

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS  
ENERGY FACILITY SITING BOARD

IN RE: INVENERGY THERMAL DEVELOPMENT : DOCKET NO. SB 2015-06  
APPLICATION TO CONSTRUCT AND OPERATE :  
THE CLEAR RIVER ENERGY CENTER :

**SUPPLEMENTAL ADVISORY OPINION**  
**OF THE RHODE ISLAND OFFICE OF ENERGY RESOURCES**

The Rhode Island Office of Energy Resources (“OER”) hereby submits this Supplemental Advisory Opinion to the Rhode Island Energy Facility Siting Board (“EFSB”) in compliance with EFSB Order No. 125.<sup>1</sup>

**I. INTRODUCTION**

Invenergy Thermal Development LLC (“Invenergy”) filed an application with the EFSB on October 29, 2015 to construct and operate the Clear River Energy Center (“CREC” or the “Facility” or the “Project”) in the town of Burrillville, Rhode Island (“Application”). The proposed Project is a 900 to 1,000 megawatt (“MW”) combined-cycle gas-fired power plant, consisting of two units each approximately 500 MW, with ultra-low sulfur distillate oil (“ULSD”) available as a backup fuel. On November 16, 2016, the above referenced docket SB-2015-06 (this “Docket”) was opened for the purpose of considering Invenergy’s Application. On January 12, 2016, a preliminary hearing was convened to determine the issues to be considered by the EFSB in evaluating Invenergy’s Application and to designate governmental agencies of the State of Rhode Island (“State”) and other local governmental entities to render advisory opinions on such issues.

In accordance with R.I. Gen. Laws § 42-98-9 and through its Preliminary Decision and Order, EFSB Order No. 86, the EFSB directed OER, in collaboration with the Rhode Island Executive Climate Change Coordinating Council (“EC4”) and with assistance from the Rhode

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<sup>1</sup> EFSB Order No. 125 was issued on February 1, 2018 and became effective as of November 27, 2017.

Island Department of Environmental Management, to “render an advisory opinion as to: (i) the impacts of the Facility on anticipated greenhouse gas emissions that would result from the proposed Facility and the cumulative impact over the life of the project and (ii) whether the Facility will conform to the requirements and provisions of the Resilient Rhode Island Act, R.I. Gen. Laws §§ 42-6.2-1 to 42-6.2-8, and [State] energy policies.”<sup>2</sup> In compliance with EFSB’s directives, OER submitted an advisory opinion dated September 12, 2016 (referred to herein as “OER’s September 2016 Advisory Opinion”).<sup>3</sup>

On November 1, 2017, Invenergy informed the EFSB that, due to permitting delays, Invenergy had been disqualified from participating in the 12<sup>th</sup> Forward Capacity Auction (“FCA”) to be conducted by the Independent System Operator-New England (“ISO-NE”) in February 2018. Consequently, Invenergy’s consultant, PA Consulting Group (“PA”), updated its analysis of the Project, assuming a one-year delay in Unit 2’s commercial operation date (“COD”), to June 1, 2022. Unit 1 of the Project had previously cleared ISO-NE’s 10<sup>th</sup> FCA, and received a Capacity Supply Obligation (“CSO”) for the capacity commitment period of June 1, 2019 to May 31, 2020.

In light of this new information, on November 3, 2017, the Conservation Law Foundation (“CLF”) filed a motion requesting that the EFSB direct the Rhode Island Division of Planning (“Planning”) and OER to issue supplemental advisory opinions that take into account the new information. CLF also requested permission for additional discovery and leave to file supplemental testimony. CLF’s motion was granted by the EFSB effective November 27, 2017.<sup>4</sup>

OER has considered the issues assigned to it for review and now submits this Supplemental Advisory Opinion in compliance with EFSB Order No. 125. This Supplemental

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<sup>2</sup> See EFSB Order No. 86, § VII B 5.

<sup>3</sup> OER’s September 2016 Advisory Opinion may be viewed at [http://www.ripuc.org/efsb/efsb/SB2015\\_06\\_ADV\\_OER.pdf](http://www.ripuc.org/efsb/efsb/SB2015_06_ADV_OER.pdf).

<sup>4</sup> See EFSB Order No. 125.

Advisory Opinion incorporates information provided by Invenenergy in this Docket and information that has otherwise become available to OER since the filing of its September 2016 Advisory Opinion.

## **II. BACKGROUND AND SOURCES OF INFORMATION**

### **A. Background**

As part of the Application before the EFSB in this Docket, Invenenergy, through its advisors, PA, provided an analysis of the regional environmental impacts of the Project.<sup>5</sup> As described in OER’s Advisory Opinion, PA utilized several software packages to support its analysis, including AURORAxmp, a production cost model that simulates the regional wholesale electric market and the operation of resources within the region.<sup>6</sup> AURORAxmp was used to analyze the impact of the Project on ISO-NE market energy prices and also on regional emissions of greenhouse gases (“GHG”), specifically, carbon dioxide (“CO<sub>2</sub>”), over a forecast period of 2019 through 2025. By comparing a forecast of emissions across the system with the Project to a reference case without the Project, PA concluded in the Application that operation of the Project will reduce CO<sub>2</sub> emissions by about 1% per year across the combined ISO-NE and New York Independent System Operator (“NYISO”) regions.

OER engaged Levitan & Associates, Inc. (“LAI”) to conduct a review of PA’s forecast model and the input assumptions that supported Invenenergy’s conclusions in its Application regarding GHG impacts of the Project. In its September 2016 Advisory Opinion, OER concluded that “the key assumptions regarding the regional market structure, fuel and emission allowance prices, supply and demand forecasts, and transmission all appear to be reasonable and

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<sup>5</sup> See Invenenergy Thermal Development LLC, “Rhode Island Energy Facility Siting Board Application, Clear River Energy Center, Burrillville, Rhode Island,” prepared by ESS Group, Inc., October 28, 2015, (“Application”), Sections 5.2 and 7.2.4.

<sup>6</sup> AURORAxmp is a commercially available software package licensed by EPIS, Inc. The model emulates the load-following dispatch instructions issued by ISO-NE (and other ISOs/RTOs), which minimizes system-wide production costs.

the model supports a reasonable forecast of the Project's impact on CO<sub>2</sub> emissions in the region."<sup>7</sup>

The following year, OER directed Invenergy to refresh its analysis of CO<sub>2</sub> emissions impact ascribable to the Project to reflect regional market developments that had taken place since the Application was filed.<sup>8</sup> The refreshed forecast also incorporated an anticipated delay in the COD of one year for both CREC units. On behalf of OER, Ellen Cool, Vice President and Principal of LAI, reviewed Invenergy's responses to OER's 3<sup>rd</sup> Set of Data Requests and offered her opinion that, despite a delay in the Project COD and other market developments properly captured in the model, operation of the Project will contribute to lowering CO<sub>2</sub> emissions across the region. She also observed that the updated model forecasted that regional CO<sub>2</sub> emissions decrease by approximately 10% on an average annual basis in the updated 2017 model relative to the model prepared for the Application, regardless of whether or not the Project was assumed to be operating.<sup>9</sup>

Following Invenergy's responses to OER's 3<sup>rd</sup> Set of Data Requests, OER learned that Invenergy was informed by ISO-NE that CREC Unit 2 failed to qualify for the 12<sup>th</sup> FCA. Therefore, OER issued its 4<sup>th</sup> Set of Data Requests to Invenergy to evaluate the impact on regional CO<sub>2</sub> emissions arising from a further delay in the COD of CREC Unit 2, as well as Unit 1. Additionally, new initiatives have been advanced by several New England states to promote more aggressive development of clean energy resources for the region. Therefore, OER's 4<sup>th</sup> Set of Data Requests also directed Invenergy to evaluate how the implementation of Sections 83C and 83D of the Massachusetts Energy Diversity Act and other regional clean energy procurements would impact its analysis. As part of the requested analysis, OER instructed

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<sup>7</sup> OER's September 2016 Advisory Opinion, Sept. 12, 2016, p. 34.

<sup>8</sup> OER's 3<sup>rd</sup> Set of Data Requests to Invenergy

<sup>9</sup> Pre-Filed Direct Testimony of Ellen G. Cool, Docket SB-2015-06, filed August 7, 2017, p. 6-8.

Invenergy to assume that a total of 890 MW of new offshore wind (“OSW”) would be in service by 2025, and that a new 1,000 MW HVDC transmission line from Canada delivering hydropower into northern New England would be developed.

Including the model supporting its original Application, Invenergy has now provided several model cases which incorporate different sets of market conditions, assumed Project COD, and other input assumptions, as summarized in Table 1.

**Table 1. Summary of Model Cases Prepared by Invenergy and PA**

Identifier	Model Vintage	Assumed COD		Includes new OSW and Hydropower?
		Unit 1	Unit 2	
Application	Prior to June 2016	June 2019	June 2020	No
OER 3 <sup>rd</sup> DRs	May 2017	June 2020	June 2021	No
OER DR 4-2	January 2018	June 2021	June 2022	No
OER DR 4-3	January 2018	June 2020	June 2022	Yes
OER DR 4-4	January 2018	June 2021	June 2022	Yes

Taking into account information which has become available since the filing of OER’s September 2016 Advisory Opinion and since the preparation of Ellen Cool’s Pre-Filed Testimony, this Supplemental Advisory Opinion addresses the following questions:

- Do any of the proposed revisions to the Project development plans or anticipated operations materially alter the conclusions of OER’s September 2016 Advisory Opinion?
- What is the impact on regional CO<sub>2</sub> emissions if the commercial operation date of one or both CREC units is delayed?
- What is the impact of the Project on regional CO<sub>2</sub> emissions if the New England states implement programs to promote more aggressive buildout of clean energy resources?

With respect to evaluating the consistency of the Project with provisions of State energy policies, OER considered:

- Will a delay in the commercial operation date of CREC impact the ability of Rhode Island to meet its GHG reduction targets under the Resilient Rhode Island Act?

- Will clean energy initiatives advanced by Rhode Island and by sister New England states negate the environmental benefits that the Project would otherwise contribute?
- Will development of the Project diminish the benefit of the clean energy resources that Rhode Island and other New England states have procured or expect to procure?

## **B. Materials Reviewed and Redacted Information**

In issuing this Supplemental Advisory Opinion, OER and LAI reviewed and relied upon the sources of information cited in Section II.C of OER’s September 2016 Advisory Opinion, which are included here by reference, as well as the following sources of information:

- Pre-Filed Direct Testimony of Ryan Hardy, filed June 30, 2017 in this Docket;
- Independent System Operator - New England (“ISO-NE”) data and publications, including the (i) results from the 11<sup>th</sup> and 12<sup>th</sup> Forward Capacity Auctions; (ii) 2016 ISO New England Electric Generator Air Emissions Report;<sup>10</sup> and (iii) 2017 CELT Report.

The public version of this Supplemental Advisory Opinion redacts information that is protected from public disclosure through an order by the EFSB as well as information for which Invenergy has filed a Motion for Protective Treatment of Confidential Information. Specifically, the information redacted in the public version of this Supplemental Advisory Opinion is or cannot be reasonably segregated from confidential information contained within the following documents for which Invenergy has sought protective treatment:

- Confidential documents described in Section II.C of OER’s September 2016 Advisory Opinion, which are included by reference;
- Three Confidential Excel spreadsheets prepared by PA and submitted on November 1, 2017, which supplement information previously provided to the EFSB and which were granted

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<sup>10</sup> The 2016 ISO New England Electric Generator Air Emissions Report is currently available at [https://www.iso-ne.com/static-assets/documents/2018/01/2016\\_emissions\\_report.pdf](https://www.iso-ne.com/static-assets/documents/2018/01/2016_emissions_report.pdf)

protective treatment on October 2, 2016 (EFSB Order No. 99) and May 23, 2017 (EFSB Order No. 112):

- *Clear River – Market Assumptions*, supplementing Confidential Exhibit A to Invenergy’s supplemental response to OER Data Request No. 3-1, dated May 2017
- *Clear River – Emissions Generation and Heat Input Results*, supplementing Confidential Exhibit B to Invenergy’s supplemental response to OER’s Data Request Nos. 3-2 and 3-2, dated June 2017
- *Clear River Economic Impact Analysis Inputs and Results*, supplementing Confidential Exhibit A to Invenergy’s supplemental response to the Division of Statewide Planning’s March 21<sup>st</sup> and 29<sup>th</sup> Sets of Data Requests, undated
- Three Excel spreadsheets prepared by PA and submitted on January 22, 2018, comprising Invenergy’s Confidential Attachments to OER’s 4<sup>th</sup> Set of Data Requests. These spreadsheets update data that has been granted protected treatment by the EFSB through the issuance of EFSB Order No. 99.
  - *Invenergy Clear River Energy Center – Emissions Impact Data – OER 4-2 (a), 4-3(a), 4-4(a)*
  - *Invenergy Clear River Energy Center – Generation, Heat Input and Emissions Data – OER 4-2(b-e)*
  - *Invenergy Clear River Energy Center – Generation, Heat Input and Emissions Data – OER 4-3(b-e)*
- Confidential Exhibit CLF 11-5, Invenergy’s response to CLF’s Data Request 11-5. Regarding this information, Invenergy has filed a motion for protective treatment of confidential information dated January 9, 2018.

### III. FINDINGS OF FACT

#### A. Findings Related to Invenergy and PA’s Updated Analysis of GHG Impacts

**In response to OER’s 3<sup>rd</sup> Set of Data Requests, PA updated its reference case model of the regional electric grid using market data and regional infrastructure information available as of May 2017. The updated reference case used to support the analysis reasonably incorporated market information available at that time.**

In response to OER’s 3<sup>rd</sup> Set of Data Requests, Invenergy and PA updated the AURORAxmp reference case model using the following updated market and infrastructure

information:

- Load forecasts were updated using the most current planning studies: ISO-NE's 2017 CELT Load Report and New York Independent System Operator's 2017 Load and Capacity Data Report.<sup>11</sup>
- Natural gas prices were updated to reflect NYMEX Henry Hub futures for 2017-2018 as of April 28, 2017. Longer term prices for Henry Hub and Algonquin Citygates were obtained from GPCM Q3 2016 data set.<sup>12</sup> GPCM (Gas Pipeline Competition Model) is an industry standard source of commodity and delivered natural gas price forecasts across North America, licensed by RBAC, Inc.
- Generating resources included all thermal and hydropower units that have been awarded a Capacity Supply Obligation through ISO-NE's 11<sup>th</sup> FCA, the most current results available when the updated reference case was prepared.<sup>13</sup>
- Resource attrition was based on publicly-announced plant retirements.

Regarding PA's updated reference case model (vintage May 2017) and the input data and assumptions prepared in response to OER's 3<sup>rd</sup> Set of Data Requests:

- The buildout of renewable resources was significantly expanded in the updated model, and appropriately included clean energy resources procured through several New England state initiatives: the Three-State Clean Energy RFP, Connecticut's procurement under Public Act 13-303 Section 1(b), and Rhode Island's Long Term Contracting Standard for Renewable Energy.
- The updated model did not, however, include the prospective development of up to 1,600 MW of OSW and up to 9.45 TWh of other clean energy resources to be procured under Sections 83C and 83D of the Massachusetts Energy Diversity Act, respectively.<sup>14</sup> Since the procurement was nascent at the time, and

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<sup>11</sup> Source: *Invenergy Thermal Development LLC's Responses to the Office of Energy Resources' Third Set of Data Requests*, DR 3-1(a) Supplemental Response.

<sup>12</sup> Source: *Invenergy Thermal Development LLC's Responses to the Office of Energy Resources' Third Set of Data Requests*, DR 3-1(b) Supplemental Response.

<sup>13</sup> Source: *Invenergy Thermal Development LLC's Responses to the Office of Energy Resources' Third Set of Data Requests*, DR 3-1(d) Supplemental Response, Confidential Exhibit A.

<sup>14</sup> Codified under new Section 83(C) and 83(D) of the Massachusetts Green Communities Act, Chapter 169 of the Acts of 2008.



none of these new resources were under contract, it was not unreasonable to omit them from the analysis.

- PA's updated RGGI CO<sub>2</sub> allowance prices were based on RGGI auction clearing prices for vintage 2017 allowances through Auction 35 on March 8, 2017, and PA's internal forecast.<sup>15</sup> In December 2017, RGGI released its updated Model Rule, which incorporates an annual 2.275% decline in the RGGI CO<sub>2</sub> cap after 2021. RGGI provided a forecast of allowance prices under the Model Rule.<sup>16</sup> Although the RGGI Model Rule forecast was issued after PA prepared its model, it is worthwhile to note that the PA forecast's price trajectory is somewhat low relative to the RGGI forecast. See Figure 1. However, as noted in OER's September 2016 Advisory Opinion (page 13 and 21), utilizing a low RGGI allowance price forecast is a conservative modeling assumption and may underestimate the potential emission reduction benefit from this Project.

**Figure 1. PA Forecasted CO<sub>2</sub> Allowance Prices vs. RGGI Model Rule**

[See Confidential Attachments]

The natural gas price forecast utilized a GPCM data set which was released by RBAC in late October 2016.<sup>17</sup> In the April to May 2017 timeframe, when the updated model was in preparation, the GPCM 4<sup>th</sup> quarter 2016 forecast would have been available. The difference between the 3<sup>rd</sup> quarter 2016 and 4<sup>th</sup> quarter 2016 forecast is very small and unlikely to have a material difference in the results. Because the analysis of GHG impacts is oriented around the difference between two forecasts – the operation of the grid and regional emissions *with* the Project in operation compared to a reference case *without* the Project – some uncertainty with respect to the trajectory of the fuel forecast is not expected to materially change PA's overall findings or conclusions.

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<sup>15</sup> Source: *Invenergy Thermal Development LLC's Responses to the Office of Energy Resources' Third Set of Data Requests*, DR 3-1(c) Supplemental Response.

<sup>16</sup> RGGI Program Review Materials are available at <https://www.rggi.org/program-overview-and-design/program-review>.

<sup>17</sup> LAI is also a licensee of GPCM, and receives alerts from RBAC when each quarterly forecast is released.

**In response to OER DR 4-3 and 4-4, PA prepared a separate reference case that incorporated the hypothetical buildout of 800 MW of OSW delivered to Rhode Island, 90 MW of OSW delivered to Long Island, NY, and 1,000 MW of hydropower imported from Canada delivered to northern New England.**

As a sensitivity case, PA prepared a model reference case that was used to test whether expanded penetration of clean energy resources across the region has an impact on the operation of the Project and its contribution to reducing CO<sub>2</sub> emissions. The 90 MW OSW project delivered to Long Island, NY represents the Deepwater South Fork Wind Farm. The South Fork Wind Farm has a contract with the Long Island Power Authority, received state approval in January 2017, and will help New York achieve its goal of drawing 50 percent of the state's power from renewable resources by 2030. Procurements in Massachusetts authorized under Section 83C and 83D of the Energy Diversity Act have not been completed and contracts have not yet been executed. The 800 MW of OSW delivered to Rhode Island and the 1,000 MW of imported hydropower are intended as proxies for projects that may be procured and be in service within the timeframe of PA's forecast. We note that measures to achieve Governor Raimondo's goal of bringing 1,000 MW of new clean energy into the state's portfolio are not fully reflected in this sensitivity case. If this full amount had been assumed in the sensitivity case, we would anticipate an incremental reduction in benefits ascribable to CREC; however, that reduction would not be sufficient to change the general conclusions below.

**For all cases analyzed, the model results support the conclusion that operation of CREC will contribute to a reduction of CO<sub>2</sub> emissions across the New England / New York region. The increased penetration of renewable resources across the region, coupled with other market developments that contribute to reducing the GHG emission intensity of the region's electric grid, would mute, but not eliminate, the emission reduction benefit of the Project. If the COD of CREC is delayed, the CO<sub>2</sub> reduction benefit will be delayed commensurately.**

As discussed in OER’s September 2016 Advisory Opinion, CREC is anticipated to be one of the most efficient gas-fired resources in the region, and therefore generation from CREC will displace generation from less efficient and higher-emitting fossil-fired resources, in accordance with how ISO-NE dispatches resources in merit order.<sup>18</sup> Table 2 provides the CO<sub>2</sub> emission reductions ascribable to CREC as a percentage of total regional (New England and New York) emissions, calculated from PA’s model runs with and without CREC. Results are presented on an annual basis and an average basis over each respective study period.<sup>19</sup> Table 3 shows the total annual reduction in thousands of short tons for each case. For all cases, model results consistently illustrate that operation of CREC will contribute to a reduction in CO<sub>2</sub> emissions across the region, ranging from about 0.4% to 1.9% of total emissions per year. If one or both CREC units are delayed, the emission reductions are similarly delayed.

**Table 2. Annual CO<sub>2</sub> Emission Reductions Ascribable to CREC (as Percent of Regional Emissions)**

<b>Model Case</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>Average Annual Reduction</b>
Application	-1.2%	-1.9%	-1.6%	-1.5%	-1.5%	-1.4%	-1.5%	-1.5%
OER 3rd DRs	-	-0.5%	-1.1%	-1.1%	-1.1%	-1.0%	-	-0.95%
OER 4-2	-	-	-0.4%	-1.0%	-1.1%	-1.0%	-1.1%	-0.91%
OER 4-3	-	-0.5%	-0.4%	-0.9%	-1.0%	-0.9%	-1.0%	-0.77%
OER 4-4	-	-	-0.4%	-0.9%	-1.0%	-0.9%	-1.0%	-0.82%

*- indicates year not included in the study period of that model case*

[Table 3 begins on next page]

<sup>18</sup> OER’s September 2016 Advisory Opinion, p. 16-17.

<sup>19</sup> Note that the study periods are different for the different cases.

**Table 3. Annual CO<sub>2</sub> Emission Reductions Ascribable to CREC (thousands of short tons)<sup>20</sup>**

Model Case	2019	2020	2021	2022	2023	2024	2025
Application	-783	-1,233	-1,122	-1,011	-998	-985	-1,002
OER 3rd DRs	-	-311	-668	-652	-659	-599	-
OER 4-2	-	-	-269	-603	-659	-599	-650
OER 4-3	-	-305	-205	-490	-588	-510	-548
OER 4-4	-	-	-209	-490	-588	-510	-548

- indicates year not included in the study period of that model case

Figure 3 through Figure 6 illustrate the same results summarized in Table 2 and Table 3, but break out the net CO<sub>2</sub> emissions for (1) New York, (2) ISO-NE without Rhode Island, (3) Rhode Island excluding CREC, and (4) CREC alone, all relative to a reference case without CREC.<sup>21</sup> The red line represents the total net impact of the Project on CO<sub>2</sub> emissions across the modeled footprint, NYISO and ISO-NE. These charts show that, for all cases analyzed, operation of CREC reduces emissions from other fossil-fired plants within Rhode Island, in the rest of New England, and in New York as well.

**Figure 2. Regional Change in CO<sub>2</sub> Emissions with CREC (Invenergy Application Case)<sup>22</sup>**

[See Confidential Attachments]

**Figure 3. Regional Change in CO<sub>2</sub> Emissions with CREC (Response to OER 3-3)<sup>23</sup>**

[See Confidential Attachments]

**Figure 4. Regional Change in CO<sub>2</sub> Emissions with CREC (Response to OER 4-2)<sup>24</sup>**

[See Confidential Attachments]

**Figure 5. Regional Change in CO<sub>2</sub> Emissions with CREC (Response to OER 4-3)<sup>25</sup>**

<sup>20</sup> Total ISO-NE and NYISO footprint CO<sub>2</sub> emissions reductions were calculated by subtracting the forecasted CO<sub>2</sub> emissions without CREC from the forecasted CO<sub>2</sub> emissions with CREC, using Invenergy’s responses to OER’s second, third, and fourth sets of Data Requests. Negative values denote a *reduction* in emissions.

<sup>21</sup> Note that the study period and CREC in-service dates are not consistent across all modeled scenarios.

<sup>22</sup> Source: *Invenergy Thermal Development LLC’s Responses to the Office of Energy Resources’ Second Data Request*, DR 2-1.

<sup>23</sup> Source: *Invenergy Thermal Development LLC’s Responses to the Office of Energy Resources’ Third Data Request*, DR 3-3.

<sup>24</sup> Source: *Invenergy Thermal Development LLC’s Responses to the Office of Energy Resources’ Fourth Data Request*, DR 4-2.

<sup>25</sup> Source: *Invenergy Thermal Development LLC’s Responses to the Office of Energy Resources’ Fourth Data Request*, DR 4-3.

[See Confidential Attachments]

**Figure 6. Regional Change in CO<sub>2</sub> Emissions with CREC (Response to OER 4-4)<sup>26</sup>**

[See Confidential Attachments]

In the updated model cases, the CO<sub>2</sub> reduction benefit (on an avoided tons per year basis) ascribable to the operation of CREC are diminished compared to the results presented in the Application. Because total regional CO<sub>2</sub> emissions are also less relative to the results presented in the Application, the magnitude of the reduction benefit as a percent of total regional emissions is relatively unchanged, as seen in Table 2. As noted in Ellen Cool's Pre-Filed testimony, three factors contribute to the decrease in overall regional CO<sub>2</sub> emissions in the updated model cases relative to the Application: (1) ISO-NE's forecast of net load across New England has decreased, in large part due to increased energy efficiency and behind-the-meter solar photovoltaic installations; (2) a decrease in natural gas prices relative to coal, causing gas-fired resources to displace coal generation; and (3) increased penetration of renewable and other clean energy resources across the region in response to new state initiatives to induce investment.<sup>27</sup>

Model cases prepared in response to OER's 3<sup>rd</sup> and 4<sup>th</sup> Set of Data Requests reflected these updates to the regional generation infrastructure and market conditions. **Figure 7** through **Figure 10** illustrate the change in annual generation from renewable resources, coal-fired resources, oil-fired resources, and gas-fired resources for each model case, relative to the Application. In these charts, the green bars represent the increase in renewable generation, and the brown and black bars represent the decrease in coal and oil generation, respectively. The grey bars show a small increase in gas-fired generation in most years. The decrease in natural gas prices relative to coal and oil give rise to a relative decrease in generation from coal and oil

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<sup>26</sup> Source: *Invenergy Thermal Development LLC's Responses to the Office of Energy Resources' Fourth Data Request*, DR 4-4.

<sup>27</sup> Pre-Filed Testimony of Ellen Cool, p. 7.

resources. Renewable resources (with no fuel cost) pick up the lion's share of the replacement generation needed to serve load as coal and oil-fueled generators become less economic, with gas-fired generation providing the balance. CREC would be one of the most efficient generators in the region, displacing generation from higher emitting fossil-fueled generators without hindering the expansion of clean energy resources. With the increase in renewable generation and decrease in coal- and oil-fired generation, the carbon intensity of the region's electric generation fleet has decreased in the updated cases relative to the Application. Therefore, in the updated cases, generation from CREC displaces relatively less coal- and oil-fired generation, and instead displaces more inefficient gas-fired generation, which mutes the avoided emissions benefit of CREC. Increasing the penetration of renewable resources and renewable energy generation in the model therefore diminishes, but does not eliminate, the claimed CO<sub>2</sub> emissions benefit of the Project.

**Figure 7. Change in MWh of Generation by Resource Category from Invenegy Application (Response to OER 3-3)<sup>28</sup>**

[See Confidential Attachments]

**Figure 8. Change in MWh of Generation by Resource Category from Invenegy Application (Response to OER 4-2)<sup>29</sup>**

[See Confidential Attachments]

**Figure 9. Change in MWh of Generation by Resource Category from Invenegy Application (Response to OER 4-3)<sup>30</sup>**

[See Confidential Attachments]

**Figure 10. Change in MWh of Generation by Resource Category from Invenegy Application (Response to OER 4-4)<sup>31</sup>**

[See Confidential Attachments]

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<sup>28</sup> Source: *Invenegy Thermal Development LLC's Responses to the Office of Energy Resources' Third Data Request*, DR 3-3.

<sup>29</sup> Source: *Invenegy Thermal Development LLC's Responses to the Office of Energy Resources' Fourth Data Request*, DR 4-2.

<sup>30</sup> Source: *Invenegy Thermal Development LLC's Responses to the Office of Energy Resources' Fourth Data Request*, DR 4-3.

<sup>31</sup> Source: *Invenegy Thermal Development LLC's Responses to the Office of Energy Resources' Fourth Data Request*, DR 4-4.

**GHG impacts when gas pipelines are constrained and CREC burns backup liquid fuel were not considered in the analysis by PA. Invenergy submitted an Addendum to its Major Source Air Permit Application in which Invenergy proposed to reduce the number of days per year that the Project would be permitted to burn ULSD, from 30 days (in the original Application) to 15 days for each unit. The CO<sub>2</sub> emissions associated with the Project's maximum annual allowable ULSD burn would be only a small offset to the total annual net reduction in CO<sub>2</sub> ascribable to the Project.**

LAI calculated the anticipated increase in annual emissions if it is assumed that CREC would operate on ULSD for the maximum number of days it has requested in its air permit Addendum. Burning ULSD in one unit for 30 days (or 15 days each unit) as proposed in the air permit Addendum instead of natural gas at CREC would result in an increase of approximately 75,850 tons of CO<sub>2</sub>.<sup>32</sup> This increase is less than the increase noted in OER's September 2016 Advisory Opinion, and would be a small offset relative to the avoided regional CO<sub>2</sub> emissions that can be ascribable to the Project running exclusively on natural gas. It should be noted, however, that if gas pipeline constraints cause CREC to operate on its backup fuel, other dual fuel plants in the region will be similarly affected, increasing baseline CO<sub>2</sub> emissions across the region.

**Whether the Project burns only natural gas or whether it burns its proposed annual maximum permissible ULSD, the Project's average annual CO<sub>2</sub> emission rate continues to remain lower than the most recently reported ISO-NE system-wide marginal emission rate. The system-wide CO<sub>2</sub> *marginal* emission rate is the appropriate comparison to the Project's emission rate because energy generated by the Project will displace generation from higher-emitting, less efficient resources that are on the margin.**

ISO-NE annually releases a report on air emissions from the region's fleet of generating resources. OER's September 2016 Advisory Opinion (at pp. 18-20) observed that the Project's average annual CO<sub>2</sub> emission rate of 760 lb/MWh when burning only natural gas, and 815

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<sup>32</sup> Pre-Filed Testimony of Ellen Cool, p. 9, lines 12-18.

lb/MWh when burning ULSD for 30 days per year in each CREC unit, was less than the 2014 ISO-NE system-wide marginal emission rate of 941 lb/MWh. Pre-filed testimony of Ellen Cool updated this observation by noting that the 2015 ISO-NE system-wide marginal CO<sub>2</sub> emission rate decreased by 2.9% to 857 lb/MWh.<sup>33</sup> Moreover, she reported that if each CREC unit burns ULSD for a maximum of 15 days per year, as proposed in the air permit Addendum, the average annual Project emission rate dropped to 776 lb/MWh. Compared to the 2015 ISO-NE report, The Project average annual emission rate remained below the system-wide marginal emission rate, whether burning only natural gas or the maximum annual USLD proposed in the air permit Addendum.

In January 2018, ISO-NE released its 2016 air emissions report. ISO-NE's average marginal CO<sub>2</sub> emission rate in 2016 was 842 lb/MWh, a further reduction of 1.7% from the prior year.<sup>34</sup> The Project's annual average emission rate, on natural gas or on the maximum annual permissible ULSD burn, remains lower than the most currently available data reflecting the system-wide marginal emission rate.

**Invenergy has proposed multiple cooling water supply source contingencies.<sup>35</sup> Regardless from which of these sites the Project's water is drawn, tailpipe emissions from water delivery trucks would constitute a minor offset to the CO<sub>2</sub> emissions reductions ascribable to CREC.**

Pre-Filed Testimony of Ellen Cool considered the impact of tailpipe emissions from water and ULSD delivery trucks and concluded that these emissions would be only a very small offset to the emissions benefit of CREC. Based on a roundtrip of approximately 40 miles for water trucks to the Primary Water Source, truck deliveries of water would result in an additional 41 to 205 tons of CO<sub>2</sub> emissions per year ascribable to CREC, depending on the number of daily

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<sup>33</sup> Pre-filed Testimony of Ellen G. Cool, Docket No. 2015-06, p. 23, lines 1-9.

<sup>34</sup> ISO New England, Inc. System Planning, "2016 ISO New England Electric Generator Air Emissions Report," January 2018, p. 3 and 24.

<sup>35</sup> CLF 11-5. Confidential Exhibit.



roundtrips and the truck fuel efficiency.<sup>36</sup> In its response to CLF 11-5, Invenergy provided a list of alternative cooling water sources located in Rhode Island, Connecticut, and Massachusetts, where the sites range from approximately 40 to 120 miles roundtrip to the Spectra Energy Algonquin Compressor Station. Assuming that water is supplied by the furthest possible contingent source at 120 miles roundtrip, tailpipe emissions from truck deliveries of water would result in an additional 123 to 613 tons of CO<sub>2</sub> emissions per year, depending on the number of daily roundtrips and the truck fuel efficiency. This remains a minor offset – less than 0.3% - to annual avoided CO<sub>2</sub> emissions summarized in Table 3, regardless of the year or model case considered.

#### **B. Findings Related to Consistency with Rhode Island Energy Policy**

**Despite a delay in commercial operation date, OER continues to find that the potential construction and dispatch of CREC will not prevent Rhode Island from achieving its GHG reduction targets as defined under the Resilient Rhode Island Act. However, if CREC does not achieve COD by 2020, it will not contribute to meeting Rhode Island’s interim 2020 goal.**

The Resilient Rhode Island Act requires submittal of “a plan that includes strategies, programs, and actions to meet targets for greenhouse gas emissions reductions as follows: (i) Ten percent (10%) below 1990 levels by 2020; (ii) Forty-five percent (45%) below 1990 levels by 2035; (iii) Eighty percent (80%) below 1990 levels by 2050.” In order to assess progress towards achieving the Resilient Rhode Island Act GHG reduction targets, the EC4 adopted a consumption-based emissions accounting methodology. Because Rhode Island is part of the interconnected regional electric grid, a reduction in regional CO<sub>2</sub> emissions from the electric sector will contribute to reducing in-State GHG on a consumption accounting basis. If CREC is delayed until after 2020, the avoided CO<sub>2</sub> emissions benefits provided by the Project will not

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<sup>36</sup> Pre-Filed Testimony of Ellen Cool, pp. 12-16.

contribute to achieving the interim 2020 goal, but would contribute to reduction targets upon achieving COD.

#### **IV. CONCLUSIONS**

##### **A. Impact of CREC on GHG Emissions**

OER confirms that PA's model utilized an industry standard chronological dispatch simulation model, AURORA<sub>xmp</sub>, to forecast hourly energy prices and CO<sub>2</sub> emissions with and without CREC. OER concludes that the key assumptions regarding the regional market structure, fuel and emission allowance prices, supply and demand forecasts, and transmission, as updated to reflect more current market conditions and regional infrastructure, are reasonable and support a reasonable forecast of the Project's impact on CO<sub>2</sub> emissions in the region. Based on this analysis, OER concludes that operation of CREC will contribute to a reduction in the region's GHG emissions from the energy sector, on the order of approximately 0.4% to 1.9% per year across New England and New York, thereby resulting in a decrease in the CO<sub>2</sub> emissions ascribable to electricity usage in Rhode Island, over at least the first 5 years of Project operations. As renewable resources, energy efficiency, and other sustainability initiatives expand the region's and Rhode Island's reliance on carbon-free resources, over the life of the Project, CREC will have a continued, but diminishing impact on reducing GHG emissions associated with electricity supply.

##### **B. Conformance with Resilient Rhode Island Act and other State Energy Policies**

OER concludes that development and operation of CREC will not prevent Rhode Island from achieving its economy-wide GHG reduction targets. State energy policies that promote investment in diversified no-to-low carbon clean energy resources, including renewables and energy efficiency, will not be adversely impacted by the Project.

## V. OER SUPPLEMENTAL ADVISORY OPINION

OER finds that:

- Despite a potential delay in commercial operation date, the Facility will contribute to reducing CO<sub>2</sub> emissions associated with electricity used in Rhode Island, which is derived from generating resources across New England, as well as imports from neighboring regions. However, CREC's contribution to reducing regional emissions is likely to diminish over time.
- Development and operation of the Project will not hinder Rhode Island from meeting its GHG reduction targets under the Resilient Rhode Island Act.
- Development and operation of the Project will not hinder the implementation of Rhode Island's clean energy policies, programs, and statutory initiatives.

Respectfully submitted,

RHODE ISLAND OFFICE OF ENERGY  
RESOURCES,  
By its attorney,



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Dated: February 26, 2018

**CERTIFICATION OF SERVICE**

I hereby certify that I filed the original and 10 hard copies of this Supplemental Advisory Opinion with the EFSB via mail. In addition, I electronically served a copy of this Supplemental Advisory Opinion to the service list. I certify that all of the foregoing was done on February 26, 2018.



A handwritten signature in black ink, appearing to read "Andrew J. M.", is positioned above a horizontal line.

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