

STATE OF NORTH CAROLINA  
UTILITIES COMMISSION  
RALEIGH

DOCKET NO. E-100, SUB 148

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of:  
Biennial Determination of Avoided Cost  
Rates for Electric Utility Purchases from  
Qualifying Facilities – 2016

DIRECT TESTIMONY

OF

KURT G. STRUNK

ON BEHALF OF

NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION

1   **Q.     PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2   A.     My name is Kurt G. Strunk. My business address is 1166 Avenue of the  
3           Americas, New York, New York 10036.

4  
5   **Q.     BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

6   A.     I am employed as a Director of National Economic Research Associates,  
7           Inc. ("NERA"). NERA is a firm of consulting economists with its principal  
8           offices in a number of major U.S. and European cities. NERA's experts  
9           have advised on power sector development since the firm's founding in  
10          1961. We have been influential in major initiatives such as marginal cost  
11          pricing for electric utilities, sector restructuring and the competitive  
12          procurement of power supply.

13  
14   **Q.     PLEASE DISCUSS YOUR PROFESSIONAL BACKGROUND.**

15   A.     I have over twenty years of professional experience working as an economist  
16          in the power sector. My practice at NERA focuses on financial matters of  
17          energy firms. I frequently serve as an expert on the requirements of  
18          investors with regard to committing capital to energy sector investments.  
19          My work in matters relating to power generation is extensive and includes  
20          resource planning, asset and contract valuation, and competitive bidding. I  
21          have worked on dozens of assignments related to power contracting and  
22          generation development.

1 My current curriculum vitae, which more fully details my educational,  
2 consulting and testifying experience, is provided in Exhibit 1 to this  
3 testimony.

4  
5 **Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NORTH**  
6 **CAROLINA UTILITIES COMMISSION?**

7 A. No, I have not.

8  
9 **Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE REGULATORY**  
10 **COMMISSIONS IN OTHER JURISDICTIONS?**

11 A. Yes. I frequently serve as an expert in matters before state and federal  
12 regulatory commissions. I have presented expert evidence in matters before  
13 the Hawai'i Public Utilities Commission, the Maryland Public Service  
14 Commission, the Massachusetts Energy Facilities Siting Board, the Nevada  
15 Public Utilities Commission, the Ohio Public Utilities Commission, the  
16 Regulatory Commission of Alaska, the Washington Utilities and  
17 Transportation Commission, as well as the Federal Energy Regulatory  
18 Commission and the National Energy Board of Canada.

19  
20 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS**  
21 **PROCEEDING?**

22 A. The purpose of my testimony is to evaluate whether reduction in term from  
23 fifteen years to ten years and proposed two-year energy pricing resets for the

1 Commission-approved standard power purchase agreement (“PPA”) rates  
2 and contract terms available to qualifying facilities (the “Standard Offer”)  
3 proposed by Duke Energy Carolinas, LLC, Duke Energy Progress, LLC  
4 (collectively, “Duke”) and Dominion North Carolina Power (“Dominion”),  
5 (collectively, the “Utilities”) will compromise the ability of new Qualifying  
6 Facilities (“QFs”)<sup>1</sup> to secure reasonable terms for the long-term financing  
7 necessary to enable construction of those facilities.

8  
9 **Q. WHAT DATA AND INFORMATION HAVE YOU RELIED UPON**  
10 **FOR THE DEVELOPMENT OF YOUR TESTIMONY?**

11 A. Exhibit 2 identifies the documents I relied upon in forming the opinions  
12 presented in my testimony. These opinions are also based on my experience  
13 working on matters related to the development of new power generation  
14 facilities in various jurisdictions.

15  
16 **Q. WHAT HAVE THE UTILITIES PROPOSED SPECIFICALLY**  
17 **RELATED TO THE STANDARD OFFER?**

18 A. Ms. Bowman, witness for Duke, explains that Duke is proposing significant  
19 changes to the Standard Offer available to QFs. Specifically, Ms. Bowman’s  
20 direct testimony identifies the following changes, among others:

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<sup>1</sup> By Qualifying Facilities, I mean new power generation facilities that meet the requirements of the Public Utility Regulatory Policies Act (“PURPA”), as implemented by the Federal Energy Regulatory Commission.

- 1           • Reducing the eligibility limit for the Standard Offer from 5
- 2           megawatts (“MW”) to 1 MW for non-hydroelectric generators;
- 3           • Transitioning to a single, 10-year PPA with fixed, levelized capacity
- 4           rates and energy rates that are adjusted every two (2) years;
- 5           • Amending Duke’s Terms and Conditions to include circumstance
- 6           that requires action by the Companies to comply with NERC and
- 7           SERC regulations as an “an emergency condition;”
- 8           • Amending the Companies’ standard PPAs to ensure that the
- 9           Commission’s eligibility threshold for the Standard Offer is not
- 10          evaded by subsequent transfers of standard PPAs to a partner or
- 11          affiliate of a developer of another QF of the same energy resource
- 12          located within one-half mile.

13          Similarly, Mr. Gaskill, witness for Dominion, has proposed the following:

- 14           • Reducing the eligibility limit for the Standard Offer from five MW to
- 15           one MW; and
- 16           • Reducing the term of the PPA from 15 years to 10 years.

17

18      **Q.     DOES YOUR TESTIMONY ADDRESS ALL OF DUKE’S AND**

19      **DOMINION’S PROPOSED CHANGES?**

20      A.     No. My testimony addresses the proposed changes that are likely to have the

21           greatest effect on the ability of QFs to have a reasonable opportunity to

22           attract capital from potential investors. These are: 1) the reduction of the

1 PPA term to ten years; and 2) the adjustment of avoided energy rates every  
2 two (2) years.

3

4 **Q. WHAT DO YOU CONCLUDE?**

5 A. I conclude that these proposed changes will not provide QFs with a  
6 reasonable opportunity to attract capital from potential investors. As I  
7 explain below, these changes will compress the recovery of capital  
8 investment in long-lived generation assets into too short a period to allow  
9 QFs to attract capital on reasonable terms.

10

11 **Q. QUALIFYING FACILITIES ARE A TYPE OF INDEPENDENT**  
12 **POWER PRODUCER. PLEASE PROVIDE BACKGROUND ON THE**  
13 **BUSINESS MODEL FOR INDEPENDENT POWER PRODUCERS.**

14 A. In states like North Carolina that have not elected to open their markets to  
15 retail competition and where wholesale competition is in most locations not  
16 facilitated by an organized wholesale market,<sup>2</sup> the business model for  
17 independent power production facilities relies on forward contracting.  
18 Independent power producers derive revenue and cash flow from the sale of  
19 energy and capacity to integrated utilities, which then sell bundled electricity  
20 service to final customers. These independent power producers typically

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<sup>2</sup> Policy makers in the United States have pursued two types of market opening: 1) the introduction of retail competition; and 2) the enabling of greater wholesale competition through the implementation of organized competitive wholesale markets. In this case, I am referring both to the lack of a competitive retail market and to the lack of an organized and easily accessible wholesale market in much of the state of North Carolina.

1 must obtain long-term contracts to secure financing and to ensure that the  
2 independent power producers are not subject to “holdup”<sup>3</sup> of these highly  
3 relationship-specific investments. The holdup problem occurs when large  
4 capital investments are made to support a specific trading relationship, and  
5 then one party to that relationship acts opportunistically to usurp the other  
6 party’s trading value.

7 Under long-term contracts used by independent power producers, the  
8 local utility typically is the purchaser of the electrical output. Holdup, in this  
9 context, would be opportunistic behavior by the purchasing utility (for  
10 example, to lower the price or to impose other unfavorable terms) after the  
11 investment has been made and the independent power producer no longer  
12 has negotiating leverage because there are no practical alternative buyers of  
13 its output. While QFs are entitled to avoided cost pricing, the pricing to  
14 which the QF will be entitled subsequent to the term of the PPA is not  
15 knowable at the time a QF makes its initial investment decision. The  
16 viability of new QFs, therefore, depends on the price and non-price terms of  
17 the PPAs that govern sales of output from those facilities and are entered  
18 into before investors commit capital to the business. Fixed pricing<sup>4</sup>  
19 committed for long contract durations – sufficient to provide a reasonable

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<sup>3</sup> See: Williamson, O. 1979, Transactions-cost economics: the governance of contractual relations. *Journal of Law and Economics* 22, 233–62, “Credible Commitments: Using Hostages to Support Exchange,” *American Economic Review*, September 1983, 73, 519–40, and *The Economic Institutions of Capitalism*, New York: Free Press, 1985. See also: Coase, R. 1937. The nature of the firm. *Economica* 4, 386–405.

<sup>4</sup> By fixed pricing, I am referring to prices that are fixed in nominal terms or prices that are fixed in real terms with period adjustments for inflation.

1           amortization of sunk investment costs for a long-lived asset – has  
2           traditionally underpinned the financing of new independent power  
3           production facilities.

4  
5   **Q.     WHAT FEATURES DISTINGUISH A FINANCEABLE PROJECT**  
6   **FROM A NON-FINANCEABLE ONE?**

7   A.    There is no bright line differentiating a financeable project from a non-  
8           financeable one. Getting a new power project financed with reasonable  
9           quantities of debt tends to hinge on factors such as the amount of equity  
10          committed, the interest rates paid, payback periods and other terms required  
11          by lenders, as well as the lenders' perceptions of risk in extending credit to  
12          the project.

13  
14   **Q.     WHAT TRADE-OFFS EXIST AMONG THE VARIOUS**  
15   **PARAMETERS AFFECTING QF DEVELOPMENT?**

16   A.    The most important trade-off among the parameters affecting QF  
17           development is between the PPA duration and the price at which a QF will  
18           have a reasonable opportunity to attract capital from potential investors.  
19           Reducing the PPA duration will increase the price at which a QF must sell in  
20           order to be able to attract financing, all else equal. If the price at which a QF  
21           must sell is in excess of the rate that reflects the utility's then avoided cost,  
22           then the QF will not be developed.

23



1   **Q.     CAN QFS SET THE PRICE AT WHICH THEY MAKE SALES TO**  
2       **THE UTILITIES?**

3   A.   No. QFs are price takers. They receive avoided cost pricing from utilities.  
4       They cannot choose the price at which they sell. However, they can choose  
5       whether they develop new facilities, and they will do that based on the price  
6       they require in order to be viable (*i.e.*, have a reasonable opportunity to  
7       attract capital from potential investors). This price is in turn based upon  
8       their costs.

9  
10       Reducing the PPA term and including 2-year energy price resets raises the  
11       \$/kWh price that a QF requires to be viable for two reasons: 1) the QF's  
12       cost of capital will increase as its investors bear more risk; and 2) as a  
13       practical matter, investors will seek shorter amortization periods for capital  
14       investments, which in turn translate to higher short-term cash flow  
15       requirements.

16  
17       Hence, reducing the term of the PPA increases the near-term costs for the  
18       QF, decreases the possibility that those costs could be recovered under  
19       avoided cost pricing, and reduces the likelihood that the QF will be  
20       developed.

21  
22       This could easily be the case not because a QF is more expensive relative to  
23       alternative resource options when compared on an apples-to-apples basis

1 (e.g., levelized \$/kWh cost over the facilities' useful life), but rather because  
2 the institutional and market framework for QFs operating in North Carolina  
3 includes PPA terms that are too short to allow reasonable access to capital.

4  
5 **Q. WHY DOES REDUCING THE TERM OF THE PPA MEAN THAT**  
6 **QFS WILL NEED TO RECEIVE HIGHER PER KWH PRICES?**

7 A. The shorter PPA gives the QF less time to recover its capital investment.  
8 The compression of the capital repayment schedule, in turn, pushes up the  
9 price that the QFs must be paid in order to be solvent in the years over which  
10 the PPA applies and debt would typically be serviced.

11  
12 **Q. BUT THE INVESTORS IN QUALIFYING FACILITIES MUST**  
13 **RECOGNIZE THE RESIDUAL VALUE OF THE FACILITY**  
14 **BEYOND THE PPA TERM. DO THEY NOT?**

15 A. Equity investors may count on a certain amount of residual value after the  
16 PPA term. But that does not mean that they will be willing to accept a large  
17 share of unrecovered capital at the end of the PPA. Forcing too much of the  
18 capital recovery into an uncertain post-PPA term will undermine the  
19 attractiveness of the investment opportunity to equity investors.

20  
21 **Q. HOW WILL LENDERS VIEW PPA ENERGY PRICING THAT**  
22 **RESETS EVERY TWO YEARS?**

1     A.     Lenders typically rely upon fixed pricing for assurance that the project will  
2           be in a position to service its debt. Lenders evaluate various credit metrics  
3           that depend on the projected cash flows, which in turn are driven by revenue,  
4           based upon the projected output of the generating facility and the fixed  
5           prices for the electrical output. The proposed reduction of the time period  
6           over which fixed rates apply will lead to lenders to view the effective PPA  
7           coverage period as only two years, even though Duke is proposing a ten-year  
8           PPA term. Lenders will significantly discount the revenues available  
9           beyond that two-year period. Because of the discounting of revenues  
10          beyond the second year, it is unlikely that project debt could be obtained in  
11          reasonable quantities for terms longer than two (2) years. In contrast, if the  
12          energy pricing were fixed for the entire period of the PPA term, that level of  
13          discounting would not occur and higher debt levels could be used to finance  
14          the project.

15  
16     **Q.     CAN THE QF DEVELOPER SOLVE SOME OF THESE PROBLEMS**  
17           **BY CONTRIBUTING MORE EQUITY?**

18     A.     In principle, the developer could contribute more equity. At the extreme end  
19           of the spectrum, the developer could contribute the entirety of funds needed  
20           to construct the facility. In practice, however, it is unlikely that the project  
21           sponsor or other equity investors would be willing to provide equity in such  
22           large quantities required to make the project viable in such a context. Equity  
23           investors in power projects are often capital constrained and seek to employ

1 debt leverage as part of attractive financial structures and to be able to offer  
2 lower prices. From their perspective, the equity investors will be taking on  
3 all of the risks of the project but the return available to do so would be lower  
4 than the expected return on the traditional structure with long-term debt.  
5 While the unleveraged equity investment carries less financial risk, all else  
6 equal, it may not offer a return high enough to make the project attractive to  
7 an equity provider. This is accentuated by the fact that an equity investor  
8 would require higher returns, all things equal, with two-year PPA energy  
9 price resets as compared to energy prices fixed for the term of a PPA.  
10 Equity investors, like lenders as discussed above, would view the two-year  
11 resets as adding significant risk to the cash flows from the investment. This  
12 in turn would drive up the cost of financing.

13  
14 **Q. YOU MENTIONED COMPRESSION OF THE CAPITAL**  
15 **REPAYMENT PERIOD FOR QFS WITH SHORTER-TERM PPAS.**  
16 **FOR COMPARISON PURPOSES, WHAT CAPITAL REPAYMENT**  
17 **SCHEDULES DOES DUKE USE FOR ITS REGULATED**  
18 **GENERATION ASSETS?**

19 A. For several out-of-state solar projects, Duke has relied upon a useful life of  
20 30 years with a corresponding depreciation rate of 3.33 percent.<sup>5</sup> For a

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<sup>5</sup> Joint Stipulation and Settlement Agreement, Cause No. 44734. Indiana Utility Regulatory Commission, dated April 15, 2016; Petition For Approval Of Depreciation Rates For Solar Photovoltaic Generating Units, Duke Energy Florida, LLC, Florida Public Service Commission Docket No. 160017-EI. January 11, 2016.

1 recent combined heat and power project in North Carolina, Duke sought  
2 approval of a useful life of 35 years.<sup>6</sup> For coal facilities subject to regulation  
3 by this Commission, I understand Duke uses a 60-year useful life, and a 40-  
4 year useful life for natural gas facilities subject to regulation by the  
5 Commission.<sup>7</sup>

6  
7 The point here is that Duke itself uses relatively long capital recovery  
8 periods for its long-lived generation assets, yet is proposing changes that  
9 reduce capital recovery periods for QFs to unreasonably short periods given  
10 the useful lives of such generating assets.

11  
12 **Q. WHAT DO YOU MAKE OF THE UTILITIES' PROPOSAL TO**  
13 **LOWER THE PROJECT SIZE TO WHICH THE STANDARD**  
14 **OFFER PPA WILL BE AVAILABLE?**

15 A. My expectation is that the smaller facilities are those that naturally have  
16 more difficulties in obtaining financing. This is why, for example, one  
17 sometimes observes pools of small projects being financed together as a  
18 group. The reduction in eligibility threshold for the Standard Offer should  
19 be expected to further challenge the financing prospects for QFs.

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<sup>6</sup> Application of Duke Energy Progress, LLC for Certificate of Public Convenience and Necessity to Construct 21 MW Combined Heat and Power Facility at Duke University, N.C.U.C. Docket No. E-7, Sub 1122, October 17, 2016.

<sup>7</sup> Christopher J. Ayers, Executive Director, NCUC Public Staff, Ratemaking Presentation, available at: <http://epic.uncc.edu/sites/epic.uncc.edu/files/media/Ratemaking%20presentation%20EPIC.pdf>.

1

2 **Q. IS YOUR ANALYSIS LIMITED TO SOLAR QFS?**

3 A. No. My analysis is not limited to solar QFs. While each technology has its  
4 own economics, the principles I have outlined above are general and not  
5 specific to a given type of generating technology.

6

7 **Q. HAVE YOU PREPARED EXHIBITS SHOWING THE EFFECTS OF**  
8 **THE PROPOSED PPA CHANGES?**

9 A. Yes, I prepared Exhibit 3 and Exhibit 4 to illustrate my analysis. Exhibit 3  
10 depicts how the Utilities' proposals will shift more risk to QFs and shorten  
11 the time period during which they can expect a stable revenue stream,  
12 thereby compromising their ability to obtain financing on reasonable terms.  
13 Exhibit 4 provides an illustration of how the Utilities' proposals will change  
14 the economics of a QF investment relative to a forecasted avoided cost rate.  
15 Together, these exhibits show how the proposed changes to the terms and  
16 conditions of the Standard Offer will unreasonably limit QFs' access to  
17 capital

18

19 **Q. PLEASE EXPLAIN EXHIBIT 3 IN MORE DETAIL.**

20 A. Exhibit 3 visually depicts two of the proposed changes to the Standard Offer  
21 that are before this Commission. For a hypothetical facility with a 30-year  
22 useful life, Exhibit 3 shows the revenue streams that would be available to  
23 QFs under several PPA constructs. For the existing Standard Offer PPA

1 construct, investors can count on contracted revenues for 15 years to support  
2 investments in new facilities. Reducing the PPA term from 15 years to 10  
3 years reduces by one third the period during which investors can count on  
4 stable revenues. Grafting onto a 10-year PPA the proposed two-year energy  
5 price reset leads to a situation where lenders and equity investors will only  
6 be able to count on two (2) years of known energy revenues during the  
7 facility's 30-year useful life. All energy revenues after the second year will  
8 be regarded by lenders and equity sponsors as risky and will be discounted  
9 accordingly.

10

11 **Q. WHAT DOES EXHIBIT 4 ILLUSTRATE?**

12 A. Exhibit 4 extends the concepts advanced in my testimony and highlighted in  
13 Exhibit 3. Using hypothetical assumptions for a new QF—including the unit  
14 size, construction cost, debt and equity ratios, tax depreciation schedule,  
15 applicable tax rates, inflation, and costs of capital—I estimate the annual  
16 revenue requirement that would be necessary for a QF to cover its fixed  
17 capital investment costs. Using the unit's capacity factor, I then calculate  
18 the levelized cost of energy over the term of the Standard Offer PPA  
19 necessary to recover fixed capital investment costs. First, I make the  
20 levelized cost calculation assuming the existing 15-year term available to  
21 QFs. Second, I make the levelized cost calculation using the 10-year term  
22 proposed by the Utilities. Third, I calculate the levelized cost with both the  
23 10-year term and two-year energy price resets. As these figures are

1 illustrative, and not intended to represent actual QF costs, I present them on  
2 a relative basis as compared to the per kWh revenue requirement under the  
3 *status quo* Standard Offer. This analysis shows that decreasing the Standard  
4 Offer PPA term and implementing two-year energy price resets will increase  
5 the revenue requirement of QFs, all else equal. The higher revenue  
6 requirement calculated for the shorter PPA term reflects compressed  
7 recovery of capital investment, while the higher revenue requirement  
8 calculated for the PPA with two-year energy price resets reflects increased  
9 price uncertainty and greater discounting of expected revenues.  
10

11 **Q. WHAT IS THE DIFFERENCE BETWEEN THE FIRST AND**  
12 **SECOND CHART IN EXHIBIT 4?**

13 A. Exhibit 4 contains two charts because I illustrate the QF economics using  
14 two scenarios: in the first, no residual value is attributed to the post-PPA  
15 term (first chart); in the second, a residual value equal to 30 percent of the  
16 initial facility investment is attributed to the post-PPA term (second chart).  
17 While many QF investors will be unwilling to count on 30 percent of the  
18 capital recovery occurring after the term of the initial PPA, I present this  
19 scenario to illustrate that the Utilities' proposals could also render infeasible  
20 QFs that are willing to accept high levels of equity investment risk.  
21

22 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

23 A. Yes.



## **KURT G. STRUNK**

### **Director**

Mr. Strunk is an expert in applied finance and energy matters with over 20 years of experience in complex commercial litigation, arbitration and regulatory proceedings. He has been retained as an expert to testify before arbitrators, the Federal Energy Regulatory Commission, US Tax Court, US Federal Court, and US Bankruptcy Court, the National Energy Board in Canada, as well as before state and provincial public utilities boards in the US and Canada. His testimonies have addressed the estimation of damages in breach of contract claims, asset and contract valuation, cost of capital, trading and risk management, the application of the just and reasonable rate standard, prudence, cost of service, regulatory reform, pipeline access and retail market issues. He has served as an advisor in over fifty public utility tariff reviews.

In the oil and gas sectors, Mr. Strunk has consulted on rate matters, mergers and acquisitions, restructurings, contract disputes, and product pricing. He has conducted numerous analyses of the procurement of fuels by electric generators. He served as an expert in regulatory hearings relating to pipeline tariffs in Canada and the United States. He has valued oil and gas assets and swaps in litigated disputes on behalf of major firms in the petroleum sector. He has also carried out studies of the reasonableness of gas supply agreements in various jurisdictions and assessed damages in connection with the early termination of such agreements.

In electric power, Mr. Strunk has advised governments, regulators, and energy companies on industry structure, regulation, and sector reform in North America, South America, Europe, Australia, Asia and Africa. He has worked extensively on matters related to all aspects of the electric power sector in the US and across the globe. In generation, Mr. Strunk recently co-authored a fairness opinion addressing a 6,300 MW nuclear power transaction in Ontario, Canada. He has advised a number of clients on the development of independent power contracts, fuel supply arrangements and competitive solicitations. With regard to transmission, he has advised on the design of transmission tariffs and on the design of electricity markets to encourage efficient transmission investment. He has advised on the electric sector reform program in Mexico, power market design and clean energy auctions, while also advising on capacity market design in US markets.

Mr. Strunk's assignments often require that he determines the appropriate return on equity capital for energy firms. He has calculated and supported required rates of return for power generators, gas distribution utilities, electric distribution and transmission companies, and other energy firms in the context of traditional tariff reviews for regulated entities, litigation and advisory work. Mr. Strunk frequently collaborates with NERA's Securities and Finance Practice. He has addressed liability and damages in broker-dealer disputes, and in securities class actions.

## Education

- 1997**                      **INSEAD (The European Institute of Business Administration),  
Fontainebleau, France**  
MBA, with Distinction, 1997
- 1993**                      **VASSAR COLLEGE,**  
**New York, USA**  
B.A., Economics, General and Departmental Honors

## Career Details

- 2017-present**            **NERA ECONOMIC CONSULTING**  
Director, New York
- 2012–2016**            **NERA ECONOMIC CONSULTING**  
Vice President, New York
- 2005–2012**            **NERA ECONOMIC CONSULTING**  
Senior Consultant, New York
- 2003–2004**            **NERA ECONOMIC CONSULTING**  
Outside Consultant, New York
- 2000–2002**            **NERA ECONOMIC CONSULTING**  
Senior Consultant, New York
- 1998–1999**            **NERA ECONOMIC CONSULTING**  
Senior Analyst, New York
- 1996**                    **NERA ECONOMIC CONSULTING**  
Associate Analyst, New York
- 1994–1995**            **NERA ECONOMIC CONSULTING**  
Research Associate, New York
- 1993–1994**            **NERA ECONOMIC CONSULTING**  
Research Assistant, New York
- 1992**                    **GÉNÉRALE DE BANQUE**  
Research Assistant, Brussels

## Languages

- English:            mother tongue  
French:             fluent  
Spanish:            fluent

## Project Experience

### EXPERT TESTIMONY

- |             |  |
|-------------|--|
| <b>2017</b> | <b>NV Energy</b><br><b>Cost of Gas / Prudence</b><br>Direct Testimony before the Nevada Public Utilities Commission, on behalf of NV Energy, addressing the prudence of the Company's gas purchases, March 1, 2017.  |
| <b>2016</b> | <b>NV Energy</b><br><b>Cost of Capital</b><br>Rebuttal Testimony before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, addressing the cost of capital for the Company's electric and gas divisions, September 23, 2016.  |
| <b>2016</b> | <b>Hawai'i Electric Light</b><br><b>Incentive Ratemaking, Fuel Adjustment Clauses</b><br>Direct Testimony before the Hawai'i Public Utilities Commission, on behalf of Hawai'i Electric Light, addressing alternative incentive mechanisms for the Company's power generation fleet and the reasonableness of the Company's proposed ECAC. September 19, 2016. |
| <b>2016</b> | <b>NV Energy</b><br><b>Cost of Capital</b><br>Certification Testimony before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, addressing the cost of capital for the Company's electric and gas divisions, August 2, 2016.   |
| <b>2016</b> | <b>NV Energy</b><br><b>Cost of Capital</b><br>Direct Testimony before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, addressing the cost of capital for the Company's electric and gas divisions, June 6, 2016.  |
| <b>2016</b> | <b>PacifiCorp</b><br><b>Cost of Capital</b><br>Oral Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital in the Company's expedited rate filing (Docket UE-152253), May 2, 2016.   |

- 2016**                      **Confidential Client**  
**Damages under Wind Power Purchase Agreement**  
Expert Report in arbitration on the valuation of damages under a PPA backed by a wind farm, April 25, 2016.
- 2016**                      **Municipality of Anchorage (ML&P), Chugach Electric Association**  
**Valuation of Gas Field and Reasonableness of Acquisition Price**  
Oral Testimony before the Regulatory Commission of Alaska on the reasonableness of the proposed acquisition of ConocoPhillips' working interest in the Beluga River Unit, April 19, 2016.
- 2016**                      **PacifiCorp**  
**Cost of capital**  
Rebuttal Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital in the Company's expedited rate filing (Docket UE-152253), April 7, 2016.
- 2016**                      **NV Energy**  
**Cost of Gas / Prudence**  
Direct Testimony before the Nevada Public Utilities Commission, on behalf of NV Energy, addressing the reasonableness of the Company's natural gas purchases, March 1, 2016.

- 2016**                      **Alliance to Protect Nantucket Sound**  
**Financing of off-shore wind farm**  
Oral Testimony before the Energy Facilities Siting Board of the Commonwealth of Massachusetts on the financeability of the Cape Wind project, January 25, 2016.
- 2015**                      **PacifiCorp**  
**Cost of capital**  
Direct Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital, November 24, 2015.
- 2015**                      **Chugach Electric Association, Inc.**  
**Regulatory principles for attributing found natural gas**  
Oral testimony before the Regulatory Commission of Alaska, addressing the regulatory treatment of gas found by the Cook Inlet Natural Gas Storage Alaska LLC, August 31, 2015.
- 2015**                      **Baltimore Gas & Electric Company**  
**Risks and rate of return for retail electricity business**  
Oral Testimony before the Maryland Public Service Commission, *in the Matter of Baltimore Gas & Electric's Application to Recover Cash Working Capital for Standard Offer Service*, Case No. 9221, August 5, 2015.
- 2015**                      **Baltimore Gas & Electric Company**  
**Risks and rate of return for retail electricity business**  
Rebuttal Testimony before the Maryland Public Service Commission, *in the Matter of Baltimore Gas & Electric's Application to Recover Cash Working Capital for Standard Offer Service*, Case No. 9221, July 22, 2015.
- 2015**                      **Chugach Electric Association, Inc.**  
**Regulatory principles for attributing found natural gas**  
Pre-filed testimony before the Regulatory Commission of Alaska, addressing the regulatory treatment of gas found by the Cook Inlet Natural Gas Storage Alaska LLC, June 5, 2015.
- 2015**                      **ATX Southwest, LLC.**  
**Cost of Capital**  
Direct Testimony before the Federal Energy Regulatory Commission, on behalf of ATX Southwest, addressing return on equity, May 28, 2015.

- 2015**                      **Chugach Electric Association, Inc.**  
**Cost of Capital**  
Responsive Testimony before the Regulatory Commission of Alaska, addressing return on equity for the Enstar Natural Gas Company, May 15, 2015.
- 2015**                      **Baltimore Gas & Electric Company**  
**Risks and rate of return for retail electricity business**  
Testimony before the Maryland Public Service Commission, *in the Matter of Baltimore Gas & Electric's Application to Recover Cash Working Capital for Standard Offer Service*, Case No. 9221, April 22, 2015.
- 2015**                      **NV Energy**  
**Cost of Gas / Prudence**  
Direct Testimony before the Nevada Public Utilities Commission, on behalf of NV Energy, addressing the reasonableness of the Company's natural gas purchases, March 1, 2015.
- 2014**                      **PacifiCorp**  
**Cost of capital**  
Oral Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital in the Company's general rate case, December 16, 2014.
- 2014**                      **PacifiCorp**  
**Cost of capital**  
Rebuttal Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital in the Company's general rate case, November 21, 2014.
- 2014**                      **PacifiCorp**  
**Cost of capital**  
Direct Testimony before the Washington Utilities and Transportation Commission, on behalf of PacifiCorp, on the cost of capital in the Company's general rate case, including the effects of transitioning away from coal, April 30, 2014.
- 2014**                      **Nevada Power Company**  
**Cost of capital**  
Direct Testimony before the Nevada Public Utilities Commission, on behalf of Nevada Power Company, on the cost of capital in the Company's general rate case, April 30, 2014.

- 2015**                      **NV Energy**  
**Cost of Gas / Prudence**  
Direct Testimony before the Nevada Public Utilities Commission, on behalf of NV Energy, addressing the reasonableness of the Company's natural gas purchases, March 1, 2014.
- 2013**                      **Sierra Pacific Power Company**  
**Cost of capital**  
Oral testimony, before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, on the cost of capital for the gas and electric divisions in the Company's general rate case, October 7, 2013.
- 2013**                      **Sierra Pacific Power Company**  
**Cost of capital**  
Rebuttal Testimony before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, on the cost of capital for the gas and electric divisions in the Company's general rate case, September 25, 2013.
- 2013**                      **Market Area Shippers**  
**(Gaz Métro, Union Gas and Enbridge Gas Distribution)**  
**Contract Renewal Alternatives for Regulated Pipeline Service**  
Pre-filed Expert Report, with Jeff Makholm, before the National Energy Board of Canada, in the Matter of TransCanada's Application for Tariff Amendments, Hearing Order RH-001-2013, July 26, 2013.
- 2013**                      **Sierra Pacific Power Company**  
**Cost of capital**  
Direct Testimony before the Nevada Public Utilities Commission, on behalf of Sierra Pacific Power Company, on the cost of capital for the gas and electric divisions in the Company's general rate case, June 4, 2013.
- 2013**                      **NV Energy Operating Companies**  
**Cost of capital**  
Direct Testimony before the Federal Energy Regulatory Commission, on behalf of NV Energy Operating Companies, on the appropriate rate of return for the consolidated transmission system, May 31, 2013.
- 2013**                      **Public Intervenor**  
**Wholesale Margins for Regulated Motor Fuels and Heating Oil**  
Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of an Application by Irving Oil Marketing GP and Irving Oil Commercial GP requesting an increase in the wholesale margins for motor fuels and heating oil*, January 29, 2013.

- 2013**                      **Public Intervenor**  
**Power sector modelling, deferral account policy, financial analysis**  
 Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of the Point Lepreau Nuclear Generating Station Deferral Account and Section 143.1 of the Electricity Act*, January 15, 2013.
- 2012**                      **Baltimore Gas & Electric Company**  
**Potomac Electric Power Company**  
**Power Purchase Agreements, Retail electric competition**  
 Oral testimony before the Maryland Public Service Commission on the financeability of a new power plant *In the Matter of Whether New Generation Resources Are Needed to Meet Long-Term Demand for Standard Offer Service*, Case No. 9214, November 26, 2012.
- 2012**                      **Public Intervenor**  
**Modelling of coal and oil plants, deferral account, financial analysis**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board *In the Matter of the Point Lepreau Nuclear Generating Station Deferral Account and Section 143.1 of the Electricity Act*, November 26, 2012.
- 2012**                      **Nevada Power Company**  
**Cost of capital**  
 Pre-filed testimony before the Federal Energy Regulatory Commission in the Nevada Power Company's Transmission Rate Case, October 31, 2012.
- 2012**                      **Public Intervenor**  
**Wholesale margins for regulated motor fuels and heating oil**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board *In the Matter of an Application by Irving Oil Marketing G.P. and Irving Oil Commercial G.P. Requesting an Increase in the Wholesale Margins for Motor Fuels and Heating Oil*, October 26, 2012.
- 2012**                      **Nevada Power Company**  
**Prudence of gas costs for 2012**  
 Pre-filed Expert Report before the Nevada Public Utilities Commission *In the Nevada Power Company's 2012 Deferred Energy Filing*, March 1, 2012.
- 2012**                      **Sierra Pacific Power Company**  
**Prudence of gas costs for 2012**  
 Pre-filed Expert Report before the Nevada Public Utilities Commission *In the Nevada Power Company's 2012 Deferred Energy Filing*, March 1, 2012.



- 2011**                      **Public Intervenor**  
**Power system loss factors, OATT, transmission regulatory policy**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board *In the Matter of a Review of the Proposed Change to the New Brunswick System Operator's Real Power Loss Factor*, October 31, 2011.
- 2011**                      **John Hancock**  
**Risk analysis of European power plant leveraged lease**  
 Oral Testimony before the U.S. Tax Court, on behalf of plaintiff in *John Hancock Life Insurance Company and Subsidiaries v. Commissioner of Internal Revenue*, October 24, 2011.
- 2011**                      **John Hancock**  
**Risk analysis of European power plant leveraged lease**  
 Rebuttal Expert Report before the U.S. Tax Court, on behalf of plaintiff in *John Hancock Life Insurance Company and Subsidiaries v. Commissioner of Internal Revenue*, August 19, 2011.
- 2011**                      **John Hancock**  
**Risk analysis of European power plant leveraged lease**  
 Pre-filed Expert Report before the U.S. Tax Court on behalf of plaintiff in *John Hancock Life Insurance Company and Subsidiaries v. Commissioner of Internal Revenue*, July 8, 2011.
- 2011**                      **Public Intervenor**  
**OATT, transmission regulatory policy**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board, *in the Review of the Proposed Changes to the New Brunswick System Operator's Open Access Transmission Tariff*, February 21, 2011.
- 2011**                      **Public Intervenor**  
**Power system loss factor, OATT, transmission regulatory policy**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board, *in the Review of the New Brunswick System Operator's Proposed Change to its Loss Factor*, February 3, 2011.
- 2011**                      **Baltimore Gas & Electric Company**  
**Risks and rate of return for retail electricity business**  
 Oral testimony before the Maryland Public Service Commission, *in the Matter of Baltimore Gas & Electric's Application to Recover Cash Working Capital for Standard Offer Service*, Case No. 9221, January 20, 2011.

- 2010**                      **Baltimore Gas & Electric Company**  
**Risks and rate of return for retail electricity business**  
 Pre-filed Expert Report before the Maryland Public Service Commission, *in the Matter of Baltimore Gas & Electric's Application to Recover Cash Working Capital for Standard Offer Service*, Case No. 9221, September 17, 2010.
- 2010**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Oral testimony before the New Brunswick Energy & Utilities Board, in the *Enbridge Gas New Brunswick Rate Case*, March 30, 2010.
- 2010**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board, *in the Matter of Enbridge Gas New Brunswick Rate Case*, March 12, 2010.
- 2009**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Oral testimony before the New Brunswick Energy & Utilities Board, *in the Review of Matters related to the Regulation of Enbridge Gas New Brunswick*, October 23, 2009.
- 2009**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board, *in the Matter of the Annual Financial Review of Enbridge Gas New Brunswick Limited Partnership*, August 21, 2009.
- 2009**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Oral testimony before the New Brunswick Energy and Utilities Board, *in the Matter of the Annual Financial Review of Enbridge Gas New Brunswick Limited Partnership*, September 15, 2009.
- 2009**                      **Public Intervenor**  
**Greenfield gas distributor, cost of service, just and reasonable rates**  
 Pre-filed Expert Report before the New Brunswick Energy and Utilities Board, *in the Matter of a Review of Matters Related to the Regulation of Enbridge Gas New Brunswick Limited Partnership*, September 21, 2009.
- 2009**                      **The City of New York**  
**Cost of service, incentives and taxi lease rates**

Oral testimony in the District Court for the Southern District of New York in *Metropolitan Taxicab Board of Trade et al. v. The City of New York et al.*, on the issue of whether the Taxi and Limousine Commission's new maximum lease rates constitute a fuel efficiency and emissions mandate that would be preempted by Federal law, May 20, 2009.

2009

**The City of New York****Cost of service, incentives and taxi lease rates**

Pre-filed expert Report in the United States District Court for the Southern District of New York in *Metropolitan Taxicab Board of Trade et al. v. The City of New York et al.*, on the issue of whether the Taxi and Limousine Commission's new maximum lease rates constitute a fuel efficiency and emissions mandate that would be preempted by Federal law, May 18, 2009.

2009

**Public Intervenor****Greenfield gas distributor, cost of service, just and reasonable rates**

Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of the examination of the formula for Enbridge Gas New Brunswick's market-based rate*, April 23, 2009.

2009

**Public Intervenor****Greenfield gas distributor, cost of service, just and reasonable rates**

Pre-filed Report before the New Brunswick Energy and Utilities Board, *In the Matter of the examination of the formula for Enbridge Gas New Brunswick's market-based rate*, March 26, 2009.

2009

**Public Intervenor****Cost of service, ISO management, OATT transmission policy**

Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of the application of the New Brunswick System Operator for changes to its Charges, Rates and Tolls*, March 18, 2009.

2009

**Public Intervenor****Cost of service, ISO management, OATT transmission policy**

Pre-filed Report before the New Brunswick Energy and Utilities Board, *In the Matter of the application of the New Brunswick System Operator for changes to its Charges, Rates and Tolls*, February 24, 2009.

2008

**Allegheny Power, Baltimore Gas & Electric****Integrated resource planning, competitive retail electric markets**

Oral testimony before the Maryland Public Service Commission, *in the Matter of the Commission's Investigation Of Investor-Owned Electric Companies' Standard Offer Service for Residential and Small Commercial Customers in Maryland*, Case No. 9117, December 15, 2008.

- 2008**                      **Allegheny Power, Baltimore Gas & Electric**  
**Integrated resource planning, competitive retail electric markets**  
 Pre-filed Report before the Maryland Public Service Commission, *in the Matter of the Commission's Investigation Of Investor-Owned Electric Companies' Standard Offer Service for Residential and Small Commercial Customers in Maryland*, Case No. 9117, October 1, 2008.
- 2008**                      **Public Intervenor**  
**Ratemaking for greenfield gas distributor**  
 Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of an application by Enbridge Gas New Brunswick for changes to its Charges, Rates and Tolls*, March 27, 2008.
- 2008**                      **Public Intervenor**  
**Ratemaking for greenfield gas distributor**  
 Pre-filed Report before the New Brunswick Energy and Utilities Board, *In the Matter of an application by Enbridge Gas New Brunswick for changes to its Charges, Rates and Tolls*, March 10, 2008.
- 2007**                      **Public Intervenor**  
**Prudence, just and reasonable standard, affiliate transactions**  
 Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls*, December 18, 2007.
- 2007**                      **Public Intervenor**  
**Nuclear power plant Cost of Service**  
 Pre-filed Report before the New Brunswick Board of Commissioners of Public Utilities, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls*, December 7, 2007.
- 2007**                      **Public Intervenor**  
**Prudence of power generation costs**  
 Pre-filed Report before the New Brunswick Board of Commissioners of Public Utilities, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls*, November 5, 2007.
- 2007**                      **Public Intervenor**  
**Prudence of power generation costs**  
 Oral testimony before the New Brunswick Energy and Utilities Board, *In the Matter of an application by the NBP Distribution & Customer Service*

*Corporation (Disco) for changes to its Charges, Rates and Tolls, June 21, 2007.*

2007

**Public Intervenor****Prudence of power generation costs**

Pre-filed Report before the New Brunswick Energy and Utilities Board, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls, June 14, 2007.*

2006

**Brookfield Energy Marketing Inc.****Valuation of power purchase agreement and power plant**

Deposition testimony before the United States Bankruptcy Court for the District of Maryland, on behalf of Brookfield Energy Marketing Inc., *In re: USGen New England, Inc.*, Debtor, Case No. 03-30465, May 22, 2006.

2006

**Brookfield Energy Marketing Inc.****Valuation of power purchase agreement and power plant**

Rebuttal Report before the United States Bankruptcy Court for the District of Maryland, on behalf of Brookfield Energy Marketing Inc., *In re: USGen New England, Inc.*, Debtor, Case No. 03-30465, May 5, 2006.

2006

**Brookfield Energy Marketing Inc.****Valuation of power purchase agreement and power plant**

Expert Report before the United States Bankruptcy Court for the District of Maryland, on behalf of Brookfield Energy Marketing Inc., *In re: USGen New England, Inc.*, Debtor, Case No. 03-30465, March 29, 2006.

2006

**Public Intervenor****Application of the prudence standard to affiliate transactions**

Oral testimony before the New Brunswick Board of Commissioners of Public Utilities, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls, March 14, 2006.*

2006

**Public Intervenor****Application of the prudence standard to affiliate transactions**

Pre-filed Report with Eugene Meehan before the New Brunswick Board of Commissioners of Public Utilities, *In the Matter of an application by the NBP Distribution & Customer Service Corporation (Disco) for changes to its Charges, Rates and Tolls, January 31, 2006.*

- 2005**                      **Dayton Power & Light Company**  
**Retail pricing for default service customers and option valuation**  
Oral testimony at hearings in Ohio Public Utilities Commission Case No. 05-276-EL-AIR, November 8 and 14 2005.
- 2005**                      **Dayton Power & Light Company**  
**Retail pricing for default service customers and option valuation**  
Deposition testimony in Ohio Public Utilities Commission Case No. 05-276-EL-AIR, November 8, 2005.
- 2005**                      **Dayton Power & Light Company**  
**Retail pricing for default service customers and option valuation**  
Testimony in Ohio Public Utilities Commission, in Support of Stipulation filed in support of Dayton's proposed settlement Case No. 05-276-EL-AIR, November 4, 2005.
- 2005**                      **Dayton Power & Light Company**  
**Retail pricing for default service customers and option valuation**  
Rebuttal testimony in Ohio Public Utilities Commission, application of financial options pricing techniques to assess the reasonableness of Dayton's proposed provider-of-last-resort charges, Case No. 05-276-EL-AIR, October 31, 2005.
- 2004**                      **Board of Public Utilities**  
**Cost of capital**  
Pre-filed testimony with Cindy Ma before the Board of Public Utilities, Newfoundland and Labrador, Canada, on "The Cost of Capital for Automobile Insurance Firms," October 13, 2004.

**CONSULTING EXPERT EXPERIENCE**

<b>2016</b>	<b>Confidential Client</b> <b>Valuation of Solar Generation Facilities</b> Advisor to counsel in dispute related to the valuation of solar facilities.
<b>2014 -Present</b>	<b>Confidential Client</b> <b>Offshore Exploration and Production Permit Arbitration</b> Advised on dispute related to an agreement between two firms to develop an offshore gas field in New Zealand in arbitration at the ICC International Court of Arbitration.
<b>2013–Present</b>	<b>Gaz Métro</b> <b>Cost Recovery of Gas Distribution System Upgrade</b> Advised client on regulatory merits of ratemaking for distribution system upgrade. Performed survey of ratemaking policies for similar upgrades in other jurisdictions in connection with proceeding before Provincial regulator.
<b>2014-Present</b>	<b>Confidential Client</b> <b>Gas Supply Agreement Negotiation</b> Advise on cost of service and LNG contract price issues in Australia.
<b>2014- Present</b>	<b>Alliance Pipeline</b> <b>Restructuring of services and tolls</b> Advised on Alliance's restructuring proposal in a matter before the National Energy Board. Supervised modelling of pipeline tolls and assessment of natural gas pipeline market power.
<b>2014-2015</b>	<b>Gazprom OAO</b> <b>Civil dispute involving gas field development and LNG importation</b> Supervised modelling of LNG netback prices and damage calculations in preparation for a jury trial before a Tarrant County, Texas District Court. Consulted with respect to a dispute between a U.S oil company and Russian oil company regarding ownership of a Russian gas field, tortious interference, and trade secret misappropriation with regards to a plan to import LNG into the United States in the mid-2000s.
<b>2014</b>	<b>FortisBC Energy Inc</b> <b>Tolling for pipeline in Canada</b> Analyzed toll methodology and advised on regulatory issues related to a tolling proposal of NGTL's North Montney Mainline, an extension of the existing NGTL Alberta System.
<b>2014</b>	<b>Royal Bank of Canada</b>



**Gas Supply Agreement Dispute**

Served as consulting expert in a gas supply agreement dispute between RBC and three municipal gas distributors in Nevada and Iowa. Case involved analysis of Basel III regulations, capital requirements, commodity swaps and interest rate swaps.

**2013****Confidential client****Valuation and pricing analysis**

Performed valuation and pricing analysis for oil pipeline dispute in Texas. Provided advice to outside counsel throughout litigation.

**2012-2014****ATCO Gas & ATCO Electric****Cost of Service / Capital Trackers**

Provided expert review of ATCO Gas and ATCO Electric's capital tracker proposals, including a survey of capital trackers in other jurisdictions.

**2012-2013****Confidential client****Valuation of oil pipeline company and its hedging positions**

Performed valuation of oil pipeline company and its hedging positions in litigation involving an alleged breach of fiduciary duty. Provided advice to outside counsel throughout litigation.

**2012-2013****Confidential client****Approaches to regulatory accounting and cost-of-service regulation**

Contributed to study assessing benefits of various approaches to regulatory accounting and cost-of-service regulation for pipelines.

**2011-2013****Confidential client****Possible outcomes of power contract disputes**

Analyzed potential litigation and settlement outcomes in a series of power contract disputes. Provided advice to outside counsel.

**2011-2012****Confidential client****Oil pipeline cost of service and depreciation policies**

Advised counsel to a shipper in an intrastate oil pipeline company rate case before the Kansas Corporation Commission.

**2011****Confidential client****Antitrust aspects of a proposed pipeline merger**

Analyzed antitrust aspects of oil pipeline combinations in connection with a proposed merger. Provided advice to outside counsel.

**2010-2011****Confidential client****Valuation of generation assets**

Performed valuation of power plant in context of alleged expropriation.



<b>2010</b>	<b>Hydro Québec, Canada</b> <b>Grid connection and upgrade cost policy</b> Analyzed grid connection and upgrade cost policy. Evaluated existing policy to allocate costs of grid upgrades to generation developers and system users. Suggested modifications to policy. Prepared benchmarking analysis comparing the company's practices to those of over a dozen other entities in North America.
<b>2008</b>	<b>Confidential client</b> <b>Allegations of energy market manipulation</b> Advised on the evaluation of allegations of energy market manipulation in the context of physical electricity trades in RTO-managed markets.
<b>2007</b>	<b>Confidential client</b> <b>Valuation of valuation of long-dated oil warrants</b> Performed valuation of long-dated oil warrants priced off Venezuelan crude oil in context of damages calculation.
<b>2006</b>	<b>Confidential client</b> <b>Damages valuation in securities class action</b> Valued damages in a securities class action related to the bankruptcy of an energy retailer.
<b>2003-2004</b>	<b>Confidential client</b> <b>Bid process advantages: generation pricing and transmission costs</b> Contributed to testimony on behalf of a large electric utility regarding an affiliate transaction that resulted from a competitive solicitation. Testimony before FERC focused on whether the affiliate was advantaged during the bid process, both with respect to generation pricing and electric transmission cost.
<b>2003</b>	<b>Confidential client</b> <b>Valuation, economic, accounting, and hedging analysis</b> Performed valuation, economic, accounting, and hedging analysis of a gas-fired power plant in an international arbitration matter.
<b>2002</b>	<b>Confidential client</b> <b>Prudence of forward power purchases</b> Contributed to testimony on behalf of an electric utility regarding the prudence of forward power purchases during the Western power crisis.
<b>2002–2003</b>	<b>Pacific Gas &amp; Electric</b> <b>Valuation of Damages Due to Gas Pipeline Capacity Withholding</b>

Performed analyses of damages from withheld pipeline capacity into California. Analyses led to \$1 billion settlement.

**2002–2003**

**Confidential client**

**Prudence of forward power purchases**

Contributed to testimony regarding the prudence of Department of Water Resources's forward power purchases during the Western power crisis.

**2002**

**Confidential client**

**Electric and gas hedging strategies for its generation assets**

Contributed to testimony on behalf of an energy marketing and trading firm regarding electric and gas hedging strategies for its generation assets, including an examination of the nature of competition among energy marketing and trading firms and strategies.

**2001–2002**

**Pacific Gas & Electric Company**

**FERC refund and other related proceedings**

Analysis and support to a California utility in the context of the FERC refund and other related proceedings, 2001-2002.

**2001–2002**

**Pacific Gas & Electric Company**

**Value of a long-term affiliate power sales agreement**

Contributed to testimony before FERC relating to the value of a long-term affiliate power sales agreement. Involved analysis and valuation of over 100 long-term power contracts in the context of this benchmarking analysis.

**2001**

**Confidential client**

**Valuation of a passive equity interest**

Contributed to testimony on behalf of a leading US energy company regarding the valuation of a passive equity interest in an IPP project in El Salvador.

**2001**

**Baltimore Gas & Electric Company**

**Business separation of Constellation Energy Group**

Contributed to testimony submitted to the Public Service Commission of Maryland on the business separation of Constellation Energy Group.

**1998**

**Baltimore Gas & Electric Company**

**Valuation of generation assets**

Performed valuation of Baltimore Gas & Electric Company's hydro, nuclear, coal and gas-fired generation assets in the context of stranded cost calculations during restructuring, 1998.

**1995–1996**

**Confidential client**

**Analysis of market concentration**

Performed HHI analyses to support testimony presenting a competitive assessment of the Western electric generation market in the US, 1995-1996.

**1994–1995**

**Confidential client**

**Damages valuation in securities class action**

Estimated losses and alleged damages for several mutual funds that invested in derivative securities.

**1994–1995**

**Confidential client**

**Damages valuation in securities class action**

Estimated losses and alleged damages for several mutual funds that invested in derivative securities.

**1994**

**Goldman Sachs**

**Default risk studies on fixed income instruments**

Prepared default risk studies on fixed income instruments for counsel to Goldman Sachs in a broker/dealer arbitration.

**1994**

**Confidential client**

**Damages valuation in securities class action**

Consulted to counsel for an infomercial company on materiality, liability, and damages in a shareholder class action suit.

**1993**

**Confidential client**

**Damages valuation in securities class action**

Assessed materiality and damages in a 10b-5 class action against a major pharmaceutical company.

**ADVISORY PROJECTS**

- 2016**                      **Utility Merger**  
**Due Diligence for Prospective Acquirer**  
 Retained by a confidential acquirer to evaluate a target utility and prospective merger benefits. Provided strategic advice and due diligence relating to the financial and regulatory implications of the acquisition.
- 2016**                      **Wind Power Transaction**  
**Due Diligence for Prospective PPA Offtaker**  
 Retained by a confidential offtaker to evaluate the costs, benefits and risks associated with a prospective long-term power purchase transaction backed by a wind farm.
- 2016**                      **Electric Utility Acquisition**  
**Due Diligence for Prospective Acquirer**  
 Retained by a confidential equity investor to evaluate load risk associated with the prospective acquisition of an interest in a regulated electric utility. Focused on risks around load forecast.
- 2015**                      **Southern Star Central Gas Pipeline**  
**Due Diligence for Prospective Acquirer**  
 Retained by a confidential equity investor to evaluate regulatory and investment risk associated with the prospective acquisition of an interest in Southern Star. Analyzed likely outcomes in the pipeline's upcoming rate case.
- 2015**                      **Independent Electricity System Operator (IESO)**  
**Reasonableness of 6,300 MW Power Transaction**  
 Retained by IESO in Ontario, Canada, to prepare, together with a team of NERA experts, an Opinion as to the Fairness of the Amended and Restated Bruce Power Refurbishment Implementation Agreement.
- 2015**                      **ESKOM, South Africa**  
**Regulatory Strategy for Cost Recovery**  
 Retained by ESKOM to advise on regulatory strategy, treatment of coal-plant operation and associated fuel costs, delays in unit online dates and other regulatory issues.
- 2014**                      **Hawaiian Electric Company**  
**Fuel Adjustment Clause and Oil Hedging**  
 Retained by Hawaiian Electric Company to provide analysis regarding the efficiency incentives embedded in the company's fuel adjustment clause (ECAC). Analyzed the possibility of hedging oil price volatility through commercially-available contracts.

<b>2014</b>	<b>Confidential Client</b> <b>Pricing Principles for Domestic Gas Reservation Policy</b> Formulated a methodology to determine a schedule of reasonable prices using a cost of service approach for gas that the company is obligated to market under the domestic gas supply policy.
<b>2012/2013</b>	<b>Atlantic Path 15</b> <b>Due Diligence Study for Confidential Potential Buyer</b> Performed regulatory due diligence in connection with the potential acquisition of Atlantic Path 15 transmission assets. Evaluated the regulatory climate at FERC and analyzed FERC decisions from prior rate cases, with a focus on allowed rate of return. Used NERA rate-of-return models to replicate the FERC methodology and to predict the rate-of-return to be allowed by FERC in the next rate case.
<b>2013</b>	<b>Energy trading entity</b> <b>Price risks and electricity transmission development</b> Retained by energy trading entity to perform an independent study of price risks and electricity transmission development in the ERCOT market.
<b>2013</b>	<b>Electric industry client</b> <b>Reactive power compensation</b> Retained by electric industry client to analyze electricity transmission tariffs and reactive power compensation in competitive electric markets.
<b>2012/2013</b>	<b>New Mexico Natural Gas Company</b> <b>Due Diligence Study for Confidential Potential Buyer</b> Performed regulatory due diligence in connection with the potential acquisition of New Mexico Natural Gas. Assessed hurdles to getting the transaction approved by regulatory authorities. Analyzed recent rate actions by the state commission and the likely outcomes of future cases.
<b>2012</b>	<b>Oil industry client</b> <b>Regulation benchmarking in downstream oil sector</b> Retained by oil industry client to advise on margins and to perform an international benchmarking of the regulation of the downstream oil sector.
<b>2012</b>	<b>Hawaiian Electric Company</b> <b>Hedging and rate stabilization</b> Retained by Hawaiian Electric Company to provide analysis regarding hedging of fuel oil and diesel fuel purchases in order to stabilize customer rates.
<b>2011</b>	<b>Confidential client</b> <b>Implications of CFTC proposed definition of swap dealer</b>

Advised on margin, capital and reporting implications of CFTC proposed definition of swap dealer under Dodd Frank.

- 2010**                      **Confidential client**  
**Leveraged lease transaction**  
 Provided litigation support services with respect to a dispute over a leveraged lease transaction.
- 2010**                      **Confidential client**  
**Valuation, risk assessment and analysis of offtake contract options**  
 Performed detailed valuation, risk assessment and analysis of offtake contract options for a hydroelectric power plant.
- 2009**                      **Potomac Edison Company**  
**Capital investment planning**  
 Performed least-cost capital investment planning on behalf of the Potomac Edison Company.
- 2009**                      **Government of New Brunswick, Canada**  
**Advised on asset valuation**  
 Advised on inputs into the valuation of NB Power's generation fleet, including the Point Lepreau Nuclear Generation Station in connection with the potential sale of NB Power to Hydro Québec. Coordinated assumptions with financial advisor for fairness opinion.
- 2009**                      **Energy East**  
**Cost of capital**  
 Advised on rate-of-return issues for electricity distributors in New York State.
- 2008**                      **Confidential client**  
**Contract design**  
 Advised on design of structured contract for new wind power plant, new electricity transmission lines and associated RFPs.
- 2008**                      **Commission for Energy Regulation**  
**Review of SOLR tariffs**  
 Advise the Commission for Energy Regulation on the review of SOLR tariffs in the Republic of Ireland.
- 2008**                      **Comisión Nacional de Energía**  
**Market mechanisms for distributions to serve default customers**  
 Advised on design and implementation of market mechanisms by which Spanish distribution utilities buy energy to serve default customers.

<b>2006–2009</b>	<b>Hawaiian Electric Company</b> <b>Hedging options for fuel</b> Performed economic and accounting analysis of hedging options for low sulfur fuel oil, diesel and fuel oil on behalf of Hawaiian Electric Company.
<b>2004–2010</b>	<b>Commonwealth Edison and Ameren’s Illinois utilities</b> <b>Competitive procurement for power supply</b> Advised Commonwealth Edison and Ameren’s Illinois utilities on the design of a competitive procurement for short- and long-term power supply, including the contractual framework for energy purchases, 2004 to 2010.
<b>2004–Present</b>	<b>New Jersey and Maryland distribution utilities</b> <b>Mark-to-market issues and credit policies</b> Advised several utilities in the Eastern Interconnection on mark-to-market issues and credit policies.
<b>1999–2008</b>	<b>New Jersey distribution utilities</b> <b>Contract design and implementation</b> Worked with credit representatives of New Jersey distribution utilities on contract design and implementation of the contract credit terms. Coordinated the utilities’ responses to changes to the forms of letters of credit proposed by bidders; oversaw bidder credit qualification process; managed approval process for alternate guaranty instruments, and served as advisor to utilities when contract interpretation issues arose, 1999 to 2008.
<b>1999–2008</b>	<b>FirstEnergy Companies</b> <b>Competitive procurement for power supply</b> Advised the FirstEnergy Companies on the design of a competitive procurement for intermediate term power supply, including the contractual framework for energy purchases, 2004-2005.
<b>2003</b>	<b>Commission for Energy Regulation</b> <b>Hedging agreement and a power plant construction agreement</b> Advised the Commission for Energy Regulation in Ireland on the structure of a long-term hedging agreement and a power plant construction agreement; assisted with the development of the hedging contract and the tender documentation; performed bid evaluation.
<b>2002</b>	<b>Sierra Pacific Resources</b> <b>Risk management strategies</b> Advised a major west coast utility in the US on the development of its risk management policy and procedures; reviewed past trading and risk

management strategies; and performed an assessment of its risk measurement and reporting techniques, including credit risk management policy.

**2000**

**Ministry of Energy, México**

**Mexican IPP solicitation program**

Advised on the development of the Mexican IPP solicitation program, including transaction structure (IPP v. BLT v. BOT), credit risk management, model contracts, and bid evaluation (the Comisión Federal de Electricidad has procured as much as 2000 MW per year of long-term power supply from IPPs).

**2000**

**Comisión Federal de Electricidad, Mexico**

**Credit and collateral requirements for a power purchase agreement**

Advised the Comisión Federal de Electricidad in Mexico on credit and collateral requirements for an-asset backed power purchase agreement with an IPP based in Mexico, including advice on the development of comparable credit and collateral requirements for an import transaction that was to be made on a firm basis with liquidated damages.

**1998–2000**

**Ministry of Energy, Mexico**

**Restructuring and privatization of the Mexican electricity sector**

Consulted to the Mexican Ministry of Energy on the restructuring and privatization of the Mexican electricity sector, the design of a competitive spot market, and the policy of IPP solicitations, electricity transmission pricing, upstream gas pricing and the development of a regulatory framework for the sector.

**1998–1999**

**Ministry of Energy, Mexico**

**Assessing competition in restructured Mexican electric generation**

Contributed to study assessing competition in restructured electric generation market in Mexico.

**1999**

**Swiss Re**

**Novel insurance packages to hedge electric price and operations risk**

Assisted Swiss Re in the development of the modeling for the creation of novel insurance packages to hedge electric price and operations risk, 1999.

**1998**

**Iberdrola S.A., Spain**

**Seminars on the deregulated markets for gas and electricity in the US**

Designed and conducted a series of three training courses for representatives of Iberdrola S.A. (Spain's principal private utility), which consisted of seminars on the deregulated markets for gas and electricity in the US, followed by a series of interviews with large utilities, IPPs, and energy marketers. Courses were designed to provide the European traders with an understanding of best practices employed by energy traders in the



US, with respect to risk management (credit, market, and operational), 1998.

- 1998**                      **C.E.L.P.E, Brazil**  
**Risk management and energy trading**  
 Assisted in training senior management of Iberdrola's Brazilian subsidiary C.E.L.P.E. in the area of risk management and energy trading.
- 1998–2000**              **Baltimore Gas & Electric Company**  
**Sector restructuring**  
 Consultant to Baltimore Gas & Electric Company on sector restructuring.
- 1998–1999**              **Baltimore Gas & Electric Company**  
**Market value estimates of generation fleet**  
 Assisted in developing market value estimates of Baltimore Gas & Electric Company's generation fleet, including Calvert Cliffs Nuclear Power Plant,.
- 1998**                      **Confidential Client**  
**Generation and fuel strategy**  
 Participated in the development of a generation and fuel strategy for a large merchant generator and energy trader.
- 1996**                      **Iberdrola, S.A, Spain**  
**Restructuring of the electricity sector**  
 Consultant to Iberdrola, S.A. on issues relating to the restructuring of the electricity sector in Spain.
- 1996**                      **Confidential client**  
**Investment strategy**  
 Consultant to a major southeastern electric utility on investment strategy in the US.
- 1996**                      **Confidential client**  
**Competitive analysis of electric generation**  
 Performed competitive analysis of electric generation market for utilities in eastern US.
- 1996**                      **New York State Electric and Gas Company**  
**Restructuring of the electricity market in New York State**  
 Consultant to the New York State Electric and Gas Company on issues relating to the restructuring of the electricity market in New York State.
- 1995–1996**              **New York Power Authority**  
**Sector restructuring**

Consultant to senior management of the New York Power Authority on issues relating to the New York Competitive Opportunities Docket.

**1995**

**Southern California Edison Company**

**Proposed restructuring of California's electric services industry**

Consultant to Southern California Edison Company on issues relating to the California Public Utilities Commission's Proposed Policies Governing Restructuring California's Electric Services Industry and Reforming Regulation.

## **Publications and Presentations**

**2016**

**Perusahaan Gas Negara**

Provided in-depth training on regulatory practice and tariff design for gas pipelines and distribution companies.  
December 2016.

**2016**

**Electricity Journal**

Low interest rates and unprecedented stock market volatility: What they mean for your next rate case.  
January-February 2016.

**2016**

**An Economic Analysis of the Acquisition of ConocoPhillips' Interest in the Beluga River Unit**, A Report Prepared for Chugach Electric Association, Inc. and Anchorage Municipal Light and Power, March 11, 2016.

**2016**

**Law Seminars International, 12th Annual National Conference on Current Issues in Electric Utility Ratemaking**

Policy Options to Address Cross Subsidies from Self Generation, March 14, 2016

**2016**

**International Arbitration Group of International Law Firm**

Applications of Economic Analysis in International Arbitration (with a focus on the Energy Sector)  
New York, January 12, 2016

**2015**

**The Electricity Journal**

Low interest rates and unprecedented stock market volatility: What they mean for your next rate case  
December, 2015

- 2015**                    **Utility Regulation Conference: Rate Case, ROE, and Reliability**  
Brave New World for Return on Equity  
Washington DC, December 10-11, 2015
- 2015**                    **Law Seminars International, Energy in the Northeast**  
Energy Sector Developments and the Cost of Capital  
Boston, September 29, 2015
- 2015**                    **Law Seminars International, Rate Case Conference**  
A Brave New World for Return on Equity  
Las Vegas, March 5, 2014
- 2014**                    **Law Seminars International, Rate Case Conference**  
Current Challenges in Determining Appropriate Rates of Return for Public  
Utilities  
Las Vegas, February 28, 2014
- 2014**                    **National Energy Agency (China) and representatives of the State Grid**  
Regulatory Accounting and the FERC Uniform System of Accounts  
Beijing, January 16, 2014
- 2012**                    **Agencia Nacional de Petroleo, Gas Natural e Combustiveis (Brazil)**  
Natural Gas Pipeline Regulation in the United States (training course)  
Rio de Janiero, September 18-19, 2012
- 2012**                    **Center for Research in Regulated Industries Eastern Conference**  
Optimal Capital Structures for Regulated Public Utilities: When Does an  
Imputed Debt Ratio Make Sense for Ratemaking Purposes?  
Eastern Conference, Delaware May 18, 2012
- 2012**                    **Energy Policy Briefing Note**  
The Real Costs of Eliminating Unsecured Credit Lines and Requiring  
Cash Collateral in OTC Swaps Markets  
Co-author: Sharon Brown-Hruska, March 13, 2012
- 2012**                    **Law Seminars International, Electric Utility Rate Case Conference**  
Marginal Cost Pricing for Rate Design  
Las Vagas, February 2, 2012.
- 2012**                    **Center for Research in Regulated Industries**  
**Advanced Workshop in Regulation and Competition**  
Gas Pipeline Overearning Investigations  
Newark, New Jersey, January 13, 2012.

- 2011**                    **Working Group of Commercial Energy Firms**  
Cost-Benefit Analysis of the CFTC's Proposed Swap Dealer Definition  
December 20, 2011.
- 2011**                    **Law Seminars International, Renewable Energy in the Pacific Northwest**  
Abundant Low-Cost Natural Gas? A Driver of Market Activity  
August 4, 2011.
- 2011**                    **Public Utilities Fortnightly**  
Zone of Reasonableness: Coping with Rising Profitability a Decade after Restructuring  
July 2011.
- 2011**                    **Law Seminars International, Electric Utility Rate Case Conference**  
Rate Design Issues Among Customer Classes  
Las Vegas, February 10, 2011.
- 2011**                    **Advanced Workshop in Regulation and Competition, Center for Research in Regulated Industries**  
Decoupling and the Cost of Equity  
Newark, New Jersey, January 14, 2011.
- 2010**                    **New York State Bar Association, Business Law Section Committee on Public Utility Law**  
Getting Renewables to Market: The Importance of Transmission Ratemaking Policy  
New York, July 24, 2010.
- 2009**                    **Law Seminars International Conference, Renewable Energy in New England**  
Getting Renewable Power to Market  
Boston, June 25, 2009.
- 2008**                    **Report for Baltimore Gas & Electric and Allegheny Power**  
Evaluation of Longer-Term Procurement Plans  
October 1, 2008.
- 2008**                    **Electricity Journal**  
The Continuing Rationale for Full and Timely Recovery of Fuel Price Levels in Fuel Adjustment Clauses  
July 2008.

- 2008**                    **Energy in the Southwest Conference**  
Natural Gas as a Fuel: Will There Be Enough? At What Prices?  
July 22, 2008.
- 2007**                    **NERA Economic Consulting**  
The Line in the Sand: The Shifting Boundary Between Markets and  
Regulation in Network Industries.  
Coauthor.
- 2007**                    **Electric Utility and Natural Gas Interdependency**  
Managing Risk in Interdependent Gas and Power Markets  
Houston, March 6, 2007.
- 2004**                    **Electricity Journal**  
FERC Imposes New Constraints on Utility Procurement  
October 2004.
- 2003**                    **Northeast Gas Storage and Supply Strategies**  
Can Your Capital Structure Handle Today's Market, Credit and Liquidity  
Risks?  
Boston, June 17, 2003.
- 1996**                    **World Bank**  
Regulatory and institutional reforms in the Chinese power sector  
Contributor, 1996.
- 1993**                    **World Development**  
Political Economy, Convergence and Growth in Less Developed Countries  
Contributor, 1996.

December 2016

## Documents Relied Upon in NERA Testimony

### 1. Documents filed in the instant docket

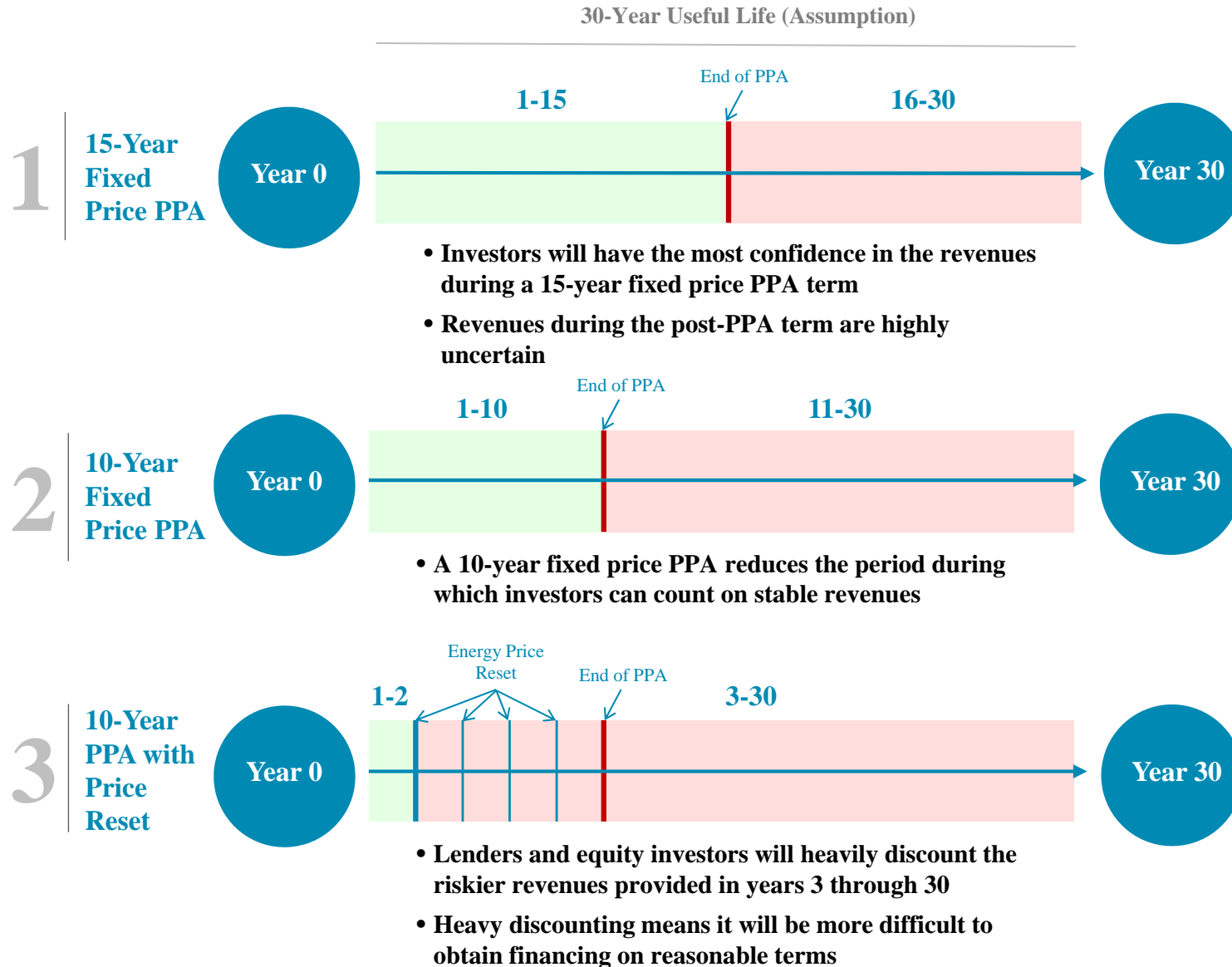
- a) Order Establishing Biennial Proceeding, Requiring Data, And Scheduling Public Hearing. State Of North Carolina Utilities Commission Raleigh. Docket No. E100-Sub 148. Janice H. Fulmore, Deputy Clerk. June 22, 2016.
- b) Order Scheduling Evidentiary Hearing and Amending Procedural Schedule. State of North Carolina Utilities Commission Raleigh. Docket No. E-100, Sub 148. February 21, 2017.
- c) Direct Testimony of Kendal C. Bowman on Behalf of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC. February 21, 2016.
- d) Direct Testimony of J. Scott Gaskill on Behalf of Dominion North Carolina Power. February 21, 2017.
- e) Initial Comments and Exhibits of Dominion North Carolina Power. November 15, 2016.
- f) Joint Initial Statement and Exhibits of Duke Energy Carolinas, LLC and Duke Energy Progress, LLC. November 15, 2016.
- g) Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's Avoided Cost filing Required. M. Lynn Jarvis, Chief Clerk, NC Utilities Commission. January 17, 2017.
- h) DNCP Avoided Cost Information, November 15, 2016.

### 2. Other documents

- i) Federal Energy Regulatory Commission, Order, Docket No. EL16-115-000, Windham Solar LLC and Allco Finance Limited, November 22, 2016.
- j) State Of Indiana, Indiana Utility Regulatory Commission. Joint Stipulation And Settlement Agreement. Cause No. 44734. April 15, 2016.
- k) Application of Duke Energy Progress, for Certificate of Public Convenience and Necessity to Construct 21 MW Combined Heat and Power Facility at Duke University. Docket No. E-7, Sub 1122. October 17, 2016.
- l) Duke Energy Florida, LLC's Petition For Approval Of Depreciation Rates For Solar Photovoltaic Generating Units. Dianne M. Triplett, Associate General Counsel, Duke Energy Florida, LLC. Docket No. 160017-EI. January 11, 2016.

- m) Christopher J. Ayers, Executive Director, NCUC Staff, Ratemaking Presentation, available at:  
[http://epic.uncc.edu/sites/epic.uncc.edu/files/media/Ratemaking%20presentation%20EPI C.pdf](http://epic.uncc.edu/sites/epic.uncc.edu/files/media/Ratemaking%20presentation%20EPI%20C.pdf).
- n) Progress Energy – Carolinas Electric Utility Plant Depreciation Rate Study Executive Summary. December 31, 2010. Docket No. E-2, Sub 1025.
- o) Ibbotson SBBI 2013 valuation yearbook: market results for stocks, bonds, bills, and inflation 1926-2012. (2013). Chicago: Morningstar.
- p) Williamson, O. 1979, Transactions-cost economics: the governance of contractual relations. *Journal of Law and Economics* 22, 233–62.
- q) Williamson, O. "Credible Commitments: Using Hostages to Support Exchange," *American Economic Review*, September 1983, 73, 519-40.
- r) Williamson, O. *The Economic Institutions of Capitalism*, New York: Free Press, 1985.
- s) Coase, R. 1937. The nature of the firm. *Economica* 4, 386–405.

## Price Risk under Alternative PPA Constructs

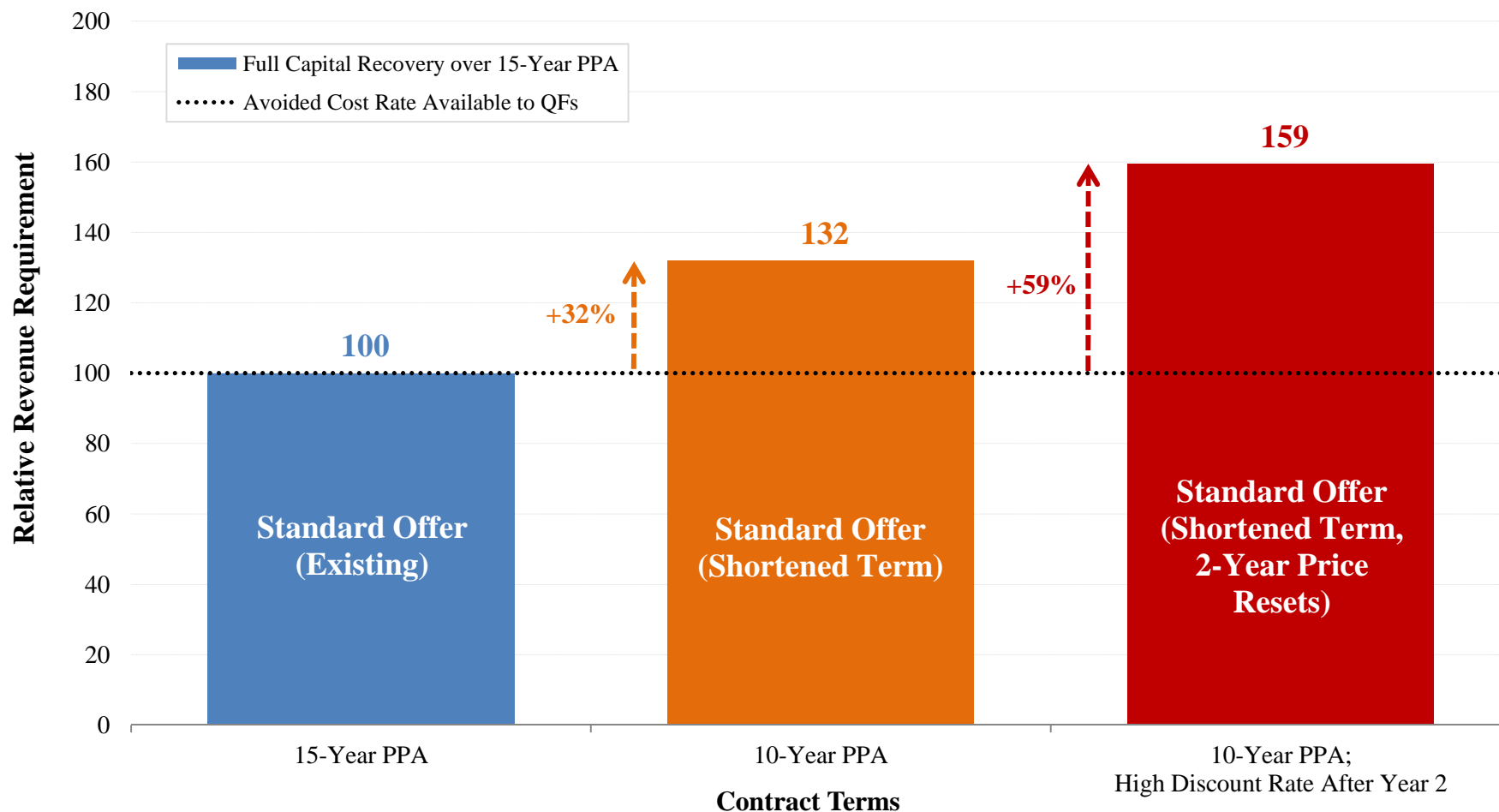




# North Carolina QF Standard Offer

## Zero Residual Value

### Levelized QF Revenue Requirement

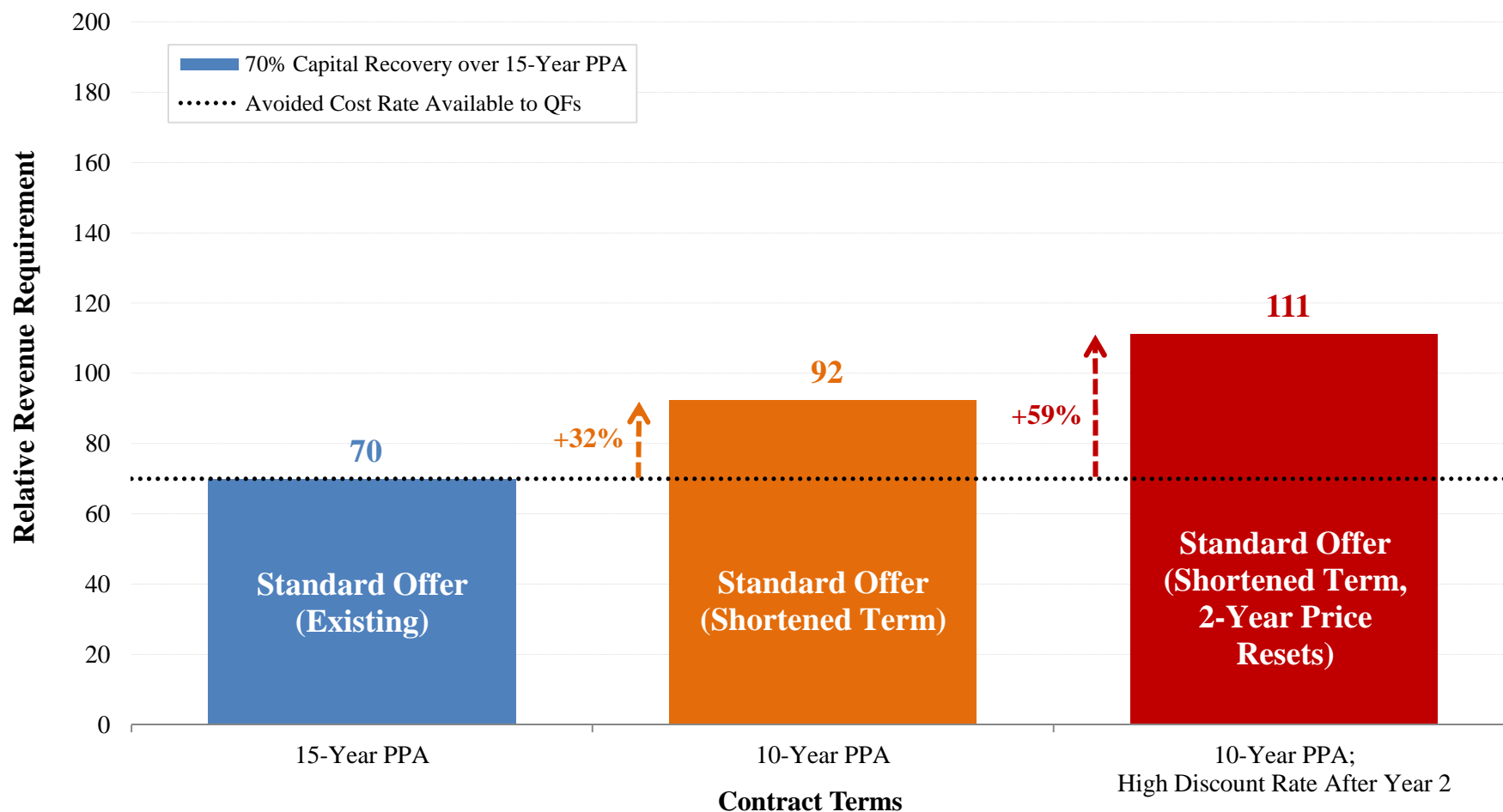


**Notes:**

- Designed to illustrate directional effect of proposed policy changes.
- Illustrative based on hypothetical capital cost and unit operating profile.
- Does not incorporate benefits of bonus depreciation, ITC, or PTC.

## North Carolina QF Standard Offer

### 30% Residual Value Levelized QF Revenue Requirement



**Notes:**

- Designed to illustrate directional effect of proposed policy changes.
- Illustrative based on hypothetical capital cost and unit operating profile.
- Does not incorporate benefits of bonus depreciation, ITC, or PTC.