Centralized Forecasting for Variable Generation

Decision to Proceed with Procurement of Services

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1 OVERVIEW

The IESO Senior Management Team has endorsed IESO staff recommendation to implement a centralized forecasting service for variable generation in Ontario.

The current decentralized forecasting approach, whereby each variable generator is responsible for producing a generation forecast and updating that forecast on regular basis, will be replaced by the centralized forecasting service. The decision to adopt centralized forecasting directly addresses a January 2009 recommendation by the Ontario Energy Board's Market Surveillance Panel.[1] Under a centralized forecasting service, variable generators will be responsible for collecting and submitting site specific data (i.e. wind speed, wind direction, output, outage information, etc.) and relaying that data to the IESO and/or to a third party service provider.[2] The third party service provider would use the site specific data in conjunction with weather forecasts and other analytical tools to produce a generation forecast for each variable generator. Under a centralized forecasting regime, variable generators will no longer have an obligation to submit generation forecasts.

The centralized forecasting service will apply to both wind and solar resources. It is possible, however, that the implementation of centralized forecasting for wind and solar resources will not occur concurrently. The IESO's initial focus will be to ensure the implementation of centralized forecasting for wind generation. The low level of solar penetration in Ontario provides the IESO with flexibility to monitor improvements to solar forecasting techniques, which at present are not as well established as wind forecasting techniques.

The IESO proposes that the cost of the centralized forecasting service be borne by Ontario's variable generators. The cost to generators is expected to represent approximately 0.1 percent

[1] *Market Surveillance Panel: Monitoring Report on the IESO-Administered Electricity Markets for the period from May 2008 – October 2008*, http://www.oeb.gov.on.ca/OEB/_Documents/MSP/msp_report_200901.pdf at page 261.
[2] In the case of embedded generators the data may be relayed to a local distribution company (LDC). The LDC would then be responsible for forwarding the data to the IESO and/or a third party service provider.

or 1/1000 of operating revenue based on 1,085 MW of installed capacity operating at a 30% capacity factor.[3]

2 Stakeholdering History

The topic of centralized wind forecasting was initially discussed by the IESO's Wind Integration Working Group. In August 2007 the group recognized the value of centralized forecasting, but recommended that "current levels of forecast errors and wind penetration do not necessitate a centralized system at this stage."[4] At the time of the recommendation, Ontario had 395 MW of installed wind capacity. Since then, Ontario's installed wind capacity has almost tripled to 1,085 MW.

On February 10, 2009 the IESO reintroduced the topic of centralized wind forecasting at an SE-57 meeting, *Embedded and Renewable Generation (including periods of surplus baseload generation)*. A paper[5] published in advance of the meeting enumerated in detail the many anticipated benefits associated with centralized wind forecasting. Briefly the benefits discussed included:

- Consistent and accurate forecasts;
- Decrease in overall forecast error;
- Aggregate forecasts for all of Ontario;
- Consistent approach to improvement requirements; and
- More cost effective than decentralized.

In addition the paper provided a summary of wind forecasting methods among certain North American ISOs. At the February 10th meeting the scope of centralized forecasting was broadened to include generation from other variable resources, such as solar.

[3] 1,085 MW of wind generation operating at 30% capacity and charged 1/1000th of revenue would represent a charge of $0.135 per MWh of production and a total annual cost for Ontario's entire wind fleet of approximately $385,000.
[4] *Wind Power Integration Working Group (SE-29) Recommendations and IESO Responses on Short Term Issues,* http://www.ieso.ca/imoweb/pubs/consult/windpower/wpsc-20080404-WG_Recommendations.pdf at page 5.
[5] *Centralized Renewable Forecasting,* http://www.ieso.ca/imoweb/pubs/consult/se57/se57-20090210-Wind-Forecasting.pdf

At a June 16, 2009 SE-57 meeting the IESO advised stakeholders that it believed centralized forecasting to be the most effective means of improving forecasts from variable resources and sought stakeholder input. A discussion paper[6] published in advance of the meeting outlined two prominent developments since the previous SE-57 meeting held on February 10, 2009. First, the Ontario government introduced the *Green Energy and Green Economy Act, 2009* (GEA) in late February 2009. The GEA passed Ontario's legislature in May 2009. The hallmark of the GEA is a feed-in-tariff, which will provide renewable generators with long-term contracts at guaranteed rates. The feed-in-tariff is expected to dramatically accelerate the development of renewable generation in Ontario, in particular variable resources such as wind and solar. Second, in April 2009, NERC published a special report, *Accommodating High Levels of Variable Generation*. The report concluded that "variable generation output forecasts in multiple time frames are critical for reducing uncertainty and maintaining system reliability" and "forecasting techniques [for variable generation] must be incorporated into day-to-day operational planning and real-time operations routines/practices."[7]

In addition to addressing recent developments, the IESO discussion paper published in advance of the June 16, 2009 SE-57 meeting also provided a summary of year-to-date performance of forecasts from Ontario's wind resources.

3 Stakeholder Written Submissions

Following the June 16, 2009 SE-57 meeting, the IESO received five written submissions relating to centralized forecasting for variable generation. Submissions from Erie Shores Wind Farm, The Power Workers' Union, Sophie Pelland of CanmetENERGY of Natural Resources Canada, and Ontario Power Generation supported centralized variable forecasting. A fifth submission from NextEra Energy (FPL Energy) via WindLogics Inc. was neutral, but suggested the IESO

[6] *Improving Forecasts from Variable Generation*, http://www.ieso.ca/imoweb/pubs/consult/se57/se57-20090616-Centralized-Wind-Forecasting.pdf

[7] *Accommodating High Levels of Variable Generation*, http://www.nerc.com/files/IVGTF_Report_041609.pdf at pages 58-59.

may wish to reconsider its assumptions regarding the performance, administrative simplicity and cost effectiveness of centralized forecasting.

Erie Shores Wind Farm was the only wind generator with operations in Ontario to provide a written submission. As such, it was uniquely positioned among respondents in that it is subject to the existing decentralized forecasting regime and will be directly subject to the new centralized forecasting regime. Erie Shores Wind Farm's submission is reproduced below in its entirety:

> "Erie Shores Wind Farm has long been in favour of a centralized, automated approach to forecasting. We strongly support this new IESO initiative and believe it will deliver a number of benefits to both the IESO as well as to wind power facility operators, for a number of reasons:
>
> - The IESO will have a decrease in overall forecast errors.
> - Accuracy can be further improved with 10-15 minute updates to the program rather than 1 hour.
> - Distributed generation production (SOC's) can be factored into the overall effect on generation vs. load.
> - There will be a huge advantage to wind power facility operators by removing the burden of hourly updates.
> - The system will be relatively easy to implement. All of the data needed for this type of forecasting is already in place as wind power facilities currently supply online data to the IESO.
> - There should be a huge overall cost savings for wind power facilities as well as the savings for the IESO arising from improved forecasting.
>
> While we have always put in a great deal of effort to satisfy the scheduling needs of the IESO, our present system is less than ideal. We support this important step and consultation and look forward to transitioning to a centralized forecasting system in the near future."[8]

[8] For a copy of the original submission see: http://www.ieso.ca/imoweb/pubs/consult/se57/se57-20090703-ErieShores.pdf

The Power Workers' Union, in addition to indicating its support for centralized variable forecasting, recommended that costs be recovered from generators using a method similar to that used by the New York ISO. In New York costs associated with centralized wind forecasting are recovered by charging each wind farm a $500 monthly fee and an additional $7.50 monthly fee per MW of installed capacity. Ms. Pelland of CanmetENERGY, a division of Natural Resources of Canada, advised the IESO of a research project that she is working on that is evaluating the performance of solar forecasting. She recommended a collaborative approach between CanmetENERGY and the IESO with regard to solar forecasting. The IESO has since spoken with Ms. Pelland about her project and possible collaborative opportunities.

4 Variable Forecasting: Compensation for Curtailment

On June 8, 2009 the Ontario Power Authority posted a draft contract for the proposed feed-in-tariff. Exhibit B to the draft contract deals with contract settlement. Importantly, s. 1.5 indicates that where the IESO issues instructions to a variable generator to reduce output, the curtailed generator will receive an additional contract payment to compensate it for the foregone hourly delivered electricity. While the OPA is still in the process of developing a methodology to determine foregone hourly delivered electricity, it is reasonable to assume that this imputed value may be based on a forecast of output or based on real-time wind speed data applied against a power curve. The former would heighten the need for accurate and independent forecasts. The latter would heighten the need for quality data collection and telemetry. Both would be achieved by centralized forecasting. For more details please refer to the OPA's feed-in-tariff web page.[9]

[9] http://www.powerauthority.on.ca/FIT/. For specific wording surrounding curtailment payments, see s. 1.5 "IESO Instructions", to Exhibit B of the FIT Contract – Draft June 8, 2009 available at http://www.powerauthority.on.ca/FIT/Storage/10/10250_FIT_Contract_Exhibits_-_Draft_June_8_2009.pdf

5 Rationale for a Generator Funded Service

The IESO proposes that the cost of the centralized forecasting service be borne by Ontario's variable generators. The rationale is as follows:

The IESO has been working with variable generators to improve forecasting results. At present variable generators are not satisfactorily meeting existing requirements relating to forecasting.[10] In addition, new and more stringent day-ahead standards will be required. Improving performance relating to existing standards and meeting new day-ahead standards would lead to additional expenditures for variable generators. Rather than incur expenditures to improve decentralized forecasts, generators will instead provide funding toward a centralized system. The net cost differential is expected to be minimal and indeed may favour a move to centralized forecasting as certain fixed cost expenditures can be spread over multiple users.

In addition, the OPA has advised the IESO that in developing the feed-in-tariff price schedule it did not deem it necessary to include an incremental payment to cover the costs of a centralized variable forecasting system, as these costs were deemed insignificant. The IESO expects the annual cost to generators associated with a centralized variable forecasting system to represent approximately 0.1 percent or 1/1000 of operating revenue. Based on an installed wind capacity of 1,085 MW operating at a 30% capacity factor this would translate to a charge of approximately $0.135 per MWh of production. Assuming modest inflation of 2.5%, the annual cost to wind generators associated with a centralized forecasting regime would be covered at least five times over by the first year's contract price escalator.[11]

[10] IESO experience is that the compliance issue relates to failure of variable generators to revise dispatch data, which relates to 24 hour staffing issues, including costs.

[11] The current feed-in-tariff price schedule contemplates that wind generators will receive a price escalation of 20% of inflation each year. Assuming inflation of 2.5%, wind generators would be paid an additional $0.675 per MWh of production in the second year of their feed-in-tariff contract, or a total of $135.675 per MWh.

6 Possible Funding Models

Other North American ISO's use either a production based model or capacity based model to recover costs associated with centralized forecasting systems. The two models are described below. The IESO does not have a strong preference and encourages stakeholders, particularly variable generators, to provide recommendations.

Production Based Model

Under a production based model, costs are recovered from generators based on a fixed charge per each MWh of output. For example, a 100 MW wind farm producing at 30% capacity would incur annual costs of $35,478, if a $0.135 MWh charge were applied (annual revenue would be $35.478 million). The same wind farm would incur annual costs of $29,565 if it operated at 25% capacity. The variability in costs associated with a production based model can be regarded as either an advantage or as a disadvantage. The advantage is that costs are proportional to revenue – lower revenues mean lower costs. The disadvantage is that generators cannot precisely budget an annual cost associated with centralized forecasting. Given the low costs associated with centralized variable forecasting, budget uncertainty is unlikely to pose a significant concern.

Capacity Based Model

Under a capacity based model, costs are recovered from generators based on a fixed charge per each MW of installed capacity. A wind farm that performs better than Ontario's fleet average would be better off under a capacity based model than under a production based model. Conversely, a wind farm that performs worse than Ontario's fleet average would be worse off under a capacity based model than under a production based model.

In New York, a modified capacity based model is applied. All generators, regardless of size, are charged a single flat monthly rate in addition to a monthly charge per MW of installed capacity. This approach creates a relative cost burden shift from larger generators to smaller generators.