STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

IN RE: Application of
Invenergy Thermal Development LLC's
Proposal for Clear River Energy Center

Docket No. 4609

# PRE-FILED DIRECT TESTIMONY

# OF

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Direct Testimony of Robert Fagan

# Introduction

**Q. Please state your name and occupation.**

A. My name is Robert M. Fagan and I am a Principal Associate at Synapse Energy Economics.

**Q. Please describe Synapse Energy Economics.**

A. Synapse Energy Economics is a research and consulting firm specializing in electricity industry regulation, planning and analysis. Synapse works for a variety of clients, with an emphasis on consumer advocates, regulatory commissions, and environmental advocates.

**Q. Please summarize your qualifications.**

A. I am a mechanical engineer and energy economics analyst, and I've analyzed energy industry issues for more than 25 years. My activities focus on many aspects of the electric power industry, in particular: production cost modeling of electric power systems, general economic and technical analysis of electric supply and delivery systems, wholesale and retail electricity provision, energy and capacity market structures, renewable resource alternatives, including wind and solar PV, and assessment and implementation of energy efficiency and demand response alternatives. I hold an MA from Boston University in energy and environmental studies and a BS from Clarkson University in mechanical engineering. My resume is included as Attachment A hereto.

**Q. Please summarize your specific experience and familiarity with electric power sector issues in Rhode Island.**

A. My professional career began in Rhode Island, working for Narragansett Electric Company as a field engineer and eventually as supervisor of electrical operations and maintenance (early 1980s). I also worked as a senior energy specialist at Rhode Islanders Saving Energy (RISE), conducting commercial and industrial facility energy assessments (late 1980s/early 1990s) and supporting the implementation of burgeoning electric utility energy efficiency programs for commercial and industrial customers. After graduate school, my consulting work over the past 20+ years has focused on myriad electric power sector issues in regulatory jurisdictions throughout the US and Canada, and included detailed engagement on specific Rhode Island energy efficiency issues as part of Synapse's work on behalf of the Rhode Island Division of Public Utilities and Carriers (during the period 2007-2011).

**Q. On whose behalf are you testifying in this case?**

A. I am testifying on behalf of the Conservation Law Foundation ("CLF").

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

A. The purpose of my testimony is to address and critique aspects of Invenergy's Clear River Energy Center application (Invenergy plant, or Invenergy project, or Invenergy application)[1] and supporting documents, in particular assertions of reliability need for the proposed power plant.

**Q. What documents do you rely upon in your analysis, and for your findings and observations?**

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[1] Rhode Island Energy Facility Siting Board Application, Clear River Energy Center, Burrillville, Rhode Island. Prepared by ESS Group, Inc. October 28, 2015.

A. I rely upon the following documents:

1. ESS Group Inc., Application to the Rhode Island Energy Facility Siting Board, Clear River Energy Center (CREC), Burrillville, Rhode Island, October 28, 2015.
2. Independent System Operator of New England (ISO NE, or ISO) Capacity, Energy, Loads, and Transmission (CELT) forecast data from current (2016) and earlier CELT reports.
3. ISO NE Final 2016 PV Forecast (April 2016) and ISO NE Final 2015 Solar PV Forecast Details (April 2015).
4. ISO NE 2015 Regional System Plan (December 2015).
5. ISO NE Installed Capacity Requirements, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2019/20 Capacity Commitment Period (January 2016), and earlier versions of similar filings to the Federal Energy Regulatory Commission (FERC).
6. Forward Capacity Auction #10 (FCA #10)[2] – 2019/2020 Capacity Commitment Period, Results Summary & Trends, March 23, 2016 (ISO NE Presentation).
7. ISO NE Internal Market Monitor 2015 Annual Markets Report, May 25, 2016.
8. ISO NE FERC Filing on Results of the Tenth Forward Capacity Market Auction (February 29, 2016).
9. Discovery request responses in this PUC docket and in the parallel RI EFSB Docket.

## Summary Observations

**Q. Please summarize your findings/observations.**

A. I have three summary observations.

1) There is no near-to-medium term reliability need for the proposed Invenergy plant;

2) Existing and projected energy efficiency and behind-the-meter solar PV resources in New England more than supplant the energy output of the proposed plant and support a reliable electric sector in Rhode Island and New England without the proposed plant; and

3) There is no longer-term reliability need for the proposed plant.

1. **There is no near-to-medium term reliability need for the proposed plant.** The

[2] The ISO NE forward capacity market auction is a market-based three-year forward capacity procurement mechanism used by the ISO NE as part of the overall capacity market construct to ensure sufficient capacity is available to meet reliability needs.

proposed power plant is not needed for near-term New England or Rhode Island electric power sector reliability. Rhode Island and New England net loads (both peak load and annual energy, concepts I explain further below) exhibit declining trends, contrary to the applicant's assertions. The applicant offers no evidence of a near-to-medium term (within the next three to eight years)[3] reliability need for this specific proposed power plant. The ISO NE forward capacity market (FCM) auction framework put forth by the applicant in support of a reliability need is not indicative of reliability need, or even economic need, for the plant. Notably, only half of the proposed plant even cleared the tenth forward capacity market auction, in contrast to the applicant's estimation.[4] Indeed, the ISO's most recent forward capacity auction results cleared (or, established a financial supply obligation for) 1,416 MW *more* than the reliability requirement for New England for the 2019/2020 planning period, which was forecast in January 2016 by the ISO NE to be 34,151 MW (net installed capacity requirement).[5] This result directly indicates *surplus* capacity in excess of reliability requirements. The auction sets price in a spot capacity market, and supports resource procurement, but proposed new resources that clear in such an auction can sell the forward "capacity supply obligation"

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[3] The most recent ISO NE Regional System Plan (November, 2015) lists "Future System Needs (MW)" through the summer of 2024. I use this end date and the proposed operation date of the Invenergy plant in 2019 as a definition of "near-to-medium term."

[4] Results of the ISO NE tenth forward capacity market auction (February, 2016) indicate that 485 MW of the Burrillville Energy Center cleared the auction. See, e.g., slide 6 of the ISO NE "Forward Capacity Auction #10 (FCA #10) – 2019/2020 Capacity Commitment Period, Results Summary & Trends," March 23, 2016, available at http://www.iso-ne.com/static-assets/documents/2016/03/a6_fca_10_results_summary.pptx. The Invenergy application indicated "PA's analysis suggests that the facility will clear the auction." Page 120.

[5] See ISO NE "Installed Capacity Requirements, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2019/20 Capacity Commitment Period", January 2016, p. 10.

that is obtained, and other resources – either existing or new – can provide any eventual physical capacity need required to support regional reliability. Subsequent secondary market capacity auctions[6] held by the ISO NE update the actual closer-in-time reliability need and allow those who obtain a capacity supply obligation in a three-year forward capacity market auction to sell that obligation.

2. **Energy efficiency and behind-the-meter solar PV dramatically lower ISO NE net load forecasts and support reliability without the proposed plant.** ISO NE energy efficiency and behind-the-meter solar PV resource projections for New England as a whole more than supplant the energy output of the proposed plant, and contribute to ensuring the reliability of the electric power system without the presence of this proposed plant by directly contributing to reduced net peak loads[7] in New England and Rhode Island. ISO NE projections of energy efficiency and behind-the-meter solar PV output *from Rhode Island alone* approach estimated energy output levels for the portion of this proposed plant that actually cleared the ISO NE's tenth FCA, which as noted was only half of the applicant's dual-unit plant proposal. The applicant ignores or minimizes the effect that these resources, and other renewable resource supplies, can have on reliability needs in

[6] See for example a description of the annual reconfiguration auctions and how secondary forward capacity auctions work, in the 2015 Annual Market Report by the ISO NE Internal Market Monitor. Available at http://www.iso-ne.com/static-assets/documents/2016/05/2015_imm_amr_final_5_25_2016.pdf.

[7] "Net peak load" as used throughout this testimony is in reference to the summer peak loads seen on the transmission grid and used by ISO NE when assessing reliability. They are net of the peak-load reducing effects of energy efficiency and behind-the-meter solar PV. Net annual energy is a reference to the *annual* energy (in kilowatt hours (kWh), or Gigawatt-hours (GWh = 1 million kWh) consumed, and is also net of the effects of energy efficiency and behind-the-meter solar PV. I note that net annual energy is *not* net of the contributions that transmission-grid-connected renewable resources (utility-scale wind, solar, and hydro) can make to further reducing the need for fossil-fueled energy generation.

both the near-to-medium term and the long term.

3. **No long-term need for the proposed plant.** The proponent offers no evidence of any longer-term reliability or other need for the proposed plant. They incorrectly inflate the energy forecast need for Rhode Island and New England. Their narrative on alternative energy resources, including energy efficiency and renewable energy resources, is completely absent of any quantitative analysis of the effect of a portfolio of energy efficiency and renewable resource supply as an alternative to the proposed plant. When considering energy efficiency and alternative new resources including behind-the-meter solar PV, other solar PV (utility scale), onshore wind, offshore wind, Canadian hydro, demand response, and storage alternatives - in addition to existing capacity resources and a recently strengthened New England transmission system - near-term and long-term reliability of Rhode Island and New England electric power sectors can be assured without reliance on the proposed power plant.

**Q. How is your testimony structured?**

A. I first explain the fundamental underpinnings of potential reliability needs for supply or demand side resources in New England and Rhode Island. I address the role that the ISO NE forward capacity market, including the forward capacity auction (FCA) and its follow-on "reconfiguration auctions"[8] plays in addressing – but not defining - these needs. I next discuss

[8] Reconfiguration auctions are described in a number of places in the ISO NE market rules and related tariff documents. The ISO NE internal market monitor report provides a summary: "Reconfiguration auctions enable the exchange of capacity supply obligations [CSO]. Each clearing price and quantity in the reconfiguration auctions depends on the amount of CSO MW market participants are willing to acquire and transfer. Market participants may submit an offer to increase or a bid to decrease a resource's total obligation. Reconfiguration auctions are also used to adjust the total capacity supply obligation amount based on updated requirements (ICR, LSR). The ISO can purchase to make up shortfalls in any annual reconfiguration auction, or buy back excess in the last annual

the critical and timely effects of energy efficiency and behind-the-meter solar PV resources in lowering net demand (both summer peak, and annual energy) in the New England region and in Rhode Island, and what that implies for reliability and the need for the proposed plant. Lastly, I address longer-term issues by discussing the ISO NE regional planning information and how it might be applied to considerations of reliability need for this proposed plant. I comment on the lag that exists in the ISO NE forecasting process, and how future needs are likely even lower than data from the most recent ISO NE Regional System Plan, and the ISO NE 2016 CELT (Capacity, Energy, Loads, Transmission) indicate. Throughout, I provide specific critiques of certain assertions in Invenergy's application.

## Reliability Needs and the ISO NE Forward Capacity Market Auction

**Q. The Invenergy application implies that the proposed plant is needed to meet reliability needs of Rhode Island and the New England region.[9] Is it?**

A. No, the proposed Invenergy plant is not needed to support electric power sector reliability in Rhode Island or in the New England region. A reliable power system requires sufficient resources and a secure transmission system, both of which currently exist in Rhode Island and New England without the Invenergy plant, and both of which will be in place in Rhode Island and New England if the proposed plant is not built.

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reconfiguration auction. Three annual auctions are conducted between the FCA and the commitment period, for the entire commitment period. There are also monthly reconfigurations auctions for each month of the commitment period." ISO NE, Internal Market Monitor Report, May 25, 2016, page 130.

[9] Rhode Island Energy Facility Siting Board Application, Clear River Energy Center, Burrillville, Rhode Island. Prepared by ESS Group, Inc. October 28, 2015. Section 7.2.2, "Analysis of Need – Reliability," and more generally, Section 7.0, "Assessment of Need."

**Q. What is system reliability?**

A. System reliability[10] consists of having sufficient resources to meet load at all times (which is generically referred to as "resource adequacy" in the electric power industry),[11] and a secure transmission system that can withstand contingencies (such as the loss of a transmission line, or successive losses of multiple transmission lines, or the loss of a major generation plant, during a time of high system load). North American Electric Reliability Corporation (NERC) standards[12] provide the high level guidance that Regional Transmission Organizations (RTOs) such as ISO NE follow to ensure both resource adequacy and transmission security.

**Q. On what basis does the Invenergy application claim that its plant is needed for reliability purposes?**

A. Invenergy erroneously claims that the ISO NE forward capacity market and its attendant forward capacity auctions (FCAs) "determine both system-wide and localized needs for both existing and new generation capacity through a competitive auction process..."[13] This is not correct; the FCM mechanisms do not determine need. Need is determined in the ISO NE annual filings to FERC[14] defining the parameters to use in the subsequent FCA, and is updated on an

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[10] System reliability as used here does not refer to distribution system outages or interruptions due to, for example, localized equipment failure or weather-related events.
[11] More specifically, reliability standards for resource adequacy in the U.S. electric power industry generally require no more than a one-in-ten years' frequency of "loss of load" events arising from a resource shortage. Based on this determination, regions can determine planning reserve margins to ensure adequate installed capacity resources.
[12] The complete set of NERC reliability standards are available here: http://www.nerc.com/pa/Stand/Reliability%20Standards%20Complete%20Set/RSCompleteSet.pdf.
[13] Invenergy application, page 115.
[14] For 2019/2020, this need was determined to be 34,151 MW of net installed capacity. See "ISO NE Installed Capacity Requirements, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2019/20 Capacity Commitment Period (January, 2016)," available at http://www.iso-ne.com/static-assets/documents/2016/01/icr_values_2019_2020_report_final.pdf.

annual basis.

**Q. What is the forward capacity market and the attendant forward capacity auctions?**

A. The forward capacity market (FCM) is the construct put in place by the ISO NE (and approved by FERC) for obtaining and selling capacity resources. The time horizon of the FCM starts with a three-year forward auction process, but continues with closer-in-time annual reconfiguration auctions, and bilateral trading opportunities in even monthly increments. In short, it is a spot market for capacity. The FCM construct, through its FCAs and bilateral contracting arrangements,[15] represent procurement arrangements but they do not determine need. The FCA for any given year – they are held each year for a single-year planning period beginning three years later – is not determining need for that year, but is rather clearing an administratively complex capacity market based on a projected forecast of resource need three years out. It is also not determinative of need for any future year or years beyond the planning period to which it applies. The most recent FCM auction in New England (known as FCA 10 or the tenth forward capacity auction held since the inception of the forward capacity market construct) was held in February of 2016.

**Q. What were the relevant results of the FCA 10?**

A. Two salient points can be taken from the results of the tenth FCA.

First, based on revised zonal boundary assumptions, the SEMA/RI zone no longer exists in New England,[16] replaced with a larger "Southeast New England" (SENE) zone that

[15] Parties with "capacity supply obligations" can generally trade those obligations to other parties at market rates.
[16] The SEMA/RI zone was a defined region composed of Rhode Island and southeastern Massachusetts. In the ninth FCA, the SEMA/RI zone cleared at a relatively high price, indicating an estimated near-term shortage of capacity

encompasses Rhode Island and much of eastern Massachusetts. The SENE zone was modeled as an import-constrained zone in advance of FCA 10. However, transmission constraints between the SENE zone and the rest of New England did not bind in the tenth forward capacity auction (the cleared spot capacity prices were the same on either side of the interface). The interface between SENE and the rest of New England is relatively strong, and includes recently-completed upgrades and new 345 kV facilities in and around the Rhode Island, Connecticut and Massachusetts borders.[17] No price premium was given to any resource because of its location in a considered import-constrained zone. This illustrates that resources throughout the rest of New England can compete to serve load in all locations in New England, and renders less important any particular proposed plant, or the need to locate in a particular zone in New England to support reliability. To the extent that net peak load trajectories continue to decline in New England, it would continue to be less likely that such constraints would bind in future auctions.

Second, the clearing price in FCA 10 was relatively low ($7.03/kW-month) compared to the clearing price for the SEMA/RI zone in the previous, ninth FCA (more than $17/kW-month). This indicates that in the span of just one year, market and transmission arrangements had changed so much that supply/demand pressures in the Rhode Island/Southeast Massachusetts region were greatly relieved – indeed, the low clearing price in FCA 10 was directly an artifact of

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for the region. With completed transmission improvements and an updated load and resource forecast for FCA 10, the zone was eliminated in favor of a larger regional zone.

[17] See, for example, the southern portion of the New England transmission map (Attachment D) which shows the recently completed reinforcements as part of the interconnected grid.

the 1,431 MW surplus capacity cleared in the auction.[18] This is due in part to the ISO's direct use, for the first time in FCA 10, of an explicit forecast of peak load that accounts for the presence of behind-the-meter solar PV in addition to energy efficiency impacts in New England.[19]

**Q. What was the result of the FCA 10 in regards to the Invenergy plant?**

A. The Invenergy plant is a proposed two-unit, 850-1000 MW combined cycle plant.[20] Only one of those two units cleared the FCA 10 auction. If one were to use Invenergy's own (flawed) definition of reliability need, only one of the 2 units would be needed based on the result of the auction.

**Q. Does the Invenergy application present any evidence for a near-term reliability need for the proposed plant?**

A. No. The applicant relies on the prospective results of the ISO NE capacity market auction to indicate a reliability need for the plant. They state "In other words, if the facility clears FCA 10, then ISO-NE will have determined CREC to be a needed resource that maximizes social surplus to meet the overall system-wide and local reliability needs of ISO-NE."[21]

**Q. Is it true that clearing the FCA 10 means that ISO-NE has determined a reliability need for this plant?**

A. No, not at all. Physical reliability needs are defined, in the near-term (for the three-year

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[18] See Attachment F.
[19] See ISO NE "Installed Capacity Requirements, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2019/20 Capacity Commitment Period" (January, 2016), pages 27-28.
[20] Invenergy project application, page 1.
[21] Invenergy project application, page 116.

ahead, 1-year period covered by any given FCA) by the installed capacity requirement for the New England system as a whole, and by the local sourcing requirements. A proposed resource such as the Invenergy plant clearing the FCA means that the resource obtains a capacity supply obligation – a financial obligation - but it doesn't mean that the resource is physically needed for reliability. In subsequent "reconfiguration" auctions, the capacity supply obligations can be sold, or traded, to other parties; and/or, the resource need for the given FCA period may be updated with the most recent forecast information available.

## Energy Efficiency and Behind-the-Meter Solar PV Supplant the Output of the Proposed Plant and Contribute to Reliability

**Q. In this section you use two related, but distinct terms: net peak load, and annual net energy. Please define and explain these terms.**

A. Net peak load (in megawatts, or MW) is the summer peak load (or maximum rate of power consumption seen all year, in MW, occurring in the summer) net of the load-reducing effects of energy efficiency, and net of the peak output of solar PV that is installed behind customer meters ("behind-the-meter solar PV" or BTM solar PV). ISO NE, in its annual CELT reports, provides forecasts for both gross peak load and net peak load. Annual net energy is the annual energy consumed net of the effects of both energy efficiency and the output of BTM solar PV. As with peak load reporting, ISO NE reports both gross and net energy usage on an annual basis. In this testimony, I refer to New England, and to Rhode Island, when using these terms. ISO NE provides (in its CELT reports) historical and forecast data for these metrics for the entirety of New England, and for each state. Lastly, in general I use ISO NE's "50/50" net peak load forecast. ISO NE provides two peak load forecasts: its 50/50 forecast, and its 90/10 forecast. The 50/50 forecast is the forecast of peak load for which there is a 50% probability it will be higher, and a 50% probability it will be lower.[22] This 50/50 peak load value is the forecast value ISO NE uses in assessing resource adequacy for reliability purposes.[23] The 90/10 peak load forecast is a forecast peak load for which there is a 10% chance that the peak load will be higher, and a 90% chance that it will be lower. I do not use the 90/10 metrics in this testimony.

**Q. Please summarize this section.**

A. Energy efficiency and behind-the-meter solar PV result in declining net peak load and declining annual net energy needs in New England and Rhode Island. Net peak load and net energy are the peak load seen by, and the energy needed from, the transmission grid; net peak load is equal to gross load minus the effect of energy efficiency and behind-the-meter solar PV. The existence of these resources alone – energy efficiency and behind-the-meter solar PV – lowers forecast net demand. When coupled with existing capacity resources, additional utility-scale solar PV, and a much-enhanced transmission grid across New England, near-term reliability for Rhode Island and the New England region is ensured without the proposed Invenergy plant.

**Q. What is the historical pattern of electric peak load and electric energy consumption in Rhode Island and New England as a whole?**

A. Figures 1 and 2 show the pattern of net peak load and annual energy consumption in

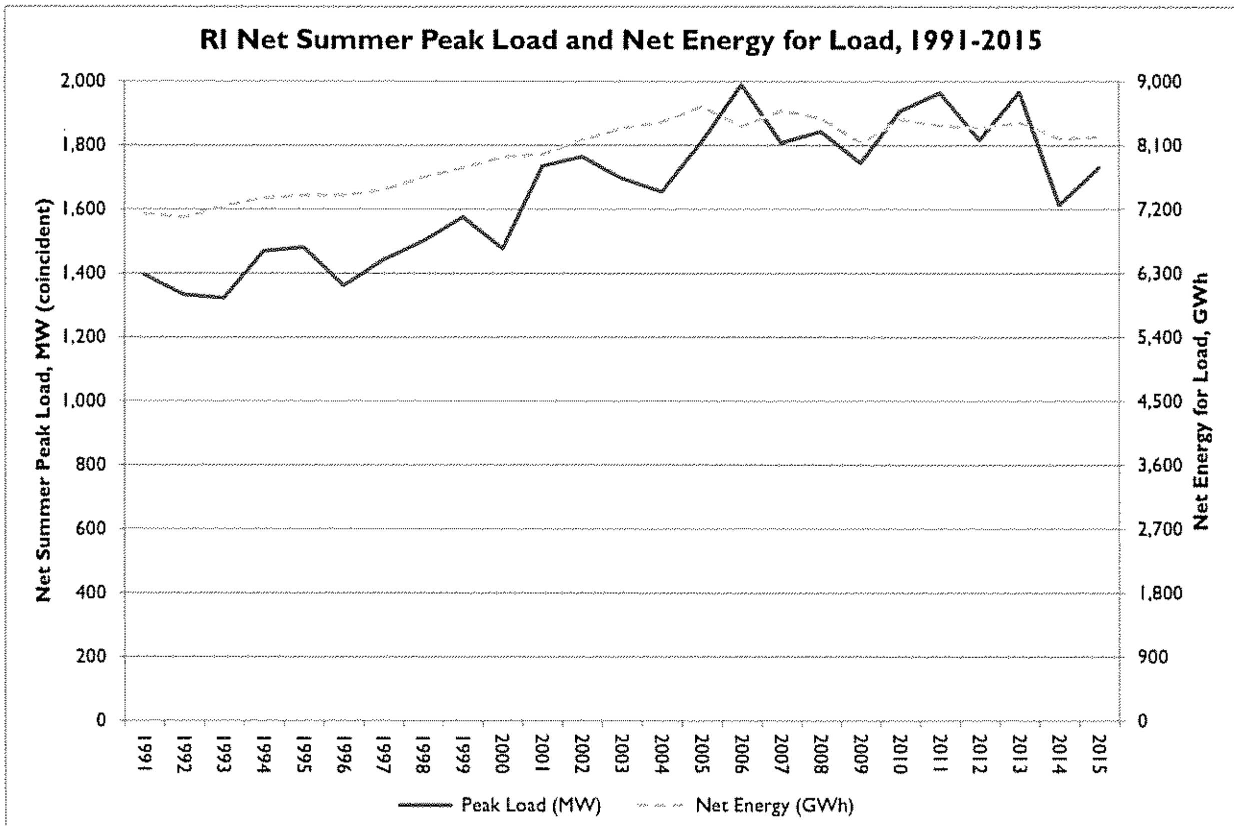
[22] See the ISO NE 2016 CELT, Tab "1.6 Frcst Distributions".
[23] See for example, ISO NE 2015 Regional System Plan, Table 4-7, Future Systemwide Needs (MW), using 50/50 Peak Load when determining representative net ICR (installed capacity requirement) need.

Rhode Island and New England. The values shown are from actual ISO NE 2016 CELT data.

**Q. What do these figures illustrate?**

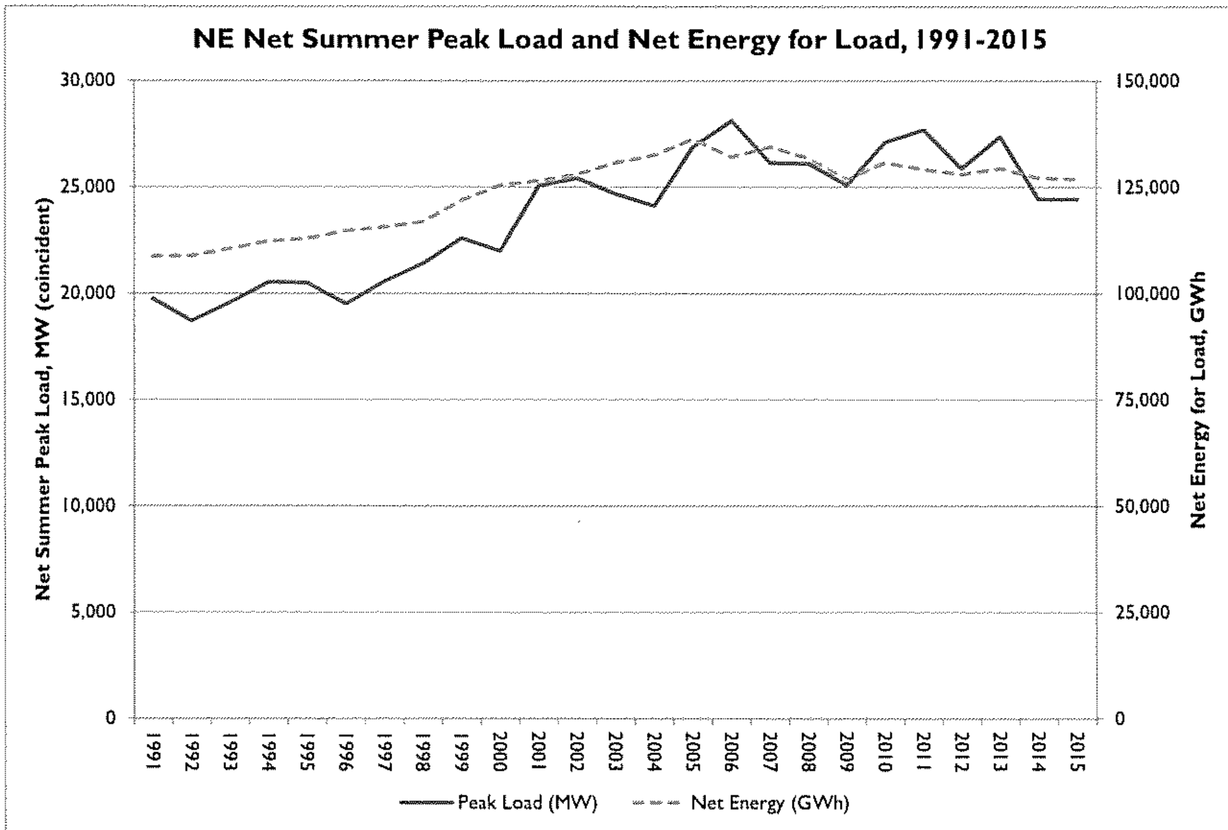
A. The figures show that for both Rhode Island, and New England as a whole, net electricity load has flattened (both summer net peak load, and annual net energy), and has begun to trend downward over the past decade, contrary to the assertion made by Invenergy.[24]

**Figure 1. Rhode Island Summer Peak Load and Annual Net Energy for Load, 1991-2015**




[24] Invenergy Application, page 121, "The State of Rhode Island's electric generation portfolio has scarcely changed over the past decade while energy use and specifically the use of electricity has significantly increased over the same period."

**Figure 2. New England Summer Peak Load and Annual Net Energy for Load, 1991-2015**




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.

**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,[25] 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.

[25] See, for example, Rhode Island PUC approval of the most recent three-year energy efficiency plan, which projects annual electric efficiency achievements of 2.5% (2015), 2.55% (2016), and 2.6% (2017). RI PUC, Docket 4443.

**Q. What level of solar PV exists in Rhode Island, and what levels are forecast for Rhode Island?**

A. As of the end of 2015, 23.6 MW exists, of which 6.4 MW is behind-the-meter. Through 2020, 158.2 MW of additional solar PV is projected to be added, for a cumulative amount of 181.8 MW. 52.6 MW of this cumulative amount is behind-the-meter solar, impacting the net peak demand and energy forecast for Rhode Island. Through 2025, ISO NE projects a total of 217.2 MW of solar PV in Rhode Island. Of this amount, 63 MW is behind-the-meter solar PV.[26]

**Q. How do solar PV resources – either behind-the-meter, or utility scale – support reliability needs in New England, and Rhode Island?**

A. Behind-the-meter solar PV resources reduce peak load and the attendant distribution and transmission losses that occur on peak; they are accorded a peak-load-reducing credit proportional to their output during times of peak demand. Peak demand occurs after the time of peak solar PV output, but still reduces peak by a value currently equal to roughly 40% of their nameplate AC rating.[27] Solar PV contributes to reducing peak load because total nameplate capacity is producing (albeit at lower than maximum levels) during the peak hours, which occur in the mid to later afternoon in New England. Behind-the meter solar PV also reduces peak period losses on the transmission and distribution system.

**Q. How do energy efficiency resources help ensure reliability in New England?**

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[26] See ISO NE Final 2016 PV Forecast, Distributed Generation Forecast Working Group, April 15, 2016. Pages 9 and 31.

[27] See 2016 ISO NE CELT, Tab 3.1.2 PV Forecast - BTM MW, which indicates a 40% peak load reduction credit for 2015, decreasing to 34.1% by 2025. The value reduces over time because the time of net system peak is moving towards later in the day, when solar output is lower (than earlier in the day).

A. Energy efficiency resources reduce peak load by reducing end use load during times of system peak, including reduced lighting, air conditioning, and other loads.

**Q. How do energy efficiency and behind-the-meter solar PV resources together help ensure reliability in New England?**

A. Energy efficiency and behind-the-meter solar PV resources exert continuous downward pressure on net peak load and net annual energy trajectories in New England, and in Rhode Island. Over the past decade or so, the effect of the presence of energy efficiency resources (and more recently, in combination with behind-the-meter solar PV resources) has been to flatten out or turn negative the projected annual load growth in New England and Rhode Island. The forecast for net load has only very recently turned negative, as seen by comparing the 2016 CELT forecast for net energy needs with earlier CELT forecasts. Figures 3 through 6 below demonstrate the trends, by showing: (i) successive vintage CELT forecasts of New England net energy for load (Figure 3); (ii) the impact of energy efficiency and behind-the-meter solar PV, by showing gross and net energy for load projections for New England (Figure 4); (iii) successive vintage CELT forecasts of Rhode Island net energy for load (Figure 5); and (iv) the impact of energy efficiency and behind-the-meter solar PV, by showing gross and net annual energy load projections for Rhode Island (Figure 6).

**Figure 3. Net Energy for Load - Forecast Trends in New England by Forecast Vintage**

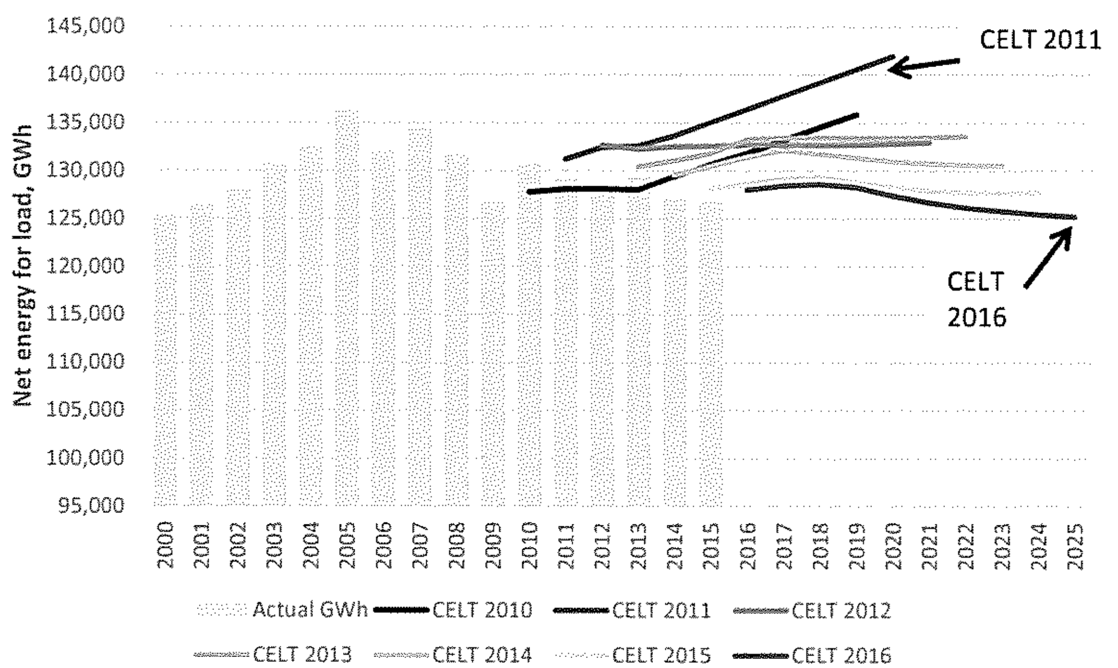



**Figure 4. Gross and Net Energy for Load – EE, Solar PV Forecast Effects in New England**

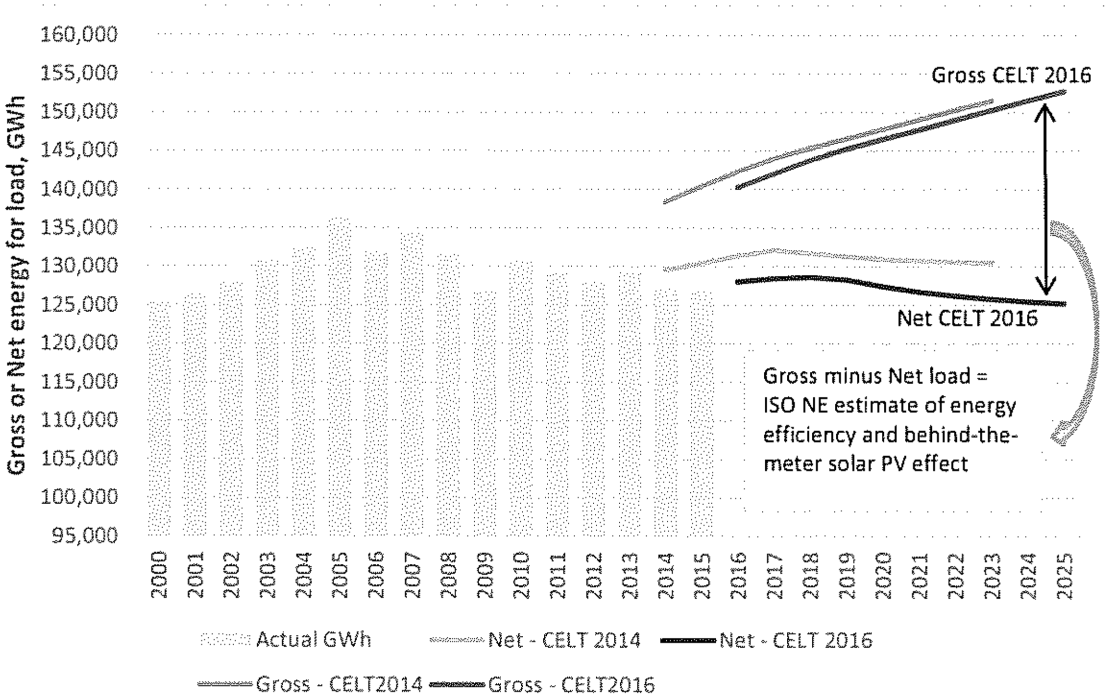


**Figure 5. Net Energy for Load - Forecast Trends in Rhode Island by Forecast Vintage**

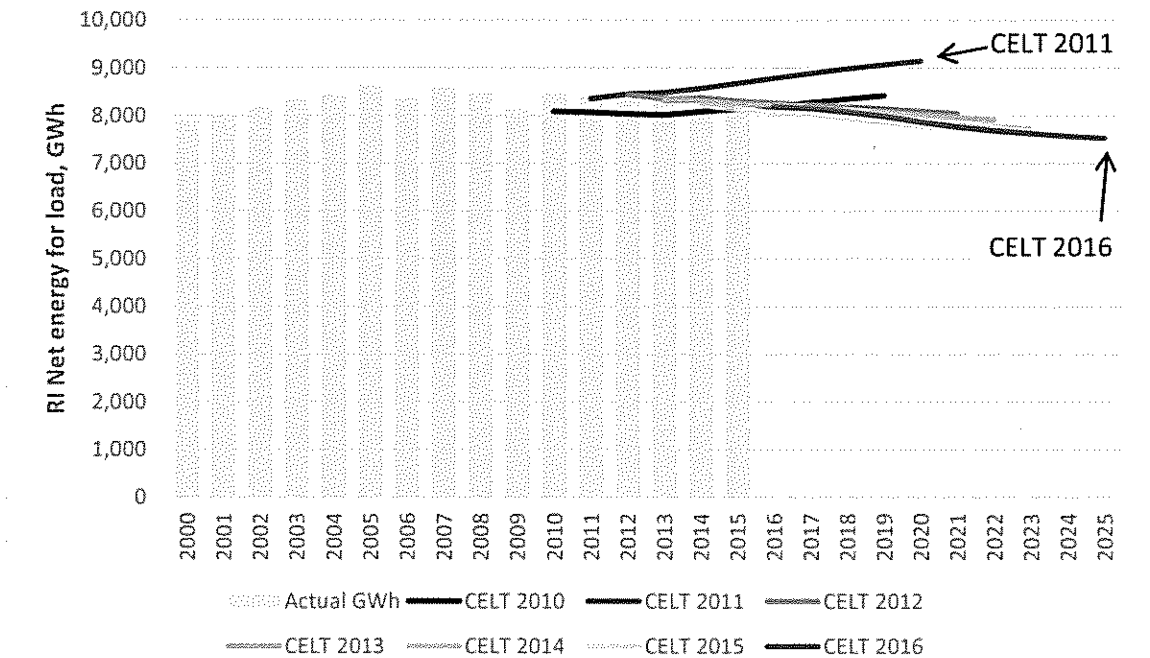
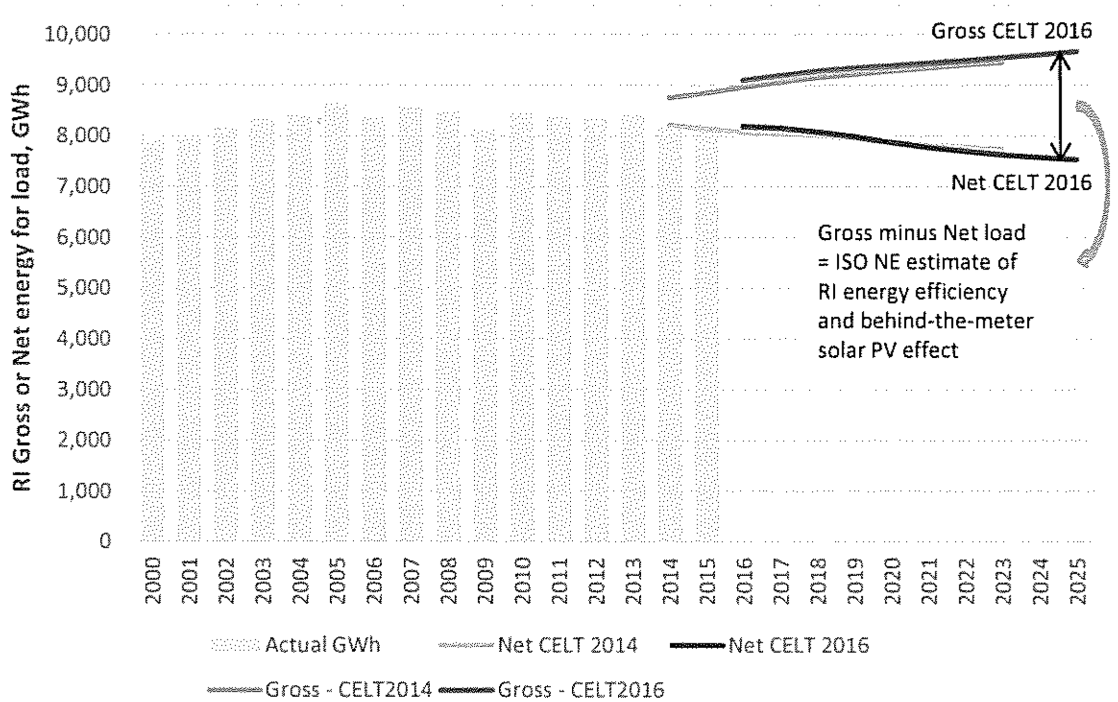



**Figure 6. Gross and Net Energy for Load – EE, Solar PV Forecast Effects in Rhode Island**




Source, Figures 3 through 6 - ISO NE, CELT Reports Data, 2010-2016, compilation by Synapse

**Q. Please summarize your observations of what Figures 3 through 6 illustrate.**

A. The data in Figures 3 through 6 illustrate that net energy needs are declining – and these data do not account for the impact that future new renewable resources other than behind-the meter solar PV may have on energy needs for the New England system. Thus the graphs illustrate that the net energy that needs to be provided from the grid – from utility scale renewables, hydro, nuclear, and conventional fossil fuel resources – is declining. To the extent that new grid-scale renewables resources are built, the net energy needs from conventional natural gas-fired resources decline even more than these graphs indicate.

**Q. Can these resources – energy efficiency, and behind-the-meter solar PV in New England, or in Rhode Island - displace the energy that might otherwise be produced by the proposed Invenergy plant?**

A. Yes, certainly if one considers New England-wide energy efficiency and solar PV; and even if one considers the ISO NE's current (likely underestimated)[28] trajectory of energy efficiency and solar PV resources in Rhode Island alone, they could provide much of the output of a 500 MW combined cycle plant, depending on the assumed or modeled level of output for the plant. Figure 4 above and Table 1 below show New England-wide energy efficiency and behind-the-meter solar PV resource output in even the first year of possible operation of the proposed Invenergy plant (i.e., 2019) as far exceeding the estimated output of the plant (4,104 GWh/year, see Table 1). Table 1 below contains the estimates for annual energy output from

[28] I address this point later in my testimony. The ISO NE forecast of solar PV resources in 2015 for future years was significantly lower than the ISO NE 2016 forecast for solar PV resources in those same future years.

energy efficiency and behind-the-meter solar PV from New England and from Rhode Island, and includes Invenergy's estimate of the annual energy output of the proposed plant. For additional comparison, it shows the energy output of a 500 MW combined cycle plant operating at a 50% annual capacity factor.

**Table 1. Comparison of Annual Energy Provision by 500 MW Invenergy Plant, and New England and Rhode Island Behind-the-Meter Solar PV and Energy Efficiency Resources As Projected by ISO NE in the 2016 CELT**

| **Annual Output, GWh** | **2020** | **2025** |
|---|---|---|
| NE EE and BTM solar PV | 19,078 | 27,518 |
| RI EE and BTM solar PV | 1,522 | 2,139 |
| | | |
| Invenergy plant average first three Years of operation – response to CLF-2-5. Equal to ~500 MW plant at 94% annual capacity factor (CF). | 4,104 | |
| 500 MW plant at 50% annual CF | 2,190 | |

Source: Gross and net load data from ISO NE, 2016 CELT. Specific Invenergy plant value from response to CLF-2-5. Output of 500 MW plant at 50% CF computed by Synapse.

**Q. What will be the annual energy output of the proposed Invenergy plant?**

A. Invenergy's response to CLF-2-5 indicated that the plant would produce roughly 4,104 GWh per year, on average over its first three years of operation. Depending on the output capacity considered for the plant, that level of output represents an annual capacity factor of roughly 47% (for a 1000 MW plant) or 94% (for a 500 MW plant).

**Q. What do the ISO's net peak load forecasts reveal for New England and Rhode Island?**

A. The net peak load forecast patterns are similar to that seen with energy, though the current CELT forecast indicates slightly increasing net peak load in New England, and slightly decreasing net peak load growth in Rhode Island, over the 2016-2025 period. Figures 7 and 8 show these data. For New England, the compound annual growth rate (CAGR), 2016-2025, is 0.17%. For Rhode Island, the CAGR is -0.07% (negative).

**Q. Do you have an opinion on whether the net peak load growth in New England will actually reach zero, or begin to be negative, any time soon?**

A. Yes. In my opinion, given the trends seen in subsequent net peak load forecasting in recent CELT reports, and looking at the overall historical trends seen in New England (1991-2015, Figure 2, and the pattern of lower forecast net peak growth with later forecast vintages seen in Figure 7, below), it is reasonable to project that the net peak load growth will continue to flatten towards zero or be negative as soon as over the next few years.

**Q. What effect will a negative net peak load forecast have on reliability?**

A. It would lead to reliability needs being secured with generally lower total capacity resources than would be needed if the peak load increased.

**Q. And what effect will a net negative peak load forecast have on the putative need to build the Invenergy facility?**

A. It would make any assumed need for the Invenergy plant less important, because a relatively greater surplus of capacity to meet reliability needs would exist if the future net peak load forecast was lower.

**Figure 7 – New England Net Peak Load Forecast**

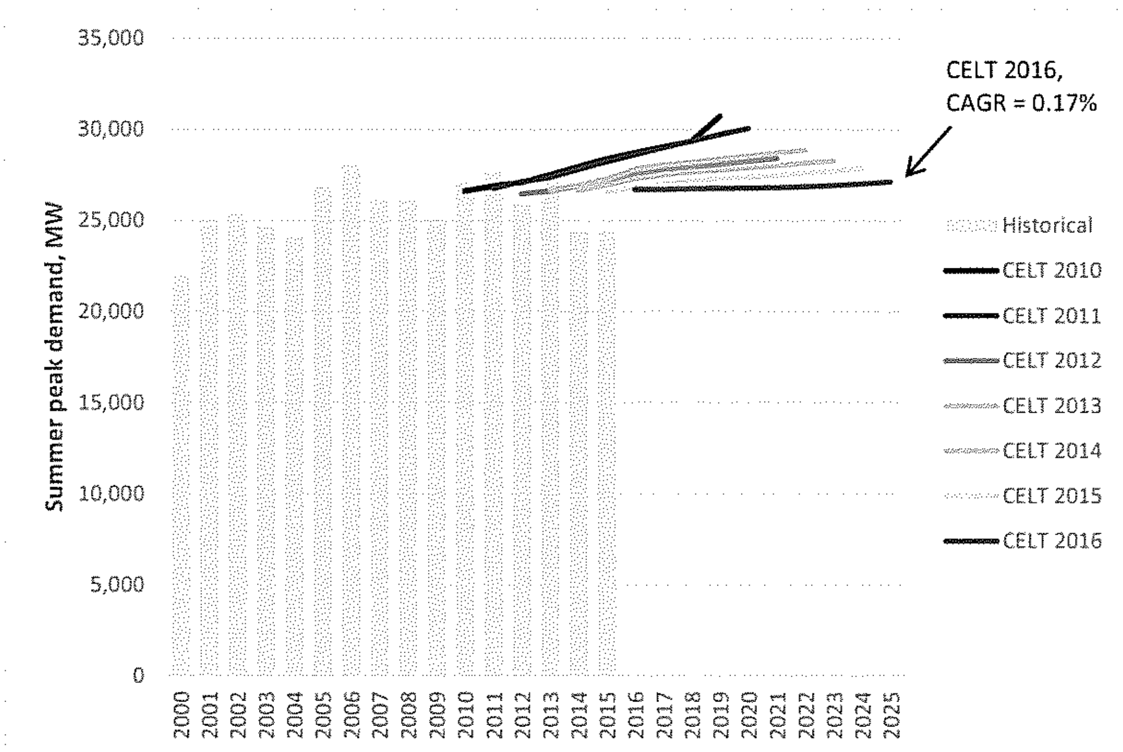
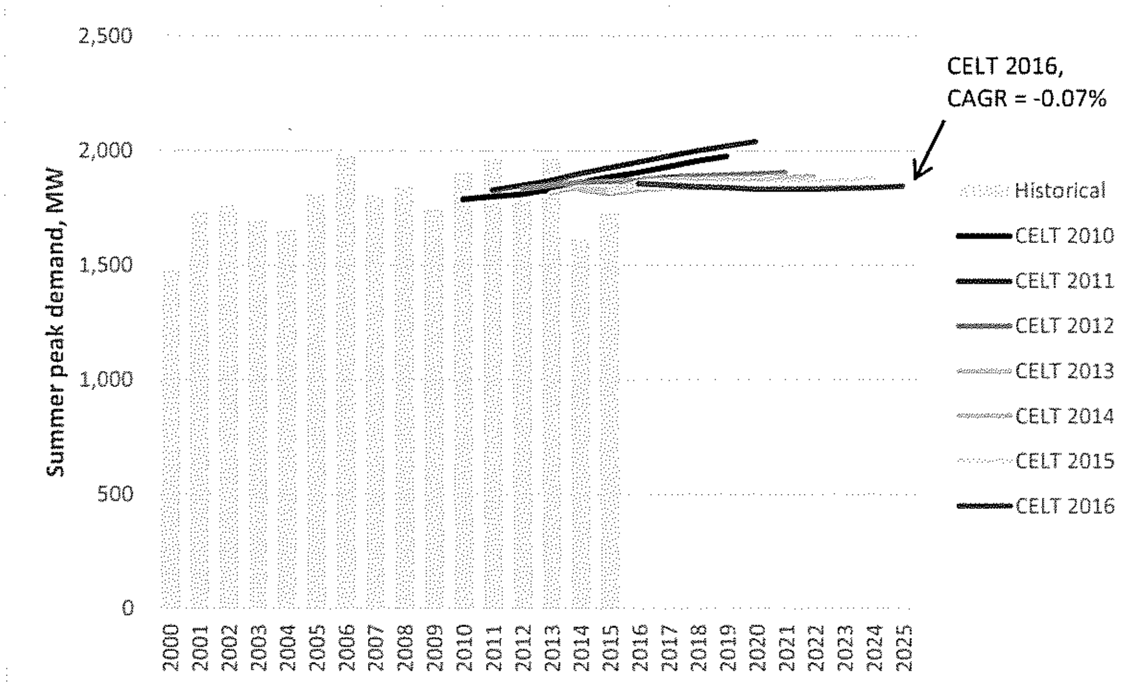



**Figure 8 Rhode Island Net Peak Load Forecast**




Source: ISO NE CELT data, 2016, 2015, 2014, 2013, 2012, 2011, 2010.

**Q. Are there other renewable resources, besides behind-the-meter solar PV, that could displace the energy otherwise provided by the proposed Invenergy plant?**

A. Yes, certainly. Utility-scale solar PV, onshore wind, offshore wind, and hydro resources from Canada could all displace the energy, and capacity, that might otherwise be provided by the Invenergy facility, or other new natural gas plants for that matter. The above Table 1 and Figures 1-8 illustrate the relative scale of the output of the proposed facility and the scale of the demand-side energy efficiency and behind-the-meter resources that could displace Invenergy plant output.

**Q. Are there specific reasons to think that the solar PV forecast contained in the current CELT report is conservative – i.e., is lower than what will actually occur?**

A. Yes. The ISO NE 2016 solar PV forecast resulted in a significantly higher level of solar PV projected for New England than the previous ISO NE forecast. Figures 9 and 10 below show, respectively, the current forecast levels (in a table taken directly from the ISO NE presentation document) and last year's 2015 solar PV forecast. Figure 11 is a comparison between last year's forecast, the earlier 2014 forecast, and this year's forecast in graphical form, from ISO NE. As seen, there was a dramatic increase in projected solar PV resources in 2016 compared to the 2015 forecast, which itself exhibited a significant increase above 2014 projections.

**Q. What reasons might exist for next year's forecast for solar PV resources in a given year being greater than this year's forecast?**

A. The underlying economics of solar PV drive the increasing penetration of the resource. Solar PV costs have dropped dramatically over the past few years, and are expected to continue to decline in cost.[29] The ISO also assumes that "historical PV growth trends across the region are indicative of future intra-annual growth rates[,]"[30] but declining solar PV costs could reasonably result in increases to the future growth rates, relative to historical patterns.

**Figure 9. ISO NE Solar PV Final Forecast, 2016**

# Final 2016 PV Forecast

*Nameplate, $MW_{ac}$*

***Note***: Values in red boldface have changed relative to the draft forecast

| States | Annual Total MW (AC nameplate rating) | | | | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | |
| CT | 188.0 | 85.5 | 104.5 | 81.0 | 81.0 | 81.0 | 55.8 | 54.3 | 45.0 | 45.0 | 45.0 | 866.1 |
| MA | 947.1 | 294.4 | 122.7 | 69.7 | 38.7 | 38.7 | 38.7 | 38.7 | 38.7 | 38.7 | 38.7 | 1,705.0 |
| ME | 15.3 | 4.7 | 4.7 | 4.4 | 4.4 | 4.4 | 4.2 | 3.9 | 3.9 | 3.9 | 3.9 | 57.9 |
| NH | 26.4 | 13.3 | 7.6 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 79.3 |
| RI | 23.6 | 21.6 | 38.7 | 36.0 | 36.0 | 25.9 | 9.1 | 6.6 | 6.6 | 6.6 | 6.6 | 217.2 |
| VT | 124.6 | 30.2 | 23.8 | 22.5 | 22.5 | 22.5 | 21.3 | 20.0 | 20.0 | 20.0 | 20.0 | 347.3 |
| Regional - Annual (MW) | 1325.0 | 449.6 | 301.9 | 217.7 | 186.7 | 176.5 | 133.2 | 127.5 | 118.2 | 118.2 | 118.2 | 3,272.8 |
| Regional - Cumulative (MW) | 1325.0 | 1774.7 | 2076.5 | 2294.2 | 2480.9 | 2657.4 | 2790.6 | 2918.1 | 3036.3 | 3154.6 | 3272.8 | 3,272.8 |

***Notes***:

(1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
(2) The forecast reflects discount factors to account for uncertainty in meeting state policy goals
(3) All values represent end-of-year installed capacities

[29] Solar PV costs have declined dramatically over the past five years, and are projected to continue to decline. See, for example, Attachment G of this testimony, from the US DOE, Solar Energy Technologies Office, "On the Path to Sunshot: Executive Summary," Figure 1. Solar PV LCOE – historical, current, and 2020 targets (page 4).
[30] ISO NE Final 2016 PV Forecast, slide 12.

**Figure 10. ISO NE Solar PV Final Forecast, 2015**

## Final 2015 PV Forecast

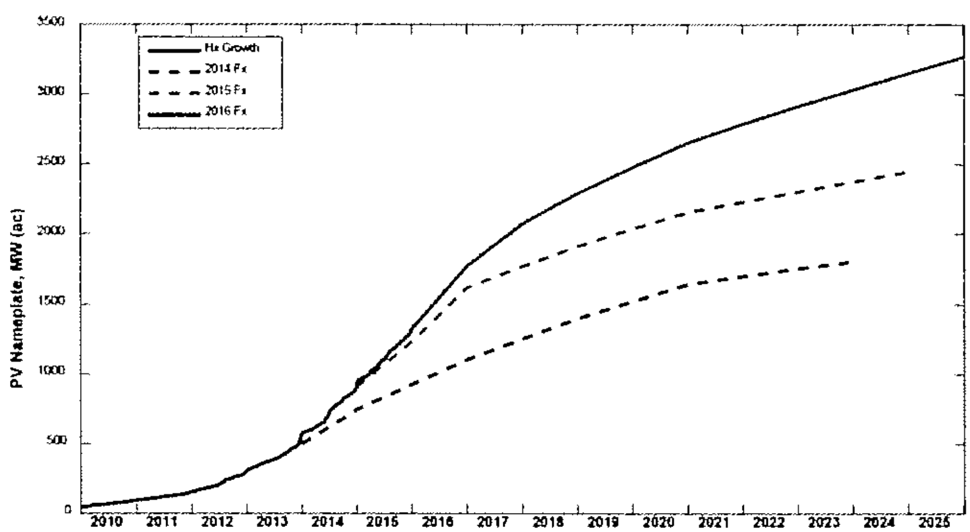
*Annual Nameplate ($MW_{ac}$)*

| States | Annual Total MW (AC nameplate rating) | | | | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | |
| CT | 118.8 | 70.9 | 89.9 | 45.8 | 43.1 | 40.4 | 40.4 | 26.9 | 26.9 | 26.9 | 26.9 | 556.8 |
| MA | 666.8 | 197.0 | 229.8 | 51.4 | 48.4 | 45.4 | 45.4 | 30.2 | 30.2 | 30.2 | 30.2 | 1,405.1 |
| ME | 10.4 | 2.2 | 2.2 | 2.0 | 1.8 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 28.9 |
| NH | 12.7 | 4.3 | 4.3 | 3.8 | 3.6 | 3.4 | 3.4 | 2.3 | 2.3 | 2.3 | 2.3 | 44.4 |
| RI | 18.2 | 9.7 | 20.4 | 27.2 | 31.0 | 29.0 | 20.6 | 7.1 | 5.4 | 5.4 | 5.4 | 179.3 |
| VT | 81.9 | 40.4 | 40.4 | 22.3 | 13.9 | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 | 4.2 | 234.7 |
| Regional - Annual (MW) | 908.8 | 324.3 | 386.9 | 152.4 | 141.7 | 126.2 | 117.8 | 74.6 | 72.9 | 72.9 | 70.8 | 2,449.1 |
| Regional - Cumulative (MW) | 908.8 | 1233.1 | 1620.0 | 1772.4 | 1914.1 | 2040.3 | 2158.1 | 2232.6 | 2305.5 | 2378.4 | 2449.1 | 2,449.1 |

Notes:
(1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
(2) The forecast reflects discount factors described on slides 4
(3) All values represent end-of-year installed capacities
(4) ISO is working with stakeholders to determine the appropriate use of the forecast

**Figure 11. ISO NE Graph Comparing 2015 and 2016 Solar PV Forecast**

## PV Growth: Reported Historical vs. Forecast




Sources, Figures 9 and 11: ISO NE, Final 2016 PV Forecast, http://www.iso-ne.com/static-assets/documents/2016/04/2016_pvforecast_20160415.pdf, slides 9-10. Figure 10: ISO NE Final 2015 Solar PV Forecast Details.

**Q. Please explain how the solar PV forecast trends seen in the above figure affects the assessment of reliability needs in Rhode Island and New England, and how they impact the need for the proposed Invenergy plant.**

A. The figures illustrate the potential for increasing levels of solar PV in future forecasts, for any given year relative to earlier forecasts. As solar PV increases, the net peak load forecast will decrease. Decreasing net peak load forecasts places downward pressure on the need for new capacity resources.

**Q. Are there specific reasons to think that the effect of energy efficiency installation efforts in Rhode Island could contribute to even lower net load forecasts in future years?**

A. Yes. The most recently approved three-year energy efficiency plan for National Grid in Rhode Island indicates an *increasing* annual target for energy efficiency installations – from 2.5% of annual energy sales in 2015, to 2.6% by 2017.[31]

**Q. Invenergy says "the use of electricity has significantly increased"[32] over the past decade. Has it?**

A. No, that is incorrect. Figure 1 above, from historical CELT data on Rhode Island electric energy use, shows that net annual energy use has actually declined.

## The Applicant Does Not Address Long-Term Reliability Needs in Rhode Island or New England

**Q. Does the Invenergy application present any evidence for a long-term reliability need**

[31] See, for example, Rhode Island PUC approval of the most recent three-year energy efficiency plan, which projects annual electric efficiency achievements of 2.5% (2015), 2.55% (2016), and 2.6% (2017). RI PUC, Docket 4443.
[32] Invenergy Application, page 121.

**for the proposed plant?**

A. No. The applicant relies only on the prospective results of the ISO NE capacity market auction to indicate a reliability need for the plant. The applicant's failure to present any evidence of a long-term reliability need for the plant is significant, because absent such a need, I don't see how this proposed plant fits with Rhode Island state energy policy that, according to the applicant,[33] emphasizes increasing energy efficiency, integration of renewable energy into the system, and achieving reductions in greenhouse gases.

**Q. How are long-term resource needs determined, or forecast, for the Rhode Island or the New England region?**

A. ISO NE sets out its current and anticipated future reliability needs in its annually-updated Regional System Plan, and documents its near-term requirements in its annual Installed Capacity Requirement filing to the Federal Energy Regulatory Commission (FERC). The annual Regional System Plan uses the most recent CELT forecast data, and each year's plan is effectively an update to the prior year's plan. ISO NE regional planning forecasts of capacity requirements do not indicate any specific need for the Invenergy plant. For example, the table below from ISO NE (Figure 12) shows the latest Regional System Plan forecast of resource needs, prior to the tenth FCA.

[33] Invenergy application, page 122.

**Figure 12. ISO NE Representative System Wide Resource Needs From 2015 Regional System Plan**

| Year | 50/50 Peak Load[a] | Representative Net ICR (Need) | FCA #9 (Known Resources)[b] | EE Forecast (New Resource)[c] | Resource Surplus/Shortage[d] |
|---|---|---|---|---|---|
| **2020/2021** | 30,182 | 34,500 | 34,695 | 477 | 672 |
| **2021/2022** | 30,487 | 34,800 | 34,695 | 695 | 590 |
| **2022/2023** | 30,804 | 35,200 | 34,695 | 900 | 395 |
| **2023/2024** | 31,131 | 35,600 | 34,695 | 1,093 | 188 |
| **2024/2025** | 31,455 | 36,000 | 34,695 | 1,274 | -31 |

(a) The 50/50 peak loads reflect the behind-the-meter PV resources.
(b) FCA #9 resource numbers are based on FCA #9 auction results, assuming no retirements and the same level of imports (i.e., most imports need to requalify for every auction). Details are available at the ISO's FERC filing, *ISO New England Inc., Docket No. ER15-Informational Filing for Qualification in the Forward Capacity Market* (November 4, 2014), http://www.iso-ne.com/static-assets/documents/2014/11/er15-___-000_11-3_14_fca_9_info_filing_public_version.pdf.
(c) EE forecast values are based on the 2015 EE forecast. Details are available at http://www.iso-ne.com/static-assets/documents/2015/04/iso_ne_final_2015_ee_forecast_2019_2024.pdf.
(d) Additional resources would be required if additional resources retired or less capacity imports obtain CSOs.

Source: Table 4-7, Future Systemwide Needs (MW), from 2015 ISO NE Regional System Plan (November 2015).

**Q. Does this table indicate a future need for the Invenergy plant?**

A. No. It indicates a relative resource surplus beginning 2020, and into the middle of the next decade. It includes the results from FCA 9, indicating that it assumes those resources would be built.

**Q. Does it include the most recent updates to the projections for solar PV forecasts in New England, or net peak load projections from the 2016 CELT?**

A. Critically, no. The plan is from December 2015, and uses net peak load forecasts from the 2015 CELT and solar PV forecasts that were developed in 2015 and which are now seen to significantly underestimate the amount of installed solar PV. The 2015 forecasts underestimated solar PV for 2019 by 441 MW (nameplate AC), and underestimated solar PV for 2024 by 705 MW (nameplate AC).[34]

[34] See Figures 9 and 10 above, comparing 2015 and 2016 ISO NE solar PV forecasts for 2019 and 2024.

**Q. Can you illustrate an updated "50/50 Peak Load" forecast based on the 2016 CELT data, for comparison to what is reflected in the above table?**

A. Yes. The table above (Figure 12) contains a 2024/2025 forecast of peak load (net of solar PV behind-the-meter resources, but exclusive of energy efficiency effects on peak load) of 31,455 MW. The 2016 CELT forecast of net peak load inclusive of behind-the-meter solar PV but excluding energy efficiency effects is 30,691 MW for 2024/2025. In other words, a one-year forward update to the data contained in this table (i.e., Figure 12) illustrates that the net peak load for which resource requirements are based for 2024 *is 763 MW lower than the prior year's estimate*.

**Q. How will that affect future capacity market reconfiguration auctions?**

A. ISO NE will update the parameters for installed capacity need to account for these types of adjustments, effectively allowing a re-balancing of capacity supply obligations by the marketplace.

**Q. How has the future ISO NE 50/50 peak load forecast, on which resource requirements for future year reliability are based, changed over the past five years?**

A. Table 2 below shows how this critical metric has changed. As noted above in Figures 7 and 8 and the discussion around changing net peak load forecast trends in New England, the effect of aggressive energy efficiency resource deployment and exponentially increasing behind-the-meter solar PV installations has dramatically altered future peak load conditions on which resource needs are based. As seen below, the ISO NE Regional System Plan forecast for resource requirements and the CELT forecast (which is the source for those resource requirement projections) have been significantly overestimating peak load, and thus resource needs, for each of the past five years. Even in the most recent Regional System Plan (based on 2015 CELT data), the overestimation of peak load (in comparison to ISO NE's own 2016 CELT forecast) is 518 MW for 2019, the year of operation for the proposed plant.

**Table 2. Pattern of 50/50 Peak Load Forecast Overestimation by ISO NE**

| ISO NE 50/50 Peak | MW Peak Load Forecast Overestimate - Years Before Current CELT | | | | |
|---|---|---|---|---|---|
| For Peak Load in: | 5 Years Out (2011 CELT) | 4 Years Out (2012 CELT) | 3 Years Out (2013 CELT) | 2 Years Out (2014 CELT) | 1 Year Out (2015 CELT) |
| 2016 | 1,232 | 857 | 807 | 587 | 130 |
| 2017 | 1,368 | 1,108 | 1,003 | 823 | 279 |
| 2018 | 1,455 | 1,205 | 1,085 | 935 | 413 |
| 2019 | 1,532 | 1,262 | 1,182 | 992 | 518 |
| 2020 | 1,615 | 1,330 | 1,260 | 1,075 | 582 |
| 2021 | | 1,391 | 1,341 | 1,126 | 623 |
| 2022 | | | 1,383 | 1,178 | 667 |
| 2023 | | | | 1,205 | 716 |
| 2024 | | | | | 763 |
| 2025 | | | | | |

Source: CELT Forecast Data, 2016, 2015, 2014, 2013, 2012, 2011 versions.
Note: 50/50 Peak load excludes the effect of energy efficiency impacts on peak load.

**Q. In general, please comment on ISO NE forecasts and planning, and what that means for any potential reliability need for this plant.**

A. As seen in the above table, ISO NE forecasts for future resource needs have been conservative over at least the past five years. As a specific example, in 2011 ISO NE overestimated by 1,232 MW the peak load that would occur in 2016. That same year its longer-term forecast, for 2020 (nine years later) overestimated peak load by 1,615 MW (relative to the 2016 CELT). The implication of these overestimations is that future needs are likely to be lower than current projections; fortunately, the structure of the capacity market allows for closer-in-time adjustments, or rebalances, to installed capacity requirements and the market procurements that meet those requirements. Thus, when assessing the longer-term reliability need for any particular proposed power plant, it is critical to keep in mind that ISO NE planning forecasts have tended to overestimate the actual needs.

**Q. Did Invenergy examine long-term resource issues including the availability of indigenous Rhode Island and regional renewable resources, or potential electric storage alternatives, and how they could affect future need for the Invenergy plant, or in general for fossil-fueled power plants?**

A. No, not to any level of detail.[35] Rhode Island's indigenous resources include considerable energy efficiency, as noted, as well as solar and offshore wind resources. New England is also considering the importation of significantly increased levels of renewable Canadian hydropower.[36] Invenergy did not explicitly consider a portfolio of these resources as providing energy that could supplant the output from the proposed Invenergy project, and that could contribute to regional capacity supply.[37] ISO NE projects an incremental 184 MW of peak load reduction (across New England) from energy efficiency installed between 2016 and 2025.[38]

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[35] Invenergy's characterization included a statement that said "Rhode Island has few indigenous energy resources and must import most of the fuels from which its electricity is generated." Page 121.

[36] Two merchant transmission projects are in progress for the potential delivery of up to roughly 2,000 MW of incremental Canadian hydro resources to the ISO NE transmission grid.

[37] Invenergy appears to have examined solar, wind, hydro, and energy efficiency alternatives individually, not as a possible portfolio, for example stating: "solar energy technologies are considered as infeasible for the Project's objectives" (page 127), and "wind energy generation is not a feasible alternative to the Project" (page 126), and "it is highly unlikely, or feasible, to rely exclusively on additional end user improvements to energy efficiency as an alternative to the need for new generation…" (page 128), and "hydropower energy generation is not a feasible alternative to the Project" (page 128).

[38] Computation by Synapse. ISO NE 2016 CELT, forecast energy efficiency impact on peak load (MW) in 2025 (337 MW) less the forecast energy efficiency impact on peak load (MW) in 2016 (153 MW).

ISO NE projects 155.9 MW of solar PV in Rhode Island by the end of 2019, and over 200 MW by 2023. This year, Rhode Island will complete installation of its first offshore wind farm, the 30 MW Block Island wind farm; and a larger southeastern Massachusetts installation (1,000 MW)[39] with a possible Rhode Island interconnection site[40] is under consideration for the future. While RI may not have indigenous fossil resources, it is rich in renewable resources and energy efficiency resources which have already contributed significantly to meeting local electric energy and capacity needs.

**Q. Does that complete your testimony?**

A. Yes.

**Attachments to Testimony**

A. Robert M. Fagan Resume
B. ISO NE 2016 CELT Table – Summer Peak Load
C. ISO NE 2016 Final PV Forecast
D. ISO NE 2016 Geographical Transmission Map – Southern New England portion
E. Discovery Response to CLF-2-5.
F. Selected page from results of FCA 10.
G. Selected page from US Department of Energy, Solar Energy Technologies Office, "On the Path to Sunshot: Executive Summary".

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[39] DONG Energy, Bay State Wind, "Bay State Wind is a utility scale offshore wind farm, located 15 miles off the coast of Martha's Vineyard, with water depths of between 130 - 165 feet. The site area was awarded by the Department of Interior's BOEM in 2015 and additional feasibility assessment and stakeholder engagement, at both a local and state level will now be undertaken. If given approval, we plan to build an offshore wind farm which could have an installed capacity of up to 1,000MW." http://www.dongenergy.com/en/business-activities_/Pages/U-S--Project.aspx.

[40] See ESS Group Inc., "Offshore Wind Transmission Study Final Report", prepared for the Massachusetts Clean Energy Center, Sept. 2014, at p. 23-25. http://files.masscec.com/research/MassCECOSWTransmissionStudy.pdf.