RAPPORT DE

PHILIP Q. HANSER

Exhibit No. ______

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DEMANDE D'APPROBATION DES CARACTERISTIQUES DU SERVICE D'INTEGRATION EOLIENNE ET DE LA GRILLE D'ANALYSE EN VUE DE L'ACQUISITION D'UN SERVICE D'INTEGRATION EOLIENNE

PREPARED DIRECT TESTIMONY

OF

PHILIP Q HANSER

On behalf of

HYDRO-QUÉBEC DISTRIBUTION

June 2013

Exhibit No. ______

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state your name and qualifications.

A. My name is Philip Q Hanser. I am a Principal of The Brattle Group, an economic and management consulting firm with offices in Cambridge, Massachusetts; Washington, D.C.; San Francisco, California; New York, New York; London, England; Rome Italy, and Madrid Spain. I have been a Principal at The Brattle Group in its Cambridge office for over fifteen years and have over thirty years of experience in the electric power industry. I have testified previously before the Régie de l'Énergie ("the Régie"), the Ontario Energy Board, the Federal Energy Regulatory Commission ("FERC") and various U.S. state public utility commissions, as well as in U.S. federal and state courts as an expert witness on electricity transmission and market design and regulation issues, among other topics. My statement of qualifications, including references to testimony I have given over the past five years, is attached as Attachment 1.

Q. How is your testimony organized?

A. The testimony is divided into six sections. Following this Introduction, Section II generally describes wind integration practices. Section III discusses the state of United States' regulatory statutes regarding wind integration. Section IV and Section V detail the methodologies of wind integration services in North American jurisdictions within organized markets and outside of such markets, respectively. Finally, Section VI describes the unique challenges to wind integration in Québec and elaborates on Hydro Quebec Distribution's service needs.

Q. What is the purpose of your testimony?

A. The Brattle Group was retained by Hydro Québec Distribution ("HQD") to review the wind integration practices in North American jurisdictions focusing on how they integrate wind generation, the allocation of integration costs, and the providers of wind integration services, including their compensation for the provision of such services. Further, we also identified the jurisdictions where formal wind integration services are defined, researched the specifics of the integration services including cost allocation and analysis of the rationale for the structure of such services. Finally, we assessed the applicability the other North American jurisdictions' wind integration practices in to the specific situation in Québec.

Q. Please summarize your conclusions

A. None of the formally defined wind integration services in all of the jurisdictions reviewed is directly comparable with the service needed by HQD. Wind integration services span different timeframes: intra-hourly, hours to days, and longer-term. In all jurisdictions researched, wind integration services as defined in tariffs only cover intra-hour services (usually to assess intra-hourly wind integration costs incurred by wind power exports to the wind power off-takers, which take care of the remaining, longer-term issues). In contrast, wind integration services needed by HQD differ substantially in length and type due to the unique regulatory situation in Québec, including the regulations related to the Heritage Pool of supply and wind power purchase requirements. Moreover, as a load serving entity, HQD has specific reliability obligations and, thus, must deal with wind impacts in all timeframes, not just intra-hourly, but also well beyond the hour.

II. OVERVIEW OF WIND INTEGRATION PRACTICES

Q. What is wind integration?

A. Wind integration refers to the ability of a system to utilize effectively its wind power resources to meet its customers' electrical demands, both in its operations and in planning.

A. Background on Power System Operations and Planning

Q. Please describe power system operations as they relate to wind integration.

A. The overarching objective of power system operations is to reliably meet demand in real time, moment by moment. The emphasis on meeting demand in real-time results from the lack of any meaningful amount of energy storage of electricity as electricity. As a result, variations in demand or generation need to be covered by appropriately changing the output of the controllable resources capable of doing so automatically, in real-time. The challenge of meeting demand and supply is usually better understood by decomposing it in different timeframes, because of the different characteristics of various resources and the different types of controls involved (including automatic controls and operator intervention). Very broadly, the three different timeframes of interest in wind integration are: intra-hourly, hours to days, and longer-term, where longer-term refers to planning or to operations planning, as opposed to operations.

Q. Please describe the longer-term timeframe and how does wind integration fit into this timeframe.

A. In the longer-term timeframe, from months to years, system operators focus on ensuring that they have sufficient capacity to meet peak power demands and sufficient energy to meet expected energy demands, as well as to have sufficient amounts of flexible resources to meet resource and demand variations. Wind integration plays a role in this timeframe because wind power can provide some capacity to meet peak power demands, although not at its full installed capacity since wind generation varies unpredictably. Also, wind plants provide energy to meet expected energy demand, which is accounted for in long-term plans. Finally, because wind is a variable energy resource, it requires other resources to balance it.

Q. Please differentiate between energy demand and capacity demand.

A. Energy, measured in kilowatt-hours (”kWh’) or similar units, is defined as the ability to produce work, such as heating, or moving objects. Energy demand does not have an intrinsic timeframe associated to it. Capacity or power demand, is the rate at which energy is demanded. I will illustrate these definitions with an example. Consider an elevator moving people from floor 1 to floor 10. It takes a given amount of energy to move the elevator, which does not depend on how fast the elevator moves (aside from losses). Because people do not want to stand inside the elevator for too long, the elevator consumes energy rather quickly, to move the people rapidly. In other words, the elevator has a power demand that is determined by the speed at which it elevates (as well as other factors, such as the weight the elevator is carrying). Power demand is sometimes referred to as capacity demand, because the system operator must have generation or other resource capacity to meet it. The terms "load," "capacity demand" and "power demand" will be used interchangeably in this testimony.

Q. Please describe the hours-to-days timeframe and how wind integration fits into this timeframe.

A. From hour-to-hour or day-to-day the focus of system operators is on scheduling controllable resources to meet the forecasted power and energy demand for the period, as well as to ensure that the resources scheduled can cope with deviations from those forecasts, and with other issues such as unanticipated outages. Wind forecasts are a potentially significant source of forecast uncertainty in this timeframe and can increase the need for controllable capacity to be scheduled within various lead times.

Q. Please describe the intra-hourly timeframe and how wind integration fits into this timeframe.

A. System operators compensate unpredictable, moment-by-moment variations in generation or demand within the hour mostly by *dispatching* the resources already scheduled for the period of interest. This timeframe can be further divided into multiple timeframes depending on the speed of response of different controls. For example, in the sub-second timeframe, the moment by moment supply-demand power balance is done by units which respond to changes in frequency through their governor controls. In the seconds to tens of seconds timeframe, the supply-demand balance is ensured by Automatic Generator Control ("AGC"), whereas in the timeframe of several minutes, supply-demand balance is done by tertiary generator control, with units following economic dispatch orders from the control center. The resource responses in the different intra-hourly timeframes are associated with different so-called *Ancillary Services*, discussed in more detail later in this testimony. Wind power variations are one such source of unpredictable resource variations, which may require additional balancing resources.

B. Wind Integration Applications

Q. Are there any differences in wind power integration approaches among different jurisdictions?

A. Yes. Jurisdictions with organized markets make the operational decisions in the different timeframes described above using organized markets. Markets are also used to determine the (marginal) price for the different services. Jurisdictions without organized markets conduct the operational decision process within each utility, and charge the associated costs of those decisions to its customers (costs included in the standard transmission tariff). The costs of these ancillary services are assessed on wind plant owners in a some jurisdictions.

Q. What services are typically included in the term "integration services"?

A. To date "integration services" include all of the services (and associated costs) necessary to compensate for the intra-hour variability and uncertainty associated with variable energy resources. It is important to note that variable energy resources are not typically made firm beyond an hour with these integration services, unless the wind plant owner or a third-party aggregator controls a pool of resources including dispatchable resources, and sells the firm output, the wind power off-taker bears the burden of dealing with the wind plant variability and uncertainty beyond the hour.

Q. What changes are developing to aid in the integration of variable energy resources?

A. As balancing authorities become increasingly attuned to dealing with the challenges of integrating variable energy resources, procedures and regulations for both operations and planning are changing to make them more compatible with managing variable energy resources. These changes include rules for the procurement and pricing of frequency regulation, load following, and ramping. Additionally, RTOs and regulatory bodies are reshaping the rules for allowing and encouraging the entry of new technologies and demand resources. For example, in March of 2011 FERC passed Order No. 745, which created a uniform compensation system for all Demand Response providers in the organized markets.[1] Also, various utilities and independent power producers have begun

[1] *FERC*, Order 745, March 15, 2011.

to install utility-scale battery storage to help balance and provide ancillary services for wind. Projects of note include Notrees Wind Storage Demonstration Project (a 36 MW energy storage system installed on site of a 152.6 MW wind farm),[2] and Luverne Distributed Energy Storage System ("DESS") (a 1 MW battery system installed on site of an 11.5 MW wind farm).[3]

Q. Are there any additional changes?

A. On a larger scale there is increased coordination between balancing areas, improved wind forecasting, and improvements in interconnection and transmission planning processes, as a result of FERC Order 764, which will be discussed next.

III. U.S. FEDERAL REGULATORY REQUIREMENTS

Q. What are the primary Federal regulatory requirements addressing wind integration in the United States?

A. FERC Orders 888-890 and 764 provide the framework, both for markets and jurisdictions without markets, for variable energy resource integration.

Q. What is the purpose of FERC Order 888?

A. FERC Order 888 aims at promoting wholesale competition through the provision of open access, non-discriminatory transmission services by public utilities, and recovery of stranded costs by public and transmitting utilities. It requires that open access be provided to transmission systems. It also requires the unbundling of ancillary services and requires transmission operators to allow transmission customers the possibility to self-supply ancillary services.[4] The unbundling of service increases the possibility of customers to self-supply, since they may choose to self-supply one service, but not another.

Q. How does FERC Order 888-A define Ancillary Services?

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[2] *EPRI,* Duke Energy Notrees Wind Storage Demonstration Project, December 12, 2012.
[3] *XCEL Energy*, Energy Storage For Wind Energy Integration: Wind-to-Battery Project Preliminary Results, Presented to Midwest Rural Energy Council, March 3, 2011.
[4] *FERC*, Order 888, April 24, 1996. p. 251-252.

A. FERC Order 888-A defined ancillary services as "Those services that are necessary to support the transmission of capacity and energy from resources to loads while maintaining reliable operation of the Transmission Provider's Transmission System in accordance with Good Utility Practice."[5]

Q. What services does FERC include in the general ancillary services category?

A. FERC includes six functional categories of ancillary services: scheduling, system control and dispatch, reactive supply and voltage control from generation sources, regulation and frequency response, energy imbalance, operating reserves – spinning and non-spinning.

Q. How does FERC define these ancillary services?

A. The following excerpts from FERC Order 888 explicates: "*Scheduling, system control and dispatch* service… provides for interchange schedule confirmation and implementation with other control areas, including intermediary control areas that are providing transmission service, …and actions to ensure operational security during the interchange… *Energy imbalance* service makes up for any net mismatch over an hour between the scheduled delivery of energy and the actual load that the energy serves in the control area. In contrast, *Regulation and frequency response* service corrects for instantaneous variations between the customer's resources and load, even if over an hour these variations even out and require no net energy to be supplied… *Operating reserve* is extra generation available to serve load in case there is an unplanned event such as loss of generation."[6]

Q. Are there any other relevant ancillary services defined by other organizations?

A. Yes. Various jurisdictions use slightly different terminology or definitions. In this testimony, we will use the Bonneville Power Authority's ("BPA") definitions .

Q. Please provide the relevant ancillary service definitions in BPA.

A. BPA defines regulation, following and imbalance ancillary services. "Variable Energy Resource Balancing Service ("VERBS") utilizes balancing reserve capacity for wind and solar resources to meet: (1) the moment-to-moment variations in generation (regulation),

[5] *FERC*, Order 888-A Appendix B, March 4 1997. p. 9.

(2) the longer timeframe variations over 10 minutes (following), and (3) the total hourly deviation between actual and scheduled output (imbalance)."[7] Although BPA defines *following*, in this report we will use the term *load following* to refer to the same service.

Q. What is the purpose of FERC Order 764?

A. FERC Order 764 was passed in 2012 to define the integration of variable energy resources. It sets the basic requirements to improve the operational procedures to facilitate variable energy resource integration. Under Order 764 each transmission provider must offer intra-hourly transmission scheduling, and interconnection customers with Variable Energy Resources ("VER"), such as wind plants, must provide meteorological and forced outage data to the transmission provider for the purpose of power production forecasting.[8]

IV. WIND IN ORGANIZED MARKETS

A. BACKGROUND ON WIND IN ORGANIZED MARKETS

Q. Please describe the operations of the organized markets as related to day to day wind integration.

A. Day to day generation and scheduling occurs in the day-ahead energy market. Day-ahead markets allow generators and load to bid in expected schedules, which the market operator uses to determine day-ahead schedules and prices.

Q. Please describe the operations of the organized markets as related to intra-hourly wind integration.

A. In the organized markets, short-term wind generation is integrated through real-time energy markets and ancillary services markets. Real-time energy markets balance deviations from generation scheduled in the day-ahead market and actual real-time load

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[6] *FERC*, Order 888, April 24, 1996. p. 211-216.
[7] *BPA,* Testimony of D. H. Fisher et al. on Generation Inputs Policy*,* BP-14-E-BPA-21.
[8] *FERC,* Order 764, June 12 2012.

conditions. The ancillary services market provides balancing for deviations that occur minute-to-minute and second-to-second.

Q. What are the current levels of installed wind capacity in the organized markets?

A. As summarized in the table below, the installed wind capacity and penetration rates vary widely across the organized markets.

Table 1: Wind Capacity in the Organized Markets

Market	Penetration Rate	Peak Load (MW)	Installed Capacity (MW)
ERCOT ISO	9.16%	66,548	9,838
IESO (Ontario)	3.27%	24,636	1,511
Midwest ISO	6.20%	98,399	12,270
New England ISO	0.93%	25,553	516
PJM ISO	1.60%	154,339	5,500

Q. How are wind plants treated in the U.S. organized markets, i.e., Regional Transmission Organizations ("RTOs")?

A. Wind plants are considered, for the most part, as any other resource, as will be detailed in the next sections.

B. WIND PARTICIPATION IN THE ENERGY MARKETS

Q. How are wind plants treated in the energy markets?

A. Wind plants are considered dispatchable resources in the RTO real-time energy markets.

Q. How can wind be a dispatchable resource?

A. Most modern wind turbines are capable of controlling their output according to dispatch instruction.

Q. What are the benefits of integrating wind generation into real-time dispatch?

A. There are many benefits, and they mostly relate to increased economic efficiency. For example, under network congestion conditions when not all wind can be dispatched, the system operator is better able to curtail a minimum amount of wind power for the shortest durations needed to relieve congestion. Market participation also minimizes the need for less efficient out-of-market actions to maintain reliable operations and permits incorporating wind plant dispatch instructions into the energy market clearing price, thus creating more efficient price signals. When wind is included in real-time dispatch, it also becomes eligible for make-whole payments that have traditionally been reserved for conventional generation.

Q. Are wind resources also allowed to participate in the day-ahead ("DA") energy market?

A. In U.S. RTOs wind is usually allowed to participate under the same terms as other types of generators. However, because real-time deviations from the day-ahead schedule result in imbalance charges for DA market participants, wind has less incentive to bid into the DA market.

C. Ancillary Services Procurement

Q. How are ancillary services procured in the organized market?

A. Ancillary services are procured in various ways in different markets. Control area operators, by design, focus on reliability metrics, which can be met with a variety of similarly defined reserves. Many of these reliability-driven ancillary services are procured through formal markets. For example, regulation is usually procured either in the real-time markets (co-optimizing the regulation procurement with the real-time energy dispatch) or in hour-ahead markets. Other ancillary services, like load following, are implicitly obtained from resources participating in the real-time energy markets, and therefore are not distinguishable as explicit ancillary services.

Q. What factors affect the procurement of ancillary services?

A. Different amounts of ancillary services may be procured depending on system characteristics, dispatch procedures, and other operating factors. For instance, some ancillary services, like frequency response, are not procured as stand-alone market products.

Q. How has the increase of VERs in the markets affected these practices?

A. The significant addition of VERs to the markets (specifically in the Electric Reliability Council of Texas ("ERCOT") and the California Independent System Operator ("CAISO") markets) is driving the need to increase the Ancillary Services requirements as well as efforts to consider the definition of new Ancillary Services, such as ramping. However, additional ancillary service needs are always considered for the entire pool of resources, rather than just for VERs.

D. TREATMENT OF CAPACITY

Q. What are capacity markets?

A. Capacity markets are used by some RTOs to ensure sufficient resources for the safe and reliable operation of the grid in real time and to provide appropriate incentives for the siting and construction of new resources needed for reliability in the future.[9]

Q. Do wind developers participate in these capacity markets?

A. Wind developers are allowed to participate in capacity markets. However, because the majority of the US markets are summer peaking and wind output tends to be low during peak hours, the nameplate capacities of wind farms are significantly de-rated in capacity markets. Current market practice is to use a percentage of nameplate capacity as the capacity value for wind.

Q. Do you have examples of wind capacity percentage ratings used in the various capacity markets?

A. The default values are: 13% in PJM[10], 14.9% system average in MISO[11]and a default value of 10% is used for summer calculations in NYISO[12].

Q. Are these values equal to the capacity factors of wind farms in each market?

A. No, these default percentages represent the expected wind output during peak load hours in each area.

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[9] *California Public Utilities Commission*, http://www.cpuc.ca.gov/PUC/energy/Procurement/RA/, Accessed April 25,2013

[10] *PJM*, PJM Manual 21 Rules and Procedures for Determination of Generating Capability Revision 09, May 2010, Page 19.

[11] *Potomac Economics,* 2011 State of the Market Report for the MISO Electricity Markets, June 2012, Page 38.

[12] *UWIG,* Wind Power and Electricity Markets, October 2011

V. WIND INTEGRATION OUTSIDE OF ORGANIZED MARKETS

Q. What rules apply to ancillary service providers outside of organized markets?

A. Transmission providers are required to offer unbundled ancillary services to all transmission customers serving load in the area, at just and reasonable costs. FERC also requires transmission operators to allow transmission customers the possibility to self-supply ancillary services.[13] The unbundling of service is mainly to allow customers to self-supply one service, but not another.

Q. Are wind power producers considered transmission customers?

A. Yes, they usually are.

Q. Are wind power producers required to purchase ancillary services in all jurisdictions outside the organized markets?

A. No, most balancing areas have no provisions for specific VER ancillary services yet.

Q. What jurisdictions do have VER-specific ancillary services?

A. Mostly entities in the Pacific Northwest, including Bonneville Power Administration, Puget Sound Energy ("PSE"), NorthWestern Energy ("NWE"), and Idaho Power Company ("IPC"). There also is a balancing area in Southwest Power Pool that has obtained FERC approval to charge for wind integration services temporarily, until the full SPP market is implemented.

Q. What causes these areas to have wind specific ancillary services charges?

A. These areas, in general, have high levels of wind energy penetration, e.g., 19% in BPA, 10% in PSE. Also, like most regions they have limited ability to provide sufficient integration services from their generation fleet with such high levels of wind penetration. Moreover, there is the additional desire in these areas to reallocate wind integration costs from power customers to wind generators.

Q. What is the motivation for this reallocation of costs?

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[13] *FERC*, Order 888, April 24, 1996. p. 251-252.

A. These areas face high costs for the integration of variable resources, and wish to ensure that the costs are allocated to the entities driving the costs. For example, in BPA and Idaho Power a large portion of wind power is exported. Thus, wind is charged integration fees to avoid burdening local load customers with the integration costs of renewables that serve customers in neighboring areas. In other areas, like NWE, wind integration services are explicitly assessed, with an opportunity to self-supply or procure from other sources, to enable competition in the supply of integration services due to their high cost.

A. Case Studies: A History of How Wind Integration Costs Have Changed

1. Bonneville Power Authority

Q. What is the makeup of BPA's balancing area?

A. BPA has an average load of between 5,000 and 7,000 MW. The majority of this load is served by hydro and nuclear facilities in the area. In May of 2012 the installed capacity of wind was 4,711 MW[14].

Q. What types of operational limitations do BPA hydro facilities have?

A. There are restrictions on BPA's hydro facilities for flood control, fish protection, and other non-power requirements. These restrictions limit the ancillary service capabilities of the hydro facilities.[15]

Q. What VER integration services does BPA offer and when were they introduced?

A. BPA offers three unbundled, separately-priced intra-hour basic integration services: Regulation, (Load) Following, and Imbalance[16]. There is an additional full-service integration service that wind generators can purchase to significantly reduce the possibility of being curtailed[17]. VER-specific services were first introduced in the 2009 rate case.

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[14] *BPA*, Wind Generation Capacity in the BPA Balancing Authority Area, May 18, 2012.
[15] *BPA,* Summary of the Upcoming BPA Wind Integration Team Work Plan 2.0, November 2010
[16] *BPA,* Testimony of Elliot E. Manzier, et al. on Overview of Wind Integration – Within-Hour Balancing Service Rate Proposal*,* WI-09-BPA-01, p. 2.
[17] *BPA,* BP-14 Initial Rate Proposal, Transmission, Ancillary and Control Area Service Rate Schedules and General Rate Schedule Provisions*,* BP-14-E-BPA-10, Nov 2012

Q. What was BPA's rationale for introducing these services?

A. As quoted from the testimony submitted by BPA to FERC: "As increasing amounts of wind generation have integrated into BPA's transmission system, the variability and uncertainty of wind generation have led to increased costs through the need for additional reserve capacity, the shift of energy generation from heavy load hours to light load hours, and reduced system efficiency. The proposed Wind Integration − Within-Hour Balancing Service rate will ensure that these costs are borne by the parties that cause the costs."[18]

Q. What methodology does BPA use to calculate the appropriate VER integration charges?

A. For the 2012-2013 and the 2014-2015 rate cases, BPA first calculated the total costs of providing integration services in the rate period, including: embedded, direct assignment, and variable costs. Embedded costs refer to the revenue requirements of the generators providing balancing services. Direct assignment costs are the costs incurred by BPA for specific wind projects. Variable costs are the costs associated with holding sufficient capacity ready to meet balancing requirements, including the Stand Ready and Deployment Costs. Total costs were then divided by the average installed capacity of wind in the rate period. For the imbalance component, the divisor was set to the average installed capacity of wind minus the expected installed capacity to self-supply this service.[19] [20] A different divisor was used for the imbalance calculations because customer supply generation imbalance program currently only includes the self-supply of imbalance energy.[21]

Q. Are these charges only assessed on wind being exported from the balancing area?

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[18] *BPA,* Testimony of Elliot E. Manzier et al. on Overview of Wind Integration – Within-Hour Balancing Service Rate Proposal, WI-09-BPA-01, p. 2.

[19] *BPA,* 2012 Final Rate Proposal, Generation Inputs Study, BP-12-FS-BPA-05, July 2011

[20] *BPA,* 2014 Initial Rate Proposal, Generation Inputs Study, BP-14-E-BPA-05, November 2012

[21] *Iberdrola*, FERC Docket ER13-1058, "Order accepting tariff re the Iberdrola Renewables, LLC," March 28, 2013.

A. No. Wind integration service rates are assessed on all wind generators in the BPA service area that choose not to self-supply integration services.[22]

Q. How have the wind integration service rates changed since they were introduced in 2009?

A. In general, the rates have been increasing since 2009. The rate for all three services was \$0.68/kW-month in 2009[23], and the proposed value for the 2014-2015 rate case is \$1.39/kW-month[24] However, in the 2014 rate case there are lower rates offered for wind generators who commit to updating their schedules every 30 or 60 minutes. For those generators that do not commit to a scheduling time frame their assumed schedule is a 60-minute persistence forecast submitted 45 minutes before an hour.[25] A summary of the combined rate in each rate period since 2009 is included below in Table 2.

Table 2: BPA Wind Integration Rate

Year	Schedule Updating Commitment	Rate (\$/kW-month)
2009	-	\$0.68
2010-2011	-	\$1.29
2012-2013	-	\$1.23
2014-2015 (Proposed)	Not Committed	\$1.39
	60 min	\$1.14
	30 min	\$0.83

Q. Is BPA taking any additional steps to try to reduce the cost of wind integration in the region?

A. As part of the FERC settlement for VER integration rates, BPA implemented six programs to facilitate wind integration in its footprint: Intra-Hour Scheduling, Dynamic Transfer Limits, Wind Power Forecasting, Customer Supplied Generation Imbalance, and

[22] *BPA,* Testimony of Elliot E. Manzier et al. on Overview of Wind Integration – Within-Hour Balancing Service Rate Proposal, WI-09-BPA-01
[23] *BPA,* 2009 Wind Integration Rate Case Final Proposal, Final Record of Decision, June 2008
[24] *BPA,* BP-14 Initial Rate Proposal, Transmission, Ancillary and Control Area Service Rate Schedules and General Rate Schedule Provisions*,* BP-14-E-BPA-10, Nov 2012
[25] *BPA,* Testimony of D. H. Fisher et al. on Generation Inputs Policy*,* BP-14-E-BPA-21.

Third-Party Supply[26]. The Customer Supplied Generation Imbalance pilot was done in collaboration with Iberdrola Renewables. Under this pilot Iberdrola procures balancing capacity with their own conventional energy resources and through contracts with third-party energy suppliers. The idea behind the pilot was to increase the current cost-effectiveness of ancillary services and to plan for future increased wind penetration levels when there won't be enough BPA-operated generation to provide sufficient capacity for wind balancing.[27][28] On March 28, 2013 FERC accepted a proposal from Iberdrola to sell imbalance services to other wind projects in the BPA footprint, effectively expanding the self-supply study. The rates paid by wind generators to Iberdrola will be negotiated on a case by case basis.[29]

2. Puget Sound Energy

Q. What is the makeup of Puget Sound Energy's balancing area?

A. PSE is a utility located in western Washington state. In 2010 they sold 23.4 million MWh of energy, supplying 49.7% with utility-owned resources and 50.3% with purchased resources.[30] Currently, wind generators are supplying approximately 10% of the total energy used by PSE customers.[31]

Q. What VER integration services does PSE offer and when were they introduced?

A. PSE offers a single VER integration service, through Schedule 13 of their Open Access Transmission Tariff ("OATT"), "Regulation and Frequency Response Service for Generators Selling Outside of the Control Area." The service effectively aggregates regulation, load following, and balancing functions. The charge for Schedule 13 was finalized in a settlement filed with FERC and is $1.55/kW-month. Charges are based on a 60-minute ahead persistence forecast.[32] There is a 30% discount to VER that update their

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[26] *BPA Wind Integration Initiatives,* http://www.bpa.gov/Projects/Initiatives/Wind/Pages/Wind-Integration-Initiatives.aspx , accessed March 2013
[27] *Iberdrola Renewables Press Release*, Pilot Project seeks to put more clean energy on the grid: Thanks to Iberdrola Renewables, BPA, and Constellation Energy collaboration, September 22, 2010.
[28] *BPA*, Generation Imbalance Self Supply Pilot, July 29, 2009.
[29] *Iberdrola*, FERC Docket ER13-1058, "Order accepting tariff re the Iberdrola Renewables, LLC," March 28, 2013.
[30] *PSE*, "About Puget Sound Energy: Washington's Oldest Local Energy Utility", March 2013
[31] *PSE,* http://pse.com/aboutpse/EnergySupply/Pages/Wind-Power.aspx, Accessed March 25, 2012
[32] *PSE,* FERC Docket No. ER11-3735-000, "Order Accepting and Suspending Proposed Tariff Revisions, Subject to Refund, and Establishing Hearing and Settlement Judge Procedures." October 20, 2011.

schedule every 30 minutes and a 50% discount to VER that update their schedule every 15 minutes. The charges went into effect September 1, 2012. VER's wishing to self-supply the ancillary services and avoid the PSE charge, are explicitly allowed to do so under the Schedule 13 settlement.[33]

Q. What was PSE's rationale for introducing these services?

A. PSE justified their development of VER-specific schedule 13 charges due to the significant development of wind resources in its balancing area. These VER additions require PSE to maintain additional regulation reserves, over the 2% of capacity previously required under Schedule 13. The costs of this additional regulation have also increased due to changes in hydro operations and the introduction of thermal units into the regulation resource pool.[34]

Q. What methodology does PSE use to calculate the appropriate VER integration charges?

A. The final VER rate was defined in a settlement, but in a previous rate proposal the rate was calculated using an average of the $/kW-year cost of the pool of resources providing regulation. The pool of regulation resources includes eight generating units that are employed on a regular basis to provide regulation capacity. The annual weighted average fixed cost of each unit was calculated by dividing the capacity of that resource by the total capacity of the pool and multiplying by the fixed cost ($/kW-year) for that unit. PSE then added the costs for all units together and divided by 12, which yielded a monthly charge.[35]

Q. Are these charges only assessed on wind being exported from the balancing area?

A. Yes.

3. Westar

Q. What is the makeup of Westar's balancing area?

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[33] *PSE*, FERC Docket Nos. ER11-3735-000 and -001.
[34] *PSE*, FERC Docket No. ER11-3735-000, Order issued Oct 20, 2011.
[35] *PSE*, FERC Docket No. ER11-3735-000, Order issued Oct 20, 2011.

A. Westar Energy, Inc. is a utility located in Kansas and is a member of the Southwest Power Pool ("SPP"). SPP currently operates a real-time Imbalance Market, but some ancillary services, such as regulation service, are provided by each of the balancing authorities that constitute SPP. [36] A full SPP market implementation has a target date of March 2014. It will include day-ahead commitment and ancillary services markets. All of the balancing authorities in SPP will be consolidated into a single SPP balancing authority.

Q. What VER integration services does Westar offer and when were they introduced?

A. Westar temporarily provides balancing services under Schedule 3A of its tariff and charges $4.44/kW-month of regulation capacity.[37] Wind exports out of the Westar balancing area or sales to the SPP Imbalance Market are required to buy or self-supply 3.32% of the installed wind capacity in regulation.[38]

Q. What was Westar's rationale for introducing these services?

A. Westar must hold sufficient on-line generating capacity in reserve to make up the moment-to-moment differences between scheduled generator output and actual generator output to match the transmission schedules at the control area interface. Westar previously recovered these costs through bilateral agreements or through the SPP OATT. The was no agreement previously in place for recovering costs for generators located within Westar's footprint but serving load outside of Westar. With the creation of the Schedule 3A tariff there is a formalized way of assessing these costs.[39]

Q. What methodology does Westar use to calculate the appropriate VER integration charges?

A. Westar calculates the total regulation requirement for the balancing area, allocates the requirement to different sources of regulation service need, and estimates the total costs of providing regulation service. The total regulation service requirement calculation

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[36] *Westar Energy, Inc.*, Letter Order issued Mar 18, 2010, FERC Docket No. ER09-1273-000
[37] *Westar Energy, Inc.*, OATT FERC Electric Tariff, Third Revised Vol. No. 5.
[38] *Westar Energy, Inc.*, Informational Filing, OATT, Schedule 3A, March 14, 2013, FERC Docket No. ER09-1273-000
[39] Westar Energy, Inc., Order Conditionally Accepting Proposed Tariff Revisions. March 18 2010, FERC Docket No. ER09-1273-000

aggregates the 10-minute schedule deviations from a 10-minute persistence forecast in the balancing area for all sources of such deviations 95% of the time[40], effectively assuming that the deviations follow a Gaussian probability distribution.

Q. Are these charges only assessed on wind being exported from the balancing area?

A. Yes, these charges are only assessed on all wind power explicitly being exported from the Westar balancing area, and on all wind power sold in the SPP Imbalance Energy Market from the Westar balancing area.

4. NorthWestern Energy

Q. What is the makeup of NorthWestern Energy's balancing area?

A. NWE is a Pacific Northwest utility located in Montana, Nebraska, and South Dakota. In 2011, the average load of NWE's Montana service territory was 1,227 MW and peak load was 1,673 MW.[41] The state of Montana has a renewable portfolio standard of 10%. In 2011, NWE met 8% of that with renewable generation and 2% with renewable energy credits rolled over from 2010.[42]

Q. What VER integration services does NWE offer and when were they introduced?

A. NWE started assessing wind integration charges in January 14, 2013 through Schedule WI-1. They offer a single wind integration service, which covers all intra-hourly services necessary to integrate wind into the Utility's electric transmission and distribution system. The services include, but are not limited to, regulating reserves, imbalance service, and scheduling assuming a 50-minute[43] persistence wind schedule.[44] [45]

Q. What was NWE's rationale for introducing these services?

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[40] *Westar Energy, Inc.*, Informational Filing, OATT, Schedule 3A, Mar 14, 2013, FERC Docket No. ER09-1273-000

[41] *NorthWestern Energy*, "At a Glance Montana: An Economic Development Fact Sheet", December 2012

[42] *NorthWestern Energy*, "About NorthWestern Energy, Montana", http://www.northwesternenergy.com/documents/about/aboutmt.pdf, Accessed April 16, 2013

[43] This time period gives system operators long enough to adjust scheduling of other units and is close enough to limit deviations, and excess charges, for wind operators.

[44] *NorthWestern Energy Electric Tariff.*, Schedule No. QF-1, Docket No.: D2012.1.3, Order No. 7199d, Tariff Letter No. 235-E

[45] *NorthWestern Energy,* Testimony of Richard D. Tabors, FERC Docket No. ER10-1138-001.

A. NWE found they needed additional regulation capacity to serve just the installed wind capacity in their footprint. David Gates Generating Station which is used to provide this regulation ability was developed to secure cost-effective long-term balancing services that were not otherwise available in NWE.[46]

Q. What methodology does NWE use to calculate the appropriate VER integration charges?

A. NWE calculates the integration cost by doing a two-scenario analysis of regulation costs at David Gates Generating Station. In the first scenario NWE assumes no installed wind capacity and 60 MW of total regulation. In the second scenario NWE models the cost of producing an additional 25 MW of regulation for the 141 MW of wind in the supply portfolio. The 25 MW number was calculated by multiplying the installed wind capacity (141 MW) by the ratio of regulation per megawatt of wind capacity necessary to comply with reliability requirements 18%. For the 2011 analysis, the incremental cost (that is, the cost above the no-wind scenario) was then divided by the expected MWh of wind contribution to get the wind integration price signal in $11.28/MWh.[47] It is important to note that this ”price signal” was not included in a tariff. For 2013, based on the rate published in their tariff, the wind integration price $5.41/MWh.[48]

Q. Are these charges only assessed on wind being exported from the balancing area?

A. No, these fees are assessed on all wind plants that exist as qualifying facilities (“QFs”) in NorthWestern (10 MW or less) that choose not to self-supply wind integration services.[49]

Q. Is NWE taking any additional steps to try to reduce the cost of wind integration in the region?

A. Wind integration services are actually offered on a distance-based schedule. NorthWestern has a long-term power purchase agreement with the 135 MW Judith Gap

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[46] *NorthWestern Energy, Inc.*, Revisions to Schedule 3, Regulation and Frequency Response, of NEW’s OATT, April 29, 2010, FERC Docket No. ER10-1273-000
[47] *NorthWestern Energy,* 2011 Electric Supply Resource Planning and Procurement Plan Document, Volume 2, Chapter 2
[48] *NorthWestern Energy Electric Tariff*, Schedule No. WI-1, Docket No.: D2012.1.3, Order No. 7199d, Tariff Letter No. 235-E, January 14, 2013.
[49] *NorthWestern Energy Electric Tariff*, Schedule No. WI-1, Docket No.: D2012.1.3, Order No. 7199d, Tariff Letter No. 235-E, January 14, 2013.

wind farm. As a result of geographic wind diversity, there will be more wind integration services required for a wind farm that is located near to Judith Gap than a wind farm of the same capacity at a greater distance to Judith Gap.

5. Idaho Power

Q. What is the makeup of Idaho Power's balancing area?

A. IPC is a utility located in the Pacific Northwest, 95% of their operating revenues come from Idaho and 5% from Oregon. In 2012, its peak load was 3,245 MW and its installed nameplate generation capacity was 3,594 MW. Energy in 2012 was generated by hydro (45%), coal (30%), long-term power purchase agreements (14%) (mostly renewable sources), natural gas and diesel (4%), and market purchased power (7%).[50]

Q. What VER integration tariff does IPC offer and when were they introduced?

A. For qualifying facilities (< 100 kW) wind integration charges are assessed as a decrement on the Avoided Cost Rate that IPC pays the facilities for their wind generation. The integration charge is capped at $6.50/MWh. The settlement accepting this rate was finalized on February 20, 2008. IPC had originally filed for a wind integration charge on February 6, 2007.[51]

Q. What was IPC's rationale for introducing these services?

A. Idaho Power contended that there are significant costs to wind integration that are not addressed in the agreed upon avoided cost rate for wind farms.[52]

Q. What methodology does IPC use to calculate the appropriate VER integration charges?

A. The assessed integration charge for IPC is from a settlement. The original integration charge was derived through production cost simulation modeling of wind integration, with a base scenario which modeled only the balancing reserves currently necessary and

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[50] *Idaho Power Comapny,* http://www.idahopower.com/AboutUs/, Accessed April 16, 2013
[51] *Public Utilities Commission of Idaho,* Order Number 30488, February 20, 2008.
[52] *Public Utilities Commission of Idaho,* Order Number 30488, February 20, 2008.

scenarios where additional balancing reserves were enforced for various quantities of wind.[53]

6. NaturEner PowerWatch LLC

Q. What is the makeup of NaturEner balancing areas?

A. NaturEner is a wind developer that has two wind-only balancing areas in Montana. NaturEner PowerWatch LLC (PowerWatch), established in 2008, is made up of 2 wind farms, Glacier Wind 1 and 2, amounting to 210 MW.[54] NaturEner Wind Watch (WindWatch) was established in November of 2012 to integrate the 189 MW Rim Rock wind farm.[55]

Q. What responsibilities does a wind-only balancing area have?

A. A wind-only balancing area must form power purchase agreements to off-take the wind generation (creating an "area load"). The balancing area must also secure contracts to assure proper transmission rights to fulfill their PPA obligations and obtain additional contracts with conventional generation entities to firm the wind power intra-hourly. Constellation Energy Control and Dispatch runs the balancing operations for NaturEner.[56][57]

Q. What was NaturEner's rationale for introducing these balancing areas?

A. NaturEner felt that they could best optimize the output from their wind farms by procuring their own contracts for wind firming capabilities and wind generation power purchase agreements.[58]

Q. Has this approach to wind balancing been successful?

A. It appears so. NaturEner now provides balancing services to the Horse Shoe Bend Wind Farm in Montana, a wind plant owned and operated by a third-party.[59]

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[53] *Idaho Power Company*, Wind Integration Study Report, February 2013
[54] PowerWatch, Operating A Wind Farm as a Balancing Authority, OSIsoft Users Conference 2012
[55] *NaturEner USA LLC*, "NERC Certifies NaturEner Wind Watch Balancing Authority", November 8, 2012.
[56] *NERC*, "NERC Balancing Authority (BA) Certification of NaturEner Glacier Wind Energy 1 (GWA) Operated by Constellation Energy Control and Dispatch (CECD)", September 3-5, 2008.
[57] *NERC*, "NERC BA Re-Certification Summary Report Constellation Energy Control and Dispatch to Operate NaturEner Wind Watch, LLC", June 21, 2012.

B. Summary of Intra-hour Wind Integration Rates

Q. Please summarize the intra-hour wind integration rates currently assessed by the areas discussed in the Case Studies.

A. The wind integration service rates, current as of April 1st, 2013, are summarized in Table 3. To reiterate the discussion in the previous section, these services cover only intra-hour wind integration. Integration services beyond the hour, such as energy firming or capacity guarantees, are beyond the scope of the services whose rates are summarized in Table 3. Because in most areas the rates are specified in $/kW-month of installed wind capacity, to be paid regardless of the actual wind energy output during the month, Table 3 also indicates the equivalent rates in $/MWh of wind energy under two assumed wind capacity factors: a published capacity factor for each region, and an assumed reference capacity factor of 35%.

Table 3: Non-market Intra-Hour Wind Integration Rate Summary

	MW Installed Capacity	Published Capacity Factor	Published Rate ($/kW-month)	Rate in $/MWh (for published capacity factor)	Rate in $/MWh (reference capacity factor of 35%)
BPA	4711	32%	$1.23	$5.27	$4.81
PSE	430	30%	$1.55	$7.08	$6.07
Westar*	614	40%	$4.44	$0.50	$0.58
NorthWestern**	141	40%	$1.58	$5.41	$6.18
Idaho Power	678	27%	*NA****	$6.50	$5.01

* Rates for Westar are for regulation only, while for the four other utilities the rate includes following and imbalance services.
** Rates for NorthWestern Energy represents a Zone 1, long-term contract rate
*** The published rate for Idaho Power is already in $/MWh

VI. WIND INTEGRATION IN HQD

A. Background on HQD

Q. What is HQD's background, as it relates to wind integration?

[58] *NaturEner USA LLC*, "NERC Certifies NaturEner Wind Watch Balancing Authority", November 8, 2012.
[59] *NaturEner USA LLC*, "NERC Certifies NaturEner Wind Watch Balancing Authority", November 8, 2012.

A. HQD is a distribution company serving a customer load of approximately 185 TWh of energy per year, including losses, and which requires approximately 38 GW of capacity.[60] HQD neither owns nor controls any generation resources, but has contracts with generation resources and secures additional generation through market purchases from neighboring markets. In particular, HQD is required by law to purchase the output of a set of independently-owned wind plants in its territory. As of the 2012 Supply Plan Follow-up, there were 1,503 MW of installed wind capacity in the HQD territory, reaching a wind energy penetration level of approximately 2.5%. By 2015 there is expected to be 3138 MW of installed wind capacity, reaching a wind energy penetration level of approximately 5.1%.[61] [62]

Q. What resources does HQD have to meet its energy demand service obligations?

A. Besides the power purchase agreements with wind plants mentioned previously, HQD has long-term supply contracts with Hydro Québec Production ("HQP"), including the Heritage Pool of resources and additional baseload and cycling contracts, a long-term contract with TransCanada Energy, and a series of contracts with biomass and small hydro projects. [63]

Q. What resources does HQD have to meet its capacity load service obligations?

A. The resources that are used to meet energy demand also partially meet HQD's capacity load service obligations, as detailed in the Supply Plan. The other capacity resources on which HQD counts are operational procedures, such as voltage reductions, interruptible supply contracts, and capacity imports from neighboring markets. In order to secure the access to these markets, the full import capacity from the state of New York through the Dennison and Massena interconnections (totaling 1100 MW) has been reserved. [64] [65] [66]

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[60] *Hydro-Québec Distribution,* État D'Avancement 2012 Du Plan D'Approvisionnement 2011-2020, filed with the Régie 1 Nov 2012

[61] *Hydro-Québec Distribution,* État D'Avancement 2012 Du Plan D'Approvisionnement 2011-2020 Annexe D, filed with the Régie 1 Nov 2012

[62] *Hydro-Québec Distribution,* État D'Avancement 2012 Du Plan D'Approvisionnement 2011-2020. Tableau 4.1, filed with the Régie 1 Nov 2012

[63] *Hydro-Québec Distribution,* Supply Plan 2011-2020*,* filed with the Régie on 1 Nov 2010., page 27.

[64] *Hydro-Québec Distribution,* Supply Plan 2011-2020*,* filed with the Régie on November 1, 2010, page 23.

[65] *Hydro-Québec TransÉnergie,* Point of Delivery/Receipt MASS, June 14, 2012

[66] *Hydro-Québec TransÉnergie,* Point of Delivery/Receipt DEN Point of Delivery CORN, March, 2012

Q. What is the Heritage Pool?

A. The Heritage Pool was established to secure a portion of Québec's energy resources for the Québec market. The legislation creating the Heritage Pool was passed in 2000 and commits HQP to supplying generation to meet an annual energy demand of up to 165 TWh of energy and a capacity demand of up to 34.3 GW.[67] HQD has an agreement with HQP to provide the appropriate ancillary services needed to ensure the reliability and security of the Heritage Pool supply, at no additional costs.[68] Any additional energy, capacity and ancillary services needed by HQD must be purchased from other sources.

Q. Does HQD have any additional contracts in place?

A. HQD has a contract with HQP for the provision of wind integration services (the Wind Integration Agreement, or "WIA").[69] The original contract had a termination date of 2011. The validity of the WIA was extended in 2012 until new agreements for wind integration services could be approved.[70]

Q. Why does HQD need a wind integration agreement separate from the agreement on the services needed to ensure the security and reliability of the heritage pool?

A. For regulatory and contractual reasons. Contractually, the agreement on the services needed to ensure the security and reliability of the Heritage Pool applies only to the Heritage Pool. Regulatorily, HQD is required by the Government of Québec to purchase wind and provide the appropriate integration services necessary to fulfill the long-term wind energy purchases.[71] The Régie has recognized HQD's need for an agreement to fulfill these obligations.[72] Furthermore, the Régie agreed to the necessity for wind integration service agreements both with the approval of the initial WIA and in the process of the WIA extension.

[67] Gouvernement du Québec, Décret 1277-2001, 24 October 2001

[68] Agreement on the services necessary and generally recognized to ensure the security and reliability of the Heritage Supply between Hydro-Québec Distribution and Hydro-Québec Production, Montréal, QC, Feb 15, 2005.

[69] Wind Power Integration Agreement between Hydro-Québec Distribution and Hydro-Québec Production, Montréal, QC, Jun 9, 2005.

[70] Gouvernement du Québec, Orders in Council 352-2003, 926-2005, 1043-2008, 1045-2008.

[71] Gouvernement du Québec, Orders in Council 352-2003, 926-2005, 1043-2008, 1045-2008.

[72] Hydro-Québec Distribution Application to extend the Wind Power Integration Agreement , App R-3799-2012, 11 June 2012, approved by the Régie on 2 Nov 2012.

B. Comparison of Wind Integration in HQD with Other Regions

Q. Can wind integration in HQD be approached similarly to the approaches taken in the jurisdictions with organized markets?

A. No, because there are no organized electricity markets in Québec. The approaches to wind integration services procurement taken by the Organized Markets in North America require the existence of fully-developed energy and ancillary services markets. There are no jurisdictions without Organized Markets that have implemented an approach similar to those in the Organized Markets.

Q. Can the situation in the jurisdictions without Organized Markets be applied to HQD?

A. Some balancing areas, namely NorthWestern Energy and NaturEner's wind-only balancing authorities, have situations similar to HQD and the approaches they have employed could partially inform the wind integration approaches to be taken by HQD. The situation in the other balancing authorities is quite different from the situation in HQD.

Q. How is the situation in NWE similar to the situation in HQD, and how is it different?

A. NorthWestern Energy did not own any generation resources until 2011. Until then, NWE contracted with Powerex, Avista, and Grant County Public Utilities District ("GCPUD") to meet its balancing needs. NWE developed David Gates Generating Station ("DGGS") with the specific purpose of securing cost-effective balancing services. While DGGS could provide services with longer timeframe than one hour, the only services included in the NWE Schedule WI-1 wind integration service are intra-hourly services, and as such the Schedule WI-1 fees are not inclusive of wind integration services in longer timeframes. As the off-taker of wind power to serve its load customers, the costs of any longer-term service for which NWE would use DGGS to meet its capacity demand would be assessed to NWE's load customers. Similarly to NWE, HQD does not own any generation resources, and is seeking cost-effective balancing services. The difference between NWE and HQD is that HQD cannot own generation resources, so developing a generation resource is not an option, but purchasing integration services is. To compare the costs assessed to NWE wind generators to the costs of wind integration services provided to HQD, there would need to be an additional cost added to the NWE rate to account for longer term capacity firming as well as other wind integration services beyond the hour.

Q. How can the NWE wind integration case be applied to HQD?

A. In NWE we find an example of a load serving entity which procured wind integration resources to meet both intra-hour and longer-term balancing needs. However the tool that NWE selected to provide for their longer-term balancing needs, building a power plant that will always be available for providing ancillary services, does not apply to the HQD situation.

Q. How do NaturEner's wind only balancing authorities relate to HQD and how are they different?

A. NaturEner's balancing authorities are similar to the HQD situation in that they are responsible only for balancing wind generation and that they must contract with third parties for both balancing services and generation off-taks. The situation in NaturEner's balancing authorities is still different from HQD because the contracts for the sale of wind generation only require that the supply be made firm two hours in advance.[73] Conversely, HQD requires capacity firming on a longer term basis. The main challenges for NaturEner are intra-hour, as NaturEner does not need to serve load; whereas HQD has both intra-hour and longer-term challenges, given its load serving entity function.

Q. How can the NaturEner wind integration case be applied to HQD?

A. In NaturEner's wind-only balancing areas we find an example of a balancing area which balances wind separately from any other resources including load.

Q. What differences exist between HQD and the other jurisdictions without organized Markets mentioned earlier in your report?

[73] *NaturEner USA LLC*, "Rim Rock Wind Farm Achieves Commercial Operation", Press Release, January 9, 2013

A. The majority of the other jurisdictions mentioned have vertically-integrated utilities that provide wind integration services through their own resources, rather than through contracts with third parties. In contrast HQD does not own any generation resources. Also, although the VER integration services costs are based on long-term costs of generation, including embedded and variable costs, the VER Integration Service is provided through short-term contracts (payments are by the hour and up to a year) rather than the longer-term contracts needed by HQD.

C. HQD SERVICE NEEDS

Q. What are Hydro-Québec Distributions service needs?

A. Because of its unique situation, HQD requires similarly unique wind integration services as compared to other regions. These unique characteristics include contract duration, the type of services sought, and the location of the service providers.

Q. What are the service duration needs of HQD?

A. The wind power purchase agreements of HQD are long-term, and as a result HQD would benefit from contracts with a longer duration than one year, to reduce its risk exposure, and for rate stability and predictability purposes. Moreover, TransÉnergie requires, in Schedule 8 of their tariff, that HQD "supply loads exceeding forecasts and offset outages and restrictions with more than one hour advanced notice."[74]

Q. Why is this service duration unique?

A. Most areas with explicit VER Integration Services provide them through short-term contracts (payments are by the hour and up to a year), probably to give flexibility to wind plants to self-procure, and also to avoid longer-term risks by the utilities providing the services (most of the capacity used to provide integration services was not originally developed for that purpose, and as a result these resources may not be available for providing VER integration services in the long term).

Q. What types of wind integration services does HQD need?

[74] *Hydro-Québec TransÉnergie*, Open Access Transmission Tariff, June 14, 2012, Original Sheet No. 174.

A. As a distribution company, HQD needs to meet both energy and capacity demands. Thus, HQD needs to procure both energy and capacity to meet the demand beyond the heritage pool requirements. Moreover, HQD does not control balancing resources. Therefore, intra-hour, hourly and longer-term integration services, including capacity firming, are required to enable HQD to use the output of its wind contracts to meet its energy and capacity demand obligation.

Q. What is unique about the types of wind integration services that HQD needs?

A. The VER integration services in US jurisdictions only include intra-hour services. Longer term services are covered either by the wind power off-takers, which have access to other resources (e.g., NaturEner contract with SDG&E), or by the wind power producers if it controls more than only wind plants (e.g., Iberdrola). Because HQD is the wind power off-taker and does not control generation resources that can be used to provide integration services, HQD needs both the intra-hourly services and the longer-term services.

Q. Where does the wind integration service provider need to be located?

A. From a technical standpoint, the location of an intra-hourly wind integration service provider to HQD needs to be such that it can receive real-time signals from the Québec transmission operator (Hydro-Québec TransÉnergie) at rates between seconds and minutes, and that it can deliver the services to Québec by modulating controllable generation or load resources.

Q. Can some wind integration service providers be located in another jurisdiction?

A. Potentially yes. However, resources in different locations may require different levels of effort to provide wind integration services. This is because Québec is only connected to neighboring interconnected systems either via DC ties or through radial AC lines linking the Beauharnois substation in Québec to the St. Lawrence and the St. Isidore substations in Ontario.

Q. Can some wind integration service providers be connected to the Québec system via the radial AC tie lines with Ontario?

A. The only generating resource in Ontario that can be connected radially to the Québec system through the Beauharnois substation is the R. H. Saunders generating station.[75] Should that resource provide wind integration service, it would require that the R. H. Saunders generating station only supply the Québec system continuously for the duration of the agreement, whereas currently the unit can supply either the Québec or the Ontario system.[76]

Q. Can some wind integration service be provided through the DC ties connecting Québec to neighboring systems?

A. Potentially yes, but there are reliability, operational and regulatory issues that would need to be resolved.

Q. What are the reliability issues related to the provision of wind integration services to HQD through DC ties?

A. At times DC ties are unavailable. For example, the Châteauguay (Québec – New York) and Outaouais DC ties (Québec – Ontario) were respectively unavailable for 1666 and 346 hours in 2012, out of the 8784 hour in the year.[77] The DC ties may be out of service due to either planned (maintenance) or unplanned (forced outage) reasons. Should wind integration services be provided through a DC tie, there would have to be provisions on how the services would be delivered to HQD when the DC tie is unavailable.

Q. What are the operational issues related to the provision of wind integration services to HQD through DC ties?

A. Because the DC ties are currently scheduled every 15 minutes or longer, having integration service providers located outside of Québec would require a significant change in the way the interconnections between Québec and its neighbors are operated. The effort to change the operational procedures could be significant, and may require upgrading tie operation systems. Even if the interconnection operations were adapted, there are other limitations that would have to be considered, depending on the specific location of the wind integration service provider.

[75] *Hydro-Québec TransÉnergie,* Point of Delivery/Receipt LAW, December, 2011
[76] *Hydro-Québec TransÉnergie,* Point of Delivery/Receipt LAW, December, 2011
[77] Data provided by *Hydro-Québec TransÉnergie,* based on data available at the HQT OASIS.

Q. Can some wind integration service be provided through the DC ties connecting Québec to New York?

A. No. Because the import capacity on the interconnections with New York is fully reserved by HQD to meet its capacity obligation,[78] potential service providers located in New York would not be able to use the interconnections between New York and Québec to provide the wind integration services, but would have to secure interconnection capacity through Ontario, New Brunswick, or New England.

Q. Are there any other issues related to the provision of wind integration services to HQD through DC ties?

A. Yes, there are market design issues related to the long-term (3-5 years) use of the DC ties between Québec and Ontario. In Ontario, the Independent Electricity System Operator ("IESO") does not allow, in its market design, "for the purchase and/or sale of any firm or non-firm transmission services. There is no system of advance reservations, physical rights and point to point service. In order for an import/export to be scheduled, it must compete on economics with internal generation that is dispatched in an economic security constrained manner."[79] The lack of this service would make it difficult for any party to provide ancillary services to HQD for a contracted period from Ontario. IESO does offer a transmission auction, where long-term transmission rights to 25% of a line's available transmission capacity are auctioned every quarter. The available capacity of a line is calculated by IESO before the auction.[80]

VII. CONCLUSION

Q. Does this conclude your testimony?

A. Yes, it does.

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[78] *Hydro-Québec Distribution,* Supply Plan 2011-2020, filed with the Régie on November 1, 2010, page 23.
[79] *IESO*, Market Manual 7: System Operations Part 7.12: Available Transfer Capability Implementation Document Issue 3.0. June 6, 2012. p. 7.
[80] *IESO*, Transmission Rights Workbook, March 2013. p. 4.