BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-100, SUB 83



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|---|---|---|
| In the Matter of: | ) | REPLY |
| Investigation of Net Metering | ) | |
| | ) | |

## NCSEA'S REPLY

NOW COMES the North Carolina Sustainable Energy Association ("NCSEA") and, pursuant to the *Order Requesting Comments* issued by the North Carolina Utilities Commission ("Commission") on 3 March 2014, files this reply in connection with NCSEA's 24 February 2014 *Motion for Disclosure and Equitable Relief* ("NCSEA's motion) and the 3 March 2014 *Response in Opposition to NCSEA Motion* ("Duke Response") filed by Duke Energy Carolinas, LLC and Duke Energy Progress, Inc. (collectively "Duke" or "Duke Energy Corporation").

## OVERVIEW

The undersigned carries a fortune cookie fortune in his wallet that reads: "Strong and bitter words indicate a weak cause." The strong and bitter words of the Duke Response to NCSEA's motion indicate a weak cause.

Neither NCSEA's motion nor this reply aims to resolve the larger, looming question about whether the net metering rules should change or not. This larger question will be resolved in any future proceeding Duke or Dominion North Carolina Power chooses to initiate.[1] Instead, NCSEA's motion and this reply aim to draw attention to Duke-induced uncertainty in the North Carolina rooftop solar market. To this end, this

[1] To be clear, NCSEA does not believe net metering should become any more expensive for rooftop solar adopters. Making net metering even slightly more expensive can have dramatic detrimental effects: In the wake of Arizona state regulators' November 2013 decision to add "a $5 monthly fee for new solar," utility APS' new solar installations dropped from 583 in January 2013 to 280 in January 2014. Exhibit A.

reply strives to focus the Commission's attention on the following points: Duke knows that its public messaging got ahead of its internal analyses. Duke knows that its public messaging presented unsupported allegations as facts. Duke also knows, or should know, that its singular position in the North Carolina electricity market imparts a gravity to its messaging that is capable of disrupting markets and that, in this case, has disrupted the rooftop solar market.

Instead of a forthright acknowledgment of public relations missteps, Duke defends its public messaging and, adhering to the old adage that "the best defense is a good offense," launches an attack on NCSEA. Duke's attack includes accusations that NCSEA's motion was filed in bad faith, that NCSEA is simply trying to secure lucre for its installer business members, and that NCSEA's motion is an attempt to suppress Duke's free speech rights. NCSEA's motion is none of those things.

Actions, including the exercise of free speech, have consequences. NCSEA's motion simply seeks Commission-crafted relief to redress the *consequence* of Duke's exercise of its free speech rights. Specifically, NCSEA's motion asks the Commission to

> guarantee, at a minimum, the continued availability of the current net metering terms and conditions for a period of 10 years[2] from the customer's install date to each residential or commercial customer who installs a net metered rooftop solar system prior to issuance of a final order in any net metering proceeding initiated in the coming year . . . [or] any other equitable relief the Commission deems appropriate

or for such other relief as the Commission deems appropriate. NCSEA's motion at p. 6. Ultimately, it is in the public interest for the Commission to restore calm to the market by creating a safe harbor within which (a) current net metering customers are provided a

[2] 10 years is a conservative estimate of a fair payback period. Actual payback periods will vary and could be longer. A recent analysis, using 2011 data, suggests the North Carolina rooftop solar payback period is approximately 13 years. **Exhibit B.**

sense of certainty[3] and (b) rooftop solar installers and their prospective customers once again feel comfortable enough to do business.

## CONTEXT: NORTH CAROLINA IS NOT AT RISK OF A NEAR-TERM SOLAR "TSUNAMI"

Duke has over 3 million customers in North Carolina.[4] Duke indicates on its website that "[w]e have about 1,000 customers using rooftop solar panels in the state." **Exhibit C.** Recent Duke data responses confirm the website statement. **Exhibit D.** Consequently, a miniscule 0.00033% of Duke's North Carolina customers are currently using rooftop solar. Going forward, Duke expects about 7,000 additional customers will be using net-metered rooftop solar by the end of 2017. **Exhibit E.** Thus, assuming Duke's customer numbers stay the same and do not increase, Duke currently expects that a similarly miniscule 0.0026% of its customers will be using net-metered rooftop solar by the end of 2017. If Duke's customer numbers increase, as they are likely to, then the 2017 percentage becomes even smaller.

By way of comparison, in 2010, California already had 86,495 net-metering customers, Colorado had 9,776 net-metering customers, and Arizona had 8,559 net-metering customers. **Exhibit F.** The number of net metering customers in each of these states has increased since 2010. Duke is in a fundamentally different position than

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[3] Over 100 of Duke's current net metering customers have filed consumer statements of position in this docket. Many of the statements recount the authors' sizeable investments in rooftop solar systems that they privately own and operate. These systems confer benefits to the grid. Duke's recently completed solar impact study, *see* **Exhibit G**, fails to quantify the benefits conferred by these systems. The costs the study quantifies – PV integration costs of $1.43/MWh in 2014 based on 673 MW of installed PV – are based on almost 300 MW more solar than is currently installed and thus are an overestimate of costs. Even with the overestimate, the study's cost quantification, prior to any consideration of offsetting benefits, amounts only to about $12/year or $1/month for a 5 kW fixed tilt rooftop system in Raleigh, NC (based on PV Watts).

[4] *North Carolina's Public Utility Infrastructure & Regulatory Climate Presented by North Carolina Utilities Commission*, slide 16 (July 2013) (accessed on 26 March 2014 at http://www.ncuc.net/overview/Overview.pdf).

utilities in these states. Through 2017, Duke does not project that it will even surpass the 2010 numbers observed in these Western U.S. states.

Consequently, the penetration of rooftop solar in Duke's territory is very different from penetration levels being observed in California, Colorado, and Arizona. Duke does not face a Western U.S.-style "tsunami" of rooftop solar.

## THE PROBLEMATIC NATURE OF DUKE'S RECENT PUBLIC MESSAGING

### A. The Duke Response Does Not Challenge or Contest That the Recent Public Messaging Occurred.

Duke does not challenge or contest that the President of Duke's North Carolina operating companies made the following statements during a 7 January 2014 legislative study committee meeting:

> [The] net metering customer is expecting to use the grid when they need it but the credited rate they pay does not fully cover their cost for the share for maintaining that infrastructure. The result is a shifting of cost from those who want solar panels to those who do not. In fact, unless we fix the rules, fixed income and low income customers, those who can least afford it, actually help pay for the solar panels of those who can afford to install them. . . . The cost burden for net metering shifts to households with fewer resources to spare and this has to change. . . . We plan to ask the Utilities Commission[5] to take a look at the rules around that metering in the state and to ensure those rules are fair to all our customers.

It is important to note that Duke's 7 January 2014 public messaging states several things as fact (rather than as allegations): First, it presents the existence of a net metering cost-shift as a fact. Second, it presents the alleged cost-shift as something that "*has to change . . . [to be] fair* to all [Duke] customers." (Emphasis added). As shown below, neither of these are facts and, even as allegations, neither is supported by a complete Duke analysis.

[5] It is curious and troublesome that Duke claims that its "public statements and communications [were] made *outside* of the purview of this Commission," Duke Response at p. 2 (emphasis in original), when the 7 January 2014 presentation specifically mentions the Commission and six Commissioners were present at the presentation.

Nevertheless, Duke proceeded to message about policy changes it would "push for" based on these unsupported allegations. Duke does not challenge or contest that, at a 22 January 2014 Duke Energy Corporation meeting with the *News & Observer* editorial board, "executives with the Charlotte power company sa[id] they will push for one change: reducing how much North Carolina households are paid for generating electricity from solar panels."[6]

**B. Duke Knows That Its Messaging Got Ahead of its Internal Analyses and That It Presented Unsupported Allegations as Fact.**

Duke's public messaging got ahead of its internal analyses. As a result, Duke's messaging portrayed unsupported allegations as facts. The best evidence that Duke knows that its public messaging got ahead of its internal analyses and that it presented market-influencing allegations as fact can be found in Duke's very own response to NCSEA's motion.

On 7 January 2014, Duke stated very definitively to legislators and Commissioners alike: "The result is a shifting of cost from those who want solar panels to those who do not." The Duke Response, filed on 3 March 2014, states that Duke's solar impact studies "remain ongoing [and f]inal results are not yet available." Duke Response at pp. 4-5. The Commission ought to ask itself the following question: How/why was Duke messaging so matter-of-factly about cost-shifting in January when it had not completed its studies?

There is another indication in the Duke Response that its messaging got ahead of its analyses. The Duke Response touches on the substance of its public messaging only

[6] *Duke Energy to seek reduction in payments to NC homes with solar panels*, Murawski, J., Charlotte Observer (22 January 2014) (accessed on 1 February 2014 at http://www.charlotteobserver.com/2014/01/22/4632104/duke-energy-to-seek-reduction.html#.Uu0QwYyYZYc).

once. But, in touching on the substance of its messaging, Duke uses a single word that highlights the problematic nature of Duke's recent public messaging. The Duke Response provides:

> As the Companies' public communications have indicated, from a policy perspective, they do believe that the current structure of its North Carolina NEM tariffs can be improved to attempt to remove possible cost-shifting between adopting and non-adopting customers.

Duke Response at p. 5. "Possible" – the word is easy to miss if you are not paying attention. In its response, filed almost two months after the 7 January 2014 presentation, Duke no longer speaks matter-of-factly about the existence of cost-shifting; instead, Duke's attorneys – who are acutely aware of the difference between an unsubstantiated allegation and a fact – wrote "*possible* cost-shifting." Duke Response at p. 5 (emphasis added). The inclusion of this qualifier – "possible" – stands in stark contrast to the matter-of-fact statements Duke made during the 7 January 2014 presentation and thereafter.

The word "possible" was likely inserted into the Duke Response because Duke became aware that its near-complete solar impact study required such a qualification. On 25 March 2014, Duke provided NCSEA with a copy of its solar impact study.[7] The study, entitled *Duke Energy Photovoltaic Integration Study: Carolinas Service Areas*, itself provides further evidence that Duke's public messaging got ahead of its internal analyses. For example, even after assuming a much higher 2014 PV penetration on Duke's system than currently exists, the study still concludes in pertinent part:

> Overall, the addition of solar DG to simulated distribution feeders caused both benefits and impacts. . . . The net benefit is very dependent on feeder topology, penetration level, and interconnection point, and should

[7] Given Duke's disclosure and the availability of the study to the public, NCSEA's motion for disclosure is moot.

> be evaluated on a case-by-case basis before assigning associated costs and benefits.

**Exhibit G** at pp. 5.1-5.2 (study report excerpt). Thus, Duke's own study ultimately concludes that blanket statements about net costs and cost-shifts cannot be (or at least have not been) substantiated.

There is no better evidence than the foregoing that Duke's public messaging got ahead of its internal analyses.

### C. Knowing That Its Messaging Got Ahead of Its Internal Analyses and That It Presented Unsupported Allegations as Fact, Duke Attempts To "Substantiate" Its Messaging But Only Succeeds in Further Evidencing the Problematic Nature of its Public Messaging.

As evidenced above, Duke knows that its public messaging got ahead of its internal analyses and that it presented allegations as fact. If the public messaging were inconsequential, Duke might have just acknowledged in its response that it had gotten ahead of itself. It did not. Instead, aware of the gravity of its public relations missteps, Duke tries to "substantiate" its public messaging by tying the messaging back to testimony and briefs it filed in 2008-2009. Duke's need to "substantiate" its messaging is strong evidence that (a) Duke is aware that its public messaging is consequential and can influence markets and (b) Duke is aware that, given its influence, messaging of unsupported allegations is a problem.

In an effort to make its messaging of unsupported allegations appear less starkly naked and more fact-like, Duke asserts that its public messaging has been "consistent with" arguments it has made in the past. The Duke Response provides:

> This message is entirely consistent with those included within both DEC's and DEP's testimony and briefs filed in this docket during the last generic proceeding on NEM before this Commission in 2008-2009.

Duke Response at pp. 5-6. Consistency, however, does not equal substantiation. Repetition of an unsupported allegation does not make it a fact.

When thoroughly considered, Duke's "consistency" defense serves only to highlight the problematic nature of Duke's recent public messaging. As stated in its response, Duke filed testimony and briefs in 2008-2009 containing allegations of cross-subsidies/cost-shifting in the net metering context. The Duke Response neglects, however, to report that a Commission order found the 2008-2009 allegations were inadequately substantiated. The Commission order also noted that, even if Duke's cost-shift allegations had been adequately substantiated, the presence of cost-shifting is only unfair if the cost outweighs the policy benefits. The Commission concluded as follows in its 2009 order:

> In response to the mandate in Senate Bill 3, the Commission sought evidence with which to quantify the potential effects of allowing larger generators to net meter. *As noted by several parties, the data submitted by the utilities provide an incomplete picture of the costs and benefits afforded by additional, and larger, net-metered renewable generation. The utilities' testimony and cost data, while asserting that the current net metering policy is rife with cross-subsidies that benefit customer-generators, focused on lost revenues rather than actual costs and ignored many potential benefits.* The Commission agrees with those parties that assert that renewable customer-owned generation almost certainly provides some additional benefits and that *the utilities should have acknowledged those benefits in their analyses.* Even so, the presence of cross-subsidies alone is not dispositive, and the evidence presented in this proceeding and the clearly enunciated State policy favoring development of additional renewable generation support expanding net metering eligibility to renewable generation with capacity up to 1 MW.[8]
>
> . . .
>
> Therefore, *given the failure to adequately quantify the actual costs and benefits of net metering* and the protections provided by the generation interconnection process, the Commission concludes that it is in the public

[8] In fact, cross-subsidies exist throughout utility tariffs in support of various State policies. Economic development rates, such as that recently approved for Progress in Docket No. E-2, Sub 681, are but one example in which the Commission has determined that certain policy benefits outweigh the cost of cross-subsidies. (Footnote in original).

> interest to allow larger customer-generators up to and including 1 MW in size to net meter and that it is not necessary to continue to impose any aggregate limit on net metering at this time.

*Order Amending Net Metering Policy*, pp. 11-12, Commission Docket No. E-100, Sub 83 (31 March 2009) (emphasis added).

The Commission expressly stated in 2009 that "the utilities should have acknowledged th[e] benefits [of rooftop solar] in their analyses" and that the utilities had failed "to adequately quantify the actual costs *and benefits* of net metering" (emphasis added). In other words, in 2009, the Commission made clear that Duke had not adequately shown a cost-shift existed, and, even if it had, a cost-shift could only be considered unfair if the Commission found that the cost outweighed the policy benefits. Despite this clear Commission rejoinder to Duke's 2008-2009 testimony and briefs, Duke still points back to its 2008-2009 filings to undergird its recent public messaging. This highlights how far out ahead of itself Duke's messaging has gotten and how exposed Duke is: Duke would rather gird itself, *post hoc*, in flawed, Commission-rejected 2008-2009 testimony and briefs than acknowledge its nakedness – i.e., that it has thus far failed to evidence the existence of a blanket cost-shift and was, as a result, unfairly messaging market-disrupting allegations as fact.

### D. Electric Utilities Have Reason to Want to Disrupt the Rooftop Solar Market and the Commission Can Reasonably Infer That Duke's Public Messaging Was Part of a Plan to Disrupt the North Carolina Rooftop Solar Market.

In an effort to "substantiate" Duke's recent public messaging, the Duke Response refers to Duke's 2008-2009 testimony and briefs. While Duke's recent messaging may be "consistent with" its Commission-rejected arguments of 2008-2009, the Duke Response does not address why Duke decided to dust off and revive its rejected

allegations after almost five years of silence on the topic. Duke's decision is especially curious given that Duke has not addressed the substantiation problems the Commission pointed out the last time Duke made such allegations. The most reasonable explanation is that Duke's recent public messaging is a simple function of opportunistic industry bandwagonism.

A January 2013 paper published by the electric utility trade organization, Edison Electric Institute ("EEI"), called national attention to the fact that rooftop solar was a distributed and – from the utilities' perspective – "disruptive" technology.[9] The paper highlights the market growth of technologies like rooftop solar via statements like: "As DER and DSM programs continue to capture 'market share,' . . . utility revenues will be reduced" (p. 1); and "[i]nvestors have no desire to sit by and watch as disruptive forces slice away at the value and financial prospects of their investment" (p. 18). The paper also provided EEI's members with a near-term game plan for "develop[ing] profit streams to counterbalance the impact of [these] disruptive forces" (p. 18) – i.e., for stifling the market growth of technologies like rooftop solar. The paper calls for several "immediate actions" by utilities to curtail the "slicing away" of market share by technologies like rooftop solar. Specifically, the paper advises utilities to immediately "[a]nalyze revision of net metering programs in all states so that self-generated DER sales to utilities are treated as supply-side purchases at a market-derived price" (p. 18).

Duke responded to the paper's call for immediate analytical action by announcing in June 2013 that it was

[9] Kind, P., *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business*, EEI (January 2013) (accessed on 16 March 2014 at http://www.eei.org/issuesandpolicy/finance/Documents/disruptivechallenges.pdf).

> initiating a comprehensive study seeking to identify and, where possible, quantify potential benefits and costs of solar generation across the entire generation, transmission and distribution systems. The goal of such an effort would be to fully understand the physical implications of large levels of solar penetration on the NC electric grid. In addition to the physical system impacts, the associated financial benefits and costs will be quantified in order to ascribe the appropriate economic impacts to this resource.

*Response to May 3, 2013 Order Requiring Verified Responses*, pp. 6-7, Commission Docket No. E-100, Sub 137 (10 June 2013). Duke indicated that its study would have implications for net metering. *Id.*

The EEI paper seems to have precipitated multiple utility challenges to net metering in the Western U.S. in 2013.[10] By late 2013/early 2014, the initial utility challenges to net metering in the Western U.S. were being followed by additional "bandwagon" utility challenges in other states. The late 2013/early 2014 momentum of the industry bandwagon appears to have caught Duke up, leading it to adopt, on 3 January 2014, the strategic objective of "[m]itigat[ion of] the impact from net-metered solar" and a "reverse Robin Hood" public message . . . all before Duke had even completed its comprehensive solar impact study. *See* **Exhibit H** at slides 2-3 (internal Duke presentation on solar DG).

Given the circumstances, the Commission can reasonably infer that Duke's recent messaging was part of a plan to, as the EEI paper put it, "counterbalance the impact of disruptive forces" (p. 18) and limit or constrain the "market share" or "slice" of technologies like net metered rooftop solar (pp. 1, 18). The intent might have been to

[10] The paper also seems to have spawned the utilities' "reverse Robin Hood" public relations campaign – i.e., the utilities' concerted effort to convince the American public that rooftop solar is unfair because low-income customers are not in a position to adopt solar but higher-income customers are and these higher-income customers are essentially "'robbing the poor' to pay for [their] fancy solar systems." *Frontlines*, Burr, M., Public Utilities Fortnightly (July 2013).

achieve a counterbalancing impact at the tail-end of a net metering proceeding, but this does not nullify the fact that Duke has achieved front-end market disruption that advances its ultimate goal.

### E. Duke's Recent Public Messaging Has Disrupted the North Carolina Rooftop Solar Market.

Duke knows, or should know, that its singular position in the North Carolina electricity market imparts a gravity to its messaging that is capable of disrupting markets.[11] As has already been noted above, the best evidence that Duke is aware that messaging of unsupported allegations is a problem is the fact that Duke felt the need to "substantiate" its recent public messaging by tying the messaging back to Commission-rejected testimony and briefs Duke filed in 2008-2009. Unfortunately for Duke, its *post hoc* "consistency" argument does not transform its unsupported allegations into fact and therefore Duke still has a problem if these allegations negatively impacted the rooftop solar market.

As evidenced by the affidavits attached to NCSEA's motion and multiple consumer statements filed with the Commission, Duke's public messaging of allegations has negatively impacted the North Carolina market. If the affidavits alone were not enough, a 3 February 2014 joint letter from homebuilder Lennar Ventures and The Dow Chemical Company to Colorado Governor Hickenlooper, attached as **Exhibit I**, supports the proposition that market disruption occurs once mere consideration of changes to net metering begins:

> Lennar and Dow know firsthand that Public Service Company's actions to date on this issue already have had a direct impact on the critically important new home market in Colorado. Sales associates at communities by Lennar report that home buyers interested in new solar homes express

[11] Duke's assertion that its public communications are no different than an NCSEA press release is absurd.

> concern about possible changes to Colorado's net metering policy. This hesitancy in purchase behavior directly impacts Colorado home builders and their ability to include solar on new housing starts. This illustrates the need for a public discussion on this issue. Clearly, the mere consideration of changes to current policies has already begun to have a negative impact.

**Exhibit I** at p. 2. While Southern Energy Management, Baker Renewables, Sundance Power Systems, and Yes! Solar Solutions may not be as large as Lennar Ventures or The Dow Chemical Company, the disruption these local companies' representatives have sworn to is no different in substance than that observed by Lennar and Dow in Colorado.

The current North Carolina market disruption created by Duke's messaging is made worse by the fact that Duke has still not filed any formal petition. The "petition-to-come" hangs like a dark cloud over the North Carolina rooftop solar market. The petition's ghostly presence has already extended by months what could be a year of further uncertainty that will accompany any formal proceeding. Given Duke's ultimate goal of limiting or constraining the "market share" or "slice" of technologies like net metered rooftop solar, it is not in Duke's interest to step in and provide near-term certainty; it may, in fact, be in Duke's interest to use the current uncertainty to assist in "running out the clock" until sunset of the North Carolina renewable energy tax credit. Because it is not in Duke's interest to restore certainty to the rooftop solar market, NCSEA has appealed to the Commission and is seeking Commission-creation of an equitable safe harbor.

## RESPONDING TO DUKE'S RED-HERRINGS

### A. Contrary to Duke's Assertions, the Equitable Relief NCSEA Seeks is Neither "Unprecedented" Nor "Inequitable."

The Duke Response asserts that NCSEA's motion seeks relief that is "unprecedented" and "inequitable." Duke Response at pp. 3-4. Precedent exists for Commission creation of safe harbors. For example, in 2008, in response to Duke's concerns, the Commission created a safe harbor for "approximately 170,000" residential customers enrolled in Duke's fixed payment program ("FPP") and balanced bill payment program ("BBP") that allowed the "existing program applicants and participants . . . to remain on the FPP and BBP[.]" *Order Ruling on Fixed Payment Programs*, pp. 14-15, Commission Docket Nos. E-7, Sub 710 and E-2, Sub 847 (14 March 2008). As Commissioner Culpepper pointed out, in his concurrence in part and dissent in part, the Commission Order approved "the continuation of the FPP and B[B]P programs on a grandfathered basis . . . indefinitely with respect to over 170,000 existing residential customers plus some unknown number of new customers who have applied to participate in these programs as of the date of this Order[.]" *Id.* at p. 18. Additional examples exist.[12] Thus, there is precedent for the type of relief NCSEA seeks.

With regard to specific precedent in the net metering context, the undersigned understands that, after favorable referral by the Senate Judiciary Subcommittee on 27

[12] The Commission has used its authority to hold open or extend the availability of riders for existing subscribers. In the last Duke Energy Progress rate case, the Commission once again approved the continued offering of Supplementary and Interruptible Standby Service Rider 57, which has not been available to new applicants since 15 September 1993, to existing customers. *Order Granting General Rate Increase*, p. 115, Commission Docket No. E-2, Sub 1023 (30 May 2013); *Transcript of Testimony, Volume 2 (Heard 3-19-13)*, p. 283, Commission Docket No. E-2, Sub 1023 (26 March 2013) (direct testimony of Duke witness Michael T. O'Sheasy); *see also, e.g., Order Discontinuing Reporting Requirement*, Commission Docket No. E-22, Sub 310 (8 February 2001) ("Rate Schedules CS and 6TS were withdrawn and Schedule SG was *closed to new customers* pursuant to Commission Order in Docket No. E-22. Sub 372 dated July 15, 1997. As of December 31, 2000, there were two customers still served on Schedule SG").

March 2014 and the full Senate Judiciary Committee on 2 April 2014, the South Carolina legislature's Senate is currently considering Duke-supported legislation[13] that contains the following provision:

> Customer-generators whose net energy metering facilities were energized prior to the availability of net energy metering rates approved by the Commission under the terms of this Chapter may remain in historic net energy metering programs through December 31, 2020.

South Carolina Senate Bill 1189, Section 58-40-20(A) (2013-2014) (previously Senate Bill 536).[14] Similarly, it appears as though California net metering customers who activate systems before 1 July 2017 will be eligible to be "grandfathered" into continuation of their current net metering tariffs for up to 20 years.[15]

Thus, the type of safe harbor NCSEA seeks for current and prospective net metering customers is not unprecedented, nor does it exceed the Commission's authority. Nor is it inequitable. To the contrary, the very reason that it has been agreed to or is being considered in other states is because it is equitable.

### B. NCSEA's Motion Does Not Seek to Suppress Duke's Free Speech Rights.

NCSEA's motion does not seek to suppress Duke's free speech rights. NCSEA's motion simply seeks Commission-crafted relief to redress the *consequence* of Duke's exercise of its free speech rights.

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[13] "Chuck Claunch, a lobbyist for Duke Energy, said after the [19 March 2014] meeting that utilities like the compromise discussed Wednesday. So do the state's electric cooperatives, co-op representative John Frick said." *Tentative deal reached on solar power in SC*, Fretwell, S., The State (19 March 2014) (accessed on 22 March 2014 at http://www.thestate.com/2014/03/19/3336444/tentative-deal-reached-on-solar.html).

[14] The bill text is available, as of 4 April 2014, at http://www.scstatehouse.gov/sess120_2013-2014/bills/1189.htm.

[15] *Solar bargain to last 20 years, for some*, Lee, M., U-T San Diego (22 February 2014) (accessed on 18 March 2014 at http://www.utsandiego.com/news/2014/feb/22/solar-billing-grandfathered/).

That said, if the Commission believes granting NCSEA's motion might "effectively [restrict] the Companies from exercising their rights[,]" Duke Response at p. 3, then it is important for the Commission to note that Duke's free speech rights are not unbounded and they can be reasonably restricted. Thirty years ago, the U.S. Supreme Court opined in pertinent part:

> Our decision today in no way disparages the national interest in energy conservation. We accept without reservation the argument that conservation, as well as the development of alternative energy sources, is an imperative national goal. Administrative bodies empowered to regulate electric utilities have the authority -- and indeed the duty -- to take appropriate action to further this goal. When, however, such action involves the suppression of speech, *the First and Fourteenth Amendments require that the restriction be no more extensive than is necessary to serve the state interest.*

*Central Hudson Gas & Electric Corp. v. Public Service Comm'n*, 447 U.S. 557, 571-572 (1980) (emphasis added).

NCSEA's motion does not seek Commission action involving the suppression of speech; instead NCSEA's motion calls upon the Commission to take narrow "appropriate action" to restore market certainty and thereby advance the long-recognized imperative national goal of developing alternative energy resources.

**C. By Working to Limit or Constrain Policies – Like Net Metering – That Enable Customers to Self-Generate, Duke Is Racheting Up the Monopoly Threat That The State Constitution Prohibits.**

In 2008, Duke said its photovoltaic distributed generation ("PVDG") program would

> allow the Company to explore the nature of solar distributed generation offerings desired by customers, [and] fill knowledge gaps to enable successful, wide-scale deployment of solar PV distributed generation . . . .

*Direct Testimony of Owen A. Smith*, p. 4, Commission Docket No. E-7, Sub 856 (25 July 2008) (Mr. Smith was a Duke witness). While **Exhibit H** contains indications that Duke is exploring a rooftop solar offering, Duke's recent public messaging calls into question whether it still aspires to enable "wide-scale deployment of solar PV distributed generation[.]" The extent to which Duke enables (or disables) deployment of rooftop solar (and other DER and DSM) will impact how a court applies N.C. Const. art. I, § 34 to the company.

For well over 100 years, our State Constitution has included a section that declares that "perpetuities and monopolies are contrary to the genius of a free State and ought not to be allowed." N.C. Const. art. I, § 34 (2013); *Frank Thrift v. Elizabeth City*, 122 N.C. 31, 36, 30 S.E. 349, 351 (1898). In 1898, our State Supreme Court succinctly explained the threat posed by monopolies:

> There can be few if any monopolies more dangerous in their tendencies, and unjust and harmful in their results, than those that pertain to municipal corporations. *In the present age of activity in scientific research and wonderful development in mechanical inventions and discoveries, it is highly improbable that any present system will long remain the best. Improved methods and cheaper appliances will result, and yet, the town would deliberately surrender to a private individual its highest attributes of delegated sovereignty, and would place beyond its power for nearly a generation all opportunity of securing for its citizens the benefits and improvements of a progressive age.*

*Id.* (emphasis added). Duke argues that its North Carolina operating companies "do not qualify as monopolies." Duke Response at p. 4. However, the more Duke limits or constrains policies – like net metering – that enable self-generation and thereby afford the citizenry an option to secure "the benefits and improvements of a progressive age," the more Duke presents the very danger that our Supreme Court found was prohibited by N.C. Const. art. I, § 34 over a century ago.

Respectfully submitted, this the 4 day of April, 2014.

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## CERTIFICATE OF SERVICE

I hereby certify that all persons on the docket service list have been served true and accurate copies of the foregoing Reply, together with any attachments, by hand delivery, first class mail deposited in the U.S. mail, postage pre-paid, or by email transmission with the party's consent.

This the 4 day of April, 2014.

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# APS sees slower pace in solar installations



By Associated Press Wednesday, February 5, 2014

PHOENIX (AP) - Fewer Arizona Public Service Co. customers are installing rooftop solar panels in the wake of state regulators' decision last November to add a $5 monthly fee for new solar customers.

APS had 280 customers in its territory add new solar installations in January. That's fewer than half the 583 customers who had installations in January 2013.

The Arizona Republic (http://bit.ly/1e38yt5) reports that solar financing and installation companies say the new state-imposed fee is responsible for the slowdown.

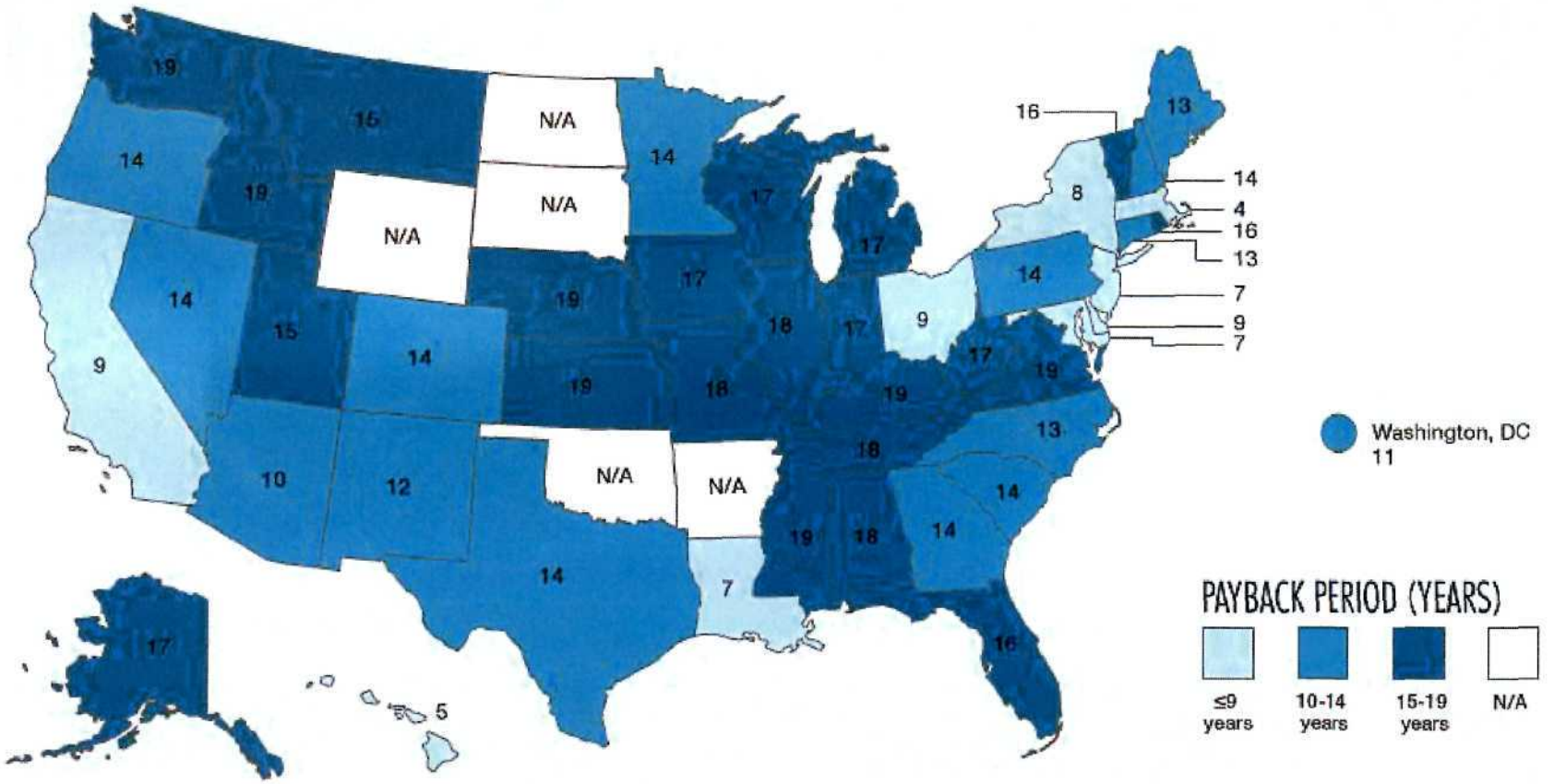
The Arizona Corporation Commission argued that so-called "net-metering" customers who sell APS their excess power generated by solar don't pay their full share of costs for using the power grid.

The commission partly agreed and approved a few much smaller fee than what APS requested.

EXHIBIT B

# HOW LONG IT'LL TAKE TO PAY FOR ITSELF

Seems like a no-brainer: High cost equals long payback time, right? Not exactly. A state with good incentives can mean a low net cost, but if electricity is cheap in that state (like Arizona or Louisiana), the payback period can still be pretty long. Conversely, a system may cost more in a given state, but if electricity prices there are high, the payback period may actually be pretty short.




SOURCE: U.S. homeowner solar estimate tool results, 2011.
Energy analytics powered by Clean Power Research

Results represent state averages and are not a guarantee of performance or savings for any particular system. Use the free solar cost estimate tool at **http://1bog.org/solar-estimate** or sign up at **http://1bog.org** to get a free cost estimate for your home.

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DUKE ENERGY.

# Frequently Asked Questions
# North Carolina

## How much solar is currently in place in North Carolina?

North Carolina is fourth in the nation in solar installed capacity. Duke Energy has approximately 200 megawatts of total installed capacity today. We expect that number to grow. North Carolina also has more than 2,000 megawatts of utility-scale projects proposed in the state.

The company has seen residential rooftop solar adoption increase by almost 50 percent each year since 2011. We have about 1,000 customers using rooftop solar panels in the state.

## Does Duke Energy provide solar energy to its customers?

We are involved in solar energy in a number of ways. Duke Energy Carolinas is piloting a rooftop solar program. Through that program, we own 10 MWs of distributed solar power. Twenty-five homes, schools and businesses are part of the pilot. Duke Energy owns and maintains the solar components, as well as the electricity generated.

Duke Energy also offers incentives to qualifying residential customers who install solar panels. The company is a sponsor of NC GreenPower, a nonprofit organization connecting individuals and organizations to renewable energy projects. In North Carolina, our regulated utilities purchase more than 200 MWs of solar energy.

We also are working to provide a renewable energy rate for large customers in the state – for example, manufacturers, data centers, college campuses and big-box retailers – who wish to offset some or all of their new load requirements with new renewable energy, including solar and wind.

These efforts are a good start, but there is more to do. Our customers want more renewable energy choices, and we are committed to providing those in an affordable and reliable way. We look forward to an opportunity to work with North Carolina leaders to make solar policies fair for all customers, encourage the use of solar energy and help us bring jobs to North Carolina.

## What issues could we potentially face regarding solar activity in North Carolina, for both customers and utilities?

The use of solar power is affecting utility customers. For example, current net energy metering policies in North Carolina credit solar customers for the full retail value of the energy they generate and send back to the grid. As this occurs, those customers avoid paying a portion of the costs necessary to provide power, including more than 80 percent of the time when their solar panels can't produce enough electricity. Those costs will be shifted to non-solar customers, and this is simply not fair.

Solar energy receives federal and North Carolina tax incentives. As solar costs are rapidly declining and usage is increasing, it may be time to evaluate whether the incentives are still needed.

## What about job growth and economic development? Is that a priority?

Duke Energy takes an active role in attracting and retaining jobs and investment in our state. In North Carolina in 2012, we helped recruit more than $1.6 billion in capital investment and approximately 6,000 new jobs. Economic development and the creation of jobs are vitally important to the communities we serve.

Solar policies and regulations need to be updated. Without changes, increased solar use will result in higher electricity prices for all customers, including non-solar customers. This will affect North Carolina's ability to compete for jobs and economic development.

DUKE ENERGY.

## Frequently Asked Questions (continued)

### What is net energy metering?

In North Carolina, net energy metering (NEM) is a billing option that credits customers with solar panels for the full retail value of the energy they generate and send back to the grid. The customer remains connected to the electric grid and uses the utility to supply electricity when their solar panels can't produce enough power, which is more than 80 percent of the time.

### What are third-party solar sales?

Third-party sales occur when a non-utility owner of a solar facility sells electricity directly to a retail customer, whether it's a homeowner, business or industry. North Carolina does not allow third-party sales of electricity and neither do several other jurisdictions.

### What is third-party leasing? What's the difference?

Third-party leasing allows the customer to lease solar generating equipment from a vendor rather than having to spend the upfront costs to purchase it. Though the customer doesn't own the equipment that is installed on their rooftop, they operate and maintain the system, and use the electricity the system produces to meet their energy needs.

Third-party sales and leasing could increase the adoption of solar, underscoring the importance of new policies and regulations to afford fair pricing for all customers.

### What are Qualifying Facilities (QFs)?

In 1978, Congress enacted the Public Utility Regulatory Policy Act (PURPA), which requires electric utilities to purchase the output from Qualifying Facilities (QFs) at the utility's avoided cost.

PURPA provides that state utility commissions are the appropriate entities to determine avoided cost rates at which the jurisdictional utilities (such as Duke Energy) must purchase the power from QFs. QFs are defined as:

- Cogenerators: generating units that produce electricity and useful steam.
- Small power producers: generating units that produce a maximum 80 megawatts of power using biomass, waste or a renewable energy source.

In North Carolina, solar QF energy may not be recovered in a timely fashion unless the solar QF sells a Renewable Energy Credit (REC) or the utility presents a base rate case. Accordingly, a significant and rapid increase in the number of solar QFs can lead to more frequent rate cases, which are costly to customers. Other states allow for the pass through of purchased power costs via a fuel clause without any restrictions specifically for QF purchases.

## DUKE ENERGY CAROLINAS AND DUKE ENERGY PROGRESS

**Request:**

Please provide data on the number of net-metered solar customers and the total capacity (MW-AC) of the solar systems of net-metered solar customers, broken down by the rate schedule under which the net-metered customer takes service.

**DEC Response:**

| Rate Schedule | As of June 30, 2013 | |
|---|---|---|
| | Cumulative Number of Net Metered Solar Customers | Total MW (ac) |
| HP-SC Hourly Pricing | 1 | 0.10 |
| NM-SC Net Metering | 97 | 0.64 |
| SCG-NC Small Customer Generator Rider | 114 | 0.85 |
| NM-NC Net Metering | 293 | 3.90 |
| **TOTAL** | 505 | 5.49 |

**DEP Response:**

| Rate Schedule | As of June 30, 2013 | |
|---|---|---|
| | Cumulative Number of Net Metered Solar Customers | Total MW (ac) |
| NC NM-Net Metering for Renewable Energy Facilities | 145 | 0.46 |
| NM - MGS | 7 | 0.25 |
| NM - Non NM Rider | 1 | 0.02 |
| NM - RES | 1 | 0.01 |
| NM - SGS | 5 | 0.59 |
| NM - SGS TOU | 2 | 0.12 |
| NM - SS LGSTOU | 1 | 0.80 |
| NM - SS SGSTOU | 2 | 0.56 |
| NM-NC Net Metering | 7 | 0.03 |
| NM-SC Net Metering | 1 | 0.00 |
| SC NM-Net Metering for Renewable Energy Facilities | 4 | 0.01 |
| TOU_D | 405 | 1.64 |
| **TOTAL** | 581 | 4.50 |

EXHIBIT
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DUKE ENERGY CAROLINAS AND DUKE ENERGY PROGRESS

**Request:**

Please provide data on the number of net-metered solar customers and the total capacity (MW-AC) of the solar systems of net-metered solar customers that have been added to DEC's and PEC's (now DEP's) systems in each of the last five years (2008 – 2012).

**DEC Response:**

| Year | Number of Annual Additions of Net Metered Solar Customers | Annual Additions MW (ac) |
|---|---|---|
| 2008 | 18 | 0.09 |
| 2009 | 30 | 0.19 |
| 2010 | 45 | 0.37 |
| 2011 | 104 | 1.64 |
| 2012 | 183 | 1.61 |
| **TOTAL** | **380** | **3.90** |

**DEP Response:**

| Year | Number of Annual Additions of Net Metered Solar Customers | Annual Additions MW (ac) |
|---|---|---|
| 2008 | 5 | 0.01 |
| 2009 | 4 | 0.02 |
| 2010 | 25 | 0.08 |
| 2011 | 145 | 1.97 |
| 2012 | 240 | 1.50 |
| **TOTAL** | **419** | **3.58** |

DUKE ENERGY CAROLINAS AND DUKE ENERGY PROGRESS

Request:

Please provide data on the number of net-metered solar customers and the total capacity (MW-AC) of the solar systems of net-metered solar customers that DEC and PEC (now DEP) expect to add to their systems in each of the next five years (2013-2017).

DEC and DEP Response:

See attached.

Forecasted NEM additions for 2013 - 2

| | Estimated Annual MW-ac Additions | | | | |
|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 |
| DEC | 2.88 | 4.97 | 10.80 | 4.37 | 5.19 |
| DEP | 2.14 | 3.21 | 12.61 | 3.35 | 3.87 |

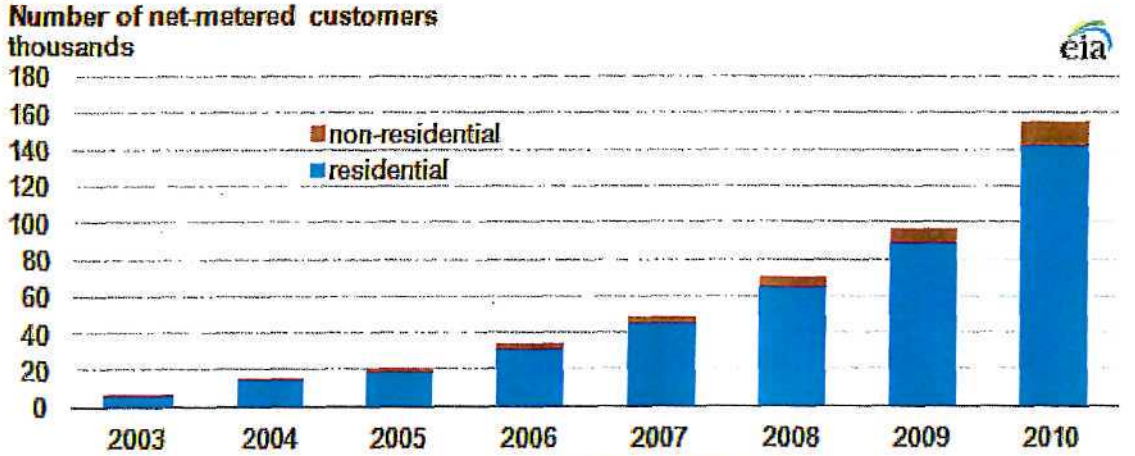
| Estimated Annual Solar Customer Additions | | | | |
|---|---|---|---|---|
| 2013 | 2014 | 2015 | 2016 | 2017 |
| 310 | 517 | 1,072 | 427 | 504 |
| 347 | 520 | 2,039 | 544 | 627 |

U.S. Energy Information Administration

# Today in Energy

May 15, 2012

## Participation in electric net-metering programs increased sharply in recent years




**Source:** U.S. Energy Information Administration, Electric Power Annual.

**Note:** The chart counts the number of net-metering customers and does not indicate the generator size or amount of generation. Non-residential includes the commercial and industrial sectors; net-metered generators in these sectors are typically larger than residential generators.

Electricity consumers are participating in net-metering programs in growing numbers. When individuals or businesses install small onsite generators (such as a rooftop solar system), they can usually enter into a net-metering agreement with their utility. Between 2003 and 2010, the average annual growth in customer participation was 56%, with a 61% increase between 2009 and 2010. While participation is increasing, electric customers with net metering represented only 0.1% of all customers in 2010.

State policies and technological developments led to an increase in residential and business consumers installing small-scale, on-site generators. Starting around the late 1990s, many states began incentive programs to encourage the installation of renewable generation (such as rebate programs, performance-based incentives, tax incentives, or low-interest loans), as well as Renewable Portfolio Standards. Tariffs standardizing aspects of net metering like compensation and interconnection rules—making it easier for consumers to participate—are also an important part of this state-based effort.

Since EIA began publishing data on the incidence of net metering in 2003, there has been growth in its application. In 2003, utilities in 38 states and the District of Columbia reported having a total of 6,813 net-metered customers. Over three quarters of those were in California with 5,242 customers; the next-largest state, Arizona, had only 330 customers.

In 2010, every state except for Tennessee reported net-metered customers. The total number of customers increased to 155,841, of which California accounted for 56% (86,495). The next largest states were Colorado (9,776), Arizona (8,559), New Jersey (7,526), and New York (5,638).

Net-metered installations were reported by 655 different investor-owned utilities, municipals, and cooperatives across the country, up from 127 in 2003. Residential applications made up 86% of total net-metered customers in 2003 and 91% in 2010.

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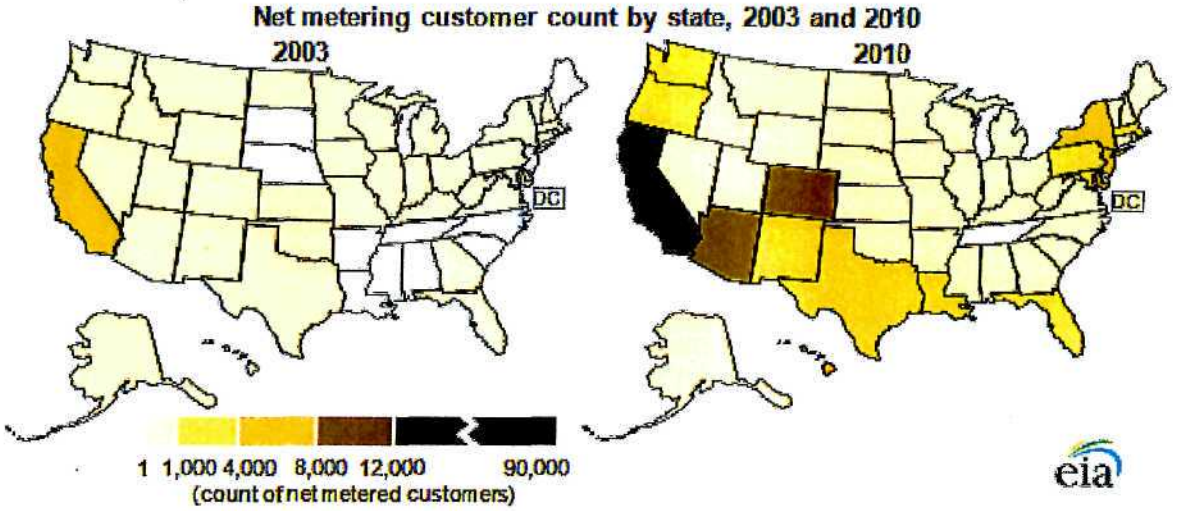


**Source:** U.S. Energy Information Administration, Electric Power Annual.

The combination of onsite generation with net metering has benefits for both consumers and utilities:

- **Consumer.** Consumers benefit from lower utility bills and increased stability in expenses (by replacing some portion of changing monthly utility bill with payments on their generator system). Also, connecting an onsite generator to the grid means no backup storage is required, decreasing the capital investment.
- **Utilities.** Utilities can benefit by having units located closer to the end users, known as distributed generation, potentially requiring less investment in transmission and distribution infrastructure. Further, onsite generation can remove or defer the need for infrastructure expansion.

A previous Today in Energy article described the differences among state net-metering policies. Upcoming articles will examine some of the technologies used for, and the size of, net-metered installations in 2010, and take a closer look at States with particularly successful net-metering programs.

U.S. DEPARTMENT OF ENERGY

# Duke Energy Photovoltaic Integration Study: Carolinas Service Areas


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March 2014


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# Executive Summary

## Overview

Solar energy collected using photovoltaic (PV) technology is a clean and renewable energy source offering multiple benefits to the electric utility industry and its customers. These benefits include cost predictability, reduced emissions, loss reduction by distributed installations, and others. Renewable energy goals established in North Carolina Senate Bill 3 (SB3), in combination with the state tax credit and decreases in the cost of PV panels, have resulted in rapid solar power penetration within the Carolinas services areas of Duke Energy. Continued decreases in PV prices are expected to lead to greater PV penetration rates than currently required in SB3.

Despite the potential benefits, PV generation is variable in nature with limited predictability. Significant penetration of PV energy is of concern to the utility industry because of its potential impact on operating reliability and integration cost to customers, and equally important, how any additional costs may be allocated to different customer groups. Some of these impacts might become limiting factors for PV energy, especially growing distributed generation installed at customer sites.

Recognizing the importance of renewable energy developments for a sustainable energy future and economic growth, Duke Energy has commissioned this study to simulate the effects of high-PV penetration rates and to initiate the process of quantifying the impacts. The objective of the study is to inform resource plans, guide operation improvements, and drive technology and infrastructure investments for a steady and smooth transition to a new energy mix that provides optimal values to customers.

## Study Team

The study team consists of experts from Pacific Northwest National Laboratory (PNNL), Power Costs, Inc. (PCI), Clean Power Research (CPR), Alstom, and Duke Energy. PNNL, PCI, and CPR performed the study on generation impacts; Duke Energy modeled the transmission cases; and distribution simulations were conducted by Alstom. PNNL analyzed the results from each work stream and produced the report.

## Study Scope and Methods

The goal of this study was to determine, for the Duke Energy service areas in the Carolinas, the impacts of solar PV on ancillary services and generation production cost, as well as voltage, power flows, and losses in the transmission and distribution systems.

Rather than adopt a more intensive approach that would take several years, this study attempts to produce results in a timely manner using available data and analytic tools, to identify areas of concern, measure the degree of impact, and provide guidance for further actions. Accordingly, the study was limited to energy production cost modeling and steady-state, power flow simulations. Potential PV impacts on system dynamic characteristics, such as frequency response and dynamic and transient stabilities, were not included the study scope.

Three scenarios were simulated in the generation study: 1) compliance solely with the goals and schedules of SB3, 2) modest increases over SB3 goals, and 3) more rapid penetration of PV. [1] Generation impacts, including reserve requirements, control performance, and production costs were evaluated with projections every other year from 2014 to 2022 (Table ES.1). Figure ES.1 shows the locations of the projected PV sites. The PV penetration evaluated ranged from 673 MW[2] to 6800 MW (2% to 20% of peak load). To provide corresponding inputs to energy production cost modeling, system variability and reserve requirements were analyzed for each case. Of the two steps in energy production cost modeling, generation commitment and dispatch was performed for the Duke Energy system as a whole, while balancing operations were modeled individually for its component balancing authorities (BA) areas (i.e., Duke Energy Carolinas [DEC] and Duke Energy Progress [DEP]).[3]

**Table ES.1.** PV Penetration Cases

| (MWac) | 2014 | 2016 | 2018 | 2020 | 2022 |
|---|---|---|---|---|---|
| Compliance | | | | | |
| DEC | 361 | 631 | 785 | 1,012 | 1,197 |
| DEP | 312 | 312 | 334 | 395 | 483 |
| Mid | | | | | |
| DEC | 431 | 816 | 1,393 | 2,006 | 2,598 |
| DEP | 331 | 506 | 867 | 1,248 | 1,642 |
| Smooth High | 2.5% | 5% | 10% | 15% | 20% |
| DEC | 500 | 1,000 | 2,000 | 3,000 | 4,000 |
| DEP | 350 | 700 | 1,400 | 2,100 | 2,000 |

Where applicable, the study relied on existing Duke Energy tools, data, and integrated resource planning assumptions. In addition, new modeling capabilities in both PV production and balancing authority operations were employed to capture the impact of PV variability up to 1-minute time scale. Resources including generators, pumped storage, demand-response, and long-term contracts were considered in the models. Load, resources, and fuel prices forecasts were consistent with Duke Energy integrated resource planning. The resource plans were developed according to projected load growth and PV installations in the compliance scenario. Therefore, the resource mix may vary from year to year, but stays constant for different PV penetration scenarios in the same study year. Data was provided by Duke Energy when available; otherwise it was simulated by the analysis team.

[1] Based on data from the interconnection queue, the level of actual penetration in the system may exceed compliance level, and is more close to the penetration level in the mid case.

[2] PV installation capacity in this document refers to alternating current (AC) capacity by default, unless noted otherwise.

[3] This treatment reflects the way Duke Energy system operates at the time of the study. Combining the two BAs or coordinating their balancing operations could potentially reduce the challenges from variable resources on generation operations, and is a subject for further studies and opportunity for operation improvement.

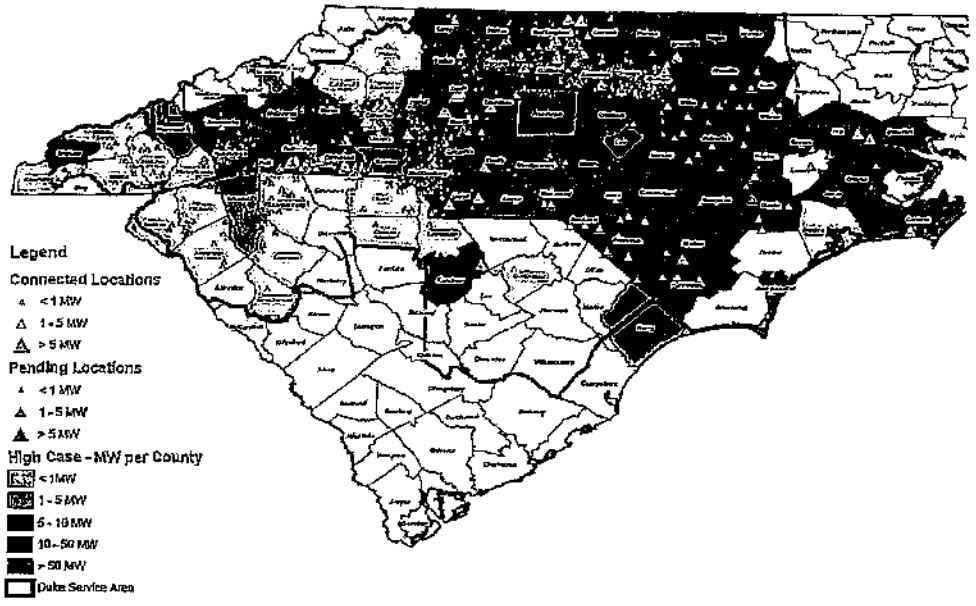



Figure ES.1. Locations of Projected PV Sites

Transmission analyses were conducted using "snapshots" of critical day types for each season, such as summer peak day.[1] The models were developed based on transmission planning cases of Duke Energy, and included 1197 MW of installed PV. The PV power output was determined from seasonal average of existing PV systems at times of the snapshots. Other PV penetration rates were not studied due to time constraints. All PV sources were assumed to operate at lagging power factors of 0.97; that is, they supply reactive power that is 25 percent of their real power output.[2,3] Transmission system voltage profiles and losses were compared between the cases with and without PV.

The same PV penetration and locations as used in the transmission analysis were assumed for the distribution study. Project PV installations were added to the DEC distribution system model taken from the Distribution Management System (DMS). Sequential power flow simulations with 30-minute intervals were performed on the entire DEC distribution system, and 3-minute interval simulations were conducted on one feeder as a case study to understand the impacts of variable PV output on feeder voltages, power flows, voltage control device operations, and system losses.

Duke Energy plans to incorporate the modeling tools that were developed during this integration study into its planning and operations tool kit and will continue to refine the approach and input as additional PV energy enters its system.

[1] This is consistent with current transmission planning and analysis procedures at Duke Energy and most other utilities. However, the "snapshot" approach is inadequate for PV impact analysis due to the variable nature of PV production and is an aspect for future improvements.

[2] This power factor is chosen based on historical measurements of selected PV sites in the DEC system. Interconnection requirements for North Carolina allow power factor to range between 0.95 lagging to 0.95 leading.

[3] Smart inverters with voltage control capability can vary reactive power output as needed for voltage regulation but have not been widely adopted in the distribution system, and therefore, was not considered in the study.

## Findings and Conclusions

The study was performed with a set of assumptions, including projected PV installations, future load growth, resource mix, and fuel prices. Current Duke Energy operation practices were followed where appropriate, and present transmission and distribution system configurations and control methods were modeled in the simulations. The study has made the following findings and conclusions under the above context.

### Generation

The study found that system net load (load minus PV production) variability increases with PV penetration. As a result, with PV penetration increasing to 20 percent of peak load in the integration cases, system day-ahead (DA) planning reserve requirements (contingency reserve excluded) increase 30 percent compared to the values without PV (reference cases), and regulation reserve requirements increase 140 percent. These reserves are capacity from conventional generators to cover forecast uncertainty and variability of the system. The trend of reserve requirements are depicted in Figures ES.2 and ES.3 using the DEC system as an example.

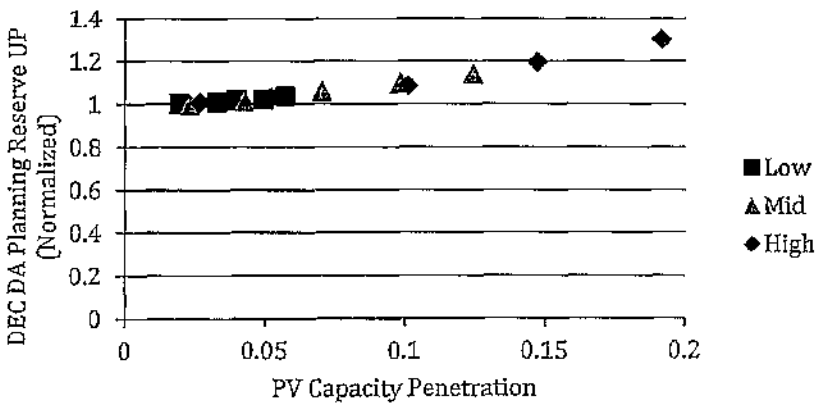



Figure ES.2. Day-Ahead Planning Reserve Up of All DEC PV Cases. Shown as the ratio between the requirements of PV case and corresponding reference case.

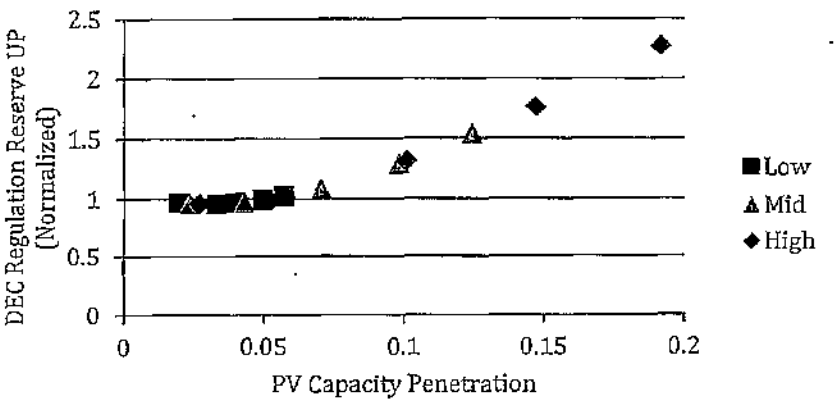



Figure ES.3. Regulation Reserve Up of All DEC PV Cases. Shown as the ratio between the requirements of PV case and corresponding reference case.

The Duke Energy system was able to maintain reliable operations in dispatch simulations, evaluated in terms of meeting ancillary service requirements and the target compliance level with North American Electric Reliability Corporation Control Performance Standards, with the caveat that contingencies were not modeled and contingency reserve requirement was assumed not affected by PV. Under the study conditions, Duke Energy's generation fleet proved capable of accommodating PV with an installation capacity of up to 6800 MW, or 20 percent of peak load, the highest level investigated in this study.

PV integration imposes additional costs on Duke Energy's current and planned conventional generating fleet, resulting from the need of additional reserves and cycling of conventional generators to compensate for PV variability. Although total system production cost decreases at higher PV penetration rates (when the cost of PV energy excluded), the unit cost for conventional generation to serve the same amount of energy increases with each increase in PV energy. Based on the load, resources, fuel prices and other assumptions made in the study, PV incurs an integration cost that ranges from $1.43 to $9.82 per megawatt-hour (MWh) of PV energy (Figure ES.4) in comparison with reference generation. The results show increasing unit PV integration cost at successively higher PV levels, which is consistent with other similar studies [3][4].

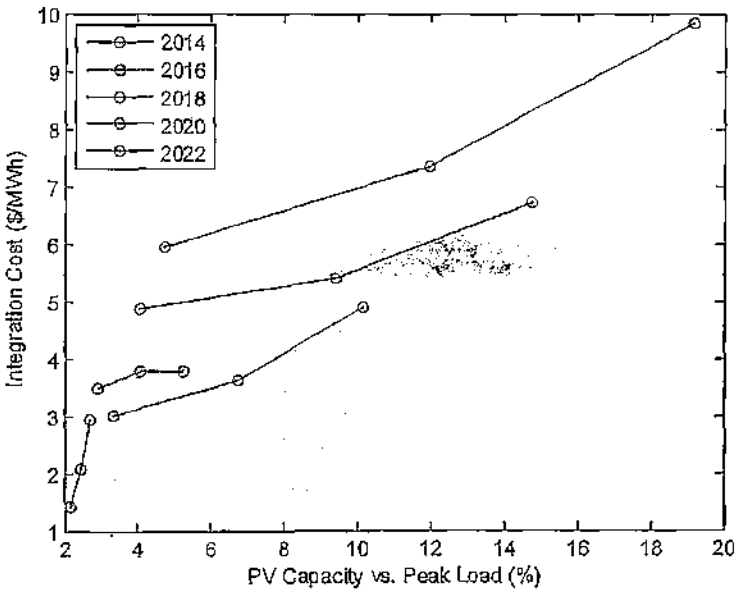



**Figure ES.4.** PV Integration Cost as a Fraction of PV Capacity to Peak Load (MW)[1]

## Transmission

As modeled, PV supplies both real and reactive power resulting in an increase in voltage magnitude proportional to the amount of PV output at sub-transmission buses where the distributed energy from PV

[1] Main factors affecting PV integration cost include resource mix and fuel prices, besides PV penetration and peak load. In the Integrated Resource Plan (IRP) used for the study, 2014 and 2016 cases have the same resource mix, while more efficient combined cycle and peaking units are added to later cases. This contribute to the result that 2016 cases show higher integration costs than those of 2018, but are more in line with the trend shown by 2014 cases. Difference in PV integration cost in years 2018 to 2022 results should be attributable to both increases in fuel price forecasts and changes in resource mixes.

sources is aggregated. The most affected areas in the Duke Energy system are in the 44-kV systems where voltage magnitude violated the upper limit in the spring and fall cases during light-load conditions. Voltage control devices modeled in the transmission system appeared not being able to handle this over-voltage issue, which suggests mitigation procedures should be investigated further.

The amount of energy loss reduction in the transmission network due to distributed PV depends on many factors such as the type of the conductors in the system, PV real power outputs and associated power factor, and the nature of load. For the four power flow snapshots analyzed, transmission loss reduction due to PV (i.e., difference in losses between the PV case and the case without PV) were between 2.6 and 5.7 percent as a percentage of PV output. As PV output and other system conditions change, the amount of loss reduction is expected to change, too. Analysis over a long time period (preferably one year or more) is needed to get a reliable assessment on the total loss reduction.

### Distribution

The addition of PV along distribution feeders was observed to provide both costs and benefits. The study here attempted to determine general trends of them, rather than quantify specific values.

During higher load periods, typically in the summer, both real and reactive losses decreased. During lower load periods, both real and reactive losses tended to increase. On average, feeders show a reduction in losses due to the addition of solar distributed generation, particularly in the summer season. Spring and fall indicate negligible changes in losses. Meanwhile, there is a wide range in the individual feeder results. Any net benefit is dependent on feeder topology, PV penetration level, and interconnection point.

In the simulation, equipment overloads tended to decrease due to the offset of local power flow by local generation, but in a few cases additional overloads were experienced mainly due to reverse power flows. In a few cases, substation power factor was negatively impacted; this may require evaluation of current capacitor settings, re-evaluation of solar installations' reactive power requirements, and in the future, perhaps the coordinated use of smart inverter technology by solar installers.

Feeders servicing PV installations experienced greater voltage fluctuations, and consequently, more control actions by voltage regulation devices. Increased regulator operations in turn reduce asset life. However, the severity or how quickly any individual PV site impacts the regulator life, depends on where the PV installation is located, its relative size, and the load on the circuit, among other factors.

## Discussion

### Generation

It should be noted that projected PV system sizes and locations, future load growth, resource mix and fuel prices, are a few assumptions that have great impact on study results. Although they were carefully made with the best data available, future system conditions will be different. The sensitivity of PV integration cost to PV locations, fuel prices, and thermal generation build-out should be investigated, in addition to the defined scenarios, to fully understand the impact of these assumptions on study results.

Of similar importance to the above assumptions are the simulation models and their parameters, such as PV production, DA and real-time forecasts, unit commitment and economic dispatch, automatic

generation control and operator actions. New study tools and procedures to model PV production and system operations were applied in the study. In some places necessary simplifications were made to produce the results timely, while in other cases reasonable improvements to operation procedure were modeled to deal with high-PV penetration rates.

For example, PV fleet forecasts for DEC and DEP in DA and real time were incorporated in reserve requirements calculations, which do not yet exist in real practice. Unit commitment was performed using actual load and PV production, instead of forecasted values as what happens in reality. Dynamic operating reserves that vary with hour of the day were applied in the unit commitment process. These models and parameters should be checked against real-world data for effectiveness as operation experience at significant PV penetration rates is accumulated over time.

In summary, refined model assumptions, additional validation of modeling tools, and improved study procedure should be attempted in future studies. Contingencies caused by conventional resources and affected by PV systems should be considered. Frequency response of the system at high-PV penetration rate, which was left out of the scope of this study, should also be investigated.

The same set of assumptions and models which affect study results significantly also point to the directions of operation and technology improvements for a smooth transition toward the high-PV energy mix. The improvements can be categorized into the following aspects:

1. *Increase Fleet Flexibility* – More flexible and efficient fleet tends to have a lower PV integration cost and better control performance, which should be taken into consideration in new generation build-out. Storage and demand response are other effective approaches to meet such goals. Fleet flexibility can also be improved by coordinating the balancing operations of DEC and DEP.

2. *Reduce Uncertainty and Variability* – Incorporating PV forecast into operation processes and improving forecast accuracy can directly reduce operation uncertainty. Aggregation of PV production in the two areas through BA coordination increases diversity and reduces total reserve requirements, which further helps lowering PV integration cost. Research is ongoing to reduce additional reserve requirements induced by PV variability through controlling power production ramp rate and providing regulation service by PV inverters.

Efforts to make the above improvements are certainly not free. Nonetheless, the attempts should be worthy if their costs are a fraction of the potential PV integration costs. These improvement solutions need to be assessed through future studies.

### Transmission

The transmission analysis is preliminary because of the seasonal day "snapshots" approach and assumptions made about PV inverter and transmission system voltage control capability to manage reactive power. Impacts on transmission on other days or over multiple day periods may have different impacts than identified here. Improvement on the coordination of the transmission voltage control devices, such as capacitor banks and inductors, could be made to alleviate the over-voltage issues with PV. Similarly, advanced inverters on the market are able to mitigate some of the reactive power impacts identified. Although those have yet to be deployed in the Duke Energy area, if these are adopted as either

an interconnection requirement or industry standard, the reactive power impacts noted here will be very different. These are several topics that should be researched further.

### Distribution

Mostly qualitative observations were made considering the limitations of the study approach, including low time resolution in the DEC system-wide study and short simulation time period in the intermittency study on the selected feeder. In the future, both overloads and reactive power requirements should be addressed through interconnection studies. If it becomes necessary for interconnection studies to thoroughly assess the economic benefits and impacts (beyond safety and reliability), it is expected that interconnection costs and time of delivery will increase and new tools may be needed.

The impacts noted will also result from a critical mass of customer-sited PV systems, although small systems typically do not require interconnection studies. These systems are the cause of widely noted distribution circuit level concerns among Hawaiian utilities, which currently experience much higher small PV system penetration rates than in this study. The present study was too limited to evaluate the distribution and magnitude of these concerns as an issue. Additional research may be warranted to assess the need for modification of interconnection procedures, incentives, and rate treatment for small systems.

# 5.0 Conclusions

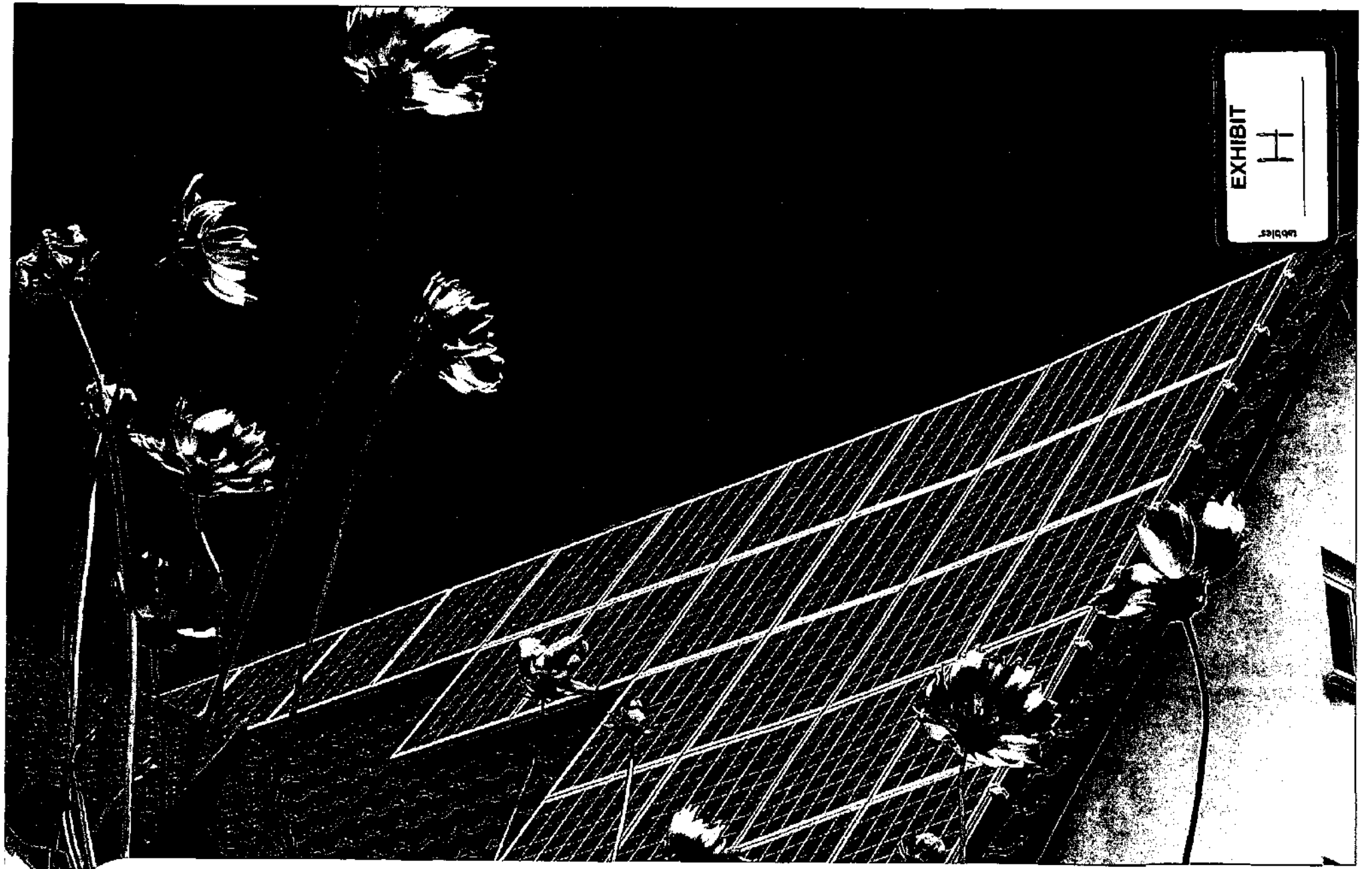
The study found that system net-load variability increases with PV penetration. With PV penetration increasing to 20 percent of peak load in the integration cases, system DA planning reserve requirements (not including contingency reserve) increase 30 percent, and RR requirements increase 140 percent compared to the values without PV (reference cases). The Duke Energy system was able to maintain reliable operations in dispatch simulations, evaluated in terms of meeting ancillary service requirements and the target compliance level with NERC CPSs, with the caveat that contingencies were not modeled. Under the study conditions, Duke Energy's generation fleet proved to be capable of accommodating PV with an installation capacity of up to 6800 MW, the highest level investigated in this study. The PV integration cost ranges from $1.43 to $9.82 per MWh of PV energy, in comparison with reference generation cases, resulting from the additional reserves and cycling of conventional generators to compensate for PV variability. The results exhibit a trend of increasing unit PV integration cost at successively higher PV levels, consistent with other similar studies [3][4].

It should be noted that projected PV system sizes and locations, future load growth, resource mix and fuel prices, are a few assumptions with great impact on study results. Refined model assumptions, additional validation of modeling tools, and improved study procedure should be attempted in future studies. The same set of assumptions and models which affect study results significantly also point to the directions of operation and technology improvements for a smooth transition toward the high-PV energy mix. The improvements can be categorized into the two target areas: increase fleet flexibility and reduce uncertainty and variability. Efforts to make these improvements are certainly not free. Nonetheless, the attempts should be worthy if their costs are a fraction of the potential PV integration costs.

The transmission analysis was based on four seasonal day "snapshots;" a common approach for transmission planning at Duke and elsewhere. Because PV supplies real and reactive power, the voltage magnitude at sub-transmission buses where the distributed energy from PV sources is aggregated has an increase in voltage magnitude proportional to the amount of PV output. The most affected areas in the Duke system are Areas 12 and 13 in the 44-kV systems where voltage magnitude violated the upper limit in the spring and fall cases. Voltage control devices modeled in the transmission system appeared unable to handle this over-voltage. Distributed PV introduces voltage control challenges during light load conditions, which suggests mitigation measure warrant further investigation. Reduction in transmission losses was identified, although the amount of energy loss reduction in the transmission network resulting from distributed PV depends on many factors such as the type of the conductors in the system, PV real power outputs and associated power factor, and the nature of load. For the four power flow snapshots analyzed, transmission loss reduction due to PV were between 2.6 and 5.7 percent as a percentage of PV output. The loss reductions observed would reduce generating requirements proportionally, which will offset some of the generating cost increases noted. Both should be factored into PV avoided costs analyses.

Overall, the addition of solar DG to simulated distribution feeders caused both benefits and impacts. The simulated distribution feeders experienced greater voltage fluctuations on feeders servicing PV installations, sometimes experiencing reverse power flows and more voltage control actions by voltage regulation devices. During higher load periods, typically in the summer, both real and reactive losses decreased. During lower load periods, both real and reactive losses tended to increase, as highlighted by the intermittency study, or remain relatively flat. The net benefit is very dependent on feeder topology,

penetration level, and interconnection point, and should be evaluated on a case-by-case basis before assigning associated costs or benefits. Equipment overloads tended to decrease due to the offset of local power flow by local generation, but in a few cases additional overloads were experienced mainly due to reverse power flows. In a few cases, substation power factor was negatively impacted; this may require evaluation of current capacitor settings, re-evaluation of solar installations' reactive power requirements, and in the future, perhaps the coordinated use of smart inverter technology by solar installers. It is expected that both overloads and reactive power requirements would be addressed in thorough interconnection studies. With PV power on the system, regulator operations tended to increase, which in turn reduces asset life. However, the severity, or how quickly any individual PV site impacts the regulator life, depends on where the PV installation is located, its relative size, and the load on the circuit, among other factors. Therefore, it is important that each interconnection study captures the impact to the regulator and determine cost impacts for that individual project. If it becomes necessary for interconnection studies to thoroughly assess the economic benefits and impacts (beyond safety and reliability) of individual installations, it is expected that interconnection costs will increase and new tools may be needed.




# Utility as a DG Provider

Update for Lynn Good | Jan. 3, 2013

DUKE ENERGY®

# Regulated Utilities DG Strategic Objectives

**DG will be an important part of our future**

- The impact on Duke is assumed to be significant, and near-term
- The Regulated Utilities are focused on **4 strategic objectives**

**Modernize Policies and Regulations**

**Mitigate**
the impact from net-metered solar

**Minimize**
QF recovery lag & impact of avoided cost methodology

**Investment**

**Recover**
the operational costs of solar

**Participate**
in solar and DG ownership

## Regulated Utilities DG Strategic Objectives

Duke's DG investment strategy is a comprehensive approach that seeks to minimize DG impacts on non-participating customers and shareholders and also continues to encourage 3rd party DG development and positions the company for investing in DG resources. The 4 Strategic Objectives include:

- Minimize the impact from net energy metering
  - Current net energy metering where customer-owned generation is credited at retail rates creates a significant cost shift to non-participating customers. Duke supports a stand-by charge or a decoupled rate structure for DG participants to minimize the cost shift issue. Duke will also support a declining incentive mechanism that softens the impact from the current rate structure to the new rate structure. As DG costs decline this incentive mechanism will be adjusted down accordingly
- Minimize QF recovery lag & impact of avoided cost methodology
  - In NC and SC, Solar QF purchases are mostly recovered through base rate cases. If fuel costs can be determined, these costs are recoverable through the fuel recovery clauses. Solar generation doesn't have a fuel cost component and generates significant shareholder cost impacts until the next base rate case. In NC, SB3 does provide the ability to recover costs if bundled with a REC.

## Regulated Utilities DG Strategic Objectives

- Minimize QF recovery lag & impact of avoided cost methodology (cont.)
  - In NC, the avoided cost calculation creates additional cost burdens on customers by requiring a capacity performance adjustment factor of 20% for solar and wind QFs and capacity payments are made even before capacity is needed for the system.
- Recover the operational costs of solar
  - Duke has engaged PNNL, Clean Power Research and Alstom to identify and quantify the additional costs and benefits created by intermittent solar generation. As expected, initial findings conclude that solar generation does have additional cost impacts on the generation, transmission and distribution systems and any benefits are clearly overstated by the solar community.
- Participate in solar and DG ownership(see next slide)

# Participate in Solar and DG Ownership

**ROOFTOP SOLAR**

- Attractive as a service provided to customers
- Potential to offer programs as "below the line" offers
- Current ownership consists of 10MWs as a rate based asset

**COMMUNITY SOLAR**

- Leverages economies of scale to provide more cost-effective solar, allowing broader customer participation
- Being developed as a pilot program

**GREEN TARIFF**

- Approved NC customer pilot program offering for new large customer loads
- Duke positioned to own renewable resources used to supply the program
- Currently accepting program participation applications

**UTILITY SCALE**

- Duke is looking at options to allow utility ownership in a way that utilizes the utility tax equity
- Duke would benefit by controlling assets and use to support grid operations
- Upfront ownership is attractive to meet RPS compliance mandates as a least cost solution. Also avoids market power test triggered by a PPA buyout option.

**DISTRIBUTION & TRANSMISSION UPGRADE**

- Utilities will have to upgrade the distribution infrastructure to accommodate increasing numbers of distributed solar PV systems
- These capital expenditures will either be rate based or allocated directly to DG resources

# Participate in Solar and DG ownership

## DG TRENDS

- Distributed solar PV positioned to continue to grow significantly
- Continued cost decline as industry moves down experience curve
- Solar PV and other DG economics becoming increasingly attractive

## BUSINESS MODEL DISRUPTIONS

- Load erosion
- Rate spiral
- Cost shifting
- New business models removing traditional barriers to adoption (e.g., third party leasing providers)

## OPPORTUNITIES

- Rooftop solar
- Community solar
- Green tariff
- Utility scale
- Distribution and transmission upgrades
- CHP and microgrids

February 3, 2014

Governor John W. Hickenlooper
Office of the Governor, State of Colorado
136 State Capitol
Denver, CO 80203-1792

Chairman Joshua Epel
Commissioner Pamela Patton
Commissioner Glenn Vaad
Colorado Public Utilities Commission
1560 Broadway #250
Denver, CO 80202

Dear Governor Hickenlooper and Colorado Public Utility Commissioners:

We are writing you on behalf of Lennar Corporation, one of the nation's leading builders of solar homes, and The Dow Chemical Company, a global supplier of renewable energy systems and green building products. Both Lennar and Dow are each separately incorporating distributed solar generation on rooftops across the state of Colorado, including several developments in the Denver area. Lennar's wholly owned subsidiary, SunStreet Energy Group, is offering Lennar homebuyers a unique solar program it calls its Solar 20/20 Plan™, which provides customers a guaranteed 20% discount on solar energy for 20 years at no upfront costs to the homebuyer. In October, 2011, Dow chose Colorado as the first state in which to launch its solar division. Dow Solar offers homebuilders and homeowners the American-made DOW POWERHOUSE™ Solar Shingle system, granting users a more financially and environmentally sustainable lifestyle.

First and foremost, investments in solar by large American companies like Dow and Lennar would not be possible without the policies promoted by Governor Hickenlooper, the Colorado Energy Office and the Colorado General Assembly. Your efforts have helped the state effectively use its natural resources, reduce carbon emissions and help Coloradans live healthier,

all while driving the creation of jobs. We thank you for your exceptional commitment to these policies and we thank you for your effort to increase transparency and stakeholder participation in the cost and benefits discussion proposed by Public Service Company of Colorado. We would also like to thank the Colorado Public Utilities Commission for their decisive and appropriate action to sever these matters to a docket separate from Public Service Company's 2014 Renewable Energy Standard Compliance Plan. Collectively, your efforts have ensured that all interested stakeholders, including those like Dow and Lennar, have an opportunity to participate in the dialogue related to distributed solar generation and net metering policies in the State of Colorado.

Lennar and Dow know firsthand that Public Service Company's actions to date on this issue already have had a direct impact on the critically important new home market in Colorado. Sales associates at communities by Lennar report that home buyers interested in new solar homes express concern about possible changes to Colorado's net metering policy. This hesitancy in purchase behavior directly impacts Colorado home builders and their ability to include solar on new housing starts. This illustrates the need for a public discussion on this issue. Clearly, the mere consideration of changes to current policies has already begun to have a negative impact.

Our companies look forward to participating in the fair and accurate study of costs and benefits of distributed solar generation and its impact on net metering. We are confident that such a study will demonstrate how distributed solar generation can help meet the state's Renewable Portfolio Standards, reduce investments needed in transmission and distribution infrastructure, and reduce the amount of electricity lost during transportation over transmission lines.

In conclusion, both Dow and Lennar look forward to being a part of Colorado's continuing success as a national leader in the deployment of distributed solar generation.

Sincerely,

Justin Onorato
Director, Corporate Development
Lennar Ventures

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# Contentious solar energy issue raised in Colorado

Net metering, a contentious issue for solar industry across US, center of debate in Colorado

AP By Donna Bryson, Associated Press | Associated Press – Wed, Mar 12, 2014 6:10 PM EDT

DENVER (AP) -- When Xcel Energy raised questions about a system known as net metering that helps determine the credit homeowners get from utility companies for putting solar panels on their roofs, regulators found the issue so contentious they separated it from a review of the renewable-energy policies of Colorado's largest utility.

On Wednesday, Colorado's Public Utilities Commission set a hearing in April to start what is likely to be a protracted process of addressing questions solar proponents fear could lead to changes that could hurt their industry.

Although most states have net-metering policies, the practice has touched off debates from Vermont to Hawaii that could have a profound effect on renewable-energy policies across the nation.

In Golden, near Denver, the city council responded to possible changes in Colorado's net-metering policies with a resolution urging regulators "to reject efforts by Xcel Energy to limit net metering."

In a joint letter to state officials, Dow, the giant chemical company that also sells rooftop solar systems, and Florida-based home developer Lennar said potential buyers of solar-equipped houses in Colorado are showing hesitancy because of concern that regulators might tinker with net metering.

"The reality is that we'd like an answer as soon as possible," David Kaiserman, whose SunStreet Energy installs solar systems in Lennar homes, said in an interview. "But we don't want to rush and get the wrong answer."

Net-metering policies across the U.S. vary, but they generally allow homeowners with solar panels on their roofs, once they have met their own needs, to get credit from utility companies for energy they put into the grid to be sold to other customers. Many homeowners with rooftop solar still must buy energy from their utility companies, and they also pay service and other charges. When homeowners have surpluses, the credit they get usually goes toward their overall energy bill.

Minneapolis-based Xcel, which has 1.3 million residential and commercial electric and gas customers in Colorado, says net-metering customers receive a 10.5-cent credit for each kilowatt hour they put on the grid, but the company values the benefit to the grid at only 5 cents a kilowatt hour. The solar industry has challenged Xcel's figures.

Xcel is not calling for changes immediately, saying it first wants to make clear to consumers what part of the net-metering credit reflects the value of the energy produced and what part should be seen as a subsidy. When it first raised the issue earlier this year, Xcel said that if regulators do not agree to that accounting, it would ask to drastically reduce the amount of solar energy it took on from rooftop producers this year.

Xcel spokesman Mark Stutz said Wednesday the company was no longer proposing a reduction, and that the company was pleased to be having a public "discussion about what we consider to be a net-metering incentive."

Jason Keyes, a lawyer who represents the Interstate Renewable Energy Council, said net-metering calculations by utility companies often leave out factors such as the possibility money could be saved by relying on renewable sources instead of building new infrastructure. The council he represents promotes renewable energy.

David Owens, executive vice president of the Edison Electric Institute, a utility industry think tank and lobbying body, acknowledges that utilities benefit by, for example, avoiding transmission costs to homeowners who are supplying their own needs.

But Owens said that from a utility's perspective, it's not clear that rooftop solar producers are paying their fair share of the costs of maintaining the grid. If they aren't, he said, the financial burden falls on customers who don't have solar systems. His institute's polling has shown that that argument resonates with rate-payers, he said.

Solar companies accuse traditional utility companies, some of which are establishing large solar projects of their own, of wanting to squash an innovative, agile competitor. Rooftop solar is a small player now, but it is growing rapidly.

Colorado voters were the first in the nation to adopt their own renewable-energy standards after passing a citizens initiative in 2004.

Denver homeowner Barbara Donachy, testifying at a utilities commission hearing earlier this year that focused on net metering, said shade and other factors make her own home unsuitable for solar. But she supports efforts to promote solar on her neighbors' roofs.

"I never thought I would be on the same side as Dow," she said later in an interview. Decades ago, Donachy protested against Dow because the company managed a bomb factory near Boulder that became a notorious hazardous waste site.

On solar, Dow's letter to the governor shows "people do have vested economic interests," she said. But "if I paid more on my utility bill and I knew that was going to lower the carbon footprint, I would do it."