REDACTED

D.P.U. 18-64/18-65/18-66
EXH. AG-DM-Rebuttal-1
February 15, 2019
Hearing Officer: Alan Topalian

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Petition of NSTAR Electric Company d/b/a Eversource Energy for approval by the Department of Public Utilities of a long-term contract for procurement of Clean Energy Generation, pursuant to Section 83D of An Act Relative to Green Communities, St. 2008, c. 169, as amended by St. 2016, c. 188, § 12	)	**D.P.U. 18-64**
Petition of Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid for approval by the Department of Public Utilities of a long-term contract for procurement of Clean Energy Generation, pursuant to Section 83D of An Act Relative to Green Communities, St. 2008, c. 169, as amended by St. 2016, c. 188, § 12	)	**D.P.U. 18-65**
Petition of Fitchburg Gas and Electric Light Company d/b/a Unitil for approval by the Department of Public Utilities of a long-term contract for the procurement of Clean Energy Generation, pursuant to Section 83D of An Act Relative to Green Communities, St. 2008, c. 169, as amended by St. 2016, c. 188, § 12	)	**D.P.U. 18-66**

REBUTTAL TESTIMONY

OF

DEAN M. MURPHY

Dated: February 15, 2019

D.P.U. 18-64/18-65/18-66
EXH. AG-DM-Rebuttal-1
February 15, 2019
Hearing Officer: Alan Topalian

TABLE OF CONTENTS

I. STATEMENT OF QUALIFICATIONS

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

A. My name is Dean M. Murphy. I am a Principal with The Brattle Group in the Boston office, located at One Beacon Street, Boston, Massachusetts 02108.

Q. Have you previously submitted direct testimony in this proceeding?

A. Yes. I submitted direct testimony in this proceeding on December 21, 2018, on behalf of the Massachusetts Attorney General's Office. In that testimony, I addressed (a) that the proposed Power Purchase Agreements ("PPAs") with H.Q. Energy Services (U.S.) Inc. ("HQ") do not provide incremental hydroelectric generation as defined in the RFP and (b) the concepts of additionality and offsetting greenhouse gas emissions. I provided recommendations on (c) potential changes to the proposed PPAs to ensure incrementality, (d) project selection, (e) evaluation team composition, (f) scaling of the quantitative net benefit and (g) the evaluation of the GWSA benefits.

Q. Please clarify how you will be referring to the various parties throughout your testimony.

A. The Massachusetts utilities, Eversource, Unitil, and National Grid, are counterparties to proposed PPAs with HQ, and proposed Transmission Service Agreements ("TSAs") with Central Maine Power Company ("CMP"). I collectively refer to the PPAs and the TSAs as "the Contracts."

Due to the number of organizations involved in this proceeding, I will use the following taxonomy with regard to Hydro-Québec. For all matters directly related to the bid, I will refer to Hydro Renewable Energy ("HRE"), a wholly owned subsidiary of Hydro-Québec which was the bidding party. For matters directly related to the PPAs, I will refer to H.Q. Energy Services (U.S.) Inc. ("HQ"), which is the Hydro-Québec counterparty to those

PPAs. When referring to documentation from Hydro-Québec and not from its subsidiaries (*e.g.*, HRE or HQ), I will refer to it directly as Hydro-Québec.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your rebuttal testimony?

A. My rebuttal testimony responds to several issues raised in the rebuttal testimony offered by Jeffery S. Waltman (Eversource), Nicolas H. Baldenko (Eversource), Timothy Brennan (National Grid), and Robert S. Furino (Unitil), collectively the "EDCs." I specifically respond to the their points on 1) the requirements of the proposed PPAs to provide hydro generation that is incremental, 2) the evaluation of MCPC 3 and GSPL II in Stage 3, and 3) the potential for future high value clean energy projects in future solicitations.

III. THE PPAS DO NOT ENSURE INCREMENTAL HYDRO GENERATION AS REQUESTED IN THE RFP AND OFFERED IN THE NECEC HYDRO BID

Q. Please summarize your response to the EDCs' rebuttal testimony regarding the PPAs' requirements for Incremental Hydroelectric Generation.

A. In my direct testimony, I showed that the proposed PPAs with HQ do not require the power delivered under the PPAs to be fully incremental to historical energy deliveries, as requested in the RFP.[1] The New England Clean Energy Connect ("NECEC") Hydro bid offered to provide 9.55 TWh of energy ("Contract Energy") that is incremental to historical deliveries, and the bid was evaluated and ultimately selected on this basis. The PPAs operationalize this incrementality requirement in Exhibit H first by defining "Baseline Hydroelectric Generation Imports," deliveries from HQ to New England that are outside the 83D PPA ("Baseline Hydro"). Exhibit H then establishes the "Minimum

[1] Exh. AG-DM, at 5-14.

Required Baseline Hydroelectric Generation Imports," ("Minimum Baseline") the required level of Baseline Hydro below which contract payments are penalized for under-delivery, to ensure that the Contract Energy will actually be incremental.[2] However, the Minimum Baseline values specified in Exhibit H to the PPAs fall far short of the historical average deliveries solicited in the RFP. In their rebuttal testimony, the EDCs have improperly re-interpreted the incrementality solicited the RFP, claiming that a very large share of historical imports are not appropriate for inclusion as Baseline Hydro. In effect, they imply that the appropriate Minimum Baseline might be near zero, pointing out that the PPAs offer stronger protections than this. The PPAs, particularly this Minimum Baseline requirement, should be amended to reflect historical average deliveries as solicited in the RFP, offered in the bid, and evaluated and selected.

Q. How does the RFP define Incremental Hydroelectric Generation?

A. The RFP states:

> "Incremental Hydroelectric Generation" means Firm Service Hydroelectric Generation that represents a net increase in MWh per year of hydroelectric generation from the bidder and/or affiliate as compared to the 3 year historical average and/or otherwise expected delivery of hydroelectric generation from the bidder and/or affiliate within or into the New England Control Area.[3]

The form PPA that accompanied the RFP adds specificity, identifying 2014-2016 as the 3 year historical period for the average.[4] Incremental Hydroelectric Generation or "Incremental Hydro" is apparently defined in this way to use historical average hydro deliveries as a proxy for what future energy deliveries from HQ would be in the absence of these PPAs. Thus, the incrementality requirement ensures that the Contract Energy

---

[2] The three PPAs use slightly different terms to refer to this Baseline concept, and they set the Minimum Baseline energy at different levels, as discussed below. Eversource and Unitil PPAs do not use the term "Minimum Required Baseline Hydroelectric Generation Imports." Instead the PPAs require a minimum level of "Baseline Hydroelectric Generation," against which damages are measured. *See, e.g.*, Exh. JU-3-A, at 86.

[3] Exh. JU-2, at 5.

[4] Draft Power Purchase Agreement, at 7 (May 12, 2017).

will be additional hydro energy, relative to HQ deliveries to New England without the Contracts.

Q. What is the Minimum Baseline requirement in the proposed PPAs, and how does this relate to historical deliveries?

A. As I outlined in my direct testimony, Exhibit H of each of the PPAs establishes an annual Minimum Baseline that must be delivered to New England in addition to the Contract Energy. The Minimum Baseline quantity differs across the PPAs. The National Grid PPA sets it at 9.45 TWh, allowing several adjustments that can reduce (but not increase) this amount.[5] The Eversource and Unitil PPAs set the Minimum Baseline at 3.0 TWh, with adjustments only for Force Majeure events.[6] Both of these Minimum Baseline requirements are far below the level of historical deliveries into New England, which averaged 14.8 TWh in 2014 through 2016.[7]

Q. Do the EDCs acknowledge that the Appendix H requirements of the PPAs are less stringent than the definition of Incremental Hydroelectric Generation in the RFP?

A. No. The EDCs claim that the PPAs contain "an appropriate threshold for the delivery of additional quantities of hydroelectric power"[8] despite the obvious discrepancy between the 14.8 TWh historical average and the much lower Minimum Baseline values of the PPAs, either 3.0 or 9.45 TWh. In fact, the EDCs claim that the incrementality requirements of the proposed PPAs are actually <u>stronger</u> than those of the RFP:

> "In fact, the Baseline Hydroelectric Generation provisions in Exhibit H negotiated by each Distribution Company provide greater protections than the

---

5 Exh. JU-3-B, at 92-95.

6 Exhs. JU-3-A, at 86-87; JU-3-C, at 84-86.

7 Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE), Appendix B to the RFP (Confidential), Section 4.2, at 19; Exh. NEER-1-8.

8 Exh. EDC-RB-1, at 21.

terms included in the form PPA for firm hydroelectric power, which was issued as part of the RFP."[9]

Q. How do the EDCs explain the gap between the PPA requirements for Minimum Baseline and the 14.8 TWh of historical average generation?

A. The EDCs begin by identifying the difficulty with establishing the differences attributable to "otherwise expected delivery." In this context, to reconcile the Exhibit H requirements of the proposed PPAs with the language of the RFP and bid, the EDCs appear to put great weight on the "and/or otherwise expected" qualifying phrase in the definition of Incremental Hydroelectric Generation ("as compared to the 3 year historical average and/or otherwise expected delivery of hydroelectric generation" [emphasis added]).[10] They give this qualifier more weight than the primary descriptor, the "3 year historical average." In doing this, they redefine the concept of incrementality, by explicitly excluding most of the historical energy deliveries from HQ into New England:

> …current deliveries may be non-firm and result from spot market trading decisions or may be under existing contracts that may not be renewed or extended. Thus, there are current deliveries that may not be appropriate for inclusion in the 'baseline' to which future deliveries are compared.[11]

[redacted] By redefining the Minimum Baseline requirement to exclude non-firm historical deliveries, the EDCs effectively claim that the clean energy deliveries under the PPA should be allowed to substitute for [redacted] historical deliveries, rather than being incremental to total historical deliveries. This appears to explain how the EDCs arrived at the low Minimum Baseline requirements in the PPAs, and their claim that these requirements are more stringent than the RFP. But the definition of Incremental Hydroelectric Generation established in the

---

9 Exh. EDC-RB-1, at 21.

10 Exh. JU-2, at 5.

11 Exh. EDC-RB-1, at 17.

12 Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE), Appendix B to the RFP (Confidential), Section 4.2, at 19.

RFP made no mention of excluding non-firm, spot, or any other types of transactions when determining the historical average deliveries that would set the baseline. [redacted].[13] The EDCs' revised interpretation of Incremental Hydro effectively says that the Contract Energy must be incremental to historical deliveries, though ignoring the vast majority of historical deliveries. This interpretation holds HQ to nothing beyond its existing contractual obligations to other parties, and makes the concept of Incremental Hydro essentially meaningless.

Q. If the EDCs' interpretation of the "and/or otherwise expected" phrase in the RFP language is not correct, how should it be interpreted?

A. The RFP does not specify how this phrase should be interpreted, but the plain language suggests that this 3-year historical average is at least a good starting point for what would be reasonably expected to occur absent the Contracts. Including the "and/or otherwise expected" phrase acknowledges that in at least some circumstances, the 3-year average might <u>not</u> be the expected amount. This can be understood as allowing for the fact that HQ may not be able to achieve that historical average in each and every year, due primarily to normal variability in hydrologic conditions. In a dry year where Hydro-Québec is unable to generate as much hydroelectric power, the reasonable expectation for HQ's deliveries into New England, absent the Contracts, might be less than 14.8 TWh. A high-water year might lead to a higher expectation. Over the three historical years used in the average, 2014-2016, HQ's deliveries to New England ranged from [redacted]

13 [redacted]

[redacted];[14] they were 17.9 TWh in 2017.[15] But on average over time, HQ should be able to match the 14.8 TWh historical deliveries. The addition of the NECEC transmission project will facilitate an increase in the amount of power that can be delivered to New England, enabling 9.55 TWh of Contract Energy in addition to the (average) 14.8 TWh of Baseline Hydro. There would have been no point in the RFP specifying the use of historical average deliveries in defining Incremental Hydro, particularly specifying which 3 years to use for the average, if this amount was not intended to guide expectations. The EDCs' interpretation that the vast majority of historical deliveries should be excluded from the Minimum Baseline, strips all meaning from the requirement that existing hydro bids should provide incremental deliveries.

Q. Have the EDCs provided any evidence that future deliveries of electricity from HQ to New England, absent the Contracts, would be expected to be lower than the three-year historical average?

A. To my knowledge, the EDCs have not expressed any particular view of how the "otherwise expected" deliveries might differ from the historical average. Their rebuttal testimony, in describing the rationale for the 9.45 TWh Minimum Baseline value used in the National Grid PPA, did claim that it would be difficult to determine the "otherwise expected" deliveries, and named some factors that might affect future deliveries, including the addition of offshore wind in Massachusetts (which might reduce demand for non-firm and short-term HQ resources), or significant changes in market conditions and/or energy policies in HQ's neighboring control areas (which could work in either direction).[16] Ultimately, "National Grid determined that it was reasonable to move forward

---

14 [redacted]

15 Hydro-Québec's 2017 annual report states that exports to New England were 52% of the 34.4 TWh of exports. Hydro-Québec Annual Report 2017, at 11.

16 Exh. EDC-RB-1, at 23-25.

based on HQUS's agreement to the 9.45 TWh Minimum Required Baseline Hydroelectric Generation Imports."[17] It is not surprising that HQ would agree to this value, of course, and even less surprising that it would agree to the 3.0 TWh Eversource and Unitil value. However, from the perspective of Massachusetts ratepayers, HQ's willingness to agree to these values would not seem to be a good justification for dramatically relaxing, and potentially eliminating, the requirement that contract deliveries be incremental to historical deliveries.

Q. What explanation did the EDCs provide for the Eversource and Unitil Minimum Baseline values being lower than National Grid's?

A. The EDCs appear to provide multiple interpretations. According to the IE's report, National Grid was interested in negotiating a minimum baseline clause while neither Unitil nor Eversource thought it was necessary.[18] The IE also indicated that the Unitil and Eversource provisions were negotiated to be [redacted][19] Eversource and Unitil state that the cover damages were priorities over other issues, including incrementality.[20] Later, they asserted that the addition of Appendix H and the requirement for a baseline of 3.0 TWh was negotiated as a further requirement for delivery without making the administration of such a provision "problematic".[21]

Q. In the quantitative evaluation of the NECEC Hydro project, did the Evaluation Team model imports from Québec at the Minimum Baseline levels specified in the proposed PPAs?

---

17 Exh. EDC-RB-1, at 25.

18 Independent Evaluator Final 83D Report Redacted, at 51 (July 24, 2018).

19 [redacted]
Revised Independent Evaluator Final 83D Report Confidential, at 53 (August 7, 2018).

20 Exh. DPU 1-23.

21 Exh. NEER-1-9, at 1.

A. No. The quantitative evaluation of the NECEC Hydro project is consistent with fully Incremental Hydro. In its modeling, TCR assumed that the interchanges with Québec would reflect 2012 levels, noting that 2012 was reflective of 2014-2016, the years specified in the form PPA for incrementality.[22] There are two other paths through which Hydro-Québec can deliver electricity into the New England ISO – through New Brunswick and through New York. TCR modeled import levels from New Brunswick to New England at 2016 levels and deliveries from New York to Massachusetts were dispatched on an hourly economic basis in the analysis.[23]

Q. Would the benefits attributable to the NECEC Hydro project in the evaluation be affected if the project had been evaluated using the Minimum Baseline deliveries reflected in the PPAs, rather than assuming it would be fully incremental as it was actually evaluated?

A. No, almost certainly not. The quantitative indirect benefits associated with GHG abatement were assessed by comparing a model run including the NECEC Hydro project with a "Base Case" run without the NECEC Hydro project.[24] If the power flows from Québec into New England were reduced in the analysis to mirror the Minimum Baseline requirements of the proposed PPAs, alternative generation would be needed to serve Massachusetts, altering the project's GHG effects and the impact on the Massachusetts GHG inventory. The extent of the changes would depend on the resource mix that replaced the reduction in HQ deliveries. Accurately quantifying the impact to the benefits would require a new Enelytix run performed by TCR; to my knowledge, such a sensitivity case has not been analyzed.

Q. Can you estimate the potential GHG impact of lower deliveries from HQ?

---

22 Exh. JU-6, at 142.

23 *Id*.

24 The base case was common across all projects evaluated.

A. I can at least establish some reference points for the potential GHG impact. The Global Warming Solutions Act ("GWSA") compliance benefits reflect the GHG reductions attributable to the project, and are likely to decrease with lower overall deliveries from Québec.[25] The low Minimum Baseline values in the PPAs reflect considerably less clean energy from HQ than the fully incremental deliveries evaluated; 11.8 TWh less with the Eversource and Unitil Minimum Baseline, or 5.35 TWh less with the National Grid value.[26] Lower deliveries would need to be made up with alternative generation, at least some of which would almost certainly be fossil, leading to greater overall Massachusetts GHG emissions.

In Figure 1, I provide an indicative estimate of the impact using three alternative assumptions about the generation that might replace the historical HQ generation not required by the proposed PPAs. I consider replacements consisting of zero-emission energy, energy equivalent to average Massachusetts imports, or a natural gas combined cycle unit. I estimate the amount of energy replaced at the National Grid Minimum Baseline (rows [2] – [4]), and again at the Eversource/Unitil Minimum Baseline (rows [5] – [7]). Of course, rows [2] and [5] show that replacement by zero-emissions generation substitutes one clean energy source for another, with no emissions impact.[27] If the lower HQ deliveries are replaced by increasing imports to Massachusetts from regions other than Québec, the replacement generation would have relatively low emissions reflecting the generation sources in those regions. At the higher National Grid

---

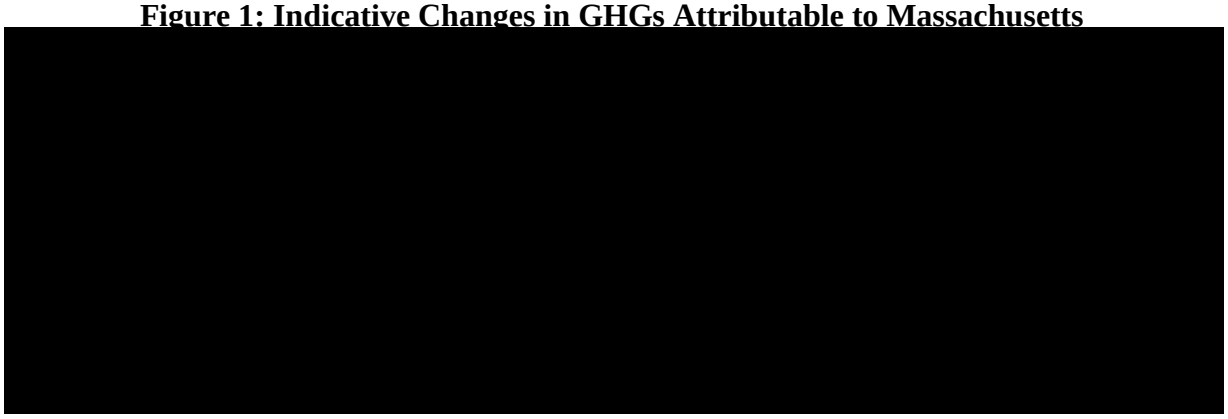
[25] The GWSA metric as employed in this solicitation also includes a component related to the number of RECs or CECs used for CES compliance, and I do not agree that this component should be included in the GWSA metric, as discussed in my direct testimony. Exh. AG-DM, at 27. For the purposes of this discussion, I have assumed that there is no adjustment to the number of CECs provided by the NECEC Hydro project for CES compliance.

[26] As discussed previously, this 5.35 TWh is lower bound on the decrease in clean energy deliveries that would be assured. National Grid's 9.45 TWh Minimum Baseline may be further reduced by several factors.

[27] The emissions factor used for Québec in the inventory model used by TCR is approximately [redacted] MMT CO_2e/MWh. For the purposes of illustration, I have assumed that a hypothetical Zero-Emitting generator would have this same *de minimis* emissions rate.

Minimum Baseline, the 2 million tons per year CO_2e abatement of a fully incremental NECEC Hydro project would drop to 0.8 million tons per year, just 41% of its former value. The Eversource/Unitil Minimum Baseline is so low that it would allow HQ to actually decrease clean energy deliveries relative to the historical average, wiping out the project's GHG offsets entirely.

Figure 1: Indicative Changes in GHGs Attributable to Massachusetts



Sources and Notes: Baseline Hydro imports into New England from Exhs. JU-3-A through C. Massachusetts average imports emissions rate is calculated as the weighted average emission rate for modeled imports excluding those from Québec (based on Att. B2 - NECEC Hydro Stage 3.xlsx, HSCI). Average emissions rate for a gas combined cycle is taken from *Environment Baseline, Volume 1: Greenhouse Gas Emissions from the U.S. Power Sector* (US Department of Energy, June 2016). Reductions in flows are assumed to occur on the direct interfaces between Hydro-Québec and New England, with flows through other regions being unaffected.

If instead of relatively low-emitting imports, the lower HQ deliveries were replaced by an efficient natural gas combined cycle plant (probably a better estimate of the actual marginal replacement in the region), all of the GHG emissions reductions of a fully incremental project could be cancelled out under either the National Grid or the Eversource/Unitil Minimum Baseline values. This is not to say that the project would necessarily cause an increase in emissions, since deliveries from HQ are unlikely to actually be lower with the NECEC Hydro project than without (though replacement with all gas could cause emissions to rise even if HQ deliveries increase overall. But this does illustrate the fact that if the PPA Minimum Baseline values do not require HQ's contract deliveries to be fully incremental, the GHG benefit attributed to the project and anticipated by ratepayers can be put in serious jeopardy.

Q. At what point during the solicitation process did the discrepancy arise between the RFP's definition of Incremental Hydroelectric Generation and the proposed PPAs?

A. It apparently arose at the last stage of the process, in the drafting of the PPAs. The definition of Incremental Hydroelectric Generation was stated in the body of the RFP, and again in the form PPA issued with the RFP, where it was given greater specificity by identifying 2014 to 2016 as the specific historical years to be used.[28] In its bid, HRE proposed to meet this definition, reflected particularly in the fact that [redacted].[29] The Evaluation Team evaluated the proposal assuming that the energy provided would be fully incremental; they ultimately selected the NECEC Hydro project as the winning bid on this basis. Up through this point, there was no apparent dispute or question about what the RFP had requested or what the NECEC Hydro bid had offered, and thus full incrementality with respect to historical generation was an integral component of the bid, similar to the bid price. In fact, if the bid had proposed to provide only the weaker version of incrementality now reflected in the proposed PPAs, the Evaluation Team should have considered disqualifying it altogether for failing to offer Incremental Hydro.

It was only in the final stage of the process, in drafting the PPAs, that the Incremental requirement was loosened. This late change, after bid selection, to lower the Minimum Baseline requirement fundamentally alters the terms of the agreement in a way that unfairly disadvantages the EDCs and their customers, who would pay for the fully incremental deliveries solicited but might receive substantially less. It might also be unfair to competing bidders, who structured their bids on the reasonable presumption that any competing hydro bids would be required to provide fully incremental generation.

---

28 Exh. JU-2, at 5; Draft Power Purchase Agreement at 7 (May 12, 2017).

29 [redacted]

Q. Is HQ able to provide energy that is fully incremental with respect to historical average deliveries?

A. The EDCs, in their rebuttal testimony, go to some length to argue that HQ is able to provide incremental generation to New England, and that the Contracts will provide it.[30] They refer to several statements in the HRE's bid that indicate that power flows from HQ into New England are currently limited by the transfer capability of the direct interties between the control areas.[31] By relieving this limitation, the new NECEC transmission link will enable the delivery of "a vast amount of clean energy generation capacity" into New England as Incremental Hydroelectric Generation.[32] The EDCs also cite a brief two-page letter from Hydro-Québec that was supplied in the Maine Public Utility Commission ("MPUC") Docket No. 2017-00232.[33] This letter claims that existing transmission limitations caused Hydro-Québec to spill water equivalent to 4.5 TWh in 2017, and 10.4 TWh in 2018 (through December 14), implying that the 2018 level of spillage could persist in the future. The letter also cites an independent meteorological study that indicates that in the 2050 horizon, average water flows in northern Québec are expected to increase on the order of 12%, which could lead to additional spilling (though 2050 is outside the PPA term).[34] The implication is that if additional transmission capability was available, this spilled water could instead be used to generate and export power to New England. The EDCs also note that Hydro-Québec recently added a new generation project in 2017 and will add another in 2020,[35] further increasing the amount of energy that can be generated, if there is the transmission capability to export it.

---

30 EDC-RB-1, at 15-16, 18-20.

31 EDC-RB-1, at 18-20 and Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE) Confidential, at 3, 19-20.

32 EDC-RB-1, at 18-19, referring to HRE bid excerpts, Exhs. EDC-RB-3 and EDC-RB-4.

33 EDC-RB-5.

34 EDC-RB-5.

35 EDC-RB-1, at 20.

Q. Does this mean that HQ would be able to provide fully Incremental Hydro as solicited by the RFP?

A. The statements by HQ and the EDCs do not make this entirely clear. Both the EDCs and the bidders have been vague, failing to offer clarity about what level of incremental hydro they are referring to, or what actual amounts of energy could be produced and delivered. They offer apparent reassurance that HQ would be able to provide sufficient generation to New England, without being specific about what that means. While stating that added transmission capability will increase the amount of power that is deliverable to New England, they offer no analysis or even an unambiguous statement regarding whether the total amount of energy delivered would or could equal the full 9.55 TWh of the Contract Energy, in addition to the 14.8 TWh of the relevant historical average. So ultimately, it is not entirely clear whether the EDCs and/or the bidders are claiming that HQ will be able to deliver fully incremental hydro, as solicited and as offered. In this respect, it would be helpful if HQ would make a clear statement about how much energy it can provide. Clearly, though, the proposed PPAs do not require HQ to deliver fully Incremental Hydro, with respect to historical average deliveries.

Q. Do HQ's actual historical exports to New England offer any insight?

A. HRE disclosed in its bid its historical deliveries to New England for years 2014-2016, averaging 14.8 TWh per year;[36] and the Hydro-Québec 2017 Annual Report cites 17.9 TWh of deliveries into New England in that year.[37] I do not have the details of Hydro-Québec's calculations, but the New England ISO publishes information on historical

---

[36] Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE) Confidential, Section 4.2, at 19; Exh. NEER-1-8. HRE reported its total deliveries from Québec to New England through the Phase II, Highgate and Derby interties or by wheeling through the New Brunswick and NYISO control areas in 2014, 2015, and 2016.

[37] Hydro-Québec 2017 Annual Report, at 11 (calculated as New England's 52% share of 34.4 TWh total sales outside Québec). The EDCs stated in rebuttal testimony that 2017 deliveries were 18.2 TWh, though the exhibit they cite references Hydro-Québec's export capabilities, not actual exports. Exh. EDC-RB-1, at 20, *citing* Exh. EDC-RB-5.

flows across the direct interface between Hydro-Québec and New England (the Phase II and Highgate interties), which provides additional perspective. Figure 2 below shows the ISO-NE data on flows on the direct interface (blue line) for the past 10 years, and overlays the available information from Hydro-Québec (bars). Comparing these data sources for the 4 years where they overlap, the average annual flow across the direct interface (ISO-NE data) in these years was about 13.26 TWh, which is about 2.29 TWh below the average 15.55 TWh of reported sales into New England. This difference is not surprising; HRE notes that Hydro-Québec sales into New England include power flows [redacted].[38]

Figure 2: Historical Deliveries from Québec into New England

Sources and Notes: Imports shown in the blue line are the sum of imports over the Highgate and Phase II interties, as reported by ISO-NE in Net Energy and Peak Load datasets. Derby intertie is not included in imports reported by ISO-NE.

The red horizontal line represents the three year average imports for 2014-2016 as reported by HRE in Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE) Confidential, Section 4.2, at 19; and Exh. NEER-1-8. The light blue bars represent HQ delivery of energy into New England as reported by HRE in their bid and in rebuttal testimony (Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE) Confidential,

[38] Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE) Confidential, Section 4.2, at 19.

Section 4.2, at 19 and Exh. EDC-RB-1, at 20) for 2014-2016. The 2017 deliveries are reported in Hydro Québec's 2017 Annual Report. The gray dashed lines are the Minimum Baseline values from the proposed PPAs.

Q. Is there other information that is relevant to the question of whether HQ would be able to provide fully incremental generation?

A. Yes. Hydro-Québec has been adding significant amounts of generation during this timeframe. After the 2014-2016 historical period that should determine the Minimum Baseline, and before the anticipated 2023 start of delivery on the PPA, HQ is adding two more generating stations as part of its Romaine complex. The 395 MW Romaine 3 station came online in 2017, and the 245 MW Romaine 4 station is anticipated in 2021.[39] These two units account for 41% of total Romaine capacity; if they provide a similar share of its 8 TWh energy, it will give HQ an additional 3.3 TWh of annual energy, on top of what it has been spilling, with which to provide Contract Energy that is fully incremental to the historical deliveries of 2014-2016.

Q. What do you conclude about whether HQ would be able to provide fully incremental generation, defined by the historical average?

A. This information on what HQ has been able to generate and deliver to New England in the past, and the increases in generating capacity it will have going forward, taken together with its reassuring (if imprecise) statements about its ability to deliver incremental power to New England if transmission capability is added, suggest that it should be able to achieve a Minimum Baseline requirement of 14.8 TWh. (Though time averaging or some other mechanism would likely be advisable to accommodate variable hydrologic conditions.) HQ's deliveries to New England have been at or above 14.8 TWh for the last several years, it has been spilling water, and the Romaine 3 and 4 additions will increase its capabilities further, so recent years are likely a better reflection of future capabilities. Hydro-Québec has implied, at least, that it can provide incremental

[39] *See* https://www.hydroquebec.com/projects/romaine.html.

hydro to New England. So there is no evidence to suggest that HQ would be unable to provide fully Incremental Hydro.

Q. If HQ were to confirm unambiguously that it will be able to provide fully incremental hydro as solicited by the RFP, would that resolve your concerns in this regard?

A. No, not by itself. Whether HQ is able to deliver incremental energy is important, of course, but is not the only relevant question. Equally important is whether the proposed PPAs require HQ to deliver fully incremental energy. Although the EDCs claim that HQ has made a commitment to deliver incremental energy,[40] the proposed PPAs as currently written do not require incrementality.

Q. What would be the impact if the PPAs do not require HQ to deliver the full historical average energy as Baseline Hydro?

A. If the PPAs do not require HQ to deliver the full historical average as Baseline Hydro, then it becomes HQ's option whether to provide the product that was solicited in the RFP and offered in the bid. HQ could, at its discretion, substitute Contract Energy for historical energy deliveries to New England, rather than providing Contract Energy that is incremental on top of the historical average. That is, it could shuffle existing resources from historical Baseline Hydro deliveries to the new contract sales into New England. Because it would not be required to sell the full historical average generation into New England as Baseline Hydro, it would then be able to sell a portion of this energy into other markets, perhaps earning a clean-energy premium on that alternative sale. Under the current PPAs, HQ would nonetheless be paid the full PPA price on the entire 9.55 TWh of Contract Energy.

---

[40] *See, e.g.*, Exh. EDC-RB-1, at 25-26 describing HQ's "commitments under Section 4.2 of its bid to deliver incremental hydroelectric generation." Section 4.2 states that HRE could provide incremental energy.

Q. Would the need for the NECEC transmission project be affected if HQ does not provide fully incremental energy?

A. The NECEC transmission link might not be necessary to deliver the amount of power required by the PPAs, since they do not require fully incremental hydro deliveries. The Eversource and Unitil PPAs require total deliveries to New England of only 12.55 TWh (9.55 TWh of Contract Energy, plus 3.0 TWh Minimum Baseline). The National Grid PPA requires total deliveries of 19.0 TWh (9.55 plus 9.45). Even the higher 19.0 TWh requirement of the National Grid PPA could be delivered by the existing transmission system with little or no expansion. Hydro-Québec has stated that its 2017 export capability to New England was 18.2 TWh,[41] and it actually delivered 17.9 TWh in 2017.[42]

This calls into question why Massachusetts customers should pay for the NECEC transmission project if it is not actually needed for the deliveries that are required under the proposed PPAs. This conundrum cannot be what was intended by the RFP, or by HRE in its bid. Further, Section 83D specifically states that its goal is to facilitate the financing of clean energy generation resources.[43] The bid itself and bidder statements since make clear the need for additional transmission, which would need to be financed (HRE confirmed that financing is necessary only for the transmission component of the bid), to deliver the Contract Energy.[44] But if the NECEC transmission is in fact not necessary because of the PPAs' weak requirements, there might be nothing to finance, undermining the 83D goal. The only logical interpretation is that the Contract Energy

---

41 Exh. EDC-RB-5.

42 Hydro-Québec's 2017 annual report states that exports to New England were 52% of the 34.4 TWh of exports in 2017. Hydro-Québec Annual Report 2017, at 11.

43 Section 83D(a) states that, "In order to facilitate the financing of clean energy generation resources…every distribution company shall jointly and competitively solicit proposals for clean energy generation and, provided that reasonable proposals have been received, shall enter into cost-effective long-term contracts for clean energy generation…"

44 Section 83D Request for Proposal Application Form, NECEC RFP Response (HRE), Appendix B to the RFP (Confidential), Section 1, at 2-3, Section 4.2, at 19-20 and Section 5.1.1, at 26; Exh. EDC-RB-5.

should be incremental to full historical deliveries, and the PPAs should require 14.8 TWh of Baseline Hydro.

Q. Under the proposed PPAs, would Massachusetts ratepayers pay for the NECEC transmission line if the energy delivered is not incremental?

A. The Minimum Baseline damages calculation of the proposed PPAs would impose no penalty until HQ's Baseline Hydro deliveries fall below 9.45 TWh, which is 5.35 TWh below the 14.8 TWh 2014-2016 historical average deliveries. That is, ratepayers would pay for the full NECEC transmission project, even if only 44% of the Contract Energy is incremental hydro.[45] Below 9.45 TWh, damages are paid on the National Grid PPA; Eversource/Unitil damages are not incurred until Baseline Hydro falls below 3.0 TWh. In fact, if HQ provided zero Baseline Hydro, delivering far less total energy than the historical average (even including the Contract Energy), Massachusetts ratepayers would still pay 41% of the total TSA payments.[46]

Q. How would you remedy this flaw in the PPAs?

A. In principle, this is relatively straightforward, as I outlined in my direct testimony.[47] For a hydro bid, maintaining Baseline Hydro deliveries at the level of historical imports, as a proxy for imports that would have occurred absent the PPA, is a key component of this procurement. The terms of the PPAs should be adjusted to provide what the RFP solicited, what the NECEC Hydro bid offered, and the way the bid was evaluated and selected. They should require the delivery of fully incremental clean hydro generation

[45] At the National Grid Minimum Baseline of 9.45 TWh, total deliveries are 19.0 TWh, only 4.2 TWh above the historical average. This is 44% of the 9.55 TWh Contract Energy.

[46] Ratepayers would actually continue to pay for the NECEC via full TSA payments regardless of the Baseline Hydro delivered. Damage payments in the context of Exhibit H Minimum Baseline shortfalls reduce the payments to HQ under the PPA, even though they are expressed as a share of the TSA payment; I refer to them here in the same way.

[47] Exh. AG-DM, at 17-19.

— *i.e.*, require 9.55 TWh of Contract Energy, in addition to 14.8 TWh of Minimum Baseline Hydroelectric Generation.

As I had noted in my direct testimony, it may be necessary to allow some adjustments to the Minimum Baseline calculation, for instance to allow for year-to-year variability in hydro conditions.[48] It might be possible to index to hydrologic conditions or total exports from Hydro-Québec, or use multi-year or rolling average requirements to smooth year-to-year variations in available energy. Five-year averaging for the Minimum Baseline requirement is already a component of the proposed National Grid PPA,[49] and time-averaging is commonly used to accommodate performance variability in PPAs, so this should not present a significant challenge.

Q. How could the proposed PPAs be modified to avoid the situation wherein ratepayers pay for unnecessary transmission capacity?

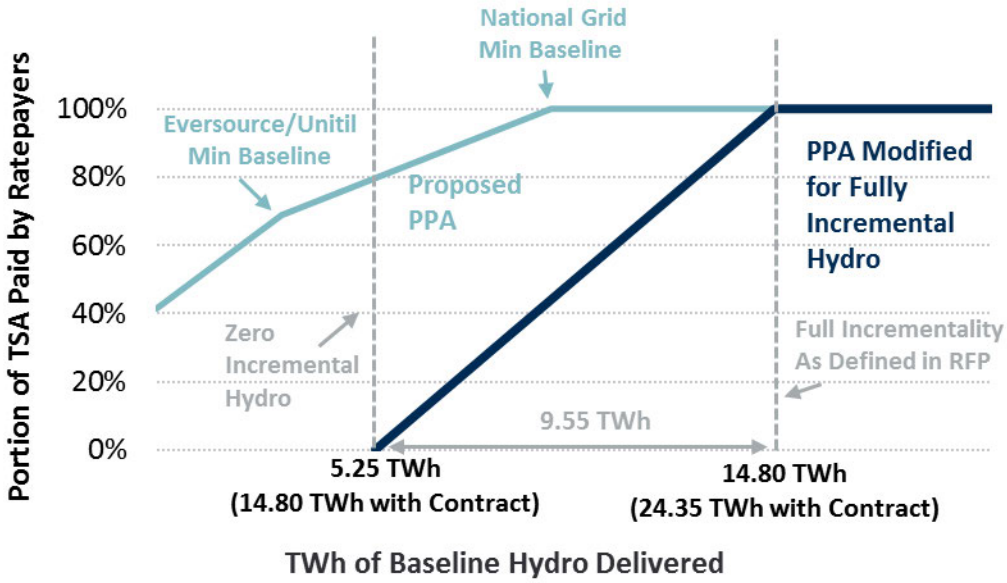
A. One reasonable approach would be to calibrate the damages calculations in Exhibit H to reflect the amount of transmission needed to deliver Incremental Hydro, as illustrated in Figure 3. Under this construct, the Minimum Baseline would be set to full incrementality, 14.8 TWh per year. Damages would be zero if HQ delivered fully Incremental Hydro — 14.8 TWh of Baseline Hydro in addition to 9.55 TWh of Contract Energy, totaling 24.35 TWh. At 5.25 TWh of Baseline Hydro, total energy delivered (including Contract Energy) would be 14.8 TWh, meaning that contract energy would just be substituting for historical average energy, and none of the energy delivered would be incremental. This 14.8 TWh could easily be accommodated with existing transmission facilities; this much and more has been delivered in recent years. Thus damages would equal 100% of the TSA payment, and ratepayers would not be required to pay for the unused NECEC transmission capacity. In essence, damages would reflect

[48] Exh. AG-DM, at 17.

[49] Exh. JU-3-B, at 92-95.

the cost of transmission capacity constructed but not needed, due to a shortfall below the Minimum Baseline.

Figure 3: Exhibit H Damages Calculation
Proposed PPAs vs PPAs Modified for Fully Incremental Hydro



Sources and Notes: Minimum Baseline values and Proposed PPA damages from Exhibits JU-3-A through C, Exhibit H. PPA Damages with Fully Incremental Hydro is equal to the TSA payment multiplied by the shortfall in Baseline Hydro, divided by the Contract Energy amount, where the shortfall in Baseline Hydro is 14.8 TWh minus Baseline Hydro delivered, and Contract Energy is 9.55 TWh.

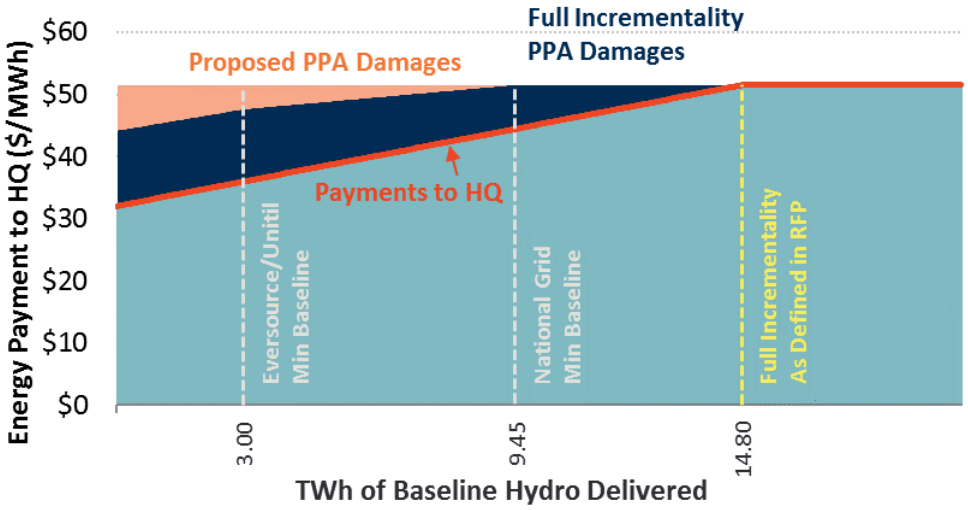
Q. Under the approach discussed above, should additional damages be assessed beyond the full TSA amount if HQ Baseline Hydro deliveries fall below 5.25 TWh?

A. Most likely, yes. The damages calculation should incentivize HQ to provide more Baseline Hydro at every level up to full incrementality of 14.8 TWh. Whether the damages function should continue at the same rate below 5.25 TWh of Baseline Hydro, or at a different rate, may warrant further consideration.

Q. If the Minimum Baseline amount was increased to 14.8 TWh, and if adjustments to that were limited, would this threaten financial harm to HQ?

A. Of course, relaxing the requirements of any contract can make it more lucrative, as the low Minimum Baseline values in the proposed PPAs are likely to do. So, relative to the current proposed PPAs, establishing the Minimum Baseline at 14.8 TWh might make the PPAs somewhat less lucrative for HQ. This could occur to the extent the lax incrementality requirements give HQ opportunities to redirect energy from New England to other markets if it is more profitable to do so. But the contract payments are intended to compensate the Seller for not just the Contract Energy, but also for the fact that this energy is incremental to the full historical Baseline Hydro. This was clear in the RFP and in HRE's bid. The contract revenue will help to offset the financial impact on HQ, if any, of strengthening incrementality requirements to reflect historical average deliveries. Figure 4 below shows how the suggested Exhibit H adjustments above would affect HQ's overall PPA revenues, as a function of its Baseline Hydro deliveries (assuming full delivery of Contract Energy). The orange area at the top left represents the damages for under-delivery of Baseline Hydro as the PPAs are currently drafted. The dark blue area represents the damages for under-delivery if the PPA was revised to require full incrementality, calibrating the amount of damages to the share of the NECEC transmission capability needed to deliver the Baseline Hydro. That is, with 14.8 TWh of Baseline Hydro, which is fully incremental, there is no penalty. At 5.25 TWh, total deliveries including Contract Energy would equal historical deliveries; Contract Energy is just substituting for historical deliveries. Since all the energy could be delivered over the existing transmission system, the penalty would be equivalent to the entire TSA payment.

Figure 4: Impact of Baseline Hydro Shortfall on PPA Payments to HQ
Proposed PPAs vs PPAs Modified for Fully Incremental Hydro



Sources and Notes: Minimum Baseline numbers and Proposed PPA damages from Exhibits JU-3-A through C, Exhibit H. The full energy price for HQ is the year one PPA price from Exhibits JU-3-A through C, Exhibit D. PPA Damages with Fully Incremental Hydro are equal to the TSA payment multiplied by a shortfall in Baseline Hydro divided by the Contract Energy amount, where this shortfall is 14.8 TWh minus Baseline Hydro delivered, and the Contract Energy is 9.55 TWh. Figure assumes penalty continues at the same rate below 5.25 TWh of Baseline Hydro.

Q. Did the Independent Evaluator ("IE") raise questions of fairness with regard to requiring full incrementality?

A. Yes. The IE stated the opinion that "The form PPA did not contain any specific provision requiring…any amount of energy other than that being committed to under the proposed contract."[50] This could be argued, given that the form PPA explicitly defined Incremental Hydro as the 2014-2016 average deliveries, though it did also qualify this with "and/or otherwise expected deliveries."[51] The IE appears to be taking the same position as the EDCs in their rebuttal testimony, relying more on the qualifying "otherwise expected" phrase than the primary description of how Incremental Hydro should be interpreted. But

[50] Independent Evaluator Final 83D Report Redacted, at 51 (July 24, 2018).

[51] Draft Power Purchase Agreement, at 7 (May 12, 2017).

in any case, the IE claimed that requiring fully incremental Baseline Hydro would have been a major liability and "raised a fairness question."[52] This fairness question is different from the one I pose above; it focuses on fairness to HQ rather than on fairness to the ratepayers ultimately responsible for the cost of the Contracts, and perhaps to other bidders. The IE did, however, recognize that the issue of providing full incrementality had been raised previously, and concluded that it would be "acceptable" to negotiate a contractual commitment for incrementality.[53]

Q. Would other potential adjustments be necessary to the Minimum Baseline value, for instance like those included in the proposed National Grid PPA?

A. Some adjustments would be warranted, particularly time averaging like the mechanism already included in the National Grid PPA, or some alternate mechanism to accommodate variability in hydrologic conditions. Some further adjustment may be necessary for longer-term shortfall in total exports, as is also included in the current National Grid PPA. On the other hand, a downward adjustment of the Minimum Baseline for low power prices, which is also currently included in the National Grid PPA, may not be necessary, since the Baseline was determined under a range of conditions that also included low prices.

Importantly, potential adjustments to the Minimum Baseline requirement should be bi-directional, to accommodate adjustments that may make the appropriate Minimum Baseline either higher or lower than the historical average, as conditions warrant. For instance, for wet years that have above average total Hydro-Québec generation (or periods of consecutive wet years, if averaging across time), the Minimum Baseline should likely be set above the historical average. Adjustments to the Minimum Baseline should protect the EDCs and their customers as well as HQ.

---

52 Independent Evaluator Final 83D Report Redacted, at 51 (July 24, 2018).

53 *Id.*, at 52.

IV. HIGHEST SCORING STAGE 2 BIDS SHOULD HAVE BEEN EVALUATED AS STANDALONE PORTFOLIO

Q. Please summarize your response to the EDCs' rebuttal testimony regarding the evaluation of the [redacted] and [redacted] bids.

A. In my direct testimony, I observed that the two highest scoring "large" projects from Stage 2 were not carried into Stage 3 as a standalone portfolio (*i.e.*, without other projects) and that such a standalone portfolio would satisfy about [redacted] of the energy targeted by the procurement.[54] In their rebuttal testimony, the EDCs asserted that a standalone portfolio of the two top bids would not fulfill the energy target for the procurement as required by the Stage 3 Evaluation Protocol, and that a future solicitation would be unlikely to procure a high-value project to fill the difference between such a portfolio and the procurement target.[55]

Q. Does the Stage 3 Protocol include a threshold requirement for the size of portfolios?

A. No. While the protocol describes the "overall goal" of the solicitation to contract for 9.45 TWh of energy, there is no stated threshold for portfolio size, and there is no requirement that all of the Contract Energy under 83D must be procured in this solicitation (as opposed to subsequent 83D solicitations). With respect to portfolio composition, the protocol states:

> The Evaluation Team will develop various combinations of top-ranked project proposals for evaluation as portfolios to determine their portfolio effect with respect to:
>
> a) The overall impact of various portfolios of proposals on the Commonwealth's policy goals, including GWSA goals as directed by DOER
>
> b) The overall cost effectiveness of various portfolios of proposals, including those portfolios that the Evaluation Consultant identifies as optimized in the Evaluation model

---

54 Exh. AG-DM, at 19-20.

55 Exh. EDC-RB-1, at 68-69.

Nowhere in this statement does the protocol provide a minimum portfolio size for evaluation in Stage 3. Furthermore, in the section of the protocol that outlines the selection process, the Evaluation Team outlines six factors for consideration. None of these factors explicitly includes a minimum annual generation quantity.

Q. Did the Evaluation Team analyze any portfolios in Stage 3 that had annual generation of less than 9.45 TWh?

A. Yes. Of the 12 portfolios that the Evaluation Team selected for analysis in Stage 3, [redacted] would have supplied less than the 9.45 TWh target.[56] The smallest Stage 3 portfolio evaluated would have supplied [redacted] target. By comparison, a portfolio consisting solely of [redacted] and [redacted] would have supplied [redacted] of this target. The EDCs now appear to imply that there is a size threshold somewhere between [redacted] and [redacted], though the Stage 3 Protocol contains no such strict threshold. In any case, a strict size threshold is not necessary if it is possible to acquire additional generation in a subsequent solicitation as is the case here. Particularly since these two bids scored so well individually, and together would have satisfied [redacted] of the overall targeted energy, a portfolio consisting of just these two should have been considered and evaluated. The results of that evaluation could have informed the tradeoff between the better performance of this portfolio versus its somewhat smaller size and the potential need for a subsequent solicitation.

Q. Do you agree with the EDCs' assertion that future procurements are unlikely to produce high scoring proposals that could "fill-in" the difference between the 9.45 TWh 83D goal and the energy supplied by the [redacted] and [redacted] bids?

A. No. In attempting to dismiss the possibility that a future procurement might produce additional attractive projects, the EDCs state that "There is no evidence to suggest that

---

[56] Revised Independent Evaluator Final 83D Report Confidential, at 70 (August 7, 2018).

an additional solicitation for the remaining 1.95 TWh would result in materially different result."[57] First, the absence of evidence is not evidence of absence. More importantly, it is unlikely that the potential renewable resources in and around New England have been exhausted by the proposals offered into this 83D solicitation. It is certainly possible, and perhaps likely, that future solicitations would attract additional high quality proposals. For example, the most recent 83C solicitation produced a winning bid whose direct price was within $6/MWh of the NECEC Hydro bid, and was below all but [redacted] of the "small" 83D proposals.[58] In addition, there were also 16 projects disqualified in this solicitation for not meeting interconnection/delivery or site eligibility requirements; several of these would have produced more than [redacted] GWh/year. These might continue development and meet requirements for a future solicitation.[59] There may also be additional potential projects that did not bid into this solicitation for any number of reasons. Indeed, TCR estimated that an additional [redacted] of renewable energy per year will need to be acquired between 2019 and 2040 to meet the existing Renewable Portfolio Standard ("RPS") targets of the New England states,[60] and this will increase further with the recent increase in the Massachusetts RPS requirement.[61] So it is unlikely that this one solicitation has revealed all of the attractive bids that might potentially be available in the region.

Q. Does this conclude your testimony?

A. Yes.

---

57 Exh. EDC-RB-1 at 69.

58 The Vineyard Wind 800 MW GLL bid offered a direct price of $64.97/MWh while the NECEC Hydro Bid offered a direct price of $59.05/MWh. Independent Evaluator Final 83C Report Redacted, at 56 (August 3, 2018), Independent Evaluator Final 83D Report Redacted, at 70 (July 24, 2018).

59 Revised Independent Evaluator Final 83D Report Confidential, at 67 (August 7, 2018). One additional project was disqualified due to being an existing facility.

60 [redacted] TWh refers to the RPS increase between the 2019 RPS requirement ([redacted] TWh) and the 2040 RPS requirement ([redacted] TWh).

61 *An Act to Advance Clean Energy*, Bill H.4857 Section 12 at lines 59-63. (July 30, 2018).