



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Rhode Island Division of
Public Utilities and Carriers
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March 13, 2020

Luly Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888

**IN RE: Docket No. 5011 -- National Grid's Review of PPA w/ Gravel Pit Solar II, LLC
Service List updated 2/13/2020**

Dear Luly,

Please find the State of Rhode Island Division of Public Utilities and Carriers, (the "Division") and the Office Energy Resources (the "OER") Pre-Filed testimony of Ellen Cool of Levitan Associates in the above captioned matter for filing with the State of Rhode Island Public Utilities Commission.

I appreciate your anticipated cooperation in this matter.

Very truly yours,

A handwritten signature in black ink, appearing to read "Jon G. Hagopian".

Jon G. Hagopian
Deputy Chief Legal Counsel

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITY COMMISSION

IN RE: THE NARRAGANSETT ELECTRIC COMPANY :
d/b/a NATIONAL GRID REVIEW OF POWER : DOCKET NO. 5011
PURCHASE AGREEMENT PURSUANT TO :
R.I. GEN. LAWS § 39-26.1 :

PRE-FILED DIRECT TESTIMONY OF
ELLEN G. COOL

On behalf of:

Rhode Island Office of Energy Resources
One Capitol Hill
Providence, Rhode Island 02908

and

Rhode Island Division of Public Utilities & Carriers
89 Jefferson Boulevard
Warwick, Rhode Island 02888

EXECUTIVE SUMMARY

Ellen G. Cool, Ph.D, is a Vice President and Principal of Levitan & Associates, Inc. and testifies on behalf of the Rhode Island Division of Public Utilities and Carriers (“Division”) and the Rhode Island Office of Energy Resources (“OER”). The Division and OER, with the assistance of Dr. Cool, participated in the review of proposals received in response to a Request for Proposals (“RFP”) for Long-Term Contracts for Renewable Energy issued by National Grid (“NGrid”), required to fulfill NGrid’s remaining requirements under the Long Term Contracting Standard (“LTC Standard”), R.I. Gen. Laws § 39-26.1. Dr. Cool testifies for the purpose of endorsing NGrid’s selection of the Gravel Pit Solar LLC 20-year Power Purchase Agreement (“PPA”).

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PUBLIC UTILITIES COMMISSION

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**RHODE ISLAND DIVISION OF PUBLIC UTILITIES AND CARRIERS AND
OFFICE OF ENERGY RESOURCES'**
PRE-FILED DIRECT TESTIMONY OF ELLEN G. COOL

1 **Q. Please state your name, title, and business address.**

2 A. I am Ellen G. Cool, Ph.D., Vice President and Principal of Levitan & Associates, Inc.
3 (“LAI”), and my business address is 20 Custom House Street, Suite 830, Boston, Massachusetts,
4 02110.

5 **Q. Please summarize your educational background and professional experience.**

6 A. I have an A.B. degree in geological sciences from Harvard University, and an M.S. and
7 Ph.D. in geological sciences from the University of Washington. From 1985 to 1999 I was an
8 environmental consultant for several environmental engineering firms, attaining the level of
9 principal and regional manager. I am currently a Vice President and Principal at LAI, which I
10 joined in 1999. I have 35 years of consulting experience in the energy and environmental
11 industries. I have advised clients on competitive procurement options for wholesale power
12 supply, including high-voltage, direct current transmission projects, natural gas-fired plants, and
13 renewable generation projects. My experience includes advising clients on environmental
14 compliance strategies and liability assessments, siting and permitting of generation, transmission,
15 and pipeline projects, cogeneration development, contract restructuring, acquisition of
16 deregulated energy service companies and the net emissions impact of new and repowered
17 generation projects. A detailed description of my experience and educational background is in

1 my curriculum vitae in Exhibit EGC-1.

2 **Q. Please describe LAI.**

3 A. LAI is a management consulting firm specializing in power market design, power and fuel
4 project evaluations, pipeline infrastructure, and competitive energy economics. Since its founding
5 in 1989, LAI has conducted numerous assignments in New England and other markets throughout
6 the United States and Canada on diverse matters pertaining to generation and transmission project
7 evaluations, wholesale energy and capacity price forecasts, retail price impacts, electric sector
8 decarbonization strategies, asset valuation, bulk power security, power and fuel procurements,
9 transaction structures, gas/electric interdependencies, natural gas infrastructure, and risk
10 management. LAI's clients have included electric and gas utilities, generators, Independent
11 System Operators ("ISOs"), Regional Transmission Organizations ("RTOs"), energy end-users,
12 state regulatory commissions, and financial institutions.

13 **Q. Have you previously testified before the Rhode Island Public Utilities Commission
14 and if so, in what matters?**

15 A. Yes. I testified on behalf of the Rhode Island Division of Public Utilities and Carriers
16 ("Division") and the Rhode Island Office of Energy Resources ("OER") in Docket No. 4822,
17 which was the docket in which the Rhode Island Public Utilities Commission ("Commission")
18 approved the Request for Proposal ("RFP"), the results of which are the subject of this docket. I
19 also submitted a memorandum and testified before the Commission in Docket 4764, which
20 involved a request by National Grid ("NGrid") to approve eight competitively-solicited long-term
21 renewable PPAs.

22 **Q. Have you previously provided expert testimony before any other regulatory
23 commission, board, or agency and if so, in what matters?**

1 A. Yes. I testified before the Rhode Island Energy Facilities Siting Board (“EFSB”) in Docket
2 SB-2015-06 regarding a certificate application for a proposed combined cycle power plant. I have
3 testified on multiple occasions before the Connecticut Public Utilities Regulatory Authority
4 regarding the integrity of procurements for renewable and conventional resources under long term
5 contract, and for standard service supplies. I testified before the Massachusetts Energy Facilities
6 Siting Board on the economic benefits, environmental impacts, and non-transmission alternatives
7 of a new 345 kilovolt (“kV”) transmission line in southeast Massachusetts, and I testified before
8 the New Jersey Board of Public Utilities regarding the environmental impact, including
9 greenhouse gas (“GHG”) emissions, associated with the proposed construction of three gas-fired
10 combined-cycle plants.

11 **Q. On whose behalf are you testifying?**

12 A. My testimony is on behalf of the Division and the OER.

13 **Q. What is your role in this proceeding?**

14 A. My firm, LAI, was engaged by the Division and OER to provide independent oversight
15 during the implementation of the RFP for Long-Term Contracts for Renewable Energy undertaken
16 by NGrid. I was asked to review the models used to analyze the costs and benefits of proposals
17 received in response to the RFP, and to evaluate whether the procurement process and the selected
18 contract are consistent with the LTC Standard, the Rules and Regulations Governing Long-Term
19 Contracting Standards for Renewable Energy (“Regulations”), 810-RICR-40-05-1, and the other
20 conditions imposed by the Commission in its approval of NGrid’s RFP in Docket No. 4822.

21 **Q. What is the purpose of your testimony?**

22 A. The purpose of my testimony is to report my observations and conclusions regarding
23 NGrid’s analysis of the proposals received in response to the RFP, and to endorse NGrid’s

1 selection of the Gravel Pit Solar LLC 20-year PPA.

2 **Q. Did you prepare this testimony yourself?**

3 A. Yes, I personally prepared this testimony.

4 **Q. Did you discuss this testimony with the Division and OER as you were preparing it?**

5 A. Yes, I did.

6 **Q. What was the purpose of the RFP?**

7 A. The purpose of the RFP was to satisfy NGrid's remaining obligations under the Long Term
8 Contracting Standard ("LTC Standard"), R.I. Gen. Laws § 39-26.1. The LTC Standard requires
9 NGrid to annually solicit proposals from renewable energy developers for new renewable energy
10 resources, and provided commercially reasonable proposals have been received, enter into long-
11 term contracts that, in the aggregate, are for a minimum of 90 MW of contract capacity. Contract
12 capacity is defined in § 39-26.1-2 as the total installed capacity under contract adjusted by the
13 capacity factor for the renewable generator.¹ NGrid had executed contracts for energy and
14 Renewable Energy Credits ("RECs") from eligible resources that met the minimum of 90 MW of
15 contract capacity by 2013. However, one of the executed contracts for renewable energy and
16 RECs was subsequently terminated, resulting in a shortfall of 10.74 MW of contract capacity.

17 Although the RFP was intended to satisfy the remaining contract capacity requirement,
18 under the LTC Standard, NGrid could voluntarily procure more than the minimum requirement.
19 The maximum target capacity to be procured was set at 400 MW in anticipation of a robust
20 competitive market for cost-effective renewable resources.²

1 For example, a 100 MW facility with a 30% capacity factor would provide 30 MW of contract capacity.

2 The 400 MW RFP target was on an installed capacity basis, not contract capacity.

1 **Q. You mentioned that you testified in related Docket 4822, in which the Commission**
2 **approved the RFP. What was the purpose of your testimony in that docket and how does it**
3 **relate to this docket?**

4 A. In Docket 4822, I was engaged by the Division and OER to provide technical support as
5 NGrid prepared the RFP documents, including the RFP itself and the forms to be used by bidders
6 to submit their price and technical proposals. The RFP was developed in concert with the Division
7 and OER and with my participation. I testified in Docket 4822 that the solicitation method,
8 eligibility requirements, and selection criteria set forth in the RFP were consistent with the LTC
9 Standard. I noted a few items that were required by the Regulations but had been omitted in the
10 draft RFP. The final RFP that was issued on August 20, 2018 satisfactorily addressed each of
11 these items. I summarized my observations and conclusions in a memorandum addressed to the
12 Commission and dated June 22, 2018, which was filed in Docket 4822, and I adopt my
13 memorandum and testimony in this docket.

14 **Q. After the final RFP was issued, how did you provide independent oversight of NGrid's**
15 **RFP process?**

16 A. NGrid engaged Tabors Caramanis Rudkevich ("TCR") to undertake the economic analysis
17 of the proposals. As you have read in NGrid's filing, TCR quantified the economic benefits of
18 the rival proposals by applying the ENELYTIX computer model, which simulates the regional
19 electricity market, and produces a detailed forecast of market energy and REC prices across New
20 England, as well as other relevant output data. Prior to the proposal due date, NGrid and TCR
21 prepared protocols to document the analytical method to be applied, and I was given an
22 opportunity to review and comment on drafts of the protocols before they were finalized.
23 Proposals submitted in response to the RFP were due to NGrid on October 18, 2018, and I received

1 full confidential copies of all proposals shortly thereafter, subject to a non-disclosure agreement.
2 As the proposals were evaluated, I participated in periodic status update meetings with NGrid and
3 TCR, along with the Division and OER, and was given multiple opportunities to review and
4 comment on TCR's model and calculations. I reviewed the primary input data and assumptions
5 used in TCR's electric system simulation model. I reviewed simulation model output data that
6 was imported into TCR's Excel workbook, which was the primary tool to compute the price
7 (quantitative) score of each proposal. TCR's Excel workbook models were transparent and
8 consultants were helpful and forthcoming with information. As part of the proposal analysis, I
9 also participated in a conference call with ISO New England ("ISO-NE"), transmission specialists
10 from NGrid, the Division, and OER to discuss the status of the proposed projects with respect to
11 their requests to ISO-NE to interconnect with the electric transmission system. I did not directly
12 participate in the non-price (qualitative) scoring of the proposals, although I was provided with a
13 summary spreadsheet of the scoring results, which was developed by NGrid. I did, however,
14 review proposals with respect to project viability, specifically technical feasibility and
15 interconnection status, and offered my opinion on these factors.

16 **Q. Have you read NGrid's filing in this docket?**

17 A. Yes, I have reviewed NGrid's filing in this docket, including testimony by NGrid witnesses
18 and Schedule NG-3, which documents TCR's economic modeling and financial analysis.

19 **Q. How did you review TCR's model and analyses?**

20 A. Consistent with prior practice applied in Docket 4764, I reviewed the input assumptions
21 and results of TCR's Base Case model, and checked the reasonableness of the forecasted energy
22 and REC prices, the projected resource retirements, new resource additions, and emissions. I
23 reviewed the set-up of representative proposal cases to check if they were consistently analyzed.

1 With my LAI colleagues, we reviewed in detail the calculations in the Excel-based financial
2 model.

3 **Primary Conclusions**

4 **Q. What are your primary conclusions?**

5 A. My primary conclusions are:

- 6 • The proposal evaluation process was consistent, in all material respects, with the
7 evaluation steps set forth in the RFP. The evaluation process was fair, objective, and
8 unbiased.
- 9 • The analysis of the costs and benefits of the proposals was robust and the methodology
10 was consistent with prior procurements reviewed and approved by the Commission in
11 Dockets 4764 and 4929. The analysis used an industry-standard electric system
12 simulation model to forecast energy and REC prices, and model input data was
13 consistent with market data and electric system infrastructure data available at the time
14 the analytical protocol was finalized.
- 15 • The contract selected by National Grid – the 50 MW Gravel Pit Solar LLC 20-year
16 PPA – was the highest-ranked project among proposals received, and it meets all the
17 criteria for selection under the LTC Standard.
- 18 • The Gravel Pit Solar LLC 20-year PPA provides 13.36 MW of contract capacity,
19 meeting NGrid’s remaining minimum requirements under the LTC Standard.
- 20 • The Gravel Pit Solar 20-year PPA is attractively priced, offering the lowest price for
21 energy and RECs among recent procurements for new, clean energy resources.
- 22 • The Gravel Pit Solar 20-year PPA provides other positive benefits, including a
23 commitment to invest in clean energy jobs training in Rhode Island. The project will

1 help reduce GHG and other priority pollutant emissions. The project also represents
2 beneficial reuse of a brownfield site.

3 • The Gravel Pit Solar 20-year PPA advances the applicable goals of Docket 4600.

4 I will discuss each of these primary conclusions in the remainder of my testimony.

5 **Proposal Evaluation Process**

6 **Q. Do you believe that the proposal evaluation process was fair and objective and if so,**
7 **why?**

8 A. Yes. The proposal evaluation process adhered to generally accepted industry practices for
9 competitive procurements for long term contracts for new resources. A consistent, pre-established
10 method was applied to all proposals, resulting in a robust, fair, and unbiased ranking.

11 **Q. Please describe the proposal evaluation process outlined in the RFP.**

12 A. The proposal evaluation process defined in the RFP was approved by the Commission in
13 Docket No. 4822. The proposal evaluation process consisted of three stages. Stage One covered
14 eligibility, threshold, and other minimum requirements. The Stage One requirements included
15 eligibility criteria specified in the LTC Standard and Regulations, and defined the allowable MW
16 size, products, contract term, and form of pricing. Proposals that satisfied Stage One requirements
17 advanced to Stage Two, the price and non-price analysis. The Stage Two analysis resulted in a
18 score (from 0 to 100) for each proposal. The price (quantitative) analysis was weighted 80%, and
19 non-price factors were weighted 20%. In Stage Three, NGrid considered portfolios of projects
20 and other economic and environmental benefits.

21 **Q. Did you have any initial concerns about whether the Gravel Pit Solar project could**
22 **meet all the eligibility and threshold requirements and if so, what were those concerns?**

23 A. Yes. Initially I was concerned that Gravel Pit Solar did not meet the threshold requirement

1 of demonstrating that it had control or an irrevocable option to acquire the proposed project site.
2 I was aware that Gravel Pit Solar had also submitted a proposal to the Connecticut Department of
3 Energy and Environmental Protection (“CT DEEP”) for a 20 MW project at essentially the same
4 location, and CT DEEP had selected this project for a contract award.

5 **Q. Were those concerns addressed?**

6 A. Yes. NGrid issued a clarifying question to Gravel Pit Solar LLC to confirm whether the
7 project was still available for evaluation and selection. Gravel Pit Solar LLC affirmed that the
8 project site has enough property to accommodate both a 20 MW and 50 MW solar facility, for a
9 total facility size of 70 MW.

10 **Q, What are your observations regarding the Stage Two price evaluation?**

11 A. The Stage Two price evaluation was a comparison of the total contract cost of the products
12 (*i.e.*, energy and RECs) to a forecast of the market value of these products over the contract term.
13 Consistent with the LTC Standard (§39-26.1-5(b) and (c), NGrid purchases the energy at the
14 contract energy price and immediately sells the energy into the wholesale spot market. Similarly,
15 NGrid purchases the RECs at the contract REC price and sells them “in a commercially reasonable
16 manner.” Therefore, the market value of the energy plus RECs is termed the “direct benefit” of
17 the proposal. The quantification of direct benefits of the proposals relied on a forecast of market
18 prices for energy and RECs that was prepared by TCR. TCR’s proprietary computer model
19 simulates the dispatch and market settlements of generation resources across the New England
20 electric grid and neighboring regions. LAI licenses a similar type of electricity system simulation
21 model, and I am familiar with the functionality and limitations of this type of model. I reviewed
22 the key input data and assumptions used by TCR in its market simulation model, including but
23 not limited to delivered fuel prices, electric load, scheduled unit additions and retirements, and

1 emission allowance prices. I concluded that the input data and assumptions were consistent with
2 industry-standard and broadly accepted forecasts for electric load, technology benchmarks, and
3 commodity fuel prices that were publicly available at the time the model protocols were prepared
4 and finalized.

5 The metric applied to score proposals based on price was the Levelized Net Unit Direct
6 Benefit (“LNUDB”). The LNUDB expresses the project direct benefits less the project direct
7 costs, levelized over the contract term, on a unitized (per MWh) basis. LNUDB is an appropriate
8 and industry-standard method for comparing projects of different technologies, capacities, and
9 contract terms. The selected project, Gravel Pit Solar 20-year term, had the highest LNUDB of
10 all proposals and portfolios analyzed.

11 **Q. Was the calculation of LUNDB based on 100% of the output of the Gravel Pit Solar**
12 **project?**

13 A. Yes, TCR’s analysis and calculation of the LNUDB was based on the energy and RECs
14 generated and paid for from the full 50 MW capacity of the project. However, subsequent to
15 selection of this project by NGrid, Block Island Utility District and Pascoag Utility District agreed
16 to purchase 0.2% and 0.8% of the output of the facility, respectively, leaving 99%, or 49.5 MW,
17 under the contract with NGrid.

18 **Q. Does the LNUDB change if NGrid’s entitlement is 49.5 MW rather than 50 MW?**

19 A. No. NGrid will receive the direct benefit of 99% of the energy and RECs generated from
20 the facility, but only pay 99% of the total cost, therefore the LUNDB metric is unchanged. I note
21 that NGrid reported that the Gravel Pit Solar 20-year PPA provides a net benefit of \$30.8 million
22 (net present value in 2018 dollars) – that is, the present value of the total direct benefit less the

1 present value of the total cost.³ Of the \$30.8 million, 99% will inure to NGrid customers, and the
2 remaining 1% will be shared by Block Island (0.2%) and Pascoag (0.8%) customers.

3 **Q. Was the proposal evaluation process for this RFP consistent with prior procurements**
4 **for renewable resources undertaken by NGrid?**

5 A. Yes. I reviewed relevant filings by NGrid in Docket No. 4929, Review of Power Purchase
6 Agreements (PPA) Pursuant to R.I. Gen. Laws 39-31, in which the Commission approved the
7 contract between NGrid and Deepwater Wind for energy and RECs from the Revolution Wind
8 Farm offshore wind facility. Although the Revolution Wind contract was approved under the
9 Rhode Island Affordable Clean Energy Security Act (R.I. Gen. Laws §§ 39-31-5 and 39-31-6),
10 the price metrics, quantitative method, and ENELYTIX computer simulation model were
11 essentially the same and performed by the same consultant, TCR. In Docket No. 4764, Review
12 of Purchase Power Agreements Pursuant to R.I. Gen. Laws § 39-26.1, the Commission approved
13 eight contracts under the LTC Standard, which were procured through the Three-State RFP. The
14 Three-State RFP also applied a similar method of evaluating the project costs and economic
15 benefits to Rhode Island. A different electric system simulation software platform, Promod, was
16 used by the consultant, but the overall analytic method was the same.

17 **Consistency of Selected Contract with the LTC Standard**

18 **Q. Does the Gravel Pit Solar 20-year PPA meet all the requirements under the LTC**
19 **Standard?**

20 A. Yes. There are several eligibility requirements enumerated in the LTC Standard. I will

³ Testimony of Stephen A. McCauley and Katherine Wilson, February 4, 2020, p. 22, line 15-18.

1 list each of these requirements and explain how the Gravel Pit Solar 20-year PPA conforms with
2 each.

3 1. R.I. Gen. Laws § 39-26.1-3(a) requires that contracts must be for a “newly developed
4 renewable energy resource,” which is defined in R.I. Gen. Laws § 39-26.1-2(6). A project
5 is considered “newly developed” if the proposed facility “must not have begun operation,
6 and developers must not have implemented investment or lending arrangements to finance
7 construction.” The Gravel Pit Solar project has not achieved financial closure and has not
8 begun construction and is therefore considered “newly developed.”

9 2. R.I. Gen. Laws § 39-26.1-2(4) and Section 3.16 of the Regulations require that an electric
10 generation facility offered in response to the solicitation must be an “eligible renewable
11 energy resource.” A solar generation project, proposed here, is an eligible renewable
12 energy resource according to R.I. Gen. Laws § 39-26-5.

13 3. § 39-26.1-3(a) limits contract terms to 15 years but permits longer contracts with
14 Commission approval. Gravel Pit submitted a conforming bid for 15 years and an alternate
15 bid for 20 years. The 20-year term bid was demonstrated to provide higher LNUDB than
16 the Gravel Pit Solar proposal for a 15-year contract.

17 4. R.I. Gen. Laws § 39-26.1-3(a) requires that projects be “commercially reasonable” in order
18 to be selected for a contract. “Commercially reasonable” is defined in § 39-26.1-2(1) as
19 having “terms and pricing that are reasonably consistent with what an experienced power
20 market analyst would expect to see in transactions involving newly developed renewable
21 energy resources....[and] a credible project operation date...” The Gravel Pit Solar PPA
22 was selected through a competitive procurement process in which the terms, pricing, and
23 reasonableness of project schedule compared favorably against rival bids submitted

1 through the RFP. The project schedule and milestones are also reasonable compared to
2 other utility-scale solar projects that are being developed in the region.

3 5. R.I. Gen Laws § 39-26.1-3(f) requires that the selected project be “below the forecasted
4 market price of energy and renewable energy certificates over the term of the proposed
5 contract, using industry standard forecasting methodologies as have been used to evaluate
6 pricing in the past solicitation processes reviewed by the commission under this section.”
7 Based on TCR’s model, I concur that the pricing under the PPA for the Gravel Pit Solar
8 20-year PPA is below the forecasted market price for energy and RECs on a present value
9 basis, resulting in a net present value of \$30.8 million (2018\$). Thus, the proposed PPAs
10 conform to the LTC Standard that “no contracts shall be awarded unless the pricing under
11 such contract(s) is below the forecasted market price of energy and renewable-energy
12 certificates over the term of the proposed contract, using industry standard forecasting
13 methodologies...” (R.I. Gen. Laws § 39-26.1-3(f))

14 6. R.I. Gen. Laws § 39-26.1-5(e), and Section 5.2 of the Regulations require that the project
15 provide other direct economic benefits to the State, such as job creation, increased property
16 tax revenues, or other similar revenues, or pricing benefits. The Gravel Pit Solar project
17 commits to investing at least \$300,000 to advance clean energy job training in Rhode
18 Island – a direct economic benefit to the State. Because the PPA has been forecasted to
19 be below market prices for energy and RECs, the project provides pricing benefits and
20 contributes to lowering electricity costs for Rhode Island customers.

21 **Q. The LTC Standard (§39-26.1-3(f)) states that the “electric distribution company may
22 elect not to acquire capacity, but shall acquire all environmental attributes and energy.”**

23 **Was it reasonable for the RFP to exclude capacity?**

1 A. Yes. Purchasing capacity would have added unnecessary risk to the transaction, because
2 the potential capacity revenues to be returned to NGrid and its customers would have been very
3 uncertain. For a resource to receive capacity revenues, it must participate and clear in ISO-NE's
4 Forward Capacity Auction ("FCA"). Under ISO-NE's Minimum Offer Price Rule ("MOPR"),
5 resources receiving a revenue stream through a state-sponsored long-term contract must offer their
6 justifiable, unsubsidized costs into the FCA, otherwise their offer will be mitigated. While there
7 is a limited quantity of MW that can be exempted from the MOPR rule in the FCA, there is a
8 substantial risk that a project with a long-term contract will not clear in the FCA. Therefore,
9 projects do not need to commit to participating in the FCA. The RFP, however, required eligible
10 bidders to demonstrate that they would be able to interconnect at the Capacity Capability
11 Interconnection Standard as defined by ISO-NE. This ensures that the energy from the project
12 can be fully delivered into the grid without material constraint or curtailment.

13 **Q. Were there other proposals submitted in response to the RFP that also met all of the**
14 **LTC Standard requirements?**

15 A. Yes. There were several other projects that also met the LTC Standard requirements. They
16 were for eligible, new renewable projects; commercially reasonable; and below the forecasted
17 market price of energy and RECs over the proposed contract term. NGrid also evaluated
18 portfolios comprised of several eligible projects. However, all these projects and portfolios scored
19 lower on the price metric than the Gravel Pit Solar 20-year project, and the Gravel Pit Solar project
20 alone was enough to fulfill NGrid's remaining obligation under the LTC Standard.

21 **Q. How does the pricing of the Gravel Pit Solar 20-year PPA compare to other contracts**
22 **procured to meet the LTC Standard and other recent procurements?**

23 A. The Gravel Pit Solar 20-year PPA is priced at a constant 5.295 cents per kWh for energy

1 and RECs over the term of the contract. This is the lowest price for energy and RECs that NGrid
 2 has procured through the LTC Standard in recent years. The table below summarizes the contract
 3 prices for the projects procured through the Three-State RFP and approved in 2018, with the
 4 Gravel Pit project included for comparison.⁴ (All prices are shown in levelized nominal dollars.)

Project	Contract Capacity ⁵ (MW)	Price (cents/kWh for energy plus RECs)
<i>Gravel Pit Solar</i>	<i>13.36</i>	<i>5.295</i>
Scituate Solar	1	9.37
Hope Farm Solar	1	9.37
Woods Hill Solar	0.3	9.95
Sanford Airport Solar	0.7	7.90
Chinook Solar	0.4	8.18
Farmington Solar	0.7	8.49
Quinebaug Solar	0.7	8.92
Cassadaga Wind	8.1 ⁶	9.22

5
 6 Moreover, since the PPA price for energy plus RECs is constant over the 20-year term, the project
 7 provides an efficient hedge against volatile market prices.

8
 9 **Consistency with Docket 4600**

10 **Q. Have you considered the Gravel Pit Solar 20-year contract with respect to the**
 11 **Commission’s goals enumerated in Docket 4600 and if so, can you please explain the**
 12 **applicability of the Docket 4600 goals to the selected contract?**

13 A. Yes. In Commission Docket 4600, Order No. 22851, the Commission adopted eight goals

⁴ Source: Narragansett Electric Company d/b/a National Grid’s Request for Approval of Eight Long-Term Renewable Energy Contracts, Commission Report and Order 23102, Docket No. 4764, p. 4, April 9, 2018. Levelized price for Cassadaga from NGrid’s response to Data Request PUC-1 in Docket No. 4764.

⁵ Contract capacity is Rhode Island’s share of the project only.

⁶ NGrid’s response to the Commission’s Data Request PUC 1-11 in Docket No. 4764 lists the contract capacity as 7.3 MW.

1 for the future electric system. In the table below, I have summarized how the Gravel Pit Solar 20-
 2 year PPA contributes to these goals.

Docket 4600 Goals	
<i>Goals of the Future Electric System</i>	<i>Contribution of Gravel Pit Solar PPA</i>
Provide reliable, safe, clean and affordable energy to Rhode Island Customers over the long term	Gravel Pit Solar will generate clean, non-emitting energy for at least 20 years, which will be injected into the regional ISO-NE grid that serves Rhode Island customers.
Strengthen the Rhode Island economy	Gravel Pit Solar has committed to invest at least \$300,000 into training Rhode Island's clean energy workforce. This investment will help train skilled workers for which there will be increasing demand in Rhode Island as the industry continues to mature.
Support economic competitiveness, retaining and creating jobs by optimizing the benefits of a modern grid and attaining appropriate rate design structures	
Address the challenge of climate change and other forms of pollution	As a non-emitting generator with very low marginal costs, the project will displace energy from fossil-fired resources and reduce regional GHGs and other pollutant emissions, including NO _x and SO ₂ .
Prioritize and facilitate increasing customer investment in their facilities where that investment provides recognizable net benefits	This goal does not appear to be applicable to this project. PPA costs will be recovered through the non-bypassable distribution rates on customers' bills. Gravel Pit Solar will be directly connected to the ISO-NE grid. It is not a distributed energy resource in which customers have elected to invest.
Appropriately compensate distributed energy resources for the value they provide to the electricity system, customers and society	This goal is not applicable, since the Gravel Pit Solar 20-year contract will be directly connected to the ISO-NE grid, and is not a distributed energy resource.
Appropriately charge customers for the cost they impose on the grid and compensate the distribution utility for the services it provides	This goal is not applicable, since it applies to distributed energy resources installed on a customer site and connected directly to the distribution system.
Align distribution utility, customer, and policy objectives and interests through the regulatory framework, including rate design, cost recovery, and incentives	This goal is not applicable, since it applies to distributed energy resources installed on a customer site and connected directly to the distribution system.

3 **Q. As part of Docket 4600, the Commission also adopted a benefit/cost framework that**
 4 **lays the groundwork for a business case for a proposed project. NGrid's Schedule NG-4**
 5 **summarized how the framework applies to the Gravel Pit Solar 20-year contact. Have you**

1 **reviewed this summary, and do you have any comments on the business case?**

2 A. The framework captures categories of costs and benefits that can be ascribed to the Gravel
3 Pit Solar project, but did not factor into the quantitative pricing (80 point maximum) score, and/or
4 were not quantified or monetized in the non-price (20 point maximum) score. In Schedule NG-
5 5, NGrid provides a quantification of the applicable Docket 4600 costs and benefits on a net
6 present value basis, derived from TCR's analysis of the project and other commercial information.

7 I have reviewed Schedule NG-5 in detail. For those categories that can reasonably be
8 quantified and monetized, I find that the reported costs and benefits are consistent with the TCR
9 model results and were appropriately calculated. I concur that some of the Docket 4600 categories
10 are applicable, but cannot be readily quantified, and that some of the categories are simply not
11 applicable to the Gravel Pit Solar project. In Exhibit EGC-2 I provide a summary of my comments
12 on each of the Docket 4600 categories.

13 **Q. Docket 4600 identifies categories of costs and benefits that create potential impacts at**
14 **the societal level. In Exhibit EGC-2 you note that societal level impacts include GHG**
15 **emissions and other environmental externality costs that can be ascribable to the Gravel Pit**
16 **Solar project. Please elaborate on the emissions benefits of the project.**

17 A. The environmental externalities are not part of the direct contract payments or contract
18 revenues. They were not monetized for the purpose of scoring and rank-ordering the proposals
19 but were separately quantified by NGrid. TCR's electric system simulation model produces data
20 on the emissions of CO₂ and NO_x from fossil generating resources across the New England
21 region. Energy generated from the Gravel Pit Solar project displaces energy from fossil resources
22 that have higher marginal production costs, thereby reducing regional emissions. By comparing
23 modeled emissions from fossil generating resources across the region with the project in service

1 (the Project Case), to modeled emissions across region without the project in service (the Base
2 Case), the net emissions benefit of the Gravel Pit project can be quantified. Operation of the
3 project reduces CO₂ and NO_x emissions across New England by approximately 46,000 short tons
4 (41,000 metric tons) per year and 11 short tons (10 metric tons) per year, respectively, on average
5 across the study period. NGrid ascribes a monetary value to the avoided emissions of CO₂ and
6 NO_x, relying on published values for the social cost of these emissions from the Avoided Energy
7 Supply Components in New England 2018 Report (“AESC Report”).⁷ The cost of CO₂ and NO_x
8 emission allowances is already embedded in the energy cost, so to avoid double-counting, the
9 allowance cost is deducted from the social cost.

10 **Q. Are there other emissions benefits that should be considered as societal benefits of the**
11 **Gravel Pit Solar project and if so, what are they?**

12 A. Yes, there are other benefits associated with emission reductions. Emissions of SO₂,
13 primarily from dispatchable oil-fired generation, may also be avoided. The TCR model did not
14 produce information on SO₂ emissions. The highest rate of SO₂ emissions in New England occurs
15 during the winter months when dual fuel units convert to oil.⁸ During these months, days are short
16 and energy production from solar plants is minimized. I would therefore expect that avoided SO₂
17 emissions ascribable to the Gravel Pit Solar project would be small, but a net positive benefit.
18 SO₂ is a precursor to fine particulates (PM_{2.5}) in the atmosphere, which contributes to increased

⁷ Synapse Energy Economics et al., *Avoided Energy Supply Components in New England: 2018 Report*, amended June 1, 2018, pp.140-144. The marginal abatement cost for CO₂ is estimated at \$100/ton (2018\$). The social value of NO_x is human health-based cost and estimated at \$13,178 (2018\$). <https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf>

⁸ ISO New England, *2018 USI-NE Electric Generator Air Emissions Report, Draft Results*. February 18, 2020. https://www.iso-ne.com/static-assets/documents/2020/02/draft_2018_marginal_results_20200213.pdf

1 mortality and morbidity. The EPA estimates that the social cost of SO₂ emitted from electricity
2 generator ranges from \$40,000 to \$90,000 per ton (2015\$).⁹ Although the quantity of avoided
3 SO₂ emission ascribable to the project is small, the associated social cost per ton is large, therefore
4 the monetized benefit may be material.

5 **Q. In Schedule NG-4, NGrid ascribes zero value to the category “Energy Demand**
6 **Reduction Induced Price Effect”, or “DRIPE.” Do you concur?**

7 A. I would clarify that the addition of any new resource, such as the Gravel Pit Solar project,
8 has some impact on the commitment and dispatch of other generation resources in the system and
9 therefore can induce a change in energy prices in some hours. However, given the relatively small
10 size of the Gravel Pit Solar project and the inherent uncertainty in any long-term forecast, the
11 magnitude and direction of the price change over the 20-year PPA are not quantifiable. It is
12 therefore reasonable to assign no value to this category.

13 **Q. Do you have any other comments on NGrid’s tabulation of cost and benefit categories**
14 **under Docket 4600 and if so, what are they?**

15 A. Yes. I have three additional comments. *First*, NGrid included as a benefit the reduction
16 in natural gas costs paid by Rhode Island’s natural gas customers. I reviewed the calculation
17 method and conclude that the results are reasonable. TCR’s simulation model captured the
18 reduction in natural gas burn ascribable to the Gravel Pit Solar project. TCR derived the resulting
19 impact to the winter basis component of delivered natural gas prices by applying a factor from the
20 AESC Study. Rhode Island’s natural gas customers benefit from the basis price reduction in

⁹ U.S. Environmental Protection Agency, Office of Air and Radiation, *Technical Support Document Estimating the Benefit per Ton of Reducing PM_{2.5} Precursors from 17 Sectors*, February 2018. https://www.epa.gov/sites/production/files/2018-02/documents/sourceapportionmentbpttsd_2018.pdf

1 winter months, but only for a portion of the total gas delivered through NGrid. LAI reviewed
2 NGrid's most recently filed gas supply plan. We confirmed that the most of NGrid's gas supply
3 is hedged and would not be affected by a basis price reduction since it has a contract path back to
4 a production point. The portion of gas supply that is affected by a winter basis reduction is only
5 the remaining portion that is purchased at the Citygate price.

6 *Second*, I note that two categories under the Power System Level include benefits and
7 disbenefits that impact the electric and natural gas bills of customers outside of Rhode Island.
8 These include impacts to energy prices in other New England states, impacts to existing long term
9 contracts for renewable resources held in other New England states, and impacts to the cost of
10 natural gas purchased by natural gas customers in other New England states. The sum of these
11 categories is a net positive benefit. I understand that NGrid has included these categories for
12 completeness.

13 *Third*, the value for the societal level category in NG-4, "Non-energy costs/benefits:
14 Economic Development" reflects the developer's commitment to invest at least \$300,000 in clean
15 energy jobs training in Rhode Island. The value shown in NG-4, \$121,371, represents this
16 investment expressed on a present value basis, assuming that one-twentieth of the total amount
17 (\$15,000) is invested each year over the 20-year contract term. This appears to be conservative.
18 Gravel Pit's proposal does not specify or commit to a schedule for the expenditure. An investment
19 schedule that front-loads the expenditures would increase the present value of the benefit and
20 accelerate workforce training initiatives.

21 **Q. Does this conclude your testimony?**

22 A. Yes.

ELLEN G. COOL

SUMMARY

A consultant with 30 years of experience advising electric and gas companies, state regulatory authorities, and large energy end users. Principal expertise includes procurement of wholesale power, fuel, and renewable resources, project financial management, environmental compliance, project siting and permitting, regulatory policy and analysis, and working group facilitation.

PROFESSIONAL EXPERIENCE

- 1999 - **Levitan & Associates, Inc.**
Vice President & Principal
Managing Consultant
Executive Consultant
Senior Consultant
- 1990 - 1999 **Harding Lawson Associates / ABB Environmental Services, Inc.**
Principal and Northeast Area Manager
Senior Program Manager
- 1988 - 1990 **TRC Consultants**
Project Manager
- 1986 - 1988 **Woodward Clyde Consultants, Inc.**
Project Manager
- 1985 - 1986 **Converse Environmental East**
Project Hydrogeologist
- 1982 **Chevron Resources Company**
Geologist
- 1979 - 1980 **U.S. Environmental Protection Agency**
Staff Scientist

CONSULTING ASSIGNMENTS

Managed LAI's provision of technical support to the MA Department of Energy Resources (DOER) in a procurement of up to 800 MW of offshore wind, authorized under Part 83C of the Green Communities Act. Reviewed the price and non-price evaluation of proposals conducted by the electric distribution companies and their advisors, and analyzed economic benefits and transmission and interconnection issues.

Managed LAI's provision of technical support to the CT Department of Energy and Environmental Protection (DEEP) in its procurement of up to 2,000 MW of offshore wind. Developed and implemented the quantitative analysis of proposals, analyzed transmission and interconnection issues, and participated in bidder interviews.

Supported NJBPU on its first procurement of offshore wind pursuant to the state's Offshore Wind Economic Development Act, which resulted in the selection of Ørsted's 1,100 MW Ocean Wind Project. Evaluated the non-price aspects of rival proposals, including project viability, potential environmental impacts, and avoided emissions. Participated in bidder interviews and contributed to a report to the NJ BPU.

Supported NYSERDA in its first offshore wind procurement, resulting in contracts for a total of approximately 1,700 MW, from Equinor's Empire Wind Project and the Sunrise Wind Project, a joint venture of Ørsted and Eversource Energy. Developed RFP documents, OREC transaction structure and evaluation metrics, and supported quantitative evaluation of proposals.

Advisor to MA DOER in preparing the Offshore Wind Study, as required by statute, to evaluate the necessity, benefits and cost of procuring an additional 1,600 MW of offshore wind. Participated in stakeholder engagement and provided analysis of wholesale market and impact and environmental benefits of increased offshore wind penetration.

Advisor to CT Department of Energy and Environmental Protection (DEEP) on multiple procurements for offshore wind, fuel cells, solar plants, anaerobic digester, and other zero-carbon resources under long term contract, pursuant to Public Acts 13-303, 15-107, 17-3, 17-144, and 19-71. Developed qualitative and quantitative evaluation criteria consistent with authorizing legislation. Analyzed of bid prices and market value of products and ranked proposals based on established criteria. Procurements resulted in the selection of contracts for energy and environmental attributes from the Millstone and Seabrook nuclear power stations, several utility-scale solar projects, and a total of 304 MW from the Deepwater Wind offshore wind project. Provided testimony before CT PURA on the net benefits of the contracts.

Advisor to the MA Department of Energy Resources (DOER) on the procurement of up to 9.45/yr TWh of clean energy resources under long term contract, pursuant to Section 83D of the Green Communities Act. The procurement resulted in a contract for incremental hydropower delivered from Quebec into the New England market.

Advisor to CT DEEP and to Rhode Island Office of Energy Resources (OER) and Division of Public Utilities and Carriers (DPUC) on the Clean Energy RFP, a regional procurement undertaken by CT, MA, and RI to procure long term contracts for new renewable resources, transmission, and large-scale hydropower resources.

Advisor to the Rhode Island OER and DPUC and on the procurement of up to 400 MW of new clean energy resources under long term contract. Provided testimony to the RI PUC on the consistency of the RFP with statutory requirements.

Advisor to the Rhode Island OER regarding the greenhouse gas impacts ascribable to the operation of a proposed 1,000 MW combined cycle plant. Participated in a public workshop, supported the preparation of OER's Advisory Opinion to the Energy Facilities Siting Board, and provided testimony before the EFSB.

As a subcontractor to the Kaye Scholer law firm, engaged by the Maryland Public Service Commission to assist in the development of regulations implementing the Maryland Offshore Wind Energy Act of 2013. Prepared qualitative and financial criteria for the screening and selection of offshore wind projects, consistent with statute and state policy objectives.

On behalf of the Connecticut Public Utilities Regulatory Authority (formerly Department of Public Utility Control), provide technical support for quarterly wholesale procurements by the state's two investor-owned utilities, including full requirements for default service. Support design of auction, development of wholesale purchase agreements, portfolio design, calculation of benchmark prices, and establishment of credit and collateral requirements. Provided testimony before the Commission regarding procurement integrity and compliance of the procurement with PURA procedures and statutory criteria.

On behalf of the Connecticut Public Utilities Regulatory Authority, facilitated a Working Group charged with developing a Procurement Plan for Standard Service to serve residential and small C&I customers who rely on the distribution company for electric supplies.

Managed LAI's participation as extension of Staff and as the Prosecutorial Unit for the Connecticut Public Utilities Regulatory Authority's procurement of new in-state peaking generation. Identified the quantity and operating performance criteria to provide requisite ancillary services for the load zone. Supported a collaborative effort to develop the RFP, proposal selection criteria, model terms and conditions, and pricing algorithm for a long-term Contract for Differences (CfD). Conducted bidder due diligence and quantitatively evaluated net benefits to ratepayers of competing proposals over a 30-year contract term. Provided written and verbal testimony before the Commission regarding our recommended projects for selection during the contested phase of the proceeding. Resulted in the development of 520 MW of peaking generation under long-term CfDs with the utilities.

Participated in scenario analysis and evaluated permit requirements for dual fuel operation as part of LAI's assignment on behalf of the Eastern Interconnection Planning Collaborative, a comprehensive study of pipeline and storage adequacy affecting bulk power security.

On behalf of the Connecticut Public Utilities Regulatory Authority, participated in settlement discussions and provided technical support regarding modifications to the CfDs for peaking generation necessitated by ISO New England market rule changes.

On behalf of the Connecticut Public Utilities Regulatory Authority, provided oversight and technical assistance in the utilities' solicitation of long term contracts for energy, capacity and RECs. Developed methods for evaluation of bids from wind farms and wood biomass plants. Provided written and oral testimony before the Commission regarding the hedge benefits of long term contracts within the utilities' portfolios, as well as other procurement options.

Advised the Connecticut Office of Consumer Counsel in the merger proceedings involving Northeast Utilities and NStar.

On behalf of the Connecticut Office of Consumer Counsel, reviewed the Integrated Resource Plans filed by the state's two investor-owned utilities and by the Connecticut Energy Advisory Board. Provided written and oral testimony before the Connecticut Commission regarding the policy and planning recommendations over a 10-year horizon.

Assisted the New Jersey Board of Public Utilities and the Governor's Office prepare the state's Energy Management Plan. The Plan broadly considered the buildout of backbone transmission projects, in-state supply and demand-side resources, including the prospective retirement of Oyster Creek nuclear facility, the environmental and job-creation benefits of the state's RPS including the solar carve-out, and expansion of the state's natural gas infrastructure.

Assisted the Long Island Power Authority with multiple competitive solicitations for new generation and HVDC transmission to serve the Island. Performed due diligence on respondents, coordinated LAI's financial analysis of rival bids, evaluated the feasibility of fuel delivery alternatives and the permitability of cable projects and gas interconnections.

On behalf of the New Jersey Board of Public Utilities, designed and implemented a solicitation to procure up to 2,000 MW of new combined cycle capacity under the Long Term Capacity Agreement Pilot Program. Evaluated permit and other development risks. Quantified net environmental benefits due to displacement of less efficient fossil generation across the region. Testified before the BPU regarding the outcome of the procurement and net environmental benefits to New Jersey.

On behalf of an investor-owned utility in the Northeast, prepared a strategic evaluation of options for its fossil generation fleet. Prepared ranges of capital and operating costs associated with probable new environmental requirements under a range of future scenarios.

On behalf of Allegheny Power, served as Independent Procurement Monitor during the solicitation of full requirements wholesale power supplies for eligible customers in Virginia. Reviewed procurement documents and protocols, monitored procurement integrity through the evaluation and award of bids, and prepared a procurement report for filing with the Virginia State Corporation Commission.

On behalf of the four Massachusetts investor owned utilities, prepared long term forecasts of energy, capacity, and REC prices to be used as benchmarks in the utilities' solicitation of renewable energy under long-term contracts as required by the Green Communities Act of 2008. Advised the utilities regarding potential energy market price suppression impacts of long-term renewable contracts.

Conducted due diligence on a portfolio of wind projects located in New England and New York on behalf of an investment bank. Evaluated energy production and deliverability issues affecting project revenues.

On behalf of NSTAR, prepared filings to the Massachusetts Energy Facilities Siting Board for a proposed 345-kV transmission line. Evaluated the need and quantified the economic benefits of the proposed project versus project alternatives, including generation and demand response. Assisted counsel with discovery and provided written and oral testimony before the Board.

On behalf of the Rhode Island Economic Development Corporation, developed a database of off-shore wind PPA prices, net metering tariff rates, and feed-in tariffs across the U.S. and Europe in connection with the economic evaluation of the Deepwater Block Island offshore wind project.

On behalf of PowerOptions, advised the non-profit corporation regarding the development of a program to install solar photovoltaic facilities on member institutions' sites across Massachusetts under PPA arrangements.

On behalf of the Maryland Public Service Commission, evaluated alternative strategies for meeting the state's growing power demands and meet its Renewable Portfolio Standards through contracting alternatives, new generation, transmission expansion, and demand-side options. Prepared long-term forecasts for the cost of environmental compliance, including greenhouse gas controls and RECs.

On behalf of a large New England water utility, managed a competitive procurement for retail power supplies for all of its pumping, reservoir, and office facilities. Projected the savings offered by competitive retail supplier relative to the electric utility's standard offer service. Worked with counsel to negotiate contract terms and conditions.

Assisted a developer prepare filings to the Massachusetts Energy Facilities Siting Board for a proposed peaking generation project. Evaluated net impact on regional air emissions ascribable to the project and the need for new quick-start resources in

northeastern Massachusetts to provide locational forward reserves. Evaluated alternative fueling strategies and fuel assurance for the project.

On behalf of the Long Island Power Authority, prepared an independent analysis of the environmental impacts and benefits of the Broadwater floating storage and regasification unit proposed for the middle of Long Island Sound.

Assisted Cornell University develop its Energy Master Plan. Evaluated the risk-adjusted economic value-added of technology alternatives for expanding the steaming capacity of the university's central heating plant, and assessed the environmental benefit of each alternative in terms of net emissions.

Prepared an expert report regarding valuation of a high-deliverability gas storage project. Advised client on opportunities for enhanced trading, marketing and contract administration.

Facilitated collaborative meetings among diverse stakeholders chartered by Connecticut Public Act 02-95. Provided a comprehensive plan and environmental policy recommendations to the State Legislature regarding submarine cables and gas pipelines across Long Island Sound and aboveground and underground transmission lines in Southwest Connecticut.

On behalf of ISO New England, analyzed fuel diversity, reliability issues, and compliance costs arising from environmental and other regulatory initiatives.

Assisted New York University with a competitive solicitation to select an on-site cogeneration project developer. Advised client on alternative project delivery structures.

Researched biomass fuel supply economics for a proposed cogeneration project to be fueled by a combination of waste wood and woody crop.

Evaluated environmental permit conditions and regulatory requirements that restrict or limit backup fuel oil use for new and existing gas-fired generation, as part of a reliability study of the natural gas infrastructure in ISO New England.

Evaluated revenue and earnings forecasts for two energy services companies as part of a due diligence assessment for the acquisition of non-regulated affiliates of a northeast utility company.

Advised a recycled paper manufacturer on electricity procurement and production alternatives, technologies for utilizing the mill's rejects stream, natural gas transportation alternatives, and permitability of proposed on-site energy projects. Managed a competitive procurement to construct on-site generation. Evaluated requirements with respect to New York State's SEQRA process, air permit modifications, Article VII, wetlands regulations, and SPDES.

Evaluated alternative energy production strategies and related environmental permitting constraints for the State University of New York campuses as part of a university system-wide review of energy procurement opportunities in New York's competitive energy market.

Analyzed non-utility generator contract reformation initiatives for Potomac Electric Power Co.

Evaluated environmental constraints associated with the feasibility of inside-the-fence cogeneration for Phelps Dodge at a primary rod mill production plant, including NEPA requirements for gas pipeline construction.

Provided litigation support, including project viability assessment, following termination of a Purchase and Sale Agreement for the acquisition of a nuclear power plant.

Analyzed effluent and flow data for three of NYSEG's coal-fired power plants in New York for compliance with the facilities' SPDES water discharge permit requirements.

Assessed risk profile and contract alternatives associated with construction of a natural gas lateral to a proposed cogen plant for National Institutes of Health.

Advised Massachusetts Water Resources Authority on reliability requirements for back-up generator systems under the EPA NPDES program.

Evaluated incremental costs of the Holyoke Hydroelectric Project resulting from conditions imposed by the Massachusetts DEP Water Quality Certification.

Developed engineering approaches and designs to comply with environmental regulations pertaining to former manufactured gas plant sites in Massachusetts, Maine, New Hampshire, and New Jersey for Bay State Gas Company, NEES, and PSE&G.

Quantified potential environmental liabilities in numerous due diligence reviews for acquisitions and divestitures of energy, railroad, and manufacturing company assets, both in the U.S. and Europe.

Evaluated and optimized engineering design of product recovery system for environmental compliance at Mobil and Coastal refineries in New Jersey.

Provided expert witness testimony for a pump manufacturer's defense against the local water department's groundwater contamination damage claim.

Evaluated risk/reward profile for site restoration and redevelopment options of a 40-acre parcel in Providence, R.I.

EDUCATION

Harvard University, Cambridge, MA
A.B., Geological Sciences

University of Washington, Seattle, WA
M.S., Ph.D., Geological Sciences

PRESENTATIONS & PUBLICATIONS

2014. "Business Opportunities in the Energy Industry and Response to Climate Change," Air & Waste Management Association, New England Section, Fall 2014 Conference.

2012. "Influence of State Policymaking on New England's Wholesale Markets – RGGI" Northeast Energy and Commerce Association, 11th Annual Power Markets Conference, Westborough, MA, October 24, 2012.

2009. "How to Shop for Power." *MassBusiness*, p. 16 (with M.J. DeCoursey).

2000. "Backup Power Risk Factors Impacting the Commercial Merit of Combined Heat and Power": Proceedings, 91st Annual Conference of the International District Energy Association, Montreal, Quebec, June 10-13, pp. 169-182.

1998. "Innovative and Cost-Effective Dual Phase Extraction using a Vacuum Truck and Standard Monitoring Wells": Amherst Soils Conference, October (with D.M. McCabe, R.K. Maggiani, F. W. Lilley).

1994. "The 1,000-Mile-Long Site: Managing and Evaluating Environmental Liabilities for the Railroad Industry." Presented at the New England Environmental Expo, Boston, MA, April (with K.A. Nelson).

1993. "Integrated Risk Management: A Tool for Strategic Decision-Making." Presented at Air & Hazardous Waste Management Conference. Hartford, CT, October 20 (with M.J. Murphy).

1992. "Reduce Sampling Errors: Careful Extraction Method Can Improve Accuracy of Soil Analyses" *Soils*; January-February; pp. 16-18.

1990. "The Interpretation of Free-Phase Floating Toluene Contamination at a Hydrologically Complex Site"; New England Environmental Expo, Proceedings (with McCabe, D.M.).

1989. "Vein Formation, Fluid Flow, and Wall Rock Geochemistry at the Lucky Friday Mine, Coeur d'Alene Mining District, Idaho"; 28th International Geological Congress, Washington, D.C. Proceedings; Vol. 1; pp. 1-323 - 1-324.

1985. (Gitlin, E.C.). "Sulfide Remobilization During Low Temperature Alteration of Seafloor Basalts", *Geochimica et Cosmochimica Acta*, 49; pp. 1567-1580.

1985. (Gitlin, E.C.). "Alteration and Fluid Flow Around a Sulfide-Carbonate-Quartz Vein, Lucky Friday Mine, Northern Idaho"; Geological Society of America, Abstracts with Program 17; pp. 593.

1985. (Gitlin, E.C.). "Small-Scale Heterogeneities in Stillwater Anorthosite II". Lunar and Planetary Science XVI; Lunar and Planetary Institute; Houston, Texas (with P.A. Salpas, I.S. McCallum, and L.A. Haskin).

Trainer, ABB Project Risk Workshop, July 1994

ASSOCIATIONS

Northeast Energy and Commerce Association, Inc., Board Member and Vice President,
Policy

ISO New England Environmental Advisory Group

Order 4600 Benefit/Cost Framework

Cost/Benefit Category		Applicability
Power System Level		
1	Energy Supply & Transmission Operating Value of Energy Provided or Saved (Time- & Location-Specific LMP)	Project will generate approximately 112,000 MWh per year of renewable energy (averaged over the contract term), with the market value of those products returned to NGrid customers over the contract term. Quantified by NGrid in Schedule NG-4 (revised).
2	Renewable Energy Credit Cost / Value	Project will generate approximately 112,000 RECs per year (averaged over the contract term). NGrid customers avoid the cost of purchasing market RECs to meet RES requirements; the market value of RECs that are surplus to RES is returned to NGrid customers. Quantified by NGrid in Schedule NG-4 (revised).
3	Retail Supplier Risk Premium	Not applicable. Energy from the project is settled in the wholesale market; no retail risk premium
4	Forward Commitment: Capacity Value	PPA does not include capacity, so no direct cost or benefit to NGrid customers. Current ISO-NE market rules make it difficult for project to clear in the Forward Capacity Market, therefore any indirect impact on capacity market prices is not quantifiable.
5	Forward Commitment: Avoided Ancillary Services Value	As a variable energy resource, project would contribute to an increase in need for load-following ancillary services. Given small size of project, impact would be small, and is not quantifiable.
6	Utility / Third Party Developer Renewable Energy, Efficiency or DER costs	Cost of energy plus RECs at fixed PPA price over contract term is paid by NGrid customers. Quantified in NGrid Schedule NG-4 (revised).
7	Electric Transmission Capacity Costs / Value	Transmission costs, including all interconnection and system upgrade costs are included in PPA price and total contract cost in Row 6.
8	Electric transmission infrastructure costs for Site Specific Resources	Transmission costs, including all interconnection and system upgrade costs are included in PPA price and total contract cost in Row 6.

9	<p>Net risk benefits to utility system operations (generation, transmission, distribution) from 1) Ability of flexible resources to adapt, and 2) Resource diversity that limits impacts, taking into account that distributed energy resources (DER) need to be studied to determine if they reduce or increase utility system risk based on their locational, resource, and performance diversity</p>	<p>Not applicable. Project will be interconnected at the ISO-NE pool transmission system level and is not a DER.</p>
10	<p>Option value of individual resources</p>	<p>Category covers indirect impact of the project on: (a) energy market; (b) REC market; and (c) the delivered cost of natural gas to customers in Rhode Island and other New England states. Regarding (a), the impact of the project on the commitment and dispatch of other energy resources in the ISO-NE system is not readily quantifiable over the PPA term. NGrid's Schedule NG-4 (revised) reasonably assigns zero value to this component. Regarding (b), increasing the supply of RECs reduces the Renewable Energy Standard compliance cost to electric customers in Rhode Island as well as in other New England states, resulting in a positive benefit. At the same time, however, the hedge value of existing long term contracts is diminished, resulting in a disbenefit. Regarding (c), operation of the project offsets fossil generation and reduces generators' demand for natural gas. This contributes to a small reduction in the winter basis component of the gas supplies that NGrid and other companies across New England purchase at the citygate price. The sum of (a), (b) and (c) calculated in NGrid Schedule NG-4 (revised) is a net positive benefit.</p>
11	<p>Investment under Uncertainty: Real Options Cost / Value</p>	<p>Included in direct and indirect costs and benefits of project. Quantified by NGrid in Schedule NG-4 (revised) in rows 1,2, 6 and 10.</p>
12	<p>Energy Demand Reduction Induced Price Effect</p>	<p>As noted in row 10, given the relatively small size of the project and the inherent uncertainty in any long-term forecast, the magnitude and direction of the price change over the PPA term are not quantifiable.</p>

13	Greenhouse gas compliance costs	The project will produce no greenhouse gases and has no embedded compliance costs. The cost of RGGI emission allowances is included as a production cost for fossil resources that are included in the simulation model.
14	Criteria air pollutant and other environmental compliance costs	The project will produce no criteria pollutants and has no embedded emission compliance costs. The cost of NO _x and SO ₂ emission allowances under the Cross State Air Pollution Rule is included as a production cost for fossil resources in NYISO in the simulation model. New England states are not subject to CSAPR and applicable state NO _x and SO ₂ allowance costs are negligible.
15	Innovation and Learning by Doing	Project contributes to incremental expansion of the solar industry and workforce experience in the region
16	Distribution capacity costs	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
17	Distribution delivery costs	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
18	Distribution system safety loss/gain	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
19	Distribution system performance	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
20	Utility low income	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
21	Distribution system and customer reliability / resilience impacts	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.
22	Distribution system safety loss/gain	Not applicable. Project will be interconnected at the ISO-NE pool transmission facility level.

Customer Level		
23	Program participant / prosumer benefits and costs	PPA costs will be recovered through the distribution charges of <u>all</u> NGrid distribution customers, and <u>all</u> NGrid distribution customers will be credited with the market value of the energy and RECs. The project is projected to be under market over the contract term, and also provide a net positive indirect market benefit. The net benefit is

		quantified in NGrid Exhibit NG-4 (revised) as the sum of rows 1, 2, 6 and 10.
24	Participant non-energy costs/benefits: Oil, Gas, Water, Waste Water	All natural gas customers will benefit from a small reduction in winter gas basis and delivered gas cost. Included in NGrid Exhibit NG-4 (revised) row 10
25	Low-income Participant Benefits	See row 23.
26	Consumer Empowerment & Choice	Not applicable
27	Non-participant (equity) rate and bill impacts	See row 23.

Societal Level		
28	Greenhouse gas externality costs	Operation of the project will displace generation from fossil-fired resources and associated greenhouse gas emissions. Avoided emissions can be valued at the social cost of carbon, less the embedded compliance (RGGI) cost. Quantified by NGrid in Schedule NG-4 (revised) in row 28.
29	Criteria air pollutant and other environmental externality costs	Operation of the project will displace generation from fossil-fired resources and associated NO _x , SO ₂ , and particulate emissions. Avoided emissions can be valued at the human-health based costs estimated by U.S.EPA. NO _x externality benefit quantified by NGrid in Schedule NG-4 (revised) in row 28.
30	Conservation and community benefits	Project is located on a gravel mine and will provide positive benefit as a beneficial reuse of a brownfield site. Not quantifiable.
31	Non-energy costs/benefits: Economic Development	Gravel Pit has committed to investing at least \$300,000 in workforce training for the clean energy industry. The proposal does not specify or commit to a schedule for the expenditures.
32	Innovation and knowledge spillover (Related to demonstration projects and other R&D preceding larger scale deployment)	Not applicable. Project is not a demonstration or R&D project.
33	Societal Low-Income impacts	The project is projected to provide energy at below-market prices over the contract term, and also provide a net positive indirect

		market benefit. The net benefit is quantified in NGrid Exhibit NG-4 (revised) as the sum of rows 1, 2, 6 and 10.
34	Public Health	Environmental externalities associated with reduced emissions of NO _x are included in NGrid Schedule NG-4 (revised). Displacement of fossil generation also reduces other priority pollutants, including SO ₂ and PM which contribute to increased morbidity and mortality, but quantities are very small and not quantifiable.
35	National Security and US international influence	Impacts on consumption of imported petroleum product unknown and not quantifiable. Origin of solar PV panels (domestic or imported) is indeterminate.