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October 13, 2017

Margaret Curren, Esq.
Chairperson
Rhode Island Energy Facility Siting Board
89 Jefferson Blvd.
Warwick, RI 02888

Re: SB: 2015-06, Invenergy Thermal Development, LLC Application to Construct and Operate the Clear River Energy Center in Burrillville, Rhode Island

Dear Chairwoman Curren:

Find enclosed herewith is an original and five (5) copies of the Rhode Island Building and Construction Trades Council's exhibits. Note, **all of these exhibits have been previously submitted**, they are only now renumbered.

In addition, the RIBCTC will address the issues raised in the Town of Burrillville's correspondence of October 10, 2017 in which the Town stated it had not received the RIBCTC's list of witnesses and objected to Mr. Vatter's rebuttal testimony.

1. The RIBCTC witness list: The RIBCTC submitted its list of witnesses to the Energy Facility Siting Board on September 7, 2017. Our witnesses will be Michael Sabitoni, Ralph Gentile and Marc Vatter (jointly), and Andrew Cortes.

2. Objection to RIBCTC Testimony: Based on its correspondence, the Town appears to only be objecting to exhibits RIBCTC8 (rebuttal testimony of M. Vatter) and RIBCTC 9 (email attached to rebuttal testimony).

If you have any additional questions please do not hesitate to contact the undersigned. Thank you for your time and attention to this correspondence.

Very truly yours,

Gregory A. Mancini

cc: Service List

SB 2015-06, Invenergy Thermal Development LLC's Application to Construction the Clear River Energy Center Power Plant in Burrillville, RI

Rhode Island Building and Construction Trade Council
Exhibit List

Direct Testimony of M. Sabitoni RIBCTC1

CV of Mr. Sabitoni RIBCTC2
(Previously marked as Exhibit 1 in Mr. Sabitoni's previously submitted testimony)

Direct Testimony of M. Vatter and R. Gentile RIBCTC3

CV of R. Gentile RIBCTC4
(Previously marked as RG-1 in M. Vatter and R Gentile's previously submitted joint testimony)

CV of M. Vatter RIBCTC5
(Previously marked as MV-1 in M. Vatter's previously submitted rebuttal testimony)

Chart of Direct Employment Trade in Construction of CREC RIBCTC6
(Previously marked as RG-2 in M. Vatter and R Gentile's previously submitted joint testimony)

Chart of Nationwide Employment Impacts of CREC RIBCTC7
(Previously marked as MV-2 in M. Vatter and R Gentile's previously submitted joint testimony)

Rebuttal Testimony of M. Vatter RIBCTC8

Email from Jonathan Black RIBCTC9
(Previously marked as Exhibit 2 in M. Vatter's previously submitted rebuttal testimony)

Direct Testimony of A. Cortes RIBCTC10

CV of Andrew Cortes RIBCTC11

RIBCTC 1

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

RE: SB 2015-06, INVENERGY THERMAL DEVELOPMENT, LLC APPLICATION TO CONSTRUCT AND OPERATE THE CLEAR RIVER ENERGY CENTER IN BURRILLVILLE, RHODE ISLAND

Pre-filed testimony of Michael F. Sabitoni

EXECUTIVE SUMMARY

The proposed Clear River Energy Center is one of if not the largest construction project in the history of the State of Rhode Island. According to numerous experts, this project will create more than 320 full-time annual construction trade jobs per year from 2018-2021. In total, this project will create more than 1,200 annual jobs for the members of the RIBCTC. These jobs will pay at least $60,000 in wages and another $30,000 in health and retirement benefits annually. If approved, will be constructed under an all-union Project Labor Agreement ("PLA"). Therefore, any and all project construction craft hires will be hired through the Rhode Island Building and Construction Trades Council ("RIBCTC") individual union halls. Michael F. Sabitoni, President of the RIBCTC, will attest to the enormous socio-economic impact this project will have on its members.

I. INTRODUCTION

Q. Please state your name, position and business address.

My name is Michael F. Sabitoni. I am President of the RIBCTC. My business address is 410 South Main Street, Providence, RI 02903.

Q. Would you please summarize your professional background and experience?

I am a third-generation Laborer. I began my career with the Laborers' International Union of North America (LIUNA) when I joined Providence, Rhode Island's Laborers' Local Union 271 in 1988. Soon after joining the ranks of the local, I worked my way up to become a general foreman and steward while attending the Community College of Rhode Island and Bryant University at night. In 2000, I became a Construction Marketing Representative for the LIUNA National LECET Fund where I tracked construction projects in the Northeast and solicited union contractors to bid on new projects. In 2003, I was appointed Field Representative for Local Union 271. In 2005, I was appointed to the position of Business Manager of that Local and was subsequently elected to that position in 2007. In 2007, I was elected President of the RIBCTC. My summary biography is appended as Exhibit 1 to my testimony.

Q. Would you please describe the organization, membership and purpose of the entity on whose behalf you are providing testimony?

The RIBCTC is a voluntary federation of seventeen (17) local trade unions dedicated to improving the lives of working men and women in the construction industry by assisting them in finding good quality jobs that provide fairness and dignity in the workplace and securing social equity. The members of the council have been involved in every major construction initiative—private or public—undertaken in and around the State of Rhode Island in the last seventy (70) years. Cumulatively, the individual unions represent approximately 9,500 workers in and around the Rhode Island area. In addition, RIBCTC member unions have the ability to draw upon a regional workforce in excess of 37,000. RIBCTC member unions include Boilermakers Local No.29, Bricklayers Local No. 3, Carpenters Local No. 94, Elevator Constructors Local No. 39, Glaziers Local No. 1333, Heat & Frost Insulators Local No. 6, IBEW Local No.99, Iron Workers Local No. 37, Laborers' Local 271, Millwrights Local No. 1121, Painters Local No. 195, Plasterers & Cement Masons No. 40, Plumbers & Pipefitters Local No. 51, Roofers & Waterproofers Local No. 33, Sheet metal Workers Local No. 17, Sprinkler Fitters Local No. 676, and Teamsters Local No. 251. RIBCTC'S principal office is located at 410 South Main Street, Providence, RI 02903.

II. POSITION OF ORGANIZATION

Q. What is the position of your organization with respect to these proceedings?

The RIBCTC has been granted Intervenor status in this proceeding.

Q. Why did your organization Intervene in these proceedings?

If approved, this project will be constructed by hundreds of uniquely qualified skilled craftsmen and women from the seventeen (17) unions of the RIBCTC. Most of these workers will be from the local area. Moreover, the workers that work on this project will be deriving one-hundred percent (100%) of their household income from working on this facility. Accordingly, no group of Rhode Island residents has a stronger economic and/or socio-economic interest in the outcome of this application to construct the Clear River Energy Center in Burrillville, Rhode Island.

III. SOCIO-ECONOMIC IMPACT

Q. How many jobs will be created by the project?

Based on my research, this is the largest construction project in the history of the State of Rhode Island. According to numerous experts, this project will create more than 320 full-time annual construction trade jobs per year from 2018-2021. By construction industry standards, being in one (1) location for more than two (2) years is a unique luxury that does not occur often. Accordingly, these types of jobs are very desirable. In total, this project will create more than 1,200 annual jobs for the members of the RIBCTC.

Q. How would approval of this project affect your members?

This project will be constructed under an all-union RIBCTC PLA with union scale wages and benefits. The PLA will require that the owner and contractor to contact our union halls for any and all hires for this project. Accordingly, approval of this project will create hundreds of well-paying construction jobs for the members of the RIBCTC for an extended period. Each one of these jobs will pay at least $60,000 in wages and another $30,000 in health and retirement benefits. These jobs will not only be well-paying, by construction industry standards, they will also last for an unusually long time.

Q. Do you have the capacity to provide skilled labor to this project?

Yes. Our hiring hall referral system provides us with the infrastructure needed to place the needed local skilled tradesmen and women on this project. Additionally, this, and every PLA we have signed in the past ten (10) years has a requirement that the general contractor utilize apprentices trained through Building Futures, a local non-profit corporation formed in a down economy that is dedicated to recruiting, training, and placing disadvantaged ***local*** low-income adults in area construction trade apprentice programs. This long-term planning has allowed the RIBCTC to be ready to meet the future skilled workforce needs of the marketplace and projects like the proposed Clear River Energy Center.

Q. How would approval of this project provide a socio-economic benefit to this state?

Based on preliminary estimates of the size of this project as well as the marketplace at large, this project will probably account for 15-20% of the entire commercial construction market in the State of Rhode Island for two plus years. This will substantially increase the employment prospects and actual income for all our local union members. This will enhance the economic and social progress of not only the workers employed on this project and their families, but any other aspects of the economy that these workers and their families happen to touch and/or participate in. Lastly, the substantial income tax these well-paying jobs generate will provide the State with significant additional income that will allow it to distribute these funds as it sees fit to further enhance the socio-economic progress of all the citizens of our State. Accordingly, a project of this size and duration will have a substantial positive socio-economic impact on the construction industry as well as an impact on our entire State.

IV. CONCLUSION

Q. Do you have anything further to add?

This proposed project would benefit this State and its workforce enormously. It would provide enormous work opportunities for local skilled tradesmen and women for an extended period of time; significant new tax revenue to the State via a substantial increase in income tax receipts, and to the Town of Burrillville through the parties' tax stabilization agreement; it would stabilize, if not lower, local energy costs thereby making local businesses more competitive in the marketplace; and, if that occurs businesses will expand and there will be additional employment opportunities for the members of the RIBCTC. Accordingly, the RIBCTC urges an expeditious review and approval of this project.

Q. Does this conclude your direct testimony?

Yes, it does.

RIBCTC 2

MICHAEL F. SABITONI

Michael F. Sabitoni is a second-generation Laborer who began his career with the Laborers' International Union of North America (LIUNA) when he joined Providence, Rhode Island's Construction and General Laborers' Local Union 271 in 1988. Soon after joining the ranks of the local, Mr. Sabitoni worked his way up to become a general foreman and steward while attending the Community College of Rhode Island and Bryant University at night.

In 1998, he joined the Laborers' New England Region Organizing Fund working on grassroots organizing campaigns throughout the region. Two years later in 2000, Mr. Sabitoni became a Construction Marketing Representative for the LIUNA National LECET Fund where he tracked construction projects in the Northeast and solicited union contractors to bid on new projects.

In 2003, Mr. Sabitoni's leadership skills and knowledge of the construction industry was recognized by Local Union 271's Executive Board and he was appointed as Field Representative for Local Union 271. In 2005 Mr. Sabitoni was unanimously appointed by Local Union 271's Executive Board to the position of Business Manager and was subsequently elected to that position in 2007. Under Mr. Sabitoni's leadership, Local Union 271's membership continues to expand and its market share numbers in the construction industry which are among the highest in the nation.

In 2007, Mr. Sabitoni's tireless leadership and commitment to working families was recognized by his fellow union leaders throughout the state when he was elected President of the Rhode Island Building and Construction Trades Council, a position which he currently holds. Mr. Sabitoni also holds the position of Chairman of the Rhode Island Laborers'' Pension Fund, the Rhode Island Laborers' Health and Welfare Fund and the Rhode Island Laborers' Annuity Fund. Along with those positions, he also serves as a Trustee on the New England Laborers' Training Trust Fund, the New England Laborers' Labor-Management Cooperation Trust and the New England Laborers' Health and Safety Fund.

In July 2012, Mr. Sabitoni's leadership was again recognized as he was unanimously appointed as the Business Manager and Secretary-Treasurer of the Rhode Island Laborers' District Council representing over 10,000 members, in both the public and private sector.

Mr. Sabitoni and his wife Joyce currently reside in Johnston, Rhode Island with their three (3) children Michael, Matthew and Cameron.

RIBCTC 3

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

RE: SB 2015-06, INVENERGY THERMAL DEVELOPMENT, LLC APPLICATION TO CONSTRUCT AND OPERATE THE CLEAR RIVER ENERGY CENTER, BURRILLVILLE, RHODE ISLAND

Pre-filed testimony of Ralph Gentile and Marc Vatter

Executive Summary

The Construction Labor Market Analyzer (CLMA) is a labor market consulting group that, among other things, analyzes the demand for the skilled construction trades based on projects in the construction queue; that is, projects under construction or planned for construction during future years. Our focus is primarily on employment impacts, especially those in the building trades. We used CLMA data for a standard 1,000 megawatt combined cycle power plant, modified to reflect recent changes to the timetable for the Clear River Energy Center (CREC), to examine its direct job impacts. We did some brief work using the National Renewable Energy Laboratory's Jobs and Economic Development Impact Model (JEDI), used by Ryan Hardy of PA Consulting and Edinaldo Tebaldi of Bryant University in their testimony for Invenergy Thermal Development LLC ("Invenergy"), to verify the reasonableness of the relationship among different types of effects on output and value added. In addition, we performed an independent analysis using the Organization for Economic Cooperation and Development's (OECD) Structural Analysis (STAN) database[1] and a study done for the Energy Information Administration (EIA) by R.W. Beck, Inc.[2]

Our analysis indicates that the construction of CREC supports the Hardy and Tebaldi testimonies in terms of job creation. If anything, it suggests higher numbers of jobs. The CLMA data provide for an average of 328 jobs per year in the trades alone during the construction period. Since the trades comprise only one

[1] http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS, accessed March 31, 2010.

[2] "Updated Capital Cost Estimates for Electricity Generating Plants", prepared by R.W. Beck for the U.S. Department of Energy, Energy Information Administration, Office of Energy Analysis, November 2010.

segment of construction workers, and there will be other types of workers as well employed at the site, total direct jobs on site will be higher.

Noting that a ramp-up in jobs associated with CREC does not occur until the close of 2018, there is a dove-tailing in demand that could lend stability to the construction trades in Rhode Island over the years 2018-2020. A crucial point is that, even if markets are tight, and a skilled worker moves from one job to a CREC job, wages are likely to increase. Since benefits and related costs like worker's compensation are usually calculated as percentages of wages, accepting a job to work on CREC will lift a worker's wage and benefits.

We regard the value added multipliers from JEDI as reasonable for the state of Rhode Island. The output multipliers are close to the value added multipliers, so we regard them as reasonable, as well.

We also examine the labor-intensity of different generating technologies nationwide. In this analysis, gas-fired generation employs more workers per dollar of spending than any other generating technologies, except solar photovoltaic and hydroelectric. While local employment impacts may be of primary interest, just as Rhode Island's government is interested in the state's contribution to global emissions of CO_2, it is also worth noting that natural gas compares favorably to other generating technologies in terms of employment impacts, when one accounts for impacts within and beyond the Rhode Island state line. This result does not depend on the current, low price of natural gas persisting into the future. It results from upstream employment in pipeline construction and extraction.

We regard Hardy and Tebaldi's estimates of the local impacts on employment and value added of CREC as reasonable. They estimate that construction and operation of CREC will create more than 605 jobs per year during 2018-2021 in Rhode Island, and 129 jobs per year thereafter, not accounting for the effects of lower electricity prices. We estimate that construction and operation of CREC would create 852 jobs per year, directly and indirectly, locally, during 2018-2021. The 852 does not include any of the secondary "induced" effects included in Hardy and Tebaldi's estimate. For the same period, we estimate impacts on value added of about $154 million per year. This does not include any effects of lower electricity prices, which *are* included in Hardy and Tebaldi's estimated $133 million per year effect on output for 2018-2021.

1. INTRODUCTION

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

My name is Ralph Gentile, Ph.D. I am Senior Economist for the CLMA, 2393 Alumni Drive, Lexington, KY 40517. My personal address is 108 Pine Street, Andover, MA 01810. I have been assisted in this testimony by Marc H. Vatter, Ph.D., an energy economist with extensive experience in the electrical utility industry. Marc's address is 9 Underhill Street, Nashua, NH 03060.

Q. On whose behalf are you testifying?

Our testimony is on behalf of the Rhode Island Building and Construction Trades Council (RIBCTC) in support of the Invenergy application for a license from the Rhode Island Energy Facilities Siting Board ("EFSB" or the "Board") to construct the CREC project in Burrillville, Rhode Island.

Q. Please describe your educational background and your professional experience.

I (Ralph Gentile) am employed as a consultant at the CLMA. I have a Ph.D. from the University of Pennsylvania. I was an assistant professor in the Economics Department of UMass Lowell before working for 25 years as an economist at the McGraw-Hill Construction Information Group. (A detailed description of my educational background and professional experience is included as Exhibit RG-1.)

Marc Vatter is a consulting economist with extensive experience in the electric utility industry. (A detailed description of Marc's education and professional experience is included as Exhibit MV-1.)

Q. What is the Construction Labor Market Analyzer?

The CLMA is a labor market consulting group that, among other things, analyzes the demand for the skilled construction trades based on projects in the construction queue; that is, projects under construction or planned for construction during future years.

Q. Can you please describe the individuals' experience with skilled construction trades and power markets?

Ralph Gentile is primarily a construction economist with training in regional economics. Since his retirement from McGraw-Hill's Construction Information Group, Ralph Gentile has written and run models of job demand and wage escalation for the skilled trades using CLMA data. Those models rely on CLMA's data collection and detailed profiles of demand for the skilled construction trades by project type, key to analyzing the tightness of labor markets for the trades.

Marc Vatter's most recent work includes production cost modeling of the electric power grids in Mexico and the Midcontinent ISO using AURORAxmp®. He has sponsored testimony before several regulatory commissions on rates, plant additions, etc.

Q. What is the purpose of your testimony in this proceeding?

Our testimony will support the socio-economic impact analysis presented by PA Consulting, whose principal, Ryan Hardy, and affiliate, Edinaldo Tebaldi, have already submitted testimony in favor of CREC, a 970 megawatt (MW) combined cycle dual fueled generation facility. It will cover the direct demand for construction workers, supervisory personnel, professionals, and operating personnel, as well as the derived demand for labor in building products and other material inputs. It will discuss the effects on incomes in the local economy. Also included are comments on the labor-intensity of combined cycle natural gas electricity generating plants compared to alternative generating technologies, as well as additional (independent) estimates of the employment impacts of CREC.

Q. Please provide an overview of your testimony.

Our testimony addresses six topics:

1. A description of the methodology used to estimate the employment impacts of CREC;
2. a discussion of direct construction jobs with reference to CLMA estimates for full time equivalent jobs by specific trade, along with an assessment of the demands on local labor markets for tradespeople;
3. the relative importance of the induced effects of CREC on output and value added in Rhode Island;
4. an assessment of labor-intensity of construction and operation of a plant like CREC relative to other generating technologies;
5. estimates of employment impacts within and beyond the Rhode Island state line;
6. a technical appendix.

2. METHODOLOGY

Q. What types of impacts do you estimate?

Our focus is primarily on employment impacts, especially those in the building trades, but we do discuss other socio-economic benefits associated with CREC.

Q. What tools were used to estimate these impacts?

Our primary source is estimates of employment impacts in the building trades from the CLMA. PA Consulting primarily relied on the National Renewable Energy Laboratory's (NREL) Jobs and Economic Development Impact Model (JEDI) to estimate employment impacts. They also used AURORAxmp®, a production cost model, and their New England capacity market model to estimate the impact of CREC on electricity prices, and used IMPLAN to examine the effects of the resulting ratepayer savings on the Rhode Island economy.

We use CLMA data for a standard 1,000 megawatt combined cycle power plant to elucidate the direct job impacts. We do some brief work using JEDI to verify the reasonableness of the relationship among different types of effects on output and value added.

In addition, we perform an independent analysis using the OECD's STAN database[3] and a study done for the EIA by R.W. Beck, Inc.[4] The OECD data contain information on value added and labor input for a large number of industrial categories, and the Beck study provides cost data for several expenditure categories and generating technologies.

Q. For what geographical area are effects estimated?

Regional Definition: The focus of the analysis is the State of Rhode Island, although parts of the Boston consolidated metropolitan area, specifically the Worcester metropolitan area, are within commuting distance. The JEDI modeling is Rhode Island-specific and accounts for the size of the state. We also examine impacts beyond the Rhode Island state line using the OECD and Beck data.

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[3] http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS, accessed March 31, 2010.

[4] "Updated Capital Cost Estimates for Electricity Generating Plants", prepared by R.W. Beck for the U.S. Department of Energy, Energy Information Administration, Office of Energy Analysis, November 2010.

Q. What types of effects are estimated?

In the methodology used here, the employment impacts come in multiple stages. The first set of impacts is called "direct effects"; these are jobs, income, output and fiscal benefits due to "onsite labor and professional services jobs". In terms of spending, it is money spent on labor for companies engaged in development and on-site construction and operation of power generation and transmission[5]. These jobs (and other effects) may be short-term, as in the case of construction jobs, or long-term, such as the operations and maintenance positions that exist throughout the life of the generation facility.

The second set of impacts is often called "indirect effects".[6] They are jobs, income, output and fiscal effects that are created due to the initial spending to build and operate a plant, not including that which is directly spent on labor. Indirect jobs include the jobs created to provide the materials, goods, and services required by the builders and operators of CREC.

The third set of effects is called "induced effects"[7]; these are secondary impacts on jobs, earnings, output and fiscal benefits created by household spending of income earned either directly from CREC or indirectly from businesses that are impacted by CREC.

In the analysis, the direct, indirect and induced effects are gross of any alternative employment that might obtain, where the level of alternative employment depends on conditions in the markets for the types of labor employed through CREC.

[5] Please see JEDI documentation, "Interpreting Results", first paragraph. http://www.nrel.gov/analysis/jedi/results.html, accessed August 1, 2017.
[6] Ibid. second paragraph.
[7] Ibid. third paragraph.

Q. What benchmarks did you use in assessing the reasonableness of the modeling results?

We studied the JEDI model, reviewing its methodology and examining its calculations. We compared its direct construction job estimates to the craft trade profiles from the CLMA's 1,000 MW combined cycle natural gas power plant example. The CLMA estimates are consistent with the direct, indirect, and induced effects estimated using JEDI. We also compared JEDI's employment impacts to those derived using the OECD and Beck data, and the latter are somewhat higher.

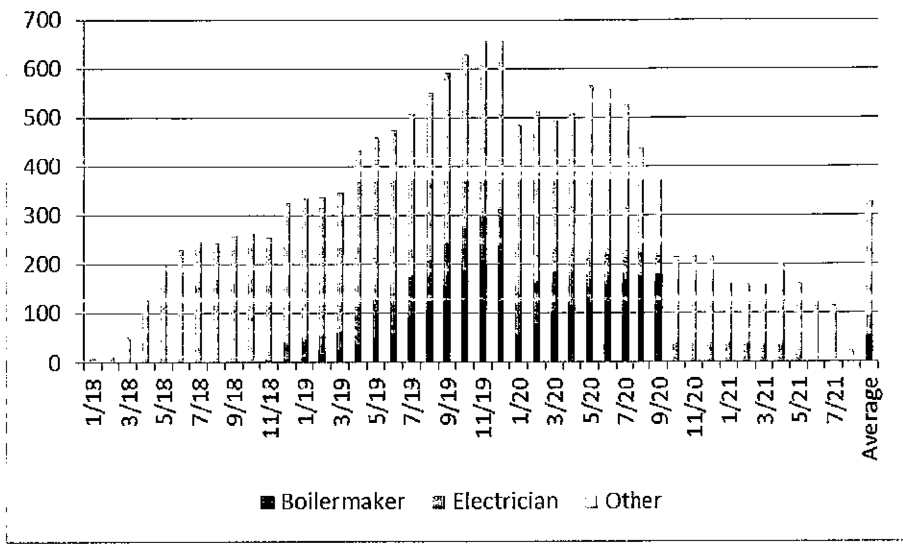
3. DIRECT IMPACTS ON THE TRADES

Q. Please provide a summary of CREC's impact on local employment in the trades.

Like the PA Consulting analysis, our analysis assumes 41 months of construction, beginning in January of 2018. This implies that the first 485 MW (half) of the plant will take two and a half years to construct, and the second 485 MW an additional year.

Our analysis indicates that the construction of the CREC supports the Hardy and Tebaldi testimonies in terms of job creation. If anything, it suggests slightly higher numbers of onsite construction jobs.

Figure 1: Direct Employment by Trade in Construction of CREC

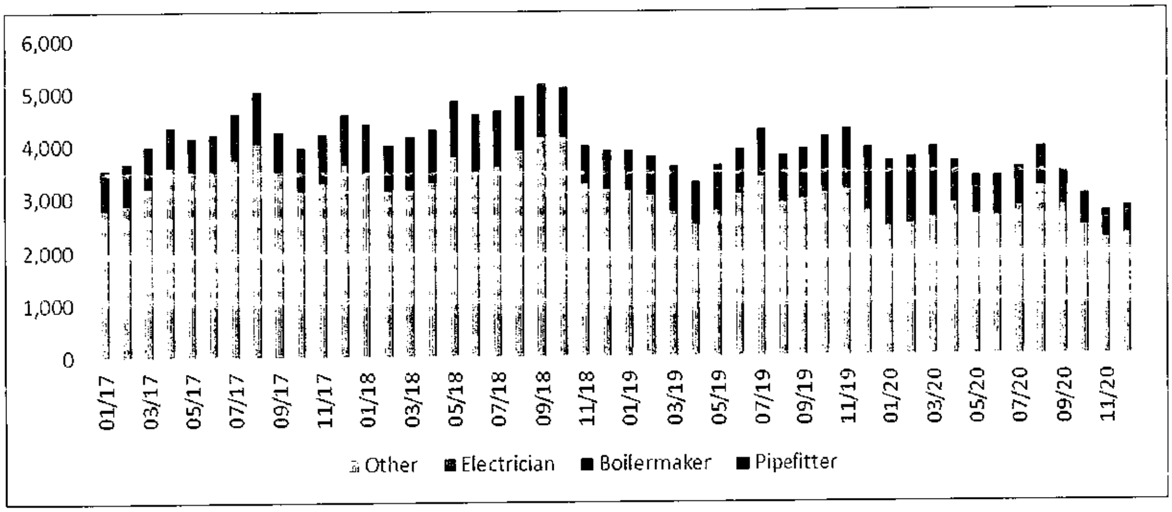


The CLMA estimates are for a standard 1,000 MW combined-cycle natural gas fired power plant built according to the construction schedule. They provide for an average of 328 jobs per year with total annual full-time equivalent jobs of 1,203, *in the trades.* (For details, please see Table 5 in Exhibit RG-2, which shows the breakdown of these jobs as per the CLMA estimates.) On page 28, lines 12-14 of his testimony, Hardy writes "The construction and operation of CREC alone – i.e., not including the electricity cost savings to the customer -- will create an average of more than 605 full-time jobs per year from 2018-2021…", but this includes indirect and induced effects that go beyond the type of direct employment described in the CLMA data, so the estimate is reasonable in light of the CLMA data.

Q. How do the jobs that will be created by the CREC fit with the prospective demand for the skilled trades going forward?

Recruiting skilled craft workers can become difficult in tight labor markets, and it is important to understand the timing of demand at the local level. An examination of the Rhode Island-wide demand for the skilled trades suggests a resetting of demand at the end of 2018. Noting that the ramp-up in jobs for CREC does not occur until the close of 2018, there is a dove-tailing in demand that could lend stability to the construction trades in Rhode Island over the years 2018-2020.

Figure 2: Direct Employment by Trade for Rhode Island Skilled Workers



Q. Are the jobs that will be provided by Invenergy LLC be well-paid with benefits?

Actual wage and benefits for skilled trade jobs at the CREC will be subject to negotiation under a Project Labor Agreement. However, there is information that bears on the question of compensation.

The Occupational Employment Statistics (OES) from the Bureau of Labor Statistics provide annual estimates of wages for individual occupations by state. For the construction trades, the dispersion between median and upper percentile wages is large, with the higher percentiles generally occurring in the commercial and industrial construction project types. In particular, industrial projects require very skilled workers, since, for example, the correct installation and testing of high voltage components and pressure vessels is extremely important. The result is substantial wage premia for these workers.

For a selected set of trades,

Table 1 presents differentials for Rhode Island workers. The crucial point is that, even if markets are tight and a skilled worker moves from one job to another at CREC, wages are likely to increase. Since benefits and related costs like workers compensation are usually calculated as percentages of wages, accepting a job to work on CREC will lift a worker's wage and benefits.

Table 1: Distributions of Wage Rates for Selected Trades in Rhode Island; 2016

Occupational Title	State	Median Hourly Wage	90th Percentile Hourly Wage	% Diff
Construction Occupations	RI	24.89	38.75	56%
Carpenters	RI	24.16	37.07	53%
Cement Masons	RI	25.12	36.56	46%
Construction Laborers	RI	20.45	29.99	47%
Electricians	RI	25.54	36.72	44%
Insulation Workers	RI	37.77	48.49	28%
Painters, Construction and Maintenance	RI	19.25	24.27	26%
Plumbers, Pipefitters, and Steamfitters	RI	28.56	47.00	65%
Sheet Metal Workers	RI	25.02	38.84	55%
Structural Iron and Steel Workers	RI	34.69	39.33	13%

Q. What socio-economic benefits will accrue to Rhode Island in conjunction with the direct, indirect and induced jobs, along with the associated increases in state incomes and output?

Construction of the CREC will produce a broad range of benefits to the local community and the state. Locally, CREC will support stable families and lift demand for housing by providing long-term employment via its operations and maintenance jobs. By adding a major ratable to the tax base, CREC will raise town revenues. State-wide, it will sustain demand for the skilled trades in late 2018 when construction employment might otherwise be slipping. Also state-wide, it will lower the cost of electricity and reduce the likelihood of outages, enhancing the attractiveness of Rhode Island to businesses. Finally, an efficient, load-following electric generating plant like

CREC will make it possible to reliably fill the gaps inherent in generation from renewable sources, making it easier for the state to reduce emissions. The tax revenue associated with CREC can fund public goods such as education, drug treatment, and recreational facilities, as decided in state and local budgeting processes. Public expenditures such as these strengthen the social fabric of the community.

Questions associated with the economic impacts of workers residing outside the state are likely moot. On page 3, lines 5-8 of his testimony, Michael F. Sabitoni, President of the Rhode Island Building and Construction Trades Council, writes:

> "If approved, this project will be constructed by hundreds of uniquely qualified skilled craftsmen and women from the seventeen (17) unions of the RIBCTC. Most of these workers will be from the local area. Moreover, the workers that work on this project will be deriving one-hundred percent (100%) of their household income from working on this facility."

Q. What will be the revenue impact of CREC on Rhode Island's tax receipts?

In terms of state revenues, CREC will make a significant contribution. Rhode Island derives income from taxing personal income at rates ranging from 3.75% to 5.99% and taxing corporate income at 9%. It imposes a sales tax of 7%. From these and other sources of revenue, Rhode Island will derive millions of dollars from the CREC.

All workers working in the State of Rhode Island owe personal income tax on their earnings at a marginal rate of 3.75%, up to an annual income of $60,550, and 4.75% for wages between $60,550 and $138,300. A conservative estimate of the impact of the CREC on state revenues due to the construction trades alone can gained by doing a few simple calculations. Based on the total 1,203 full-time construction jobs in the trades, assuming a work-year of 2,080 hours, and using the 90th percentile income from the 2016 Occupational Employment Survey for Rhode Island, each worker would contribute over $3,200 to state coffers, so that total gain to the state would be nearly $4.0 million. This estimate is for the trades alone, so adding the impacts of all additional direct, indirect and induced jobs, would create a much larger total. Specifically, jobs related to CREC would contribute state tax revenues of $30 million during construction, including $15 million in sales taxes, $11 million in individual income taxes, and $2 million in corporate income taxes, using data on the Rhode Island economy from the Census Bureau and the Federal Reserve, as well as our estimated $154 million in value added.[8]

4. RELATIVE IMPORTANCE OF THE INDUCED EFFECTS

Q. Did you do any calculations using the NREL's JEDI model, which Ryan Hardy and Edinaldo Tebaldi used to estimate local economic impacts of building and operating CREC?

Yes, briefly, in order to verify the reasonableness of those calculations. We populated JEDI with data on a generic combined cycle plant similar to CREC. We wanted to verify that the multipliers used to derive induced effects were reasonable. In NREL's definitions, this multiplier is the ratio of total effects to the sum of direct and indirect effects. We calculated the number for both output and value added[9], and for expenditures on both construction and operation. We found the following multipliers.

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[8] See https://www.census.gov/govs/state/ and https://fred.stlouisfed.org/series/RINGSP, accessed August 2, 2017.
[9] "Value added" is the amount by which the value of an article is increased at each stage of its production, exclusive of initial costs. When summed over the entire supply chain, it is a measure of final output.

Table 2: Multipliers on Direct and Indirect Effects of Construction and Operation of CREC

	Output	Value Added
Construction	1.37	1.33
Operation	1.30	1.28

Q. How do you know if these multipliers are reasonable?

One way to put the multipliers for value added in perspective is to evaluate what we call the corresponding "marginal propensity to leak". That is, the implied fraction of each dollar received in Rhode Island that is either spent out of state or saved. For the construction value added multiplier, the implied fraction is 0.25. For the operational output multiplier, the implied fraction is 0.22. We regard these as reasonable for the state of Rhode Island. The output multipliers are close to the value added multipliers, so we regard them as reasonable, as well.

5. LABOR-INTENSITY BY GENERATING TECHNOLOGY

Q. Did you estimate employment impacts over a larger area and for different generating technologies?

We examined the labor-intensity of different generating technologies on a national level. Table 3 shows the results of an analysis originally done in 2011 by Economic Insight, Inc. for PacifiCorp, based on the OECD and Beck data. It shows dollars of spending per annual full time equivalent worker by generating technology and capital, fuel, and operations and maintenance expenditure categories.[10] The lower the number, the more workers are employed per dollar of spending. In this analysis, combined cycle gas-fired generation employs more workers per dollar of spending than any other generating technologies, except solar photovoltaic and hydroelectric. The effects correspond to the direct and indirect effects estimated using JEDI, with a key

[10] Unfortunately, oil-fired generation is not included. On page 14, lines 14-15 of his testimony, Hardy writes that Clear River would primarily replace coal- and oil-fired generation.

difference: Whereas JEDI was used to estimate local impacts, these estimates apply even when the supply chain extends out of state. By this criterion, gas-fired generation is among the most labor-intensive of the technologies.

Table 3: 2016$ of Spending on Electric Generators Per Annual Full Time Equivalent Worker

	Capital	Fuel	O&M	Total
Geothermal Binary	$142,352		$153,545	$150,309
Wind	$143,020		$156,931	$150,339
Solar Thermal	$140,918		$170,049	$164,587
Solar PV	$119,016		$149,957	$132,784
Nuclear	$132,710	$311,366	$149,759	$165,017
Coal	$132,862	$166,109	$156,931	$156,222
Coal with CCS	$138,237	$166,109	$156,931	$156,812
Natural Gas	$139,994	$136,906	$156,931	$138,577
Biomass	$136,689	$157,868	$156,931	$154,779
Hydroelectricity	$120,565		$156,931	$129,233
U.S. Economy				$121,650

Q. If solar PV and hydro employ more workers per dollar spent, why not rely on those technologies, rather than natural gas?

On page 12, lines 8-11 of his testimony, Hardy explains that load-following gas-fired generation and intermittent solar generation are more complements in production of electricity than substitutes. Solar generation produces energy when the sun shines, and gas-fired generation fills in the gaps between that output and load. As to hydropower, in terms of overall employment impacts, it is superior to gas, but there are other considerations in deciding what source of power to rely on. In particular, suitable hydro sites and transmission routes for importation of hydropower are limited in supply.

Q. Is it a problem that only direct and indirect effects, and not induced effects, are estimated in Table 3?

No. Especially when comparing technologies, induced effects can reasonably be assumed to be similar.

Q. Should the Rhode Island EFSB be interested in employment impacts outside the state?

Hardy points out on page 22, lines 14-20 of his direct testimony that "[The Regional Greenhouse Gas Initiative] recognizes that greenhouse gas emissions are a global issue, and not a localized emissions issue," and that Rhode Island was a leader in making the initiative a reality. On page 38, lines 24-25, he writes, with his own emphasis: "The Resilient Rhode Island Act was enacted to help reduce overall *global* emissions regarding the *global* issue of climate change."

While local employment impacts may be of primary interest, just as Rhode Island's government is interested in the state's contribution to global emissions of CO_2, it is also worth noting that natural gas compares favorably to other generating technologies in terms of employment impacts, when one accounts for impacts within and beyond the Rhode Island state line.

Q. You said that the analysis was originally done in 2011. Have you updated it in any way?

We updated the price of natural gas and, insofar as it factors into the analysis, oil, as those elements are particularly relevant to the CREC project and volatile. We also replaced the Beck numbers with updated overnight capital and operations and maintenance costs for an advanced combined cycle plant from the EIA.[11]

Q. Does the result that natural gas compares favorably to other technologies in terms of employment impacts depend on the current, low price of gas persisting into the future?

No. We assume that the price of natural gas will be $6.50/MMbtu, in 2016 dollars. That is the levelized price of natural gas used in electric power generation from the EIA's *Annual Energy*

[11] See "Assumptions to the Annual Energy Outlook 2017", Table 8.2.

Outlook reference case forecast, which is often used in analysis throughout the energy industries. In that forecast, the 2017 price is $3.61/MMbtu (2016$), which is 59% lower than what we have assumed.

Q. Why, then, does natural gas compare favorably to other technologies in terms of employment impacts?

Gas-fired generation has large employment impacts that go beyond the generators themselves. First, natural gas pipeline construction creates a large number of jobs. Completion of the Algonquin Incremental Market (AIM) project notwithstanding, gas pipeline facilities in New England reach full loading during winter months. That CREC is being built as a dual fueled unit is in part a response to that constraint. It is reasonable to assume, then, that additional gas-fired generation will require additional pipeline capacity (and additional oil-fired generation may, as well). Some of these impacts will occur nearby. According to the Manhattan Institute,[12]

> Transportation costs are high for key materials used in exploration, drilling, and the construction of gas-processing plants and pipelines. Therefore, support industries, including well support, steel, sand and gravel, concrete, trucking, and scientific and engineering services, often arise locally. Most of these support activities are not easily outsourced to foreign suppliers. (p. 5)

Second, advances in hydraulic fracturing for shale gas have made the process of extraction more labor-intensive.

> As is not true of conventional oil and gas wells, shale energy output declines steeply during the first few years of production. As a result, operators must be continually drilling new wells. If the market price is strong, the large initial output generates high rates of return and

[12] Considine, T.J., Watson, R.W., and Considine, N.B. The Economic Opportunities of Shale Energy Development. *Energy Policy and the Environment* No. 9, Manhattan Institute, May 2011.

> continuous incentives to keep drilling. This is one reason that regional economies with shale plays are enjoying a boom in job creation, tax revenues, and income growth. (p. 1)

This is not to say that hydraulic fracturing is without environmental risks, but the focus of our testimony is on employment.[13] Upstream labor-intensity, not accounted for in Hardy and Tebaldi's estimates, will rise over time as shale gas replaces conventional gas.

> …the labor-intensive aspects of shale gas development accelerate over time and can persist for decades, if the reserves in place are large enough. (p. 5)

Q. Did you use these sources to estimate the employment impacts of CREC?

Yes. Table 6, included as Exhibit MV-2, shows nationwide employment impacts based on the OECD and Beck data by OECD industrial category. We assume a plant factor of 65%. We have endeavored to report impacts on the same temporal basis as Hardy and Tebaldi, but the "annual" impacts of operations on employment in pipeline transport should be interpreted loosely, as most of that employment occurs in the construction, rather than operations, of the pipelines.

Q. In light of the estimates in Table 6, do you regard Hardy's estimates of the local employment impacts of CREC as reasonable?

Yes, we do. On page 5, lines 18-21 of his testimony, Tebaldi reports estimates that construction and operation of CREC will create more than 605 jobs per year during 2018-2021, and 129 jobs per year in operations thereafter. These numbers include direct, indirect, and induced effects, but not the effects of lower electricity prices. Using the OECD and Beck data, suppose that, in construction, one counts a fourth of electrical and optical equipment and electrical machinery and apparatus not elsewhere classified, and all of fabricated metal products, except machinery and equipment, construction, and finance, insurance, real estate and business services as local.

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[13] The Environmental Protection Agency's final report on the impacts of hydraulic fracturing on drinking water resources is available at https://cfpub.epa.gov/ncea/hfstudy/recordisplay.cfm?deid=332990, accessed August 2, 2017.

Then, the estimates in Table 6 imply that construction and operation of CREC would create 852 jobs per year, directly and indirectly, locally, during 2018-2021. The 852 does not include any of the induced effects in Hardy and Tebaldi's estimate of 605.

This result comports with the assessment of The Rhode Island Statewide Planning Program:

> "...the magnitude of the employment, earnings, and economic output benefits described by Invenergy are reasonable, or even low, and consistent with a finding of positive economic impact for the state."[14]

Suppose, in operation, one counts half of electrical and optical equipment and electrical machinery and apparatus not elsewhere classified, three fourths of sale, maintenance and repair of motor vehicles and motorcycles - retail sale of automotive fuel, transport and storage, and computer and related activities, and all of electricity, gas, and water supply as local. Then, the estimates in Table 6 imply that operation of CREC after 2021 would create 89 jobs per year, which also does not include any of the induced effects included in Hardy and Tebaldi's estimate of 129.

Q. Did you calculate corresponding estimates of value added?

Yes. Using the OECD and Beck data by industry and capital expenditure category, corresponding direct and indirect local impacts of construction and operations are about $116 million per year for 2018-2021. Applying the multiplier 1.33 from Table 2 gives total (direct, indirect, and induced) impacts on value added of about $154 million. This does not include any effects of lower electricity prices, which are included in Hardy and Tebaldi's estimated $133 million per year effect on output for 2018-2021 on page 28, line 21 of Hardy's direct testimony. Table 4 summarizes local impacts on employment during the construction years from the different sources.

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[14] See Tebaldi's testimony, page 7, lines 8-10.

Table 4: Impacts on Annual FTE in Rhode Island 2018-2021

Source	Direct	Direct and Indirect	Direct, Indirect, and Induced	Lower Electricity Prices
CLMA	328			
OECD/Beck		852		
JEDI			605	
IMPLAN				75

Q. How do your results depend on your assumptions about construction lead time?

The base case assumption is that the first half of CREC would be built and commence operations in 29 months, and the second half would require an additional 12 months. According to Table 8.2 of the EIA's "Assumptions to the Annual Energy Outlook 2017", lead time for a 429 MW advanced combined cycle plant is 36 months. Accordingly, we might alternatively assume that the 970 MW CREC facility would require 53 months to construct. If so, construction and operation of CREC would create 619 jobs per year, directly and indirectly, locally, during 2018-2022, and about $112 million per year in value added, compared to which Hardy and Tebaldi's estimates are still reasonable. Allowing longer lead time also implies that there would be less pressure to fill construction jobs with workers from out of state, and that the jobs filled by Rhode Islanders would be longer in duration.

Q. How were the OECD and Beck data used to make these estimates?

Please see the technical appendix.

Q. Does this conclude your direct testimony?

Yes, it does.

7. TECHNICAL APPENDIX

Q. How are dollars per job calculated in the Economic Insight analysis?

The following discussion accompanies the analysis.

We begin with costs of capital, fuel, and O&M used to produce electric power by generating technology, from the Energy Information Administration (EIA) and other sources. We would like to estimate the total labor associated with production of that power and divide the costs by the labor to estimate the jobs associated with spending on the different technologies. We have a good idea which industries contribute labor to production of electric power for each generating technology, but we do not know how much labor each industry contributes, or the sum of those contributions. We describe a method here that uses data on value added and employment from the Organization for Economic Cooperation and Development (OECD), together with estimated costs from a study[15] done by R.W. Beck for EIA, to approximate the sum of those contributions and, therefore, dollars of spending per job.

We calculate dollars per unit of labor used to produce a "final" good as a weighted average of dollars per unit of labor in the industries that contribute intermediate goods. The method has two significant limitations. The first is that available data do not conform precisely to the cost streams (e.g. fuel costs of natural gas-fired generators) whose employment effects we would like to estimate. The adaptation is to use data for industries that overlap with those cost streams, or for industries where labor employs similar skills and physical capital. Industries that compete for labor with those feeding into generation using a technology of interest are good candidates. The second limitation is that we assume that value added per unit of labor employed in each

[15] "Updated Capital Cost Estimates for Electricity Generating Plants", prepared by R.W. Beck for the U.S. Department of Energy, Energy Information Administration, Office of Energy Analysis, November 2010.

industry is the same when producing intermediate goods used for electric power as when industry output is used to produce other goods.

The OECD STAN database provides valued added, employment, and labor compensation, among other data, for a large number of industrial categories. Using these, we have constructed data on value added per unit of labor for the industrial categories relevant to generation of electric power. We express cost per unit of labor contributed to production of one unit of a "final" good (e.g. natural gas delivered to a combined cycle generator) as a weighted average of value added per unit of labor employed producing each intermediate good (e.g. pipeline transport of natural gas):

$$\sum_{i=1}^{N} \frac{P_i Q_i}{L_i} a_i = \frac{\sum_{i=1}^{N} P_i Q_i}{\sum_{i=1}^{N} L_i} \tag{1}$$

$$\sum_{i=1}^{N} a_i = 1 \tag{2}$$

where there are N intermediate goods; a_i is the weight assigned to Intermediate Good i; P_i is its price *net of costs for preceding intermediate goods used to produce* Q_i units; L_i is the labor contributed to produce Q_i; and $P_i Q_i / L_i$, then, is value added per unit of labor. Value added over all intermediate goods equals cost of the final good, $C \equiv \sum_{i=1}^{N} P_i Q_i$.

For example, C could be fuel costs for electric power produced using natural gas, one of the $P_i Q_i$s could be the value added to production of that power from pipeline transport, and the corresponding L_i the labor contributed to transport the gas. From the OECD STAN database, we have value added per unit of labor, $P_i Q_i / L_i$, for "land transport - transport via pipelines", and we have a forecast of costs for fuel from the EIA, the value for C. Thus, we have all but one of the data needed to quantify the weight we assign to value added per unit of labor for Intermediate Good i:

$$a_i = \frac{1}{N}\left(\frac{L_i}{P_iQ_i}\Big/\frac{L}{C}\right) = \frac{L_i}{L}\frac{C}{N \times P_iQ_i} \tag{3}$$

where L is the sum of all labor contributed; $\sum_{i=1}^{N} L_i = L$. L is the datum we do not know before the fact, but we choose it to satisfy (2). In calculating this weighted average, dollars per unit of labor, P_iQ_i/L_i, are weighted in direct relation to units of labor per dollar. Plugging (3) into (1) gives

$$\begin{aligned}\sum_{i=1}^{N}\frac{P_iQ_i}{L_i}a_i &= \sum_{i=1}^{N}\frac{P_iQ_i}{L_i}\frac{L_i}{L}\frac{C}{N \times P_iQ_i} \\ &= \sum_{i=1}^{N}\frac{C}{LN} = N \times \frac{C}{NL} \\ &= \frac{C}{L}\end{aligned}$$

C/L is dollars of spending per unit of labor used to produce the final good, and multiplying it by the number of units of labor that constitute a "job" gives dollars per job.

Once the a_i's and L are known, employment impacts by industry can be derived using $L_i = La_i$. Value added is given by multiplying employment impacts by the weighted average of spending per job across expenditure categories from the Beck study.

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Exhibit RG-1 Curriculum Vitae
Ralph Gentile

Current Affiliations:
Research Associate, Institute for Construction Economic Research, Lansing, Michigan.
Principal Economist, Construction Labor Market Analyzer (myCLMA), Lexington, Kentucky.

Experience:
Principal Economist, (2015-present)
Construction Labor Market Analyzer
Forecasted skilled trade wage escalation rates for companies planning multi-year projects.
Analyzed and updated market prospects for petroleum, natural gas and commodity chemicals.

Senior Economist (1993-2014)
Research & Analytics Group, McGraw-Hill Construction
Wrote and maintained econometric models to forecast construction.
Produced detailed quarterly forecasts and special studies.
Designed and maintained databases for very large construction projects
Areas of Research:
Large Project Forecasts –methodology for using Dodge Reports information to forecast construction projects ($5+ million) to start.
Skilled Trades Forecasts – tool for estimating state and national demand for individual construction trades using occupational employment, census of construction, and Dodge starts data.
Product Demand Studies – designed methods to forecast demand for building products based on federal (input-output, economic census, put-in-place, and other) data.

Economist
Real Estate Analysis and Planning Service, McGraw-Hill Construction. (1989-1993)
Modeled and forecasted construction, rents and absorption for commercial and residential real estate in fifty metropolitan areas for the Real Estate Analysis and Planning Service. Also responsible for forecasting commercial and institutional building at the regional and national levels.

Assistant Professor.
Department of Economics, University of Massachusetts, Lowell, MA. (1984-1989)
Taught courses in microeconomics, macroeconomics, econometrics, statistics, and quantitative methods to undergraduate and graduate students. Conducted research on the geographic mobility for scientists, engineers and technical workers.

Research Associate (1981-1984)
Regional Science Research Center, Cambridge, MA
Responsible for providing research support for input-output models, methods and forecasts

Education:

1981 Ph.D. University of Pennsylvania, Philadelphia, Pennsylvania
1976 M.A. University of Pennsylvania, Philadelphia, Pennsylvania

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Exhibit RG-1 Curriculum Vitae
Ralph Gentile

1973 B.A. Haverford College, Haverford, Pennsylvania

Selected Publications and Reports:

Skilled Trades Employment in the Pipeline Industry: 2006-2015. Institute for Construction Economic Research. June 2017.

State Economic, Wage and Per Diem Forecasts for Selected Construction Trades, 2016Q3, (Louisiana, Texas, and Beaumont-Port Arthur). Construction Labor Market Analyzer, (forthcoming), September 2016.

Natural Gas Prices and Construction. Oil and Gas Report #6, Construction Market Analyzer, July 2016.

Construction Prospects in the Intermediate and Long-Run. Oil and Gas Report, Construction Labor Market Analyzer, May 2016.

Employment, Wages, and Market Share Estimates for the National Association of Construction Boilermakers Employers - Great Lakes Division. Construction Labor Market Analyzer, April 2016.

State Economic, Wage and Per Diem Forecasts for Selected Construction Trades, 2016Q2, (Louisiana, Texas, and Beaumont-Port Arthur). Construction Labor Market Analyzer, February 2016.

The Industrial Recession: How Bad? Oil and Gas Report #4, Construction Labor Market Analyzer, February 2016.

Wage and Per Diem Forecasts for Selected Construction Trades, 2016Q1, (Louisiana, Texas, and Beaumont-Port Arthur). Construction Labor Market Analyzer, February 2016.

Reading the Tea Leaves: Capital Spending Along the Gulf Coast. Oil and Gas Report, Construction Labor Market Analyzer, November 2015.

Act Two: Low Energy Prices and Construction. Oil & Gas Report #2, Construction Labor Market Analyzer, September 2015.

Wage and Per Diem Forecasts for Selected Construction Trades, 2015Q3, (Louisiana, Texas, and Beaumont-Port Arthur). Construction Labor Market Analyzer, August 2015.

Wage and Per Diem Forecasts for Selected Construction Trades, 2015Q1, (Louisiana, Texas, and Beaumont-Port Arthur). Construction Labor Market Analyzer, February 2015.

Presentations and Older Reports:

Wage Escalation Rates for the Skilled Construction Trades – Some Practical Issues and Modeling Considerations. ICERES Research Symposium, July 21, 2016.

Improving Construction Demand Analytics. A Presentation. National Institute of Building Sciences, Washington, DC (December 12-13, 2013).

Transportation Infrastructure: Gearing Up for Change. *A McGraw-Hill Construction Special Report:* Principal in multiple author study. McGraw-Hill Construction Research and Analytics, (October 2009).

Forecasting Construction Labor Demand—A Working Model. *Paper Presented at Construction Economics Research Network, Washington, DC.* (December 6th, 2007).

Associations & Memberships: American Economic Association, National Association for Business Economics.

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Education

Ph.D. in Economics, Brown University, Providence, RI, 2006

M.A. in Economics, Brown University, Providence, RI, 1999

B.A. in Economics with departmental honors, University of Oregon, Eugene, OR, 1986

Consulting Experience

Consulting Economist, Nashua, NH and Portland, OR, January 2010 – present

- Affiliated with Birch Energy Economics, Post Falls, ID, July 2015 – present
- Affiliated with Economic Insight, Sisters, OR, January 2010 – January 2013
- Used AURORAxmp® (xmp) to forecast wholesale electric prices in Michigan and sponsored testimony on behalf of Michigan Public Service Commission staff
- Recent work in newly restructured wholesale power market in Mexico
  - Used xmp to model expansion and operation of wholesale power grid for independent generators
  - Estimated Herfindahl-Hirschman indices of market concentration
  - Forecasted hourly loads and prices for power
  - Developed methodology and forecasted prices for clean energy certificates,
  - Developed methodology and forecasted prices for ancillary services
  - Adapted methodology and forecasted costs of congestion in a "zonal" model
- Used xmp to model electric resource planning in the Pacific Northwest
- Used xmp to estimate trade benefits of Entergy and South Mississippi Electric Power Association joining regional transmission organizations, sponsored testimony before the Mississippi Public Service Commission (MPSC)
- Assessed application to install pollution controls on coal plant; testified before the MPSC

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- Estimated dollars of spending per employee by generating technology
- Analyzed issues regarding pricing and royalties in geothermal and natural gas leases in California and Texas;
- Analyzed pricing and alleged use of market power in California power crisis
- Edited several scholarly articles written by non-native speakers of English
- Estimated lost earnings in a wrongful death lawsuit and testified to report
- Edited scholarly research written by non-native speakers of English

Assistant consulting economist to personal injury and wrongful death litigants, Allan M. Feldman, Providence, RI, 2002-2003

- Worklife evaluation for litigation related to personal injury or wrongful death

Research Associate, Synapse Energy Economics, Cambridge, MA, July 1998 - February 1999

- Evaluated forecasts of electricity prices submitted in "stranded-cost" claim by four Maryland utilities

Associate Economist, Economic Insight, Portland, OR, May 1988 - September 1988

- Surveyed forecasts of electricity prices and estimates of demand elasticities related to litigation over Washington Public Power Supply System bond defaults

Technical Assistant, ECO Northwest, Eugene, OR, July 1986 - August 1987

- Worklife evaluation for litigation related to personal injury and wrongful death; wrote company training manual on the subject

TEACHING EXPERIENCE

Visiting Assistant Professor of Economics, Universidad del Pacifico, Jesús María, Lima, Peru, September 2014

- Taught topical graduate course in Energy Economics

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Visiting Assistant Professor of Economics, Pacific University, Forest Grove, OR, August 2008 - May 2009

- Taught principles of microeconomics, environmental economics, and international trade

Lecturer in Economics, Eastern Connecticut State University, Willimantic, CT, August 2005 - May 2006

- Taught principles of microeconomics

Teaching Assistant to Harl Ryder and others, Brown University, Providence, RI, September 1999 - May 2002

- Teaching Assistant for Principles of Micro- and Macroeconomics
- **Teacher, English as a Second Language**, Changsha Normal University of Water Resources and Electric Power, Changsha, Hunan, PRC, August 1987 - January 1988, Brown University, Providence, RI, Summer 2001

<u>GOVERNMENTAL EXPERIENCE</u>

Associate Economist, New York Department of Public Service, Albany, NY, August 2006 - December 2007

- Projects in energy conservation and pollution control

Industry Economist, Bonneville Power Administration, Portland, OR, May 1994 - June 1997

- Authored and testified to marginal cost analysis in 1996 rate case
    - Helped prepare inputs to and interpreted and applied results of Power Marketing Decision Analysis Model (PMDAM) to rate design and to planning and evaluation of generation and conservation resources
    - Prepared and conducted public meetings on analysis and its implications for rate design
    - Fielded and incorporated comments from a variety of participants

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- Authored rate case study, documentation, and testimony

Public Utilities Specialist, Bonneville Power Administration, Portland, OR, September 1988 - May 1994

- Conducted research on marginal costs of generating and marketing hydropower on the West Coast
- Prepared workshop briefing material, rate case studies, and documentation supporting Marginal Cost Analysis and other rate-related issues as assigned
- Evaluated contracts for disposition of wholesale power

RESEARCH

Title	Status	Availability
OPEC's Kinked Demand Curve	(2017) *Energy Economics*, 63, pp. 272-287.	https://doi.org/10.1016/j.eneco.2017.02.010
Macroeconomic Risk and Residential Rate Design	International Association for Energy Economics (IAEE) Working Paper No. 15-208; under review	http://ssrn.com/abstract=2596258
Social Discounting with Diminishing Returns on Investment	Under review	http://ssrn.com/abstract=1078502
The Impact of International Trade on Electric Loads in Mexico	IAEE Working Paper No. 17-301; non-technical version published in IAEE Energy Forum	http://ssrn.com/abstract=2928817 https://www.iaee.org/en/publications/newsletterdi.aspx?id=406
Stockpiling to Contain OPEC	Dissertation chapter; IAEE Working Paper No. 17-136; presented at 12/08 IAEE conference in New Orleans	http://ssrn.com/abstract=912311
OPEC's Demand Curve	Dissertation chapter; reviewed at http://knowledgeproblem.com/2008/05/14/	http://ssrn.com/abstract=1127642
The Cause and Effect of Exclusionary Zoning in Central Cities	Dissertation chapter; under review	http://ssrn.com/abstract=636962

Research Assistant to Allan M. Feldman, valuation of individual earning capacity, Brown University, 2000

Research Assistant to J. Vernon Henderson, industrial location in Indonesia, Brown University, Summer 1999

AWARDS

- Twelve monetary awards for job performance at Bonneville Power Administration
- Award for best undergraduate research project in economics at University of Oregon; examined deregulation of U.S. airline industry

OTHER ACTIVITIES

Monitored the House Science, Technology, and Energy Committee in Concord, NH for the Northeast Energy and Commerce Association

Peer Reviewer for *Land Economics*: effects of endowments of petroleum resources on corruption, 2008; hedging in coal contracts under the acid rain program, 2010-11; suburban agriculture as an amenity, 2012; prorationing versus unitization in the U.S. petroleum industry in the 20th century

Founded and Managed "Micro Lunch" seminar, Brown University, 2001-2002

Role of Expert Witness in Lewis & Clark Law School's mock personal-injury litigation, 1996

Peer Advisor, Department of Economics, University of Oregon, 1984-1986

MEMBERSHIPS

American Economic Association; Association for Christian Economists; International and United States Associations for Energy Economics; Northeast Energy and Commerce Association; National Association of Forensic Economics; Editorial Freelancers Association

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Exhibit RG-2

Table 5: Direct Employment by Trade in Construction of CREC

Craft	1/18	2/18	3/18	4/18	5/18	6/18	7/18	8/18	9/18	10/18	11/18	12/18	1/19	2/19	3/19	4/19	5/19	6/19	7/19	8/19	9/19	10/19	11/19
Boilermaker	0	0	0	0	0	0	0	0	0	2	3	5	8	12	15	22	29	34	51	67	83	98	108
Boilermaker Welder	0	0	0	0	0	0	0	0	0	0	0	3	3	6	9	15	21	26	42	57	74	91	102
Carpenter (Scaffold Builder)	0	0	0	0	16	32	32	32	32	32	31	31	30	30	29	28	27	26	25	24	23	22	21
Concrete Finisher / Cement Mason	0	0	17	52	69	69	68	66	65	62	60	58	56	52	50	46	44	42	37	34	31	29	27
Craft Helper	0	0	0	0	17	35	36	38	39	40	41	41	43	43	44	44	45	45	46	46	46	45	46
Electrician	0	0	0	0	0	0	0	0	0	0	0	35	36	39	41	77	80	81	84	86	87	87	88
Instrumentation Technician	0	0	0	0	0	0	0	0	0	0	0	8	8	8	8	16	17	17	18	18	18	18	19
Insulator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	9	10
Ironworker (Reinforcing)	0	0	20	60	80	78	75	68	63	55	48	42	36	21	19	14	13	11	0	0	0	0	0
Ironworker / Welder (Structural)	0	0	0	0	0	0	17	18	35	38	38	40	41	42	42	43	43	43	42	41	40	39	38
Laborer	4	5	6	6	6	7	8	9	9	10	10	11	11	12	12	12	12	12	13	12	12	12	12
Lineman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Millwright	0	0	0	0	0	0	0	0	0	0	0	0	5	13	16	19	29	36	43	50	55	60	65
Operator (Heavy Crane)	0	0	0	0	0	0	0	5	5	11	11	12	12	13	13	13	13	13	13	13	13	13	13
Operator (Heavy Equipment)	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Painter	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	3	5	7	9	11	13
Pipefitter	0	0	0	0	0	0	0	0	0	0	0	14	15	16	16	31	32	33	34	35	36	36	36
Pipefitter / Combo Welder	0	0	0	0	0	0	0	0	0	0	0	15	16	17	18	34	35	36	37	38	39	39	39
Sheet Metal Worker	0	0	0	0	0	0	0	0	0	3	3	3	6	7	8	9	10	10	13	13	14	15	16
Sum	11	12	50	125	196	228	242	243	255	261	255	325	335	339	348	435	461	478	511	553	595	633	660

Exhibit RG-2

Table 5: Direct Employment by Trade in Construction of CREC (continued)

Craft	12/19	1/20	2/20	3/20	4/20	5/20	6/20	7/20	8/20	9/20	10/20	11/20	12/20	1/21	2/21	3/21	4/21	5/21	6/21	7/21	8/21	Average
Boilermaker	116	31	43	55	62	68	81	85	88	89	0	0	0	0	0	0	0	0	0	0	0	23
Boilermaker Welder	111	25	36	49	56	64	79	84	88	90	0	0	0	0	0	0	0	0	0	0	0	20
Carpenter (Scaffold Builder)	19	19	17	16	16	14	13	13	8	7	7	7	6	6	6	5	5	4	4	4	0	23
Concrete Finisher / Cement Mason	17	16	14	13	12	11	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	45
Craft Helper	45	44	44	43	43	41	41	41	22	22	21	21	21	20	20	19	19	18	18	17	0	34
Electrician	87	87	86	84	83	80	63	45	44	43	42	41	41	39	38	37	35	17	0	0	0	36
Instrumentation Technician	19	19	19	19	19	18	18	18	17	10	10	9	9	9	9	9	8	8	8	8	8	8
Insulator	13	15	17	23	25	26	18	10	11	13	15	16	17	18	19	19	19	10	0	0	0	1
Ironworker (Reinforcing)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
Ironworker / Welder (Structural)	21	21	20	19	19	19	17	17	16	0	0	0	0	0	0	0	0	0	0	0	0	28
Laborer	11	11	10	10	9	9	8	8	8	5	5	4	4	4	4	3	3	3	3	3	2	10
Lineman	0	0	0	0	0	50	55	60	0	0	0	0	0	0	0	0	50	55	60	56	0	0
Millwright	69	71	76	34	36	37	40	41	42	44	45	45	45	0	0	0	0	0	0	0	0	17
Operator (Heavy Crane)	12	7	7	7	6	6	6	6	6	5	0	0	0	0	0	0	0	0	0	0	0	8
Operator (Heavy Equipment)	8	8	7	7	7	7	5	4	4	4	4	4	3	3	3	3	3	2	0	0	0	8
Painter	18	22	27	32	33	34	23	11	12	16	20	21	23	26	27	27	27	14	0	0	0	2
Pipefitter	37	36	36	36	36	36	35	35	34	19	18	18	18	18	17	17	17	16	16	16	15	15
Pipefitter / Combo Welder	39	39	39	38	38	37	37	36	20	20	20	19	19	18	18	18	17	17	16	15	0	16
Sheet Metal Worker	17	17	18	8	9	9	9	9	10	10	10	10	10	0	0	0	0	0	0	0	0	6
Sum	660	488	515	493	509	568	560	531	439	397	216	216	216	162	160	159	203	164	126	119	24	328

RIBCTC 7

Exhibit MV-2

Table 6: Nationwide Employment Impacts of CREC

(annual full time equivalent worker)

OECD Industrial Category	Construction (Total)	Operation (Annual)
C11 Extraction of crude petroleum and natural gas and related services	0	549
C24X Chemicals excluding phamaceuticals	0	10
C28 Fabricated metal products, except machinery and equipment	183	0
C30T33 Electrical and optical equipment	478	21
C31 Electrical machinery and apparatus, n.e.c.	3,238	20
C40T41 ELECTRICITY, GAS AND WATER SUPPLY	0	5
C45 CONSTRUCTION	1,013	0
C50 Sale, maintenance and repair of motor vehicles and motorcycles - retail sale of automotive fuel	0	27
C60T63 Transport and storage	0	28
C60 Land transport - transport via pipelines	0	1,103
C65T74 FINANCE, INSURANCE, REAL ESTATE AND BUSINESS SERVICES	1,193	0
C65 Financial intermediation, except insurance and pension funding	550	0
C71 Renting of machinery and equipment	283	0
C72 Computer and related activities	0	19
MLTECH Medium-low technology manufactures	143	0
Sum	7,082	1,783

RIBCTC 8

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

RE: SB 2015-06, INVENERGY THERMAL DEVELOPMENT, LLC APPLICATION TO CONSTRUCT AND OPERATE THE CLEAR RIVER ENERGY CENTER IN BURRILLVILLE, RHODE ISLAND

Rebuttal testimony of Marc H. Vatter

Executive Summary

Q. What is the purpose of your testimony?

I comment on some aspects of the testimonies of Robert M. Fagan, a witness for the Conservation Law Foundation, and Glenn C. Walker, a witness for the town of Burrillville.

Q. Please summarize your comments on Mr. Fagan's testimony.

I comment on his direct testimony and focus on two issues:

1) Mr. Fagan plays down the effects of economic growth on load growth, especially the role of the Great Recession in the slowdown in load growth since 2006. He emphasizes the roles of energy efficiency and behind-the-meter solar photovoltaic generation (BtM PV) in lowering net loads since 2006. I argue that energy efficiency is important, but that the macroeconomy is more important to the accuracy of predictions of load. Neither the ISO nor any other observer expects the Great Recession to be repeated in the near future, and load growth will be correspondingly more rapid, contributing to the anticipated need for CREC. I also suggest that the ISO's assumptions regarding economic growth going forward may still be on the pessimistic side, so the need for CREC may be greater than anticipated.

2) In assessing the need for CREC, Mr. Fagan focuses on annual peak and energy loads, to the exclusion of the need for dispatchable generation, other than, by implication, Canadian hydropower, to fill the gaps between intermittent solar and wind generation and load. I argue that a combination of gas-fired generation and Canadian hydropower is the least expensive complement to intermittent renewables in New England.

Q. Please summarize your comments on Mr. Walker's testimony.

I comment on Mr. Walker's initial and supplemental testimonies. Regarding his initial testimony, I question two points:

1) I question his forecast for the "next several" ISO forward capacity auctions (FCAs). He forecasts capacity prices of $5.00-$6.00/kw-mo, and that CREC will not be awarded a capacity supply obligation (CSO). His forecast is partly based on prices and supply and demand conditions in FCAs 10 and 11, but ignores the much higher prices that obtained in FCAs 8 and 9, and any trend in capacity prices since the auctions began. I argue that CREC will be a competitive source of capacity at prices below trend.

2) I challenge his argument that "CREC's fast start, ramping, and flexibility characteristics" will be supplanted by energy storage technologies during the 2020s. I argue that gas-fired generation will remain a less expensive way to integrate intermittent solar and wind generation into the generating fleet.

Regarding his supplemental testimony, I criticize a fallacious argument that a resource must clear a capacity auction to be needed, and challenge his assumption that the capacity factor for clean generation is 90%. A typical capacity factor for solar generation is a little over 20%, and below 50% for wind.

1. INTRODUCTION

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

My name is Marc H. Vatter, Ph.D., Consulting Economist. My address is 9 Underhill Street, Nashua, NH 03060.

Q. On whose behalf are you testifying?

My testimony is on behalf of the Rhode Island Building and Construction Trades Council (RIBCTC) in support of the Invenergy Thermal Development LLC (Invenergy) application for a license from the Rhode Island Energy Facilities Siting Board (RIEFSB) to construct the Clear River Energy Center (CREC) project in Burrillville, Rhode Island.

Q. Please describe your educational background and your professional experience.

I am a consulting economist with extensive experience in the electric utility industry. My most recent work includes production cost modeling of the electric power grid in Mexico using AURORAxmp® and testimony before the Michigan Public Service Commission. I have sponsored testimony before several regulatory commissions on rates, plant additions, etc. (My curriculum vitae is included as Exhibit 1.)

Q. What is the purpose of your testimony?

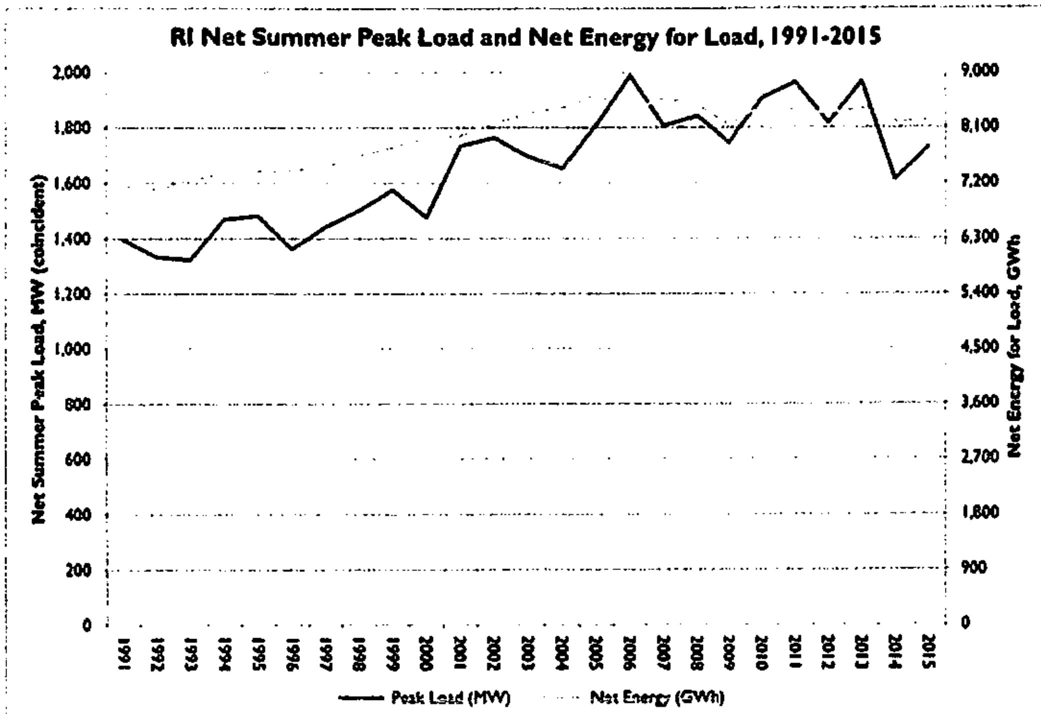
I comment on some aspects of the testimonies of Robert M. Fagan, a witness for the Conservation Law Foundation, and Glenn C. Walker, a witness for the town of Burrillville.

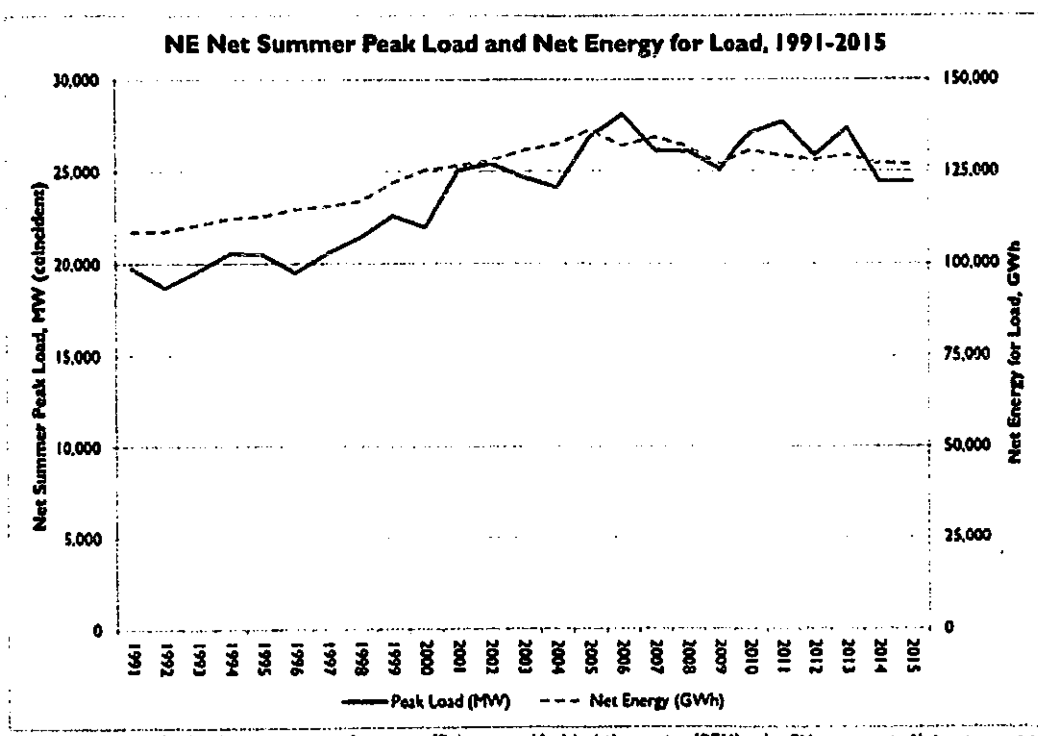
2. COMMENTS ON THE TESTIMONY OF ROBERT M. FAGAN

Q. Please comment on Mr. Fagan's lack of attention to the effects of economic growth on load growth.

Mr. Fagan testifies that CREC will not be needed because load growth in New England and Rhode Island have leveled off and begun to trend down. He includes the following graphs on pages 14 and 15, reprinted here as Figure 1.

Figure 1: Graphs reprinted from direct testimony of Robert Fagan





Note: Net energy for load is energy net of energy efficiency and behind-the-meter (BTM) solar PV resources. Net summer peak load is summer coincident peak load, net of the effects of energy efficiency and BTM solar PV. Source: ISO NE, 2016 CELT.

The graphs show loads rising from 1991 until 2006 and leveling off and turning down from 2006 to 2015. According to Mr. Fagan, "The figures show that for both Rhode Island, and New England as a whole, net electricity load has flattened (both summer net peak load, and annual net energy), and has begun to trend downward over the past decade, contrary to the assertion made by Invenergy." (page 14, lines 3-5) He attributes this primarily to rising acquisition of energy efficiency resources and BtM PV:

> Q. What is the cause of the change to the often-heard conventional wisdom that electric load is growing?
>
> A. There are multiple factors, but two dominating factors are Rhode Island's increasing investment in energy efficiency resources, and its investment in behind-the-meter solar PV resources. Rhode Island also has significant levels of utility-scale solar PV resources, in addition to its behind-the-meter solar PV resources. (page 15, lines 7-12)

Q. Do you agree that energy efficiency and BtM PV were the "dominating factors" in the slowdown in load growth?

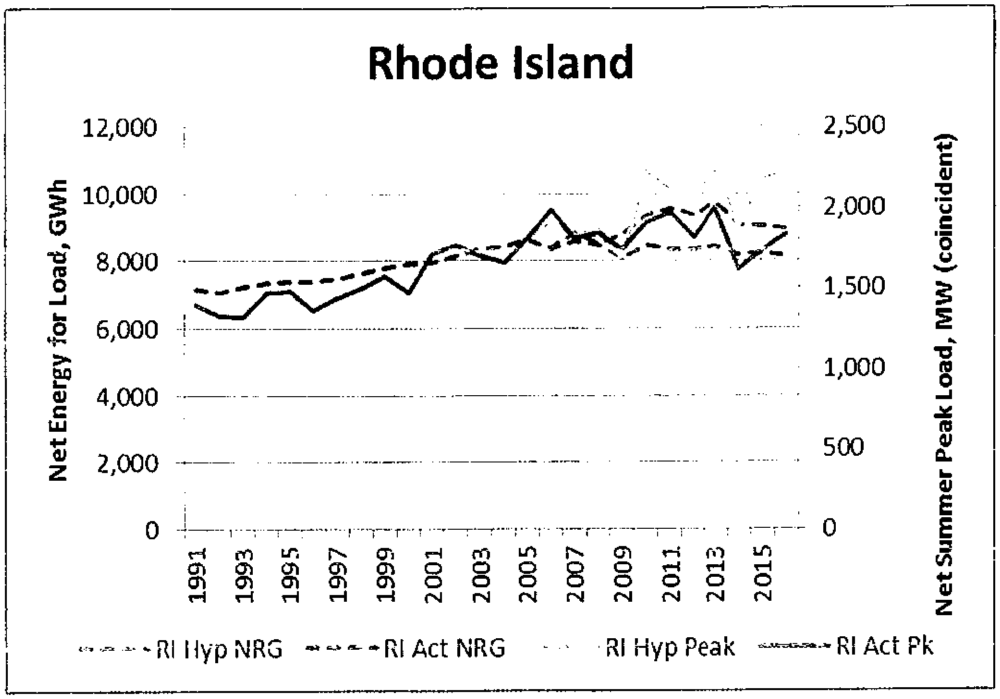
No, I do not. Among the "multiple factors" that Mr. Fagan does not specify is slower economic growth associated with the Great Recession. Using the data used in the New England ISO's CELT model[1], real gross state product (GSP) in Rhode Island grew at an average annual rate of 2.75% from 1991 to 2006, but only 0.02% from 2006 to 2015. Total GSP for New England grew at an average annual rate of 2.91% from 1991 to 2006, but only 0.57% from 2006 to 2015. When I analyze CELT data statistically, I find that both energy efficiency and real GSP are highly statistically significant factors influencing annual energy and peak load, but that information on real GSP adds more to the accuracy of predictions of

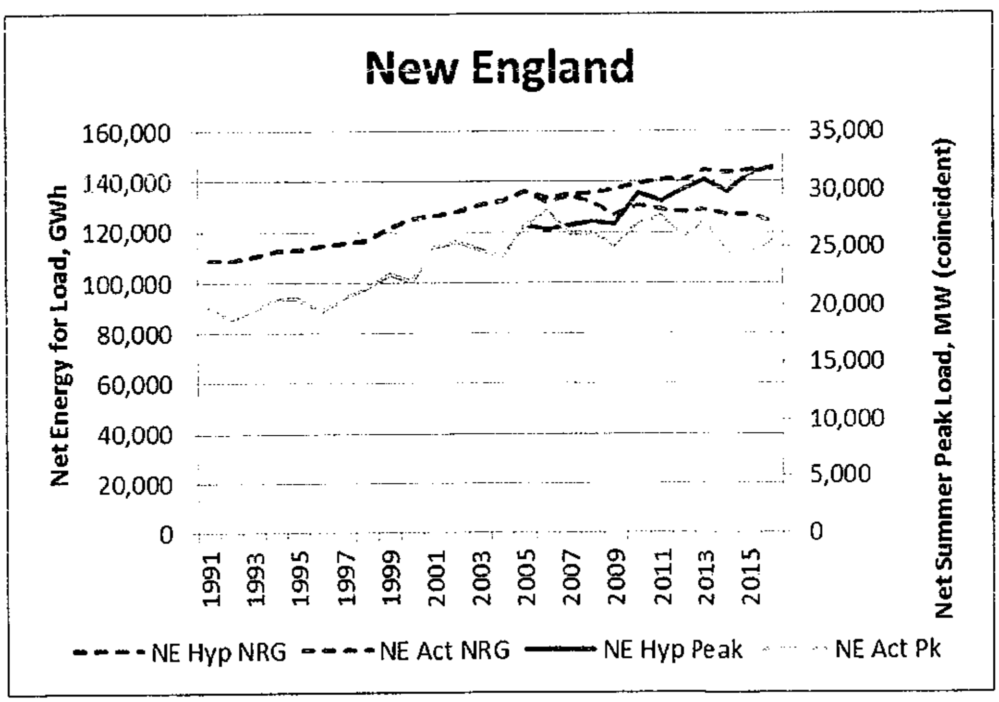
[1] See data for New England Independent System Operator's Capacity, Energy, Load, and Transmission forecast model, 2017, "2017-05-01 Forecast Data 2017", available at https://www.iso-ne.com/system-planning/system-forecasting/load-forecast, accessed August 5, 2017.

load than does information on energy efficiency and BtM PV. See the technical appendix for a discussion of the analysis.

Figure 2 shows the load trajectories depicted in Figure 1, along with loads in both Rhode Island and New England as a whole if the Great Recession had not occurred. I derive the loads for this hypothetical case using the statistical model discussed in the appendix, and I assume that economic growth from 2006 to 2016 would have continued at the same rate as it did from 1991 to 2005. Without the recession, loads grow more rapidly in every case. The downturn in energy loads in Rhode Island comes much later, and peak loads in Rhode Island never turn down. Moreover, neither energy loads nor peak loads in New England as a whole ever turn down. The slowing of load growth that actually occurred resulted substantially from a slowing of the regional economy, and I submit that this was also a, if not the, "dominating factor".

Figure 2: Actual and hypothetical loads in Rhode Island and New England if the Great Recession had not occurred

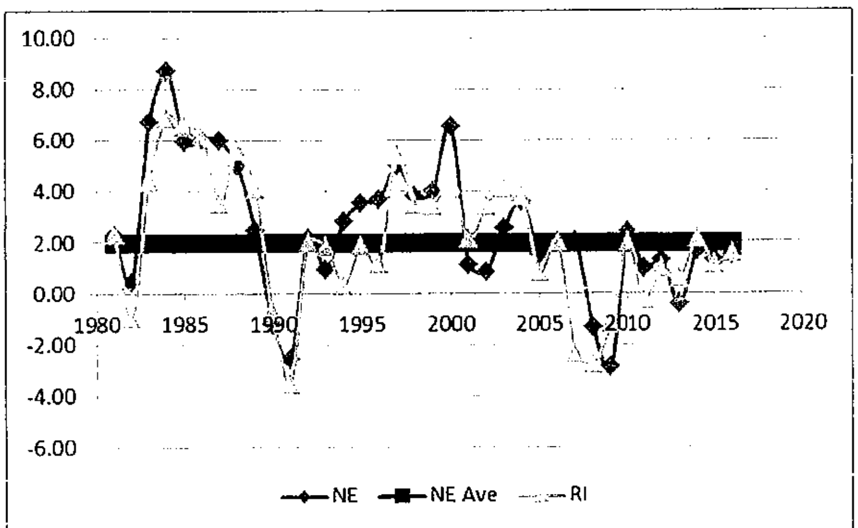




Q. Do you expect economic growth to be as slow going forward as it has been since 2006?

No, I do not. Figure 3 shows how annual economic growth in New England was largely below its 1981-2016 average of 1.98%[2] during 2006-2016.

Figure 3: Annual percentage growth in gross state product in New England and Rhode Island; 1981-2016



It is not expected that economic growth going forward will be as slow as it was from 2006 to 2016. In its 2017 CELT Report[3], the ISO forecasts annual economic growth in New England as a whole to be 1.92% to 2027, and 1.73% in Rhode Island. Both numbers are close to the average for 1981-2016, and well above annual growth from 2006 to 2016. Slow load growth between 2006 and 2016 resulted substantially from slow economic growth, and, other things being the same, load growth should be more rapid going forward, increasing the anticipated need for CREC.

The ISO forecasts economic growth in New England to 2027 slightly below the 1981-2016 average, an average that was brought down by the Great Recession. Not all forecasts are

[2] The Rhode Island average over 1981-2016 was 1.72%.
[3] Ibid.

below such a historical average. U.S. economic growth averaged 2.35% annually from 1981 to 2016, and the Organization for Economic Cooperation and Development forecasts U.S. growth of 2.51% annually from 2016 to 2027.[4] If the ISO's forecast of below average economic growth for New England is too pessimistic, then its load forecast will be too low, and the need for CREC will be greater than anticipated.

Q. Please comment on the role of gas-fired generation in integrating intermittent renewable resources.

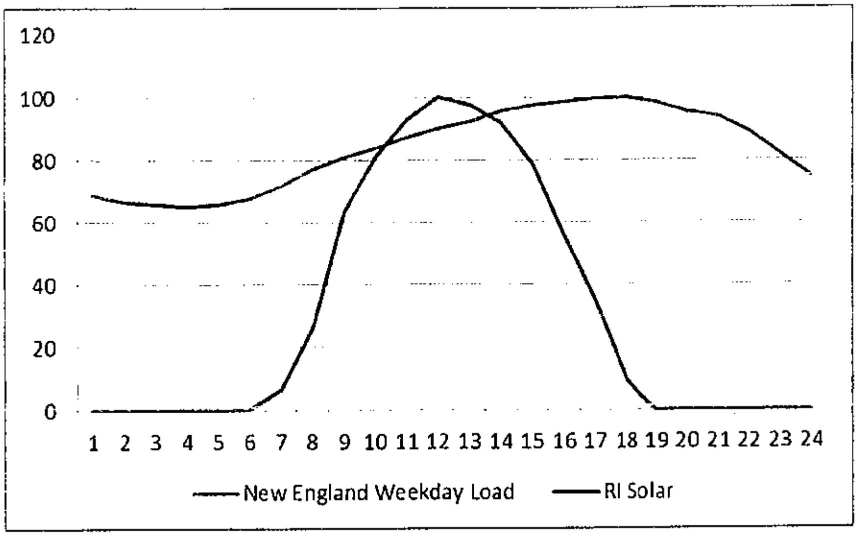
Mr. Fagan measures the need for resources in terms of annual peak and energy loads, such as those depicted in Figure 1. He argues that future load can be served using solar, wind, energy efficiency, and hydroelectric resources, without additional gas-fired generation like CREC. He does not comment on the intermittency of solar and wind. It is well understood in electric resource planning that solar and wind generators cannot be dispatched so that their generation coincides with load in real time. Consequently, integration of these resources into the generating fleet requires some complementary storage or generating technology capable of "shaping" output to meet load.

Figure 4 shows hourly shapes for load in New England and solar generation in Rhode Island for a weekday in early August.[5] The surge in solar output is much sharper than that in load, and it occurs considerably earlier in the day. The two hardly coincide. Actual load and solar output in any given hour are less certain than these shapes, which further increases the need for complementary storage or generation.

[4] See https://data.oecd.org/gdp/gdp-long-term-forecast.htm#indicator-chart, accessed August 12, 2017.

[5] Loads come from the NE ISO and are for early August, 2017; https://www.iso-ne.com/isoexpress/web/reports/load-and-demand, accessed August 14, 2017. Rhode Island solar output comes from the NREL; https://www.nrel.gov/grid/solar-power-data.html, accessed August 14, 2017.

Figure 4: Weekday hourly load and solar generation shapes; % of maximum



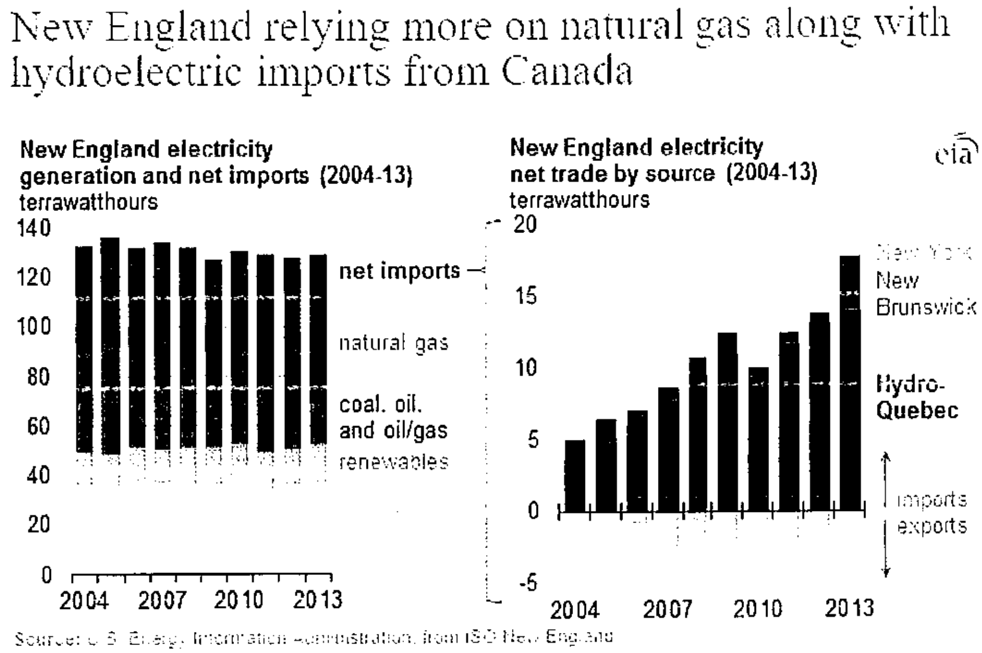
Estimates of the technical potential for demand-side flexibility vary widely[6], and economic potential is generally less. The Canadian hydropower Mr. Fagan mentions is ideal for shaping solar and wind output, but the transmission needed to import it has been contentious. The New Hampshire Site Evaluation Committee's approval process for the Northern Pass transmission project has been long and involved.[7] Figure 5 shows coal- and oil-fired generation in New England being displaced over time with a combination of Canadian hydropower and additions of gas-fired generation.[8]

[6] See Pacific Gas & Electric, "Demand side resources for renewables integration", September 2014, available at https://static1.squarespace.com/static/573ca4db22482e9a6c805853/t/5750a95601dbae39a9a572e3/146490402592 9/DSM+for+Renewables+Integration.pdf, accessed August 5, 2017.

[7] See https://www.nhsec.nh.gov/projects/2015-06/2015-06.htm, accessed August 5, 2017.

[8] See https://www.eia.gov/todayinenergy/detail.php?id=17671, accessed August 9, 2017.

Figure 5: Reprinted from Energy Information Administration



As yet, battery storage, flywheels, and compressed air remain expensive means for shaping solar and wind output. According to Lazard, the levelized cost of lithium-ion battery storage to "...assist in the integration of largescale variable energy resource generation (e.g., utility-scale wind, solar, etc.)" is now between $267/MWh and $561/MWh. Figure 6 shows the ranges of costs for that and other technologies.[9] All of them are considerably higher than the cost of a resource like CREC. Based on capital cost data from the Energy Information Administration (EIA), and assuming amortization over 20 years at 6.33%, a fuel cost of $6.50/MMBtu, a heat rate of 6,300 Btu/kwh, and a capacity factor of 65%, the levelized total cost of an advanced combined-cycle natural gas plant is around $55/MWh.[10]

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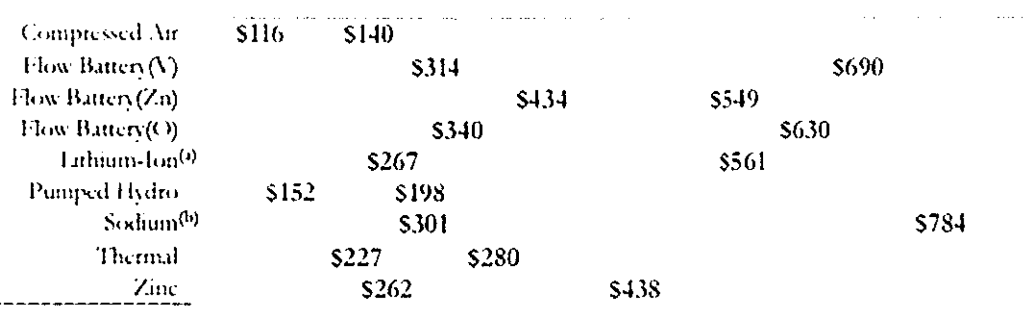
[9] See Lazard's Levelized Cost of Storage – Version 2, December 2016, pages 6 and 11, available at https://www.lazard.com/media/438042/lazard-levelized-cost-of-storage-v20.pdf, accessed August 9, 2017.
[10] Overnight capital costs are $1,094/kw . See EIA Table 8.2 from Cost and Performance Characteristics of New Generating Technologies, *Annual Energy Outlook 2017*, available at https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf, accessed August 9, 2017. I assume fixed O&M of $15/kw-yr and variable O&M of $3/MWh. See National Renewable Energy Laboratory, "Cost and

Figure 6: Reprinted from Lazard; $/MWh costs for energy storage technologies



Gas-fired generation like CREC, therefore, is an important tool for integrating intermittent solar and wind. A study at the National Bureau of Economic Research[11] finds that "...a 1% increase in the share of fast-reacting fossil generation capacity is associated with a 0.88% increase in renewables in the long run...Our analysis points to the substantial indirect costs of renewable energy integration and highlights the complementarity of investments in different generation technologies for a successful decarbonization process."(abstract)

3. COMMENTS ON THE TESTIMONY OF GLENN C. WALKER

Q. How much confidence do you have in Mr. Walker's forecast of capacity prices?

It could easily be low, given the history of capacity prices. On page 8, lines 5-8 of his initial testimony, Mr. Walker forecasts prices of $5.00-6.00/kw-mo in "the next several auctions", with reference to some qualitative factors. In the subsequent question, he states that "Given the surplus of capacity that was procured in FCA 11" he also does not "anticipate that Unit 2 will receive a CSO in the next several auctions". Again on page 10, lines 1-3, he only discusses FCAs 10 and 11.

He does not mention that capacity prices in FCAs 8 and 9 were much higher, that prices have exhibited considerable variability. In FCA 9, "Even before the auction started, there were not

Performance Assumptions for Modeling Electricity Generation Technologies", pp. 55-57; available at https://www.nrel.gov/docs/fy11osti/48595.pdf, accessed August 25, 2017.

[11] See http://www.nber.org/papers/w22454?utm_campaign=ntw&utm_medium=email&utm_source=ntw, accessed August 5, 2017.

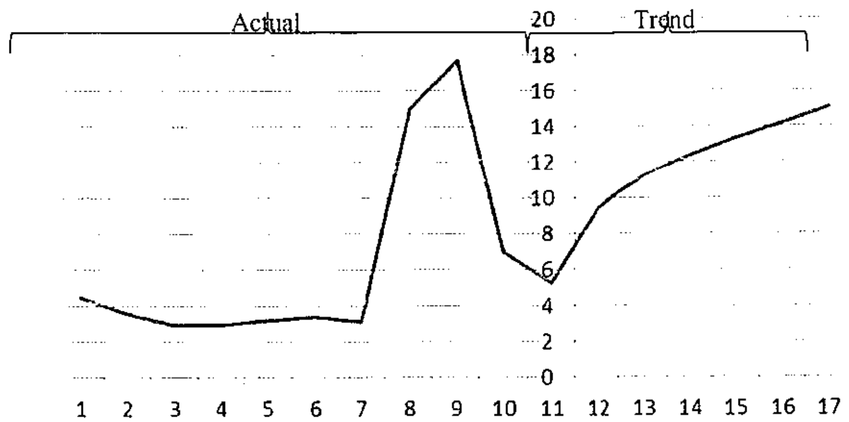
enough new and existing resources, combined, to provide the capacity needed in the SEMA/RI zone in 2018-2019....Administrative pricing rules were triggered because of SEMA/RI's inadequate supply. Under these rules, the 353 MW of new resources in the zone will receive the auction starting price of $17.73/kW-month, while the 6,888 MW of existing resources in the zone will receive $11.08/kW-month, which is based on the net cost to build a new resource."[12]

If there is a trend in capacity prices in Rhode Island, based on *all* the past FCAs, it is higher than $5.00-6.00/kw-mo going forward. Figure 7 shows the trend in capacity prices for new generation in Rhode Island going forward to FCA 17. In FCA 12, the trend starts out at $9.45/kw-mo, and rises to $15.06/kw-mo by FCA 17. Using cost data from the EIA and NREL, the levelized fixed cost of an advanced combined cycle gas plant is $9.41/kw-mo[13], and CREC Unit 1 cleared FCA 10 at a price of $7.03/kw-mo. Actual prices may not reach the trend, but at prices below the trend, CREC Unit 2 would be a competitive source of capacity.

[12] ISO press release "Annual Forward Capacity Market Auction Acquires Major New Generation Resources for 2018-2019", p. 2; available at https://www.iso-ne.com/static-assets/documents/2015/02/fca9_initialresults_final_02042015.pdf, accessed August 21, 2017.

[13] Overnight capital costs are $1,094/kw, amortization is over 30 years at 6.33%, and fixed O&M is $9.94/kw-mo. See EIA Table 8.2 from Cost and Performance Characteristics of New Generating Technologies, *Annual Energy Outlook 2017*, available at https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf, accessed August 9, 2017.

Figure 7: $/kw-mo for new generation in Rhode Island in NE-ISO forward capacity auctions



Forward Capacity Auction

Mr. Walker claims that his forecasted prices are high enough to prevent older units from retiring, but low enough that CREC will not obtain a CSO. His $5.00-$6.00/kw-mo range is below the historic average price of $6.26/kw-mo. Given the upward direction of any trend in prices, it is more likely that prices will be higher than lower than $6.26/kw-mo. The standard deviation of historic prices is $5.18/kw-mo, so a price one standard deviation above average is $11.44/kw-mo, which, like the trend, is more than high enough for CREC to obtain a CSO.

Q. Do you agree with Mr. Walker that CREC will not be a resource of choice for backing up intermittent renewable generation?

No, I do not. On page 11, lines 10-20 of his initial testimony, Mr. Walker argues that "CREC's fast start, ramping, and flexibility characteristics" will be supplanted by energy storage technologies during the 2020s. Most storage technology is still far from being competitive with natural gas as a way to shape the output of intermittent renewables. As noted in my comments on Mr. Fagan's testimony, the levelized cost of storage technologies used to "...assist in the integration of largescale variable energy resource generation (e.g., utility-scale wind, solar, etc.)" are in the hundreds of dollars per MWh (See Figure 6.), while the levelized total cost of an advanced combined-cycle natural gas plant is around $55/MWh.

Q. Please clarify the purpose of a CSO.

Mr. Walker's statements on page 6, lines 12-16 of his supplemental testimony are a misuse of conventional terminology.

> Clearly the second unit is not needed. If the RIEFSB granted approval for the entire 1,000 MW facility, the RIEFSB would allow the construction of at least 500 MW that has failed to obtain a CSO and would be surplus to the existing resources. Therefore, the proposed 1,000 MW facility is not needed in the state and/or region for energy of the type to be produced by CREC.

A CSO is an obligation to provide capacity, which is priced in $/kw-mo in the FCAs and represents the ability to meet load during short, peaking periods, usually a single hour; not "energy", which is priced in $/MWh, and the need for which is often defined over longer periods of time, such as a year.

Q. In his testimony, did Ryan Hardy, a witness for Invenergy, imply that a resource must obtain a CSO in order to be needed?

No, he did not. Mr. Walker's argument on page 6, line 18 to page 7, line 7 of his supplemental testimony is fallacious. He takes Mr. Hardy's statement that if a resource clears an FCA, then it is needed, to imply the converse: that if it does not clear an FCA, then it is not needed. Mr. Hardy did not, however, assert the converse, and it does not follow from what he did assert.

Q. Please comment on Mr. Walker's assumed capacity factor for clean energy projects.

On page 14, line 9 of his supplemental testimony, Mr. Walker assumes a 90% capacity factor for clean energy projects. A typical capacity factor for solar PV is a little over 20%, and below 50% for wind, as shown in Figure 8.[14]

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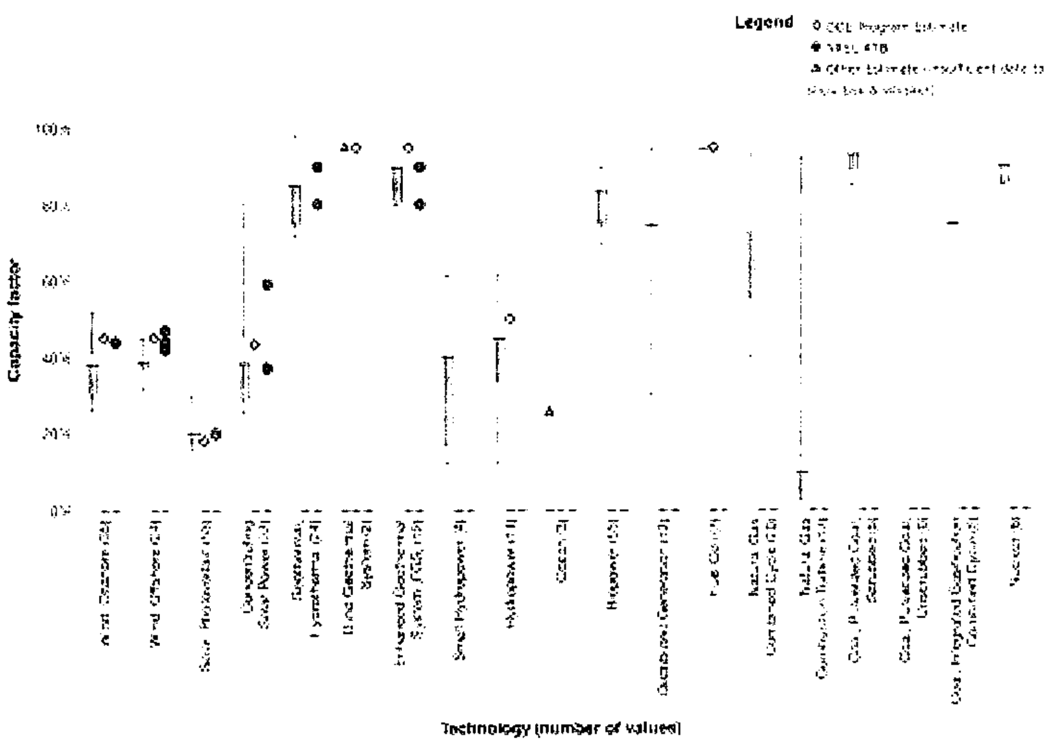
[14] See http://www.nrel.gov/analysis/tech_cap_factor.html, accessed August 9, 2017.

Figure 8: Reprinted from National Renewable Energy Laboratory; Capacity factors by generating technology



Q. Does this conclude your rebuttal testimony?

A. Yes, it does.

<u>Technical Appendix</u>

Q. Please describe your analysis of the factors driving electric loads during 1991-2016.

I use the "sureg" command in Stata® to simultaneously estimate the effects of the variables in the ISO's dataset on annual energy and peak load. In a seemingly unrelated regression, the errors in prediction of peak load may correlate with those in the prediction of energy load. The ISO provides data for the six New England states from 1991 to 2016, for a panel of 156 observations. The variables in the dataset include actual net energy for load (GWh), passive demand resources (PDR or "energy efficiency"; GWh), behind-the-meter solar PV (BtM PV; GWh), real price of electricity (2016 cents/kwh), New England composite consumer price index (CPI; Base=2016), population (Ths.), personal income (Mil $), disposable income (Mil $), nonagricultural employment (Ths.), real gross state product (real GSP; Mil. 09$), unemployment rate (%), cooling degree days (base 65F), and heating degree days (base 65F). The difference between the, also included, gross and net coincident summer peak loads (MW) is the ISO's "reconstitution" of the sum of the contributions of PDR, BtM PV, and Operating Procedure 4 (OP4), invoked when capacity runs short, to meeting gross peak load. I begin by regressing net annual energy and coincident peak load on all of the variables, with the following exceptions: Heating degree days is not included in the equation for summer peak; reconstitution (MW) of PDR, BtM PV, and OP4 is only included in the equation for summer peak; and PDR (GWh) and BtM PV (GWh) are only included in the equation for annual energy. I also examine a deterministic trend variable (Year) and indicator variables for each of the states. I then eliminate regressors that are not statistically significant or whose coefficients do not have the expected sign. I also eliminate the CPI once all nominal dollar-denominated variables have been eliminated. Having done so, I arrive at the model shown in Table 1.

Table 1: Regression model of net annual energy (GWh) and summer peak (MW) load

	Net Annual Energy (GWh)		Net Coincident Summer Peak (MW)	
	Coefficient	Std. Err.	Coefficient	Std. Err.
PDR (GWh)	-1.026	0.055		
Reconstitution of PDR, BtM PV, & OP4 (MW)			-0.813	0.130
Real GSP	0.089	0.002	0.025	0.001
Real price of electricity	-171.516	35.167		
Heating degree days	0.390	0.119		
Cooling degree days	2.682	0.767	2.016	0.328
Maine	-7100.545	375.699	-332.605	161.621
Massachusetts	12229.250	323.298	1321.608	143.598
New Hampshire	-8084.595	348.755	-322.678	151.036
Rhode Island	-10003.770	352.390	-775.122	154.515
Vermont	-10367.880	409.052	-668.047	174.655
Constant	13746.870	1104.828	561.256	213.580

All of the variables in Table 1 are highly statistically significant, except the indicator variables for Maine and New Hampshire. Those indicator variables are significant at the 95% level. A lagged dependent variable added to either equation is not statistically significant. Notably, BtM PV is far from statistically significant if added to the energy equation. This may be due to difficulty in measurement. An email from Jonathan Black at the ISO, attached as Exhibit 2, explains that net load and PDR are observed, but that BtM PV and, therefore, gross load are estimated. Still, its lack of statistical significance casts doubt on the importance of BtM PV as a predictor of net energy load.

The largest *t*-statistics in both equations are those associated with real gross state product. Retail prices of electricity are set in rate filings and may not be sensitive to contemporaneous changes in load. However, if I treat price as endogenous, then instrument for it using its own lag, and follow the same procedure, I also come out with the model in Table 1, and very similar statistics.

Root mean squared error (RMSE) is the square root of the average squared deviation of observations of the dependent variable from the values predicted by a regression equation. It is a widely used measure of the predictive accuracy of an equation. In order to compare the predictive accuracy of the variables Mr. Fagan refers to as "dominating", PDR and BtM PV, to that of real GSP, I compare the mean squared errors when those variables are alternately excluded from the model in Table 1. Table 2 shows the result.

Table 2: Root Mean Squared Errors of Alternative Regression Models

	Full Model	Model w/o PDR, BtM PV, & OP4	Model w/o Real GSP
Net annual energy for load	569.3	1034.0	2066.5
Net coincident summer peak	260.3	295.4	630.6

PDR, BtM PV, and OP4 lower RMSE in the energy equation by 60%, and by 13% in the peak load equation. However, including real GSP in the model cuts RMSE in the energy equation by 129%, and by 88% in the peak load equation. I conclude that, though they are all significant, the macroeconomy, as measured by real gross state product, is more important to the accuracy of predictions of electric load than are energy efficiency and behind-the-meter solar photovoltaics.

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Exhibit 2
Email from Jonathan Black

Hi Marc,

Answers in red below. Let me know if you have further questions.

Jon

Jon Black, Manager – Load Forecasting

System Planning

ISO New England Inc.

Holyoke, MA 01040

Tel: (413) 540-4745

E-mail: jblack@iso-ne.com

ISO-NE PUBLIC

The information in this email and in any attachments is intended to be conveyed only to the designated recipient(s). If you are not an intended recipient of this message, please delete the message and notify the sender.

From: Marc Vatter

Sent: Monday, August 14, 2017 11:37 PM

To: jdblack@iso-ne.com

Subject: Observed Variables

Hi Jonathan,

I hope you would not mind answering a brief question. In the ISO's historic data, not its forecast, of the four variables listed below, which are observed, and which are estimated?

gross load Estimated (because it is based on estimates of BTM PV)

net load Observed

passive demand resources Observed

behind-the-meter solar generation Estimated

425 Thank you for your attention.

426 Best regards,

427 Marc Vatter

428 603.402.3433 (land)

429 503.227.1994 (cell)

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STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

RE: SB 2015-06, INVENERGY THERMAL DEVELOPMENT, LLC APPLICATION TO CONSTRUCT AND OPERATE THE CLEAR RIVER ENERGY CENTER IN BURRILLVILLE, RHODE ISLAND

Pre-filed testimony of Andrew L. Cortes

EXECUTIVE SUMMARY

Building Futures is a domestic non-profit tax-exempt corporation that provides a comprehensive construction pre-apprenticeship program for disadvantaged Rhode Island residents for placement in multiple construction trade Registered Apprenticeship programs that was formed in 2007. If this project is approved, fifteen percent (15%) of the workforce hours will be completed by apprentices. Any new apprentices referred to this project through any of the union halls of the Rhode Island Building and Construction Trades Council (RIBCTC) will be Building Futures' program graduates. Meaning, all of these referrals will be Rhode Island residents. Additionally, since Building Futures was formed ten (10) years ago it has placed two-hundred twenty-five (225) of its graduates in a down economy into the local union trade workforce; some of which may be referred to this project. All of these workers are also Rhode Island residents.

I. INTRODUCTION

Q. Please state your name, position and business address.

My name is Andrew L. Cortes, Executive Director of Building Futures. My business address is One Acorn Street, Providence, RI 02903.

Q. Would you please summarize your professional background and experience?

For the past fifteen (15) years, non-profit workforce development has been my profession. Prior to that, I worked as Carpenter, Cabinet Maker, Carpenter Foreman, and Project Superintendent.

Registered Apprenticeship has been central to my own career since completing the United Brotherhood of Carpenters and Joiners of America Apprenticeship program in 1994. During my career in the construction industry, experience was gained across all elements of the sector, from an entry-level carpenter's apprentice, to managing construction of complex multi-million-dollar projects. These experiences allowed me to develop both deep trade and industry knowledge, and to understand the challenges and rewards facing all businesses. Three (3) years after moving to Rhode Island in 2002, I left private sector employment and became the director of a YouthBuild program. The experience gained in reinventing YouthBuild Providence was meaningful. Graduation rates were brought to 92% from 37%, young adults gained diverse careers and eight major construction projects were completed, including building new homes for low-income families. However, I found that program model limited if one is seeking to meet an industry's need for skilled labor at the appropriate volume and cost. Therefore, concurrently to operating YouthBuild Providence, I designed a sector-based initiative driven by a program model that could effectively meet the scale of the construction industry's demand for skilled labor, while training and placing low-income adults of Rhode Island into employment as apprentices – this effort was launched in 2007 as Building Futures. My summary biography is appended as Exhibit 1 to my testimony.

Q. Would you please describe the organization, membership and purpose of the entity on whose behalf you are providing testimony?

Building Futures is a domestic non-profit tax-exempt corporation that serves low-income Rhode Island residents by providing a comprehensive construction pre-apprenticeship program for placement in multiple construction trade Registered Apprenticeship programs. It was and is designed to meet future workforce demand needs of the Rhode Island marketplace. The entirety of the programming in our first eight (8) years leveraged the well-established Registered

Apprenticeship programs within the construction sector to great impact. Building Futures is now a nationally recognized model of best practices, both in program and policy efforts. To date, we have been involved with at least 80 local construction projects that implemented apprentice utilization programs, which have placed 225 Building Futures apprentices despite the down economy, 70 of whom have completed their apprenticeship programs and are now journeypersons. All of the workers we have trained and placed are from Rhode Island. The first-year retention for Building Futures graduates is 97 percent, and nearly 80 percent since the program's inception. The average starting wage for these workers is $17 per hour. The average wage of these workers upon completion of an apprenticeship program is $37 per hour, with benefits. These results achieved by Building Futures demonstrate the purpose of our organization well. Our mission is to meet employer and industry need for skilled workers through the Registered Apprenticeship system, while creating family-sustaining career opportunities for low-income diverse residents of Rhode Island.

II. POSITION OF ORGANIZATION

Q. What is the position of your organization with respect to these proceedings?

Building Futures is the pre-apprenticeship and apprenticeship utilization program partner of the Rhode Island Building and Construction Trades Council (RIBCTC), which has been granted Intervenor status in this proceeding.

Q. Why does your organization offer testimony in these proceedings?

If approved, this project will implement an apprenticeship utilization program, (AUP), in partnership with Building Futures through the project labor agreement (PLA). AUP ensures that 15 % of the total labor hours are performed by registered apprentices by each contractor. When a contractor does not have an incumbent apprentice worker to achieve this goal, a graduate from

Building Futures will be referred to the project through the union halls of the RIBCTC. All of these referrals will be Rhode Island residents.

III. SOCIO-ECONOMIC IMPACT

Q. How many registered apprentices will be employed by the project?

According to numerous experts, this project will create more than three-hundred (320) full-time annual construction trade jobs per year from 2018-2021 for a total of more than twelve-hundred (1,200) full time jobs for the duration of the project. If so, at least forty-eight (48) and as much as one-hundred and eighty (180) of these positions would be registered apprentices in accordance the PLA apprentice utilization program. Currently, only half of the workers in Rhode Island's total construction industry workers are under the age of forty-five (45) with the average age of union tradespeople often being above fifty (50). Based on previous AUP experience, approximately half (1/2) of these new positions would Building Futures graduates continuing or entering employment in their respective Registered Apprenticeships. And, as previously stated herein, all of these workers will be from Rhode Island.

Q. How would approval of this project affect Building Futures' low-income program participants?

Exceptional careers for disenfranchised residents have been provided through previous apprentice utilization programs on large scale construction projects. It is unusual to have a construction project of this anticipated length, which is extremely helpful as it provides predicable apprenticeship opportunities for our graduates, which allows Building Futures to ramp up training activities to meet specific project demand. Current graduates employed as registered apprentices will become journeyworkers on this specific project, allowing for additional pre-apprenticeship program graduates to be placed into employed as registered apprentices.

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ANDREW L. CORTÉS

One Acorn Street
Providence, Rhode Island 02903
acortes@bfri.org |401.919.5919 x.207

Professional Experience

Building Futures, Executive Director | Project Director
January 2007 – Present

Summary of Responsibilities:

- Design, evaluation and management of all aspects of Building Futures, including: Apprenticeship RI initiative, pre-apprenticeship and apprentice utilization programs, partnership development, strategic planning, and systemic change agenda related to all aspects of Building Futures' organizational mission and engagements
- Grant development and management of $1.2M Annual Budget
- Community, public, government and industry relations within growth sectors of Rhode Island
- Research and synthesis of relevant best practices

YouthBuild Providence, Director | Construction Manager
January 2004 – July 2010 | December 2002 – January 2004

Summary of Responsibilities:

- Direction of all aspects of YouthBuild programming: academic curriculum, construction and workforce training, coupled with sustained community service;
- Creation and guidance of strategic opportunities for organizational growth;
- Development and management of grants;
- Development of community relations and union/employer partnership;
- Ongoing graduate support, arranging placements and providing guidance.

Carpenter, Cabinetmaker, Forman, Superintendent | July 1990 – December 2002
United Brotherhood of Carpenters and Joiners of America | July 1990 – Present

Summary of Positions

Site Superintendent, Carpenter Foreman, Journeyworker Carpenter: 1997 – 2002
Maron Construction, 180 Buttonhole Dr., Providence, RI 02940 (2002) | RP Iannuccillo & Sons, Construction, 70 Calverly St., Providence, RI 02908 (2001) | Clifford & Galvin Construction, 244 Liberty St., Suite 7a, Brockton, MA 02301-5554 (2000) Monarch Industries, 10 New Road, East Providence, RI 02916 (1999) | Design Workshops, 57 Columbia Square, San Francisco, CA 94103 (1998) | HP Incorporated, 543 Howard Street, San Francisco, CA 94105 (1997)

- Project management (including estimating, change orders, RFI's, cost tracking);
- Surveying, earthwork, site layout, design, construction and erection of concrete forms and concrete placement;
- Management and performance of carpentry phases;
- Supervision and coordination of subcontractors;
- Layout, wood and metal framing, roof systems, door, hardware and millwork installation;
- Finish Carpentry, millwork fabrication and installation, historic renovation/restoration, cabinet making.

Carpenter Foreman, Journeyworker Carpenter, Cabinetmaker, 1990 – 1997
Nibbi Brothers Construction, 1433 17th Street, San Francisco, CA 94107

- Surveying, site layout, building layout, form construction, concrete placement;
- Class A&B construction, metal framing, commercial wood framing, timber framing, roof framing, stair construction;

- Exterior and Interior finish carpentry, commercial door installation, panic/fire hardware installation, cabinetmaking;
- Responsible for a variety of projects up to $22 million in scope.

Selected Civic Engagements

2016 – Present	Local Workforce Development Board(s) Member
2012 – Present	Chairperson, Rhode Island State Apprenticeship Council
2010 – Present	Chairperson, US Department of Labor, Federal Advisory Committee on Apprenticeship
2003 – Present	Consortium America (NMTC) Advisory Board
2013 – 2015	Chairperson, Board of Commissioners, Rhode Island Housing Mortgage & Finance Corporation.
2011 – 2014	Steering Committee, Alliance to Improve Construction-Demand Forecasting
2010 – 2013	Federal Reserve Bank, Community Development Advisory Council
2003 – 2012	Commissioner, Providence City Plan Commission
2009 – 2011	Emerald Cities Collaborative, National Council
2009	YBTAP Design Team, US. Department of Labor designated Subject Matter Expert
2007	Poverty, Work and Opportunity Task Force, Providence Mayor David Cicilline
2003 – 2006	Chairperson, Olneyville Collaborative (19 non-profit collective organization)

Selected Presentations, Seminars and Trainings

"Building Effective Partnerships" One Day Training
LiUNA, Annual Instructors Conference
Session for International Training Directors
Chicago IL – June 2012

"Innovative Partnerships" & "Pre-apprenticeship Strategies"
Eastern Seaboard Apprenticeship Conference
Portland, ME – May 2012

"Strategies for Increasing Diversity"
22nd Annual EEO Conference, US Department of Labor
Washington, DC – August 2011

"Greening of Registered Apprenticeship"
Eastern Seaboard Apprenticeship Conference

Niagara Falls, NY – May 2011
"Developing a Strategic Initiative"
NE Regional LiUNA Apprenticeship Symposium
Foxwoods, CT – March 2010

"Models, Results and Impacts: Registered Apprenticeship YouthBuild Demonstration Project"
US Department of Labor
National (Virtual) – February 2009

Partnership for Working Families – Presentation
AFL-CIO Building & Construction Trades Department
Annual Legislative Conference – May 2009

Keynote Speaker
Registered Apprenticeship Regional Action Clinic
US Department of Labor
Boston, MA – September 2010

"Pre-apprenticeship: Career Path Starts here"
National Conference on Reemployment, US Dept. of Labor
Washington DC – December 2010

"Building Sustainable Futures"
Offshore Wind Development Conference
Providence, RI – October 2010

"Connecting to Registered Apprenticeships"
Aspen Institute, Workforce Strategies Initiative
National (Virtual) Presentation –September 2011

"Registered Apprenticeship: Strategies for the New Economy" US Department of Labor, Region 1 – June 2010

"Data Analysis to Inform Employer Engagement"
US Department of Labor | National (virtual) – February 2008

"How to Connect YouthBuild Programs to Registered Apprenticeships" US Department of Labor, YouthBuild Grantee Conference, Dallas, TX – February 2008

National Workforce Partnership Conference Presentation
National Fund for Workforce Solutions
Chicago, IL – December 2007

Education

1994	Baccalaureate Degree in Industrial Arts (State of California)
1994	Journeyworker Status, completion of Registered Apprenticeship with Honors (Straight A record)
1989	High School Diploma (Self-Designed & State Approved education program)