MAY 20, 2020

Variable Generation Forecasting Tool Webinar

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Meeting Participation

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Meeting Participation (continued)

- When asking a question, state your name and who you represent so those participating are aware
- This webinar is conducted according to the IESO Engagement Principles

Purpose

- To discuss improvements to scheduling inputs when the variable generator (VG) forecast tool is disabled.

Agenda

- Background
- Issue and Impacts
- IESO Responses
- Implementation

Background

Market Surveillance Panel

- The Market Surveillance Panel (MSP) made the following two-part recommendation in their April 29, 2019 report:

Recommendation 3-1:

1. "The IESO should formalize the process by which it determines when to disable and re-enable the variable forecasting tool, and should communicate that process to market participants to increase transparency."

Market Surveillance Panel (continued)

2. "When a variable generator is on mandatory dispatch and the forecasting tool is disabled, the IESO should set the generator's unconstrained schedule at its forecasted output rather than its maximum offered capacity.

- The IESO's response to this recommendation was:

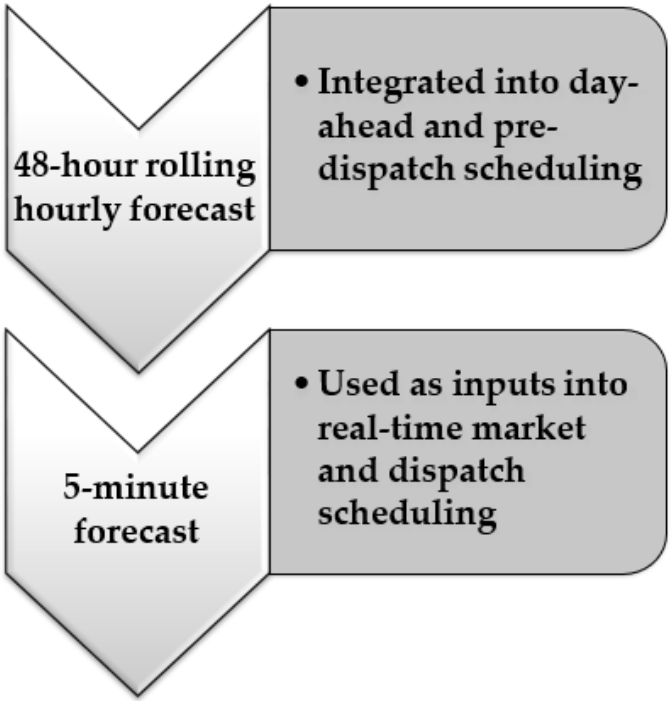
1. The IESO agreed that the process to disable/re-enable the VG tool should be formalized in Market Manuals and communicated to participants.

Market Surveillance Panel (continued)

2. The IESO also agreed to perform an assessment of solutions that best reflect a VG's capability when the tool is disabled.

Background: VG Forecast Tool

- The IESO relies on centralized wind and solar forecasting to provide reliable day-ahead hourly, and real-time estimates of energy output from these generators.
- These forecasts help the IESO anticipate the output of VG and better manage variability and uncertainty to maintain system reliability.



VP Dispatches

‘Obligation indicator’ field beside the dispatch instruction on MP’s workstation screen is populated by ’release’ or ‘mandatory’ to indicate whether the instruction must be followed.

‘Release’

- Most of the time, VGs are expected to generate according to ambient conditions

VP Dispatches (continued)

‘Mandatory

- If an economic or security constraint exists on the system, IESO may issue a mandatory dispatch
- VG is required to change its output to that specified in the mandatory instruction

Issue

Disabling the Forecast Tool

- The IESO monitors output from generators on a real-time basis
- If the observed VG output is significantly different from the forecasted amounts, the IESO can decide to temporarily disable the 5- minute VG forecast tool

Disabling the Forecast Tool (continued)

- When the forecast tool is disabled:
  - The forecast data will no longer be used as an input into scheduling
  - Instead of the forecast, for VG resources the actual output from the previous dispatch interval is used to estimate output for the next interval. The IESO refers to this estimate as the "persistence" forecast
- These actions are necessary to ensure that the IESO is not under or over forecasting VG output and supply adequacy and security are maintained

Disabling the Forecast Tool: Market Pricing

- When the VG forecast tool is disabled, persistence values are used for availability in market scheduling except when a mandatory dispatch instruction is issued
  - When a VG receives a mandatory dispatch the resource's full offered capacity is used to reflect availability for market scheduling
  - This maximum capacity value is typically much higher than capability

Disabling the Forecast Tool: Market Pricing (continued)

Mandatory Dispatch

- The full offered capacity of the resource is used as the available MW quantity for market scheduling
- Depending on ambient conditions, this quantity could be much higher than actual availability
- This can create market price distortions

Issue: Market Impact

In this circumstance…

- Our tools may schedule the resource up to its maximum offer quantity in the real-time unconstrained market sequence
- This creates an ‘artificial supply’ in the unconstrained sequence which can suppress prices and potentially create higher CMSC payments
- Price-suppression can also create broader market inefficiencies (for example, artificially low prices could encourage inefficient exports and consumption)

IESO Responses

Recommendation Part 1: Advisory Notice

- To address part 1 of the MSP recommendation, the IESO made changes to Market Manual 7.2; no Market Rule changes were required
- Edits specify that the IESO will issue an advisory notice when the tool is disabled/re-enabled and the circumstances under which the IESO may disable the forecast (in a footnote)
- The following changes were posted for stakeholder review on November 1, 2019 for a two-week period and finalized as part of Baseline 42.1 in December 2019:

Recommendation Part 1: Advisory Notice (continued)

3. **Advisory Notices**

   Advisory notices allow us to present information to market participants that is not addressed through the Adequacy Report and the Transmission Limits Reports.

Recommendation Part 1: Advisory Notice (continued)

Publication of advisory notices is exception-based, since advisory notices are intended to provide information on events that are not captured through the regularly scheduled publication of the reports noted above.

Recommendation Part 1: Advisory Notice (continued)

For example, if we need to identify that an external jurisdiction has made a reliability declaration calling upon Ontario capacity for firm energy exports, or the disabling/re-enabling of the five-minute Variable Generation forecasting tool[4], this will be communicated via an advisory notice.

[4] At the discretion of the IESO, we may disable the five-minute Variable Generation forecasting tool when the forecast differs from the actual output by at least 50 MW.

Recommendation Part 2: Input Accuracy

- In order to fix the issue, we need to change the input
  - Need to replace ‘full offered capacity’ with a value that is more reflective of actual capability
  - The more accurate the input, the more accurate (and efficient) the pricing outcome

Recommendation Part 2: Input Accuracy

- IESO considered potential options to address the input issue including:
  1. Using a forecast
  2. Using a capacity factor
- The next slides outline these options and compare them against the status quo on the basis of improved accuracy

Option 1: Re-Route the Forecast

- When the 5-minute forecast tool has been 'disabled' it is more accurate to describe it as 'disconnected'.
  - It does not stop providing data, rather that data is not used as a scheduling input.
- Instead of completely disabling, the IESO could instead 're-route' the forecast so that it could still be used as an input quantity for mandatory dispatches (even if disabled elsewhere).

Option 2: Capacity Factor

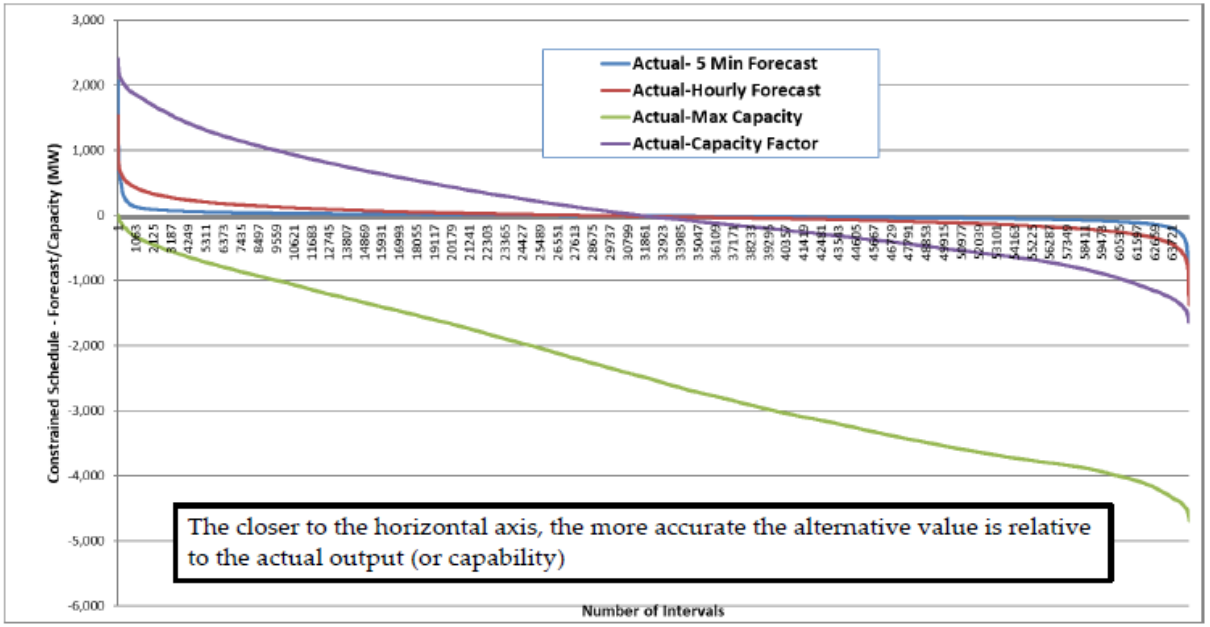
- Develop historical capacity factors for each facility as an input quantity
  - To do this analysis, the IESO derived seasonal capacity factors based on average capacity factor on a quarterly basis over the past three years
  - For a new resource, for which the historical data above was not available, the average capacity factor from all VG resources of the same technology in the year was used

Analysis of Options

- IESO prepared an analysis of these options to determine which would generate the most improved accuracy over the status quo
- The chart on the next slide illustrates the duration curve of the actual output minus alternative amount in all intervals when the 5-minute forecast tool was disabled (May 2016 to June 2019)

Difference of Actual Output vs. Alternatives When Forecast Tool Disabled (May 2016 to June 2019)

Figure 1



Results

- All options yield a significant improvement over the status quo (i.e. using the maximum offered quantity)
- The analysis shows that replacing the maximum offered quantity with the 5-minute forecast as the input would be the best alternative

Percentage of Improvement	5-Minute Forecast	Hourly Forecast	Capacity Factor
	98% ☑	95%	74%

Impacts

- Replacing full offered capacity with the 5-minute forecast input in the unconstrained sequence will:
  - Reduce the price distortion impacts of the status quo
  - More accurate market prices will improve efficient dispatch of internal and external resources (including imports and exports)

Implementation

Implementation

- The IESO is currently working with its scheduling system vendor to update the input to the unconstrained ('market') sequence
- The IESO expects to roll out this change in Q4 2020
  - The IESO will prepare and execute a test plan to ensure scheduling changes are working as designed before rolling out this change
  - Impacts from COVID-19 may impact timelines
- A communication will be published in the IESO Bulletin notifying stakeholders prior to the change being implemented
- Questions can be sent to engagement@ieso.ca

Appendix

Inputs used when the 5-minute VG forecast is disabled

- When operating under a release, the generator is expected to produce according to ambient conditions. A persistence-based forecast based on a telemetry snapshot of output from the previous interval will be used in the constrained and unconstrained sequences.

Inputs used when the 5-minute VG forecast is disabled (continued)

- If the generator receives a mandatory instruction, the Hourly forecast is used as the maximum constraint in the **constrained** sequence. However, in the **unconstrained** sequence (used for setting price), the generator's **offered quantity** (which is usually their nameplate capacity) is used.
  - This means that in the unconstrained sequence, the generator can be scheduled up to their nameplate capacity rather than a forecast amount.

Inputs used when the 5-minute VG forecast is disabled (continued)

- Registered market participants subject to centralized forecasting (i.e. are classified as intermittent and variable generators) are obligated to submit as its quantity component the generation facility's full capacity available for production (i.e. installed capacity less outages).

See Market Rules Chapter 7, section 3.4.1.4B.

Note re: 'Actual' Output Capability

- When a VG receives a mandatory dispatch (i.e. a dispatch down), its actual output tends to be lower than its true capability.
- Therefore, its actual output, which is supposed to be close to the instruction amount, cannot be readily used for accuracy assessment against any value (neither the maximum offered quantity, the hourly forecast nor the estimated capacity based on historical capacity factor.)

Note re: 'Actual' Output Capability (continued)

- To calibrate which value is more representative of the true capability, IESO used values at other VG units that are free to generate power at the time when a VG is receiving a mandatory instruction.
- The values provide a more accurate measure of how well the hourly forecast tool/capacity factor/maximum capacity is compared to the actual output when there is no manual or automatic curtailment.

Note re: ‘Actual’ Output Capability (continued)

- The numbers are aggregated to provide overall impact on the market. This approach should provide a more accurate comparison of the actual capability and other alternatives at the time when the VG forecast tool is disabled.

Disabling the Forecast: Contracts

- The forgone energy calculation component of contract settlement with VGs is not impacted when the 5-minute forecast tool is disabled.
  - The disabling of the forecast as an input into the DSO does not prevent the data continuing to be used in foregone energy calculations.