- **Different Participant Setpoint Behavior**: Duke Energy provided Guidehouse with thermostat setpoint schedule data for participants,[5] which provided some insight into how participants in DEC and DEP use the setback features of their thermostats. Setbacks are defined as the temperature setpoint programmed by a participant when a building is likely to be unoccupied, and more aggressive setbacks generally lead to energy savings. Guidehouse found that a greater percentage of DEC participants use setbacks for both heating and cooling seasons as compared to DEP participants. About 60% of DEC participants used heating setbacks as compared to about 40% of DEP participants, and about 40% of DEC participants used cooling setbacks as compared to

[5] Available setpoint schedule data was primarily for participants who installed a device after February 2019 and spanned the period of March 2019 through January 2020. Nevertheless, the data provided some insight into differing behavior among DEP and DEC participants.

about 30% for DEP. These differences between unoccupied and occupied setpoints suggest that DEC participants are more likely to exhibit energy efficient behavior than DEP participants, supporting Guidehouse's finding of greater kWh savings for DEC. This analysis is discussed in further detail in Appendix A.3. Further investigation of participant behavior before and after installation of the smart thermostat may provide additional insight into this phenomenon.

- **Use of Air Conditioning (AC) in Response to Temperature**: Higher AC usage for DEC participants for a given increase in temperature suggests a higher potential for savings. Guidehouse's regression modeling indicates for each incremental cooling degree day experienced, DEC participants increase their electricity demand by more than DEP participants. This modeling result indicates that when DEC and DEP participants are exposed to the same temperature, DEC participants on average use more electricity, suggesting that DEC participants tend to use their AC units more than DEP participants. The total cooling load over the summer season may still be higher for DEP customers, as it is generally warmer in DEP territory.

- **Differences in AC Size**: Larger AC units also suggests a higher potential for energy savings. Guidehouse found that the average size of AC units for DEC thermostats (4.3 tons, average over all thermostats) was slightly higher than DEP thermostats (4 tons, average over all thermostats). Depending on the efficiency of installed equipment, this difference may indicate differences in energy consumption between DEC and DEP participants.

- **Different Participant Business Types**: Differences in business types or operations between the territories may lead to variation in the flexibility to achieve energy savings. Based on SIC code, Guidehouse found that DEC participants include a larger share of Manufacturing and Retail participants, while DEP participants include a larger share of Finance and Services participants. In the manufacturing sector, DEC participants exhibited higher consumption (339 kWh / day) than DEP participants (152 kWh / day). While this difference does not completely account for the differences in savings achieved, it does illustrate that businesses have different consumption patterns and therefore may have a different capability of reducing HVAC usage via the thermostat.

These hypotheses can be used to direct future efforts in evaluation and program design. Potential activities to investigate these hypotheses include:

- **AC Size and Usage**: Further investigate available thermostat telemetry data and any additional available HVAC equipment characteristics (i.e. capacity, SEER/EER) that can be collected for DEC and DEP participants and directly compare the runtime and energy consumption of connected equipment on hot weather days. Alternatively, AMI data for summer 2021 (to be collected for the DR evaluation) may be used to compare whole facility energy consumption directly on hot weather days. In the future, existing thermostat type and temperature setpoints could be collected at the time of installation of the new device, to enable future investigation.

- **Participant Business Types and Behavior:** Future evaluations could include, for example, participant surveys to assess business capacity for saving energy (e.g., ability to curtail AC use during business hours) and willingness and ability to save energy via

the thermostat (e.g., preferences for setpoints before and after installing the device). Participant surveys can also be used to understand how customers in each territory are engaging with the online portal.

3.3 Net-to-Gross

Evaluations of demand-side management programs typically estimate both net and gross savings, and often present a net-to-gross (NTG) ratio based on the evaluated percentage of energy reductions that may be ascribed either to free ridership (which decreases the NTG ratio) or to program spillover (which increases the NTG ratio).

Free ridership is typically defined as the percentage of savings that would have occurred absent the presence of the program. Spillover is typically defined as incremental savings actions undertaken by a program's participants not directly incented by the program.

All savings presented in this report should be considered net.

3.3.1 Energy Efficiency Impacts

The energy efficiency impacts of this program are net of any free ridership. This is because most of the key program elements that drive savings are not available in the consumer market. Furthermore, the program is designed primarily as a demand response program and it is unlikely that energy impacts driven by free ridership occur because participants enroll in demand response.

A participant is considered a free rider when it can be demonstrated that even absent the program the participant would have purchased the efficient equipment and adopted the efficient behavior promoted by that program.

In the case of this program, the energy efficiency equipment being deployed requires educated action on the part of the participant to achieve energy savings. This action requires information feedback provided by program-specific tools. Simply purchasing a Wi-Fi enabled thermostat would not yield any savings. Savings are delivered by the participants taking appropriate and impactful actions that the education, information feedback via the portal, and program-specific thermostat pre-sets empower them to do. It is the combined effect of these elements, packaged in a single offering, that results in the savings estimated in this evaluation.

Key program elements that customers could not acquire in the open market, elements that are essential for achieving the energy efficiency savings include:

- **Multi-Source Information.** Although some Wi-Fi-enabled thermostats for commercial enterprises allow the user to observe thermostat run-times (real-time and historical) the EnergyWise Business online portal allows users to observe things like thermostat run-times and set-points alongside consumption values. This more clearly identifies potential bill savings to participants than commercially available products.

  The portal doesn't just display HVAC usage and run-time characteristics, but combines both sets of information to deliver customized participant business-specific

benchmarking, identifying for the participant (at portal login) periods of high usage and opportunities for bill savings.

- **Education and Tech Support.** When participants enroll, the thermostat is installed *and set up* by industry professionals in consultation with the key business decision-maker. This means that initial thermostat settings for all businesses will be calibrated to deliver savings without impinging on the core business. Additionally, the installer ensures that the participant can access all portal and thermostat functionality while they are on site. The program therefore delivers both a nearly universal adoption of initial energy saving settings and ensures that the business owner understands and can access and use the tools provided.

  In addition to the significant assistance provided at enrollment and installation, Duke Energy maintains a call center for participant technical support, specially trained for supporting this program, the thermostat and portal.

- **Maintenance and Energy-Saving Prompts.** In addition to the standard battery of energy efficiency tips and maintenance prompts, a key feature of the Duke Energy portal not otherwise available in the consumer market is its automated analysis of equipment condition – for example monitoring the relationship between run-time and temperature – and alerting the user when monitored metrics suggest maintenance could deliver cost-effective bill savings. This targeted advice effectively provides users with a customized maintenance schedule and reminders and is a program-specific feature, rather than a thermostat capability that could be obtained through the consumer market.

These elements are all major factors that drive savings and are all specific to the programmatic context of the technology deployed. Given that these elements are available only through participation in the program, Guidehouse believes the energy savings found in this evaluation are net savings.

4. Findings, Conclusions, and Recommendations

The principal EM&V findings and conclusions regarding the estimated energy impacts are as follows:

- **Participants are estimated to have reduced an average of 1,026 kWh per device in DEC and 423 kWh per device in DEP for the period of March 2019 through February 2020.** More savings were realized in summer months compared with winter, which reflects the fact that only some participants use electric heating. Guidehouse has developed hypotheses for the difference in savings between DEC and DEP participants, which may be used to guide future evaluation and program implementation.

- **Guidehouse concluded that selecting a suitable non-participant comparison group was not possible with the data available for estimating energy impacts.** Guidehouse observed evidence of differing evolution of consumption patterns between participants and selected matches from the pre- to post-installation periods, which suggests that the consumption behavior of selected matches may not evolve in similar ways as participants as would be assumed when using a comparison group. This result suggests that an MCG comprised of non-participants is unsuitable for estimating energy efficiency impacts for small and medium-sized businesses in this program.

Based on the impact findings above, Guidehouse recommends that Duke Energy consider the following recommendations:

- **Consider customer targeting or outreach activities to increase energy savings.** Targeting more customers with electric heat could increase winter energy savings. Guidehouse understands that future program data will have more accurate tracking of HVAC equipment types, which would facilitate such targeting efforts. Duke Energy may wish to consider increasing outreach encouraging participants to adopt more energy efficient setpoints. Although program technicians assist participants with initial thermostat setup, it is unclear how the settings persist over time. Following up with participants to encourage them to optimize these settings may increase the amount of energy savings achieved in the program.

- **Consider using future process evaluations to better understand differences in savings estimated in DEP and DEC service territories.** Consistent with the findings of the prior evaluation conducted by another evaluator, Guidehouse estimated that average savings per participant were lower for DEP participants than for DEC participants. Participant interviews or surveys may be used to better understand the factors that cause DEP participants to exhibit lower savings. For example, surveying DEC and DEP participants may show differences in willingness to use temperature setbacks or capability of reducing HVAC consumption based on business operation considerations.

5. Summary Form

EnergyWise Business
2019-2020
Completed EMV Fact Sheet

Description of Program

EnergyWise Business is a commercial HVAC load control program that targets small and medium businesses. At the time of enrollment participants are provided either with a thermostat or a load switch, with most customers having a thermostat. Participants must have a password-protected wireless network in order to qualify for a thermostat.

Participants may elect to be controlled using one of three cycling strategies: 30%, 50%, or 75%. Incentive for participation increases commensurate with the increased aggressiveness of the cycling strategy selected.

Impact Evaluation Methods

Guidehouse estimated energy impacts via a regression analysis of monthly consumption data for the estimation period of March 2019 through February 2020, for participants who installed a thermostat between January 2018 and February 2019.

Impact Evaluation Details

- **The program generated 5,440 MWh (DEC) and 1,122 MWh (DEP) of savings from March 2019 through February 2020.**
- **Participants are estimated to have reduced an average of 1,026 kWh / device (DEC) and 423 kWh / device (DEP) for the period of March 2019 through February 2020.** More savings were realized in summer months compared with winter, which reflects the fact that only some participants use electric heating. Guidehouse has developed hypotheses for the difference in savings between DEC and DEP participants, which may be used to guide future evaluation and program implementation.

Date:	2021-01-22
Region:	DEC and DEP
Evaluation Period	EE: 2019 – 2020
DR Event Program Impact (MW)	
EE Program Impact (MWh)	
Program total for participants with thermostats (Mar 2019 – Feb 2020	DEC: 5,440 MWh DEP: 1,122 MWh
Net-to-Gross Ratio	1

6. Program Impacts for Duke Energy Analytics

DSMore table - DEC-DEP SBDR Therm

Appendix A. Detailed Energy Efficiency Impact Methodology

This appendix includes a more detailed description of Guidehouse's methodology for estimating energy efficiency impacts and ruling out the suitability of an MCG, resulting in a within-subject regression analysis.

A.1 Assessment of Matched Comparison Group

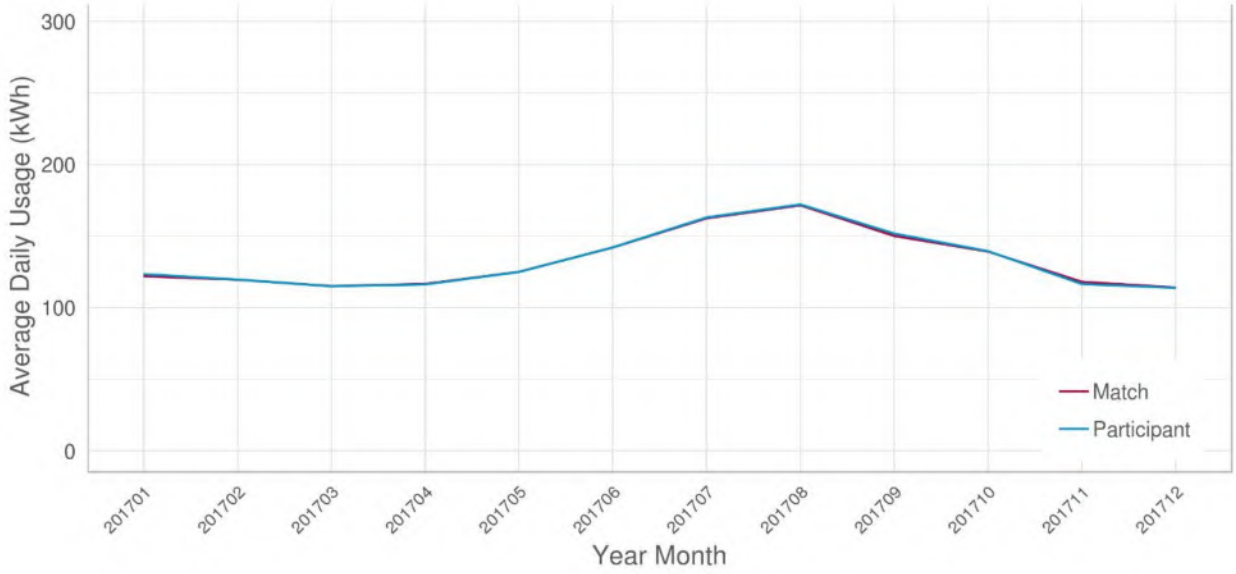
In absence of true experimental design (e.g., a randomized control trial), using an MCG is generally the preferred evaluation method for estimating energy savings for a program like EnergyWise Business. An MCG generally allows evaluators to control for unobserved trends in energy use that are unrelated to the installation of the program thermostat but consistent in effect across both participants and non-participants such as changes in energy use associated with macroeconomic factors. This approach is also commonly referred to as quasi-experimental and reduces the likelihood of specification bias.[6] Within-subject models that do not use a comparison group tend to be much more sensitive to model specification than models with a comparison group, which rely more heavily on contemporaneous observations of non-participant consumption to estimate participant baseline consumption.

Guidehouse developed an MCG where each participant was assigned a "match", which is the non-participant within the same SIC division (first two digits of the SIC Code) that has the most similar consumption patterns in the matching period (e.g., January to December 2017).[7] Figure A-1 and Figure A-2 compare average daily usage by month during the matching period between participants and matches for DEC and DEP, respectively. In general, the selected matches for both DEC and DEP, on average, exhibited similar behavior in the matching period, before any participants have installed the thermostat. DEP participants and matches showed large differences in the matching period. The underlying assumption of using an MCG is that the relative difference between participant and MCG consumption is consistent over time in absence of the treatment, conditional on the independent variables included in the regression equation, such that subsequent differences after installation of the thermostat can be attributed to energy savings.

[6] An LDV approach using an MCG, conditional on the assumption that the two groups' consumption will (absent the treatment) trend in a similar fashion, will tend to be less sensitive to what variables are included (or left out) of the model specification.

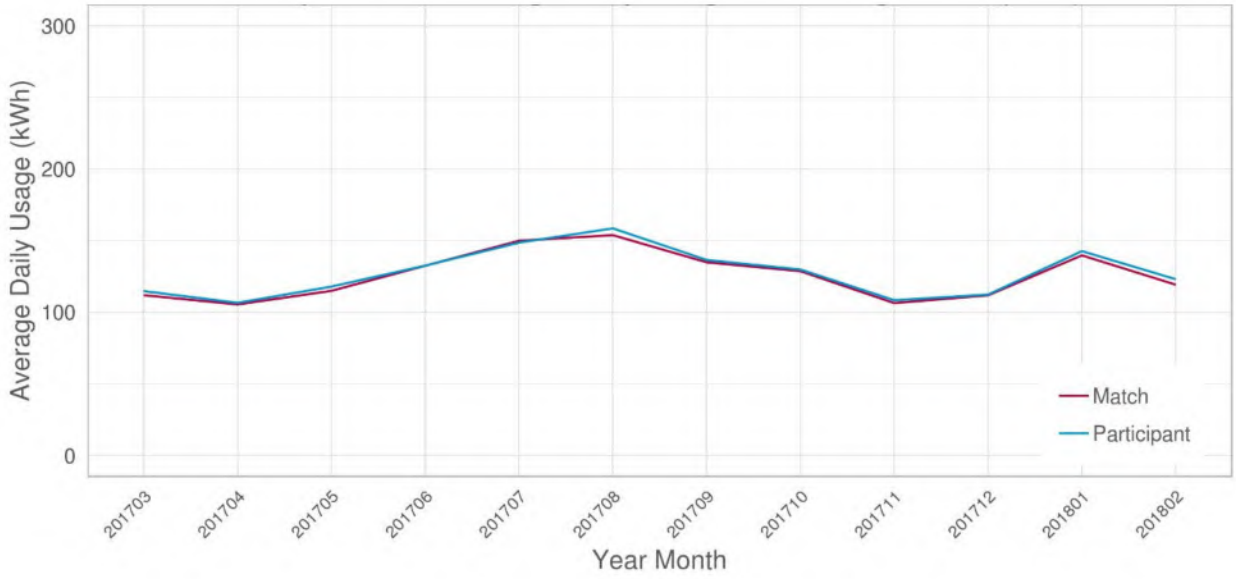
[7] For a small number of DEP customers who installed in January or February of 2018, data was only available for March 2017 onwards. Therefore, for DEP customers who installed in January 2018, the matching period was defined as March through December 2017. For DEP customers who installed in February 2018, the matching period was defined as March 2017 through January 2018. For all other DEP customers, the matching period was defined as March 2017 through February 2018.

Figure A-1. Comparison of Average Daily Usage – Matching Period (DEC)



Source: Guidehouse analysis of DEC and DEP data

Figure A-2. Comparison of Average Daily Usage – Matching Period (DEP)



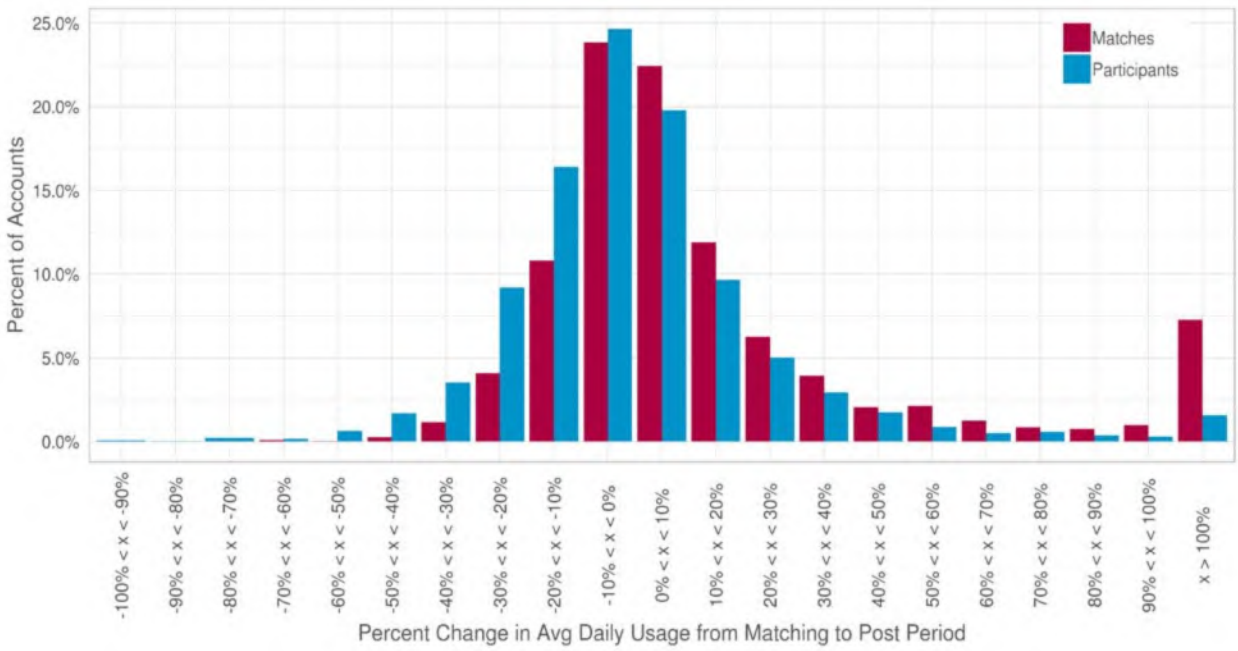
Source: Guidehouse analysis of DEC and DEP data

However, Guidehouse observed some large differences in the post-installation period, particularly for DEC participants and corresponding matches where changes in winter consumption would be unexpected as a result of installing a thermostat. As a result, Guidehouse further investigated match quality. Guidehouse observed that many participants changed their consumption significantly between the pre- and post-installation period (2017 to 2019). This phenomenon may be expected for small businesses, where changes in operations or tenancy may occur. However, these swings in usage may bias impacts if they either:

- Are not experienced similarly by participants and matches, e.g., if matches exhibit large swings in usage that participants do not;
- Are asymmetric, e.g., if swings are more likely to be increases than decreases, then large swing upwards will not 'cancel out' with large swings downward.

Figure A-3 shows the distribution of such changes for both participants and matches. In the middle of the distribution, (i.e. changes in consumption of ±10%), some differences are expected since the participants have installed a thermostat. However, higher levels of change such as increasing consumption by +100% are unexpected and not plausibly related to the installation of a thermostat. The selected matches showed a much higher proportion of customers that increased consumption by more than 100%, which suggests that the selected matches may have evolved differently over time, despite exhibiting similar consumption in the pre-installation (i.e., matching) period.

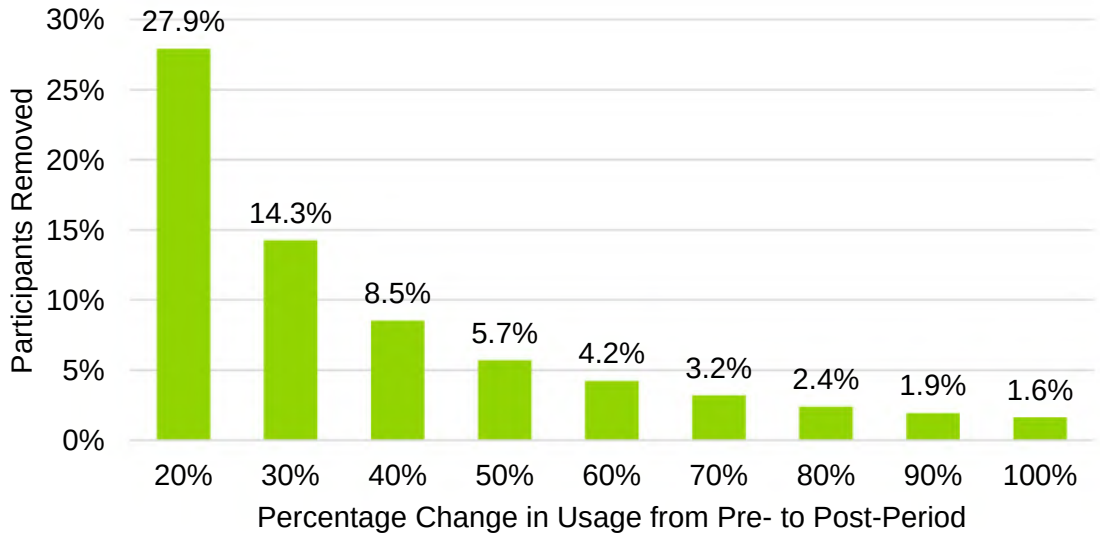
Figure A-3. Distribution of Change in Average Usage, Participants vs Matches



Source: Guidehouse analysis of DEC and DEP data

To test the sensitivity of savings estimates, Guidehouse investigated "trimming" the participant sample to remove customers that exhibited changes in average consumption larger than a certain percentage. Figure A-4 shows the percent of participants (for DEC and DEP combined) that would be removed at different thresholds, from ±20% to no trimming of the sample. For example, if the condition is set that customers whose consumption either doubles or falls to zero (±100% change) should be removed, 1.6% of customers must be "trimmed" from the estimation set.

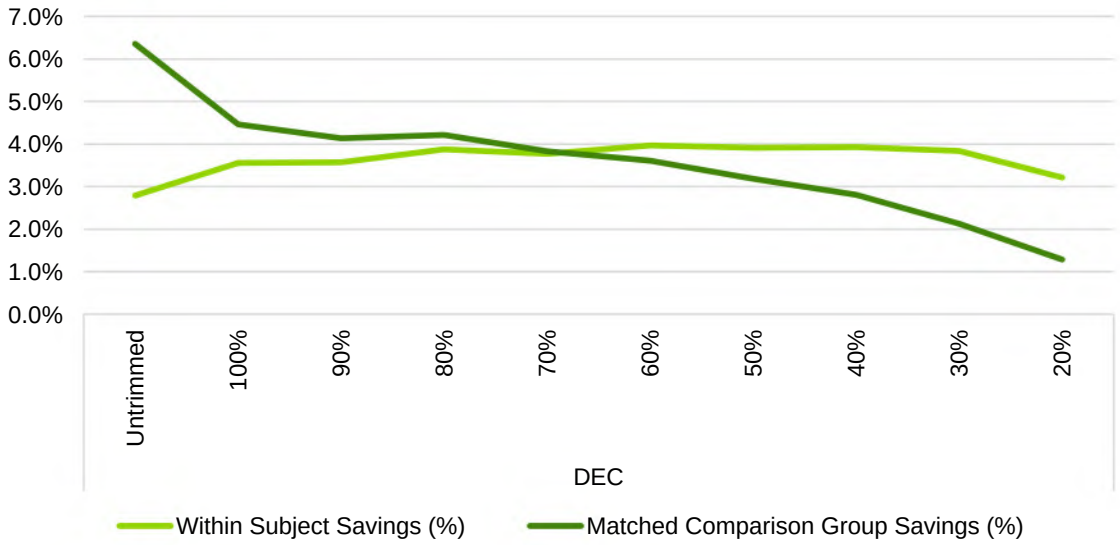
Figure A-4. Comparison of Average Daily Usage – Post Period



Source: Guidehouse analysis of DEC and DEP data

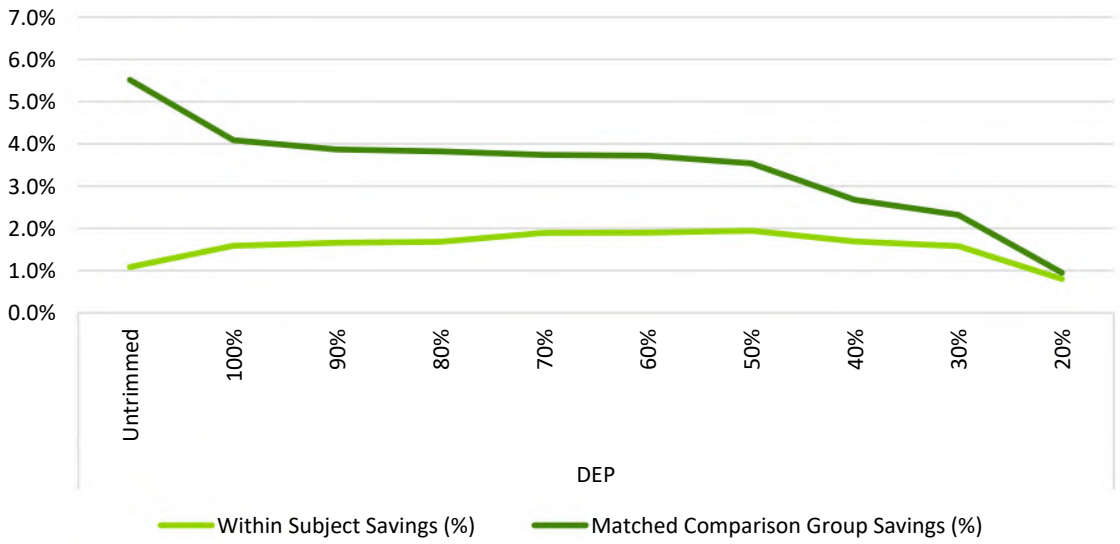
Guidehouse then explored the sensitivity of estimated savings at each level of trim, with the selected MCG and using the within-subjects approach. Guidehouse found that the savings estimates generated using an MCG varied substantially between different trim levels. In contrast, savings estimates estimated without an MCG were much less sensitive, as shown in Figure A-5 and Figure A-6. For both DEC and DEP, aside from the untrimmed and ±20% thresholds, savings estimates are relatively consistent as shown by the flatter profile of the within-subjects' lines.

Figure A-5. Comparison of Percent Savings Estimates at Different Trim Thresholds - DEC



Source: Guidehouse analysis of DEC and DEP data.

Figure A-6. Comparison of Percent Savings Estimates at Different Trim Thresholds - DEP



Source: Guidehouse analysis of DEC and DEP data.

The sensitivity of estimated savings to trim when using the selected MCG suggests that trimming the sample affects the group of participants differently than the selected matches, and therefore suggests that the selected matches may have evolved differently in terms of energy consumption behavior than participants for reasons unrelated to the EnergyWise for Business program.

Based on this investigation, Guidehouse concluded that an LDV approach with MCG is inappropriate for evaluating the impacts of energy efficiency for small businesses in the DEP and DEC territories.[8] Additionally, Guidehouse imposed a restriction on participants for the sample to have a change in average consumption of less than 100% between the pre- and post-installation periods. Guidehouse selected this threshold for the following reasons:

- this threshold removes approximately 2% of participants that could be considered outliers who increased their consumption by more than double their 2017 amount;
- the resulting sample of participants exhibits changes in usage that are more symmetric (i.e. between -100% and 100% of 2017 consumption); and
- estimated savings results were not sensitive to further trim levels.

Guidehouse proceeded with the analysis using a within-subject approach which considers participants only and compares consumption before and after installation of the thermostat.

[8] This finding should be understood to be specific to this program and set of jurisdictions, and caution should be used in generalizing this result to other jurisdictions, or even to other programs within this same jurisdiction.

A.2 Regression Model Specification

DEC and DEP participants were modeled separately. Equation A-1 shows the within-subjects model regression equation used for both models. These models estimate participant average daily usage in a given bill period as a function of month of year, cooling and heating degree days, and participation in Duke Energy's other energy efficiency programs. Only participant data is included in the models for the period from January 2016 through February 2020 (for DEC) and March 2017 through February 2020 (for DEP).

Equation A-1. Within-Subjects Regression Model

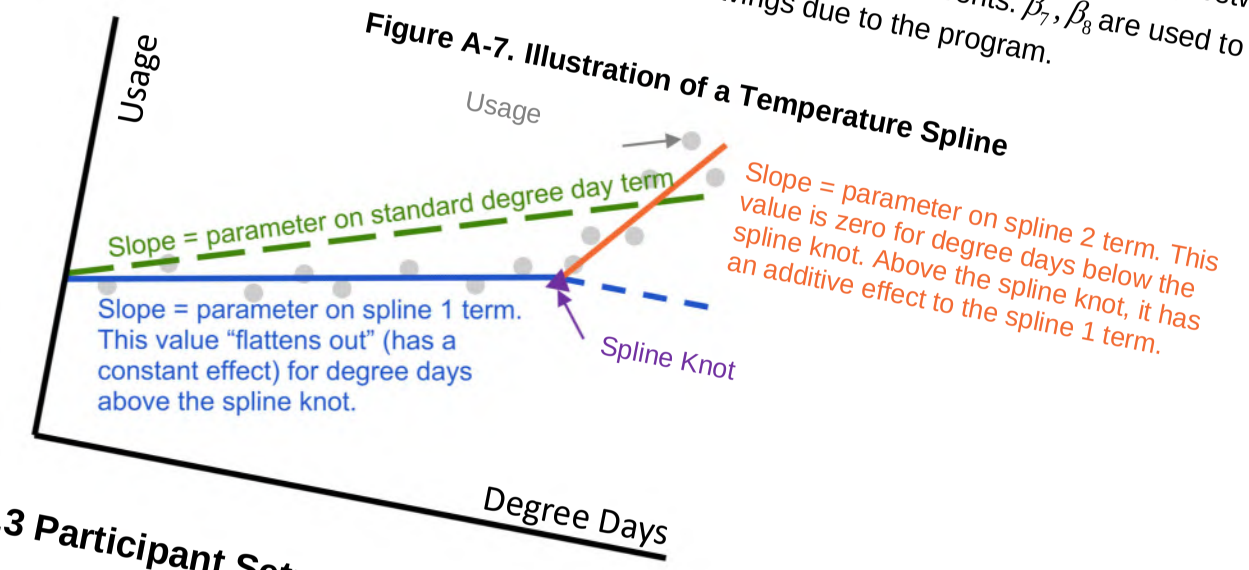
$$ADU_{it} = \alpha_i + \sum_J \beta_{1j} Month_{jt} + \beta_2 CDD_{it} + \beta_3 spline_1 HDD_{it} + \beta_4 spline_2 HDD_{it} + \beta_5 CrossPart_{it}$$
$$+ \beta_6 Treatment_i \cdot CDD_{it} + \beta_7 Treatment_i \cdot spline_1 HDD_{it} + \beta_8 Treatment_i \cdot spline_2 HDD_{it} + \varepsilon_{it}$$

Where,

i	= The subscript identifying the customer.
t	= The subscript identifying the month of sample.
α_i	= The customer-specific fixed effect.
ADU_{it}	= Average daily consumption of kWh by customer *i* in month of sample *t*.
$Month_{jt}$	= A set of binary variables taking a value of 1 when *j* = *t* and 0 otherwise; *j* indexes months 1-12.
CDD_{it}	= average cooling degree days (base 65°F) in month of sample *t*.
$spline_1 HDD_{it}$, $spline_2 HDD_{it}$	= a set of variables acting as a temperature spline for the average heating degree days (base 65°F) in month t experienced by customer I, with a spline knot of 19. As illustrated in Figure A-7, the spline models temperature dependent consumption with a different relationship at lower temperatures below the spline knot. The higher temperature component of the spline accounts for increased electricity usage at very cold temperatures, where auxiliary heating may be used for heat pumps.
$CrossPart_{it}$	= A dummy variable equal to 1 if customer *i* participated in a related small business energy efficiency program (e.g. Small Business Energy Saver, etc.) during, or in any of the months prior to, month of sample *t*; and 0 otherwise.
$Treatment_{it}$	= A dummy variable equal to 1 if customer *i* installed their smart thermostat during, or in any of the months prior to the month of sample *t*; 0 otherwise.
ε_{it}	= The error for customer *i* during month of sample *t*. Standard errors are estimated from model residuals and are cluster-robust to account for any heteroskedasticity or serial correlation at the business level.

β = Parameter estimates. These values are the estimated relationship between demand and the variable for which the beta represents. β_7, β_8 are used to estimate average daily energy savings due to the program.

Figure A-7. Illustration of a Temperature Spline



A.3 Participant Setpoint Analysis

Guidehouse performed analysis of available thermostat setpoint telemetry data for participants in the program, to provide insight into the differences in estimated energy savings between DEP and DEC participants. Duke Energy provided a set of thermostat telemetry data for participants in both DEC and DEP territories. The data contained a log of participant thermostat setpoint schedules spanning the time period of March 2019 through January 2020, where entries appear every time a schedule is created. Customers can create a setpoint schedule in different ways: by day of week, by weekday and weekend, or by occupied and unoccupied. 95% of participants chose to set an unoccupied vs occupied schedule. Only 15% chose to set a daily schedule (10% of customers chose to use both types of schedules at different times). No DEP participants used a daily setpoint schedule, i.e. they only used an occupied vs unoccupied schedule.

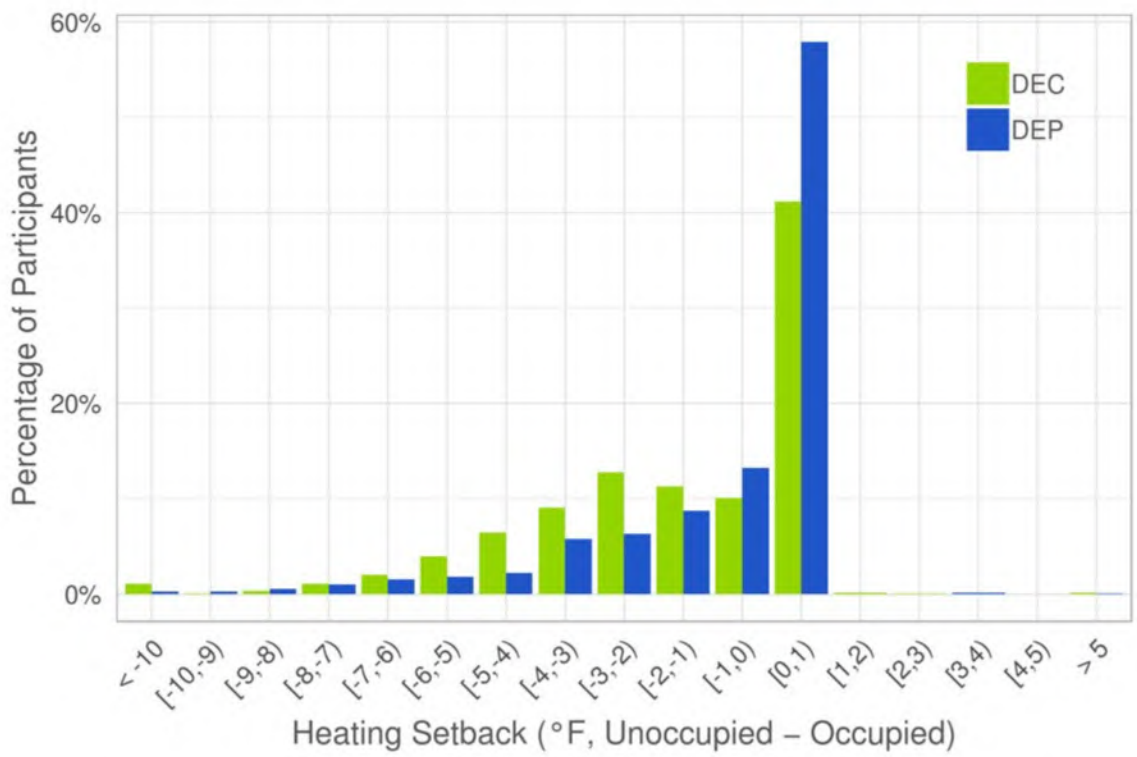
The data contained schedules for participants who installed a device between January 2019 through February 2020; however, there was little overlap with the evaluation sample of those who installed between January 2018 and February 2020, as 98% of devices in the available data were installed after February 2019. Nevertheless, the data still provides insight into DEP and DEC participants, so Guidehouse analyzed the data to discover any trends that may explain differences in observed energy savings.

Since no DEP participants used a daily schedule, Guidehouse focused on comparing unoccupied and occupied setpoints to understand the extent to which customers in each territory use temperature setbacks, or a more energy efficient setpoint, when their business is unoccupied. In the summer, a setback corresponds to a higher setpoint, while in the winter a

setback corresponds to a lower setpoint. A larger setback indicates more energy efficient behavior.

Figure A-8 compares the distribution of observed heating setbacks between DEC and DEP participants. Almost 60% of DEP participants with telemetry data do not appear to use any heating setback, compared with about 40% of DEC participants (indicated by the tall bars on the right of the distribution). Furthermore, setbacks for DEC participants are generally more aggressive than DEP, as indicated by the higher green bars for various setback levels. This suggests that DEC participants are exhibiting more efficient behavior on average than DEP participants during the heating season.

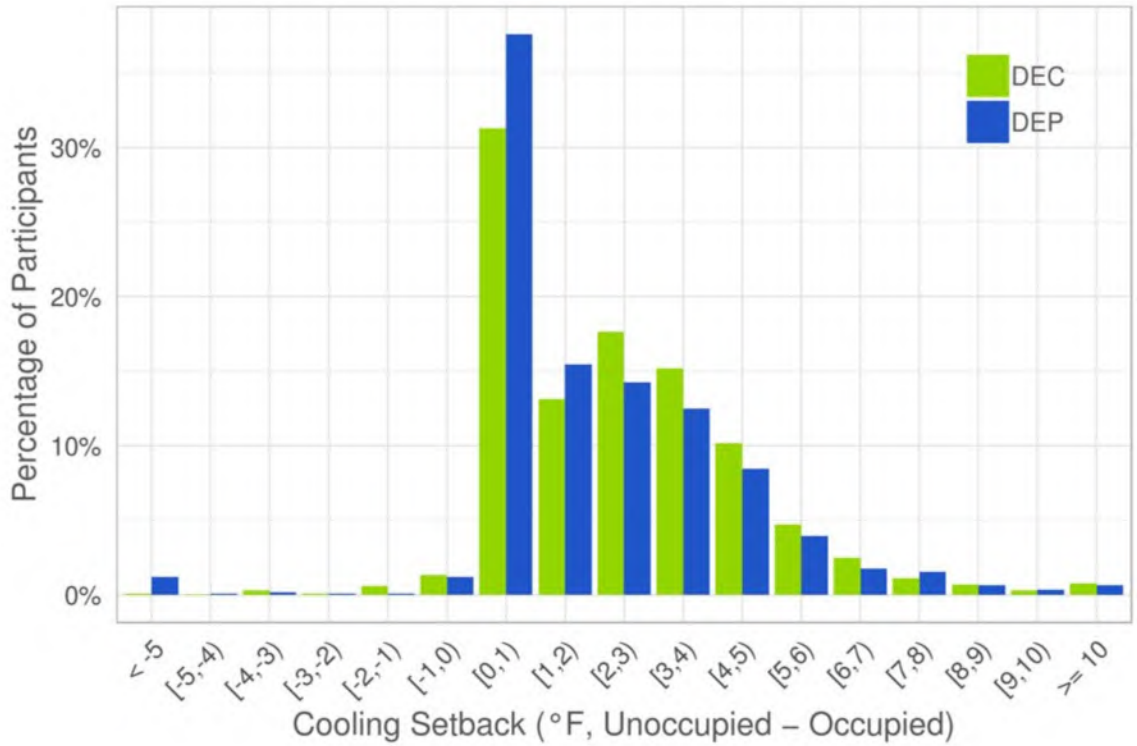
Figure A-8. Distribution of Observed Heating Setbacks



Source: Guidehouse Analysis

Similarly, Figure A-9 compares the distribution of observed cooling setbacks between DEC and DEP participants. Almost 40% of DEP participants with telemetry data do not appear to use any cooling setback, compared with about 30% of DEC participants. Furthermore, setbacks for DEC participants are generally more aggressive than DEP, as indicated by the higher green bars for various setback levels. This suggests that DEC participants are exhibiting more efficient behavior on average than DEP participants for the cooling season.

Figure A-9. Distribution of Observed Cooling Setbacks



Source: Guidehouse Analysis

Across both heating and cooling, occupied and unoccupied setpoints suggest that DEC participants exhibit more energy efficient behavior on average than DEP participants. Almost 60% of DEP participants do not use any heating setback, and almost 40% do not use a cooling setback. Comparatively for DEC participants, ~40% do not use a heating setback and ~30% do not use a cooling setback.

The differences in setback behavior may explain some of the differences in the estimated kWh savings between DEP and DEC. Note that this analysis was based on a more recent sample of participants than those used for estimating kWh savings. Nevertheless, the data provided some insight into differing behavior among DEP and DEC participants. Guidehouse also did not have data on behavior prior to installation of the thermostat; however, since a large portion of participants appear to not use any setback, we may assume that these customers did not use one before installing the new thermostat either.

I/A

Evans Rebuttal Exhibit 1
Docket No. E-2, Sub 1273

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Opinion Dynamics

Duke Energy Carolinas

Low Income Weatherization Program (2016–2018) Evaluation Report – Final

April 16, 2021

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1. Evaluation Summary

This report presents findings from our impact and process evaluation of the Duke Energy Carolinas (DEC) Low Income Weatherization Program (hereafter referred to as the Weatherization Program or the program), covering the period of April 2016 to December 2018. The impact evaluation results are based on a combination of billing analysis and engineering analysis. Process evaluation results are based on a program materials review, interviews with program staff and participating agencies, and a telephone survey of program participants. In addition, this report includes a limited process evaluation of the new DEC Weatherization Pilot in Durham, North Carolina, based on an in-depth interview with pilot program staff and a program materials and tracking data review.

This report includes a high-level description of the evaluation methodologies as well as results, findings, and recommendations. The associated appendix includes additional detail on the impact methodology and results.

1.1 Program Summary

The Weatherization Program aims to improve the health, safety, and energy efficiency of income-qualified Duke Energy customer households by leveraging existing weatherization programs to provide a comprehensive package of electric conservation measures at no cost to DEC customers. Duke Energy's implementation partners are the program administrator (the North Carolina Community Action Association, or NCCAA); the database administrator (TRC; previously Lockheed Martin); and a network of local implementing agencies that include community action agencies (CAAs), local governments, and other nonprofit organizations that enroll customers and complete weatherization projects. DEC initially designed the program to leverage federally funded state weatherization assistance programs (State WAPs), in which implementing agencies already participate. DEC pays a fixed price per State WAP project completed at qualifying DEC customer's homes, with the requirement that agencies then use the funds to support future weatherization-related activities. In an effort to bypass strict DOE program funding rules and to encourage more participation in South Carolina, DEC introduced a new participation channel in 2018 in which agencies could submit qualifying weatherization projects originally funded from their operating budget or another source.

Weatherization Program participants must live in an individually metered single-family home with a household income less than or equal to 200% of the federal poverty guideline. The Weatherization Program offers two participation tiers for owner-occupied homes, as well as a refrigerator replacement offering to both owners and renters (with landlord approval). Tier I covers eligible projects at homes using less than 7 kWh per square foot annually and provides up to $600 for air sealing and low-cost energy efficiency upgrades like LEDs, domestic water heater tank insulation, low-flow shower heads, faucet aerators, and others. Tier II covers eligible projects at homes using at least 7 kWh per square foot annually and provides up to $4,000 for Tier I measures plus insulation improvements. Tier II projects can qualify for a higher funding cap of $6,000 if they include a qualifying heat pump upgrade or replacement. Refrigerator replacement is available even if the home did not receive any Tier I or Tier II measures. Refrigerator replacement eligibility and incentive levels are dependent on the old refrigerator's size and a two-hour metering test.

1.2 Evaluation Objectives

We established the following objectives for this evaluation:

- Review and update, as necessary, deemed savings estimates through a review of measure assumptions and calculations;

- Verify measure installation and persistence;
- Estimate program energy (kWh) and summer and winter peak demand (kW) savings;
- Determine participants' level of satisfaction with the program and measures received;
- Identify non-energy benefits realized by participants;
- Identify barriers to agency participation in the program and recommend strategies for addressing those barriers;
- Identify program strengths and potential ways that the program can increase average savings per household; and
- Compare the program design, participation levels, and savings potential of the Weatherization Program to early achievements of DEC's Durham Low Income Weatherization Pilot to assess Pilot performance and potential for savings.

To achieve these objectives, we completed a number of data collection and analytic activities:

- Impact evaluation activities included a review of program-tracking data, a deemed savings review, development of in-service rates (ISRs), an engineering analysis, and a consumption analysis.
- Process evaluation activities included a review of program materials; interviews with Duke Energy program staff, implementing agency staff, NCCAA and TRC staff, and Durham Pilot program managers; and a survey of participating customers.

1.3 High Level Findings

During the evaluation period, 1,706 households participated in the Weatherization Program, completing over 2,000 projects. The majority of participants (81%) completed a Tier II project; only 10% of participants completed a Tier I project. In addition, 24% received a replacement refrigerator, either as a stand-alone measure (8%) or in combination with Tier I or Tier II services (15%).

Impact Findings

Based on our impact analysis, we estimate that the projects completed during the evaluation period generate close to 3.2 million kWh of annual energy savings, 539 kW of annual summer coincident demand savings, and 935 kW of annual winter coincident demand savings. Tier II participants account for the largest share to program-level savings (89%) while Tier I participants and refrigerator replacements account for 1.3% and 9.6%, respectively, of total program energy savings.

Table 1 presents annual per-household and program-level net ex post savings for the evaluation period.

Table 1. Summary of Impact Results

Project Type	Number of Participants	Net Annual Savings Per Household			Net Annual Program Savings		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier I	176	241	0.0724	0.0416	42,398	12.7	7.3
Tier II	1,387	2,042	0.3544	0.6438	2,832,531	491.5	892.9
Refrigerator Replacement	404	758	0.0864	0.0864	306,097	34.9	34.9
Total [a]	1,706				3,181,027	539.2	935.2

[a] The total number of unique participants is smaller than the sum of project types since some households complete more than one project.

Based on program-tracking data, almost all Tier I and Tier II participants (96% and 97%, respectively) received air sealing. The vast majority (91%) of Tier II participants also received insulation, and 74% received duct system sealing or insulation—measures not offered to Tier I participants. Larger shares of Tier II participants than Tier I participants received water heating measures, weatherstripping, lighting, and heating system tune-ups. Overall, 24% of participants received a new refrigerator and 19% an HVAC replacement or upgrade. Notably, 8% of participants only received a new refrigerator and 14% only received an HVAC replacement/upgrade.

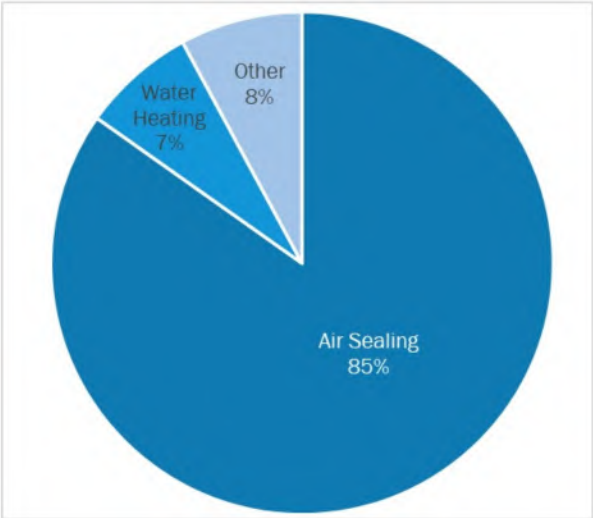
Table 2. Measure Mix

Measure Category	% of Participating Households Receiving Measure Category [a]		
	All Participants (N=1,706)	Tier I Participants (N=176)	Tier II Participants (N=1,146)
Air Sealing	75%	96%	97%
Insulation	61%	n/a	91%
Duct System	50%	n/a	74%
Water Heating	50%	31%	70%
Weatherstripping	43%	35%	59%
Lighting	26%	26%	35%
Heating System Tune-Up	19%	6%	27%
Refrigerator Replacement	24%	19%	17%
HVAC Replacement/Upgrade	19%	1%	7%

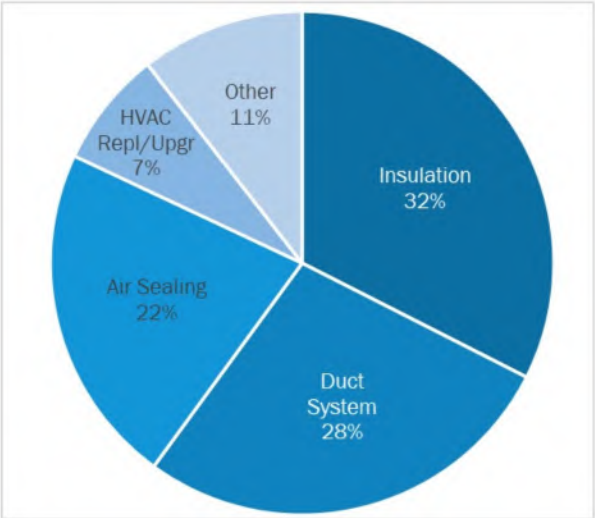
[a] Values are based on program-tracking data and do not incorporate ISRs.

Based on the engineering analysis, Tier I savings during the evaluation period came primarily from air sealing (85%). Another 7% came from water heating measures and 8% came from other Tier I measures (including heating system tune-ups, lighting measures, and weather-stripping). Tier II savings, on the other hand, were dominated by insulation (32%), duct sealing and insulation (28%), and air sealing (22%). HVAC replacements/upgrades accounted for 7% of engineering-based Tier II savings during the evaluation period, while other Tier II measures (including water heating measures, heating system tune-ups, lighting, and weather-stripping) contributed 11% (see Figure 1).

Figure 1. Measure Contribution to Total Tier I and Tier II Energy Savings



Tier I kWh Savings



Tier II kWh Savings

Process Findings

The process evaluation found that the DEC Weatherization Program continues to benefit from previously established relationships, implementation processes, and program-tracking systems. Program and implementation staff reported no major changes to the program since the previous evaluation aside from the new participation channel established in 2018. Participating agencies also reported minimal changes to how they implement and participate in the Weatherization Program, and many reported the DEC funds allow them to complete more weatherization jobs than they would have otherwise.

Key process findings include:

- **Program Participation.** Participation in the Weatherization Program has been increasing steadily since the program began in 2015. Agencies work hard to inform clients about the program through multiple advertising channels (newspaper ads, in-person events, agency websites, etc.) and half of interviewed agencies indicated the number of projects they complete each year is increasing.

- **New Participation Channel.** Prior to 2018, agencies could only submit projects originally funded by the State WAP for reimbursement from Duke Energy. Now, agencies may submit for reimbursement projects they originally funded through their operating budget or another source. This opened the possibility of non-CAA organizations, such as non-profit organizations, to participate in the program and bring Weatherization Program services to their clients. Half of the agencies we interviewed indicated they had used this new participation channel. One agency, a non-profit organization, indicated they used this participation channel exclusively and only performed refrigerator replacements since their organization was not equipped to perform more extensive weatherization on clients' homes.

- **Satisfaction.** The process evaluation showed high satisfaction with the Weatherization Program. Interviewed agency staff often provided unprompted praise for the program implementation team and underscored the importance of the program to their clients. Agencies found the logistical elements of the program—including program organization, communication, and reporting—to be key program

strengths. Participants were also highly satisfied with the program overall. A key concern for participants is high energy bills, and survey results suggest the program is helping participants in this respect, with 73% and 58% of respondents reporting lower summer and winter electricity bills, respectively, following participation in the program.

- **Non-Energy Impacts.** In addition to lowering energy bills, the Weatherization Program provides substantial non-energy benefits to participants including improved home comfort in the summer and winter, reduced draftiness, and better lighting. To a lesser extent, survey respondents also reported lower outdoor noise levels and home maintenance costs, improved quality of life, safer homes, and increased water efficiency.

- **South Carolina Policy Barriers.** Despite the new participation channel—introduced in 2018 to encourage participation by South Carolina agencies—barriers to program participation remain high in South Carolina, and no projects were completed in the state during this evaluation period. While the new participation channel has not yet resulted in program participation in the state, program staff continue to conduct outreach and provide additional support to South Carolina agencies and to encourage future program participation.

- **Durham Pilot.** Between October 2018 and December 2019, Duke Energy offered a weatherization pilot in Durham, North Carolina, which served a total of 206 customers. One goal of this pilot was to determine if the current DEC Weatherization Program design and funding model could be improved to expand program services to South Carolina and into the Duke Energy Progress (DEP) service territory. The limited process evaluation of the Durham Pilot found key differences between the pilot and the Weatherization Program in program eligibility, implementation, and measure mix:

  - Not relying on agencies to implement the program made the Durham Pilot implementation smoother and more flexible, and access to customer data allowed Pilot staff to target the program to the customers who needed it most. Since the Durham Pilot was entirely funded by DEC, participants did not need to spend time completing federal or state assistance program applications, which greatly reduced administrative burden on participants.

  - Compared to DEC Weatherization projects in the evaluation period, Durham Pilot projects were more likely to include both weatherization measures and an HVAC upgrade. Additionally, Durham Pilot participants were more likely to receive a refrigerator replacement. Based on the measure mix, we believe that the Durham Pilot has the potential to provide per household savings on par with, or possibly greater than, the savings estimated for the DEC Weatherization Program. Since this evaluation did not include a formal impact assessment, however, more rigorous impact analysis would be required to quantify the savings of the Durham Pilot.

  Overall, pilot staff were highly satisfied with the performance of the pilot and indicated that participants were particularly grateful for program services they may have otherwise waited years to receive. Given the continuing policy barriers in South Carolina, despite the new participation channel, a program design similar to the Durham Pilot could be a good option for bringing weatherization services to customers in South Carolina and/or the DEP service territory.

1.4 Evaluation Recommendations

We have developed the following recommendations based on the results of our evaluation:

- **Consider tracking several additional parameters within the program-tracking system, if feasible. to enhance the accuracy of future deemed savings estimates.** Our deemed savings review (see Appendix B) identified a few parameters that are currently not tracked in program data: (1) pre- and post- blower door results in units of reduced cubic feet per minute (CFM); (2) presence or type of cooling at participating homes; (3) water heating fuel of participating homes; and (4) the installed location (e.g., bathroom, kitchen) for each low-flow faucet aerator. Some of this information is currently collected in the participant survey but having it in the program-tracking data for the population of participants would enhance the accuracy of future deemed savings estimates. We therefore recommend asking weatherization agencies to enter this information into the program's tracking system, if available.

- **Consider changing the reimbursement structure or increase reimbursement amounts.** The current Tier II incentive structure provides up to $6,000 for Tier II projects. TRC and NCCAA indicated that agencies may struggle covering the cost of HVAC replacements with the current reimbursement amount, which has not increased since the program began in 2015. In addition, this reimbursement cap may also prevent participants from receiving weatherization services in addition to HVAC replacements/upgrades: Based on program-tracking data, only 6% of Tier II projects include both HVAC replacements/upgrades and other Tier II measures, compared to 34% in the Durham Pilot, which provided higher incentives. Agencies may be able to provide additional energy saving measures in Tier II homes, leading to deeper savings, if the overall Tier II incentive amount was increased.

- **Increase support to agencies in program marketing and outreach.** Agencies noted that communication and organization of the program were key strengths and frequently provided unprompted praise for staff at Duke Energy and NCCAA. One area agency identified for potential additional Duke assistance was marketing and outreach to help increase customer awareness of the program. This could be through information about the program on customer bills or on Duke Energy's website, or by developing testimonials from past program participants with examples of bill savings and other benefits—such as non-energy impacts (NEIs) reported by many surveyed participants—derived from their weatherization projects.

- **Explore options to increase the uptake of comprehensive weatherization projects though the new participation channel.** The new participation channel allows non-profit and other organizations to provide program services to customers who may not have been able to receive them otherwise. One objective of this channel was to overcome barriers to participation in South Carolina, as State policies prevent CAAs from participating in the program. Based on program-tracking data through April 2020, however, the new channel has not been successful in encouraging South Carolina organizations to participate in the program. In addition, information from our agency interviews suggest that some non-CAAs may not be equipped to facilitate the implementation of weatherization projects and thus limit their activity to equipment replacement. The program should continue to explore ways to promote participation in South Carolina, by identifying suitable partner organizations (with prior weatherization expertise) and/or providing non-CAA organization with additional support in implementing weatherization services.

- **Consider expanding the Durham Pilot to include the South Carolina service territory.** Given the substantial policy barriers that continue to block participation in South Carolina, one way to provide weatherization upgrades to South Carolina customers is to introduce a program design similar to the Durham Pilot. Based on our review of project types and measures installed through the pilot, the

savings potential for a program design similar to the pilot appears to be on par with, or even greater than, savings observed for the Weatherization Program. In addition, pilot participants and staff were very satisfied with the experience, and there were very few implementation challenges. If policy barriers persist, or the new participation channel fails to increase participation in South Carolina, this may be an option to expand services in the state.

2. Program Description

This section describes key elements of program design, implementation, and performance. The evaluation period addressed in this report is April 1, 2016 through December 31, 2018. This is the second evaluation of the DEC Weatherization Program; the first evaluation covered the period of February 1, 2015 through March 31, 2016.

2.1 Program Design

The Weatherization Program aims to improve the health, safety, and energy efficiency of income-qualified Duke Energy customer households. The program does so by providing customers with comprehensive home weatherization services and repairs that reduce electric energy consumption. The program distributes funding through a network of CAAs and other similar organizations (collectively referred to as "agencies"), which serve Duke Energy's residential electric customers. The program reimburses agencies for work completed at eligible homes.

The DEC Weatherization Program offers two tiers of funding for weatherization upgrades to owner-occupied homes, as well as refrigerator replacements to both homeowners and renters (with landlord approval). Tier I covers eligible projects at homes using less than 7 kWh per square foot annually and provides up to $600 for air sealing and low-cost energy efficiency upgrades like LEDs, domestic water heater tank insulation, low-flow shower heads, faucet aerators, and others. Tier II covers eligible projects at homes using at least 7 kWh per square foot annually and provides up to $4,000 for Tier I measures plus insulation improvements. Tier II projects can qualify for a higher funding cap of $6,000 if they include a qualifying heat pump upgrade or a heat pump system replacement. Refrigerator replacement is available even if the home did not receive any Tier I or Tier II measures. Refrigerator replacement eligibility and incentive levels are dependent on the old refrigerator's size and a two-hour metering test.

In 2018, the program introduced a new participation channel, which broadened the type of organizations that can participate in the program and the funding sources for projects. Prior to this change, only CAAs were eligible to participate, and they could only submit qualifying DOE/State WAP projects for reimbursement. Now, other organizations, such as non-profits, are also eligible to submit projects, and the projects do not have to be DOE/State WAP projects but could be funded from the organization's operating budget or another funding source. DEC made this change to offer an alternative participation channel that can work within the strict DOE guidelines in South Carolina.

2.2 Program Implementation

During the evaluation period, DEC contracted with NCCAA and their subcontractor TRC to implement the Weatherization Program. In total, 15 local agencies participated in the program—including CAAs, local and regional government offices, and other non-profit organizations. These agencies also implement a variety of poverty relief activities, including the State WAP. NCCAA and TRC oversee agency submittals, invoicing, and program-tracking; train agencies on the program and requirements; support participating agencies in making the most of program funding; and conduct outreach to potential new agencies.

2.3 Program Performance

During the evaluation period the program served 1,706 unique households. The majority of participants (81%) completed a Tier II project. Only 10% of participants completed a Tier I project and 24% received a replacement

refrigerator. Based on the impact analysis, the program achieved average annual savings of 241 kWh per Tier I participant and 2,042 kWh per Tier II participant. Refrigerator recipients saved an additional 758 kWh per year. Table 3 summarizes program participation as well as per household energy and demand savings, by project type.

Table 3. Annual Per Household Savings

Project Type	Number of Participants	Net Annual Savings Per Household		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier I	176	241	0.0724	0.0416
Tier II	1,387	2,042	0.3544	0.6438
Refrigerator Replacement	404	758	0.0864	0.0864
Total [a]	1,706			

[a] The total number of participants is greater than the sum of project types since some households complete more than one project.

3. Overview of Evaluation Activities

3.1 Program Staff Interviews

We conducted in-depth interviews with Duke Energy program staff (supporting both the DEC Weatherization program and Duke's Durham Weatherization Pilot) and the DEC Weatherization Program administrator. The main purpose of each interview was to gain insight into program implementation processes and to develop research objectives for the evaluation. In particular, the interviews allowed us to identify consistencies and inconsistencies across the program, processes that are working well, and processes that could be improved moving forward.

3.1.1 Duke Energy Program Staff Interview

Opinion Dynamics conducted an in-depth interview with the DEC Weatherization Program manager in November 2019. The purpose of the interview was to gauge changes in program design and implementation since the last evaluation, and DEC's current expectations for the Weatherization Program, including the program's goals, successes, and challenges over the evaluation period. The interview also covered changes to the program's measure mix, agency participation, and barriers to program participation.

3.1.2 Program Administrator Staff Interview

We conducted one in-depth interview with NCCAA (the program administrator) and its subcontractor TRC. TRC maintains the program-tracking database and serves as the day-to-day contact for agencies, providing them with training and implementation support. This interview explored program-wide coordination, delivery, and enrollment processes. It provided insight into the program's reimbursement process and gauged the administrators' satisfaction with program elements. The interview also helped identify key similarities and differences across implementing agencies and any barriers to agency participation.

3.1.3 Duke Energy Durham Weatherization Pilot Staff Interview

As part of our limited process evaluation of the DEC Weatherization Pilot program in Durham, NC, we conducted one interview with the DEC Weatherization Pilot program manager and community outreach manager. The objective of the interview was to document the program design of the pilot, identify early implementation successes and challenges, and enable comparisons to the Weatherization Program.

3.2 Implementing Agency Staff Interviews

Fifteen agencies, all located in North Carolina, submitted projects to the DEC Weatherization Program during the evaluation period. These agencies each received funding for an average of 136 projects (range: 1 to 746 projects per agency). We conducted semi-structured in-depth interviews with a sample of six of the 15 participating agencies selected to represent varied types of organizations and levels of program participation. We explored changes to the program since the last evaluation, feedback on implementation processes and funding structure, as well as agencies' satisfaction with the program and views about successes and barriers to participation.

We completed these interviews in June and July 2020. Responding agencies completed 82% of the 2016–2018 projects. Table 4 summarizes the sample and outcome.

Table 4. Agency Interview Sample

Participating Agencies	Agencies in Sample	Completed Interviews	Cooperation Rate
15	6	6	100%

3.3 Program Materials Review

Opinion Dynamics reviewed the program's procedures manual and the program-tracking database. We reviewed changes made to the manual in October 2017 and October 2018, relative to the program's original 2015 manual. We found the manual sections relating to program operations, customer eligibility guidelines, and measure installation guidelines to be complete and of high quality.

3.4 Participant Survey

Opinion Dynamics implemented a computer-assisted telephone interviewing (CATI) survey in June and July 2020. The survey gathered data to verify participation in the program; develop measure-level estimates of installation, persistence, and in-service rates (ISRs); and support our process evaluation.

The survey sample design and sample size were based on customers who participated during the evaluation period. Of the 1,706 participants in the database, we drew a random sample of 620 valid telephone numbers. We used this sample to complete 102 participant telephone interviews. The average length of the interviews was approximately 15 minutes; the response rate was 18%.

We calculated the response rate using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR). We chose to use AAPOR Response Rate 3 (RR3), which includes an estimate of eligibility for sample units that we were unable to reach. We present the formulas used to calculate RR3 and the definition of each variable used in the formulas below.

$$RR3 = I / ((I + R + NC + O) + (e * U))$$

$$e = (I + R + NC) / (I + R + NC + E)$$

Table 5. Survey Disposition Category Key

Disposition Code	Disposition Category	Number of Customers
Complete interview	I	102
Eligible incomplete interview	N	7
Survey-ineligible household	X1	1
Not a household	X2	41
Household with undetermined survey eligibility	U1	331
Undetermined if household	U2	138
Estimated proportion of cases of unknown survey eligibility that are eligible	Incidence/e1	99%
Estimated proportion of cases of unknown household eligibility that are eligible	e2	91%

3.5 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine the net energy savings attributable to the DEC Weatherization program during the evaluation period. We used separate linear fixed effects regression (LFER) models to estimate the overall net ex post program savings for Tier I and Tier II participants. The fixed effect in our models is the customer, which allows us to control for all household factors that do not vary over time. The consumption analysis used customers who participated from April 2016 through December 2018 as the treatment group and those who participated from January 2019 through March 2020 as the comparison group.

While we conducted consumption analysis for both Tier I and Tier II participants, this evaluation only relies on consumption analysis results for Tier II participants. For Tier I participants, we used a combination of engineering analysis results and impact results from the prior evaluation to assess program savings. We were not able to use Tier I consumption analysis results because they were not statistically significant.[1]

Section 4.1.1 provides a summary of the consumption analysis approach; Appendix A contains the detailed methodology description.

3.6 Engineering Analysis

The engineering analysis served several purposes: (1) to develop demand-to-energy savings ratios for Tier I and Tier II projects; (2) to develop ex post energy and demand savings for refrigerator replacements; (3) to understand the relative contribution of different measures to Tier I and Tier II savings; and (4) to develop inputs into Tier I energy savings.

The engineering analysis consisted of two components:

- Measure verification and development of measure-specific ISRs, and
- A deemed savings review of all program measures.

We verified measures and developed measure-specific ISRs based on responses to the participant survey. As part of the deemed savings review, we reviewed measure-level savings and revised input assumptions, as needed, to be consistent with standard industry practice and other Duke Energy Carolinas program assumptions and to align with applicable versions of reviewed TRMs (e.g., Illinois, Indiana, Mid-Atlantic). We also integrated data gathered through the participant survey, for example, the share of participating households with electric domestic water heating.

Appendix B provides more detail on the methods and input assumptions used in the deemed savings review and engineering analysis.

[1] Two factors likely contributed to the inability of the model to detect statistically significant savings: (1) the small number of Tier I participants and (2) the small expected savings of Tier I measures, relative to baseline household electricity usage.

4. Gross Impact Evaluation

4.1 Methodology

The gross impact analysis for the 2016–2018 DEC Weatherization Program included a consumption analysis as well as an engineering analysis. The consumption analysis determined the net evaluated energy (kWh) impacts for Tier II. The engineering analysis supplemented the consumption analysis by:

- Providing a ratio of demand savings (kW) to energy savings (kWh), which is then applied to the consumption analysis net energy savings to calculate net evaluated demand savings;
- Developing ex post energy and demand savings for refrigerator replacements;
- Providing insight into the relative contribution of different measures to Tier I and Tier II savings; and
- Developing inputs into Tier I energy savings.

While we conducted consumption analysis for both Tier I and Tier II participants, this evaluation only relies on consumption analysis results for Tier II participants. For Tier I participants, we used a combination of engineering analysis results and impact results from the prior evaluation to assess program savings. We were not able to use Tier I consumption analysis results because they were not statistically significant.

4.1.1 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine the overall evaluated program savings from Tier I and Tier II projects. Consumption analysis is a statistical analysis of energy consumption recorded in utility billing records. Because billing records reflect whole-building energy use, the method is well suited for studying the combined impact of the Weatherization Program's mix of energy-efficiency measures per home. Total program savings from Tier I and Tier II projects are estimated by examining variation among participants' monthly electricity consumption pre- and post-program period, relative to the variation in a comparison group's electricity consumption during those times.

Data Cleaning and Preparation

Prior to specifying the models, we performed thorough cleaning of the consumption and participation data. We checked data for gaps and inconsistencies as well as for sufficiency. Among other checks, we ensured that the participants retained in the analysis had sufficient pre- and post-participation consumption data, participation dates were accurate, and the consumption data was free of outliers, such as bill periods with unreasonably small or unreasonably large consumption.

Comparison Group Selection

Incorporating a comparison group into the consumption analysis allows evaluators to control for changes in economic conditions and other non-program factors that might affect energy use during the study period. Like many other energy efficiency programs, the Weatherization Program was not designed as an experiment. As such, we leveraged a quasi-experimental approach to the evaluation by developing a comparison group of participants. There are multiple approaches to selecting a comparison group, including the use of future participants, past participants, or similar non-participants. When possible, using future program participants as a comparison group is a preferred method. The use of future participants—who are similar to the evaluated

participants—as the comparison group allows to effectively control for self-selection biases. We relied on a comparison group of customers who participated in the Weatherization Program between January 1, 2019 and March 31, 2020.

We performed equivalency checks to assess the similarity of treatment and comparison groups in terms of energy consumption, weather, and housing characteristics in order to validate that the comparison group can serve as a valid baseline. We performed equivalency analysis by tier as well as among Tier II HVAC and weatherization customers separately to ensure balanced consumption among key Tier II subpopulations. Analysis of weather patterns indicates nearly perfect equivalency between the treatment and comparison group customers. Treatment and comparison group participants are also similar across key housing characteristics, such as home vintage, size, and type. As for the consumption data, Tier I treatment participants are a little more likely to have higher heating load than comparison group participants, while Tier II treatment participants are more likely to have a slightly higher cooling load. Both factors are controlled for in the model and are therefore not concerning from a potential bias perspective.

Controlling for Participation in Other Programs

Some customers participated in other Duke Energy programs after participating in the Weatherization Program. Including those customers in the consumption analysis would result in double counting of savings from other programs and artificially inflating the estimate of savings from the Weatherization Program. We dropped those customers from the analysis so that we can get the most accurate estimate of the effects of the Weatherization Program. As part of the analysis, we identified and dropped Weatherization Program participants who cross-participated in the Appliance Recycling Program,[2] the Residential Energy Efficient Products & Services Program, the Smart $avers Residential Program, and the Residential Energy Assessments Program.[3] Overall, we dropped 51% of Tier I and 53% of Tier II participants.

Table 6 below summarizes final participant counts used to develop consumption analysis models.

Table 6. Accounts Included in the Consumption Analysis Model

Program Component	Treatment Group	Comparison Group	Total
Tier I	55	65	120
Tier II	469	469	938
Tier II Weatherization Measures	*438*	*267*	*705*
HVAC Replacement/Upgrade	*40*	*228*	*268*

[2] The Appliance Recycling Program was discontinued at the end of 2015 but residual participation continued through June 2016.

[3] Notably, we only dropped cross-participants who participated in other programs during the 12-month post-period. We retained participants who participated more than a year after participating in the Weatherization Program.

Modeling

We used a Linear Fixed Effects Regression (LFER) model for this analysis. Each tier was analyzed in a separate regression model because the tiers are expected to provide different levels of per-home savings due to differing measures, features, and customer eligibility criteria.[4]

LFER models for each tier included a series of explanatory variables designed to improve our estimate of savings relative to the baseline (i.e., what participants' consumption might have been during the post-program period, had they not received program services). The relationship of interest is between the dependent variable (monthly energy use) and a "dummy" variable that indicates whether an individual participated in the Weatherization Program. Based upon Duke Energy's requests to isolate savings from refrigerator replacements separately from the package of measures provided for each tier, we included an indicator variable to capture the effect of a refrigerator replacement in addition to the tier-related measures, which removes the effect of the refrigerator from the effects of the rest of the measures installed. In addition to excluding savings from the refrigerator measure, Duke Energy was interested in understanding savings from the new HVAC replacement/upgrade measure within the Tier II program component. To accommodate that request, we estimated a Tier II model that included an indicator variable for HVAC replacement/upgrade so that we could separate the impact of this measure from the impact of other Tier II measures.

Consumption analyses typically include a series of additional variables to explain non-program variation in monthly energy use pre- and post-participation. Following best practice, we used a fixed-effects model, which captures the effect of household-specific characteristics that do not vary over time (as customer-specific intercepts).[5] We also included weather (heating degree days and cooling degree days) in the model. Additionally, we included monthly dummies to further control for seasonal differences in energy consumption overall. After controlling for all of these outside influences, the final model results for the DEC Weatherization Program reflect savings associated with installed measures and any behavioral changes from energy efficiency knowledge gained during their participation process.

Appendix A contains a detailed discussion of the consumption analysis methodology, including data cleaning steps, the equivalency assessment for the comparison group (including cross-participation), and the final model specification and outputs.

4.1.2 Engineering Analysis

As part of the impact evaluation, Opinion Dynamics conducted an engineering analysis for each Weatherization Program measure installed during the evaluation period. The engineering analysis consisted of two distinct steps: (1) measure verification and development of measure specific ISRs; and (2) a deemed savings review of all program measures. Both are described below.

[4] Note that participants who only received a refrigerator replacement were excluded from the consumption analysis.

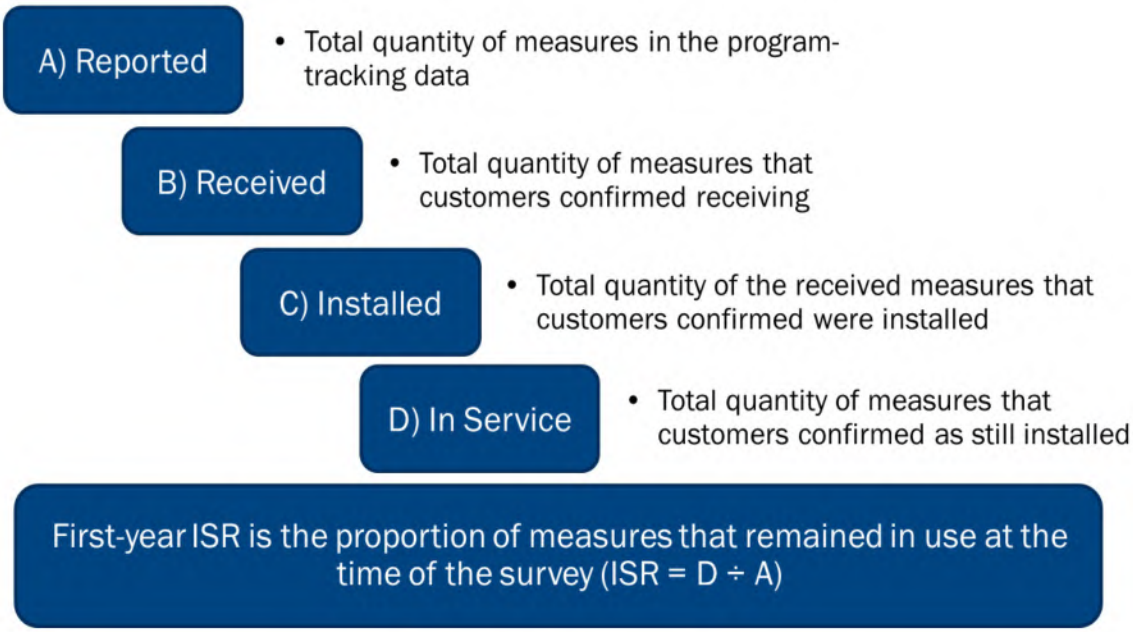
[5] This includes factors such as building square footage, appliance stock, habitual behaviors and preferences, household size, and others.

Measure Verification

The participant survey included questions designed to verify that participants received and installed program measures and that those measures remained in place and operational. The measure-level ISRs represent the share of measures in the program tracking data that was still in service at the time of the survey, based on 102 completed telephone interviews. Our engineering analysis applied the ISRs to ex post deemed savings to develop total engineering savings.

Figure 2 outlines the method for deriving the ISR for each measure. During the survey, we asked participants to confirm that they received the quantity of measures recorded in Duke Energy's program tracking data and, when necessary, to provide the correct quantity. We also asked participants to confirm the quantity of measures that were installed and remained in service at the time of the survey.

Figure 2. In-Service Rate Components



Based on the survey responses, we calculated the verification, installation, and persistence rates, as well as the resulting ISR–using the equations shown below–for each participant and each measure they received. We then developed averages of all four rates for each measure group.

1) $Verification\ Rate = \frac{(B)Received\ Quantity}{(A)Reported\ Quantity}$

2) $Installation\ Rate = \frac{(C)Installed\ Quantity}{(B)Received\ Quantity}$

3) $Persistence\ Rate = \frac{(D)In\ Service\ Quantity}{(C)Installed\ Quantity}$

4) $First\ Year\ InService\ Rate = \frac{(D)In\ Service\ Measures}{(A)Reported\ Measures}$

In previous evaluations of the DEC Weatherization Program and other DEC direct-install programs, Opinion Dynamics found that participants had difficulty verifying certain measures, and that the nature of certain

measures made verification of installation and persistence unnecessary. As such, we made the following assumptions:

- **Water heater tank wrap, pipe wrap, and duct sealing/insulation:** For these measures, we assumed 100% for all four rates as participants are often not aware of the installation of these measures, but once installed, they are unlikely to be removed.
- **Door weather-stripping, refrigerator replacement, heating system upgrade, air sealing, and insulation:** We asked participants to verify receipt of these measures but assumed that agency staff installed 100% of the verified items. We also assume that 100% of installed air sealing and insulation remained installed as they are difficult to remove.

Ex Post Deemed Savings

We used several resources and assumptions to conduct our deemed savings review, including previous DEC low income program evaluations, relevant TRMs (specifically IL, IN, and Mid-Atlantic) and other secondary sources (such as ASHRAE Fundamentals and the US EPA air source heat pump calculator) to examine algorithms and assumptions. Where possible, we used DEC-specific assumptions to estimate measure-specific deemed savings including participant survey data, program-tracking data, and supplemental refrigerator test data. For more information on the algorithms and inputs that our engineering team used to develop deemed savings estimates for each measure, see Appendix B.

Total Program Gross Savings

We developed total program gross savings, by tier, by applying the measure-specific ISRs to the ex post deemed values. We then multiplied the adjusted deemed savings by the measure quantity provided in the program tracking database to arrive at total program savings. Where savings for certain measures rely on electric heating equipment or the presence of cooling equipment, our engineering team developed fuel-specific deemed values and applied them based on the HVAC equipment specified within the program tracking database. Since the database does not provide water heating fuel type, however, we developed weighted savings for water conservation measures based on participant survey responses, which indicated that 78% of participating homes have electric water heating.

We then estimated per household savings for each tier by dividing total tier savings by the number of households participating in that tier.

4.1.3 Tier I Savings

Because the consumption analysis did not generate statistically significant results for Tier I participants, we developed per household Tier I savings using a combination of engineering analysis results and results from the prior evaluation. Specifically, the analysis consisted of the following steps:

- **Step 1:** Develop a ratio of per household Tier I savings based on (1) engineering estimates from this evaluation and (2) normalized engineering estimates from the prior evaluation; and
- **Step 2:** Apply the Tier I savings ratio from Step 1 to Tier I consumption analysis results from the prior evaluation.

The goal of this analysis was to develop a measure of Tier I activity during this evaluation period relative to Tier I activity during the last evaluation period that can then be applied to Tier I consumption analysis results from the prior evaluation.[6] The following subsections provide more detail on the two steps.

Ratio of Tier I Engineering-based Savings

We developed the Tier I savings ratio using the following equation:

$$\begin{aligned} \textit{Tier I Savings Ratio} &= \textit{Per HH Tier I Savings}_{2016\text{-}18} \,/\, \textit{Normalized per HH Tier I Savings}_{2015\text{-}16} \\ &= 1{,}014 \text{ kWh} \,/\, 1{,}103 \text{ kWh} \\ &= 0.92 \end{aligned}$$

The numerator in this equation (1,014 kWh) is the per household Tier I savings as estimated in the engineering analysis for this evaluation (see Section 4.1.2).

The denominator (1,103 kWh) is estimated by multiplying, for each Tier I measure, the 2015–16 ISR-adjusted quantity by the 2016–18 average Tier I savings value. We "normalized" the 2015–16 Tier I engineering analysis results with deemed savings values from this evaluation to isolate changes in program activity (i.e., changes in the measure mix and the average quantity of measures received by each Tier I participant) between the two evaluation periods. This normalization step was important because updates to deemed savings assumptions resulted in changes to deemed savings values between the two evaluations, in particular for air sealing, the dominant Tier I measure. These changes were made, in part, to develop more consistent assumptions between various Duke program evaluations (as requested by regulatory staff) and are not necessarily reflective of changes in the operation or outcomes of the Weatherization Program.

Final Tier I Savings

We estimated the final per household Tier I savings for the 2016–18 evaluation period as follows:

$$\begin{aligned} \textit{Final Per HH 2016–18 Tier I Savings} &= \textit{Tier I Savings Ratio} * \textit{2015–16 Tier I Savings}_{\textit{Consumption Analysis}} \\ &= 0.92 * 262 \text{ kWh} \\ &= 241 \text{ kWh} \end{aligned}$$

The final Tier I per household savings thus leverage the Tier I consumption analysis results from the prior evaluation (262 kWh) but adjust those results by the change in Tier I activity (on a per household basis) between the two evaluation periods (92%).

[6] We selected this approach since the previous evaluation of this program found that engineering analysis results alone do not provide a good proxy for the consumption analysis. However, engineering analysis results from this evaluation, relative to those from the prior evaluation, provide a good indication of changes in program activity that can be used to adjust the consumption analysis results from the prior evaluation.

4.2 Results

4.2.1 Consumption Analysis

This section provides per-participant consumption analysis results. Appendix A contains the complete results of the models. Table 7 summarizes the results of the consumption analysis models for Tier I and Tier II. The variable "Post" represents the main effect of the treatment, i.e., the change in average daily consumption (ADC) attributable to participation in the DEC Weatherization Program, controlling for whether or not the participant had also received a refrigerator replacement and/or an HVAC replacement/upgrade (applicable to Tier II only). Local weather (expressed as Cooling Degree Days, CDD, and Heating Degree Days, HDD) also significantly impacted consumption.[7]

As can be seen in the table, the participation coefficient for Tier I is not statistically significant, indicating that the model did not establish a statistically significant relationship between participation in the program and energy consumption. For Tier II, all program-related coefficients are statistically significant and negative, indicating a negative relationship between participation and energy consumption, i.e., the presence of savings.

Table 7. Results of Tier I and Tier II Consumption Analysis Models

Variable	Tier 1 Coefficients	Tier 2 Coefficients
Post (Participation Date)	1.071	-5.685***
Refrigerator Replacement Indicator	1.592	-7.262***
HVAC Improvements	--	-4.682**
CDD (Cooling Degree Days)	0.024	0.031***
HDD (Heating Degree Days)	0.008**	0.017***
Constant (Average Intercept)	16.784***	31.924***
Observations (Number of customer bills)	4,816	38,325
Adjusted R-squared	0.527	0.677

* p<0.1, ** p<0.05, *** p<0.01.

Table 8 shows the estimated annual per-home savings for the program. As noted above, the results in the Tier I and Tier II rows reflect the effect of the Weatherization Program alone (any changes in energy use due to other programs are not included) and exclude impacts of the program refrigerator installations. For Tier II, the table isolates estimated savings for Tier II weatherization measures and HVAC replacement/upgrades, respectively.[8] It should be noted that the estimates of percent savings per home are based on the *modeled*

[7] The coefficients for the monthly dummies are presented in Appendix A.

[8] The category "Tier II weatherization measures" includes all Tier II measures other than HVAC Replacement/Upgrade, i.e., it includes measures such as lighting and water heating measures.

baseline usage, including the pre-period usage of both treatment and control group participants, controlling for weather. As such, Table 8 presents a single baseline usage estimate for overall Tier II savings as well as savings for Tier II weatherization measures and the HVAC replacement/upgrade measure.

The savings estimate for Tier I participants is not statistically significant at 90% confidence, indicating that the model could not detect a savings signal. The small sample size relative to the variability in the consumption data as well as the nature and depth of Tier I improvements (smaller expected savings) are likely the key drivers of the model performance. Savings for Tier II participants, on the other hand, are large and statistically significant. Tier II participants saved an average of 2,042 kWh per year, which represents 11.3% of their baseline usage. Savings from Tier II weatherization measures are 2,075 kWh per year, while savings from HVAC replacements/upgrades are 1,709 kWh per year.

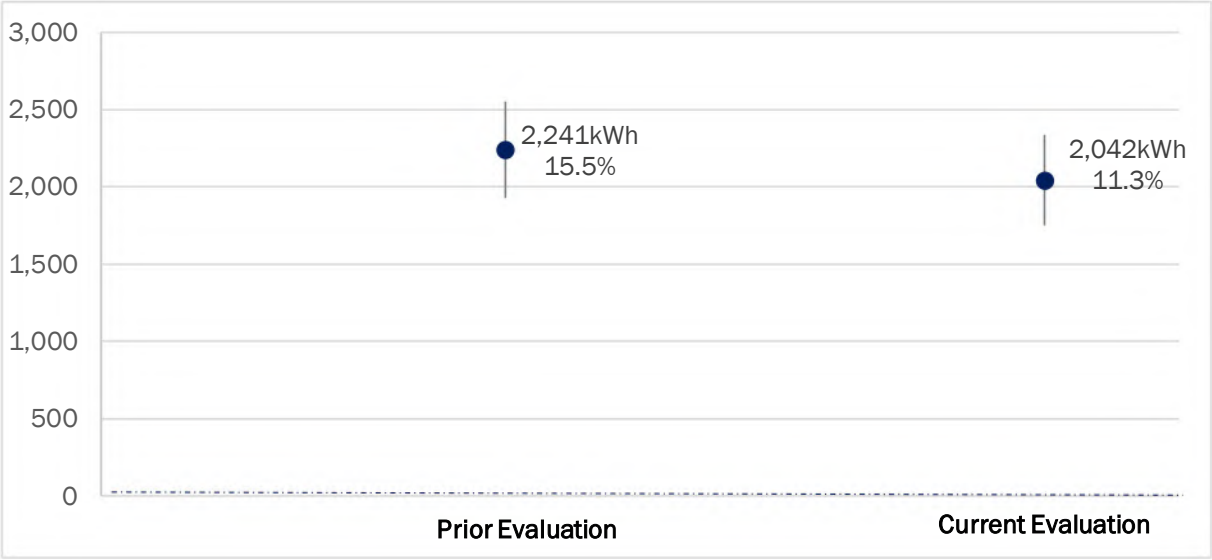
Table 8. Annual Per-Participant Energy Savings from Consumption Analysis

Program Component	Modeled Treatment Participants	Per-Participant Baseline Energy Use (kWh/yr)	Ex Post Annual Savings per Participant (kWh)	Average Annual Savings per Participant (% of Baseline Use)	
			kWh Savings	90% Confidence Interval	
Tier I	55	10,198	-391[a]	-1,107 to 325	-3.8%
Tier II	469	18,087	2,042	1,750 to 2,334	11.3%
Tier II Weatherization Measures	*438*	*18,087*	*2,075*	*1,767 to 2,383*	*11.5%*
HVAC Replacement/Upgrade	*40*	*18,087*	*1,709*	*472 to 2,945*	*9.5%*

[a] Savings for Tier I participants are not statistically significant at 90% confidence.

Compared to the prior evaluation, our Tier II results represent a small, but statistically not significant reduction in annual per household savings. Figure 3 compares the Tier II results from the two evaluations. As can be seen in the figure, the error bounds around the two savings estimates overlap, indicating that the difference between the two estimates is not statistically significant.

Figure 3. Comparison of Tier II Savings to Prior Evaluation



4.2.2 Engineering Analysis

This section provides the results of the engineering analysis, including ISRs and ex post deemed energy and demand savings estimates for each measure offered by the Weatherization Program. In addition, this section summarizes total program and per household savings estimates for the 2016–2018 evaluation period, by project type; provides insight into the contribution of various measures to Tier I and Tier I savings; and presents the Tier I and Tier II demand-to-energy ratios (used to develop Tier I and Tier II demand savings).

Measure Verification Results

Our measure verification analysis showed high ISRs for all measures, as shown in Table 9. DEC Weatherization participants reported that 100% of LEDs, 93% of door weather-stripping, and 85% of efficient showerheads remained in service at the time of the survey. Additionally, while 22% of participants did not recall receiving faucet aerators, 96% of those that did recall having them installed reported that they were still installed at the time of the survey.

Table 9. First Year Measure In-Service Rates

Measure Category	Verification Rate	Installation Rate	Persistence Rate	ISR[a]
LEDs	100%	100%	100%	100%
Faucet Aerators	78%	100%	96%	74%
Showerheads	94%	100%	90%	85%
Door Weather-stripping	99%	Not Asked	91%	93%
Air Sealing	96%	Not Asked	Not Asked	96%
Insulation	98%	Not Asked	Not Asked	98%
Refrigerator	95%	Not Asked	100%	95%
Heating System	100%	Not Asked	100%	100%
Pipe Insulation*				100%
Water Heater Insulation Wrap*				100%
Duct Sealing/Insulation*				100%
CFLs**				84%
Water Heater Temp Adjustment**				100%
Heating System Tune-Up**				90%

[a] Note that each rate is developed as the average of respondent-level rates. As such, the ISR may not equal the product of the three other rates.

* Not verified through the participant survey and assumed 100% ISR

** ISR based on 2015 DEC Weatherization participant survey

Ex Post Deemed Savings Results

Table 10 provides the estimated gross per-unit energy and demand savings for all measures installed through the DEC Weatherization Program. As described in Section 4.1.2, we based the measure-level savings on secondary research and applied Weatherization Program-specific assumptions on household characteristics, where applicable.

Table 10. Ex-Post Per-Unit Deemed Savings Estimates

Measure	Tier	Per-Unit Energy Savings (kWh)	Per-Unit Summer peak demand (kW)	Per-Unit Winter peak demand (kW)
Water Heating				
DWH Pipe Insulation (10' sections)	Tier I	142	0.016	0.016
DWH Tank Insulation	Tier I	82	0.009	0.009
Water Heater Temp Adjustment	Tier I	59	0.007	0.007
Low-Flow Showerhead	Tier I	118	0.009	0.017
Low-Flow Aerator	Tier I	74	0.005	0.010
Lighting				
13W CFL	Tier I	16	0.002	0.001
18W CFL	Tier I	35	0.005	0.003
5W Generic LED	Tier I	20	0.003	0.001
5W Specialty LED	Tier I	20	0.003	0.001
9W LED	Tier I	34	0.005	0.002
Air Sealing and Weather Stripping				
Air Sealing (per home)*	Tier I	896	0.310	0.150
Door Weather Stripping (per door)*	Tier I	28	0.010	0.005
Insulation				
Attic Insulation - Cellulose, Blown - R-30*	Tier II	1.0	0.0001	0.0004
Attic Insulation - Cellulose, Blown - R-38*	Tier II	1.1	0.0001	0.0004
Attic Insulation - Fiberglass, Blown - R-30*	Tier II	1.0	0.0001	0.0004
Attic Insulation - Fiberglass, Blown - R-38*	Tier II	1.1	0.0001	0.0004
Belly Fiberglass Loose*	Tier II	0.9	0.0001	0.0003
Floor Insulation - Fiberglass, Batts - R-19*	Tier II	0.9	0.0001	0.0004
Wall Insulation - Fiberglass, Blown - R-13*	Tier II	0.8	0.0001	0.0003
Wall Insulation - Cellulose, Blown - R-13*	Tier II	0.8	0.0001	0.0003
Knee Wall Insulation*	Tier II	0.9	0.0001	0.0004
Manufactured Home Roof Cavity*	Tier II	0.9	0.0001	0.0004
Heating System				
Heating System Tune-up (per system)	Tier I	488	0.023	0.088
Duct Insulation (per system)*	Tier II	261	0.042	0.095
Duct Sealing (per system)*	Tier II	1,316	0.210	0.479
HVAC Upgrade/Replacement				
Heat Pump Upgrade (per heat pump)	Tier II	834	0.096	0.313
Heat Pump Replacement (per heat pump)	Tier II	1,438	0.168	0.541
Refrigerator				
ENERGY STAR® Refrigerator (15 cu. ft.)	Tier I	936	0.107	0.107
ENERGY STAR® Refrigerator (18 cu. ft.)	Tier I	692	0.079	0.079
ENERGY STAR® Refrigerator (21 cu. ft.)	Tier I	835	0.095	0.095

* Weighted based on mix of 2016–18 participants with different heating fuel and cooling equipment.

Total Program and Per-Household Savings

We calculated total program savings for the evaluation period by applying the ISRs shown in Table 9 to the per-unit estimates shown in Table 10. We then multiplied these ISR-adjusted per-unit estimates by the respective measure quantities in the program tracking database.

Table 11 summarizes total gross program energy and demand savings, by measure, for the 2016–2018 evaluation period. It also shows average measure quantity per participating household.

Table 11. Engineering Analysis Total Gross Savings by Measure

Measure	Unit	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Average Qty per Household
Water Heating					
DWH Pipe Insulation	Water heaters	92,443	10.55	10.55	0.4
DWH Tank Insulation	Water heaters	45,237	5.16	5.16	0.3
Water Heater Temp Adjustment	Water heaters	3,557	0.41	0.41	< 0.1
Low-Flow Showerhead	Showerheads	54,085	3.93	7.85	0.3
Low-Flow Aerator	Aerators	46,290	3.15	6.30	0.5
Lighting					
13W CFL	Lamps	21,352	3.16	1.53	0.8
18W CFL	Lamps	23,842	3.53	1.71	0.4
5W Generic LED	Lamps	669	0.10	0.05	< 0.1
5W Specialty LED	Lamps	669	0.10	0.05	< 0.1
9W LED	Lamps	24,529	3.63	1.76	0.4
Air Sealing and Weather Stripping					
Air Sealing	Households	1,160,999	378.85	218.77	0.72
Door Weather Stripping	Households	44,890	14.46	8.66	0.88
Insulation					
Attic Insulation - Cellulose, Blown - R-30	Sq. Feet	49,514	6.88	19.07	28
Attic Insulation - Cellulose, Blown - R-38	Sq. Feet	85,168	11.83	32.80	46
Attic Insulation - Fiberglass, Blown - R-30	Sq. Feet	357,907	49.71	137.84	202
Attic Insulation - Fiberglass, Blown - R-38	Sq. Feet	377,195	52.39	145.27	204
Belly Fiberglass Loose	Sq. Feet	172,431	23.95	66.41	110
Floor Insulation - Fiberglass, Batts - R-19	Sq. Feet	359,150	49.88	138.32	229
Wall Insulation - Fiberglass, Blown - R-13	Sq. Feet	19,646	2.73	7.57	10
Wall Insulation - Cellulose, Blown - R-13	Sq. Feet	13,602	1.89	5.24	15
Knee Wall Insulation	Sq. Feet	7,657	1.06	2.95	5
Manufactured Home Roof Cavity	Sq. Feet	79,721	11.07	30.70	51
Heating System					
Heating System Tune-up	Households	161,797	6.03	30.28	0.2
Duct Insulation	Households	3,682	0.50	1.43	< 0.1
Duct Sealing	Households	1,265,635	176.00	487.21	0.5

Measure	Unit	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Average Qty per Household
HVAC Upgrade/Replacement					
Heat Pump Upgrade	Households	158,449	18.30	59.54	0.1
Heat Pump Replacement	Households	185,559	21.66	69.73	0.1
Refrigerator					
ENERGY STAR Refrigerator (15 cu. ft.)	Refrigerators	68,827	7.85	7.85	< 0.1
ENERGY STAR Refrigerator (18 cu. ft.)	Refrigerators	112,883	12.88	12.88	0.1
ENERGY STAR Refrigerator (21 cu. ft.)	Refrigerators	124,387	14.19	14.19	0.1

Table 12 summarizes total and per household gross program energy and demand savings, by project type.

Table 12. Engineering Analysis Gross Program Savings

Project Type	Unique Participating Households	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Total Program Savings				
Tier I	176	178,487	53.6	30.8
Tier II	1,387	4,662,487	809.0	1,469.8
Tier II Weatherization Measures	*1,146*	*4,318,480*	*769.1*	*1,340.6*
HVAC Replacement/Upgrade	*318*	*344,008*	*40.0*	*129.3*
Refrigerator Replacement	404	306,097	34.9	34.9
Total	1,706	5,147,071	897.6	1,535.6
Average Savings per Household				
Tier I	176	1,014	0.305	0.175
Tier II	1,387	3,362	0.583	1.060
Tier II Weatherization Measures	*1,146*	*3,768*	*0.671*	*1.170*
HVAC Replacement/Upgrade	*318*	*1,082*	*0.126*	*0.406*
Refrigerator Replacement	404	758	0.086	0.086

Measure Mix and Contribution to Tier I and Tier II Savings

Based on program-tracking data, almost all Tier I and Tier II participants (96% and 97%, respectively) received air sealing. The vast majority (91%) of Tier II participants also received insulation, and 74% received duct system sealing or insulation—measures not offered to Tier I participants. Larger shares of Tier II participants than Tier I participants received water heating measures, weather-stripping, lighting, and heating system tune-ups. Overall, 24% of participants received a new refrigerator and 19% an HVAC replacement or upgrade. Notably, 8% of participants only received a new refrigerator and 14% only received an HVAC replacement/upgrade.

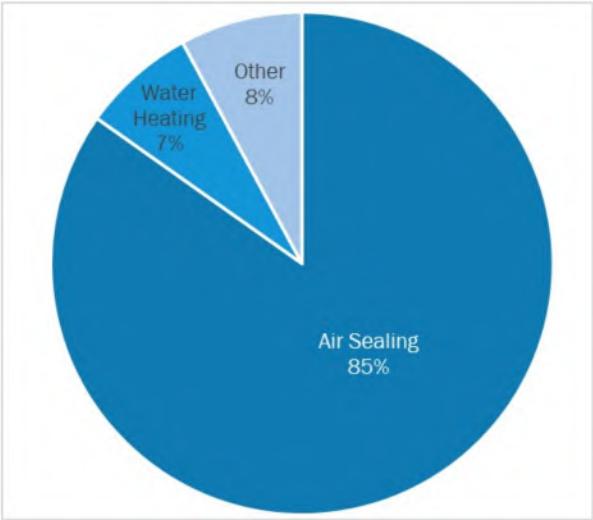
Table 13. Measure Mix

Measure Category	% of Participating Households Receiving Measure Category [a]		
	All Participants (N=1,706)	Tier I Participants (N=176)	Tier II Participants (N=1,146)
Air Sealing	75%	96%	97%
Insulation	61%	n/a	91%
Duct System	50%	n/a	74%
Water Heating	50%	31%	70%
Weather-stripping	43%	35%	59%
Lighting	26%	26%	35%
Heating System Tune-Up	19%	6%	27%
Refrigerator Replacement	24%	19%	17%
HVAC Replacement/Upgrade	19%	1%	7%

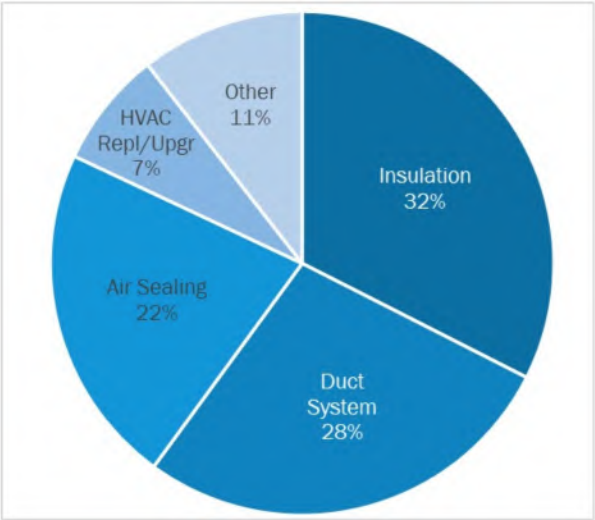
[a] Values are based on program-tracking data and do not incorporate ISRs.

Based on ex post gross engineering analysis results, Tier I savings during the evaluation period came primarily from air sealing (85%). Another 7% came from water heating measures and 8% came from other Tier I measures (including heating system tune-ups, 3%; lighting measures, 3%; and weather-stripping, 2%). Tier II savings, on the other hand, were dominated by insulation (32%), duct system sealing and insulation (28%), and air sealing (22%). HVAC replacements/upgrades accounted for 7% of engineering-based Tier II savings during the evaluation period, while other Tier II measures (including water heating measures, 5%; heating system tune-ups, 3%; and lighting and weather-stripping, 1% each) contributed 11% (see Figure 4).

Figure 4. Measure Contribution to Total Tier I and Tier II Energy Savings



Tier I kWh Savings



Tier II kWh Savings

Demand-to-Energy Ratios

Using the estimated savings from Table 12, we calculated overall kW-per-kWh savings ratios, by Tier (see Table 14). We used these ratios to estimate per household net demand savings for Tier I and Tier II.

Table 14. Engineering Demand-to-Energy Ratios

Project Type	Total Gross Energy Savings (kWh)	Summer Coincident Peak Savings (kW)	Winter Coincident Peak Savings (kW)	Summer Ratio Multiplier (summer demand/energy savings)	Winter Ratio Multiplier (winter demand/energy savings)
Tier I	178,487	53.62	30.80	0.0003004	0.0001726
Tier II	4,662,487	809.04	1,469.84	0.0001735	0.0003152

4.2.3 Tier I Savings

A comparison of installed units (inclusive of evaluation-specific ISRs) between the two evaluation periods shows that participants during the 2016–2018 evaluation period were more likely to complete air sealing and received more weather stripping than participants during the 2015–16 evaluation period but installed fewer efficient lamps (CFLs or LEDs). In addition, the average Tier I home during the 2016–18 evaluation period was less likely to receive a heating system tune-up or implement any of the five water heating measures offered by the program.

Applying 2016–2018 per unit savings for Tier I participants to installed units results in annual per household Tier I savings of 1,014 kWh during the current evaluation period, compared with 1,103 kWh for the prior evaluation period. The resulting Tier I Savings Ratio is 0.92 (1,014 kWh / 1,103 kWh), meaning that based on the measure mix and installed measure quantities, per household Tier I savings for the 2016–18 evaluation period could be expected to be 92% of Tier I savings for the 2015-16 evaluation period.

Table 15 summarizes the comparison between Tier I participants in the two evaluation periods.

Table 15. Tier I Savings Comparison with Participants from Prior Evaluation

Measure	Savings Unit	Installed Units / Participant [a]		2016-18 per Unit kWh Savings [b]	Per Participant kWh Savings	
		2015-16	2016-18		2015-16	2016-18
Air Sealing and Weather Stripping						
Air Sealing	Home	0.90	0.92	926.6	831	852
Door Weather Stripping	Door	0.56	0.62	30.2	17	19
Lighting						
CFL 13W	Lamp	2.20	0.41	16.2	36	7
CFL 18W	Lamp	0.64	0.29	35.5	23	10
LED 5W Generic	Lamp	-	0.03	20.3	-	1
LED 5W Specialty	Lamp	-	0.08	20.3	-	2
LED 9W	Lamp	-	0.36	34.5	-	12
Heating System						
Heating System Tune Up	System	0.11	0.05	603.9	65	31

Measure	Savings Unit	Installed Units / Participant [a]		2016-18 per Unit kWh Savings [b]	Per Participant kWh Savings	
		2015-16	2016-18		2015-16	2016-18
Water Heating						
DWH Pipe Insulation	10' Section	0.28	0.19	141.8	40	27
DWH Tank Insulation	System	0.26	0.21	82.1	21	17
Water Heater Temp Adjustment	System	0.10	0.02	59.3	6	1
Low Flow Showerheads	Showerhead	0.23	0.14	118.1	27	17
Low Flow Aerators	Aerator	0.50	0.24	74.4	37	18
Total Tier I Savings					1,103	1,014

[a] Inclusive of evaluation-specific ISRs

[b] Savings represent averages for Tier I participants only and are exclusive of ISRs.

Applying the Tier I Savings Ratio of 0.92 to the Tier I consumption analysis result from the prior evaluation (262 kWh per household) results in estimated per household Tier I savings of 241 kWh for the 2016–18 evaluation period:

*Final Per Household Tier I Savings = 0.92 * 262 kWh = 241 kWh*

4.3 References

The following sources were used in the engineering analysis:

- ASHRAE Fundamentals. Appendix: Design Conditions for Selected Locations. Chapter 14
- ENERGY STAR® Air Source Heat Pump Calculator
- Illinois Technical Reference Manual. Version 6.0. February 11, 2016
- Indiana Technical Reference Manual. Version 2.2. July 28, 2015
- Michigan Evaluation Working Group Showerhead and Faucet Aerator Meter Study Memorandum. June 2013
- Mid-Atlantic Technical Reference Manual. Version 9.0. October 2019
- Baseline refrigerator energy consumption based on test measurement data provided by Duke Energy for 142 refrigerators
- 2016–2018 DEC LI Weatherization program tracking database
- 2016–2018 DEC LI Weatherization participant survey conducted by Opinion Dynamics in 2020
- Opinion Dynamics Corporation. Duke Energy Carolinas – 2015 Low Income Weatherization Program Evaluation Report. June 13, 2018.

5. Process Evaluation—Weatherization Program

5.1 Researchable Questions

Based on discussions with Duke Energy program and evaluation, measurement, and verification (EM&V) staff, the evaluation team developed the following process-related research questions:

- Have there been any major process changes since the last evaluation, and what effects have they had on CAA participation levels, measure mix, and per-household savings?
- What are the major strengths of the program? Are there specific ways that the program could be improved to be more effective in the future?
- Are participating agencies satisfied with the program? What are their barriers to program participation (i.e., are there limiting factors to achieving greater participation)?
- What policy barriers to agency participation still exist in the South Carolina portion of DEC's service area? What, if any, program process improvements can DEC make to enhance its impact in that state?
- Are participants satisfied with the program and measures received? What types of non-energy benefits have they received since participating?

5.2 Methodology

Our process evaluation relied on (1) interviews with program staff, the program coordinators (NCCAA and TRC), and six participating agencies; (2) review of program materials and program-tracking data; and (3) analysis of the participant survey.

The full survey instrument can be found in Appendix C.

5.3 Key Findings

5.3.1 Program Participation

The 2016–2018 program comprised the second, third, and fourth years of the DEC Weatherization Program. Between April 1, 2016 and December 31, 2018, 15 participating agencies in North Carolina served 1,706 households. The majority of participating households (81%) completed a Tier II project; 10% completed a Tier I project; and 24% received a new refrigerator (either in combination with a Tier I or Tier II project, or as a stand-alone measure).

Of the 15 participating agencies, eleven were already active during the prior evaluation period and four were new to the program. The 15 agencies submitted between 1 and 746 weatherization projects, with an average of 136 (Table 16.

Table 16. 2016-2018 CAA Projects by Tier

Agency	Tier I	Tier II	Refrigerator Replacement	Total
Blue Ridge Community Action Inc.	102	497	147	746
Blue Ridge Opportunity Commission	9	39	3	51
Cabarrus County Planning & Development Services	7	27	9	43
Central Piedmont Community Action Inc.*	0	2	0	2
Charlotte Area Fund Inc.*	0	0	18	18
Community Action Opportunities	12	159	25	196
Four Square Community Action Inc.	5	17	24	46
I CARE Inc.	1	13	1	15
Macon County Government	3	40	0	43
Mountain Projects Inc.	1	28	4	33
Piedmont Triad Regional Council	4	451	118	573
Rebuilding Together of the Triangle*	0	1	0	1
Resources for Seniors	14	39	16	69
Salisbury-Rowan Community Action Inc.*	1	8	1	10
Yadkin Valley Economic Development District Inc.	17	145	38	200

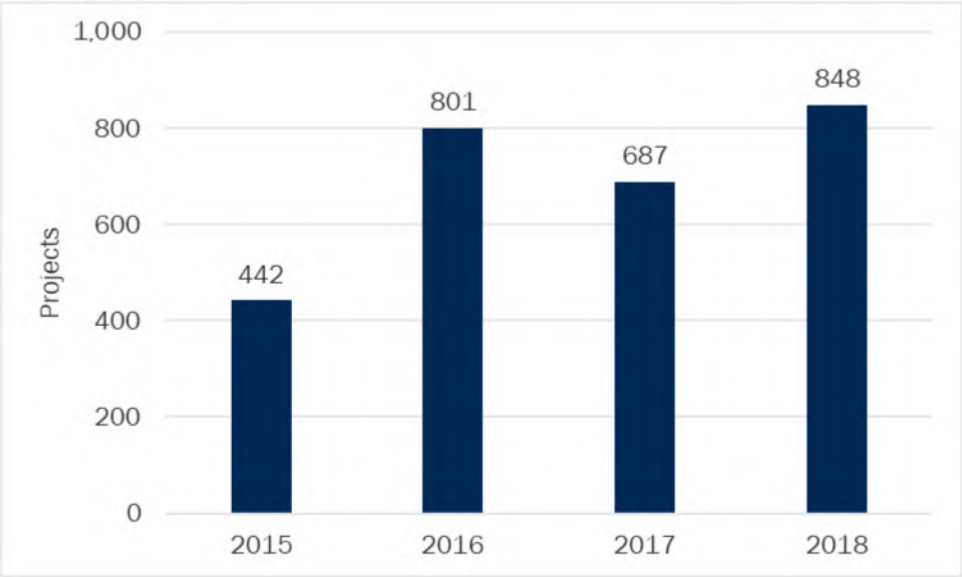
*Denotes agencies new to the DEC Weatherization program in the 2016–2018 evaluation period, based on a review of participating agencies in the 2015–2016 evaluation period.

During the evaluation period, the program provided incentives for over 2,000 projects at 1,706 homes, all in North Carolina.[9] On an annual basis, 2018 represented the largest number of projects (848) since program initiation in 2015 while 2017 saw a dip in project completion (687) compared to 2016 (801).

Figure 5 shows the total number of projects completed each year, from 2015 through 2018. It should be noted that 2016 includes 290 projects from the prior evaluation period (which included January through March 2016).

[9] Projects are defined by project numbers found in the tracking database, which denotes HVAC and refrigerator replacements as separate projects when a participant also receives Tier I or Tier II measures.

Figure 5. DEC Weatherization Projects Per Year 2015-2018

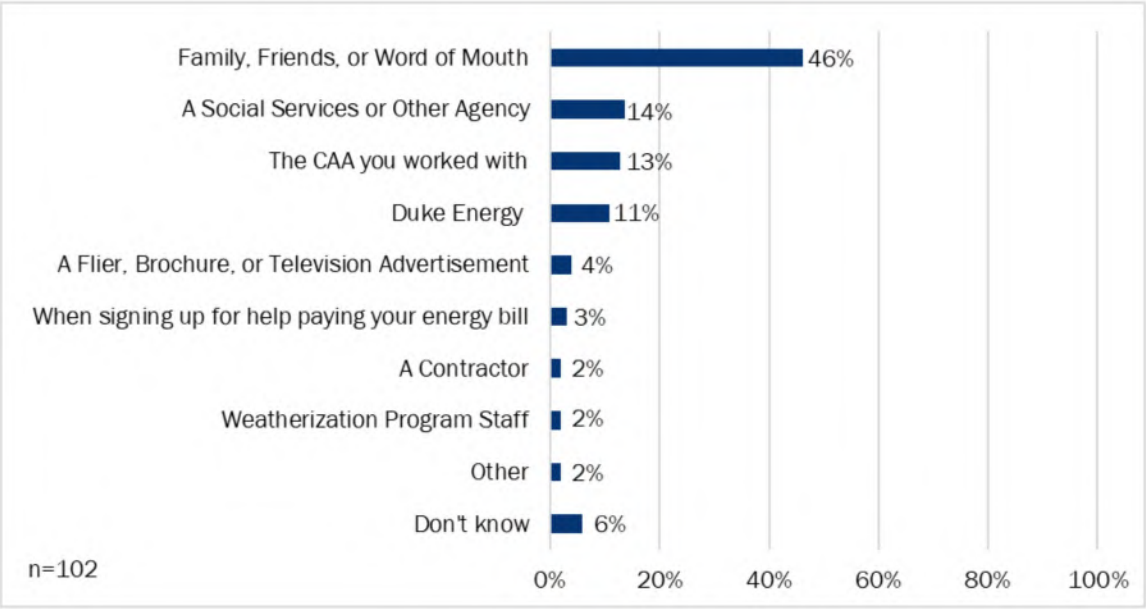


5.3.2 Program Outreach and Motivators of Participation

Agencies complete their own marketing and outreach to generate a local pipeline of State and DOE weatherization projects; Duke Energy does not conduct any additional marketing. Interviewed agencies (n=6) most often reported marketing the program through newspaper ads, fliers, in-person marketing (events and door-to-door canvassing), partnerships with other organizations, and their own websites (4/6). Only half of interviewed agencies market the program on social media and even fewer use mail (2/6) or television ads (1/6).

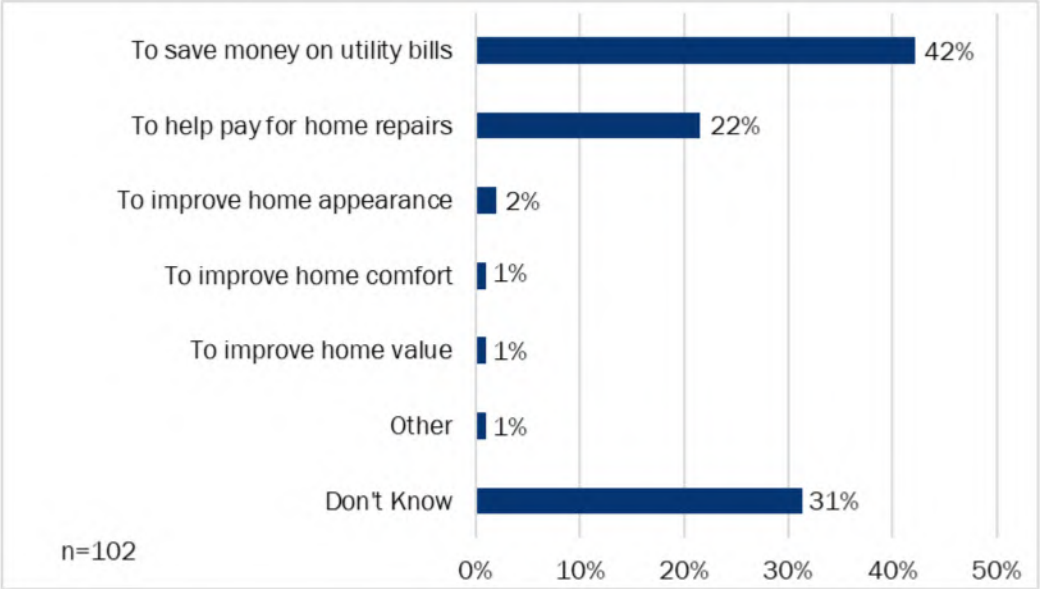
According to responses to the participant survey, nearly half (47%) of participants learned about the Weatherization Program through word of mouth; smaller shares of participants learned about the program through social services or another agency (14%), their CAA (13%), or directly from Duke Energy (11%) (see Figure 6).

Figure 6. How Participants First Heard About the DEC Weatherization Program (Multiple Response)



The main driver of customer participation is to save money on utility bills (42%) or to help pay for home repairs (22%) (see Figure 7). Interestingly, making the home more comfortable is not a main motivator for participation, even though it is a main non-energy benefit identified by participants (see Section 5.3.4).

Figure 7. Participants' Main Motivation in Signing Up for Weatherization



5.3.3 Participating Agencies' Program Experience

In general, agency staff expressed great appreciation for the DEC Weatherization Program and emphasized the high level of need for weatherization services among their clients. DEC Weatherization projects represent a large portion of weatherization jobs completed by the agencies and half of interviewed agencies utilized the new participation channel in which they can submit projects for reimbursement that were not originally DOE or State WAP projects. Most interviewed agencies provide additional services for their clients outside of weatherization, but all reported their clients have difficulty paying high energy bills. Agencies did not significantly change how they implement or participate in the program since the last evaluation, and policy barriers in South Carolina continued to prevent program participation in the state.

Agency Participation Summary

All but one agency we interviewed (5/6) had been involved with the DEC Weatherization Program prior to the current evaluation period; the only new agency we interviewed reported first participating in the DEC Weatherization Program in May 2016. Most interviewed agencies (5/6) reported they complete weatherization projects through DOE/State WAP while half (3/6) also complete projects through LIHEAP. One agency reported they only complete refrigerator replacement projects for the DEC Weatherization Program, although they provide other services to their clients outside of the Weatherization Program. Three agencies indicated they had utilized the new participation channel, in which they completed and submitted projects that were not originally DOE or State WAP projects. Overall, agencies submit an average of 81% of their total weatherization projects to DEC for reimbursement. All interviewed agencies reported that they submit 100% of eligible projects for DEC Weatherization Program reimbursement. Table 17 presents an overview of agency activity and program participation during the evaluation period.

Table 17. Agency Activity and Participation

Agency Metrics	Average	Range
Number of DEC projects (n=6)	306	18 to 746
Share of DEC projects relative to all weatherization jobs (n=5)	81%	64% to 91%
Percent of all weatherization jobs that were originally DOE funded (n=5)	21%	15% to 40%
Percent of all weatherization jobs that were originally LIHEAP funded (n=3)	66%	60% to 70%
Percent of eligible projects submitted for DEC Weatherization Program reimbursement (n=5)	100%	100% to 100%

Key Services and Customer Concerns

Most interviewed agencies (4/6) perform a wide variety of services in their communities beyond weatherization; only two interviewed agencies reported they exclusively provide weatherization services and health and safety upgrades to their clients' homes. Half of agencies (3/6) also have senior assistance and/or nutrition programs, and many agencies perform other necessary work in their communities through workforce development programs (2/6), childcare and education programs (1/6), and environmental compliance programs (1/6).

All six interviewed agencies reported that the biggest housing/energy concern their clients face are extremely high energy bills, which can be a struggle to pay on a low or fixed income. Half of interviewed agencies (3/6) also noted their clients' homes were in need of repairs or upgrades, such as gaps in doors or missing insulation. Two agencies reported their clients have trouble maintaining adequate indoor temperatures. One interviewee reported their clients sometimes resort to dangerous ways of warming their homes, saying "when

your heat breaks you wind up … getting gallon jugs and putting kerosene in them and getting a kerosene heater and bringing it into your house. Then it smokes your house up but you're warm and it's dangerous."

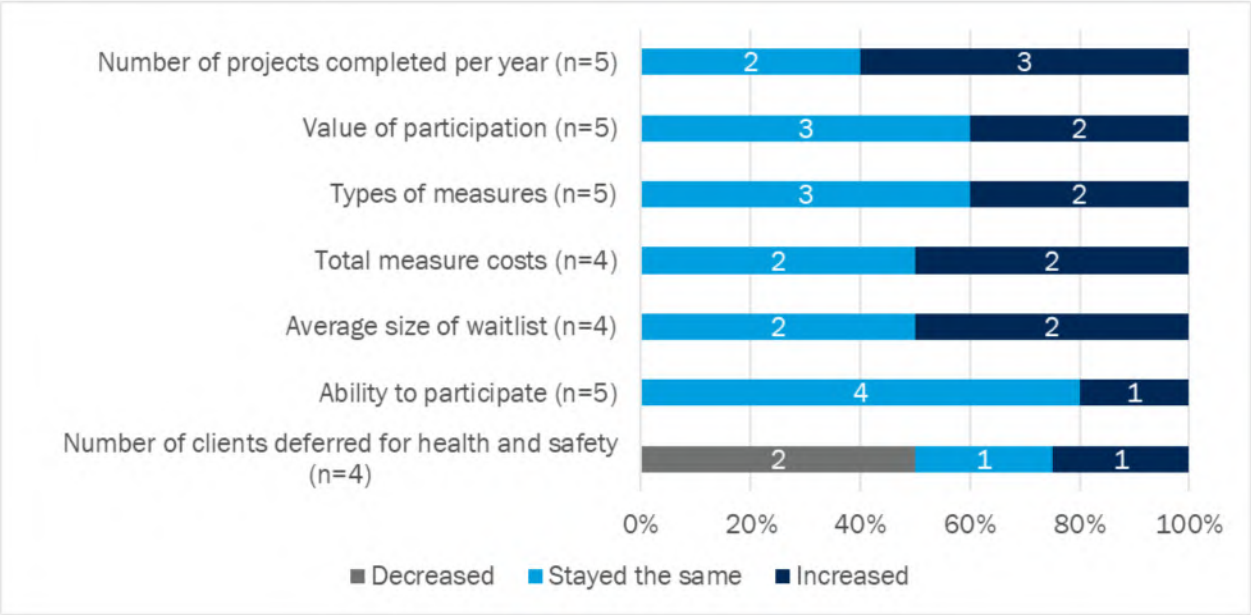
Program Changes

In 2018, the DEC Weatherization Program introduced a new participation channel in which agencies could submit for reimbursement qualifying weatherization projects funded from their operating budget or another source. Prior to this change, agencies could only submit qualifying DOE/State WAP projects for DEC Weatherization reimbursement. This change allowed agencies other than CAAs, such as non-profit organizations, to be able to deliver program services to their clients in North and South Carolina. DEC made this change in an effort to bypass the strict DOE rules for how agencies spend weatherization funds and to increase program participation in South Carolina. Three out of six agencies indicated they used this new participation channel, utilizing grants, operating budgets, and credit at local home improvement stores to fund the projects before they received reimbursement from DEC.

Interviewed agencies that also participated in the program during the prior evaluation period (2015 to Q1 2016, n=5) noted only minimal changes in how they delivered or participated in the DEC Weatherization Program during the evaluation period. Two of these five agencies reported they did not change anything about how they delivered or participated in the program since the last evaluation. One agency noted they were able to hire additional staff and serve more clients on their deferral list, and another agency noted they started submitting for HVAC replacement projects during this evaluation period. One agency reported they decreased spending on health and safety due to the loss of a $3,000 per house payment for health and safety measures from DEC. The agency noted this occurred in 2017 or 2018, when the funds for the Helping Home Fund (HHF) ran out.

To further understand specific changes to program implementation, we asked agency staff to identify changes that may have occurred in a variety of program areas over the past four years. The most frequently reported change was an increase in the number of projects completed per year (3/5). Figure 8 summarizes agency responses.

Figure 8. Changes to Agency Participation



Agency staff noted that changes to the types of measures installed include HVAC replacements (1/6) and the new measures DEC added to the program during this evaluation period, including roof cool seal (1/6). One agency noted their ability to participate increased over the last four years since they were able to complete weatherization jobs at more homes.

We also asked the returning agencies if there have been any changes over the last four years in how they coordinate the implementation of multiple weatherization programs. Half of agencies reported no changes (2/4). One agency reported their coordination efforts tend to change within their funding cycle, rather than from year to year, but have not changed substantially over the last four years. Another agency reported they increased outreach efforts to other community agencies and nonprofits, and ensure their partnering agencies are aware of Weatherization Program requirements so they can get referrals.

Policy Barriers

Our last evaluation identified significant policy barriers to agency participation in the DEC Weatherization Program in both states but specifically in South Carolina. During the current (2016–2018) evaluation period, many interviewed agencies in North Carolina reported being able to complete more projects per year and reduce the number of people they defer for health or safety reasons; however, policy barriers remain in South Carolina, and not one South Carolina agency participated during the evaluation period.

In 2015, DOE's policies in North Carolina required that agencies spend DEC funding within the same program year. This limited agencies' willingness to participate in the first year of the program because they were not certain that they could spend both the DEC and State WAP funding. This hesitancy led North Carolina agencies to request less than the full value of available funds. Since then, DOE revised its policy, allowing North Carolina agencies to use DEC Weatherization funds as 'unrestricted' income beginning in 2016. As noted above, participating agencies are now requesting funding for 100% of their eligible projects. The North Carolina agencies' annual number of DEC program-eligible State WAP projects provided an upper bound to the amount of funding Duke Energy reasonably expected to distribute each year until the recent addition of the new participation channel. This new participation channel allows participating agencies to submit completed DEC Weatherization projects for reimbursement, regardless of the original funding source. Three of the six interviewed agencies indicated they used this new participation channel, and used funds from other programs, grants, or their operating budgets to pay for the project before receiving reimbursement from Duke Energy.

In South Carolina, agencies continue to struggle to participate in the DEC Weatherization Program. According to NCCAA, South Carolina has a relatively high need for weatherization services and could benefit greatly from DEC Weatherization funding. DOE considers DEC Weatherization Program reimbursements in South Carolina "program income," and agencies must return any unspent program income to DOE at the end of the WAP fiscal year. This could result in DOE reducing funding allocations to the South Carolina agencies in future program years. To prevent this, the State WAP does not allow South Carolina agencies to participate in the DEC Weatherization Program. In addition, NCCAA reported that CAAs in South Carolina are entirely state funded, and CAA employees are considered "state-paid employees." While CAAs receive enough funding from the state to cover their payroll, they often do not have funds left over to pay for weatherization projects, and CAA employees are barred from working on projects using privately funded grants, including DEC Weatherization projects. One of the goals of the new participation channel was to overcome these barriers by allowing non-profits or other non-CAA organizations to provide program services. The program has so far remained unsuccessful in expanding program services into South Carolina, however, despite this new participation channel. NCCAA and TRC believe that the program will continue to struggle in South Carolina as long as these state policies remain in place.

Growing the Program

During the previous evaluation, 12 agencies participated in the DEC Weatherization Program. Since then, one agency left and four new agencies joined the program, bringing the total number of participating agencies in the 2016–2018 evaluation period to 15. Program administration staff reported that they do not perform agency recruitment for the program, and new agencies typically start participating in the program due to reassigned service territories. Program administration staff indicated that some new agencies tend to complete HVAC or refrigerator replacement projects due to the "safer" nature of those projects (in terms of agencies knowing the reimbursement amount upfront), and oftentimes homes are in need of HVAC replacements (if they do not have working heat) before they can receive weatherization services through the State WAP. Program administration staff also noted that participating agencies can be non-profit agencies that do not specialize in weatherization or home upgrades due to the new flexible participation channel. This option is particularly attractive for South Carolina as restrictions surrounding State WAP and the use of private funds continue to be a policy barrier for weatherization agencies in the state.

A minor barrier to agency interest found in the last evaluation was a limited capacity to spending program funding once agencies received it due to funding restrictions surrounding State WAP projects, particularly in South Carolina. Although no new projects were completed in South Carolina during the evaluation period, many agencies in North Carolina were able to spend their DEC Weatherization reimbursements, and three of six interviewed agencies indicated they could weatherize more homes or otherwise increase their participation in the program if the program offered more money.

5.3.4 Non-Energy Impacts

NEIs include a range of occupant health, safety, and economic outcomes that participants may realize beyond the energy and cost savings of energy-efficient upgrades. NEIs can provide significant additional benefits to participants and can be a powerful motivator for program participation.

The participant survey included questions about changes in electricity bills and in different aspects of the home's comfort following program participation. Most Weatherization Program participants reported that their summer and winter electricity bills were lower compared to before they participated in the program and that they experienced other beneficial changes. Beneficial NEIs reported by two-thirds or more of participants include increased home comfort in both summer and winter, reduced draftiness, and better lighting. Fewer than half of respondents reported a reduction in outdoor noise and home maintenance costs (Table 18). In addition, a small share of respondents (less than 20%) reported other beneficial changes as a result of their participation, including improved quality of life, improved water efficiency in their homes, and improved home safety.

Table 18. Impacts Reported by Participants

Impact Category	Positive Change	No Change/ About the Same	Negative Change
Energy Impacts			
Summer electricity bills (n=99)[a]	73% *Bills are lower*	24%	3% *Bills are higher*
Winter electricity bills (n=99)[a]	58% *Bills are lower*	32%	10% *Bills are higher*
Non-Energy Impacts			
Home comfort in the summer (n=102)	76% *More comfortable*	22%	2% *Less comfortable*
Home comfort in the winter (n=101)	70% *More comfortable*	26%	4% *Less comfortable*
Home draftiness (n=100)	68% *Less drafty*	26%	6% *More drafty*
Lighting (n=9)[b]	67% *Better*	33%	0% *Worse*
Amount of outdoor noise heard when all windows are closed (n=98)	46% *Less noise*	49%	5% *More noise*
Home maintenance costs (n=96)	33% *Lower costs*	53%	14% *Higher costs*

[a]Asked only of those who pay their own electric bill.

[b]Asked only of those who received LEDs.

These findings suggest the Weatherization Program provides value to participants beyond energy savings. Increased home comfort and reduced draftiness could be beneficial for customer health and safety, especially as climate change alters temperature patterns. Improved lighting provides a higher sense of safety in and around the home. Lower energy bills and home maintenance costs help alleviate energy burdens and allow customers to spend their money on essential items, such as food and medicine.

DEC should consider providing information regarding improved home comfort, draftiness, and lighting quality to agencies to help them market the program. Duke could also use this information to recruit new agencies to the program whose clients face high energy bills or uncomfortable homes in the winter and summer.

5.3.5 Program Satisfaction and Strengths

Overall, program administration staff, implementing agency staff, and participants are all highly satisfied with the DEC Weatherization Program:

- **NCCAA and TRC program administration staff gave the program a satisfaction score of six out of six, saying they were very satisfied and "we'd love to do more but we've got what we've got, and it's made a big difference."** Program administration staff are particularly pleased with the new flexible participation channel for agencies, who are no longer required to complete DOE or LIHEAP projects to be reimbursed by DEC. This allows for other nonprofits, not just CAAs, to participate in the program, which could help reduce the policy barriers to participation in South Carolina. Program administration staff are also extremely pleased with their interactions with Duke Energy and reported that Duke Energy has been a great partner to them and the CAAs. They also reported the program has likely reduced the size of agency waitlists and agencies have been able to serve more people than they

would have otherwise. In addition, program administration staff noted HVAC and refrigerator replacement projects as program strengths, which allow other agencies or non-profits to participate in the program, as well as the recent increase in the incentive for refrigerator replacements. Program administration staff noted they would like to increase participation, but they are satisfied with the work they do, and it makes a big difference in the lives of clients.

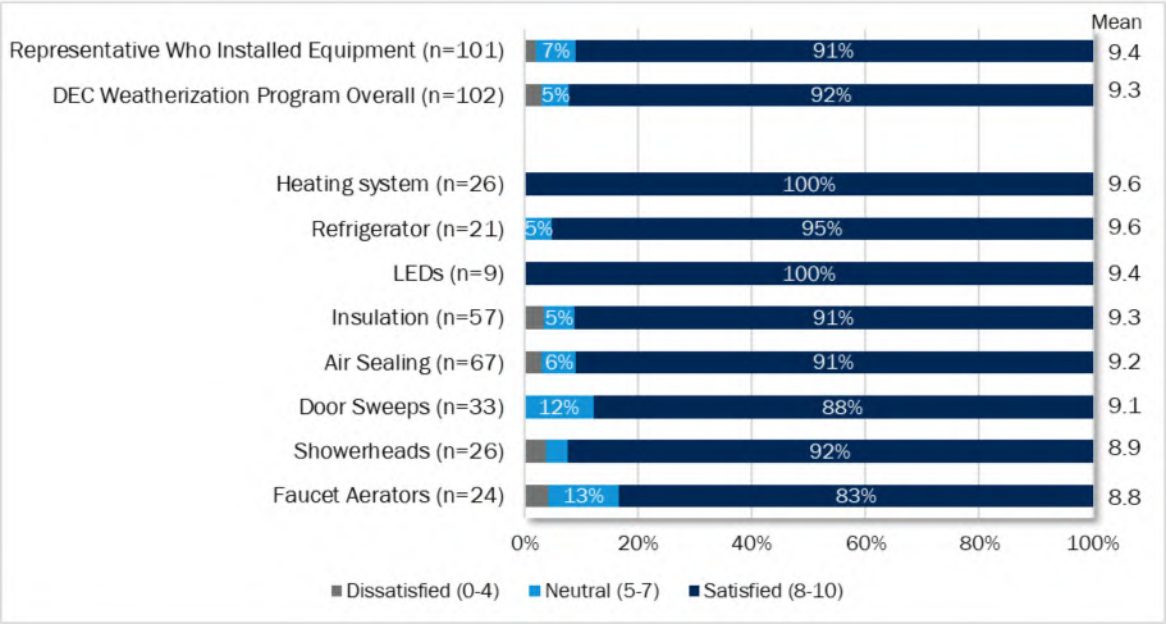
- **Agency staff are very satisfied with the program as well, giving it an average rating of 5.9 out of 6 (n=6).** Agency staff reported few issues with implementation and underscored the value of the program to their communities. Agencies are particularly satisfied with logistical elements of the program, and most interviewed agency staff members noted program organization, communication, and the ease of participation and reporting requirements as key program strengths (5/6). One staff member mentioned the flexibility of reimbursements was a key program strength and another highlighted the program's role in their agency serving more clients. Agency staff frequently provided unprompted praise for program administrative staff during our interviews, one saying "… the folks that were back and just willing to help you any way they could to implement and get this program going. The resources were phenomenal, the teamwork. I've never seen anything like it. It was just great."

  As noted above, only one of the interviewed agencies indicated they began participating in the program during the evaluation period. This agency reported no issues with blending Duke funds with other sources of funding, obtaining DEC reimbursements, or meeting participation or documentation requirements. This agency also participates in the State WAP and the Blue Cross Blue Shield home upgrade program. When asked to compare the DEC Program to the other weatherization and home upgrade programs they participate in, this agency staff member reported there were no major implementation differences, aside from the State WAP eligibility guidelines surrounding heating fuel type.

- **Participants are also satisfied with all components of the program.** As shown in Figure 9, 94% of participants reported that they were satisfied with the program overall, and 93% reported that they were satisfied with the weatherization representative who installed the equipment.[10] Moreover, across the measures we verified, most participants were satisfied with the equipment they received (ranging from 83% of those who received faucet aerators to 100% of participants who received LEDs and efficient heating systems). Common reasons for dissatisfaction with equipment include participants not satisfied with the performance of the equipment (low pressure from faucet aerators or showerheads) and not noticing a difference in their home following installation of air sealing or insulation.

[10] Satisfied is defined as a rating of 8 to 10 on a scale of 0 to 10, where 0 means "not at all satisfied" and 10 means "very satisfied."

Figure 9. Participant Satisfaction with DEC Weatherization Program and Equipment



- **The DEC Weatherization Program helps to alleviate the biggest home and energy concern agencies reported their customers faced: high energy bills.** All interviewed agencies reported paying their energy bills was a key issue for their customers and saving money on energy bills was the most common motivator for participating in the program (reported by 42% of survey respondents). Survey results suggest the program is helping participants in this respect, with 73% of respondents reporting lower summer electricity bills and 58% of respondents reporting lower winter electricity bills following participation in the program.

- **The program is delivering substantial non-energy benefits to program participants including improved home comfort in the summer and winter, reduced draftiness, better lighting, and, to some extent, lower outdoor noise levels and home maintenance costs.** Several survey respondents also mentioned additional benefits they have experienced since participating in the program, including improved quality of life, safer homes, and increased water efficiency. Participating agencies can utilize this research as a way to market the program to hesitant clients.

5.3.6 Program Challenges and Opportunities for Improvement

While all interviewed agencies were highly satisfied with the program overall, most (4/6) also noted some challenges in program implementation. Two agencies reported they wished the program provided more funds to agencies, either through more measures covered by the program, such as stove or natural gas furnace replacements, or increased funds for health and safety repairs. Two agencies also noted they experienced internal staffing issues during the evaluation period, which prevented them from completing more projects. One of these agencies reported the biggest challenge they had was recruiting employees to perform the actual weatherization work on homes and explained that when they informed applicants of the nature of the job, many turned the position down. One agency reported a challenge for them was getting new participants to provide firsthand testimonials for use in marketing materials. This agency staff member explained that new participants were often wary of letting others know they participated in the program because “you don't want everybody to know that you got your heating system fixed because they might come steal it.”

Interviewed NCCAA and TRC staff acknowledged one particular challenge for participating agencies is the reimbursement amount for energy saving measures, particularly for HVAC and refrigerator replacements. While the incentive amount for refrigerator replacements recently increased, the incentive for HVAC replacements has not, and agencies struggle to pay for these measures in the allotted cost cap. Program administrators also noted that the inconsistent funding environment CAAs often have to deal with is a challenge, since the program year starts July 1 but CAAs do not receive state funds until October 1. CAAs would often have to lay-off staff during the summer because they simply do not have the funds available to spend on payroll.

Suggestions for Program Changes

When asked for suggestions on how Duke Energy could improve the program to be more effective in the future, most agencies (4/6) reported the program could be improved by providing program funds for more measures, such as stove/oven replacements, natural gas furnace replacements, or additional health and safety upgrades. Agency staff also suggested Duke Energy could increase program marketing efforts (2/6), provide educational materials to customers about the program and the benefits of energy efficiency in their homes (2/6), and provide additional training to agency staff (2/6).

Program administration staff suggested revising the fixed payment model and pivoting to a reimbursement model. For example, program administration staff suggested providing agencies up to $4,000 for Tier II measures, and not just reimbursing a fixed cost for each unit of the approved measures each agency installs. They also suggest “stacking” Tier II and HVAC replacement dollars, so a single home could be eligible for $4,000 in Tier II measures plus $6,000 for an HVAC replacement.

Program administrators also suggest increasing health and safety funds. Agency staff cannot weatherize a home that is unsafe. Many homes are being left out of the program, due to lack of funds for needed health and safety improvements, and Duke Energy does not realize any savings from those homes. Programs like the HHF provide some support for health and safety, but many agencies have to fund these upgrades from their operating budget or another source so they can complete weatherization. Program administration staff suggest an HHF-type program that covers the DEC service territory to provide funding for health and safety upgrades.

6. Process Evaluation—Durham Pilot

In 2018, Duke Energy launched a new weatherization pilot based in Durham, North Carolina. The Durham Pilot provided weatherization services and health and safety upgrades to 206 income-qualified Durham residents between October 2018 and December 2019.

As part of our evaluation of the DEC Low Income Weatherization Program, we conducted a limited process evaluation of the Durham Pilot, addressing the following research objectives:

- How do program design, implementation, and participation of the Durham Pilot compare to the DEC Weatherization Program?
- What are the relative advantages and disadvantages of the two program designs?
- How do the two offerings compare in terms of per-home savings potential?

This limited process evaluation included an in-depth interview with pilot staff and a focused program-tracking database analysis to document program design, identify early implementation successes and challenges, and make comparisons to the Weatherization Program.

6.1.1 Pilot Overview

Duke Energy launched the Durham Pilot in 2018, with the intent to determine how and if the current DEC Weatherization Program design could be improved and expanded into Duke Energy Progress (DEP) service territory. A secondary intent of the pilot was to determine if a different funding model could be used to expand weatherization services into South Carolina, where current DEC Weatherization Program funds qualify as program income, which limits CAA participation in the program.

Duke Energy conducted this pilot in Durham, North Carolina due to a combination of factors. DEC ran the Low Income Neighborhood Energy Savers (NES) Program in Durham, and preliminary customer data collected from the NES Program indicated there was a high density of potentially qualified customers in the Durham area. Durham Pilot staff noted that many people who participated in the NES Program could derive additional benefits from weatherization services, and DEC would realize greater electric savings if they provided those services to customers. In addition, the program administrator, NCCAA, is headquartered in Raleigh, making the logistics of launching the pilot there appealing to pilot staff.

The Durham Pilot was designed to bring weatherization services to customers who may not have been able to receive these services from a CAA. The pilot had eligibility requirements similar to Tier II of the Weatherization Program (income of no more than 200% of Federal Poverty Guidelines and energy usage of at least 7 kWh per square foot) and offered the same measures (prioritizing insulation, air sealing, and duct sealing, and offering baseload lighting and DHW measures). The pilot did not offer a Tier I option for lower usage customers. Similar to the Weatherization Program, it offered HVAC upgrades and replacements as part of Tier II services as well as refrigerator replacements.

6.1.2 Comparison to DEC Weatherization Program

Although DEC designed the Durham Pilot to provide the same services to customers as the DEC Weatherization Program, there are a few key differences in the design and implementation of the two offerings:

- **Program Implementation.** The Durham Pilot relied on Duke Energy staff and NCCAA, rather than agencies, to complete weatherization projects. Durham Pilot staff were responsible for providing all funding, program services, and oversight for each Durham Pilot project. Pilot staff hired independent, qualified contractors to go to homes to complete assessments and install energy saving measures. Durham Pilot staff were also responsible for following up with participants on any issues.

- **Program Eligibility.** Participation in the pilot was limited to income-eligible customers with energy usage of at least 7 kWh per square foot. Unlike the Weatherization Program, the pilot did not offer a Tier I option for lower usage customers.

- **Marketing and Outreach.** The Durham Pilot conducted proactive marketing and outreach for the program by microtargeting NES Program participants and other potentially qualified customers with letters and other program materials. This is in stark contrast to the Weatherization Program, wherein CAAs are responsible for marketing the program. Durham Pilot staff reported that "with this design, we have the information where we're going to the customers versus sitting back and waiting for the customers to come to us." Durham Pilot Staff also reported that qualified customers were often not aware of the pilot or that Duke Energy provided energy saving programs like this.

- **Customer Prioritization:** The Durham Pilot served qualified customers on a first come, first served basis. In contrast, CAAs operating through the Weatherization Program must prioritize homes with lead, small children, or elderly occupants when providing weatherization services due to DOE and State WAP requirements. This can result in some customers waiting several years for vital weatherization services. Durham Pilot staff recalled a particular customer, a veteran, who waited nine years for weatherization services since they did not meet the high priority criteria.

- **Measure Cost:** Duke Energy paid the full cost of each measure in the Durham Pilot, compared to a percentage of each measure in the Weatherization Program. CAAs are responsible for covering the remainder of the measure cost, either through funds from another program (such as State WAP or LIHEAP) or through their operating budget. While this funding approach is less cost-effective than rebating a portion of the cost, it allowed for higher percentage of more comprehensive projects than the Weatherization Program. It might also allow Duke Energy to expand weatherization services into DEP territory and South Carolina. Weatherization Program funds qualify as program income in South Carolina, which affects federal funding for CAAs in the state and prevents them from participating in the program.

6.1.3 Early Successes and Pilot Advantages

Although pilot staff did not formally survey customers, they reported high participant satisfaction with the program and the services they received. The program served customers who, according to pilot staff, may have had to wait for years before receiving services from the DEC Weatherization Program. Interviewed staff relayed participant feedback that the contractors were respectful, worked hard to help them, and often understood the participants' situation. Pilot staff were commonly told by participants that they did not know Duke Energy offered any programs of this nature and felt they could trust program staff. As one pilot staff member put it, "We can count on one hand the number of issues that arose, and those issues that did arise were resolved pretty quickly."

Interviewed pilot staff remarked that it was easier to work directly with the program administrator, as opposed to delegating the work to CAAs. Additionally, Pilot staff identified having access to important customer data as another advantage of not relying on CAAs for implementation. This customer data enabled Pilot staff to identify and target customers most in need of weatherization services and provide education on ways to lower energy

costs and burden. Pilot staff also reported that customers may be hesitant to participate in the DEC Weatherization Program due to the bureaucracy associated with applying for a federal or state assistance program. Since the Durham Pilot did not leverage DOE or State WAP projects, the administrative burden on customers was greatly reduced.

6.1.4 Pilot Challenges

Although Durham Pilot staff were generally satisfied with how the Pilot performed, they did encounter a few implementation challenges. Some customers (about 5% of applicants) who made initial contact with Durham Pilot staff did not follow up with their information, which left Pilot staff uncertain if these customers were still interested in the program. Program staff also reported it was a challenge to get some qualified customers to schedule their in-home assessment with a qualified contractor. Program staff sent letters to customers informing them they would lose their spot in the program if they did not make an appointment.

Another issue for the Durham Pilot was having to turn down customers because the health and safety upgrades their homes required exceeded the resources of the program. This is a common issue for many weatherization programs, including the Weatherization Program, and the Durham Pilot staff partnered with other programs and agencies such as Habitat for Humanity and the HHF to provide health and safety upgrades for many participants.

Finally, the funding approach of covering the full project cost without contributions by agencies might make this program design difficult to implement on a larger scale.

6.1.5 Pilot Participation and Outcomes

The Durham Pilot served 206 customers between October 2018 and December 2019. In total, the pilot funded 148 Tier II projects, including 52 HVAC replacements, and replaced 123 refrigerators. The pilot partnered with the HHF to provide up to $3,000 for health and safety upgrades before providing weatherization services. The pilot did not have any savings or participation goals, nor did pilot staff have any expectations of how the pilot would perform.

Durham Pilot staff did not directly compare participant characteristics or pilot activity to the Weatherization Program, and limited data prevents a full savings comparison between the two offerings. As part of our limited process evaluation, we analyzed program tracking data and compared key participant metrics across the two offerings. Key differences include:

- Participants in the Durham Pilot, on average, had slightly smaller homes and slightly higher energy use intensities.
- A smaller percentage of Durham Pilot participants have electric heat.
- A larger percentage of Durham Pilot participants live in multifamily homes.

Table 19. Comparison of Participant Characteristics

Participant Metrics	Durham Pilot (N=206)	Weatherization Program (N=1,706)
Average Annual Income	$20,138	$17,477
Average Square Footage	1,189	1,311
Estimate Annual Electricity Usage (kWh)	13,808	14,030
Estimated Energy Use Intensity (kWh/sqft)	11.6	10.7
Participants with Electric Heating	57%	65%
Participants in Multifamily Homes	19%	5%
Participants in Single Family Homes	81%	95%

While a full savings comparison between the pilot and the Weatherization Program was not possible within the scope of this evaluation, a comparison of the types of projects completed through the two offerings and the measure mix provides interesting insights into potential savings. It should be noted, however, that these insights are merely directional and intended for guidance purposes only.

Table 20 compares the percentage of participants who completed various types of weatherization projects. As noted above, the pilot did not offer a Tier I option, while 10% of Weatherization Program participants completed a (lower-savings) Tier I project. While a higher percentage of Weatherization Program participants completed a Tier II project (81% compared to 72%), pilot Tier II projects were more likely to include both weatherization measures and an HVAC replacement/upgrade (34% compared to 6%). In addition, a much higher percentage of pilot participants received a new refrigerator (60% compared to 24%), and more than half of them also completed a Tier II project (similar to Weatherization Program refrigerator recipients). This comparison suggests a higher savings potential (based on project type alone) for pilot participants compared to Weatherization Program participants.

Table 20. Comparison of Project Types

Project Type	% of All Participants	
	Durham Pilot (N=206)	Weatherization Program (N=1,706)
Tier I	0%	10%
Tier II	72%	81%
Wx Measures & HVAC Replacement/Upgrade	*34%*	*6%*
Weatherization Measures Only	*65%*	*77%*
HVAC Replacement/Upgrade Only	*1%*	*17%*
Refrigerator Replacements	60%	24%
Refrigeration Replacement & Weatherization	*52%*	*55%*
Refrigerator Replacements Only	*48%*	*45%*

A comparison of measures included in Tier II projects (see Table 21) shows additional differences between the pilot and the Weatherization Program. While both offerings provided most Tier II participants with air sealing and insulation, pilot participants were less likely to receive duct system insulation/sealing and much

less likely to receive water heating measures and weather stripping. No pilot Tier II participants received a heating system tune-up, compared to 27% of Weatherization Program participants. On the other hand, higher shares of pilot participants received lighting measures (57% compared to 35%) and HVAC replacements/upgrades (35% compared to 7%).

Given the relatively high savings impact of air sealing, insulation, and duct sealing/insulation, and the significant savings associated with HVAC replacements/upgrades, this comparison suggest a savings potential of the pilot on par with or even higher than for the Weatherization Program.[11] However, it also appears that some opportunities for savings might have been missed as few pilot participants received water heating measures, weather stripping, and heating system tune-ups. Given that the pilot targeted Durham, NC—an area previously served by the NES Program, which offered some of the same measures—it is possible that some of the participants not provided with these measures did not have a need for them.

Table 21. Comparison of Tier II Measure Mix

Measure Category	% of Tier II Participants	
	Durham Pilot (N=148)	Weatherization Program (N=1,387)
Air Sealing	92%	97%
Insulation	90%	91%
Duct System	65%	74%
Lighting	57%	35%
HVAC Replacement/Upgrade	35%	7%
Water Heating	22%	70%
Weather Stripping	9%	59%
Heating System Tune-Up	0%	27%

[11] It should be noted that savings from many of these measures depend on installed quantities as well as home characteristics, such as space and water heating fuel types. Detailed consideration of these factors was out of the scope of this analysis.

7. Key Findings and Recommendations

During the evaluation period, 1,706 households participated in the Weatherization Program, completing over 2,000 projects. The majority of participants (81%) completed a Tier II project; only 10% of participants completed a Tier I project. In addition, 24% received a replacement refrigerator, either as a stand-alone measure (8%) or in combination with Tier I or Tier II services (15%).

7.1 Key Impact Findings

Based on our impact analysis, we estimate that the projects completed during the evaluation period generate close to 3.2 million kWh of annual energy savings, 539 kW of annual summer coincident demand savings, and 935 kW of annual winter coincident demand savings. Tier II participants account for the largest share to program-level savings (89%) while Tier I participants and refrigerator replacements account for 1.3% and 9.6%, respectively, of total program energy savings.

Table 22 presents annual per-household and program-level net ex post savings for the evaluation period.

Table 22. Summary of Impact Results

Project Type	Number of Participants	Net Annual Savings Per Household			Net Annual Program Savings		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier I	176	241	0.0724	0.0416	42,398	12.7	7.3
Tier II	1,387	2,042	0.3544	0.6438	2,832,531	491.5	892.9
Refrigerator Replacement	404	758	0.0864	0.0864	306,097	34.9	34.9
Total [a]	1,706				3,181,027	539.2	935.2

[a] The total number of unique participants is smaller than the sum of project types since some households complete more than one project.

7.2 Key Process Findings

The process evaluation found that the DEC Weatherization Program continues to benefit from previously established relationships, implementation processes, and program-tracking systems. Program and implementation staff reported no major changes to the program since the previous evaluation aside from the new participation channel established in 2018. Participating agencies also reported minimal changes to how they implement and participate in the Weatherization Program, and many reported the DEC funds allow them to complete more weatherization jobs than they would have otherwise.

Key process findings include:

- **Program Participation.** Participation in the Weatherization Program has been increasing steadily since the program began in 2015. Agencies work hard to inform clients about the program through multiple advertising channels (newspaper ads, in-person events, agency websites, etc.) and half of interviewed agencies indicated the number of projects they complete each year is increasing.
- **New Participation Channel.** Prior to 2018, agencies could only submit projects originally funded by the State WAP for reimbursement from Duke Energy. Now, agencies may submit for reimbursement

projects they originally funded through their operating budget or another source. This opened the possibility of non-CAA organizations, such as non-profit organizations, to participate in the program and bring Weatherization Program services to their clients. Half of the agencies we interviewed indicated they had used this new participation channel. One agency, a non-profit organization, indicated they used this participation channel exclusively and only performed refrigerator replacements since their organization was not equipped to perform more extensive weatherization on clients' homes.

- **Satisfaction.** The process evaluation showed high satisfaction with the Weatherization Program. Interviewed agency staff often provided unprompted praise for the program implementation team and underscored the importance of the program to their clients. Agencies found the logistical elements of the program—including program organization, communication, and reporting—to be key program strengths. Participants were also highly satisfied with the program overall. A key concern for participants is high energy bills, and survey results suggest the program is helping participants in this respect, with 73% and 58% of respondents reporting lower summer and winter electricity bills, respectively, following participation in the program.

- **Non-Energy Impacts.** In addition to lowering energy bills, the Weatherization Program provides substantial non-energy benefits to participants including improved home comfort in the summer and winter, reduced draftiness, and better lighting. To a lesser extent, survey respondents also reported lower outdoor noise levels and home maintenance costs, improved quality of life, safer homes, and increased water efficiency.

- **South Carolina Policy Barriers.** Despite the new participation channel—introduced in 2018 to encourage participation by South Carolina agencies—barriers to program participation remain high in South Carolina, and no projects were completed in the state during this evaluation period. While the new participation channel has not yet resulted in program participation in the state, program staff continue to conduct outreach and provide additional support to South Carolina agencies and to encourage future program participation.

- **Durham Pilot.** Between October 2018 and December 2019, Duke Energy offered a weatherization pilot in Durham, North Carolina, which served a total of 206 customers. One goal of this pilot was to determine if the current DEC Weatherization Program design and funding model could be improved to expand program services to South Carolina and into the Duke Energy Progress (DEP) service territory. The limited process evaluation of the Durham Pilot found key differences between the pilot and the Weatherization Program in program eligibility, implementation, and measure mix:

  - Not relying on agencies to implement the program made the Durham Pilot implementation smoother and more flexible, and access to customer data allowed Pilot staff to target the program to the customers who needed it most. Since the Durham Pilot was entirely funded by DEC, participants did not need to spend time completing federal or state assistance program applications, which greatly reduced administrative burden on participants.

  - Compared to DEC Weatherization projects in the evaluation period, Durham Pilot projects were more likely to include both weatherization measures and an HVAC upgrade. Additionally, Durham Pilot participants were more likely to receive a refrigerator replacement. Based on the measure mix, we believe that the Durham Pilot has the potential to provide per household savings on par with, or possibly greater than, the savings estimated for the DEC Weatherization Program. Since this evaluation did not include a formal impact assessment, however, more rigorous impact analysis would be required to quantify the savings of the Durham Pilot.

Overall, pilot staff were highly satisfied with the performance of the pilot and indicated that participants were particularly grateful for program services they may have otherwise waited years to receive. Given the continuing policy barriers in South Carolina, despite the new participation channel, a program design similar to the Durham Pilot could be a good option for bringing weatherization services to customers in South Carolina and/or the DEP service territory.

7.3 Evaluation Recommendations

We have developed the following recommendations based on the results of our evaluation:

- **Consider tracking several additional parameters within the program-tracking system to enhance the accuracy of future deemed savings estimates.** Our deemed savings review (see Appendix B) identified a few parameters that are currently not tracked in program data: (1) pre- and post- blower door results in units of reduced cubic feet per minute (CFM); (2) presence or type of cooling at participating homes; (3) water heating fuel of participating homes; and (4) the installed location (e.g., bathroom, kitchen) for each low-flow faucet aerator. Some of this information is currently collected in the participant survey but having it in the program-tracking data for the population of participants would enhance the accuracy of future deemed savings estimates. We therefore recommend asking weatherization agencies to enter this information into the program's tracking system, if available.

- **Consider changing the reimbursement structure or increase reimbursement amounts.** The current Tier II incentive structure provides up to $6,000 for Tier II projects. TRC and NCCAA indicated that agencies may struggle covering the cost of HVAC replacements with the current reimbursement amount, which has not increased since the program began in 2015. In addition, this reimbursement cap may also prevent participants from receiving weatherization services in addition to HVAC replacements/upgrades: Based on program-tracking data, only 6% of Tier II projects include both HVAC replacements/upgrades and other Tier II measures, compared to 34% in the Durham Pilot, which provided higher incentives. Agencies may be able to provide additional energy saving measures in Tier II homes, leading to deeper savings, if the overall Tier II incentive amount was increased.

- **Increase support to agencies in program marketing and outreach.** Agencies noted that communication and organization of the program were key strengths and frequently provided unprompted praise for staff at Duke Energy and NCCAA. One area agency identified for potential additional Duke assistance was marketing and outreach to help increase customer awareness of the program. This could be through information about the program on customer bills or on Duke Energy's website, or by developing testimonials from past program participants with examples of bill savings and other benefits—such as non-energy impacts (NEIs) reported by many surveyed participants—derived from their weatherization projects.

- **Explore options to increase the uptake of comprehensive weatherization projects though the new participation channel.** The new participation channel allows non-profit and other organizations to provide program services to customers who may not have been able to receive them otherwise. One objective of this channel was to overcome barriers to participation in South Carolina, as State policies prevent CAAs from participating in the program. Based on program-tracking data through April 2020, however, the new channel has not been successful in encouraging South Carolina organizations to participate in the program. In addition, information from our agency interviews suggest that some non-CAAs may not be equipped to facilitate the implementation of weatherization projects and thus limit their activity to equipment replacement. The program should continue to explore ways to promote participation in South Carolina, by identifying suitable partner organizations (with prior weatherization

expertise) and/or providing non-CAA organization with additional support in implementing weatherization services.

- **Consider expanding the Durham Pilot to include the South Carolina service territory.** Given the substantial policy barriers that continue to block participation in South Carolina, one way to provide weatherization upgrades to South Carolina customers is to introduce a program design similar to the Durham Pilot. Based on our review of project types and measures installed through the pilot, the savings potential for a program design similar to the pilot appears to be on par with, or even greater than, savings observed for the Weatherization Program. In addition, pilot participants and staff were very satisfied with the experience, and there were very few implementation challenges. If policy barriers persist, or the new participation channel fails to increase participation in South Carolina, this may be an option to expand services in the state.

8. Summary Form

Duke Energy Carolinas
Low Income Weatherization Program

Completed EM&V Fact Sheet

Program Description

The DEC Weatherization Program reimburses local implementing agencies that have recently completed qualifying weatherization projects at Duke Energy customer homes. Electric conservation measures are provided at no cost to the customer. A tiered project structure is used to allocate reimbursements to agencies: Tier I applies to low usage homes and offers air sealing and low-cost energy efficiency upgrades (including lighting and low-flow aerators and showerheads); Tier II applies to higher usage homes and offers more comprehensive energy efficiency measures (including insulation and HVAC upgrades/ replacements) in addition to Tier I measures.

Date	April 16, 2021
Region(s)	Duke Energy Carolinas
Evaluation Period	April 1, 2016–December 31, 2018
Annual kWh Savings (ex post net)	3,181,027 kWh
Coincident kW Impact (ex post net)	Summer: 539.2 kW Winter: 935.2 kW
Per Participant kWh Savings	Tier I: 241 kWh Tier II: 2,042 kWh Refrigerator: 758 kWh
Measure Life	Not evaluated
Net-to-Gross Ratio	N/A
Process Evaluation	Yes
Previous Evaluation(s)	June 2018

Evaluation Methodology

The evaluation team performed a process and gross impact evaluation.

The process evaluation included a participant survey and interviews with participating surveys. We also performed a limited process analysis of the Durham Pilot.

The gross impact evaluation included an engineering analysis and a consumption analysis and leveraged results from the prior evaluation.

Impact Evaluation Details

- We determined annual per household energy savings for Tier II participants using consumption analysis.
- We determined annual per household energy savings for Tier I participants based on a combination of engineering analysis results and results from the prior evaluation.
- We estimated demand savings for Tier I and Tier II participants based on engineering analysis-based demand-to-energy ratios, applied to energy savings.
- We developed savings for refrigerator replacements and HVAC replacements/ upgrades through engineering analysis.
- The engineering analysis applied deemed savings values to measures distributed and in service. In-service rates were calculated based on information collected in the participant survey.

9. DSMore Table

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

DSMore - DEC Weatherization Prog

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Guidehouse

EM&V Report for the EnergyWise Home Demand Response Program

Summer PY2019

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Included as Separate Documents

Appendix C: EM&V Sample Event-Day Load Profiles

Filename: "*Appendix C - EMV Sample Plots 2020-02-14.pdf*"

Description: Includes plots of average EM&V participant profiles and baselines on the 17 EM&V event days.

Appendix D: Output Summary

Filename: "*DEP EnergyWise Appendix D - Output Summary 2020-05-19.xlsx*"

Description: Includes all modeling outputs and graphics referred to in the report below.

Appendix E: Output Summary

Filename: "*DEP EnergyWise Appendix E – Ex Ante Tool 2020-05-19.xlsx*"

Description: Excel tool to allow user to generate ex ante predictions of DR impacts per participant under varying weather conditions, operability assumptions and times of day.

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Evaluation Summary

The EnergyWise Home (EnergyWise) demand response (DR) program offers Duke Energy Progress (DEP) residential customers the opportunity to earn credits on their electricity bill by allowing DEP to remotely cycle and curtail air conditioners (A/C) during times of peak seasonal load in the summer months (available system wide) and space- and water-heating equipment in winter months (Western region customers only). This report covers the evaluation, measurement, and verification (EM&V) activities for the summer of 2019. For this evaluation, Guidehouse Inc. (Guidehouse, formerly Navigant Consulting, Inc.)[1] performed a data logger study and parallel analysis using DEP's recently deployed Advanced Metering Infrastructure (AMI) to estimate program impacts.

At the time of the final program-wide summer event of 2019, the program had nearly 187,000 participants, representing nearly 240,000 controlled appliances. DEP called two program-wide curtailment events in the summer of 2019, the first being a 30-minute full shed (100% cycling) event, and the second being a two and a half hour 65% cycling event. In addition, DEP called 17 EM&V events that were applied only to the sample of participants who were involved in the data logger study, known as the "EM&V sample". The estimated program impacts for the two program-wide events are shown in Table 1.

Table 1. Program-Wide Event Impacts

Event Date	Cycling Strategy	Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Disconnection Rate	Pop. Avg. Impact per Participant (kW)	Total Program Impact (MW)
2019-07-02	100%	93.8	1.81	16%	11%	1.61	300
2019-07-17	65%	93.9	1.17	17%	11%	1.04	194

In addition to estimating program capability (known as "ex-ante") impacts and historical (known as "ex-post") impacts for the EM&V events and program-wide curtailment events, a key objective of this evaluation was a comparison of the data logger and participant AMI data for the purposes of evaluation. The approach to this task and the results of this analysis are reported below.

Evaluation Methods

Guidehouse used three core components for the evaluation approach:

- Sample Selection and Experimental Design
- EM&V Regression Estimation
- Comparison of AMI and Logger-Estimated Impacts

[1] Guidehouse LLP completed its acquisition of Navigant Consulting, Inc. and its operating subsidiaries on October 11, 2019. For more information, see: https://guidehouse.com/news/corporate-news/2019/guidehouse-completes-acquisition-of-navigant

Sample Selection and Experimental Design

The estimated impacts presented in this evaluation report are based on a sample of participants from the overall population that agreed to have data loggers installed so that each curtailed A/C unit's consumption could be monitored in isolation of the rest of the household load. This sample of participants was also subjected to more EM&V events than the overall population to provide Guidehouse with more data points from which impacts could be estimated.

A key feature of this evaluation is the parallel analysis undertaken by Guidehouse of the EM&V sample using both logger and AMI data. Guidehouse's goal was to produce two analyses that were virtually identical, differentiated only by the input data used: quarter-hourly logger data, or quarter-hourly AMI data. By eliminating all differences except for the input data for the dependent variable, Guidehouse's goal was to isolate only those differences that were due to the different data sources.

As in all previous evaluations since 2016, Guidehouse worked with DEP to carefully select EM&V events to maximize the value of information they provided for the estimation of program capability and used a robust experimental design to ensure estimates of impacts are unbiased. In this case the experimental design requires that for any given EM&V event only half of the EM&V sample are curtailed, ensuring a contemporaneous control group for all events.

EM&V Regression Estimation

As in previous years, impacts were estimated through the use of panel data fixed-effects regression. Guidehouse took great care in preparing the analytical work to eliminate any differences between the analysis applied to the EM&V participants' logger data and their AMI data. An observation of demand for a given point in time was included only if it was available in both data sets, and the regression specification applied to both data sets is identical. The estimation data sets are of identical dimensions.

Comparison of AMI and Logger-Estimated Impacts

Guidehouse compared impacts estimated using both sets of data closely. When differences were observed, despite being statistically non-significant, Guidehouse carefully considered the relative benefits of the two sources of data, and concluded that—for the purposes of evaluating the overall program impacts and capability—the AMI data are more suitable.

In considering the two data types, and the relative advantages each of them offer and the fact that the estimated impacts derived from both sources of data are very similar, Guidehouse has concluded that:

- **AMI data delivers more accurate impacts.** It is likely that for this evaluation the AMI-estimated impacts drawn from the EM&V sample of participants are a more accurate reflection of the average impact per participant than those derived from the logger data (since AMI data tracks true power and accounts for any secondary effects, such as the use of fans to provide additional cooling during events).
- **AMI data are much less costly to collect than logger data.** DEP could reduce future evaluation costs by not deploying data loggers in years in which an empirical analysis is required, and instead use the data provided by the existing (and continually expanded) AMI network.

Finally, in addition to the above, Guidehouse undertook an ad hoc analysis of DEP system load data to compare with estimated population impacts derived from the EM&V sample's AMI data. Guidehouse's simplified system load analysis appears to validate the EM&V estimation, delivering an estimated impact of 296 MW for the July 2 full shed event, very close to the estimated 300 MW delivered by the parameters estimated using the EM&V sample's AMI data.

Findings and Conclusions

The principal EM&V findings and conclusions regarding the summer event demand impacts for PY2019 are as follows:

- **AMI data will provide a more accurate estimate of program impacts.** Logger data obtained from outdoor loggers that do not monitor true power but rely on spot measurements of compressor power factor will not match the accuracy delivered by the AMI network. Furthermore, there may be other event-related impacts not captured by outdoor loggers such as supplemental cooling by non-controlled HVAC equipment (window AC units) or changes in AHU fan runtime. Guidehouse recommends that future evaluations be undertaken using AMI data.

- **Estimated impacts for 100% cycling population event are in line with previously estimated per participant program capability.** Guidehouse has estimated that the average per participant impact during the program population 100% cycling event was 1.61 kW (approximately 1.26 kW per A/C unit curtailed). This is consistent with the predicted capability delivered by the "Ex Ante Tool" (Appendix B of the Summer 2018 evaluation) which predicts an average demand impact of 1.51 kW when the disconnection rate, event temperatures and times are applied to that tool.

- **The 100% cycling (full load shed) population event delivered approximately 300 MW of demand response.** The average temperature during this event was approximately 94°F . The participant average impact of 1.61 kW multiplied by the 186,285 participants enrolled at the time delivers 300 MW. An additional validation exercise carried out with system-level minute-by-minute data provides an estimated system impact for this event of 296 MW (see Appendix B).

- **Estimated impacts for the 65% cycling population event are in line with previously estimated per participant program capability.** The average temperature during this event was approximately 94°F. Guidehouse has estimated that the average per participant impact during the program population 65% cycling event was 1.04 kW (approximately 0.81 kW per A/C unit curtailed). This is approximately 7% lower than the impact delivered by the "Ex Ante Tool" referred to above, well within the band of relative precision (+/- 17%) for this estimate.

- **The estimated program capability at design criteria temperature (100°F) for a connected switch is 1.44 kW per participant when applying 65% cycling and 2.29 kW per participant when applying 100% cycling.** On a per A/C unit basis, these estimates are 1.12 kW (65% cycling) and 1.79 kW (100% cycling). These values must be de-rated by the assumed disconnection rate of 11% before scaling them to the participant population size. This derating results in a capability of 1.28 kW per participant when applying 65% cycling and 2.04 kW when applying 100% cycling. Caution must be exercised when using these values as they consist of predictions outside the range of temperatures observed in the summer of 2019, in which the highest event temperature was 96°F. These impacts, as with all those included in this report, are at the meter, and do not account for losses.

- **A strong experimental design and rigorous regime of test events are crucial to delivering robust estimates of program capability.** Analysis in Appendix B demonstrates the importance of an experimental design, a carefully selected estimation sample, and a large diversity of test events for obtaining accurate estimates of program capability. The benefits of this approach are demonstrated by contrasting the EM&V estimates of population impacts with estimated impacts derived from overall system demand.

All impacts provided in this report should be considered at the meter and should be scaled up by the appropriate loss factor when, for example, determining avoided cost benefits for cost-effectiveness testing.

1.0 Introduction

The EnergyWise program provides residential customers the opportunity to earn credits on their electricity bill by allowing DEP to remotely cycle and curtail air conditioning (in the summer) and water heater and heat pump auxiliary heating strips (in the winter, Western region customers only) during times of seasonal peak load. This report covers the evaluation, measurement and verification (EM&V) activities for the summer of 2019. At the time of the final program-wide summer event of 2019, nearly 187,000 customers were participating in the AC curtailment program, representing nearly 240,000 controlled appliances.

EM&V is a term adopted by DEP and refers generally to the assessment and quantification of the energy and peak demand impacts of an energy efficiency or DR program. For DR, estimating reductions in peak demand is the primary objective, as energy impacts are generally negligible. EM&V also can encompass an evaluation of program processes and customer feedback typically conducted through participant surveys. The summer PY2019 EM&V cycle did not include a process evaluation.

DEP has been deploying residential AMI since late 2017. Certain geographic areas within the DEP service territory received AMI earlier than others. When this evaluation began in the early summer of 2019, about half of the EnergyWise participants were equipped with AMI. A key objective of this evaluation was to leverage data from the new AMI to calculate DR impacts for comparison with data loggers deployed by Guidehouse.

Guidehouse estimated impacts using quarter-hourly AMI data from a sample of 87 participating households (the EM&V sample), which also received data loggers installed by Guidehouse staff. Participating households were split randomly into two separate samples, and only one group was curtailed for each of the 17 EM&V events called by DEP throughout the summer. These groupings are referred to as Group A and Group B throughout this report. In 2019, the overall EnergyWise program population was subject to two DR events.

1.1 Objectives of the Evaluation

This EM&V report is intended to support program improvements and to verify program impacts as per the requirements established by the North Carolina Utilities Commission and the Public Service Commission of South Carolina.

The key objectives for the impact analysis conducted as part of this evaluation were identified in Guidehouse's evaluation plan; these include the following:

- **Logger Data Analysis.** Guidehouse has estimated the ex-post (actual event) and the ex-ante (projected capability under a range of temperatures) DR impacts of the EM&V sample using data collected by data loggers deployed by Guidehouse for the summer of 2019. Event-level impacts are presented in this report, and quarter-hourly impacts are included in Appendix E, an Excel spreadsheet attached as a separate document.
- **AMI Data Analysis.** Guidehouse has estimated the ex-post and ex-ante DR impacts of the EM&V sample using whole-house AMI data. Event-level impacts are presented in this report, and quarter-hourly impacts are included in Appendix E, an Excel spreadsheet attached as a separate document.
- **Comparing Impacts.** Guidehouse has compared the two sets of estimated impacts, discussed the differences between them, identified which data series is most appropriate for ongoing EM&V, and supported this assertion with evidence from some ancillary analysis.

- **Snapback Impacts.** Guidehouse has estimated the snapback impacts of events and presented them below in the same format as in previous evaluations. Quarter-hourly estimates of snapback impact are included in Appendix E, an Excel spreadsheet attached as a separate document.
- **Providing a clear technical description of the analytic approach.** A detailed description of the approach Guidehouse used may be found in Appendix E. This is most suitable for technical reviewers or those interested in reproducing the analysis. A higher-level description of Guidehouse's approach may be found in Chapter 2.0 of this report.

Guidehouse also performed an additional task to help validate the estimated program capability derived from the EM&V sample. DEP provided Guidehouse with high-frequency system demand data as well as AMI data for the EnergyWise participants for whom such data are available. These sets of data have been used to develop an ad hoc "top-down" validation procedure intended to provide readers with greater confidence in the magnitude on Guidehouse's estimated impacts. The approach and results of this analysis may be found in Appendix B.

1.2 Program Overview

The EnergyWise program was developed in response to DEP's determination that a curtailable load program would be a valuable resource for the company, and that it would provide an opportunity to engage directly with customers to help reduce costly seasonal peak demand. The program seeks to attract DR resources by providing incentives to residential customers to allow DEP to remotely cycle and curtail the most important driver of summer peak demand typically found in the home: central air conditioning.

The program offers an annual bill credit of $25 (per appliance type controlled) to customers that choose to allow DEP to cycle their central air conditioners (summer only), electric auxiliary heat strips, and/or water heaters (winter only).

Eligibility. To be eligible for participation in the summer component of the EnergyWise program, a household must meet the following criteria:

- Participants must occupy the residence where the controls are installed. Renters must complete a Tenant Authorization Form and the landlord/property owner must approve.
- Residential electricity service must be in the name of the participant, and the participant must be subject to an approved residential rate.
- Participants must be in an area that can receive the EnergyWise Home paging signal.
- Participation also requires that participants have electric central air conditioning or a centrally ducted heat pump.

Incentives. Each participant receives a $25 yearly bill credit upon joining the summer program, and then an additional $25 bill credit every 12 months they remain on the program.

Marketing. DEP is responsible for all marketing of the EnergyWise program. Participant enrollments are generated through a mix of direct mail, bill inserts, email, outbound calling, and door-to-door canvassing.

1.3 Reported Program Participation

This section reports the overall program participation for the summer EnergyWise program in the summer of PY2019. In total, approximately 186,285 individual customers participated in the 100% full shed test event on July 2, and 186,844 individual customers participated in the 65% event on July 17. The date, time, and length of each event and other characteristics are provided in Table 1-1.

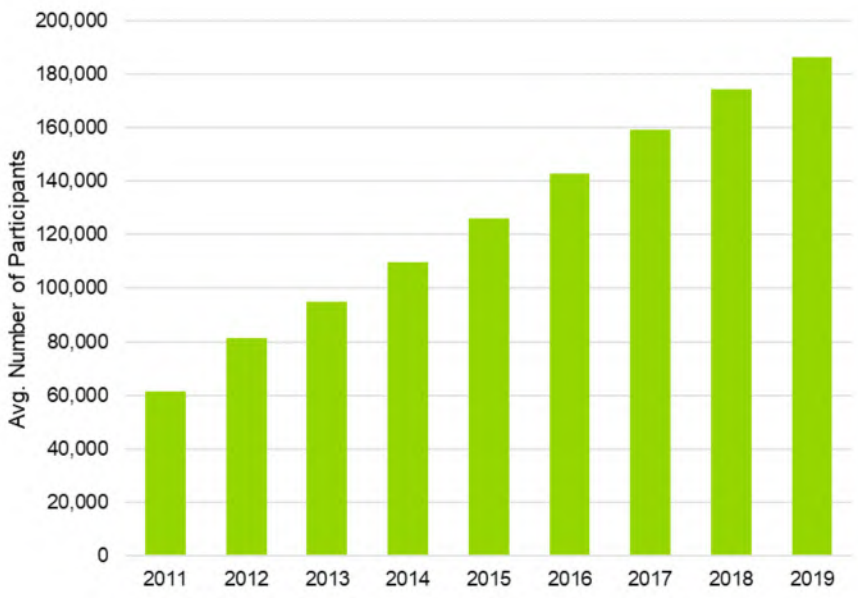
Table 1-1. Overall Summer PY2019 Program Participation by Event

Date	Start Time	End Time	Event Length (Hours)	Number of Participants	Number of A/C Units	Cycling Strategy	Temperature (ºF)
2019-07-02	16:30	17:00	0.5	186,285	238,588	100%	94
2019-07-17	15:30	18:00	2.5	186,844	239,323	65%	94

Source: DEP

Since 2011, program growth has been stable and consistent at approximately 15,000 incremental participants joining per year (see Figure 1-1).

Figure 1-1. Historical EnergyWise Summer Participation



Source: DEP

Altogether the 186,844 participants that were enrolled for the last event of 2019 have a total of 239,323 central air-conditioning units enrolled, or approximately 1.28 per participant. This ratio has not changed meaningfully over time; in the first year Guidehouse evaluated this program there were approximately 1.3 enrolled central air conditioners enrolled for each participant, a statistically identical value to that in PY2019.

2.0 Evaluation Methods

This chapter of the evaluation report provides a description of the approaches used to conduct the impact evaluation. Additional technical details of the approach used may be found in Appendix A.

Guidehouse estimated demand reduction and snapback impacts using a fixed effects regression analysis applied to participant interval data (logger and AMI data), weather data, and data flags indicating the intervals in which events took place. The remainder of this chapter details the data and the econometric method used in the analysis. Appendix A provides further discussion of the regression models used.

This chapter is divided into three sections:

- **EM&V Sample Participants and Events.** This section describes the sample of participants exposed to the EM&V events, and the timing and temperatures associated with those events.
- **Data Used for Impact Evaluation.** This section describes the data used to estimate impacts and, where relevant, how it was collected.
- **Method for Estimating Capability and Impacts.** This section describes the empirical approach used by Guidehouse to estimate the relationship between event periods and event impacts required to deliver ex-ante (capability) and ex-post (historical) impacts.

2.1 EM&V Sample Participants and Events

The estimated impacts presented in this evaluation report are based on the AMI data from a sample of participants from the overall population that also agreed to have data loggers installed so that each curtailed device's consumption could be monitored in isolation of the rest of the household's demand. This sample of participants was also subjected to more events than the overall population to provide Guidehouse with more data points from which impacts could be estimated.

Altogether, Guidehouse obtained useable logger data from 87 participating homes with controlled AC units (out of 104 homes at which loggers were installed).[2] In addition to logger data, Guidehouse was provided with quarter-hourly AMI data for these participating homes to allow the parallel analysis described below.

A key feature of this evaluation is the parallel analysis undertaken by Guidehouse of the EM&V sample using both logger and AMI data. Guidehouse's goal was to produce two analyses that were virtually identical, differentiated only by the input data used: quarter-hourly logger data, or quarter-hourly AMI data. By eliminating all differences except for the input data for the dependent variable, Guidehouse's goal was to isolate only those differences that were due to the different data sources. This is discussed in greater detail below.

Guidehouse randomly allocated each EM&V participant site to one of two groups: Group A and Group B. This enabled a randomized control trial (RCT) experimental design, where when one group is subject to curtailment, the other is not. This means that only event days needed to be included in the analysis. Guidehouse then randomly assigned participants to one group or the

[2] The data for the remaining homes was discarded during the QC process for a variety of reasons, including logger failure, significant gaps in data, and several A/C units that had been replaced during the duration of the study.

other by using summer energy usage strata. The purpose of this approach (discussed in greater detail below) was to improve estimation accuracy.

A key concern of DR evaluations when all participants are subject to the same events is that there remain some non-event days that sufficiently resemble (in terms of temperature and other factors) the event days. This is required to allow for the estimation of a robust baseline. One problem with this approach is that often events are highly correlated with extreme weather events, meaning that baselines are often projected out of sample (i.e., baselines are predicted over temperature conditions that may not actually have been observed on non-event days).

Subjecting only half of all EM&V participants to each event ensures the existence of event-like, non-event days in the sample and provides additional information (from the non-curtailed devices) that helps estimate the counterfactual event demand (the baseline). These factors improve model accuracy by substantially reducing the likelihood of model specification bias compared to a purely within-subject approach.

EM&V participants were subjected to 17 DR events, Seven for Group A, 10 for Group B. The date, time, event length, EM&V group controlled, appliances controlled, and mean event temperature (in °F) are shown in Table 2-1.

Table 2-1. Air Conditioner EM&V Sample Participation

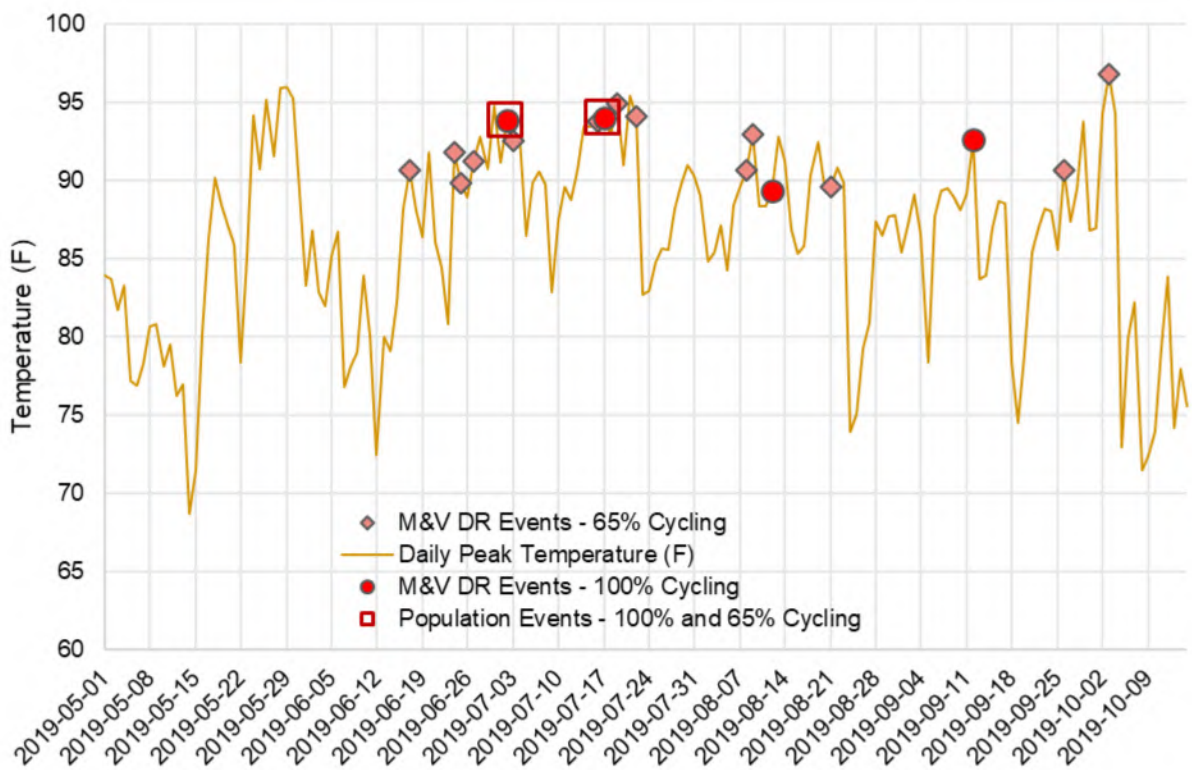
Date	Start Time	End Time	Event Length (Hours)	Number of Participants	Number of A/C Units	Cycling Strategy	Temperature (°F)	M&V Group
2019-06-17	16:00	18:00	2	44	58	65%	90	A
2019-06-24	17:00	19:00	2	42	55	65%	92	A
2019-06-25	16:00	18:00	2	40	56	65%	89	B
2019-06-27	16:00	18:00	2	40	56	65%	91	B
2019-07-02	16:30	17:00	0.5	43	59	100%	94	B
2019-07-03	16:00	18:00	2	44	58	65%	92	A
2019-07-16	16:00	18:00	2	43	59	65%	90	B
2019-07-17	16:30	17:00	0.5	44	58	100%	94	A
2019-07-19	16:00	18:00	2	44	58	65%	94	A
2019-07-22	16:00	18:00	2	43	59	65%	92	B
2019-08-08	17:00	19:00	2	42	58	65%	90	B
2019-08-09	17:00	19:00	2	42	55	65%	93	A
2019-08-12	16:30	17:00	0.5	42	58	100%	87	B
2019-08-21	16:00	18:00	2	39	54	65%	89	B
2019-09-12	16:30	17:00	0.5	40	53	100%	92	A

Date	Start Time	End Time	Event Length (Hours)	Number of Participants	Number of A/C Units	Cycling Strategy	Temperature (°F)	M&V Group
2019-09-26	17:00	19:00	2	37	52	65%	89	B
2019-10-03	17:00	19:00	2	35	50	65%	96	B

Sources: Guidehouse logger data, DEP event schedule data, and National Oceanic and Atmospheric Administration (NOAA) temperature data

Figure 2-1 illustrates the timing of the EM&V and population events across the summer. The daily peak temperature is shown as the yellow line. EM&V events are indicated by pink diamonds (65% cycling events) or red circles (100% cycling). The two population events are indicated by the transparent red squares.

Figure 2-1. Timing and Temperature of EnergyWise DR Events



Sources: DEP event schedule data and DEP-provided temperature data

2.2 Data Used for Impact Evaluation

The impact evaluation made use of four sources of data:

- **Logger data.** Five-minute interval logger data from loggers connected to each participating HVAC unit in an EM&V participant's home. These data were aggregated to quarter-hourly frequency for the analysis.
- **AMI data.** Quarter-hourly interval AMI data from EM&V participants' AMI meters.

- **Event scheduling data.** The schedule of events deployed to the program population and the EM&V groups.
- **Weather data.** DEP provided hourly weather data to ensure the impact analysis weather data are consistent with the weather DEP uses for load forecasting. The weather file contains timeseries dry bulb temperature data for multiple cities in the service territory. DEP provided a set of weights for each city which Guidehouse used to average the temperature into a single dataset. To align the data with the logger and AMI datasets which are both at 15-minute intervals, Guidehouse interpolated the hourly weather to quarter-hourly values, assuming the value in each hour was recorded at 15 minutes past the hour.

In May 2019, Guidehouse installed loggers on 133 outdoor AC compressors at 104 participant homes. The field technicians enclosed the data loggers inside the AC unit's electronics access panel. The data loggers were set to log at 5-minute intervals and remained in the field from mid-May through mid-October, or approximately 5 months.

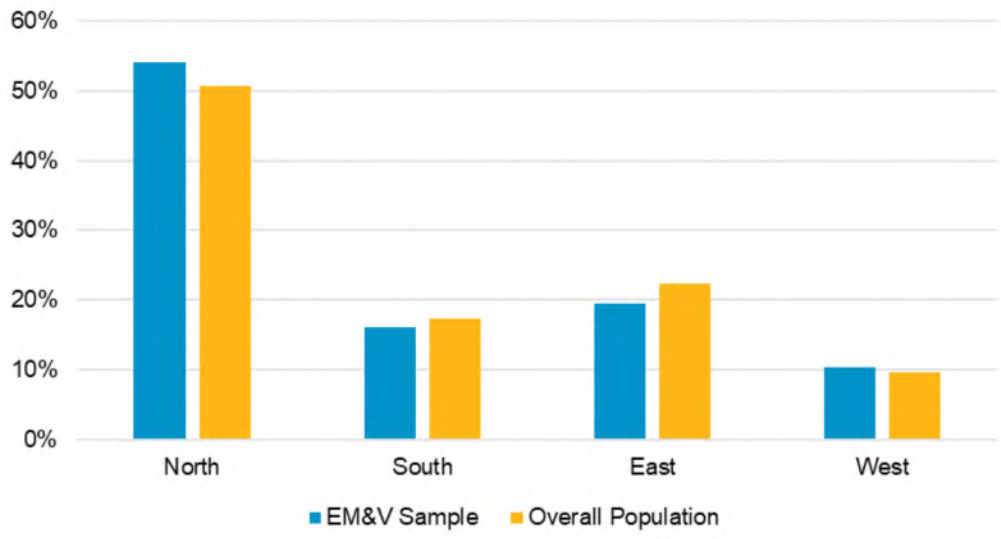
Data logger installers visited 121 residences during the deployment of the data loggers. Of these:

- There were two sites at which data logger installation was not possible due to poor access, no accessible disconnecting means, impending AC replacement planned, etc.
- There were 15 sites (each with a single EnergyWise switch) at which the switch that controls equipment cycling was either non-functional or disconnected. Based on the 135 switches inspected and the discovery of the 15 non-functioning switches (that were not logged), this delivers an operability rate of 88.9%.[3] This value has been applied to aggregate program-level savings values included in this report.

The selection of EM&V participants was made to ensure that the sample had a reasonably representative mix of number of appliances controlled, that the sample was geographically representative of the participant population, and that all EM&V participants had AMI data available to enable the comparative analysis described below. Figure 2-2 shows the geographic distribution by DEP region of the EM&V sample (yellow columns) and the overall population (blue columns).

[3] This operability rate is lower than in 2016 when the study was last conducted. Anecdotally there were a number of switches that were disconnected due to AC replacements, which may have been due to flooding and other damage caused by hurricanes or other storms that have occurred since the 2016 study took place, especially Florence in 2018 which saw widespread flooding.

Figure 2-2. Geographic Distribution of EM&V Sample and Population



Source: Guidehouse analysis

2.3 Method for Estimating Capability and Impacts

As noted above, a distinguishing feature of the summer 2019 evaluation is the parallel analysis applied to EM&V participant logger and AMI data. This analysis was structured by Guidehouse such that any differences in estimated impacts would be attributable only to qualities of the input data themselves. As such, when pursuing the two analyses, Guidehouse ensured that:

- The model specification (i.e., the regression equation) applied to both the AMI and logger data was identical.
- The time series for each participant was identical across both series. That is, an observation for a given participant in a given quarter hour was only included in the logger data estimation set when it was also present in the AMI data set, and vice versa.

Guidehouse used an econometric technique known as a fixed effects regression to estimate the impacts of the devices curtailed. Fixed effects regression is a form of linear regression commonly used to estimate the impact of DR programs. The technique is applied to a set of observations of some variable of interest (in this case electricity demand) from several different individuals (i.e., program participants)—also known as longitudinal or panel data—over time.

Fixed effects regression assigns each individual appliance its own dummy variable. In this way, Guidehouse may control for each individual's time-invariant characteristics such as the size of a participant's home, its orientation, etc. The fixed effects regression equation was estimated twice; once using the logger data, once with the AMI data.

EM&V events with two different cycling strategies were deployed in the summer of 2019. There were four 100% cycling events (30 minutes each), and thirteen 65% cycling events (two hours each). A separate regression was estimated for each of the two types of event. Event impacts were estimated as a function of the quarter-hour of the day in which the event took place and the 3-hour exponential moving average of cooling degree quarter hours. Impacts are estimated as a function of temperature in order that program capability can be projected for any given set of temperatures.

Formal model specifications with additional input variable detail may be found in Appendix A of this report.

All estimates of uncertainty presented in this report are derived from standard errors that have been clustered at the individual participant level.

3.0 Impact Findings

The discussion of program impacts on winter demand is divided into the following sections:

1. **Comparison of AMI and Logger-Estimated Impacts.** This section provides graphics demonstrating the quality of the baseline estimated using both AMI and logger data, compares the estimated impacts derived from each set of data, notes the differences, provides a reasonable hypothesis for explaining these differences and concludes by recommending which data set is likely to deliver impacts that are more accurate.
2. **Historical (Ex-Post) Impacts.** This section provides the estimated impacts of A/C curtailment during the 17 EM&V events as well as the two population events.
3. **Forecast Curtailment Capability.** This section provides the estimated DR capability of A/C curtailment across a variety of different temperatures.
4. **Net-to-Gross.** This section outlines why the appropriate net-to-gross factor for this program should be 1.

All impacts reported in this chapter should be considered “at the meter” and should be scaled up by the appropriate loss factor when, for example, determining avoided cost benefits for cost-effectiveness testing.

3.1 Comparison of AMI and Logger-Estimated Impacts

Historically, ex-post and ex-ante EnergyWise demand response impacts have been estimated using data collected from data loggers deployed to a representative sample of participating households (see Section 2.2). With the recent availability of AMI data for some participants, DEP requested that Guidehouse continue to select an EM&V sample (so that a relatively large number of test events could be called), deploy data loggers, but also collect AMI data. Guidehouse then produced side-by-side estimates using both sets of data to help DEP understand what the potential implications could be if future evaluations were to be undertaken with AMI data only. As noted in Section 2.3, Guidehouse explicitly designed the estimation process so as to ensure that the only difference between the two analyses was the data used in the estimation.

Note that all the impacts presented in this section are the directly estimated impacts from the two data sources, and do not reflect two important adjustments that are applied in order to scale EM&V sample per-participant impacts to the population: the disconnection rate (Guidehouse does not deploy loggers to homes where it is found that the load switch has been disconnected) and the average number of controlled appliances per home (on average participants in the EM&V sample have 1.36 controlled appliances each, whereas the average program participant in the program as a whole has 1.28 controlled appliance).

This section is divided into four sub-sections:

1. Comparison of 65% Cycling Impacts
2. Comparison of 100% Cycling Impacts
3. Identifying the Most Appropriate Data for Analysis: Logger vs. AMI
4. Recommendations for this and Future Evaluations

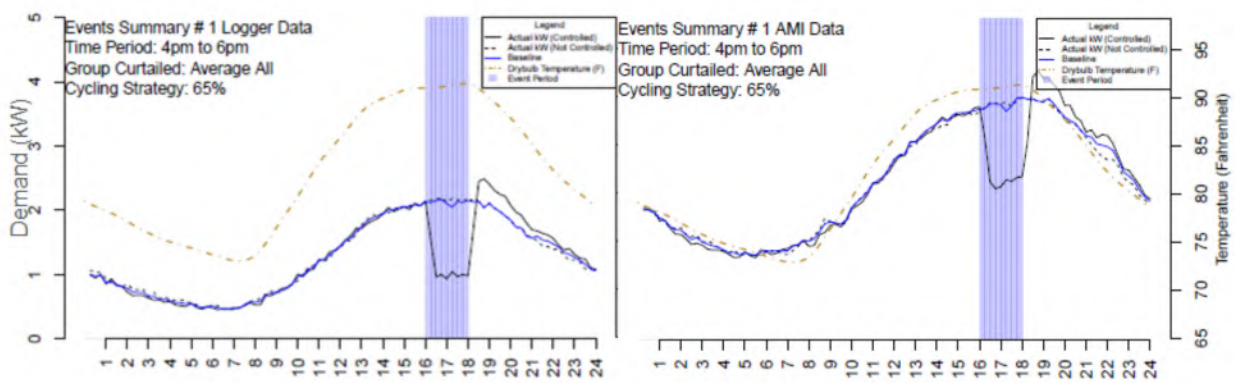
3.1.1 Comparison of 65% Cycling Impacts

For the 65% cycling events, both AMI and logger data appear to be delivering strong baselines, as may be seen in Figure 3-1.

This figure provides two plots. The profile and baseline on the left is derived from participant logger data, and the profile and baseline on the right is derived from participant AMI data. Both plots show the average observed demand of curtailed participants (black solid line) and of un-curtailed participants (black dotted line). Also shown by the blue solid line is the estimated counterfactual demand from curtailed participants—the baseline. This is the demand predicted by the regression-estimated model parameters under the assumption that no event takes place. The average difference between these two lines delivers the estimated impact. These three lines are all read against the left axis, which shows average kW. The dark yellow dashed line shows the average dry bulb temperature in each period in Fahrenheit, and is read against the right axis.

The difference in magnitude between the streams of data is that the logger data on the left-hand side of the figure above shows only the demand from the controlled (curtailed) A/C compressors in EM&V participant households, whereas the graph on the right shows the demand used by the whole home.

Figure 3-1. Baselines and Load Profiles – 65% Cycling



Sources: Guidehouse logger data, DEP EnergyWise participant AMI data, DEP event schedule data, DEP-provided temperature data, and Guidehouse analysis

Plots for each event individually, for both logger and AMI data analyses may be found in Appendix C, in a separate document.

The average estimated impact of the thirteen 65% EM&V cycling events delivered by the AMI data is 1.12 kW, with a relative precision of +/-17.06%. The relative precision indicates that the 90% confidence interval that surrounds the point estimate of 1.12 kW extends from 0.93 kW to 1.32 kW.[4]

The average estimated impact of the same thirteen EM&V events delivered by the logger data is 1.04 kW, approximately 6.8% less than that delivered by the AMI data. The relative precision of

[4] As per the requirements of the DOE's Universal Methods Project for evaluation with panel data, all standard errors are clustered at the individual participant level.

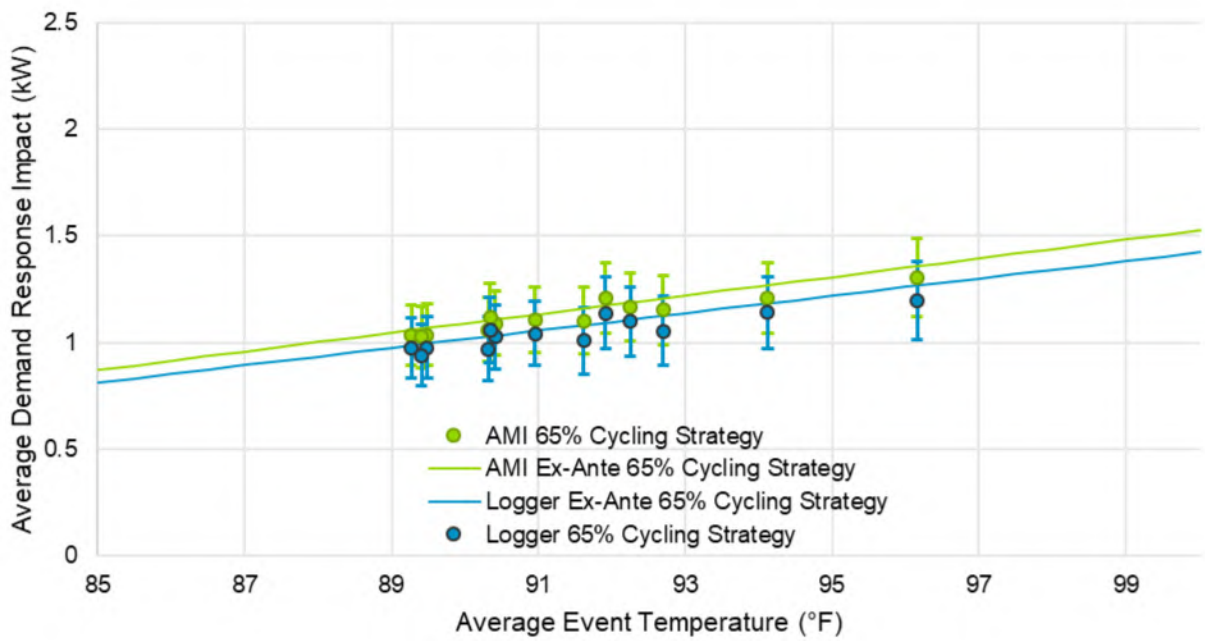
U.S. Department of Energy, *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures January 2012 – September 2016,* August 2018

the logger data estimate is +/- 14.98%, meaning that the 90% confidence interval that surrounds the point estimate of 1.04 kW extends from 0.89 kW to 1.2 kW.

The difference between the two sets of average impacts is not statistically significant at the 90% level of confidence. This means that we cannot reject the hypothesis that there is no difference between the two sets of estimated values. The proximity of the results and their confidence intervals are shown in Figure 3-2.

In this graph, the ex-post impact/event temperature pairs are represented by blue (logger data) and green (AMI data) circle markers. The whiskers represent the 90% confidence interval around each estimate, and the lines running through the markers represent the ex-ante predictions for the series of temperature values shown in the x-axis.

Figure 3-2. Comparison of 65% Cycling Impacts, AMI vs. Logger Data



Sources: Guidehouse logger data, DEP EnergyWise participant AMI data, DEP event schedule data, DEP-provided temperature data, and Guidehouse analysis

As shown above, the distance between the two sets of estimates is very small, and the confidence intervals of the ex-post estimates show considerable overlap, indicative of the statistical non-significance of the difference highlighted above.

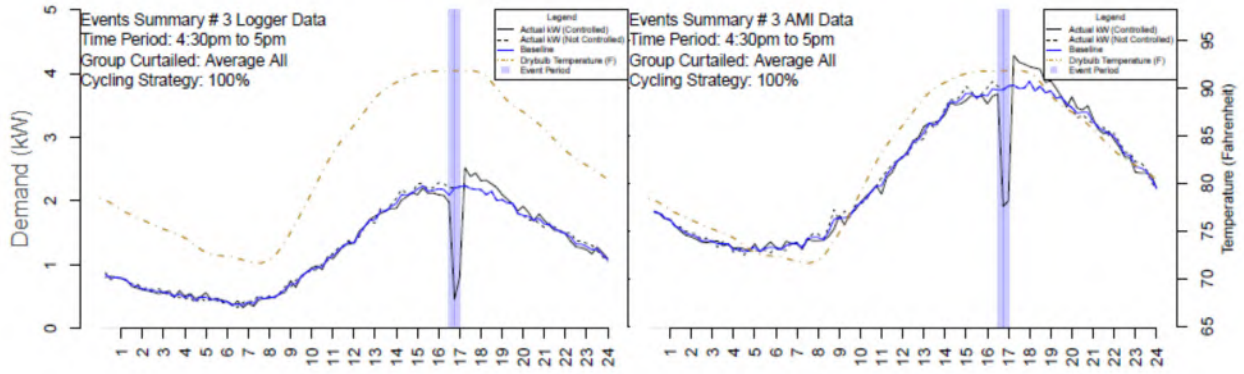
3.1.2 Comparison of 100% Cycling Impacts

For the 100% cycling events, both AMI and logger data appear to be delivering strong baselines, as seen in Figure 3-3.

This figure provides two plots. The profile and baseline one the left is derived from participant logger data, and the profile and baseline on the right is derived from participant AMI data. As above, both plots show the average observed demand of curtailed participants (black solid line) and of un-curtailed participants (black dotted line), as well as the estimated baseline (blue line) and the temperature (yellow dashed line, read off the right-hand axis).

The difference in magnitude between the streams of data is that the logger data on the left-hand side of the figure above shows only the demand from the controlled (curtailed) A/C compressors in EM&V participant households, whereas the graph on the right shows the demand used by the whole home.

Figure 3-3. Baselines and Load Profiles – 100% Cycling



Sources: Guidehouse logger data, DEP EnergyWise participant AMI data, DEP event schedule data, DEP-provided temperature data, and Guidehouse analysis

Plots for each event individually, for both logger and AMI data analyses may be found in Appendix C, in a separate document.

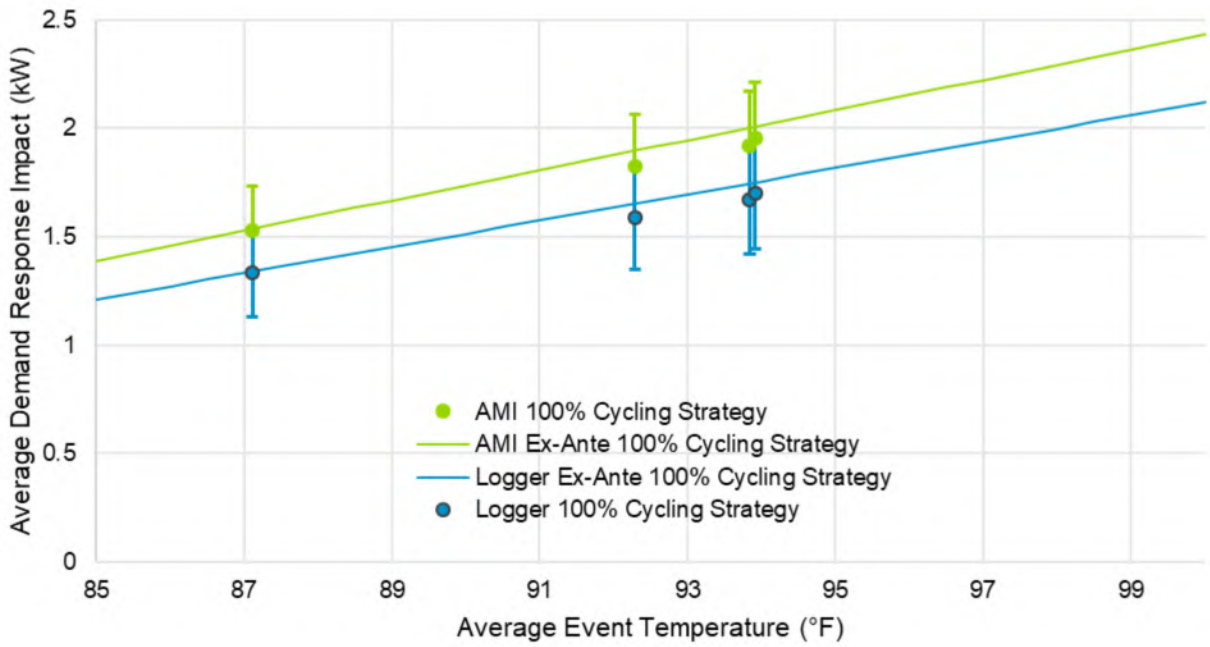
The average estimated impact of the four 100% cycling events delivered by the AMI data is 1.81 kW, with a relative precision of +/-15.7%. The relative precision indicates that the 90% confidence interval that surrounds the point estimate of 1.81 kW extends from 1.52 kW to 2.09 kW.

The average estimated impact of the same four events delivered by the logger data is 1.58 kW, approximately 12.8% less than that delivered by the AMI data. The relative precision of the logger data estimate is +/- 15.14%, meaning that the 90% confidence interval that surrounds the point estimate of 1.58 kW extends from 1.34 kW to 1.81 kW.

The difference between the two sets of average impacts is not statistically significant at the 90% level of confidence. This means that we cannot reject the hypothesis that there is no difference between the two sets of estimated values.

The proximity of the results and their confidence intervals are shown in Figure 3-4, below. In this graph, the ex-post impact/event temperature pairs are represented by blue (logger data) and green (AMI data) circle markers. The whiskers represent the 90% confidence interval around each estimate, and the lines running through the markers represent the ex-ante predictions for the series of temperature values shown in the x-axis.

Figure 3-4. Comparison of 100% Cycling Impacts, AMI vs Logger Data



Source: Guidehouse analysis

As shown above, the distance between the two sets of estimates is small, but not as small as the distance between the 65% cycling events. Although the confidence intervals of the ex-post estimates show considerable overlap, indicative of the statistical non-significance of the difference highlighted above, Guidehouse believes that the difference between the two sets of values is sufficiently material to warrant additional consideration. Often (though not always), in empirical evaluation, a non-significant result is treated as a no impact. In this case, however, despite the statistical non-significance of the difference between the two sets of impacts, the difference is substantial enough to warrant some additional consideration. The possible reason for this difference is discussed in the section that follows this one.

3.1.3 Identifying the Most Appropriate Data for the Analysis: Logger vs. AMI

Guidehouse carefully designed its parallel analysis of the logger and AMI data ensure that any differences between the estimates provided by the two sets of data could be attributable only to physical processes underlying the data, and not some artifact of the analysis itself. Despite finding that the differences between the estimated impacts derived from the two sets of data are not statistically significant, the magnitude of the absolute difference made it clear that this report should include some analysis to identify which source of data would be most appropriate for delivering evaluated impacts for PY2019, and for future evaluations of this program. Table 3-1 provides a summary of different factors that affect the results based on the source of the data (i.e., AMI vs. logger).

Table 3-1. AMI vs Logger Data by Characteristic

Characteristic	AMI Data	Logger Data	Advantage
Observed Value	AMI meters measure true power on a quarter-hourly basis.	Data loggers[5] measure amperage not true power.[6] Power values are estimates obtained by applying observed amps to spot-measurements of A/C compressor power factor.	**AMI Data.** True power is observed, vs. estimated.
Appliance Demand	AMI data measure whole-house demand. The demand of the controlled appliance cannot be observed in isolation.	Each logger provides an appliance-specific time series of demand. This enables analyses such as identifying non-response or partial response for connected devices.[7] This can be helpful to program staff as the program develops to better understand and observe technical issues associated with load switches.	**Logger Data.** With AMI data the appliance demand can only be estimated (disaggregated) not observed.
Program Impacts	AMI data measure whole-house demand, which is the combined effect of A/C curtailment (demand reductions) as well as any indirect effects (e.g., additional use of fans or window units to maintain preferred indoor temperature).	A logger data analysis considers only the appliance demand. There is a risk here that estimated impacts may not capture interactions between the appliance curtailed, and other equipment/behaviors.	**AMI Data.** If there are secondary effects impacting DR, the analysis should account for these..
Deployment and Data Collection	Data are collected automatically on an ongoing basis, and so are available at relatively low cost. Careful sampling is required, including over-sampling in some strata, as the sample of AMI-equipped participants may not be representative of the overall participant population (those with and without AMI data).	Logger deployment is very expensive. Field work is typically the single highest cost of a logger-enabled evaluation. Logger deployment (dedicated customer visits) is helpful, however, in identifying participant connectivity and operability (i.e., what portion of the population's load switch remains connected).	**AMI Data.** Though the information gathered by site visits is useful in understanding impacts, it is not sufficiently valuable to offset logger deployment costs.

To summarize, the advantage in using AMI data to estimate impacts is that:

- AMI data provides measured true power instead of an estimate of true power via logged amps and spot measurements of voltage and power factor.
- AMI data includes all loads in the home. All possible impacts are therefore taken into account in the analysis, whereas the logger data only provides estimated impacts from the primary controlled load, ignoring possible secondary effects of the event elsewhere in the home.

[5] Of the type historically deployed for the evaluation of this and other demand response programs.

[6] True power logging is more expensive and involved, so many DR evaluations utilize current transducer (CT) loggers coupled with power factor and voltage measurements. Since power factor spot measurements are only taken during logger deployment and collection (spring and fall, respectively), and compressor power factor is a function of the compressor load, spot measurements may understate A/C demand (and potentially) impacts on very hot days.

[7] In previous years' evaluations, Guidehouse has identified what proportion of A/C units (and in winter auxiliary heat strips) have failed to curtail or only partially curtailed, in response to Duke Energy's control signal.

- AMI data are much less costly to collect than logger data, though site visits for logger install can also yield useful information beyond just the logger data.

3.1.4 Recommendations for this and Future Evaluations

Given that AMI data measure true power and capture any potential secondary or offsetting effects (e.g., increased fan usage) during events, Guidehouse believes that the prudent approach for this year's evaluation is to treat the AMI data-estimated impacts as the best available estimates of demand response impacts on a per-participant basis. Given this finding along with the cost of deploying data loggers to an EM&V sample and the increasing availability to participant AMI data, Guidehouse recommends that all future evaluations of the EnergyWise home program be conducted with AMI data obtained from an EM&V sample of program participants.

Guidehouse would further recommend that DEP consider recruiting an EM&V sample of participants every year to be subjected to EM&V curtailment events, given the substantial reduction in evaluation costs from foregone fieldwork. The impacts of these EM&V events (and resulting project capability) could then be produced on either an annual basis, or processed and evaluated every 3 years (if the current triannual evaluation cycle is maintained).

This would enable DEP to better understand the evolving capability of its program in response to the changing characteristics of the program population or other exogenous events (e.g., identifying changes in estimated switch disconnection rates in response to flooding).

3.2 Historical (Ex-Post) Impacts

The ex-post impacts are the estimated impacts for the actual events that were called in the summer of 2019. This section is divided into three sub-sections.

1. **Population Event Impacts.** This sub-section summarizes the estimated program-level impacts of the two events called for the entire program population.
2. **EM&V Event Impacts.** This sub-section summarizes the estimated impacts of the 17 events called for the EM&V sample.
3. **Quarter-Hourly DR and Snapback Impacts.** This sub-section summarizes the average quarter-hourly EM&V event and snapback across the three types of events: the 65% cycling strategy events that began at 4pm and ended at 6pm, the 65% cycling strategy events that began at 5pm and ended at 7pm, and the 30-minute 100% cycling strategy events.

Note that, per the findings of Section 3.1, above, all results presented in the remainder of this chapter are derived from those estimated using EM&V participant AMI data.

3.2.1 Population Event Impacts

This sub-section provides detail regarding the average event impacts for the two events to which the entire program population was subject in the summer of 2019.

The full population of EnergyWise participants was subject to two events in the summer of 2019:

- July 2, from 4:30 to 5pm, 100% cycling
- July 17, from 3:30 to 6pm, 65% cycling

Table 3-2 summarizes the average event impact for each of these events, when extrapolated out to the population. The average temperature during both events was approximately 94°F. The population event on July 2 began at 4:30pm and ended at 5:00pm and the population event on July 17 began at 3:30pm and ended at 6:00pm.

Table 3-2. Population Event Estimated Impacts

Event Date	Cycling Strategy	Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Disconnection Rate	Pop. Avg. Impact per Participant (kW)	Total Program Impact (MW)
2019-07-02	100%	93.8	1.81	16%	11%	1.61	300
2019-07-17	65%	93.9	1.17	17%	11%	1.04	194

Source: Guidehouse analysis

Note that the 65% population event began at 3:30 pm, 30 minutes prior to the first quarter hour (4 pm to 4:15 pm) of the earliest EM&V event. There are, therefore, no quarter-hourly parameters available to deliver the impact in the period between 3:30 and 4:00 pm based on the estimated relationship between temperature and demand. Guidehouse applied the average estimated impact between 4 pm and 6 pm for this time period.

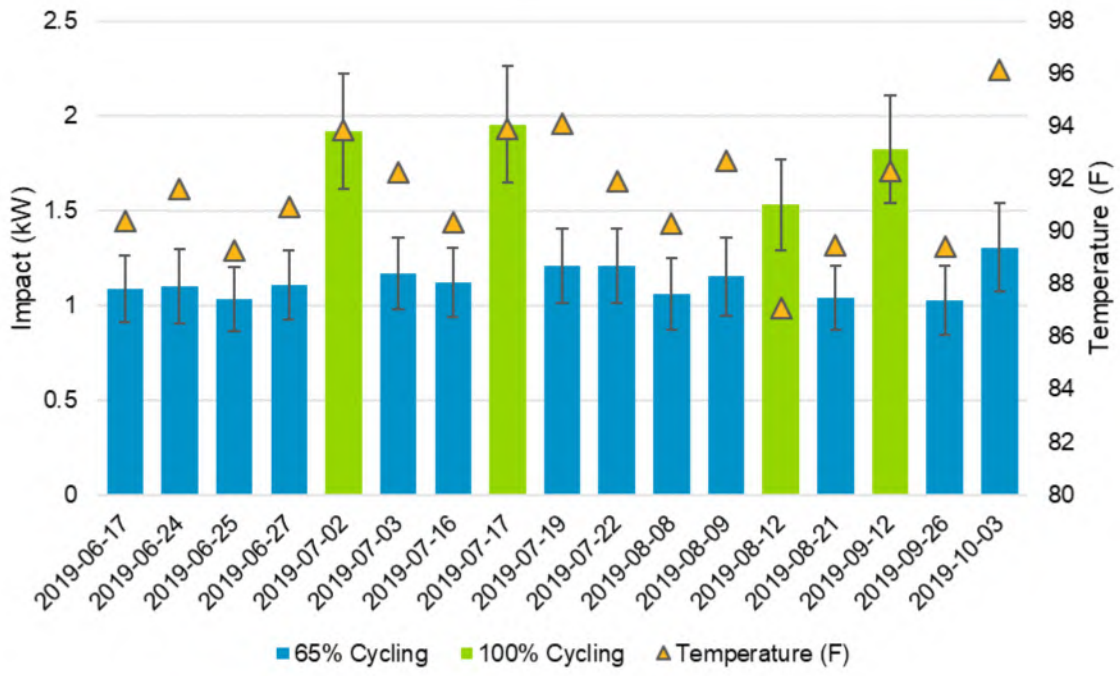
The table above reflects two key adjustments made to the estimated per-participant impact. One impact is explicit in that table—the adjustment to reflect the disconnection rate described in Section 2.2. The other is implicit and, when applied, delivers the estimated values included in the "Impact Per Participant (kW)." Guidehouse has, when using the EM&V sample impacts for projecting population impacts, scaled them to reflect the difference in the average number of controlled A/C units per participant. In the EM&V sample there are an average of approximately 1.36 controlled A/C units per participant. In the population as a whole, however there are only an average of approximately 1.28 controlled A/C units per participant.[8] The impacts in the "Impact Per Participant (kW)" reflect this adjustment. Accounting for the average of 1.28 controlled A/C units per participant, the average 100% cycling event impact of 1.61 kW per participant becomes 1.26 kW per A/C unit, and the average 65% cycling event impact of 1.04 kW per participant becomes 0.81 kW per A/C unit.

3.2.2 EM&V Event Impacts

Figure 3-5 provides a graphical summary of the estimated DR impact of A/C curtailment for all 17 of the events in the summer of 2019. Each vertical bar represents the average estimated event impact of either a 65% cycling event (blue bars) or a 100% cycling event (green bars). The 90% confidence interval is identified by the whiskers, and the yellow triangles (to be read off the right axis) identify the average event dry bulb temperature.

[8] The inputs required to replicate this value may be found in Appendix E attached as a separate document.

Figure 3-5. Average Event Impacts by Cycling Strategy



Source: Guidehouse analysis

Note that none of these impacts (nor those in the tabular summary shown in Table 3-3) have been adjusted to reflect the estimated disconnection rate or the population average number of A/C appliances per household.

The results shown above in Figure 3-5 are also summarized in a tabular fashion in Table 3-3. Note that there are three distinct type of event:

- 4 pm to 6 pm 65% cycling events
- 5 pm to 7 pm 65% cycling events
- 4:30 pm to 5 pm 100% cycling events

The values included in Table 3-3, as well as the graphic above may be found in the spreadsheet Appendix E, attached as a separate document.

Table 3-3. Average Event Impacts

Event Date	Start Time	End Time	Cycling Strategy	Estimated Impact (kW)	Relative Precision +/-% (90% Confidence)	Temperature (°F)
2019-06-17	16:00	18:00	65%	1.09	16.3%	90
2019-06-24	17:00	19:00	65%	1.10	17.9%	92
2019-06-25	16:00	18:00	65%	1.03	16.2%	89
2019-06-27	16:00	18:00	65%	1.11	16.2%	91
2019-07-02	16:30	17:00	100%	1.92	15.7%	94
2019-07-03	16:00	18:00	65%	1.16	16.2%	92
2019-07-16	16:00	18:00	65%	1.12	16.3%	90
2019-07-17	16:30	17:00	100%	1.95	15.7%	94
2019-07-19	16:00	18:00	65%	1.21	16.2%	94
2019-07-22	16:00	18:00	65%	1.21	16.3%	92
2019-08-08	17:00	19:00	65%	1.06	17.9%	90
2019-08-09	17:00	19:00	65%	1.15	17.9%	93
2019-08-12	16:30	17:00	100%	1.53	15.7%	87
2019-08-21	16:00	18:00	65%	1.04	16.2%	89
2019-09-12	16:30	17:00	100%	1.82	15.7%	92
2019-09-26	17:00	19:00	65%	1.03	17.9%	89
2019-10-03	17:00	19:00	65%	1.31	17.9%	96

Source: Guidehouse analysis

These results may be further summarized by averaging them by type of event (cycling strategy and time span). This coarser summary is provided in Table 3-4. As noted above, these impacts have not been adjusted for the estimated disconnection rate or to reflect differences in the average number of A/C units curtailed per participant between the EM&V sample and the population. Rather these reflect the estimated values derived directly from the EM&V sample's AMI data.

Table 3-4. Average Impact by Type of Event

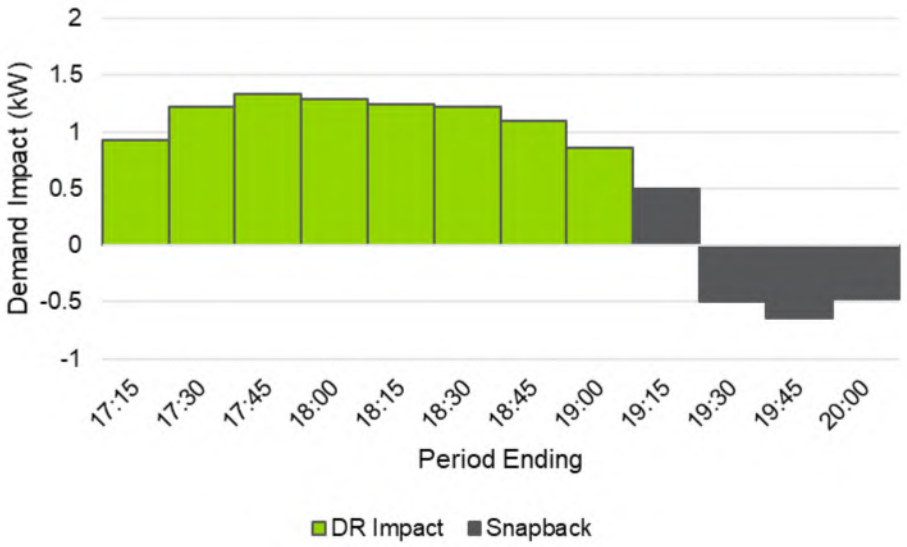
Number of Events	Start Time	End Time	Cycling Strategy	Estimated Impact (kW)	Relative Precision +/-% (90% Confidence)	Temperature (ºF)
8	16:00	18:00	65%	1.12	16%	91
5	17:00	19:00	65%	1.13	18%	92
13	All 65% Events		65%	1.12	17.06%	92
4	16:30	17:00	100%	1.81	15.7%	92

Source: Guidehouse analysis

3.2.3 Quarter-Hourly DR and Snapback Impacts

Average quarter-hourly program impacts for 65% cycling events are illustrated graphically in Figure 3-6. Although snapback is estimated for more than just a single hour following the event, only a single hour is shown in the graphics below. As may be seen, as in previous evaluations, there continue to be demand response impacts during the first hour of the snapback period. As noted in previous years, this is a result of ramping; controlled appliances are released gradually from curtailment in the period following the end of the DR event.

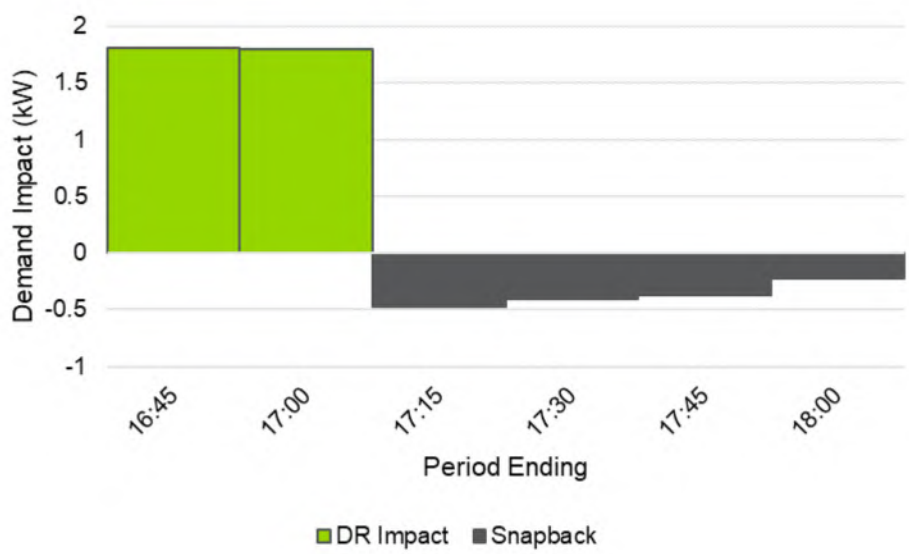
Figure 3-6. Average Quarter-Hourly Impacts – 65% Cycling



Source: Guidehouse analysis

Figure 3-7 presents the average quarter-hourly impacts across the four 100% cycling events, both during the four 30-minute test events, as well as in the first hour of the snapback period immediately following the end of the DR event. Note that unlike the longer 65% events (intended to mimic economic curtailment) there does not appear to be the same gradual relaxing of control in the snapback period, with snapback (demand increases) appearing immediately following the end of the event. The data underlying these charts may be found in Appendix E, the spreadsheet accompanying this report.

Figure 3-7. Average Quarter-Hourly Impacts – 100% Cycling



Source: Guidehouse analysis

3.3 Forecast Curtailment Capability

This section provides the estimated EnergyWise DR capability, or ex-ante impacts. These estimates are Guidehouse's projection of how much DR the program could offer under a range of different possible temperatures at different cycling levels. This estimate of capability is based on the regression-estimated relationships between DR impacts and outdoor temperature from which the ex-post impacts were also developed.

It is this forecast of capability that provides the truest estimate of a given DR program's value as a system resource because it provides DEP staff with an understanding of how much of a demand reduction the program may be counted on to deliver in future system peak conditions. This is also why it is the forecast DR capability that should be used to calculate the benefits for any cost-benefit ratio test (e.g., total resource cost test, or TRC).

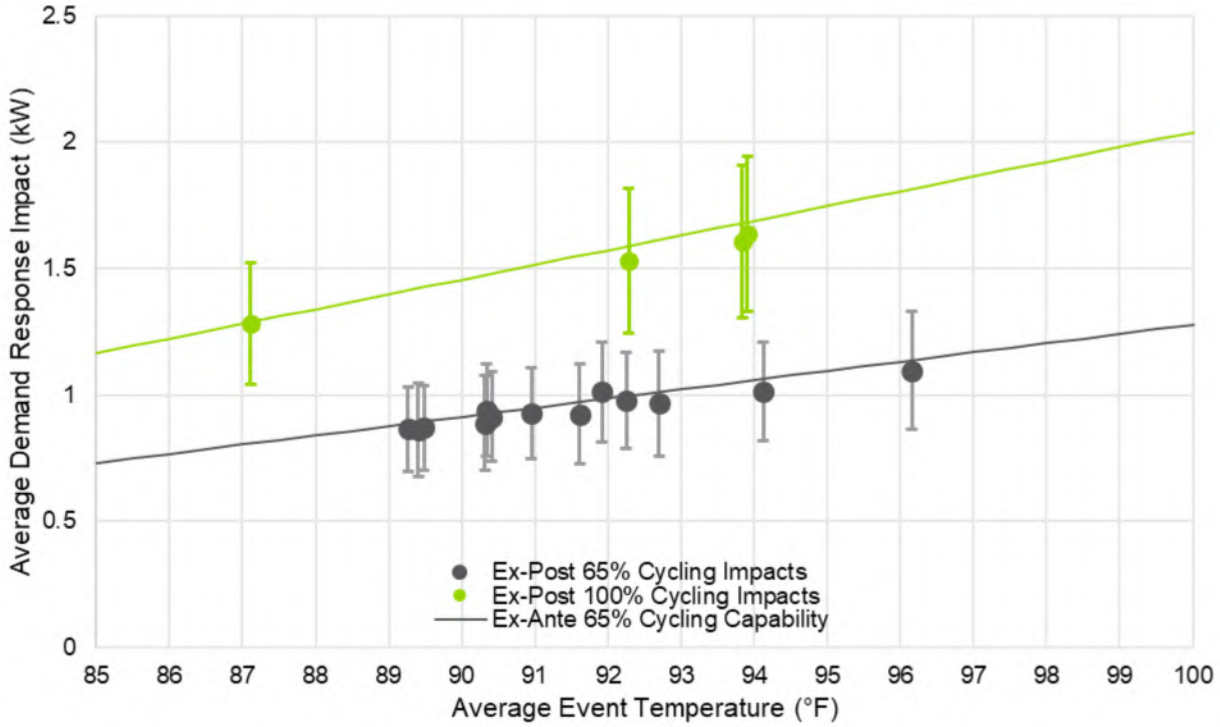
Forecast program capability per participant is projected by applying a series of temperature values to the estimated model parameters. Guidehouse's projected capability (shown in Figure 3-8) assumes that the temperature at which the capability is estimated lasts the entire length of the event and is the same as the temperature in the 3 hours leading up to the event.

This second assumption is required due to the manner in which impacts are estimated. Because homes have thermal mass, a sudden swing in outdoor temperature does not immediately provoke a concomitant swing in cooling load—it takes time for the building's indoor temperature to rise above the setpoint temperature because of that outdoor temperature swing. This is reflected in Guidehouse's estimation approach (see Appendix A for more details), where impacts are modeled as a function of a 3-hour exponential moving average of cooling degree quarter-hours (outdoor temperature). Therefore, projecting capability requires an assumption of what the temperature is in the 3 hours leading up to the event.

Figure 3-8 provides the average projected capability per participant of the program from 80°F to 100°F for 65% cycling (grey line) and 100% cycling events (green line).[9] Actual estimated EM&V event impacts are represented on this chart as grey (65% cycling) or green (100% cycling) circles, with the 90% confidence interval around each estimate represented by the whiskers. The values underlying this plot may be found in Appendix E, the Excel spreadsheet that accompanies this report.

Note that the values shown on this graph have been adjusted to reflect the two adjustments referenced in Section 3.2.1: the disconnection rate (11%) and the difference between the average number of controlled A/C units per participant in the EM&V sample (1.36) and the average number of controlled A/C units per participant in the population (1.28).

Figure 3-8. Estimated Ex-Ante Program Capability per Participant



Source: Guidehouse analysis

3.4 Net-to-Gross

Evaluations of demand-side management programs typically estimate a net-to-gross (NTG) ratio based on the evaluated percentage of demand reductions that may be ascribed either to free ridership (which increases the NTG ratio) or to program spillover (which reduces it). Free ridership is typically defined as the percentage of demand reductions that would have occurred anyway, absent the presence of the program. Spillover is typically defined as incremental demand reductions undertaken by a program's participants not directly incented or promoted by the program administrator. In this case, because demand reductions are estimated in contrast to

[9] All values underlying this plot may be found in the spreadsheet appendix attached to this report as a separate document. Ex-ante values in this document go as high as 104°F.

an implied estimated baseline[10] that captures expected participant behavior absent an event, Guidehouse can confidently state that the free ridership is 0: absent the EnergyWise program, none of the observed demand reductions would have taken place. It is possible that there may have been some spillover resulting from the program (from participants becoming more aware of their sites' consumption profiles, for example). However, it is likely impossible to estimate such an effect in a sufficiently robust manner and the assessment of such impacts is beyond the scope of this report.

Since spillover cannot be robustly estimated and because free ridership must, by program design, be considered 0, Guidehouse considers the EnergyWise program to have a NTG ratio of 1.

10 That is, the average level of behavior implied by the estimated parameter values of the regressions used.

4.0 Findings, Conclusions, and Recommendations

This chapter is divided into two sections:

1. Findings and Conclusions
2. Recommendations

4.1 Findings and Conclusions

The principal EM&V findings and conclusions regarding the summer event demand impacts for PY2019 are as follows:

- **AMI data will provide a more accurate estimate of program impacts.** Logger data obtained from outdoor loggers that do not monitor true power but rely on spot measurements of compressor power factor will not match the accuracy delivered by the AMI network. Guidehouse recommends that future evaluations be undertaken using AMI data.
- **Estimated impacts for 100% cycling population event are in line with previously estimated per participant program capability.** The average temperature during this event was approximately 94°F. Guidehouse has estimated that the average per participant impact during the program population 100% cycling event was 1.61 kW (approximately 1.26 kW per A/C unit curtailed). This is consistent with the predicted capability delivered by the "Ex Ante Tool" (Appendix B of the Summer 2018 evaluation) which predicts an average demand impact of 1.51 kW when the disconnection rate, event temperatures and times are applied to that tool.
- **The 100% cycling (full load shed) population event delivered approximately 300 MW of demand response.** The average temperature during this event was approximately 94°F. The participant average impact of 1.61 kW multiplied by the 186,285 participants enrolled at the time delivers 300 MW. An additional validation exercise carried out with system level minute-by-minute data provides an estimated system impact for this event of 296 MW (see Appendix B).
- **Estimated impacts for the 65% cycling population event are in line with previously estimated per participant program capability.** Guidehouse has estimated that the average per participant impact during the program population 65% cycling event was 1.04 kW (approximately 0.81 kW per A/C unit curtailed). This is approximately 7% lower than the impact delivered by the "Ex Ante Tool" referred to above, well within the band of relative precision (+/- 17%) for this estimate.
- **The estimated program capability at design criteria temperature (100°F) for a connected switch is 1.44 kW per participant when applying 65% cycling and 2.29 kW per participant when applying 100% cycling.** On a per A/C unit basis, these estimates are 1.12 kW (65% cycling) and 1.79 kW (100% cycling). These values must be de-rated by the assumed disconnection rate of 11% before scaling them to the participant population size. This derating results in a capability of 1.28 kW per participant when applying 65% cycling and 2.04 kW when applying 100% cycling. Caution must be exercised when using these values as they consist of predictions outside the range of temperatures observed in the summer of 2019, in which the highest event temperature was 96°F. These impacts, as with all those included in this report, are at the meter, and do not account for losses.

- **A strong experimental design and rigorous regime of test events are crucial to delivering robust estimates of program capability.** Analysis in Appendix B demonstrates the importance of an experimental design, a carefully selected estimation sample, and a large diversity of test events for obtaining accurate estimates of program capability. The benefits of this approach are demonstrated by contrasting the EM&V estimates of population impacts with estimated impacts derived from overall system demand.

4.2 Recommendations

Based on the first finding above, that whole-house AMI data delivers a more accurate estimate of impacts (when the estimation sample is carefully selected, a robust experimental design applied, etc.) than logger data, Guidehouse recommends that DEP consider:

- Using AMI data for impact evaluation going forward. This will substantially reduce evaluation costs.
- Expanding the size of the EM&V sample. With a much lower per-participant cost, DEP may wish to consider expanding the size of the EM&V sample, perhaps to several thousand individuals (~1-2% of the participant population). This would allow:
  - **Greater precision.** Larger samples will mean smaller standard errors and more precise estimated impacts.
  - **Greater granularity.** With a larger sample, proportionately distributed, robust estimates of impacts can be obtained on a region-by-region basis, providing DEP with greater insight into how this resource can be used for local constraints.
  - **A more continuous insight into how capability is evolving.** If a new EM&V sample is selected every year and subjected to 12 to 20 EM&V events, DEP can more closely monitor program capability, or at least better understand how it is evolving over time. Currently, empirical evaluations of this program are conducted only approximately every 3 years (2011, 2013, 2016, 2019), largely due to the cost involved in logger deployment. With that cost eliminated, DEP might either use an annually selected EM&V sample to update its projected capability each year, or more granularly evaluate changes in capability over time every 3 years (continuing the current evaluation cycle). This could provide DEP with a better understanding of the ongoing viability of the program and opportunities it offers.

5.0 Summary Form

EnergyWise Home

Summer PY2019

Completed EMV Fact Sheet

Description of Program

Duke Energy's EnergyWise program is a DR program offered to residential customers in the DEP territory.

EnergyWise is a direct load control program. Participants receive an incentive to allow DEP to control their air conditioners (in the summer), their heat pump auxiliary heat strips (in the winter), or their electric water heaters (winter or summer). Only participants in the Western region are curtailed in the winter.

This report evaluates the capability of the program as of the summer of 2019. In summer 2019, two events were called for the entire program population (100% cycling and 65% cycling, and 17 events were called for the M&V sample used to evaluate capability.

Date:	2020-08-19
Region:	DEP
Evaluation Period	Summer 2019
DR Event Impact per Participant (kW)	
Central Air Conditioner	1.61 (100% Cycling) 1.04 (65% Cycling)
DR Event Program Impact (MW)	
Central Air Conditioner	300 (100% Cycling) 194 (65% Cycling)
Net-to-Gross Ratio	1

Evaluation Methods

Guidehouse estimated DR impacts for central air conditioners by applying regression analysis to an EM&V sample of program participants selected to be representative of the overall population.

Guidehouse applied a randomized control style experimental design, randomly allocating sample participants to one of two groups, with each group acting as a treatment or control group for different events. This ensures a robust contemporaneous control group and unbiased estimate of impacts. Impacts were estimated with panel data regression analysis.

Guidehouse has compared the estimated impacts of the two program population events with observed demand at the system level and found that changes in system level demand were consistent with the impacts estimated.

Impact Evaluation Details

- **Full load shed of A/C units delivered an average impact of 1.61 kW per household.** The total estimated program impact of the 186,285 households participating in that event was 300 MW. The relative precision is +/-16% at the 90% confidence level.

- **Cycling A/C units at 65% delivered an average impact of 1.04 kW per household.** The total estimated program impact of the 186,844 households participating in that event was 194 MW. The relative precision is +/-17% at the 90% confidence level.

- **AMI data measures true power and accounts for any secondary, non-compressor effects on demand response of A/C curtailment and should therefore be considered (when derived from a representative sample of participants) to deliver a more accurate estimate of per-participant impacts than logger data from the same participants.** Guidehouse's side-by-side analysis found that impacts estimated using the EM&V sample group's AMI data were slightly (non statistically significantly) higher than impacts estimated using the same group's logger data. A few alternative hypotheses for what might be driving these differences are identified in the text. It is recommended that future evaluations use AMI data for impact analysis.

Appendix A. Regression Model Specification

This appendix provides additional technical details regarding the model specification used by Guidehouse to estimate the impact of the 100% and 65% cycling events.

Four estimation sets were employed: one for each cycling strategy and input data combination. So:

- 65% cycling with logger data
- 65% cycling with EM&V participant AMI data
- 100% cycling with logger data
- 100% cycling with EM&V participant AMI data

In each case, only the relevant event days were included; no non-event days are included in the estimation set.

The model specification is presented, with variable descriptions, below.

$$y_{i,t} = \alpha_i + \sum_{h=1}^{H=96} \beta_1^h \cdot qhe_t^h + \sum_{m}^{M=5} \sum_{h=1}^{H=96} \beta_2^h \cdot qhe_t^h \cdot month_t^m + \sum_{h=1}^{H=96} \beta_3^h \cdot qhe_t^h \cdot hbu_t + \sum_{h=1}^{H=96} \beta_4^h \cdot qhe_t^h \cdot EMAcdqh_t + \sum_{h=1}^{H=96} \gamma_1^h \cdot qhe_t^h \cdot c_{i,t} \cdot EMAcdqh_t + \sum_{s=1}^{S=156} \gamma^s \cdot s_{it}^s + \varepsilon_{it}$$

Where:

$y_{i,t}$	=	Customer *i's* demand (kW) in quarter hour of sample *t*.
qhe_t^h	=	A set of 96 dummy variables, one for each quarter hour of the day, equal to 1 when hour of sample t falls in quarter hour of day h, and zero otherwise.
$month_t^m$	=	A set of five dummy variables, each one equal to one when quarter hour of sample t falls month m and zero otherwise.
hbu_t	=	The average heat build-up hour of sample t. This is a 72-hour geometrically decaying average of cooling degree hours. It is calculated in the following manner: $cbu_t = \sum_{h=1}^{72} 0.96^h \cdot cdh_{t-h} \Big/ 1,000$. This value is calculated on an hourly basis and values are then interpolated across the higher frequency quarter hours using the same approach as for the temperature data (see Section 2.2).

$EMAcdqh_t$	=	The 3-hour exponential moving average of cooling degree hours observed in quarter hour of sample t.
$c_{i,t}$	=	A dummy variable equal to one if participant i is subject to curtailment in quarter-hour of sample t, and zero otherwise.
$prekWh_{idh}$	=	Customer i's average demand during hour of day h, in day-type d of the pre-program (i.e., summer 2017) period. The day-type is that of the day on which hour of sample t falls. See A.1 for more details.
s_{it}^{s}	=	A set of 156 dummy variables to capture the effects of snapback. Each variable is equal to 1 when quarter hour of sample t is the s-th hour observed since the end of the event observed on the day on which hour of sample t occurs. For example, if the event occurs between 4:30 pm and 5:00 pm, in the interval from 5:00 pm to 5:15 pm $s_{it}^{s=1}=1$, and all other dummies are zero; in the interval from 5:15 pm to 5:30 pm $s_{it}^{s=2}=1$ and all other dummy variables are equal to zero, etc.

Appendix B. System-Level Validation

In previous years of the EnergyWise Home summer evaluations, Guidehouse undertook a system-level validation exercise. This was performed in the mini-analysis evaluation cycles, those years in which impacts of actual events were estimated by applying parameter estimates estimated in the logger data analysis years to observed temperature and time of day variables.

These analyses (performed for program years 2014 and 2015) were typically inconclusive, providing evidence of curtailment, but with limited precision. Since that time, the program population has grown significantly, meaning that program impacts (particularly of emergency events) are much more apparent when observing system-level data. Given this, Guidehouse and DEP determined that it would be a useful validating exercise to once more undertake a system-level analysis, identifying indicative impacts estimated based on a comparison of one-minute frequency system load data with a day-matched baseline and day-of symmetric baseline adjustment.

As implied above, this analysis depends only on two curtailment events (each with a different cycling strategy) and should be understood to be ancillary to the core analysis of the EM&V sample, which makes use of a much more sophisticated experimental design and estimation approach and includes more than eight times as many test events.

The indicative results of the system data analysis align reasonably closely with the impacts projected for the overall program population for the two events to which all participants were subject: the 100% cycling event from 4:30 to 5:00 pm on 2019-07-02 and the 65% cycling event from 3:30 to 6:00 pm on 2019-07-17. These results are reproduced from Section 3.2.1 in Table B-1 for convenience.

Table B-1. Population Event Estimated Impacts

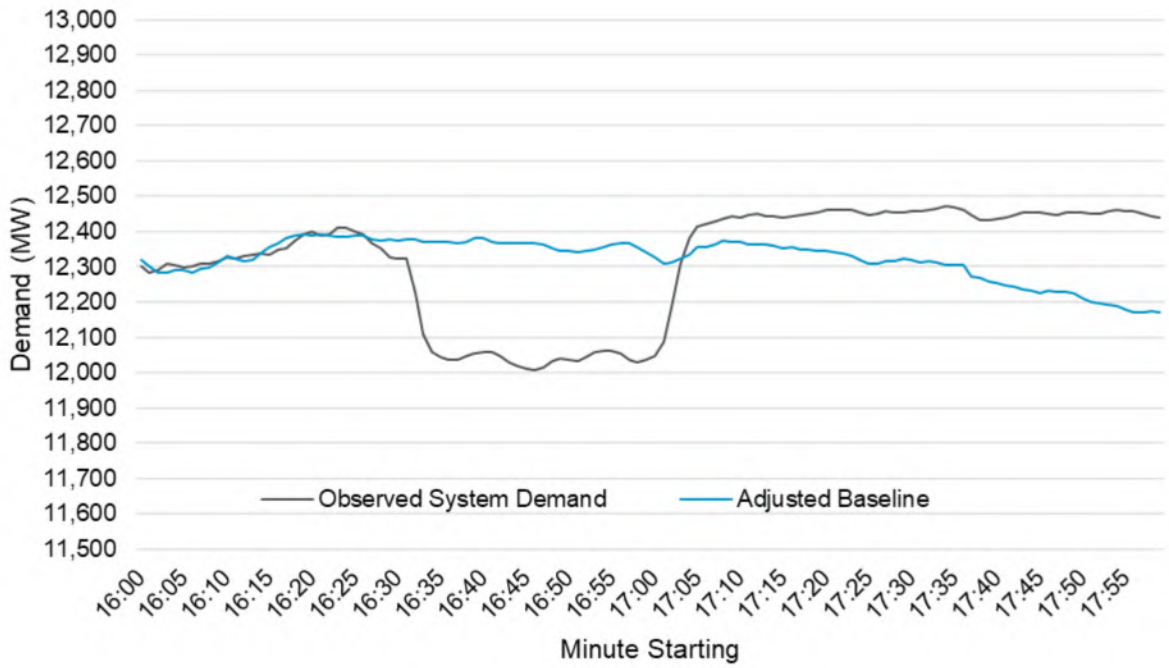
Event Date	Cycling Strategy	Temperature (ºF)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Disconnection Rate	Pop. Avg. Impact per Participant (kW)	Total Program Impact (MW)
2019-07-02	100%	93.8	1.81	16%	11%	1.61	300
2019-07-17	65%	93.9	1.17	17%	11%	1.04	194

Source: Guidehouse analysis

Figure B-1 plots the actually observed minute-by-minute DEP system demand (gray line) beginning 30 minutes prior to the July 2 100% cycling event, and extending for an hour following the 30-minute event. This plot also shows a baseline (blue line) providing an approximate estimation of the counterfactual demand (i.e., what demand might have been, absent an event).[11]

[11] The approach for estimating the baseline is described in greater detail below.

Figure B-1. System Demand and Estimated Baseline – 2019-07-02



Source: DEP System Data and Guidehouse analysis

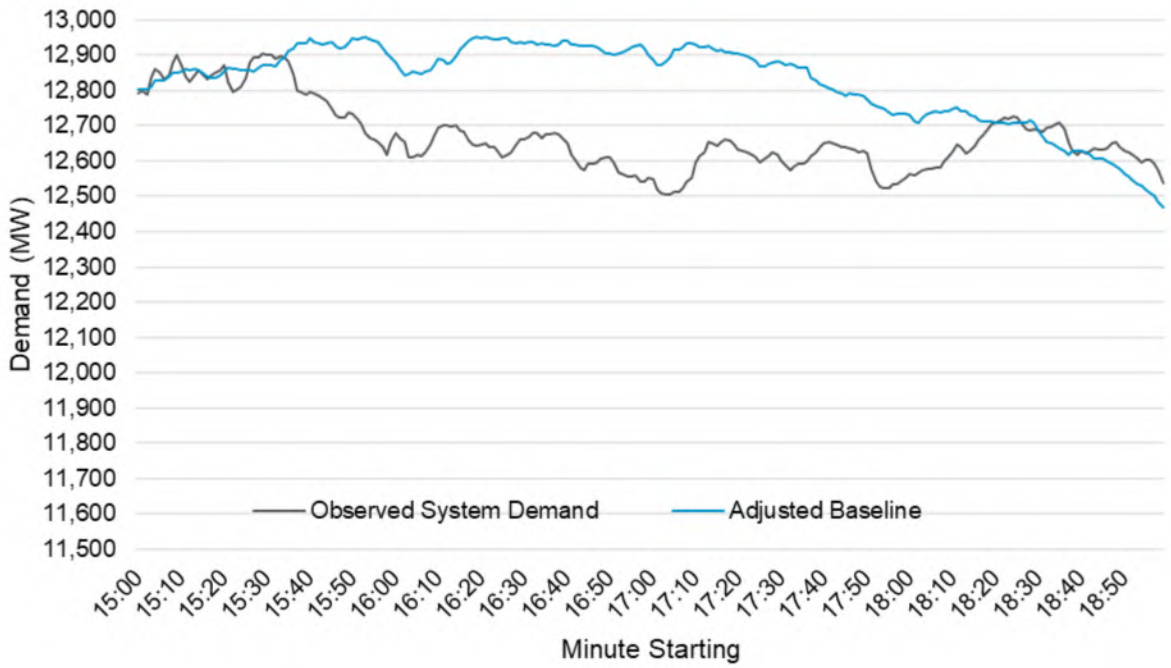
The baseline appears reasonable, in context of the observed actual and estimated counterfactual demand of the EM&V groups during events (e.g., as seen in Figure 3-3), showing alignment with actuals in the hours immediately preceding the event and evidence of some snapback in the hours following the event.

The average difference in demand between the baseline and actual demand values in this period is 296 MW. Although caution must be used to avoid over-interpreting this result (per the description below, this approach is relatively simple and does not control for non-program curtailment by other DEP customers, etc.), the estimated value here aligns very closely with the 300 MW (+/- 16%) estimated based on the EM&V sample. This alignment of results, and the intuitively appealing shape of the baseline in Figure B-1 provide additional confidence in the robustness of the estimate delivered by the EM&V data.

Figure B-2 plots the actually-observed minute-by-minute system demand (gray line) beginning 30 minutes prior to the July 17 65% cycling event and extending for an hour following the two-and-a-half-hour event. This plot also shows a baseline (blue line) providing an approximate estimation of the counterfactual demand (i.e., what demand might have been, absent an event).[12]

[12] The approach for estimating the baseline is described in greater detail below.

Figure B-2. System Demand and Estimated Baseline – 2019-07-02



Source: DEP System Data and Guidehouse analysis

The baseline appears reasonable if perhaps a bit high. The baseline and actuals are closely aligned in the hour preceding the event, but there is very little evidence of any snapback in the hour following the event.

The average difference in demand between the baseline and actual demand values in this period is 247 MW. This is higher than the estimate delivered by the analysis of the EM&V group – that impact is approximately 21% less than the value derived here. Despite this, after considering the relative uncertainty of the EM&V sample estimate (+/- 17%), system losses (the EM&V sample results are “at the meter”) and other potential sources of uncertainty inherent in the relatively unsophisticated baseline approach applied to the system data, the system level results are sufficiently well-aligned to provide some additional confidence in the robustness of the estimate delivered by the EM&V data.

The baseline in both of the cases above was developed in the following way:

- Estimate an unadjusted baseline – the average demand by minute of the day across the two hottest non-event non-holiday weekdays in July and August (2019-07-19 and 2019-08-09)[13]
- Calculate the difference between the average baseline and system demand in the 30 minutes immediately preceding the event.

[13] Guidehouse had originally planned to use the *three* hottest non-event non-holiday weekdays July or August – consistent with the regression analysis applied to the AMI data of the population of participants for whom such data are available (see below). Unfortunately, upon inspection of the data, it became clear from the load shape that on one of the three day selected (2019-07-15) there appeared to be some meaningful amount of non-program peak shaving taking place. This day was therefore discarded from the baseline pool.

- Scale the entire baseline (for the given event) linearly based on that difference.

This is very similar to day-matching customer baseline (CBL) with symmetrical day-of adjustment often used for settlement in large consumer demand response programs (e.g., DEP's Demand Response Automation, DRA program). This analysis is ancillary to the core work performed with the EM&V sample, and should be understood to be an ad hoc validation exercise intended to provide Guidehouse, DEP, and readers of this report with some additional confidence in the values reported. This analysis is not, nor is intended to be, a sophisticated decomposition of DEP's system loads. Such an analysis is out of scope, and would require the use of a considerable volume of additional data.

Listebarger Exhibit 1

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Summary of 2021 DSM/EE Rates

	Source:	cents/kWh Rate	Reg Fee	Billing Rate
Residential Rate				
EMF Rate - DSM	Listebarger Exhibit 2, page 5	0.001	0.000	0.001
EMF Rate - EE	Listebarger Exhibit 2, page 4	0.056	0.000	0.056
Projected Rate - DSM	Listebarger Exhibit 2, page 2	0.114	0.000	0.114
Projected Rate - EE	Listebarger Exhibit 2, page 1	0.549	0.001	0.550
Total Residential Rate		0.720		0.721
General Service				
EE EMF Rate	Listebarger Exhibit 2, page 4	0.040	0.000	0.040
EE Projected Rate	Listebarger Exhibit 2, page 1	0.637	0.001	0.638
Total General Service EE Rate		0.677		0.678
DSM EMF Rate	Listebarger Exhibit 2, page 5	-0.008	0.000	-0.008
DSM Projected Rate	Listebarger Exhibit 2, page 2	0.061	0.000	0.061
Total General Service DSM Rate		0.053		0.053
Lighting EE Rate				
Lighting EE EMF Rate	Listebarger Exhibit 2, page 4	0.005	0.000	0.005
Lighting EE Projected Rate	Listebarger Exhibit 2, page 1	0.119	0.000	0.119
Total Lighting EE Rate		0.124		0.124

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Energy Efficiency Rate Derivation

NC Rate Class	Adjusted NC Rate Class kWh Sales [1]	Rate Class Energy Allocation Factor [2]	EE Revenue Requirements: Residential Programs [3]	CIG Programs [4]	DSDR [5]	Non-DSDR Allocated A&G and Carrying Costs[6]	DSDR Allocated A&G and Carrying Costs[7]	Total of Allocated Costs	Total EE Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = Σ (3 thru 7)	(9) = (8) / (1)
Residential	16,576,122,049	62.52%	$ 63,245,421	$ -	$ 3,408,568	$ 7,926,723	$ 16,380,531	$ 90,961,243	0.549
General Service	9,578,145,621	36.12%	$ -	$ 44,084,752	$ 1,969,565	$ 5,488,633	$ 9,465,128	$ 61,008,078	0.637
Lighting	360,847,443	1.36%	$ -	$ -	$ 74,201	$ -	$ 356,590	$ 430,791	0.119
NC Retail	26,515,115,113	100%	$ 63,245,421	$ 44,084,752	$ 5,452,335	$ 13,415,355	$ 26,202,248	$ 152,400,111	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Listebarger Exhibit 6.
(2) Rate Class Energy Allocation Factor is derived in Listebarger Exhibit 5, page 5, column (4).
(3) Residential Program costs are allocated solely to the Residential Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) Non-Residential Program costs are allocated solely to the General Service Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) DSDR Costs allocated using the Rate Class Energy Allocation Factor from column (2) in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(6) Non-DSDR A&G and Carrying Costs are allocated on the basis of Non-DSDR revenue requirements (excluding incentives and net lost revenues).
(7) DSDR A&G Costs and Carrying Costs are allocated using the Rate Class Energy Allocation Factor from column (2).

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Demand-Side Management Rate Derivation

			DSM Revenue Requirements					
NC Rate Class	Adjusted NC Rate Class kWh Sales [1]	Rate Class Demand Allocation Factor[2]	EnergyWise Program Costs[3]	CIG DR Program [4]	Allocated A&G Costs[5]	Allocated Carrying Costs[5]	Total of Allocated Costs	Total DSM Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = Σ (3 thru 6)	(8) = (7) / (1)
Residential	16,576,122,049	68.84%	$ 15,249,279	$ -	$ 844,263	$ 2,850,869	$ 18,944,411	0.114
General Service	9,552,012,298	31.16%	$ -	$ 4,391,128	$ 331,527	$ 1,119,484	$ 5,842,139	0.061
Lighting	360,212,520	0.00%	$ -	$ -	$ -	$ -	$ -	-
NC Retail	26,488,346,867	100.00%	$ 15,249,279	$ 4,391,128	$ 1,175,790	$ 3,970,353	$ 24,786,549	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Listebarger Exhibit 6.
(2) Rate Class Demand Allocation Factor is derived in Listebarger Exhibit 5, page 6, column (5).
(3) EnergyWise costs are directly assigned solely to the Residential Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) CIG DR Program costs are directly assigned solely to the General Service Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) A&G and Carrying Costs are allocated on the basis of revenue requirements (excluding incentives and net lost revenues).

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Rate Period Revenue Requirement Summary - NC Level
January 2022 - December 2022

			NORTH CAROLINA JURISDICTIONALLY ALLOCATED RETAIL COSTS ONLY																
			O&M	Insurance	A&G Expense	Capitalized O&M and A&G	Amortization of Capitalized O&M	Amortization of Capitalized A&G	Prior Period Amortization	DSDR Capital Costs	Income Taxes on DSDR Capital Costs	DSDR Property Taxes	DSDR Depreciation	Carrying Costs Net of Taxes	Income Taxes on Carrying Cost	Rev Reqmt Before PPI & NLR	Net Lost Revenue Recoupment	Program Performance Incentive	Rev Reqmt With PPI & NLR
			(1)	(2)	(3)	(4)	(5)	(6)		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
						ΣCols(1)thru(3)	((1)+(2))/10 or 5 or 3	(3)/3								ΣCols(5)thru(15)			ΣCols(16)thru(18)
	NC DSM Program Expenses																		
1	CIG DR	*Per Forecast*	1,754,390		-	1,754,390	584,797	-	1,406,284							1,991,081		263,724	2,254,804
2	EnergyWise	*Per Forecast*	10,645,101		-	10,645,101	1,064,510	-	9,932,548							10,997,058		4,252,220	15,249,279
3	EnergyWise for Business	*Per Forecast*	2,522,669		-	2,522,669	840,890	-	1,486,373							2,327,263	29,532	(220,471)	2,136,324
4	Total DSM	*Σ Lines 1 thru 2*	14,922,160	-	-	14,922,160	2,490,197	-	12,825,205	-	-	-	-	-	-	15,315,402	29,532	4,295,473	19,640,407
5	DSM Assigned A&G and CCost	*Per Forecast*	-		1,273,332	1,273,332		424,445	751,345					3,258,608	711,745	5,146,143			5,146,143
6	Total DSM and Assigned Costs	*Σ Lines 4 thru 5*	14,922,160		1,273,332	16,195,492	2,490,197	424,445	13,576,550					3,258,608	711,745	20,461,545	29,532	4,295,473	24,786,549
	NC EE Program Expenses																		
7	Res Home Advantage	*Per Forecast*	-			-	-	-	17,926							17,926	-	517	18,443
8	Residential Smart $aver/Home Ener	*Per Forecast*	2,836,474			2,836,474	283,647	-	4,437,766							4,721,413	941,657	(33,910)	5,629,161
9	Neighborhood Energy Saver/Weath	*Per Forecast*	2,632,146			2,632,146	263,215	-	1,271,797							1,535,012	335,971	235,924	2,106,907
10	Solar Hot Water Pilot	*Per Forecast*	-			-	-	-	-							-		-	-
11	EE Lighting (Res)*	*Per Forecast (allocated)*	4,368,050			4,368,050	873,610	-	5,068,591							5,942,201	2,097,968	2,546,988	10,587,157
12	Res Appliance Recycling	*Per Forecast*	-			-	-	-	322,281							322,281		31,968	354,249
13	My Home Energy Report*	*Per Forecast*	5,621,998			5,621,998	5,621,998	-	-							5,621,998	9,262,304	332,908	15,217,210
14	Residential New Construction	*Per Forecast*	13,011,253			13,011,253	1,301,125	-	8,195,331							9,496,456	3,082,444	809,645	13,388,544
15	Multi-Family	*Per Forecast*	1,653,453			1,653,453	330,691	-	1,343,970							1,674,661	1,538,764	394,652	3,608,077
16	Energy Education Program for Schoo	*Per Forecast*	1,087,376			1,087,376	217,475	-	465,923							683,398	446,543	168,500	1,298,440
17	Save Energy and Water Kit/Applianc	*Per Forecast*	4,323,640			4,323,640	864,728	-	954,459							1,819,187	3,748,547	1,030,914	6,598,648
18	Residential Energy Assessments	*Per Forecast*	3,014,793			3,014,793	602,959	-	1,646,582							2,249,541	1,824,710	364,347	4,438,598
19	Residential Found Revenue	*Per Forecast*														-	(12)		(12)
20	Subtotal-Residential	*Σ Lines 7 thru 19*	38,549,183		-	38,549,183	10,359,448	-	23,724,627					-	-	34,084,075	23,278,894	5,882,452	63,245,421
21	CIG Energy Efficiency	*Per Forecast*	0					-	1,850,729							1,850,729			1,850,729
22	EE Lighting (General Service)*	*Per Forecast (allocated)*	529,416			529,416	105,883	-	614,203							720,086	412,165	943,798	2,076,049
23	Energy Efficiency for Business	*Per Forecast*	-			-	-		-							-			-
24	Smart Saver Prescriptive	*Per Forecast*	11,031,922			11,031,922	3,677,308		5,492,914							9,170,222	6,841,558	4,174,035	20,185,814
25	Smart Saver Custom	*Per Forecast*	3,961,123			3,961,123	1,320,374		2,001,612							3,321,986	1,812,086	640,148	5,774,221
26	Smart Saver Performance Incentive	*Per Forecast*	208,003			208,003	69,334		148,616							217,950	362,845	96,968	677,764
27	Small Business Energy Saver	*Per Forecast*	8,868,395			8,868,395	2,956,132	-	5,363,439							8,319,571	3,703,150	1,519,614	13,542,336
28	Business Energy Report	*Per Forecast*	-			-	-	-	-							-			-
29	General Service Found Revenue	*Per Forecast*														-	(22,160)		(22,160)
	Subtotal-General Service	*Σ Lines 21 thru 29*	24,598,859	-	-	24,598,859	8,129,031	-	15,471,513	-	-	-	-	-	-	23,600,544	13,109,644	7,374,563	44,084,752
30	Total of EE Programs	*Σ Lines 20 + 29*	63,148,042		-	63,148,042	18,488,479	-	39,196,140					-	-	57,684,619	36,388,539	13,257,015	107,330,173
31	EE Assigned A&G and CCost	*Per Forecast*			5,618,202	5,618,202		1,872,734	2,430,075					7,478,987	1,633,559	13,415,355			13,415,355
32	Total EE and Assigned Costs	*Lines 30 + 31*	63,148,042		5,618,202	68,766,245	18,488,479	1,872,734	41,626,215					7,478,987	1,633,559	71,099,974	36,388,539	13,257,015	120,745,529
	NC DSDR Program Expenses																		
33	DSDR Program	*Per Forecast*	4,414,974	712,082		5,127,056	512,706	-	4,939,629							5,452,335	-	-	5,452,335
34	DSDR Assigned A&G and CCost	*Per Forecast*				-		-	-	11,173,004	2,709,102	674,033	9,982,628	1,364,708	298,773	26,202,248			26,202,248
35	DSDR Proforma Adjustment	*Per DSDR Summary analysis*														-			-
36	Total DSDR and Assigned Costs	*Σ Lines 33 thru 34*	4,414,974	712,082	-	5,127,056	512,706	-	4,939,629	11,173,004	2,709,102	674,033	9,982,628	1,364,708	298,773	31,654,583	-	-	31,654,583
37	Rate Period Totals	*Lines 6 + 32 + 36*	82,485,176	712,082	6,891,535	90,088,793	21,491,382	2,297,179	60,142,393	11,173,004	2,709,102	674,033	9,982,628	12,102,303	2,644,076	123,216,102	36,418,070	17,552,489	177,186,661

*All Non-Residential programs are amortized over a 3 year period. The Residential Lighting Program, Multi-Family EE, EE Education, Save Energy and Water Kit and Residential Energy Assessments are recoverable over a 5 year period. My Home Energy Report is recoverable over a 1 year period. All other Residential EE programs are recoverable over 10 years.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Energy Efficiency Experience Modification Factor Rate Derivation

			EE EMF Revenue Requirement								
NC Rate Class	Adjusted NC Rate Class kWh Sales (1)	Rate Class Energy Allocation Factor (2)	Residential Programs(3)	CIG Programs(4)	DSDR (5)	Non-DSDR Allocated A&G and Carrying Costs(6)	DSDR Allocated A&G and Carrying Costs(5)	Total of Allocated Costs	Less: Prior Period EE Rate Adjustment(7)	Adjusted EE EMF Revenue Requirement	Total EE EMF Rate (cents/kWh)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = Σ (3 thru 7)	(9)	(10)=(8)-(9)	(11) = (10) / (1)
Residential	16,576,122,049	62.52%	$ 63,753,433	$0	$ 12,582,268	$ 7,451,032	$ 918,646	$ 84,705,379	$ 75,503,707	$ 9,201,672	0.056
General Service	9,578,145,621	36.12%	$0	$ 44,616,173	$ 7,270,385	$ 4,712,221	$ 530,819	$ 57,129,598	$ 53,278,068	$ 3,851,530	0.040
Lighting	360,847,443	1.36%	$0	$0	$ 273,905	$ -	$ 19,998	$ 293,903	$ 274,954	$ 18,949	0.005
NC Retail	26,515,115,113	100.00%	$ 63,753,433	$ 44,616,173	$ 20,126,558	$ 12,163,252	$ 1,469,463	$ 142,128,880	$ 129,056,729	$ 13,072,151	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Listebarger Exhibit 6.
(2) Rate Class Energy Allocation Factor is derived in Listebarger Exhibit 5, page 5, column (4).
(3) Residential Program costs are allocated solely to the Residential rates in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) Non-residential Program costs are allocated solely to the General Service rates in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) DSDR Costs allocated using the Rate Class Energy Allocation Factor from column (2) in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(6) Non-DSDR A&G and Carrying Costs are allocated on the basis of Non-DSDR revenue requirements (excluding incentives and net lost revenues) assigned in preceding columns.
(7) Amounts are derived in Listebarger Exhibit 2, page 7.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS,LLC
Docket No. E-2, Sub 1273
Demand-Side Management Experience Modification Factor Rate Derivation

			DSM EMF Reven			DSM EMF Revenue Requirement					
NC Rate Class	Adjusted NC Rate Class kWh Sales (1)	Rate Class Demand Allocation Factor(2)	Allocated DSDR Program Costs (3)	EnergyWise Program Costs(3)	CIG DR Program (4)	Allocated A&G Costs(5)	Allocated Carrying Costs(5)	Total of Allocated Costs	Less: Prior Period DSM Rate Adjustment(6)	Adjusted DSM EMF Revenue Requirement	Total DSM EMF Rate (cents/kWh)
	(1)	(2)	(3)	(3)	(4)	(5)	(6)	(7) = Σ (3 thru 6)	(8)	(9)=(7)-(8)	(10) = (9) / (1)
Residential	16,576,122,049	68.84%	$0	$ 15,482,558	$ -	$ 668,256	$ 2,673,186	$ 18,823,999	$ 18,579,285	$ 244,714	0.001
General Service	9,552,012,298	31.16%	$0	$ -	$ 4,022,142	$ 250,192	1,000,829	$ 5,273,163	$ 6,038,059	$ (764,895)	(0.008)
Lighting	360,212,520	0.00%	$0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
NC Retail	26,488,346,867	100%	$0	$ 15,482,558	$ 4,022,142	$ 918,448	$ 3,674,015	$ 24,097,162	$ 24,617,344	$ (520,181)	
	CHK				CHK						

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Listebarger Exhibit 6.
(2) Rate Class Demand Allocation Factor is derived in Listebarger Exhibit 5, page 6, column (5).
(3) EnergyWise costs are directly assigned solely to the Residential Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) CIG DR costs are directly assigned solely to the General Service Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) A&G and Carrying Costs are allocated on the basis of revenue requirements (excluding incentives and net lost revenues) assigned in preceding columns.
(6) Amounts are derived in Listebarger Exhibit 2, page 7.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
EMF Period Revenue Requirement Summary - NC Level
January 2020 - December 2020

		O&M	Insurance	A&G Expense	Capitalized O&M and A&G	Amortization of Capitalized O&M	Amortization of Capitalized A&G	Prior Period Amortization	DSDR Capital Costs	Income Taxes on DSDR Capital Costs	DSDR Property Taxes	DSDR Depreciation	Carrying Costs Net of Taxes	Income Taxes on Carrying Cost	Rev Reqmt Before PPI & NLR	Net Lost Revenue Recoupment	Program Performance Incentive	Rev Reqmt With PPI & NLR
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
					ΣCols(1)thru(3)	((1)+(2))/10	(3)/3								ΣCols(5)thru(13)			ΣCols(14)thru(16)
	NC DSM Program Expenses																	
1	CIG DR	1,501,957			1,501,957	500,652	-	1,592,919					-	-	2,093,571		256,702	2,350,273
2	EnergyWise	11,625,907			11,625,907	1,162,591	-	9,043,633					-	-	10,206,224		5,276,333	15,482,558
3	EnergyWise for Business	1,465,227			1,465,227	488,409		1,239,186							1,727,595	67,077	(122,803)	1,671,869
4	Total DSM	14,593,091			14,593,091	2,151,652	-	11,875,738					-	-	14,027,391	67,077	5,410,232	19,504,700
5	DSM Assigned A&G and CCost	-		1,189,929	1,189,929		396,643	521,805					3,014,136	659,879	4,592,463			4,592,463
6	Total DSM and Assigned Costs	14,593,091		1,189,929	15,783,020	2,151,652	396,643	12,397,543					3,014,136	659,879	18,619,853	67,077	5,410,232	24,097,162
	NC EE Program Expenses																	
7	Residential Home Advantage	-			-	-	-	224,324					-	-	224,324	-	140,907	365,231
8	Residential Smart $aver/Home Energy Impro	5,249,930			5,249,930	524,993		4,587,643					-	-	5,112,636	939,237	227,693	6,279,566
9	Neighborhood Energy Saver/Weatherization	321,648			321,648	32,165		1,407,709					-	-	1,439,874	218,847	-	1,658,721
10	Solar Hot Water Pilot	-			-	-		15,912					-	-	15,912	-	-	15,912
11	EE Lighting (Res)*	4,887,760			4,887,760	977,552		8,466,701					-	-	9,444,253	3,451,495	4,249,585	17,145,334
12	Appliance Recycling	-			-	-		550,144					-	-	550,144	2,348,711	91,207	2,990,061
13	My Home Energy Report	5,922,407			5,922,407	5,922,407		-					-	-	5,922,407	9,317,886	355,484	15,595,776
14	Residential New Construction	15,125,754			15,125,754	1,512,575		5,420,737					-	-	6,933,312	2,279,593	704,807	9,917,712
15	Home Depot CFL	-			-	-	-	-					-	-	-	-	-	-
16	Energy Education Program for Schools	311,456			311,456	62,291		524,566							586,857	286,666	-	873,523
17	Save Energy & Water Kits	1,775,894			1,775,894	355,179		586,962							942,141	-	1,283,005	2,225,146
18	Residential Energy Assessments	1,774,101			1,774,101	354,820		1,182,001							1,536,821	925,674	358,285	2,820,780
19	Multi-Family	716,655			716,655	143,331		1,605,072							1,748,403	1,584,081	538,755	3,871,239
20	Found Revenue															(5,569)		(5,569)
21	Subtotal-Residential	36,085,606			36,085,606	9,885,313	-	24,571,771	-	-	-	-	-	-	34,457,084	21,346,621	7,949,729	63,753,433
22	CIG Energy Efficiency	-			-	-		3,262,526					-	-	3,262,526			3,262,526
23	EE Lighting (Gen Svc)*	592,274			592,274	118,455		1,026,881							1,145,336	731,665	1,509,366	3,386,367
24	Energy Efficiency for Business	-			-	-		-							-			-
25	Smart Saver Prescriptive	6,210,114			6,210,114	2,070,038		5,332,093							7,402,131	6,646,957	6,596,738	20,645,825
26	Smart Saver Custom	2,626,137			2,626,137	875,379		1,264,161							2,139,540	1,311,985	746,352	4,197,877
27	Smart Saver Performance Incentive	184,423			184,423	61,474		127,151							188,625	135,338	68,688	392,651
25	Small Business Energy Saver	3,809,900			3,809,900	1,269,967		6,383,405					-	-	7,653,372	3,493,751	1,662,323	12,809,447
28	Business Energy Report	-			-	-		-							-	-	-	-
29	Found Revenue															(78,520)		(78,520)
30	Subtotal-General Service	13,422,848			13,422,848	4,395,313	-	17,396,217	-	-	-	-	-	-	21,791,530	12,241,176	10,583,467	44,616,173
31	Total of EE Programs	49,508,454			49,508,454	14,280,626	-	41,967,988					-	-	56,248,614	33,587,797	18,533,196	108,369,607
32	EE Assigned A&G and CCost	-		3,784,831	3,784,831		1,261,610	1,965,374					7,331,252	1,605,016	12,163,252			12,163,252
33	Total EE and Assigned Costs	49,508,454		3,784,831	53,293,285	14,280,626	1,261,610	43,933,361					7,331,252	1,605,016	68,411,866	33,587,797	18,533,196	120,532,859
	NC DSDR Program Expenses																	
34	DSDR Program	4,079,423	806,948		4,886,370	488,637	-	4,843,364	7,133,285	1,576,055	726,281	5,358,937			20,126,558	-		20,126,558
35	DSDR Proforma Adjustments							-							-			-
36	DSDR Assigned A&G and CCost	-		-	-		-	-					1,205,537	263,926	1,469,463			1,469,463
37	Total DSDR and Assigned Costs	4,079,423	806,948	-	4,886,370	488,637	-	4,843,364	7,133,285	1,576,055	726,281	5,358,937	1,205,537	263,926	21,596,021	-	-	21,596,021
38	Test Period Totals	68,180,968	806,948	4,974,760	73,962,676	16,920,915	1,658,253	61,174,269	7,133,285	1,576,055	726,281	5,358,937	11,550,926	2,528,820	108,627,740	33,654,874	23,943,428	166,226,042

*All Non-Residential programs are amortized over a 3 year period. The Residential Lighting Program, Multi-Family EE and EE Education are recoverable over a 5 year period.
My Home Energy Report is recoverable over a 1 year period. All other Residential EE programs are recoverable over 10 years.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
EMF Adjustment Summary
January 2020 - December 2020

Line	Description	Residential DSM	Residential DSDR	Residential EE	Residential Total	General Service DSM	General Service DSDR	General Service EE	General Service Total	Lighting DSM	Lighting DSDR	Lighting EE	Lighting Total	Totals DSM	Totals DSDR	Totals EE	Totals Total
1	Test Period DSM/EE Rate Billings [1] *Amounts from Listebarger Exhibit 4*	$ 18,632,590	$ 13,157,554	$ 63,302,627	$ 95,092,771	$ 5,940,410	$ 7,243,328	$ 46,248,475	$ 59,432,213	$ -	$ 277,433	$ -	$ 277,433	$ 24,573,000	$ 20,678,315	$ 109,551,102	$ 154,802,417
2	Less: Uncollectible Allowance in Rates[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Over or (Under) collection of Uncollectibles [3]	(53,305)	(20,093)	(170,956)	(244,354)	(1,466)	(1,238)	(18,140)	(20,844)	-	-	-	-	(54,771)	(21,331)	(189,096)	(265,198)
4	True up of Vintage 2019 PPI [4] *Amounts from Summary (2019) - Exhibit*	-		14,713	14,713	-		-	-			-	-	-	-	14,713	14,713
5	True up of Vintage 2017 Lost Revenue through Year 2019 [5] *Amounts from Evans Exhibit 2 pages 4-7*			(0)	(0)			(0)	(0)					-	-	(0)	(0)
6	True up of Vintage 2018 Lost Revenue through Year 2019 [6] *Amounts from Evans Exhibit 2 pages 4-7*			(44,830)	(44,830)			-	-			-	-	-	-	(44,830)	(44,830)
7	True up of Vintage 2019 Lost Revenue through Year 2019 [7] *Amounts from Evans Exhibit 2 pages 4-7*			(793)	(793)			$ 86,932	86,932				-	-	-	86,139	86,139
8	Interest on Overcollections/(Undercollections) [8] *Amounts from Listebarger Exhibit 3*	-	-	(734,515)	(734,515)	99,115	-	(281,290)	(182,175)	-	(2,479)	-	(2,479)	99,115	(2,479)	(1,015,805)	(919,168)
9	Net Adjustments to DSM/EE EMF Clause *Σ Lines 1 through 8*	$ 18,579,285	$ 13,137,461	$ 62,366,246	$ 94,082,992	$ 6,038,059	$ 7,242,090	$ 46,035,978	$ 59,316,126	$ -	$ 274,954	$ -	$ 274,954	$ 24,617,344	$ 20,654,505	$ 108,402,224	$ 153,674,073
		To Listebarger Exhibit 2 page 5	$75,503,707 *To Listebarger Exhibit 2 page 4*			*To Listebarger Exhibit 2 page 5*	$53,278,068 *To Listebarger Exhibit 2 page 4*			*To Listebarger Exhibit 2 page 4*				*To Listebarger Exhibit 2 page 5*	$129,056,729 *To Listebarger Exhibit 2 page 4*		

[1] Actual DSM/EE Rate billings for test period *(January 2020 through December 2020)*.
[2] The Company is not requesting an adjustment for uncollectibles in this proceeding.
[3] The Company's actual uncollectible experience was greater than the rate approved in the last rate case proceeding. An adjustment is necessary.
[4] See Evans Exhibit 1 page 3 for a detail list of Vintage 2017 programs impacted by EM&V true-ups
[5] See Evans Exhibit 2 page 6 for a detail list of Vintage 2017 programs impacted by EM&V true-ups
[6] See Evans Exhibit 2 page 6 for a detail list of Vintage 2018 programs impacted by EM&V true-ups
[7] See Evans Exhibit 2 page 6 for a detail list of Vintage 2019 programs impacted by EM&V true-ups
[8] Calculated interest obligation associated with test period *(January 1, 2020 through December 31, 2020)*.

Please note: Exhibit may not foot due to rounding.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Estimated Return Calculation - Residential EE & DSM Programs Vintage 2020

		Residential EE Costs	Residential DSM Costs	Residential DSDR Program Costs Incurred	Total EE and DSM to be recovered	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
2020	January	4,026,764	1,301,735	1,297,242	6,625,741	6,156,043	100.00%	(6,156,043)	469,697
2020	February	3,799,533	1,228,278	1,224,039	6,251,850	5,808,658	100.00%	(5,808,658)	443,192
2020	March	3,360,742	1,086,429	1,082,680	5,529,851	5,137,841	100.00%	(5,137,841)	392,010
2020	April	2,705,162	874,500	871,482	4,451,144	4,135,603	100.00%	(4,135,603)	315,541
2020	May	2,402,941	776,800	774,120	3,953,861	3,673,573	100.00%	(3,673,573)	280,288
2020	June	3,166,416	1,023,609	1,020,077	5,210,102	4,840,759	100.00%	(4,840,759)	369,343
2020	July	4,377,378	1,415,078	1,410,195	7,202,651	6,692,057	100.00%	(6,692,057)	510,594
2020	August	4,968,003	1,606,010	1,600,468	8,174,481	7,594,994	100.00%	(7,594,994)	579,487
2020	September	4,213,064	1,361,960	1,357,260	6,932,284	6,440,856	100.00%	(6,440,856)	491,428
2020	October	2,528,730	817,464	814,643	4,160,838	3,865,877	100.00%	(3,865,877)	294,961
2020	November	2,344,915	758,042	755,426	3,858,383	3,584,863	100.00%	(3,584,863)	273,520
2020	December	4,014,468	1,297,760	1,293,281	6,605,509	6,137,246	100.00%	(6,137,246)	468,263
		41,908,116	13,547,666	13,500,914	68,956,695	64,068,371			4,888,325

DEP is undercollected on program costs and undercollected in total, therefore the Company is calculating interest on the program cost piece of the balance.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			2020 tax rate				10.00%			0.76867	
2020	January	469,697	23.1330%	108,655	108,655	361,042	0.008333	1,504	1,504	0.76867	1,957
2020	February	912,890	23.1330%	102,524	211,179	701,711	0.008333	4,428	5,932	0.76867	7,718
2020	March	1,304,899	23.1330%	90,684	301,862	1,003,037	0.008333	7,103	13,036	0.76867	16,959
2020	April	1,620,440	23.1330%	72,994	374,856	1,245,584	0.008333	9,369	22,405	0.76867	29,148
2020	May	1,900,728	23.1330%	64,839	439,695	1,461,033	0.008333	11,278	33,682	0.76867	43,819
2020	June	2,270,071	23.1330%	85,440	525,136	1,744,936	0.008333	13,358	47,041	0.76867	61,197
2020	July	2,780,666	23.1330%	118,116	643,251	2,137,414	0.008333	16,176	63,217	0.76867	82,242
2020	August	3,360,153	23.1330%	134,053	777,304	2,582,849	0.008333	19,668	82,885	0.76867	107,829
2020	September	3,851,581	23.1330%	113,682	890,986	2,960,595	0.008333	23,098	105,983	0.76867	137,878
2020	October	4,146,542	23.1330%	68,233	959,219	3,187,322	0.008333	25,616	131,599	0.76867	171,203
2020	November	4,420,062	23.1330%	63,273	1,022,493	3,397,569	0.008333	27,437	159,036	0.76867	206,897
2020	December	4,888,325	23.1330%	108,323	1,130,816	3,757,508	0.008333	29,813	188,849	0.76867	245,682
								188,849			245,682
			Twelve months return on 2020 Year End Balance			3,757,508		375,751			488,832
			Total return on Residential EE& DSM Programs								734,515

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Estimated Return Calculation -Non-Residential DSM Programs Vintage 2020

		Non-Residential DSM Program Costs Incurred	Non-Residential Allcoated Carrying Costs & A&G	Total Program Costs Incurred	NC Non-Residential DSM Revenue Collected	NC Non- Residential DSM Program Collection %	Non- Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
2020	January	326,122	101,398	427,520	481,483	100.0000%	(481,483)	(53,963)
2020	February	340,165	105,764	445,929	502,216	100.0000%	(502,216)	(56,287)
2020	March	313,720	97,542	411,262	463,173	100.0000%	(463,173)	(51,911)
2020	April	279,032	86,757	365,789	411,960	100.0000%	(411,960)	(46,171)
2020	May	266,326	82,806	349,132	393,201	100.0000%	(393,201)	(44,069)
2020	June	326,524	101,523	428,047	482,076	100.0000%	(482,076)	(54,029)
2020	July	392,810	122,132	514,942	579,940	100.0000%	(579,940)	(64,998)
2020	August	423,434	131,654	555,088	625,153	100.0000%	(625,153)	(70,065)
2020	September	401,205	124,743	525,948	592,334	100.0000%	(592,334)	(66,387)
2020	October	322,576	100,296	422,872	476,248	100.0000%	(476,248)	(53,376)
2020	November	295,718	91,945	387,663	436,595	100.0000%	(436,595)	(48,932)
2020	December	335,976	104,462	440,438	496,031	100.0000%	(496,031)	(55,593)
		4,023,609	1,251,021	5,274,630	5,940,410		(5,940,410)	(665,781)

DEP is overcollected on program costs, but undercollected in total. Interest is calculated on program cost piece of the balance.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected

		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			2020 tax rate				10.00%			0.76867	
2020	January	(53,963)	23.1330%	(12,483)	(12,483)	(41,480)	0.008333	(173)	(173)	0.76867	(225)
2020	February	(110,250)	23.1330%	(13,021)	(25,504)	(84,746)	0.008333	(526)	(699)	0.76867	(909)
2020	March	(162,160)	23.1330%	(12,009)	(37,513)	(124,648)	0.008333	(872)	(1,571)	0.76867	(2,044)
2020	April	(208,331)	23.1330%	(10,681)	(48,193)	(160,138)	0.008333	(1,187)	(2,758)	0.76867	(3,588)
2020	May	(252,400)	23.1330%	(10,194)	(58,388)	(194,012)	0.008333	(1,476)	(4,233)	0.76867	(5,508)
2020	June	(306,429)	23.1330%	(12,499)	(70,886)	(235,543)	0.008333	(1,790)	(6,023)	0.76867	(7,836)
2020	July	(371,427)	23.1330%	(15,036)	(85,922)	(285,505)	0.008333	(2,171)	(8,194)	0.76867	(10,660)
2020	August	(441,492)	23.1330%	(16,208)	(102,130)	(339,362)	0.008333	(2,604)	(10,798)	0.76867	(14,048)
2020	September	(507,879)	23.1330%	(15,357)	(117,488)	(390,391)	0.008333	(3,041)	(13,839)	0.76867	(18,003)
2020	October	(561,255)	23.1330%	(12,348)	(129,835)	(431,420)	0.008333	(3,424)	(17,263)	0.76867	(22,458)
2020	November	(610,187)	23.1330%	(11,319)	(141,155)	(469,032)	0.008333	(3,752)	(21,015)	0.76867	(27,339)
2020	December	(665,781)	23.1330%	(12,860)	(154,015)	(511,766)	0.008333	(4,087)	(25,101)	0.76867	(32,656)
								(25,101)			(32,656)
			Twelve months return on 2020 Year End Balance			(511,766)		(51,177)			(66,578)
			Total return on Non-Residential DSM								(99,234)

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Estimated Return Calculation -Non-Residential EE & DSDR Programs Vintage 2020

		Non-Residential EE Costs Incurred	Non-Residential DSDR Costs Incurred	Total Program Costs Incurred	NC EE Non-Residential Revenue Collected	NC Non-Residential EE Program Collection %	Total EE Revenue Collected	NC DSDR Non-Residential Revenue Collected	NC Non-Residential DSDR Program Collection %	DSDR Program Costs Revenue Collected	Total EE & DSDR Revenue Collected	(Over)/Under Collection
2020	January	2,348,269	725,122	3,073,391	2,230,636	100.0000%	(2,230,636)	673,267	100.0000%	(673,267)	(2,903,903)	169,488
2020	February	2,158,214	652,726	2,810,940	2,050,102	100.0000%	(2,050,102)	606,049	100.0000%	(606,049)	(2,656,150)	154,790
2020	March	2,036,676	600,593	2,637,269	1,934,652	100.0000%	(1,934,652)	557,643	100.0000%	(557,643)	(2,492,295)	144,974
2020	April	1,771,327	533,269	2,304,596	1,682,595	100.0000%	(1,682,595)	495,134	100.0000%	(495,134)	(2,177,729)	126,867
2020	May	1,559,791	509,047	2,068,838	1,481,656	100.0000%	(1,481,656)	472,644	100.0000%	(472,644)	(1,954,300)	114,538
2020	June	2,002,818	624,749	2,627,567	1,902,489	100.0000%	(1,902,489)	580,073	100.0000%	(580,073)	(2,482,562)	145,005
2020	July	2,541,549	752,233	3,293,782	2,414,233	100.0000%	(2,414,233)	698,440	100.0000%	(698,440)	(3,112,673)	181,109
2020	August	2,940,569	810,303	3,750,872	2,793,265	100.0000%	(2,793,265)	752,357	100.0000%	(752,357)	(3,545,622)	205,250
2020	September	2,951,396	766,632	3,718,029	2,803,550	100.0000%	(2,803,550)	711,809	100.0000%	(711,809)	(3,515,359)	202,669
2020	October	2,259,526	616,995	2,876,521	2,146,338	100.0000%	(2,146,338)	572,873	100.0000%	(572,873)	(2,719,211)	157,310
2020	November	1,838,645	564,600	2,403,245	1,746,540	100.0000%	(1,746,540)	524,225	100.0000%	(524,225)	(2,270,765)	132,480
2020	December	2,094,969	644,934	2,739,903	1,990,025	100.0000%	(1,990,025)	598,814	100.0000%	(598,814)	(2,588,838)	151,065
		26,503,750	7,801,205	34,304,955	25,176,081		(25,176,081)	7,243,328		(7,243,328)	(32,419,409)	1,885,546

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			2020 tax rate				10.00%			0.76867	
2020	January	169,488	23.1330%	39,208	39,208	130,280	0.008333	543	543	0.76867	706
2020	February	324,278	23.1330%	35,808	75,015	249,263	0.008333	1,581	2,124	0.76867	2,764
2020	March	469,252	23.1330%	33,537	108,552	360,700	0.008333	2,542	4,666	0.76867	6,070
2020	April	596,119	23.1330%	29,348	137,900	458,219	0.008333	3,412	8,078	0.76867	10,509
2020	May	710,658	23.1330%	26,496	164,396	546,261	0.008333	4,185	12,263	0.76867	15,954
2020	June	855,663	23.1330%	33,544	197,941	657,723	0.008333	5,017	17,280	0.76867	22,480
2020	July	1,036,772	23.1330%	41,896	239,836	796,936	0.008333	6,061	23,341	0.76867	30,365
2020	August	1,242,022	23.1330%	47,480	287,317	954,705	0.008333	7,299	30,639	0.76867	39,860
2020	September	1,444,691	23.1330%	46,883	334,200	1,110,491	0.008333	8,605	39,244	0.76867	51,055
2020	October	1,602,002	23.1330%	36,391	370,591	1,231,411	0.008333	9,758	49,002	0.76867	63,750
2020	November	1,734,481	23.1330%	30,647	401,238	1,333,244	0.008333	10,686	59,688	0.76867	77,652
2020	December	1,885,546	23.1330%	34,946	436,183	1,449,363	0.008333	11,594	71,283	0.76867	92,735
								71,283			92,735
			Twelve months return on 2020 Year End Balance			1,449,363		144,936			188,555
			Total return on Non-Residential EE programs								281,290

DEP program costs and undercollected in total, therefore the Company is calculating interest on the program cost piece of the balance.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Estimated Return Calculation -Lighting DSDR Programs Vintage 2020

		Lighting DSDR Program Costs Incurred	Lighting Allocated Carrying Costs & A&G	Total Program Costs Incurred	NC Lighting Revenue Collected	NC Lighting Program Collection %	Lighting Program Costs Revenue Collected	(Over)/Under Collection
2020	January	25,157	1,837	26,994	25,481	100.0000%	(25,481)	1,513
2020	February	22,734	1,660	24,393	23,026	100.0000%	(23,026)	1,367
2020	March	22,825	1,666	24,491	23,119	100.0000%	(23,119)	1,372
2020	April	22,696	1,657	24,353	22,989	100.0000%	(22,989)	1,365
2020	May	22,626	1,652	24,278	22,917	100.0000%	(22,917)	1,360
2020	June	22,631	1,652	24,283	22,922	100.0000%	(22,922)	1,361
2020	July	22,613	1,651	24,264	22,904	100.0000%	(22,904)	1,360
2020	August	22,541	1,646	24,186	22,831	100.0000%	(22,831)	1,355
2020	September	22,541	1,646	24,187	22,831	100.0000%	(22,831)	1,355
2020	October	22,589	1,649	24,238	22,880	100.0000%	(22,880)	1,358
2020	November	21,634	1,580	23,214	21,913	100.0000%	(21,913)	1,301
2020	December	23,319	1,703	25,021	23,619	100.0000%	(23,619)	1,402
		273,905	19,998	293,903	277,433		(277,433)	16,470

DEP is undercollected on the DSDR program, therefore, interest is calculated on the total.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected

		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			2020 tax rate				10.00%			0.76867	
2020	January	1,513	23.1330%	350	350	1,163	0.008333	5	5	0.76867	6
2020	February	2,880	23.1330%	316	666	2,214	0.008333	14	19	0.76867	25
2020	March	4,252	23.1330%	317	984	3,268	0.008333	23	42	0.76867	54
2020	April	5,617	23.1330%	316	1,299	4,317	0.008333	32	73	0.76867	95
2020	May	6,977	23.1330%	315	1,614	5,363	0.008333	40	114	0.76867	148
2020	June	8,338	23.1330%	315	1,929	6,409	0.008333	49	163	0.76867	212
2020	July	9,698	23.1330%	315	2,243	7,454	0.008333	58	221	0.76867	287
2020	August	11,053	23.1330%	314	2,557	8,496	0.008333	66	287	0.76867	373
2020	September	12,409	23.1330%	314	2,870	9,538	0.008333	75	362	0.76867	471
2020	October	13,767	23.1330%	314	3,185	10,582	0.008333	84	446	0.76867	580
2020	November	15,068	23.1330%	301	3,486	11,582	0.008333	92	538	0.76867	700
2020	December	16,470	23.1330%	324	3,810	12,660	0.008333	101	639	0.76867	832
								639			832
			Twelve months return on 2020 Year End Balance			12,660		1,266			1,647
			Total return on DSDR Lighting								2,479

Listebarger Exhibit 4

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
2020 Actual Revenues

Rate Period	DSM	DSDR	EE	Total
Residential	$ 18,632,590	$ 13,157,554	$ 63,302,627	$ 95,092,771
General Service	5,940,410	7,243,328	46,248,475	59,432,213
Lighting		277,433		277,433
Total	$ 24,573,000	$ 20,678,315	$ 109,551,102	$ 154,802,417

EMF				
Residential	$ 216,468	$ (6,052,506)	$ (2,850,716)	$ (8,686,754)
General Service	(1,128,182)	(3,200,205)	13,470,626	9,142,239
Lighting		(103,097)		(103,097)
Total	$ (911,714)	$ (9,355,808)	$ 10,619,910	$ 352,388

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Allocation Factor For Year 2018
Allocation Factors from 2018 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	38,153,842		
2	SC Retail MWh Sales Allocation	Company Records	6,438,789		
3	Total Retail	Line 1 + Line 2	44,592,631		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**85.5608674%**		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,699,632	487,425	4,187,058
6	Non Residential	Company Records	3,915,717	698,002	4,613,719
7	Total	Line 5 + Line 6	7,615,350	1,185,427	8,800,777
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.5304240%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**42.0375642%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**44.4928598%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**48.5812530%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**51.4187470%**		

NOTE: These allocation factors are used for Vintage 2018 based on the Cost of Service Study filed in April 2018.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Allocation Factor For Year 2019
Allocation Factors from 2019 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	40,300,849		
2	SC Retail MWh Sales Allocation	Company Records	6,761,081		
3	Total Retail	Line 1 + Line 2	47,061,930		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**85.6336514%**		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,850,873	500,552	4,351,425
6	Non Residential	Company Records	3,913,139	691,398	4,604,537
7	Total	Line 5 + Line 6	7,764,011	1,191,950	8,955,962
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.6909847%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**42.9978695%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**43.6931152%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**49.5990092%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**50.4009908%**		

NOTE: These allocation factors are used for vintages 2019 based on the filed Cost of Service Study (April 2019).

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Allocation Factor For Year 2020
Allocation Factors from 2020 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	37,938,229		
2	SC Retail MWh Sales Allocation	Company Records	6,302,325		
3	Total Retail	Line 1 + Line 2	44,240,554		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**85.7544161%**		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,632,210	478,603	4,110,813
6	Non Residential	Company Records	3,933,899	718,509	4,652,408
7	Total	Line 5 + Line 6	7,566,109	1,197,112	8,763,221
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.3393647%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**41.4483435%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**44.8910211%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**48.0063105%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**51.9936895%**		

NOTE: These allocation factors are used for vintages 2020-2021 based on the most recently filed Cost of Service Study (May 2020).

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Allocation Factor For Year 2021
Estimated Allocation Factor For Year 2022
Allocation Factors from 2021 Filed Cost of Service Study

Line			MWh
	Sales Allocator at Generation		
1	NC Retail MWh Sales Allocation	Company Records	36,168,412
2	SC Retail MWh Sales Allocation	Company Records	5,930,061
3	Total Retail	Line 1 + Line 2	42,098,473
	Allocation 1 to state based on kWh sales		
4	NC Retail	Line 1 / Line 3	**85.9138342%**

	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,877,909	495,826	4,373,734
6	Non Residential	Company Records	3,918,308	682,909	4,601,217
7	Total	Line 5 + Line 6	7,796,217	1,178,735	8,974,952
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.8663950%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**43.2081296%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**43.6582654%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**49.7409033%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**50.2590967%**		

NOTE: These allocation factors are used for vintages 2021-2022 based on the most recently filed Cost of Service Study (May 2021).

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Energy Allocation Factors - Applicable to EE Program Costs

North Carolina Rate Class Energy Allocation Factors

Rate Class	Total NC Rate Class Sales (MWh) [1]	Opt-Out Sales[2]	Adjusted NC Rate Class MWh Sales	Rate Class Energy Allocation Factor
	(1)	(2)	(3) = (1) - (2)	(4) = (3) / NC Total in Column 3
Residential	16,576,122	-	16,576,122	62.52%
General Service	21,324,998	(11,746,852)	9,578,146	36.12%
Lighting	375,968	(15,120)	360,847	1.36%
NC Retail	38,277,088	(11,761,973)	26,515,115	100.00%

NOTES:

(1) Total NC Rate Class Sales (MWh) are for the forecasted year ending December 2022.

(2) Opt-Out sales are provided in Listebarger Exhibit 6. Since sales are not forecasted by individual customer, historic opt-out sales are assumed to be unchanged during the rate recovery period.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Demand Allocation Factors - Applicable to DSM Programs

North Carolina Rate Class Demand Allocation Factors

Rate Class	Total NC Rate Class Sales [1]	Sales Subject to Opt-Out [2]	Rate Class Demand [3]	Revised Rate Class Demand	Rate Class Allocation Factor
	(1)	(2)	(3)	(4) = ((1 - 2) / 1) * 3	(5) = (4)/Total of Column 4
Residential	16,576,122	-	3,877,909	3,877,909	68.84%
General Service	21,324,998	(11,772,985)	3,918,308	1,755,111	31.16%
Lighting	375,968	(15,755)	0	0	0.00%
NC Retail	38,277,088	(11,788,741)	7,796,217	5,633,019	100.00%

NOTES:

(1) Total NC Rate Class Sales (MWh) are for the forecasted year ended December 2022.

(2) Opt-Out sales are provided in Listebarger Exhibit 6. Since sales are not forecasted by individual customer, historic opt-out sales are assumed to be unchanged during the rate recovery period.

(3) The Coincident Peak ("CP") demands are based on the 2020 CP occurring on July 17 during the hour ended at 1600 EDT.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1273
Determination of Lighting Allocation Factors

January through December 2020

		Bulb %s		Allocation Factors	
1	Residential	81.70%	*Per M&V*	89.19%	*Lines 1 / (1 + 2)*
2	General Service	9.90%	*Per M&V*	10.81%	*Lines 2 / (1 + 2)*
3	Leakage	8.40%	*Per M&V*	0.00%	*-NA-*
4	Totals	100.00%	*Σ Lines 1 thru 3*	100.00%	*Σ Lines 1 thru 3*

Listebarger Exhibit 6

Duke Energy Progress, LLC
Docket No. E-2, Sub 1273
Forecasted 2022 kWh Sales

Line	Spring 2022 Sales Forecast - kWh	Total 2022
	North Carolina Retail:	
1	Residential	16,576,122,049
2	Non-Residential	21,324,997,788
3	Lighting	375,967,831
4	Total Retail	**38,277,087,668**

	Non-Residential	Gross kWh	Opt-outs	Net kWh
5	Energy Efficiency	21,324,997,788	(11,746,852,167)	**9,578,145,621**
6	DSM	21,324,997,788	(11,772,985,490)	**9,552,012,298**
7	Lighting - EE	375,967,831	(15,120,388)	**360,847,443**
8	Lighting - DSM	375,967,831	(15,755,311)	**360,212,520**

[1] Actual Opt-Out volumes for the twelve-months ending December 31, 2020.

I/A

Docket No. E-2, Sub 1273
Exhibit FBW-1

Forest Bradley-Wright
4532 Bancroft Dr. New Orleans, LA 70122
(504) 208-7597; forest@forestwright.com

PROFESSIONAL EXPERIENCE

Energy Efficiency Director: Southern Alliance for Clean Energy, Knoxville, TN **April 2018 – Present**

- Regulatory filings, testimony, strategy, and stakeholder management on integrated resource planning, energy efficiency program design, cost recovery and related matters throughout the Southeast.

Senior Policy Director: Alliance for Affordable Energy, New Orleans, LA **February 2017 – April 2018**

- Regulatory filings, strategy, and stakeholder management on integrated resource planning and energy efficiency rulemaking, power plant proposals and related matters at the city and state level.

Consultant: Utility Regulation and Energy Policy **December 2014 – February 2017**

- Technical and strategic guidance on clean energy policy and utility regulation for Opower, Gulf States Renewable Energy Industries Association, the Alliance, and Mississippi PSC candidate Brent Bailey.

Candidate: Louisiana Public Service Commission **July - December 2014**

- Won the open primary and secured 49.15% of the vote in the general election against a highly favored, well-funded incumbent.
- Raised nearly $500,000 in campaign contributions while publicly pledging not to accept money from monopoly companies regulated by the PSC.
- Campaign focused on ethical leadership, reducing bills, energy efficiency, the rights of customers to generate solar energy, and government transparency.

Utility Policy Director: Alliance for Affordable Energy, New Orleans, LA **October 2005 – June 2014**

- Directed successful policy efforts for energy efficiency, renewable energy, and integrated resource planning at the Louisiana PSC and New Orleans City Council, spurring every major Louisiana utility investment in clean energy over the past decade.
- Reviewed and filed intervenor comments, met with commissioners, utilities, and technical consultants, assembled and managed relationships with a broad coalition of stakeholders, worked with media, and served as the organization's public face.
- Launched and managed energy efficiency and solar workforce training programs, public education campaigns, and direct service projects to improve energy performance in over 100 homes following the city's rebuild post-Katrina.

Owner and Director: EcoPark LLC (d.b.a. The Building Block), New Orleans, LA **February 2008 – Present**
Created an innovative co-location business center to serve as a catalyst for moving green commerce and social entrepreneurship to the mainstream.

- Developed the business concept and plan, brought initial funding to the project, hired staff, established brand identity, and secured tenants.

Sustainable Development Team Facilitator: Shell International, New Orleans, LA **May 2001 – June 2004**

- Worked to facilitate a paradigm shift within corporate management's core business practices toward social and environmental issue management.
- Engaged a diverse team of professionals across the company to identify energy and resource inefficiencies and methods to reduce carbon emissions from venting and flaring in oil and natural gas exploration and production.
- Analyzed ways to incorporate sustainability accounting into each stage of new venture development for major drilling projects.

EDUCATION

Tulane University

- **Master of Arts in Latin American Studies, 2011**
  Concentration in environmental law, business, and international development
- **Bachelor of Arts with Honors in Latin American Studies, 2001**

EXPERT WITNESS TESTIMONY

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy, North Carolina Justice Center, and North Carolina Housing Coalition. Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. §62-133.9 and Commission Rule R8-69; Docket No. E-7, Sub 1249. May 10th, 2021.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy, North Carolina Justice Center, and North Carolina Housing Coalition. Application of Duke Energy Progress, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. §62-133.9 and Commission Rule R8-69; Docket No. E-2, Sub 1252. August 26th, 2020.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy, North Carolina Justice Center, and North Carolina Housing Coalition. Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. §62-133.9 and Commission Rule R8-69; Docket No. E-7, Sub 1230. May 22nd, 2020.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy, North Carolina Justice Center, and North Carolina Housing Coalition. Application of Duke Energy Progress, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. §62-133.9 and Commission Rule R8-69; Docket No. E-2, Sub 1206. August 19th, 2019.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy and League of United Latin American Citizens. Docket Nos. 20190015-EG, 20190016-EG, 20190018-EG, 20190019-EG, 20190020-EG, 20190021-EG- Commission Review of Numeric Conservation Goals for Florida Power & Light, Gulf Power Company, Duke Energy Florida, Orlando Utilities Commission, Jacksonville Electric Authority, Tampa Electric Company. June 10th, 2019.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy and North Carolina Justice Center, Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. §62-133.9 and Commission Rule R8-69; Docket No. E-7, Sub 1192. May 20th, 2019.

Forest Bradley-Wright, Direct Testimony on Behalf of Southern Alliance for Clean Energy, Georgia Power Company's Application for the Certification, Decertification, and Amended Demand Side Management Plan, Docket No. 42311. April 25th, 2019.

OTHER REGULATORY FILINGS

Forest Bradley-Wright, Comments on Behalf of Southern Alliance for Clean Energy, Re: Mississippi Power Company's Notice of IRP Cycle Pursuant to Commission Rule 29 – MPSC Docket 2019-UA-231. March 22nd, 2021

Forest Bradley-Wright, Comments on Behalf of Southern Alliance for Clean Energy, Re: Proposed amendment of Rule 25-17.0021 F.A.C., Goals for Electric Utilities – FPSC Docket No. 20200181. February 15th, 2021

Forest Bradley-Wright and George Cavros, Comments on Behalf of Southern Alliance for Clean Energy, Re: Entergy Mississippi, LLC Notice of IRP Cycle Pursuant to Commission Rule 29 – MPSC Docket 2019-UA-232. July 17th, 2020

Forest Bradley-Wright, Comments on Behalf of Southern Alliance for Clean Energy, Re: Mississippi Power Company's Notice of IRP Cycle Pursuant to Commission Rule 29 – MPSC Docket 2019-UA-231. March 24th, 2020

Forest Bradley-Wright, Comments on Behalf of Southern Alliance for Clean Energy, Order Establishing Docket to Investigate the Development and Implementation of an Integrated Resource Planning Rule – MPSC Docket 2018-AD-64. February 15th, 2019

Forest Bradley-Wright and Daniel Brookeshire, Comments on Behalf of North Carolina Sustainable Energy Association and Southern Alliance for Clean Energy, Duke Energy Progress, LLC's Proposed Non-Profit Low-Income Weatherization Pay for Performance Pilot, Docket No. E-2, Sub 1187. November 9th, 2018

Forest Bradley-Wright, Comments on Behalf of Southern Alliance for Clean Energy, Order Establishing Docket to Investigate the Development and Implementation of an Integrated Resource Planning Rule – MPSC Docket 2018-AD-64. August 1st, 2018

Forest Bradley-Wright and Logan Burke, Comments on Behalf of Alliance for Affordable Energy, Rulemaking to Study the Possible Development of Financial Incentives for the Promotion of Energy Efficiency by Jurisdictional Electric and Natural Gas Utilities, Louisiana Public Service Commission Docket R-31106. June 20th, 2017

Forest Bradley-Wright and Logan Burke, Comments on Behalf of Alliance for Affordable Energy, Rulemaking to Establish Integrated Resource Planning Components and Reporting Requirements for Entergy New Orleans, Docket No. UD-17-01. May 25th, 2017

Forest Bradley-Wright and Logan Burke, Comments on Behalf of Alliance for Affordable Energy, Rulemaking to Study the Possible Development of Financial Incentives for the Promotion of Energy Efficiency by Jurisdictional Electric and Natural Gas Utilities, Louisiana Public Service Commission Docket R-31106. March 7th, 2017

Forest Bradley-Wright and Jeff Cantin, Post Hearing Brief on Behalf of Gulf States Renewable Energy Industries Association, Petition for a Certificate of Convenience and Necessity for Alabama Power, Docket No. 32382. August 19th, 2015

PUBLICATIONS

Forest Bradley-Wright and Heather Pohnan, Third Annual Energy Efficiency in the Southeast Report, Southern Alliance for Clean Energy. January 26th, 2021

Forest Bradley-Wright and Heather Pohnan, Energy Efficiency in the Southeast 2019 Annual Report, Southern Alliance for Clean Energy. January 21st, 2020

Forest Bradley-Wright and Heather Pohnan, Energy Efficiency in the Southeast 2018 Annual Report, Southern Alliance for Clean Energy. December 12th, 2018

DUKE ENERGY PROGRESS, LLC

Request:

Please provide DEP's line loss assumptions for 2020 used to convert savings on the customers' side of the meter to savings at the generator:

a. For energy; and
b. For peak demand.
c. Please specify if they are based on average or marginal line loss rates.

Response:

a. and b. DEP applied a line loss factor of (1+0.051) to convert savings "at the meter" to savings "at the generator" for both energy and peak demand.

c. The 5.1% value represents an average loss rate.

Person responding: Melissa Adams, Manager, Program Performance

DUKE ENERGY PROGRESS, LLC

Request:

For each program in DEP's DSM/EE portfolio, please provide:

a. UCT and TRC cost-effectiveness test scores with corresponding total costs and benefits for 2016, 2017, 2018, 2019, and 2020, including:
   i. A detailed explanation of the inputs and calculation methods used for UCT and TRC
   ii. An illustrative example showing how the calculations are done using a common efficient HVAC measure.
b. The projected cost effectiveness scores for each program in the 2021 and 2022 forecasts;
c. The measures and programs offered in 2018, 2019, and 2020 that were removed because there were deemed no longer cost effective for 2021 and 2022;
d. Measures and programs that have UCT and/or TRC cost effectiveness score between 0.85 and 0.99 that were not included in DEP's 2021 and 2022 portfolios along with their respective cost effectiveness scores and projected kW and kWh savings impact that would have been expected if they had been included.

Response:

The Company objects to SACE DR 1-4(a) (ii), requesting an illustrative example showing how calculations are done using a common HVAC measure, on the ground that it is requesting the Company to perform a new and additional analysis. That objection notwithstanding, and without waiving said objection, please refer to "SACE DR 1-4 a and b.xlsx" and "SACE DR 1-4 c and d.docx."

SACE%20DR%201-4 %20a%20and%20b.xl

SACE%20DR%201-4 %20c%20and%20d.d

Person responding: Steven A. LoConte, Senior Program Performance Analyst

I/A

CCL-SACE DR1-4

1-4.For each program in DEP's DSM/EE portfolio, please provide:
a.UCT and TRC cost-effectiveness test scores with corresponding total costs and benefits for 2016, 2017, 2018, 2019, and 2020, including:
i.A detailed explanation of the inputs and calculation methods used for UCT and TRC
ii.An illustrative example showing how the calculations are done using a common efficient HVAC measure.
b.The projected cost effectiveness scores for each program in the 2021 and 2022 forecasts;

Note: Minor variances in Total Portfolio NPV of AC and Program Costs due to rounding

a/b		2016					
		NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT	TRC
	Appliance Recycling Program	76,177	(129,701)	(50,266)	-	-0.59	-0.96
	Appliances and Devices	-	-	-	-		
	Energy Education Program for Schools	1,693,087	783,357	213,524	-	2.16	2.97
	EnergyWise Home	70,854,171	6,887,758	5,487,905	-	10.29	50.62
	Home Energy Improvement	6,991,688	5,692,422	4,298,396	9,582,983	1.23	0.64
	Neighborhood Energy Saver	1,167,680	1,943,051	1,203,816	-	0.60	1.58
	Multi-Family Energy Efficiency Program	7,155,924	1,936,126	697,690	-	3.70	5.78
	My Home Energy Report	7,524,461	5,575,910	-	-	1.35	1.35
	Residential Energy Assessments	4,853,362	1,342,291	202,452	-	3.62	4.26
	Residential New Construction	19,280,066	8,903,911	7,975,698	12,942,488	2.17	1.39
	Energy Efficient Lighting	44,883,085	16,511,512	14,347,450	6,858,992	2.72	4.97
	Save Energy and Water Kit	13,873,513	638,558	371,460	-	21.73	51.94
	Residential Service - Smart$aver	-	-	-	-		
	Low Income Weatherization Pilot						
	Energy Efficiency for Business	47,824,935	13,404,039	11,208,315	28,768,577	3.57	1.54
	Business Energy Report	309,365	65,808	-	-	4.70	4.70
	Non-Res SmartSaver Performance	-	24,482	-	-	0.00	0.00
	Commercial, Industrial, & Governmental Demand Response	(10,684,733)	-	-	-		
	EnergyWise for Business	164,697	1,053,456	46,835	-	0.16	0.16
	Small Business Energy Saver	32,988,897	8,838,269	8,173,844	13,318,382	3.73	2.36
	Non-Residential Smart $aver Prescriptive	-	-				
	Non-Residential Smart $aver Custom	-	-				
	Total Portfolio	**248,956,375**	**73,471,249**	**54,177,117**	**71,471,423**	**3.39**	**2.74**

i UCT is the sum of the net present value of avoided capacity, energy and T&D divided by total program costs
TRC is the sum of the net present value of avoided capacity, energy and T&D divided by the sum of total program costs and the participant costs less participant incentives

ii See the UCT and TRC columns for part a for the formulas used to calculate the UCT and TRC

I/A

2017						2018				
NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT	TRC	NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT
-	5,339	-	-	0.00	0.00	-	-	-	-	
-	-	-	-			-	-	-	-	
1,376,442	799,072	216,906	-	1.72	2.36	1,261,493	676,815	191,202	-	1.86
62,410,503	6,502,032	6,094,495	-	9.60	153.14	55,969,845	5,817,271	5,179,747	-	9.62
6,313,442	6,654,031	5,151,334	11,690,091	0.95	0.48	-	-	-	-	
1,117,743	1,702,549	1,177,799	-	0.66	2.13	1,682,598	1,845,739	1,264,146	-	0.91
10,163,052	2,403,372	961,410	-	4.23	7.05	8,510,661	2,409,743	768,609	-	3.53
6,972,509	6,454,921	-	-	1.08	1.08	9,855,291	7,687,891	-	-	1.28
5,512,365	1,781,190	213,628	12,908	3.09	3.49	5,373,630	1,851,965	242,814	10,940	2.90
21,481,837	11,156,278	9,654,017	15,834,693	1.93	1.24	22,773,890	13,189,949	11,169,768	9,823,602	1.73
39,549,493	11,689,156	10,354,220	7,648,783	3.38	4.40	33,768,459	9,815,496	7,837,838	-	3.44
17,187,186	849,614	622,934	-	20.23	75.82	10,207,890	825,279	408,963	-	12.37
-	-	-	-			6,300,631	7,168,833	5,595,885	9,077,791	0.88
								-	-	
77,891,372	20,789,293	18,402,384	51,782,736	3.75	1.44	-	-	-	-	
737	19,432	-	-	0.04	0.04	-	-	-	-	
335,899	140,661	46,706	209,151	2.39	1.11	810,508	201,559	138,274	646,499	4.02
3,551,967	1,393,650	1,269,200	-	2.55	28.54	1,413,457	1,154,642	1,187,855	-	1.22
858,655	1,329,140	-	-	0.65	0.65	151,899	2,108,030	629,260	-	0.07
26,945,514	8,383,422	7,733,531	12,633,064	3.21	2.03	22,343,579	8,858,213	7,857,678	11,929,015	2.52
-	-	-	-			65,320,575	11,515,913	9,131,886	23,055,883	5.67
-	-	-	-			8,907,939	2,174,163	1,111,868	4,935,057	4.10
281,668,716	**82,053,151**	**61,898,563**	**99,811,427**	**3.43**	**2.35**	**254,652,345**	**77,301,500**	**52,715,794**	**59,478,787**	**3.29**

I/A

	2019							
TRC	NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT	TRC	NPV of AC	Program Cost
-	-	-	-	-			-	-
-	10,419,429	2,160,799	1,099,624	1,379,802	4.82	4.27	8,646,551	3,051,854
2.60	1,039,694	747,483	186,360	200,113	1.39	1.37	456,210	388,273
87.79	53,221,850	5,806,874	5,617,524	-	9.17	281.08	8,817,400	1,110,200
-	-	-	-	-		-	-	-
2.89	1,438,897	1,671,298	1,095,666	1,174,420	0.86	0.82	196,865	401,046
5.19	5,977,179	2,156,484	567,005	620,998	2.77	2.70	1,389,245	892,251
1.28	11,676,738	6,299,307	-	-	1.85	1.85	10,897,311	7,369,336
3.32	4,344,111	2,113,798	168,539	189,464	2.06	2.03	4,050,428	2,160,729
1.92	19,396,567	15,113,951	12,656,251	11,233,867	1.28	1.42	22,840,461	18,861,261
17.07	35,415,070	13,447,031	11,329,673	7,252,368	2.63	3.78	20,092,826	5,995,694
24.52	-	-	-	-		-	-	-
0.59	5,417,341	6,411,758	4,338,824	6,539,280	0.84	0.63	5,453,175	6,517,089
	75,533	27,356	19,092	-	2.76	9.14	61,168	51,370
-	-	-	-	-		-	-	-
-	-	-	-	-		-	-	-
1.14	606,333	267,186	129,784	482,944	2.27	0.98	1,239,947	386,339
(42.56)	4,394,068	1,811,347	1,242,733	-	2.43	7.73	2,964,614	1,352,902
0.10	923,654	2,412,880	1,005,890	123,454	0.38	0.60	686,030	1,896,524
1.73	17,456,367	7,301,790	6,380,717	10,838,854	2.39	1.48	10,837,185	5,004,816
2.57	31,482,596	7,877,838	5,763,360	11,646,372	4.00	2.29	28,517,362	7,863,953
1.49	9,658,177	2,776,482	1,580,493	4,849,778	3.48	1.60	9,481,018	3,514,807
3.03	**212,943,604**	**78,403,665**	**53,181,535**	**56,531,713**	**2.72**	**2.60**	**136,627,796**	**66,818,443**

2020				2021					
Participant Incentives	NPV Participant Costs (net)	UCT	TRC	NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT	TRC
-	-			-	-	-	-		
1,188,978	1,379,802	2.83	2.67	13,099,464	1,552,345	946,542	687,571	8.44	10.13
83,075	200,113	1.17	0.90	1,372,059	998,933	280,177	264,916	1.37	1.39
6,592,211	-	7.94	(1.61)	13,517,088	6,906,770	4,588,239	-	1.96	5.83
-	-		-	-	-	-	-		-
165,786	1,174,420	0.49	0.14	1,834,467	2,102,637	1,727,124	1,674,021	0.87	0.90
162,346	620,998	1.56	1.03	7,060,550	2,673,548	746,801	734,182	2.64	2.65
-	-	1.48	1.48	11,325,840	7,016,406	-	-	1.61	1.61
143,311	189,464	1.87	1.84	7,550,953	3,713,085	343,145	473,797	2.03	1.96
16,331,257	11,233,867	1.21	1.66	19,911,473	15,182,173	13,448,496	12,650,072	1.31	1.38
4,787,340	7,252,368	3.35	2.37	7,651,434	3,850,337	3,225,136	1,957,577	1.99	2.96
-	-		-	-	-	-	-		-
4,726,175	6,539,280	0.84	0.65	2,764,092	4,842,705	2,909,158	5,023,872	0.57	0.40
16,932	-	1.19	1.78	-	-	-	-		-
-	-		-	-	-	-	-		-
-	-		-	-	-	-	-		-
256,693	482,944	3.21	2.02	1,721,451	608,576	392,157	1,358,245	2.83	1.09
1,401,894	-	2.19	(60.51)	4,596,557	2,590,719	2,435,930	-	1.77	29.70
917,440	123,454	0.36	0.62	941,042	3,446,547	1,724,705	75,666	0.27	0.52
4,105,057	10,838,854	2.17	0.92	14,886,828	7,420,102	6,756,705	11,361,733	2.01	1.24
5,660,029	11,646,372	3.63	2.06	39,254,442	11,648,055	8,726,018	20,761,927	3.37	1.66
1,716,319	4,849,778	2.70	1.43	10,047,403	3,932,557	2,301,091	7,130,008	2.55	1.15
48,254,845	**56,531,713**	**2.04**	**1.82**	**157,535,145**	**78,485,496**	**50,551,423**	**64,153,584**	**2.01**	**1.71**

2022					
NPV of AC	Program Cost	Participant Incentives	NPV Participant Costs (net)	UCT	TRC
-	-	-	-		
13,976,572	5,032,531	3,921,740	7,103,274	2.78	1.70
1,850,249	1,265,659	372,363	342,638	1.46	1.50
4,145,545	2,911,345	945,751	-	1.42	2.11
-	-	-	-		-
2,590,613	3,063,705	2,453,001	2,279,880	0.85	0.90
4,982,779	1,924,548	1,250,294	1,075,574	2.59	2.85
10,729,556	6,543,763	-	-	1.64	1.64
7,838,136	3,422,188	344,880	476,184	2.29	2.21
20,458,026	15,144,537	13,937,691	12,814,919	1.35	1.46
12,414,397	5,700,439	4,664,172	2,340,979	2.18	3.68
-	-	-	-		-
3,338,996	3,301,534	1,939,350	5,521,478	1.01	0.49
85,792	86,901	27,400	-	0.99	1.44
-	-	-	-		-
-	-	-	-		-
1,123,866	401,977	248,952	862,250	2.80	1.11
4,671,542	2,210,447	2,032,888	-	2.11	26.31
804,045	2,904,079	1,911,715	-	0.28	0.81
25,640,082	10,322,430	8,663,452	15,877,605	2.48	1.46
39,447,957	12,680,811	9,296,095	17,040,091	3.11	1.93
10,548,581	4,610,576	2,458,112	7,226,284	2.29	1.12
164,646,734	**81,527,471**	**54,467,856**	**72,961,155**	**2.02**	**1.65**

DUKE ENERGY PROGRESS, LLC

Request:

Please provide a spreadsheet of total energy savings achieved by each of the Company's DSM/EE programs, in GWh, for 2018, 2019, and 2020.

Response:

Please see attached file, "SACE - DR1-21," for total energy savings achieved by each of the Company's DSM/EE programs, in GWh, for 2018, 2019, and 2020.

SACE DR1-21.xlsx

Person responding: Steven A. LoConte, Senior Program Performance Analyst

I/A

SACE DR 1-21

1-21. Please provide a spreadsheet of total energy savings achieved by each of the Company's DSM/EE programs, in GWh, for 2018, 2019, and 2020.

	Residential Programs	2018 System Energy Reduction (GWh)	2019 System Energy Reduction (GWh)	2020 System Energy Reduction (GWh)
	EE Programs			
1	Appliance Recycling Program	-	-	-
2	Energy Efficient Appliances and Devices	15.25	19.59	18.78
3	Energy Education Program for Schools	2.56	3.28	1.46
4	Energy Efficient Lighting	25.64	33.35	18.94
5	Residential Service – Smart $aver	7.23	6.76	6.89
6	Low Income Weatherization Pilot	-	0.13	0.11
7	Multi-Family Energy Efficiency	13.83	11.86	2.82
8	Neighborhood Energy Saver	3.54	3.70	0.51
9	Residential Energy Assessments	7.75	7.83	7.15
10	Residential New Construction	14.26	16.34	20.01
11	Save Energy and Water Kit	-	-	-
12	Total for Residential Conservation Programs	90.08	102.83	76.66
13	My Home Energy Report (1)	164.07	154.60	154.96
14	Total Residential Conservation and Behavioral Programs	254.14	257.44	231.63
15	EnergyWise	-	-	-
16	Total Residential	254.14	257.44	231.63

	Non-Residential Programs	2018 System Energy Reduction (GWh)	2019 System Energy Reduction (GWh)	2020 System Energy Reduction (GWh)
	EE Programs			
17	Business Energy Report	-	-	-
18	Energy Efficient Lighting	6.76	8.78	4.99
19	Energy Efficiency for Business	-	-	-

20	**Non-Residential Smart $aver - Prescriptive**	84.98	49.68	46.35
21	**Non-Residential Smart $aver Custom**	11.90	13.13	12.77
22	**Non-Residential Smart $aver Performance Incentive**	1.52	1.36	3.10
23	**Small Business Energy Saver**	40.30	36.43	23.47
24	**Total for Non-Residential Conservation Programs**	145.46	109.38	90.69
25	**EnergyWise for Business**	0.04	1.06	0.55
26	**Commercial, Industrial, & Governmental Demand Response**	-	-	-
27	**Total for Non-Residential DSM Programs**	0.04	1.06	0.55
28	**Total Non Residential**	145.50	110.44	91.24
29	**Total All Programs**	399.64	367.87	322.86
30	DSDR	48.06	38.08	32.10
31	**Total with DSDR**	447.70	405.96	354.96

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

DUKE ENERGY PROGRESS, LLC

Request:

Please provide a calculation of DSM/EE portfolio savings with and without line loss (1) as a percentage of total annual sales; and (2) as a percentage of annual sales to non-opt-out customers:

a. for the year 2020 (as a percentage of 2019 retail sales); and
b. forecasted for the year 2022 (as a result of forecasted 2021 sales).

Response:

The Company objects to this data request on the ground that it requests the Company to perform new work or analysis.

Person responding: Melissa Adams, Manager, Program Performance

DUKE ENERGY PROGRESS, LLC

Request:

In Docket E-2, Sub 931, the Commission authorized DEP to shift from using the Total Resource Cost test to the Utility Cost Test as the primary basis for evaluating the cost effectiveness of energy efficiency programs, beginning in 2022. Please indicate how much additional savings DEP is projecting for 2022 using the UCT compared to what would have been achieved using the TRC, both in aggregate and broken out by program.

Response:

The Company objects to this data request on the ground that it requests the Company to perform a new analysis or projection and because it seeks information that is not relevant to this annual rider proceeding. Without waiving said objection, the Company provides as follows:

No additional savings are projected for 2022 using the UCT compared to TRC. There have been no changes to program offerings based on the shift from TRC to UCT for the 2022 projection.

Person responding: Steven A. LoConte, Senior Program Performance Analyst

Pathways for Energy Efficiency in Virginia

Scenarios for Virginia Electric and Power Company to Achieve the Virginia Clean Economy Act Energy Efficiency Savings Goals

Prepared by:

Liz Bourguet and Jim Grevatt

June 3, 2021

Energy Futures Group, Inc

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Contents

About the Authors

Energy Futures Group (EFG) is a clean energy consulting firm based in Hinesburg, Vermont and with offices in Boston and New York. EFG specializes in the design, implementation and evaluation of programs and policies to promote investments in energy efficiency, renewable energy, other distributed resources, and strategic electrification. EFG staff have worked on these issues on behalf of energy regulators, other government agencies, utilities and advocacy organizations across the United States, Canada, Europe, and China.

Liz Bourguet is a Senior Analyst at Energy Futures Group in Hinesburg, Vermont. She joined EFG in 2020 after graduating from the Yale School of Forestry and Environmental Studies with a Master of Environmental Management, specializing in environmental policy analysis. Her capstone report, Opportunities and Challenges for Investor-Owned Utilities in a Changing Climate, prepared for the Natural Resources Defense Council, assessed grid modernization and utility financing in the face of increasing wildfires in California. Her professional experience includes work for National Wildlife Federation and Environmental Advocates of New York, where she organized environmental campaigns, drafted policy recommendations, advocated for environmental legislation through lobbying and public outreach, and conducted research on energy policy and transportation issues. Most recently she held an internship with the US Climate Alliance, where she provided research and recommendations on best practice climate policies to the coalition of states committed to the Paris Agreement.

Jim Grevatt has 30 years of experience in energy efficiency program planning and operations. At Energy Futures Group Jim has advised regulators, program implementers, and advocates in twenty-three states and provinces, and has provided expert witness testimony in fourteen of those jurisdictions. Jim has hands-on experience with industry-leading approaches to designing and managing energy efficiency programs, including multi-family, low income, residential retrofit, new construction, HVAC, and efficient products programs. His in-depth knowledge of program operations and clear understanding of strategic thinking and planning ensure that programs achieve their desired market impacts. In past leadership roles at Efficiency Vermont, the DCSEU, and Vermont Gas, Jim had overall responsibility both for program design and operations, assuring that programs were efficient and effective.

I. Executive Summary

Introduction and Purpose

This report was developed to explore whether, by effectively implementing a suite of energy efficiency programs similar to those currently implemented by other large utilities, Virginia Electric and Power Company ("Dominion" or "Company") can meet and exceed the savings requirements of the Virginia Clean Economy Act ("VCEA"). The report was requested by a group of clean energy non-profits in Virginia, including the National Housing Trust ("NHT"), The Nature Conservancy ("TNC"), the Virginia chapter of the Advanced Energy Economy ("Virginia AEE"), and the American Council for an Energy Efficient Economy ("ACEEE").[1]

To support our analysis we created a model that builds off the programs that have been approved for implementation by the State Commerce Commission ("SCC" or "Commission") prior to 2021.[2] The model incorporates reported costs and savings from a dozen large utility energy efficiency portfolios ("comparison utilities" or "comparison portfolios")[3] and allows comparison of the savings results of user-defined scenarios that describe different combinations of programs at varying penetration levels. We created four different sample scenarios that highlight different policy priorities while maintaining opportunities for all eligible customer sectors, in each case demonstrating compliance with VCEA savings requirements. ***Our work shows that meeting the 2022-2025 savings requirements is achievable without extraordinary or unusual efforts by simply implementing the kinds of energy efficiency programs that commonly provide the majority of energy savings for leading electric utilities.*** The Company can meet its savings requirements with longer lasting comprehensive savings for commercial and residential customers, lower cost but shorter-lived measures, or a reasonable balance of the two. In each case we find the Company can also meet the VCEA requirements for energy efficiency investments for low-income communities, however these expenditures must increase significantly as other programs ramp up if the Company is to meet this obligation. Dominion can continue to work with its stakeholders to identify program opportunities while also focusing on implementing and expanding the key programs that will drive savings results if it expects to meet its VCEA requirements.

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[1] In this report, we refer to ACEEE, NHT, TNC, and Virginia AEE as the "core project team".

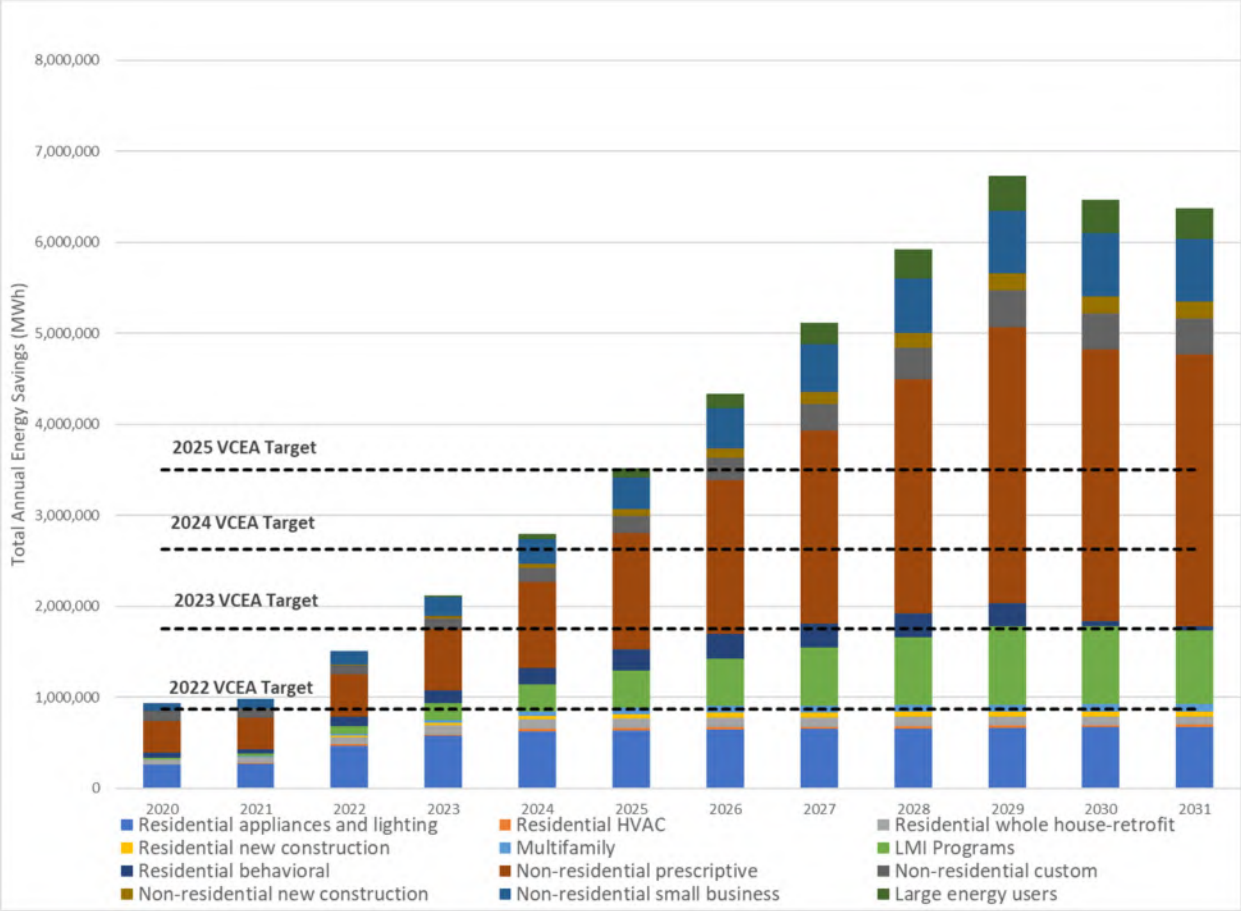
[2] These are programs that have been approved in Phase I through Phase VIII, referred to in Dominion's IRP as "Category 1" programs.

[3] To learn more about how we selected and utilized comparison utilities see Appendix A.

We further show that much of the savings achieved from programs geared towards meeting the 2022-2025 savings requirements are likely to persist through the decade – thus targets set by the Commission for 2026 and beyond should be achievable ***and*** should be established at considerably higher levels than the 5.0% total annual savings expected for 2025.

These points are illustrated below in Figure 1, which represents the expected results of the "Balanced Lower Cost"[4] scenario:

Figure 1: Example Scenario that Meets 2022-2025 VCEA Savings Targets



While the evidence provided by other large utilities gives us confidence that these results are reasonable and achievable, it is also clear that Dominion must act quickly to ramp up its program savings if it is to comply with the statute. We discuss this further below.

[4] The four scenarios are described in greater detail below.

Energy Efficiency Savings Requirements

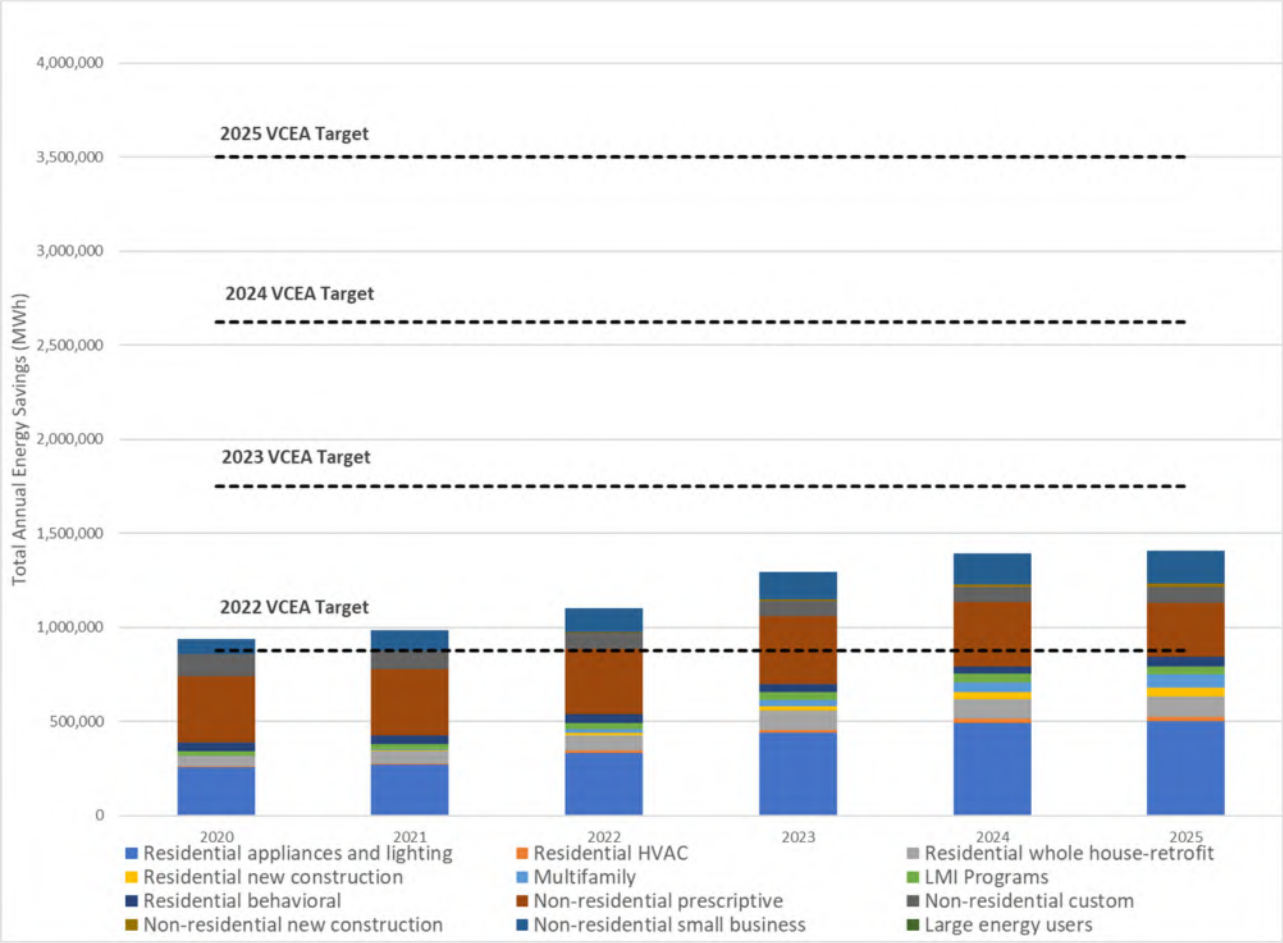
The VCEA, signed into law by Governor Northam in 2020, contains numerous provisions to accelerate Virginia's transition to clean energy, including a requirement that certain utilities achieve specified energy efficiency savings beginning in 2022. The law requires that in 2022 Dominion achieve total annual energy efficiency savings equal to at least 1.25% of its 2019 annual jurisdictional retail electric sales.[5] In 2023 the requirement doubles to 2.5%, then increases to 3.75% in 2024, and to 5.0% in 2025. Beginning in 2026, the law provides that the SCC shall establish new energy efficiency savings targets.

Figure 2 below is based on a scenario in which all new programs are set to "0" penetration so that only Dominion's programs that were approved prior to 2021 are modeled. It illustrates our analysis showing that if Dominion successfully implements its programs, it should achieve its 2022 VCEA saving requirement simply through the programs that were approved prior to 2021. However, it also shows that savings must be increased rapidly for the utility to achieve the savings requirement in 2023-2025. When compared with Dominion's modest portfolio of currently approved programs, achieving the VCEA requirements will demand significant increases in customer participation and a four-to-five-fold increase in incremental annual savings.[6] This will only occur through focused planning and skillful program implementation. Because many other utilities are already implementing successful, large-scale programs, we conclude it is reasonable that Dominion can also do what is required to meet the VCEA requirements.

[5] Total annual savings are the savings in a particular year from new measures installed in that year plus the savings still persisting from measures installed in prior years.

[6] Incremental annual savings are the savings in a particular year ***only*** from new measures installed in that year. Incremental annual savings do not include savings from measures installed in earlier years that are still active.

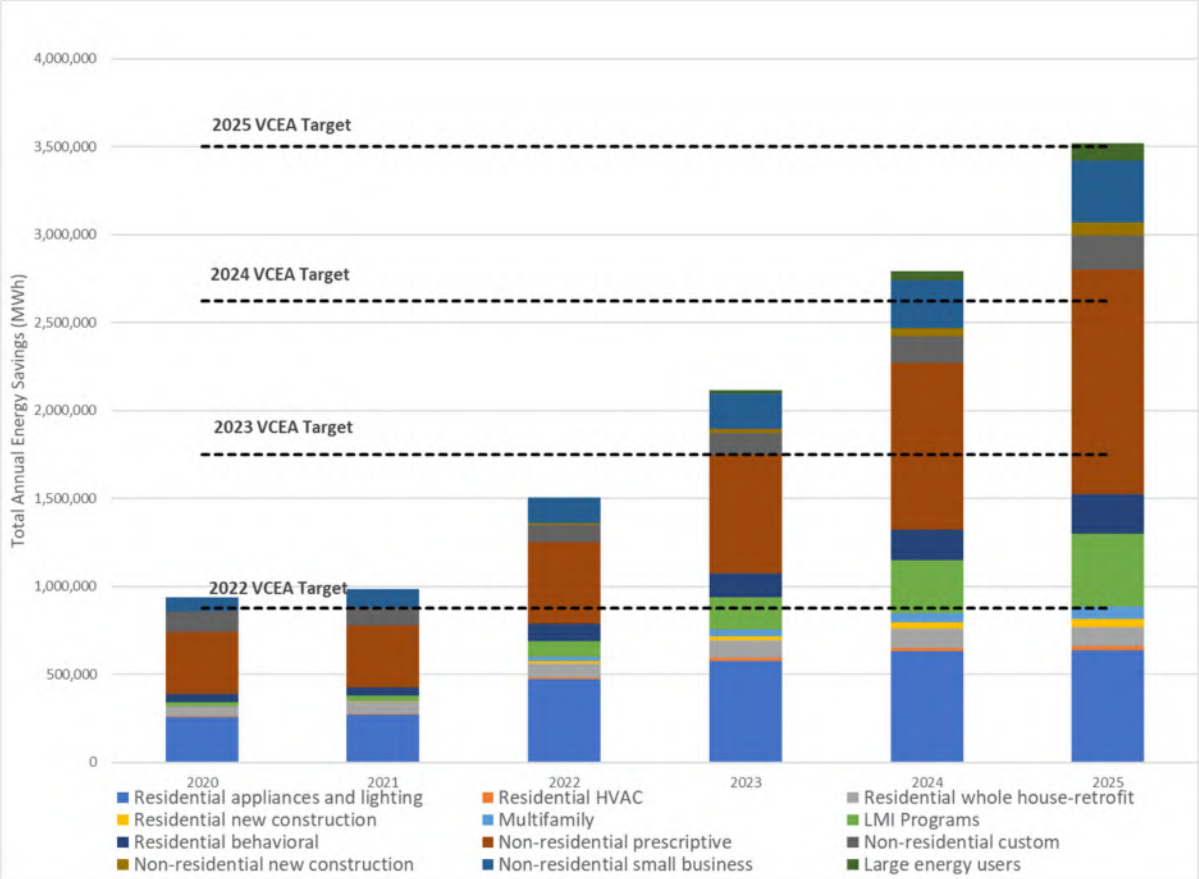
Figure 2: Savings from Dominion Programs Approved Prior to 2021



In Figure 3, we build programs up from the savings level illustrated in

Figure 2 to illustrate an example scenario in which the savings from programs approved by the SCC prior to 2021 are shown in 2020 and 2021 and then ramped up beginning in 2022 to achieve the VCEA savings requirements for 2023-2025. To ramp these programs up starting in 2022, we look to realistic program penetration rates achieved by other utilities.

Figure 3: Example Scenario that Meets 2022-2025 VCEA Savings



VCEA Requirements for Historically Underserved Customers

The VCEA further provides that at least 15% of the proposed costs of the Company's energy efficiency programs "shall be allocated to programs designed to benefit low-income, elderly, or disabled individuals or veterans"[7] ("LMI"). The Company will need to rapidly and effectively ramp up not only its residential and non-residential energy efficiency programs to meet the VCEA requirements, but it will also need to increase the scale of its proposed programs for low-income, elderly, or disabled individuals or veterans. Because the LMI requirement is framed as a percentage of total proposed portfolio spending and because it is evident that Dominion must increase overall spending to meet the VCEA savings requirements, the Company clearly will also need to propose increased LMI spending. The Pathways model checks whether the proposed LMI

[7] SB 851, lines 1866-1867.

programs meet the 15% portfolio spending requirement, and each of the four sample scenarios we created complies.

Expected Results from Currently Approved Programs

Our analysis of Dominion's currently approved (through Phase VIII) energy efficiency programs suggests that the Company could meet the VCEA savings requirement in 2022 if the approved programs achieve their intended results, but it will fall far short of meeting its obligations in 2023-2025 (as shown in Figure 2). It also appears that the approved program budgets will fall short of the 15% LMI requirement. In our analysis, the Company has proposed approximately $355 million in total portfolio spending from 2020-2025, and just under $39 million, or 11%, for total LMI programs in the same period.[8] Looking only at the programs that were approved prior to 2021, the Company appears poised to achieve roughly 6%-8% of its portfolio spending for LMI programs in 2022 and 2023, far short of the 15% requirement. While the LMI percent of portfolio spending increases to between 13%-15% for approved programs in 2024 and 2025, it is important to recognize that the implementation, and thus the spending, of many programs that were approved in earlier phases will be completed in those years. As a result, the overall budgets from only programs that were approved prior to 2021 are much lower than will be required to achieve the energy savings requirements. In other words, overall portfolio spending must increase to meet the savings requirements, thus LMI investments must also increase to comply with the 15% of proposed spending requirement.

II. Different Scenario Approaches and Results

Leading utilities typically rely on similar types of programs to achieve the majority of their energy efficiency savings simply because, despite regional differences in the predominance of certain savings opportunities, the electric technologies that we rely on are more similar than they are different across different utility service territories. Residential and commercial lighting and controls, industrial process and operational efficiency, heating and cooling equipment efficiency and building shell improvements, motors, refrigeration, and appliances – all of these tend to provide relevant and cost-effective savings opportunities in many parts of North America, even though the specific savings levels may vary regionally. However, while there are many similarities between utility energy efficiency approaches, individual utilities may emphasize certain program

[8] Program budgets through Phase VIII, assuming budget is allocated equally across five implementation years.

types over others based on the specific characteristics of their customer base and the policy priorities in their jurisdictions.

Dominion can meet its VCEA energy savings requirements through a variety of combinations of different program types, with each scenario reflecting differing priorities. In this report we highlight four example scenarios, but model users can explore additional scenarios in the Excel-based tool that we created. In the model, users can toggle each program between several different penetration levels and can determine ramp-up rates and start and stop years for program implementation to illustrate the multiple pathways available to Dominion to achieve its savings requirements.

The scenarios vary in emphasis and include energy efficiency portfolios focused on:

1) increased opportunities for historically underserved customers ("enhanced LMI"),
2) high residential savings ("high residential"),
3) small businesses ("high small business"), and
4) a "balanced" portfolio that seeks to provide some opportunities to all segments while minimizing program costs ("balanced lower cost").

Each scenario adheres to the requirements that Dominion meet its 2022-2025 VCEA savings targets as well as its 15% spending requirement on programs serving LMI customers established by the VCEA. ***The four example scenarios above illustrate that Dominion can achieve its 2022-2025 VCEA targets and its spending commitment to LMI customers. Importantly, we found that if program costs for Dominion are in line with the average program costs of the comparison utilities' portfolios, each of the four scenarios described below would also lead Dominion to comply with its Grid Transformation and Security Act (GTSA) requirement to propose at least $870 million in energy efficiency program investments between 2018-2028.***

Below are descriptions of the four example scenarios that we modeled to illustrate how Dominion can meet its energy savings requirement while emphasizing savings for different customer segments. We illustrate the results of each of these example scenarios in Appendix B. While each scenario has a different emphasis, each includes a balanced portfolio of programs that delivers energy efficiency to multiple customer segments. In each example scenario the bulk of new programs are modeled to launch in 2022 and ramp up over several years.

1. The **enhanced LMI scenario** emphasizes programs that maximize savings for historically underserved customers and exceeds the 15% LMI spending requirement. The LMI program

categories included are low-income multifamily, low-income single family, and low-income low cost, which includes programs such as LED or energy efficiency kits distributed through food banks and other avenues. This scenario is achieved through high levels of savings from each of the three LMI program categories. High levels of savings for this portfolio also come from non-residential prescriptive and small business programs. Moderate levels of savings come from each of the residential programs.[9]

2. The **high residential scenario** focuses on savings achieved from residential programs that provide significant savings to families and households. This includes high levels of savings from residential HVAC, whole house retrofits, new construction, market rate multifamily, and, to some extent, appliances, and lighting (reflecting changing standards and market maturity for screw-based LED lighting). This scenario also emphasizes LMI programs. This portfolio includes moderate levels of savings from non-residential prescriptive, small business, and large energy user programs.

3. The **high small business scenario** emphasizes energy savings for small business customers, while prioritizing non-residential prescriptive programs that could also benefit small businesses. In addition to its non-residential program focus, the scenario also achieves a moderate level of savings from residential LMI programs and residential appliances, near-term lighting, and behavioral programs.

4. The **balanced lower cost portfolio** is a portfolio of programs that reflect the lower end of potential program spending necessary for Dominion to meet VCEA targets through 2025 and its LMI spending requirement. It accomplishes this by balancing moderate levels of savings through residential energy efficiency programs with high-yield non-residential programs that provide the majority of the required savings. The residential programs include moderate levels of savings through residential behavioral, appliances and near-term retail lighting, and LMI programs. The non-residential programs include a high level of savings from the non-residential prescriptive program and moderate level of savings through non-residential small business and large energy users.

In

[9] Spending and savings targets for LMI energy efficiency programs are a starting point for measuring equity across utilities' efficiency portfolios. Utilities can also consider other metrics to ensure an equitable distribution of benefits across their portfolio. For example, researchers at the University of Michigan developed the Energy Efficiency Equity baseline (E3b) to examine differences in socioeconomic characteristics and policy approaches in each utility service territory and understand how these factors change over time. See their report to learn more: poverty.umich.edu/research-publications/policy-briefs/a-multi-state-analysis-of-equity-in-utility-sponsored-energy-efficiency-investments-for-residential-electric-customers/

Figure 4 below, we provide a comparison of the costs and savings for the comparison portfolios with the four example scenarios we created in our model in implementation year 2025. The example scenario costs are higher than the comparison portfolios for two primary reasons. First, in each of the example scenarios, residential lighting savings are dramatically reduced compared with the 2018 comparison portfolios due to the likelihood of federal standards being implemented. Second, the 15% LMI spending requirement results in greater LMI expenditures than we found with many of the comparison portfolios.

Figure 4: 2025 Program Scenarios and 2018 Comparison Utilities (Nominal 2018 $)

Portfolio totals	First year program costs	Total Incremental annual savings (MWh)	First year $/MWh	Weighted Average Measure Life	Incremental lifetime savings (MWh)	Levelized cost ($/MWh) in 2025
High Residential VCEA	$ 232,395,980	944,443	$ 246.07	10.24	9,671,806	$ 31.29
Balanced Lower Cost VCEA	$ 161,889,140	924,030	$ 175.20	9.70	8,962,107	$ 23.24
High Small Business VCEA	$ 193,592,982	999,061	$ 193.78	9.97	9,956,343	$ 25.16
Enhanced LMI VCEA	$ 227,414,935	1,055,232	$ 215.51	10.21	10,778,819	$ 27.45
Entergy Arkansas	$ 50,930,300	255,930	$ 199.00	14.74	3,772,407	$ 19.40
MidAmerican Energy	$ 63,804,277	322,760	$ 197.68	13.60	4,389,538	$ 20.38
Xcel Minnesota	$ 107,451,885	565,220	$ 190.11	12.80	7,234,811	$ 20.46
Baltimore Gas and Electric	$ 114,626,581	616,559	$ 185.91	10.10	6,227,249	$ 23.89
Consumers Energy	$ 117,838,710	641,648	$ 183.65	11.72	7,520,118	$ 21.08
Ameren Missouri	$ 66,483,135	364,080	$ 182.61	11.25	4,095,898	$ 21.61
Commonwealth Edison	$ 352,988,361	2,064,720	$ 170.96	9.90	20,440,728	$ 22.31
DTE Electric	$ 127,955,350	777,405	$ 164.59	12.60	9,795,299	$ 17.92
Duke Energy Carolinas	$ 128,422,575	858,096	$ 149.66	8.20	7,036,387	$ 22.69
AEP Ohio	$ 62,864,638	467,385	$ 134.50	12.02	5,617,973	$ 15.16
Duke Energy Ohio	$ 32,134,301	292,107	$ 110.01	9.31	2,719,521	$ 15.07
First Energy Ohio	$ 30,597,049	286,819	$ 106.68	11.25	3,226,709	$ 12.63

Each of the four scenarios illustrates a different approach that Dominion could use to meet its 2022-2025 energy savings targets within cost parameters that are consistent with comparison utilities.[10] Beyond 2025, the scenarios show the potential for Dominion to achieve significant continued savings through 2030.

III. Savings Opportunities Beyond 2025

The VCEA calls for the Commission to assign savings requirements for the utilities after the current 2022-2025 period that is prescribed in statute. Utility programs, including those of many

[10] Note that the 15% LMI spending requirement leads to higher overall portfolio costs than are representative of the comparison portfolios. The scenario modeling also reflects an end to retail efficient LED bulb promotions after 2023, based on assumed market maturity and implementation of federal lighting efficiency standards.

if not all of the comparison utilities, are operated on a multi-year basis, and energy savings opportunities will continue to exist for Dominion and its customers well beyond 2025. The model we developed allows the user to set start and end years for each base program, and we assumed that Dominion would ramp up energy efficiency programming at a rate necessary to meet the VCEA requirements – likely somewhere between 1.0%-1.5% incremental annual savings as a percent of sales on an ongoing basis. This level of savings is achievable, based on the accomplishments of the comparison utilities we used as the basis for our modeled results. Doing so would lead to significant bill savings for Virginians, improved economic conditions for customers, and would support reduced climate damage due to inefficient energy use.

By definition, maximizing the implementation of cost-effective energy efficiency reduces the Company's costs to meet its primary mandate: providing safe and reliable energy. Investments in energy efficiency can reduce the need for expensive infrastructure investments – costs which are ultimately borne by customers. When energy efficiency can make generation, transmission, and distribution investments unnecessary, or even when it can defer those investments for a period of time, it becomes a critical component of the Company's resource and investment management. For this reason, the VCEA calls for the Commission to determine future goals for Dominion. Our model suggests that there will continue to be ample opportunity for the Company to aggressively pursue energy efficiency goals, thus supporting its ability to meet its primary obligation at the lowest cost to customers.

IV.Conclusion

Our review of the program pathways used by a dozen comparably-sized utility energy efficiency providers, and the application of modeling based on their reported results, shows that Dominion can reasonably achieve the VCEA savings requirements with the timely, effective implementation of best-practice energy efficiency programs. Currently approved programs, should the Company achieve its planned savings, will only carry it towards its 2022 VCEA savings requirement. To meet savings requirements for 2023 and beyond, Dominion will need to aggressively increase its savings from energy efficiency programs. Dominion can pursue a variety of program and portfolio options, but it must act in the near term to begin ramping up such programs in order to meet its 2023-2025 savings obligations and maximize benefits for all Virginians. Dominion can continue to work with its stakeholders to identify program opportunities while also focusing on identifying and implementing expansion of the key programs that will drive savings results to meet its VCEA requirements.

Appendix A – Methodology

In order to assess the implications of different combinations of programs and savings levels for Dominion to achieve its VCEA targets, we created an Excel-based modeling tool. The tool incorporates savings and costs from Dominion's currently proposed and approved programs (through Phase VIII), as well as data from comparison utilities used to ground the model in realistic savings opportunities. We developed four example scenarios with varying levels of emphasis on specific program categories to illustrate how Dominion can meet its energy savings targets. Model users can develop new scenarios to further explore program emphases that align with their priorities.

The first step in the process of developing the model was to identify the common energy efficiency program types from which program administrators achieve most of their portfolio savings. Without attempting to model detailed specific program designs, we use these "base programs" to illustrate where Dominion would most reasonably focus its efforts to achieve the majority of its savings in the proposed scenarios. After receiving feedback from the core project team and from experts at EFG, we identified 12 base program categories. For residential programs, the base programs were appliances and lighting, HVAC, whole house-retrofit, new construction, multifamily (cross-cutting residential and commercial), low-income, and behavioral. We further divided the low-income category into single-family, multi-family, and low-income low cost. Non-residential base program categories included non-residential prescriptive, custom, new construction, small business, and large energy users. Note that while the model includes an appliances and lighting base program, historically the vast majority of savings in these program types have come from the promotion of efficient lightbulbs at retail locations. Given the likelihood of federal lighting standards implementation, and the inevitability of transformation in screw-based standard lighting, we recommend that any future use of the model to develop additional scenarios assume a very limited implementation time frame for retail lighting – if any at all – consistent with the approach we used.

We then mapped Dominion's current and proposed programs to the base program categories. We consulted the core project team for this step. Dominion's current and proposed programs served as an input for savings through 2025 in the model – the last implementation year for which the programs are currently approved.

In order to develop realistic scenarios for Dominion to achieve its VCEA targets, the model needed to include savings, costs, and average measure life data from similar utilities. We selected 12 comparison utilities achieving at least one percent incremental annual savings in relatively similar geographies, including utilities located in the Southeast or Midwest. These include AEP

Ohio, Ameren Missouri, Baltimore Gas and Electric, Commonwealth Edison, Consumers Energy, Duke Energy Carolinas, DTE Electric, Duke Energy Ohio, Entergy Arkansas, MidAmerican Energy, First Energy Ohio, and Xcel Minnesota. Data for each utility come from their 2018 DSM annual reports.

We used the comparison portfolios to develop inputs for the model. First, we mapped each utility program to base program categories in order to easily create unified metrics. Programs that could not clearly be mapped to the base programs were not included, as our intent was not to represent all available program types, but rather to focus on the kinds of programs that large utilities have typically used to achieve high savings levels. Using reported program data available through the utilities' 2018 DSM annual reports, we determined savings, costs, and average useful measure life (when available) for each utility. We used sales data from the 2018 EIA Annual Electric Power Industry Report[11] to calculate savings as a percent of sector MWh sales for each base program for each utility. We used net savings where those were reported by the utilities and converted reported gross savings to net savings using the 83.1% default net to gross ratio that ACEEE calculated in its 2020 Utility Scorecard.[12] By dividing reported program costs by reported net annual MWh savings, we calculated costs per first year MWh saved. We also collected data from the comparison utilities' 2018 DSM annual reports for weighted average useful measure life ("EUL") by program for utilities that report this metric. Where EUL data were not specifically provided but lifecycle savings were reported in addition to annual savings, we used those data to calculate the EUL by program.

We then compiled the data from the comparison utilities and averaged them for each of the metrics (savings, costs, and average measure life) by base program to determine inputs for the model. We used the percentage of sectors sales for each base program as the input for penetration rates in the model scenarios. The average of percent sector sales across utilities served as the medium penetration rate for that base program. High penetration rate is the average of the three highest sector sales percentages, and the low penetration rate is the average of the three lowest. Costs for each base program are the average of all costs per MWh from the comparison utilities after we removed outliers from the calculation.[13] We calculated the average

[11] U.S. Energy Information Administration, *Annual Electric Power Industry Report*, *Form EIA-861 detailed data files*, accessed October 28, 2020, www.eia.gov/electricity/data/eia861/.

[12] ACEEE 2020 Utility Scorecard, p.10. www.aceee.org/research-report/u2004.

[13] Not all of the comparison utilities implemented programs that could be clearly mapped to our base program categories, and in some cases the range of program costs for the comparison utilities was large. Presumably, this

measure life for each base program by taking the average of all comparison utilities reporting this metric.

We created an Excel-based modeling tool that projects multi-year total portfolio energy savings by summing savings from the base programs and the savings from Dominion's approved and proposed programs. The model allows users to alter inputs for certain variables (penetration rate, ramp up period, and start/end date) that will change the level of savings achieved from the base programs (within given parameters) to calculate multi-year energy savings. We built protections into the model to limit users' ability to develop scenarios that are not grounded in the empirical evidence provided by the comparison portfolios. For example, a user cannot create a scenario with base programs above the high penetration rate – even though it might be possible for a utility to achieve that higher level of savings. High penetration rate is not meant to represent a maximum achievable scenario; rather, it is intended to represent a savings level for which there is a high level of confidence in its achievability, based on the performance of the three highest performing utilities in our comparison for each base program. The input table from the model is illustrated below in Figure 5:

is primarily because of differences in implementation strategies. To reduce the likelihood of using costs in the model that were skewed by less representative programs, the high and low outlier costs were not included in the determination of average.

Figure 5: Model Input Selection

Inputs - Start Here				
	Penetration rate	Ramp up years	Start year	End year
Residential appliances and lighting	MED	2	2022	2023
Residential HVAC	LOW	4	2022	2030
Residential whole house-retrofit	MED	4	2022	2030
Residential new construction	LOW	4	2024	2030
Multifamily	MED	4	2022	2030
Residential behavioral	MED	4	2022	2030
Non-residential prescriptive	HIGH	4	2022	2030
Non-residential custom	LOW	4	2022	2030
Non-residential new construction	LOW	4	2022	2030
Non-residential small business	MED	4	2022	2030
Large energy users	MED	4	2023	2030
LMI Programs:				
Low-income multifamily	MED	2	2022	2030
Low-income single family	MED	2	2022	2030
Low-income low-cost	MED	2	2022	2030

The modeling tool allows the user to change four variables for each base program to create new portfolio scenarios: penetration rate, ramp up period, year of program start, and end year of each program. Penetration rate is the level of uptake of a program, represented by a percent of Dominion's sector sales. The options for input for penetration rate are zero, low, medium, and high. Each option represents a specified level of savings as a percent of sector sales and reflects the range of program achievement by comparable utilities and program administrators. The ramp up period describes the period of time a program requires to reach its full incremental annual savings level. The ramp up of savings increases linearly, and the input can be between one to five years. The start year and end year of each program define a program's implementation life, indicating how long a new program will achieve incremental annual savings. New proposed programs will start in or after 2022 and their savings are added to those expected to occur as a result of Dominion's programs that were approved prior to 2021. The model will project new incremental annual and total annual savings through 2031, to incorporate 10 years of savings from 2022, when the first modeled programs are implemented.

Once the model reflected the inputs of both Dominion's Category 1 programs and the metrics from the comparison portfolios, we developed scenarios to illustrate pathways for Dominion to meet the VCEA targets. EFG consulted the core project team to create a list of scenarios most useful for Dominion and Virginia stakeholders. We developed the following scenarios: balanced

lower cost, enhanced LMI, high residential, and high small business. These scenarios reflect varying emphasis on specific base programs. The enhanced LMI scenario, for example, places an emphasis on low-income programs and results in a spending more than the required 15 percent on LMI programs. Through each of these scenarios, Dominion could achieve its VCEA targets and LMI spending requirement.

The model indicates whether the inputs reflect a scenario in which Dominion would achieve its 2022-2025 targets and illustrates incremental annual savings and total annual savings in future years through 2031. The model also includes costs output, a determination of whether Dominion would meet the 15 percent LMI spending requirement in the scenario, and a comparison of the levelized costs in program implementation year 2025 of the user-created scenario to the levelized costs of the four example scenarios and the comparison utilities' 2018 reported portfolio results.[14]

[14] Comparison utility data for the Cost Comparison tab were taken from ACEEE 2020 Utility Scorecard, Appendix B.

Table 1: Base Program $/ First Year MWh Saved. Pink cells denote outliers

	AEP Ohio	Ameren Missouri	Baltimore Gas and Electric (BGE)	Commonwealth Edison (ComEd)	Consumers Energy	Duke Energy Carolinas (DEC)	DTE Electric	Duke Energy Ohio	Entergy Arkansas	MidAmerican Energy	First Energy Ohio	Xcel Minnesota	Average	Average - outliers removed
Residential appliances and lighting	$ 136.49	$ 202.91	$ 146.39	$ 165.01	$ 148.77	$ 222.59	$ 124.78	$ 112.18	$ 215.86	$ 201.09	$ 106.62	$ 58.21	**$ 153.41**	**$ 151.17**
Residential HVAC		$ 233.06	$ 945.19	$ 735.04	$ 322.36	$ 1,030.96	$ 392.09		$ 188.08			$ 516.17	**$ 545.37**	**$ 538.28**
Residential whole house-retrofit			$ 681.35	$ 393.34	$ 665.94	$ 366.40	$ 356.60	$ 405.80	$ 314.29	$ 708.19		$ 1,901.08	**$ 643.67**	**$ 511.09**
Residential new construction	$ 504.28		$ 656.84	$ 1,685.63	$ 825.41		$ 570.26			$ 406.75		$ 268.15	**$ 702.47**	**$ 592.71**
Multifamily					$ 425.96	$ 168.70	$ 202.40		$ 111.91	$ 559.04		$ 357.78	**$ 304.30**	**$ 288.71**
Low-income multifamily			$ 2,782.80	$ 1,313.59	$ 474.03		$ 2,377.95					$ 2,878.35	**$ 1,965.34**	**$ 2,189.96**
Low-income single family			$ 6,834.55	$ 3,720.77	$ 407.62	$ 1,240.54	$ 1,141.91	$ 1,172.11				$ 858.95	**$ 2,196.64**	**$ 1,626.86**
Low-income low-cost				$ 118.42									**$ 118.42**	**$ 118.42**
Residential behavioral	$ 18.64		$ 31.97	$ 19.04	$ 31.32	$ 41.24	$ 76.80	$ 43.37		$ 50.76		$ 112.81	**$ 47.33**	**$ 42.07**
Non-residential prescriptive	$ 120.35	$ 136.30	$ 274.86	$ 138.78		$ 150.98	$ 82.54	$ 128.33	$ 172.01	$ 180.29	$ 106.31	$ 129.93	**$ 147.33**	**$ 140.36**
Non-residential custom	$ 103.43	$ 152.41	$ 429.07	$ 340.34	$ 180.47	$ 205.38	$ 159.48	$ 136.06	$ 326.48	$ 235.09		$ 133.22	**$ 218.31**	**$ 207.66**
Non-residential new construction	$ 160.33	$ 119.96		$ 340.26						$ 126.56		$ 227.55	**$ 194.93**	**$ 171.48**
Non-residential small business	$ 286.34	$ 225.51	$ 503.25	$ 267.72	$ 265.32	$ 200.22		$ 249.54	$ 267.11		$ 101.00		**$ 262.89**	**$ 251.68**
Large energy users	$ 128.89			$ 208.28								$ 121.06	**$ 152.74**	**$ 152.74**

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Table 2: Base Program Savings % of Sector Sales

	AEP Ohio	Ameren Missouri	Baltimore Gas and Electric (BGE)	Commonwealth Edison (ComEd)	Consumers Energy	Duke Energy Carolinas (DEC)	DTE Electric	Duke Energy Ohio	Entergy Arkansas	MidAmerican Energy	First Energy Ohio	Xcel Minnesota	Average	Average Highest 3	Average Lowest 3
Residential appliances and lighting	0.7728%	0.1046%	0.8594%	1.2952%	0.7664%	0.6773%	1.1614%	1.2657%	0.4491%	0.9451%	1.2988%	1.4526%	0.9207%	1.3489%	0.4104%
Residential HVAC		0.3459%	0.0642%	0.0357%	0.0692%	0.0228%	0.0824%		0.1425%			0.1613%	0.1155%	0.2166%	0.0409%
Residential whole house-retrofit			0.4440%	0.0857%	0.0415%	0.0261%	0.0232%	0.0357%	0.3850%	0.0678%		0.0039%	0.1237%	0.3049%	0.0177%
Residential new construction	0.0371%		0.0426%	0.0008%	0.0042%		0.0519%			0.0512%		0.0299%	0.0311%	0.0486%	0.0116%
Multifamily			0.0222%	0.0417%	0.0573%	0.0721%	0.0172%		0.0578%	0.1243%		0.0216%	0.0518%	0.0847%	0.0203%
Low-income multifamily			0.0028%	0.0314%	0.0287%		0.0072%					0.0042%	0.0149%	0.0225%	0.0048%
Low-income single family			0.0072%	0.0107%	0.0773%	0.0176%	0.0206%	0.0050%				0.0173%	0.0223%	0.0385%	0.0076%
Low-income low-cost				0.3434%									0.3434%		
Residential behavioral	0.4921%		1.4611%	0.9916%	0.3163%	1.0847%	0.3930%	1.1146%		0.5349%		0.1647%	0.7281%	1.2202%	0.2914%
Non-residential prescriptive	0.7950%	0.8773%	0.8074%	0.7887%		0.3603%	0.7618%	0.8252%	0.0933%	0.6985%	0.2979%	1.7637%	0.7336%	1.1554%	0.2505%
Non-residential custom	0.2461%	0.4372%	0.7142%	0.0757%	1.2369%	0.0655%	0.3530%	0.3165%	0.8756%	1.6953%		1.0480%	0.6422%	1.3268%	0.1291%
Non-residential new construction	0.1749%	0.0963%		0.0366%						0.7798%		0.4908%	0.3157%	0.6353%	0.0665%
Non-residential small business	0.0954%	0.0751%	0.1300%	0.3410%	0.2269%	0.1568%		0.1782%	0.1317%		0.4987%		0.2038%	0.3555%	0.1002%
Large energy users	0.1147%			0.0528%								0.3991%	0.1889%	0.3991%	0.0528%

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Appendix B – Four Example Scenarios

Figure 6: Enhanced LMI Scenario Inputs and Outputs

	Penetration rate	Ramp up years	Start year	End year		
Residential appliances and lighting	MED	2	2022	2023		
Residential HVAC	MED	4	2022	2030		
Residential whole house-retrofit	MED	4	2022	2030		
Residential new construction	MED	4	2024	2030		
Multifamily	MED	4	2022	2030		
Residential behavioral	MED	4	2022	2030		
Non-residential prescriptive	HIGH	4	2022	2030		
Non-residential custom	LOW	4	2022	2030		
Non-residential new construction	LOW	4	2022	2030		
Non-residential small business	HIGH	4	2022	2030		
Large energy users	MED	4	2023	2030		
LMI Programs:						
Low-income multifamily	HIGH	2	2022	2030		
Low-income single family	HIGH	2	2022	2030		
Low-income low-cost	HIGH	2	2022	2030		
Outputs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Total Incremental annual savings	0.23%	0.07%	0.80%	1.05%	1.25%	1.42%
Total annual savings as a % of 2019 Retail Sales	1.34%	1.41%	2.21%	3.18%	4.29%	5.52%
VCEA Savings Targets	-	-	1.25%	2.50%	3.75%	5.00%
Target met?	-	-	Yes	Yes	Yes	Yes
LMI 15% cost requirement met?			Yes	Yes	Yes	Yes
LMI total annual savings as a % of total portfolio savings	2.21%	2.55%	6.03%	8.60%	10.54%	11.28%

Figure 7: Enhanced LMI Scenario Savings

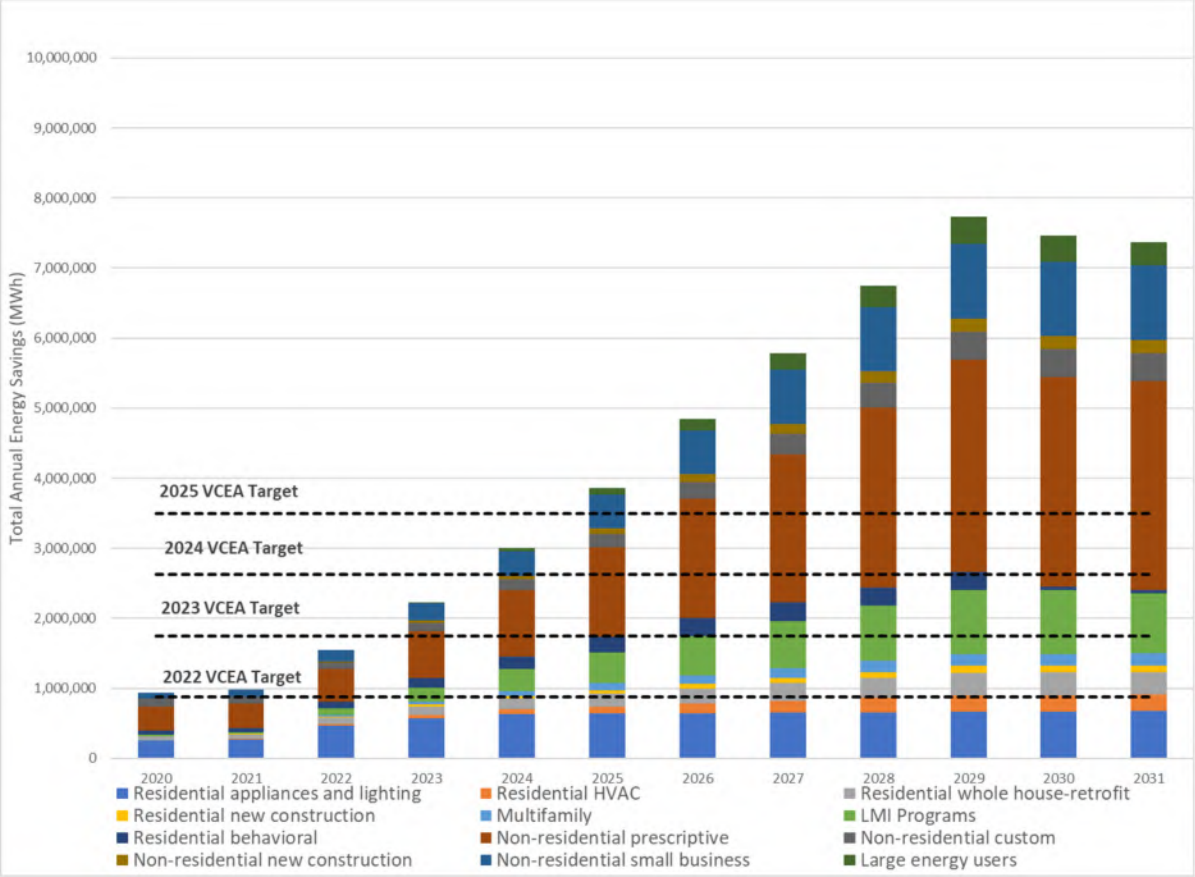

Figure 8: Enhanced LMI Scenario Costs through 2025

	2020	2021	2022	2023	2024	2025
Residential appliances and lighting	$ 9,820,000	$ 11,960,000	$ 32,718,380	$ 11,960,000	$ 2,140,000	$ 2,140,000
Residential HVAC	$ 33,820,000	$ 33,820,000	$ 6,036,061	$ 9,513,106	$ 11,590,152	$ 15,067,198
Residential whole house-retrofit	$ 4,680,000	$ 6,920,000	$ 11,632,796	$ 15,167,393	$ 14,021,990	$ 17,556,587
Residential new construction	$ -	$ 7,200,000	$ 7,200,000	$ 7,200,000	$ 8,574,806	$ 9,605,910
Multifamily	$ -	$ 2,920,000	$ 5,208,501	$ 6,924,877	$ 8,641,253	$ 10,357,629
LMI Programs	$ 9,300,000	$ 13,360,000	$ 26,801,255	$ 38,171,883	$ 49,542,511	$ 49,542,511
Residential behavioral	$ 1,860,000	$ 1,860,000	$ 4,144,476	$ 5,857,834	$ 7,571,191	$ 7,424,548
Non-residential prescriptive	$ 12,040,000	$ 14,140,000	$ 30,427,087	$ 35,442,403	$ 42,817,718	$ 55,033,033
Non-residential custom	$ -	$ -	$ 2,691,745	$ 4,710,554	$ 6,729,363	$ 8,748,172
Non-residential new construction	$ -	$ 3,020,000	$ 4,164,931	$ 5,023,629	$ 5,882,328	$ 6,741,026
Non-residential small business	$ 7,180,000	$ 11,240,000	$ 15,525,664	$ 22,264,912	$ 26,524,160	$ 33,263,408
Large energy users	$ -	$ -	$ -	$ 4,773,965	$ 8,354,440	$ 11,934,914
Total cost ($/year)	$ 78,700,000	$ 106,440,000	$ 146,550,897	$ 167,010,557	$ 192,389,911	$ 227,414,935

Figure 9: High Residential Scenario Inputs and Outputs

	Penetration rate	Ramp up years	Start year	End year		
Residential appliances and lighting	MED	2	2022	2023		
Residential HVAC	HIGH	4	2022	2030		
Residential whole house-retrofit	HIGH	4	2022	2030		
Residential new construction	HIGH	4	2024	2030		
Multifamily	HIGH	4	2022	2030		
Residential behavioral	MED	4	2022	2030		
Non-residential prescriptive	MED	4	2022	2030		
Non-residential custom	LOW	4	2022	2030		
Non-residential new construction	LOW	4	2022	2030		
Non-residential small business	MED	4	2022	2030		
Large energy users	MED	4	2023	2030		
LMI Programs:						
Low-income multifamily	MED	2	2022	2030		
Low-income single family	HIGH	2	2022	2030		
Low-income low-cost	MED	2	2022	2030		
Outputs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Total Incremental annual savings	0.23%	0.07%	0.75%	0.96%	1.12%	1.26%
Total annual savings as a % of 2019 Retail Sales	1.34%	1.41%	2.16%	3.05%	4.03%	5.10%
VCEA Savings Targets	-	-	1.25%	2.50%	3.75%	5.00%
Target met?	-	-	Yes	Yes	Yes	Yes
LMI 15% cost requirement met?			Yes	Yes	Yes	Yes
LMI total annual savings as a % of total portfolio savings	2.21%	2.55%	6.10%	8.86%	11.04%	12.01%

Figure 10: High Residential Scenario Savings

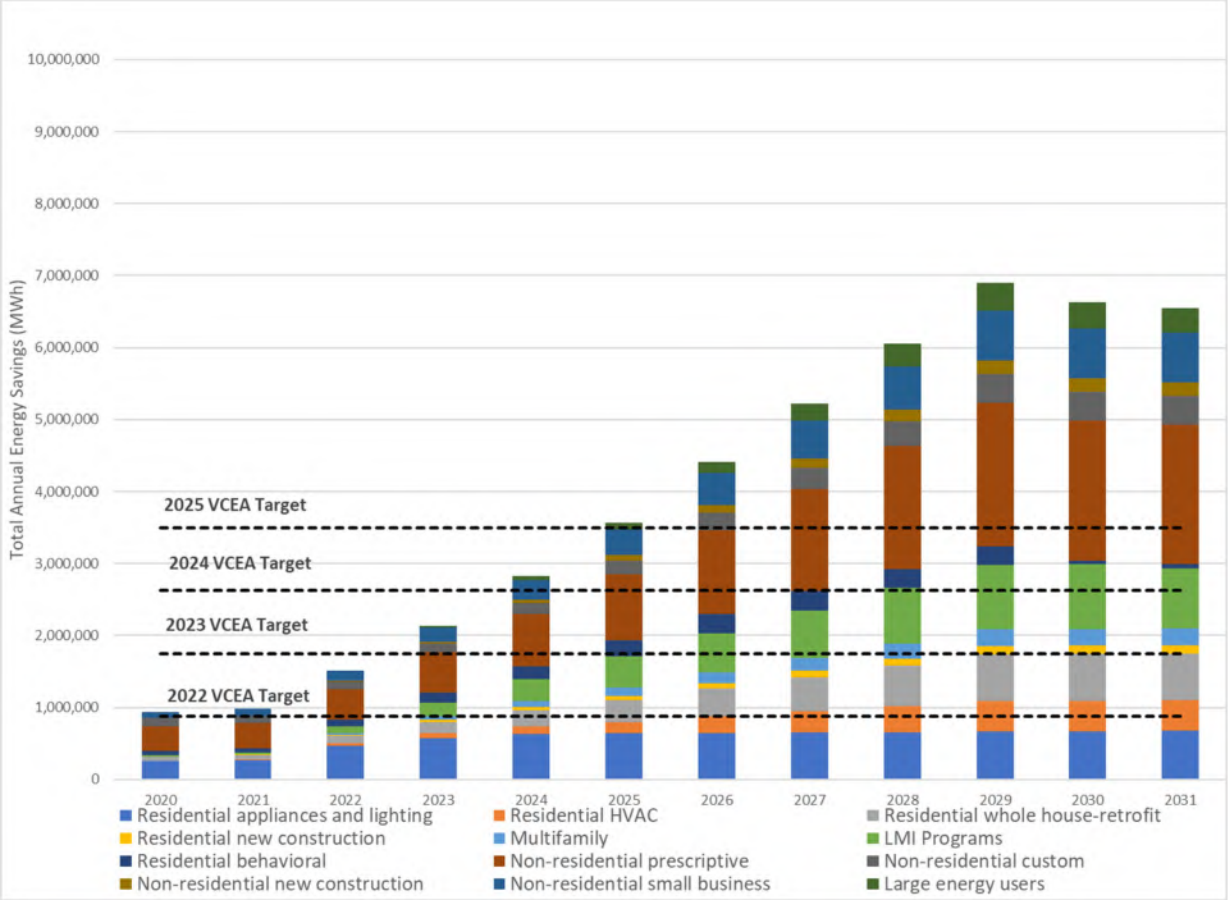

Figure 11: High Residential Scenario Costs through 2025

	2020	2021	2022	2023	2024	2025
Residential appliances and lighting	$ 9,820,000	$ 11,960,000	$ 32,718,380	$ 11,960,000	$ 2,140,000	$ 2,140,000
Residential HVAC	$ 33,820,000	$ 33,820,000	$ 10,093,604	$ 16,613,807	$ 21,734,010	$ 28,254,213
Residential whole house-retrofit	$ 4,680,000	$ 6,920,000	$ 18,540,453	$ 27,255,794	$ 31,291,134	$ 40,006,474
Residential new construction	$ -	$ 7,200,000	$ 7,200,000	$ 7,200,000	$ 9,346,151	$ 10,955,765
Multifamily	$ -	$ 2,920,000	$ 6,664,752	$ 9,473,315	$ 12,281,879	$ 15,090,443
LMI Programs	$ 9,300,000	$ 13,360,000	$ 24,327,924	$ 34,461,887	$ 44,595,849	$ 44,595,849
Residential behavioral	$ 1,860,000	$ 1,860,000	$ 4,144,476	$ 5,857,834	$ 7,571,191	$ 7,424,548
Non-residential prescriptive	$ 12,040,000	$ 14,140,000	$ 24,480,440	$ 25,035,769	$ 27,951,099	$ 35,706,429
Non-residential custom	$ -	$ -	$ 2,691,745	$ 4,710,554	$ 6,729,363	$ 8,748,172
Non-residential new construction	$ -	$ 3,020,000	$ 4,164,931	$ 5,023,629	$ 5,882,328	$ 6,741,026
Non-residential small business	$ 7,180,000	$ 11,240,000	$ 11,690,200	$ 15,552,849	$ 16,935,499	$ 20,798,149
Large energy users	$ -	$ -	$ -	$ 4,773,965	$ 8,354,440	$ 11,934,914
Total cost ($/year)	$ 78,700,000	$ 106,440,000	$ 146,716,905	$ 167,919,404	$ 194,812,942	$ 232,395,980

Figure 12: High Small Business Scenario Inputs and Outputs

	Penetration rate	Ramp up years	Start year	End year		
Residential appliances and lighting	MED	2	2022	2023		
Residential HVAC	LOW	4	2022	2030		
Residential whole house-retrofit	LOW	4	2022	2030		
Residential new construction	LOW	4	2024	2030		
Multifamily	LOW	4	2022	2030		
Residential behavioral	MED	4	2022	2030		
Non-residential prescriptive	HIGH	4	2022	2030		
Non-residential custom	LOW	4	2022	2030		
Non-residential new construction	LOW	4	2022	2030		
Non-residential small business	HIGH	4	2022	2030		
Large energy users	MED	4	2023	2030		
LMI Programs:						
Low-income multifamily	MED	2	2022	2030		
Low-income single family	HIGH	2	2022	2030		
Low-income low-cost	MED	2	2022	2030		
Outputs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Total Incremental annual savings	0.23%	0.07%	0.78%	1.01%	1.18%	1.34%
Total annual savings as a % of 2019 Retail Sales	1.34%	1.41%	2.19%	3.12%	4.17%	5.31%
VCEA Savings Targets	-	-	1.25%	2.50%	3.75%	5.00%
Target met?	-	-	Yes	Yes	Yes	Yes
LMI 15% cost requirement met?			Yes	Yes	Yes	Yes
LMI total annual savings as a % of total portfolio savings	2.21%	2.55%	6.03%	8.66%	10.69%	11.53%

Figure 13: High Small Business Scenario Savings

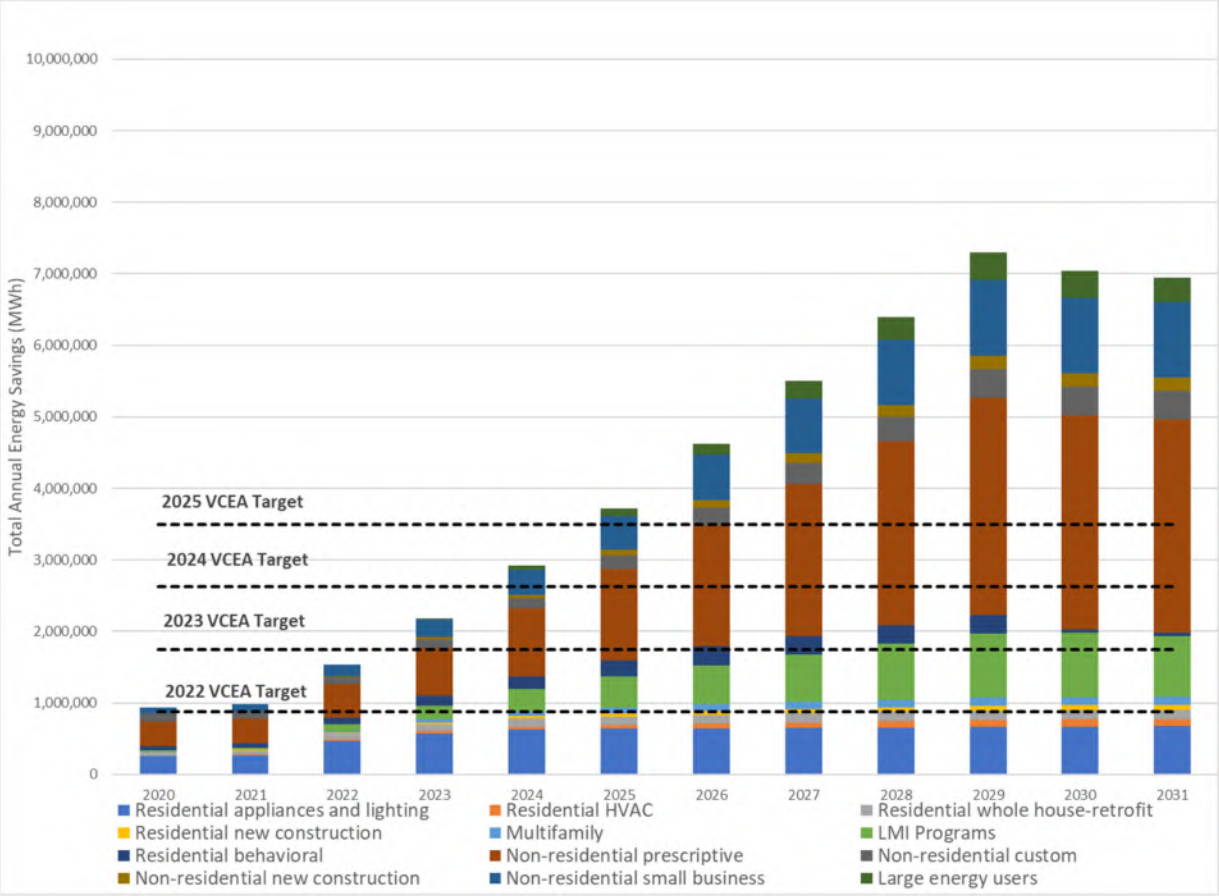

Figure 14: High Small Business Scenario Costs through 2025

	2020	2021	2022	2023	2024	2025
Residential appliances and lighting	$ 9,820,000	$ 11,960,000	$ 32,718,380	$ 11,960,000	$ 2,140,000	$ 2,140,000
Residential HVAC	$ 33,820,000	$ 33,820,000	$ 3,041,287	$ 4,272,252	$ 4,103,217	$ 5,334,182
Residential whole house-retrofit	$ 4,680,000	$ 6,920,000	$ 7,595,929	$ 8,102,876	$ 3,929,822	$ 4,436,769
Residential new construction	$ -	$ 7,200,000	$ 7,200,000	$ 7,200,000	$ 7,714,829	$ 8,100,951
Multifamily	$ -	$ 2,920,000	$ 3,818,502	$ 4,492,378	$ 5,166,254	$ 5,840,130
LMI Programs	$ 9,300,000	$ 13,360,000	$ 24,327,924	$ 34,461,887	$ 44,595,849	$ 44,595,849
Residential behavioral	$ 1,860,000	$ 1,860,000	$ 4,144,476	$ 5,857,834	$ 7,571,191	$ 7,424,548
Non-residential prescriptive	$ 12,040,000	$ 14,140,000	$ 30,427,087	$ 35,442,403	$ 42,817,718	$ 55,033,033
Non-residential custom	$ -	$ -	$ 2,691,745	$ 4,710,554	$ 6,729,363	$ 8,748,172
Non-residential new construction	$ -	$ 3,020,000	$ 4,164,931	$ 5,023,629	$ 5,882,328	$ 6,741,026
Non-residential small business	$ 7,180,000	$ 11,240,000	$ 15,525,664	$ 22,264,912	$ 26,524,160	$ 33,263,408
Large energy users	$ -	$ -	$ -	$ 4,773,965	$ 8,354,440	$ 11,934,914
Total cost ($/year)	$ 78,700,000	$ 106,440,000	$ 135,655,925	$ 148,562,689	$ 165,529,170	$ 193,592,982

Figure 15: Balanced Lower Cost Scenario Inputs and Outputs

	Penetration rate	Ramp up years	Start year	End year		
Residential appliances and lighting	MED	2	2022	2023		
Residential HVAC	ZERO	4	2022	2030		
Residential whole house-retrofit	ZERO	4	2022	2030		
Residential new construction	ZERO	4	2024	2030		
Multifamily	ZERO	4	2022	2030		
Residential behavioral	MED	4	2022	2030		
Non-residential prescriptive	HIGH	4	2022	2030		
Non-residential custom	LOW	4	2022	2030		
Non-residential new construction	LOW	4	2022	2030		
Non-residential small business	MED	4	2022	2030		
Large energy users	MED	4	2023	2030		
LMI Programs:						
Low-income multifamily	MED	2	2022	2030		
Low-income single family	MED	2	2022	2030		
Low-income low-cost	MED	2	2022	2030		
Outputs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Total Incremental annual savings	0.23%	0.07%	0.75%	0.95%	1.10%	1.23%
Total annual savings as a % of 2019 Retail Sales	1.34%	1.41%	2.15%	3.03%	3.99%	5.03%
VCEA Savings Targets	-	-	1.25%	2.50%	3.75%	5.00%
Target met?	-	-	Yes	Yes	Yes	Yes
LMI 15% cost requirement met?			Yes	Yes	Yes	Yes
LMI total annual savings as a % of total portfolio savings	2.21%	2.55%	5.96%	8.63%	10.77%	11.73%

Figure 16: Balanced Lower Cost Scenario Savings

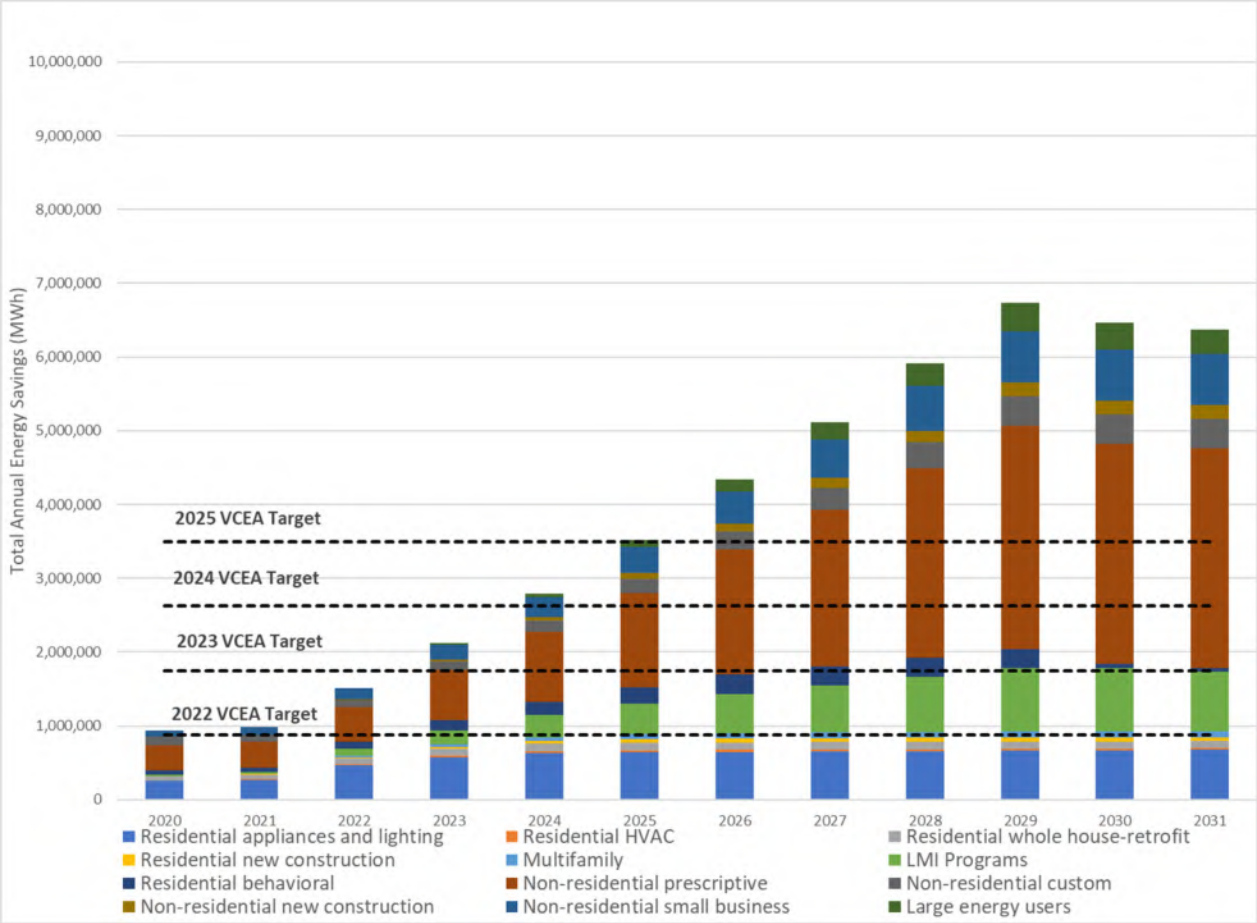

Figure 17: Balanced Lower Cost Scenario Costs through 2025

	2020	2021	2022	2023	2024	2025
Residential appliances and lighting	$ 9,820,000	$ 11,960,000	$ 32,718,380	$ 11,960,000	$ 2,140,000	$ 2,140,000
Residential HVAC	$ 33,820,000	$ 33,820,000	$ 1,400,000	$ 1,400,000	$ -	$ -
Residential whole house-retrofit	$ 4,680,000	$ 6,920,000	$ 6,920,000	$ 6,920,000	$ 2,240,000	$ 2,240,000
Residential new construction	$ -	$ 7,200,000	$ 7,200,000	$ 7,200,000	$ 7,200,000	$ 7,200,000
Multifamily	$ -	$ 2,920,000	$ 2,920,000	$ 2,920,000	$ 2,920,000	$ 2,920,000
LMI Programs	$ 9,300,000	$ 13,360,000	$ 20,384,649	$ 28,546,974	$ 36,709,298	$ 36,709,298
Residential behavioral	$ 1,860,000	$ 1,860,000	$ 4,144,476	$ 5,857,834	$ 7,571,191	$ 7,424,548
Non-residential prescriptive	$ 12,040,000	$ 14,140,000	$ 30,427,087	$ 35,442,403	$ 42,817,718	$ 55,033,033
Non-residential custom	$ -	$ -	$ 2,691,745	$ 4,710,554	$ 6,729,363	$ 8,748,172
Non-residential new construction	$ -	$ 3,020,000	$ 4,164,931	$ 5,023,629	$ 5,882,328	$ 6,741,026
Non-residential small business	$ 7,180,000	$ 11,240,000	$ 11,690,200	$ 15,552,849	$ 16,935,499	$ 20,798,149
Large energy users	$ -	$ -	$ -	$ 4,773,965	$ 8,354,440	$ 11,934,914
Total cost ($/year)	$ 78,700,000	$ 106,440,000	$ 124,661,468	$ 130,308,208	$ 139,499,837	$ 161,889,140

Appendix C – Data Sources: Dominion and Comparison Portfolios

AEP Ohio. 2019. *2018 Portfolio Status Report of the Energy Efficiency and Peak Demand Response Programs.* Case No. 19-1099-EL-EEC, May 14. Columbus: Ohio PUC (Public Utilities Commission). dis.puc.state.oh.us/TiffToPDf/A1001001A19E14B25118C02745.pdf.

Ameren Missouri. 2019. *Ameren Missouri's Demand-Side Program Annual Report for 2018.* Case No. EO-2019-0372, May 29. Missouri PSC (Public Service Commission). efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EO-2019-0372&attach_id=2019017972.

BGE (Baltimore Gas and Electric Company). 2019. *2018 Year-End EmPOWER Maryland Report of the Baltimore Gas and Electric Company.* Case No. 9494, February 15. Baltimore: Maryland PSC (Public Service Commission). webapp.psc.state.md.us/newIntranet/Casenum/NewIndex3_VOpenFile.cfm?FilePath=//Coldfusion/Casenum/9400-9499/9494/\103.pdf.

Commonwealth Edison. 2019. *ComEd Summary Impact Evaluation Report—Energy Efficiency/Demand Response Plan: Program Year 2018 (CY2018)*. Prepared by Navigant Consulting. Springfield: Illinois Commerce Commission. s3.amazonaws.com/ilsag/ComEd_CY2018_Summary_Evaluation_Report_2018-04-30_Final.pdf.

Consumers Energy. 2019. *Supplemental Direct Testimony of Theodore A. Ykimoff on Behalf of Consumers Energy Company*. Case No. U-20365, September 16. Lansing: Michigan PSC (Public Service Commission). mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000006VIRoAAO.

DTE Energy. 2019. *DTE Electric Company's Application for Approval of the Reconciliation of Its Energy Waste Reduction Plan Expenses for the Plan Year 2018.* Case No. U-20366, May 31. Lansing: Michigan PSC (Public Service Commission). mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000004n98cAAA.

Duke Energy Carolinas. 2019. *Duke Energy Carolinas, LLC's Application for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider*. Docket No. E-7, Sub 1192, February 26. Raleigh: North Carolina Utilities Commission. starw1.ncuc.net/NCUC/ViewFile.aspx?Id=7ef72466-ed10-4587-89bd-e19bf2b175cc.

Duke Energy Ohio. 2019. *In the Matter of the Annual Energy Efficiency Status Report of Duke Energy Ohio, Inc.* Case No. 19-621-EL-EEC, March 29. Columbus: PUCO (Public Utilities Commission of Ohio). dis.puc.state.oh.us/TiffToPDf/A1001001A19C29B13241I04490.pdf.

Entergy Arkansas. 2019. *Arkansas Energy Efficiency Program Portfolio Annual Report.* Docket No. 07-085-TF, May 2. Little Rock: Arkansas PSC (Public Service Commission). apscservices.info/Efilings/Docket_Search_Documents.asp?Docket=07-085-TF&DocNumVal=561.

MidAmerican Energy Company. 2019. *Energy Efficiency Plan.* Docket No. EEP-2012-0002, May 1. Des Moines: Iowa Utilities Board. efs.iowa.gov/cs/groups/external/documents/docket/mdax/odq2/~edisp/1846096.pdf.

Ohio Edison. 2019. *Energy Efficiency and Peak Demand Reduction Program Portfolio Status Report to the Public Utilities Commission of Ohio.* Docket Nos. 19-1020-EL-EEC, 19-1021-EL-EEC, 19-1022-EL-EEC, May 15. dis.puc.state.oh.us/CaseRecord.aspx?CaseNo=19-1020-EL-EEC.

Virginia Electric and Power Company: Estimated savings for Phase I through Phase VIII from Case No. PUR-2020-00035, Appendix 6D and Appendix 6I; Program budgets from Case No. PUR-2019-00201, Direct Testimony of Michael T. Hubbard. Incremental annual savings were determined as the change from one year to the next. Five year total budgets were allocated equally by implementation year.

Xcel Minnesota. 2019. *Status Report & Associated Compliance Filings: Minnesota Electric and Natural Gas Conservation Improvement Program.* Docket No. E,G002/CIP-16-115, April 1. Minnesota Department of Commerce. edockets.state.mn.us/Efiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BA066D969-0000-C119-9E6C-26A4634F87C5%7D&documentTitle=20194-151545-01.

DUKE ENERGY PROGRESS, LLC

Request:

Please quantify the additional efficiency savings attributable to those recommendations.

Response:

DEP does not track the incremental savings that can be attributed to Collaborative contributions. The savings attributed to LIHTC participation in the NCEEDA program, which is a promotional opportunity identified by Collaborative members, can be tracked separately and can be found in the response to 1-16.

Person responding: Lynda Shafer, Senior Strategy & Collaboration Manager

I/A

Docket No. E-2, Sub 1273
Exhibit FBW-9

Duke Energy's Income Qualified Weatherization Pilot

WX Direct

Sep 09 2021 OFFICIAL COPY

Project Types

Weatherization – Priority List of Measures

- Air Sealing
- Attic Insulation
- Duct Sealing
- Duct Insulation
- Belly Insulation (Mobile Home)
- Wall Insulation
- Tier 1 Base Load Packages
  - LED and Electric Hot Water Heater Measures

HVAC – Replacement of inefficient electric heat systems (must be operable)

- 15 SEER 8.2 HSPF Heat Pump

Applications

Number of Homes	Percentage of Total Applications	Response Rate based on 3782 Letters	Application Status
205	44%	5.4%	Completed
50	11%	1.3%	Deferred due to water, structural, housekeeping, etc. (In Home Assessment competed)
15	3%	0.4%	Owner occupied, no services needed (In Home Assessment completed)
3	1%	0.1%	Not interested after In Home Assessment
95	20%	2.5%	Over income
38	8%	1.0%	Energy usage below 7 kWh per sq. ft.
23	5%	0.6%	Never returned calls or provided income
30	6%	0.8%	No follow-up by customer (income and energy use qualified)
11	2%	0.3%	Renter occupied, rental company owns fridge or no fridge needed
470			**Total Applications Submitted**

- In the absence of HHF funding, the deferral rate would have been 23% of all applications submitted. (Total 109: 50 deferred above + 59 HHF homes)

Project Summary

Paid by Project Type	DEC Direct WX Projects	DEC Direct WX Total	Average Cost Per Project
Refrigerator Replacement	123	$ 101,771.25	$ 827.41
HVAC Replacement	52	$ 310,903.58	$ 5,978.92
WX Tier 2	149	$ 485,483.76	$ 3,258.28
Total Paid	**324**	**$ 898,158.59**	
Admin Fees (NCCAA)		$ 42,769.57	
Program Delivery (LM)		$ 51,323.37	
Total Paid		**$ 992,251.53**	

HHF Projects for DEC WX Direct	Total Projects	Paid	Average Cost Per Project
H&S	49	$ 64,056.03	$ 1,307.27
HVAC	19	$ 19,175.41	$ 1,009.23
Total	**68**	**$ 83,231.44**	

- 59 Homes supplemented with HHF projects to avoid deferral
- 50 Homes were deferred because of extreme conditions or costs that exceed the $3,000 HHF Health & Safety available

Completed Homes (205)

Number of Projects Per Home	Homes by Category
1	111
2	70
3	24

- Homes with 1 project – Refrigerators (58), Tier 2 (52), HVAC (1)
- Homes with 2 projects – Refrigerator/Tier 2 (43), Tier 2/HVAC (27)
- Homes with 3 projects – Refrigerator, Tier 2 & HVAC (24)
- 59 Homes (39%) with Tier 2/HVAC projects received HHF services ($83K) to support WX projects including duct and HVAC repair, vapor barrier, mold/mildew remediation, CO2/smoke detector installation, debris removal, bath vent installation, floor insulation repair and attic/crawl access.

Home Characteristics

- Average Sq. Ft. per home - 1205
- Foundation - basement (9), crawl (119), slab (77)
- Primary Heating Fuel Source- electric (116), kerosene (1), natural gas (83), propane (3), wood (1), oil (1)
- Hot Water Heater Fuel Source - electric (154), natural gas (50), propane (1)
- Average Annual kWh – 13,825

Annual kWh	Number of Homes in this Range
10,000 and below	58
10,001 - 15,000	68
15,001 - 20,000	47
20,001 - 25,000	23
25,001 - 30,000	7
30,001 and above	2
	205

Occupants & Income

- Average Income - $21,116
- Average Number of Occupants - 2

Number of Occupants	Average Income
1	$15,167
2 - 4	$25,232
5 & up	$28,731

Number of Occupants	Number of Homes
1	88
2 - 4	105
5 & up	12

DEC WX Direct & HHF – Measures

DEC WX Measures	
Air Sealing	134
Attic Insulation	128
Baseload Lighting Package	83
Baseload Water Package	30
Clean and/or Replace Dryer Vent	2
Door Weatherstripping	13
Duct Sealing	94
Floor Insulation - Fiberglass, Batts - R19	23
HVAC Replacement	52
Heating System Repair	17
Heating System Tune Up	13
Knee Wall Insulation	2
Vapor Barrier	12
Refrigerator Replacement 15 cu ft	35
Refrigerator Replacement 18 cu ft	43
Refrigerator Replacement 21 cu ft	45

HHF Measures	
Attic/Crawl Access/Repair	2
Bath Vent Installation	2
CO2/Smoke Detector	1
Debris Removal/Floor Insulation Removal	9
Duct Repair/Replace	20
Electrical Repair	1
Floor	5
Hot Water Heater Replacement	2
HVAC Repair	22
Mold/Mildew Remediation	3
Plumbing	3
Range Replacement	1
Rotten Wood Repair	2
Sewage/Septic Repair	3
Vapor Barrier	7
Wall/Ceiling Replacement/Repair	2
Window Replacement/Repair	1

Lessons Learned

Challenges

- This type program requires many customer "touches"
- General concern with answering phone from unknown number – required multiple calls to schedule
- Schedules not a priority for some clients – minor problem with no-shows or last-minute cancellations
- Delivery/Quality issues with Lowe's – changing vendors mid-program

What worked

- Clear Guidelines on Eligibility, Budgets, Processes and Expectations
- Contractors who provided both HVAC and Weatherization most cost-effective model
- Early notification to customers who don't respond – such as "pre-qualified, last chance" letters
- Engagement and Enthusiasm of Contractor Network
- Targeted Customer Outreach – Letters from Duke Energy
- Quick response to any issues/callbacks
- Accuracy in initial SOW and estimates – very few scope changes
- Helping Home Funds to address deferral issues
- Leveraging with other programs for deferral / cost concerns
- Customer Focused Management, Program Delivery and Administrative Teams

DUKE ENERGY PROGRESS, LLC

Request:

Please provide an explanation and analysis related to the principal factors leading to forecasted declines for DEP's 2021 and 2022 projections compared to the savings levels achieved in 2017, 2018, and 2019. Please describe the drivers and where the effects show up, including:

i. What are the top five measure categories that account for the greatest reduction impacts?

ii. What internal and / or external factors led to these reductions?

iii. Which programs are the most affected and what are the corresponding impacts of each major factor on each program?

iv. Which programs are the most affected by assumed changes in customer participation and what are the corresponding impacts on each program?

a. Please provide all relevant work papers used to provide responses to the above questions.

Response:

i. top 5 greatest kWh reductions

1. Residential Retail Lighting -52% (17,692,831 kWhs)
2. Small Business Energy Saver -5% (1,705,096 kWhs)
3. Residential Smart Saver T-stat -34% (792,164 kWhs)
4. EnergyWise for Business -96% (630,190 kWhs)
5. Multifamily Energy Efficiency -30% (506,233 kWhs)

ii. Internal and external factors that led to the reduction:

Residential Retail Lighting, reduction in A lamp LEDs because of federal standard changes. The program has focused on hard-to-reach retailers with lower sales volume, such as the Goodwill and Dollar General, which generally serve customers less likely to change lamps to LEDS.

Small Business Energy Saver - The program has fundamentally stayed the same from 2017 through 2022. Duke has updated technology included in the Program to meet customer needs. However, sales and project sizes have been on the decline. The Program completed almost the same number of projects from year to year with lower overall energy savings.

Residential Smart Saver - Smart thermostat previous projections were underestimated for 2021 and 2022. Actual participation was higher, and the current budget cycle projections have been increased to reflect actuals.

EnergyWise for Business - The major impact was a reduction in claimed savings from the EM&V completed in 2017. The allowed energy savings per installed Smart Thermostat were reduced to 13 kWh. Duke has completed a new evaluation of the energy savings in 2021 and found the smart thermostats are saving 423 kWh per installed thermostat.

Multi-family Energy Efficiency - For the Multi-family Pipe-wrap, the kWh impacts were reduced due to program EM&V beginning in 2019.

iii. Residential Retail lighting, Small Business Energy Saver, Residential Smart Saver smart t-stats, EnergyWise for business and Residential Multi-family.

iv. Residential Retail Lighting -57% (1,255,626) annual participation reduction.

a. Please see attached.

SACE DR1-27 Attachment.zip

Person responding: Rick Mifflin, Director, Products & Services

I/A

Docket No. E-2, Sub 1273
Exhibit FBW-11

Carolinas Income Qualified Budgeting

Budgeting Considerations

- Energy Efficiency spend ratepayer funds and should be done prudently and responsibly
- The initial filing and historical program performance is used to help determine customer demand for the program
- Experience in other jurisdictions is considered, but the specific territory characteristics weigh more heavily
- In the Carolinas, the budget can be exceeded if the additional cost is driven by customer demand
- Include risks or market changes that need to be considered
- Define the capability of the resources and ability to flex
- Remaining market potential

DUKE ENERGY

I/A

DEC v. DEP Income Qualified Budgeting

Why does DEC have a larger budget than DEP?

- DEC is about 40% larger and has more income qualified customers
- DEC has an existing weatherization program
- No DEP weatherization program was filed initially and has been delayed in recent years to evaluate the following:
  - Learn from DEC and why there was over $1M unspent annually
  - Consider cost effective pilot program in Asheville area
  - Consider NES 2.0 approach providing deeper measures
- DEP's Neighborhood Energy Saver was purposely constrained to $2M budget when filed in 2008
- NES 2.0 was filed and approved, but we are just now launching after the COVID suspension. Experience will allow for "right sizing" the budget

DUKE ENERGY

SUMMARY OF CERTAIN PORTIONS OF DEP'S 2017 DSM/EE MECHANISM[1]

1. Eligible non-residential customers may opt out of either or both of the DSM and EE categories of programs, as well as opt back into either or both. Beginning on January 1, 2016, separate DSM and EE billing rates became available to Non-Residential opt-out-eligible customers. A customer receiving program incentives from either a DSM or an EE program will be required to pay the respective portion(s) of the DSM/EE and DSM/EE EMF billing rates for a period of not less than 36 months.

2. In general, DEP shall be allowed to recover, through the DSM/EE and DSM/EE EMF rates, all reasonable and prudent costs of Commission-approved DSM/EE programs. However, any of the Stipulating Parties may propose a procedure for the deferral and amortization over a maximum of ten years of all or a portion of DEP's non-capital program costs to the extent those costs are intended to produce future benefits, and may propose to defer and amortize related non-incremental administrative and general (A&G) costs over a maximum of three years. Deferred program and A&G costs shall be allowed to accrue a return at the overall weighted average net-of-tax rate of return approved in DEP's most recent general rate case (net of income taxes). For program costs not deferred for amortization in future DSM/EE riders, the accrual of a return on any under-recoveries or over-recoveries of cost will follow the requirements of Commission Rule R8-69(b), subparagraphs (3) and (6), unless the Commission determines otherwise.

3. DEP shall be allowed to recover NLR as an incentive (with the exception of those amounts related to research and development or the promotion of general awareness and education of EE and DSM activities), but shall be limited for each measurement unit installed in a given vintage year to those dollar amounts resulting from kWh sales reductions experienced during the first 36 months after the installation of the measurement unit. NLR related to pilot programs are subject to additional qualifying criteria.

4. The eligibility of kWh sales reductions to generate recoverable NLR during the applicable 36-month period will cease upon the implementation of a Commission-approved alternative recovery mechanism that accounts for NLR, or new rates approved by the Commission in a general rate case or comparable proceeding that account for NLR.

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[1] For a summary of revisions made to the 2017 Mechanism by the 2020 Mechanism, please see the testimony accompanying this Appendix.

5. NLR will be reduced by net found revenues, as defined in the Revised Mechanism, occurring in the same 36-month period. Net found revenues will be determined according to the "Decision Tree" process included in the Revised Mechanism.

6. DEP shall be allowed to recover a PPI per vintage year for its DSM and EE portfolio based on a sharing of actually achieved and verified energy and peak demand savings (excluding those related to general programs and measures and research and development activities). The inclusion of pilot programs in any PPI calculation is subject to additional qualifying criteria. Unless the Commission determines otherwise in an annual DSM/EE rider proceeding, the amount of the pre-income-tax PPI to be recovered for the entire allowable DSM/EE portfolio for a vintage year shall be equal to 11.75% multiplied by the present value of the estimated net dollar savings associated with the DSM/EE portfolio installed in that vintage year (as determined by the UCT). Low-income programs or other programs approved with expected UCT results less than 1.00 shall not be included in the portfolio for purposes of the PPI calculation; nor shall the Demand Side Distribution Response (DSDR) program. The PPI for each vintage year shall ultimately be trued up based on net dollar savings as verified by the EM&V process and approved by the Commission. Unless the Commission determines otherwise, the PPI shall be converted into a stream of no more than ten levelized annual payments, incorporating the overall weighted average net-of-tax rate of return approved in DEP's most recent general rate case as the appropriate discount rate.

7. For Vintage Years 2019 and afterwards, the program-specific per kilowatt (kW) avoided capacity benefits and per kWh avoided energy benefits used for the initial estimate of the PPI and any PPI true-up will be derived from the underlying resource plan, production cost model, and cost inputs that generated the avoided capacity and avoided energy credits reflected in the most recent Commission-approved Biennial Determination of Avoided Cost Rates as of December 31 of the year immediately preceding the date of the annual DSM/EE rider filing, but using, for program-specific avoided energy benefits, the projected EE portfolio hourly shape rather than an assumed 24x7 100 megawatt (MW) reduction.

8. If the Company achieves incremental energy savings of 1% of its prior year's system retail electricity sales in any year during the five-year 2015-2019 period, the Company will receive a bonus incentive of $400,000 for that year.

QUALIFICATIONS AND EXPERIENCE

MICHAEL C. MANESS

I am a graduate of the University of North Carolina at Chapel Hill with a Bachelor of Science degree in Business Administration with Accounting. I am a Certified Public Accountant and a member of both the North Carolina Association of Certified Public Accountants and the American Institute of Certified Public Accountants.

As Director of the Accounting Division of the Public Staff, I am responsible for the performance, supervision, and management of the following activities: (1) the examination and analysis of testimony, exhibits, books and records, and other data presented by utilities and other parties under the jurisdiction of the Commission or involved in Commission proceedings; and (2) the preparation and presentation to the Commission of testimony, exhibits, and other documents in those proceedings. I have been employed by the Public Staff since July 12, 1982.

Since joining the Public Staff, I have filed testimony or affidavits in a number of general, fuel, and demand-side management/energy efficiency rate cases of the utilities currently organized as Duke Energy Carolinas, LLC, Duke Energy Progress, LLC., and Virginia Electric and Power Company (Dominion Energy North Carolina) as well as in several water and sewer general rate cases.

I have also filed testimony or affidavits in other proceedings, including applications for certificates of public convenience and necessity for the construction of generating facilities, applications for approval of self-generation deferral rates, applications for approval of cost and incentive recovery mechanisms for electric utility demand-side management and energy efficiency (DSM/EE) efforts, and applications for approval of cost and incentive recovery pursuant to those mechanisms.

I have also been involved in several other matters that have come before this Commission, including the investigation undertaken by the Public Staff into the operations of the Brunswick Nuclear Plant as part of the 1993 Carolina Power & Light Company fuel rate case (Docket No. E-2, Sub 644), the Public Staff's investigation of Duke Power's relationship with its affiliates (Docket No. E-7, Sub 557), and several applications for business combinations involving electric utilities regulated by this Commission. Additionally, I was responsible for performing an examination of Carolina Power & Light Company's accounting for the cost of Harris Unit 1 in conjunction with the prudence audit performed by the Public Staff and its consultants in 1986 and 1987.

I have had supervisory or management responsibility over the Electric Section of the Accounting Division since 1986, and also was assigned

management duties over the Water Section of the Accounting Division during the 2009-2012 time frame. I was promoted to Director of the Accounting Division in late December 2016.

DAVID M. WILLIAMSON

I am a 2014 graduate of North Carolina State University with a Bachelor of Science Degree in Electrical Engineering. I began my employment with the Public Staff's Electric Division in March of 2015. In August of 2020, the Electric Division merged with the Natural Gas Division to form the Energy Division, where I am a part of the Electric Section - Rates and Energy Services. My current responsibilities include reviewing applications, making recommendations for certificates of public convenience and necessity of small power producers, master meters, and resale of electric service, and interpreting and applying utility service rules and regulations. Additionally, I am currently serving as a co-chairman of the National Association of State Utility and Consumer Advocates' (NASUCA) DER and EE Committee.

My primary responsibility within the Public Staff is reviewing and making recommendations on DSM/EE filings for initial program approval, program modifications, EM&V evaluations, and on-going program performance of Electric and Natural Gas' portfolio of EE programs. I have filed testimony in various DEC, DEP, and DENC Demand Side Management/Energy Efficiency rider proceedings, as well as recent Electric and Natural Gas general rate case proceedings.

I/A

Duke Energy Progress, LLC
Comparison of "As-Filed" Cost-Effectiveness Scores to Previous DSM/EE Riders
Docket Number E-2, Sub ____

Public Staff
Williamson Exhibit #1
E-2, Sub 1273

	Evans Exhibit 7 in Sub 1206 Vintage 2020				Evans Exhibit 7 in Sub 1252 Vintage 2021				Evans Exhibit 7 in Sub 1273 Vintage 2022				Percent Change from previous V2020 to V2021	
Program	**UCT**	**TRC**	**RIM**	**PCT**	**UCT**	**TRC**	**RIM**	**PCT**	**UCT**	**TRC**	**RIM**	**PCT**	**UCT**	**TRC**
Residential Programs														
Energy Education Program for Schools	1.35	1.38	0.51	10.30	1.37	1.39	0.56	9.10	1.46	1.50	0.60	8.95	6%	8%
Energy Efficient Appliances & Devices	14.59	15.40	0.88	34.77	8.44	10.13	0.84	31.03	2.78	1.70	0.55	4.37	-67%	-83%
Energy Efficient Lighting	2.01	2.70	0.71	6.42	1.99	2.96	0.63	7.09	1.92	3.24	0.58	9.47	-3%	9%
Residential Smart $aver (Home Energy Improvement)	1.60	0.97	0.69	1.66	0.57	0.40	0.33	1.39	1.01	0.49	0.43	1.38	77%	23%
Multi-Family	2.65	2.65	0.54	24.31	2.64	2.65	0.58	20.70	2.59	2.85	0.57	10.49	-2%	7%
Neighborhood Energy Saver	0.49	0.49	0.31	2.23	0.87	0.90	0.49	2.51	0.85	0.90	0.48	2.61	-3%	0%
Residential Energy Assessments	2.15	2.19	0.56	49.13	2.03	1.96	0.54	30.63	2.29	2.21	0.56	31.28	13%	12%
Residential New Construction	1.55	4.93	1.30	6.84	1.31	1.38	0.58	3.40	1.35	1.46	0.58	3.48	3%	5%
My Home Energy Report	1.01	1.01	0.43	-	1.61	1.61	0.65	-	1.64	1.64	0.64	-	2%	2%
EnergyWise Home	5.27	15.93	5.27	-	1.96	5.83	1.96	-	3.77	26.74	3.77	-	93%	359%
Residential Total	**2.56**	**3.68**	**1.11**	**7.90**	**1.76**	**1.95**	**0.68**	**5.95**	**1.77**	**1.69**	**0.60**	**5.22**	0%	-13%
Non-Residential Programs														
Energy Efficient Lighting	4.03	2.03	0.86	4.04	3.93	1.92	0.88	3.69	4.31	7.27	1.30	9.47	9%	278%
Smart $aver Performance (Custom)[1] / **Smart $aver Performance (Prescriptive)[1]**	2.61	1.17	0.94	2.19	3.16	1.52	0.89	-	2.89	1.68	0.87	3.26	-9%	11%
Smart $aver Performance Incentive	4.05	0.99	1.09	1.54	2.83	1.09	1.00	1.79	2.80	1.11	1.00	1.83	-1%	2%
Small Business Energy Saver	2.51	1.55	0.86	2.85	2.01	1.24	0.76	2.50	2.48	1.46	0.85	2.76	24%	18%
EnergyWise ® for Business	0.27	0.46	0.27	-	0.27	0.52	0.27	-	0.28	0.81	0.28	-	3%	55%
Commercial Industrial Governmental Demand Response	1.84	28.03	1.84	-	1.77	29.70	1.77	-	2.11	26.31	2.11	-	19%	-11%
Non-Residential Total	**2.59**	**1.77**	**0.92**	**3.21**	**2.41**	**1.49**	**0.86**	**2.72**	**2.48**	**1.66**	**0.86**	**3.18**	3%	12%
Overall Portfolio total	**2.57**	**2.51**	**1.02**	**4.52**	**2.01**	**1.71**	**0.75**	**3.90**	**2.07**	**1.68**	**0.71**	**4.09**	3%	-2%

[1] Similar to what DEC has done, DEP is combining the Performance Custom and Performance Prescriptive programs due to their similarities in participants and renaming them Non-Residential Smart Saver (formerly known as EE for Business)

I/A

Duke Energy Progress, LLC
Comparison of Actual Cost-Effectiveness Scores to Previous DSM/EE Riders
Docket Number E-2, Sub ____

Public Staff
Williamson Exhibit #2
E-2, Sub 1273

	Evans Exhibit 7 in Sub 1145 Vintage 2018				Evans Exhibit 7 in Sub 1174 Vintage 2019				Evans Exhibit 7 in Sub 1206 Vintage 2020			
Program	**UCT**	**TRC**	**RIM**	**PCT**	**UCT**	**TRC**	**RIM**	**PCT**	**UCT**	**TRC**	**RIM**	**PCT**
Residential Programs												
Energy Education Program for Schools	1.86	2.60	0.76	-	1.39	1.37	0.48	11.58	1.17	1.16	0.35	11.38
Energy Efficient Appliances & Devices	12.37	24.52	1.11	-	4.82	4.27	0.75	12.30	2.83	2.47	0.40	10.35
Energy Efficient Lighting (Res and Non-Res)	3.44	17.07	0.91	-	2.63	3.78	0.70	8.52	3.35	4.07	0.50	9.65
Residential Smart $aver (Home Energy Improvement)	0.88	0.59	0.48	1.40	0.84	0.63	0.44	1.78	0.84	0.63	0.35	1.78
Multi-Family	3.53	5.19	0.67	-	2.77	2.70	0.56	21.75	1.56	1.58	0.35	21.54
Neighborhood Energy Saver	0.91	2.89	0.63	-	0.86	0.82	0.47	2.68	0.49	0.49	0.31	2.47
Residential Energy Assessments	2.90	3.32	0.71	473.05	2.06	2.03	0.54	38.16	1.87	1.88	0.38	56.26
Residential New Construction	1.73	1.92	0.74	3.88	1.28	1.42	0.54	3.96	1.21	1.44	0.39	4.22
My Home Energy Report	1.28	1.28	0.56	-	1.85	1.85	0.66	-	1.48	1.48	0.43	-
EnergyWise Home	9.62	87.79	9.62	-	9.17	281.08	9.17	-	7.94	7.94	7.94	-
Residential Total	**3.04**	**4.15**	**1.32**	**10.71**	**2.65**	**3.13**	**1.11**	**7.84**	**1.77**	**1.83**	**0.47**	**7.36**
Non-Residential Programs												
Smart $aver Performance (Custom)[1]	3.69	1.43	1.18	2.21	3.48	1.60	0.99	2.78	2.70	1.55	0.56	3.42
Smart $aver Performance (Prescriptive)[1]	5.79	2.59	1.19	3.53	4.00	2.29	0.90	4.33	3.63	2.00	0.58	3.77
Smart $aver Performance Incentive	4.02	1.14	1.06	1.82	2.27	0.98	0.75	2.37	3.21	2.03	0.47	5.07
Small Business Energy Saver	2.52	1.73	0.99	2.75	2.39	1.48	0.85	2.78	2.17	1.39	0.57	2.59
EnergyWise ® for Business	0.07	0.10	0.07	-	0.38	0.60	0.30	17.15	0.36	0.68	0.27	24.28
Commercial Industrial Governmental Demand Response	1.22	-42.56	1.22	-	2.43	7.73	2.43	-	2.19	26.91	2.19	-
Non-Residential Total	**3.80**	**2.13**	**1.11**	**3.19**	**2.87**	**1.88**	**0.91**	**3.57**	**2.68**	**1.80**	**0.59**	**3.54**
Overall Portfolio total	**3.29**	**3.03**	**1.22**	**4.48**	**2.72**	**2.60**	**1.02**	**4.90**	**2.04**	**1.82**	**0.52**	**4.87**

[1] Similar to what DEC has done, DEP is combining the Performance Custom and Performance Prescriptive programs due to their similarities in participants and renaming them Non-Residential Smart Saver (formerly known as EE for Business)