

Dispatchable Variable Generation and the Renewed Market

Introduction

This issue of Quick Takes provides an overview of market and process changes related to market renewal which will affect variable generation. Variable generation for the purposes of this document refers to dispatchable generation resources with a fuel type of wind or solar photovoltaic that have an installed capacity of 5 MW or greater, or that are directly connected to the IESO-controlled grid.

Renewed Market Main Features

The IESO is implementing a renewed electricity market to address existing inefficiencies and to enable the IESO to realize significant operational improvements, reducing costs for market participants and improving the ability to integrate emerging and new technologies. Key changes include:

- Introduction of a Day-Ahead Market (DAM) which will create financially binding schedules, increasing operational and financial certainty for suppliers.
- Implementation of a two-settlement system, whereby the financially binding DAM schedules will be settled at day-ahead prices, with deviations in real-time operations from day-ahead schedules settled at real-time prices.
- Replacement of the current two-schedule market design (i.e., having unconstrained prices and constrained scheduling) with a Single Schedule Market (SSM). Under an SSM, scheduling and prices will both be determined by constrained algorithms which take losses and physical system limitations into consideration.
- Replacement of the current unconstrained Hourly Ontario Energy Price (HOEP) with the use of Locational Marginal Prices (LMPs) for settlement. LMPs will be calculated for every injection and withdrawal location on the grid, sending more transparent and efficient price signals that will reflect global and local system constraints.
- Enhancements to the pre-dispatch resource scheduling and commitment processes, including multi-hour optimization and the use of new dispatch data parameters for some resource types.

- Development of new Market Power Mitigation measures to better support the transparency and fairness of the market.

Registration

Market registration is the overall process by which new or existing participants provide information needed for approval to operate in the IESO-administered markets. It has two sub-processes: 'Authorize Market' and 'Program Participation and Register Equipment'.¹

Changes to the market registration process which affect variable generation primarily relate to the new requirement to submit the following information which will be used in market power mitigation processes:

- 1) Market Control Entity: A market control entity is any entity (registered on its own with the IESO or not) that has the ability to control or influence the market participant's offers schedules in the day-ahead and/or real-time market through, e.g., an ownership, controlling, subsidiary or beneficiary relationship (see Market Rules Chapter 7, section 22.9 for details).
- 2) Market Control Entity for Physical Withholding: A single market control entity which satisfies criteria outlined in Market Rules Chapter 7, section 22.9 must be disclosed as a generation resource's market control entity for physical withholding.
- 3) Reference Levels and Quantities: Reference levels are IESO-determined estimates of dispatch data parameters and quantities that a resource would have submitted if it were subject to unrestricted competition. These are used in market power mitigation processes. For variable generation, energy offer and energy ramp rate reference levels will be determined.

Dispatch Data Submission

Currently, variable generation is required to provide a day-ahead offer equal in quantity to its available capacity. That is, they are to reflect total installed capacity, less any net derates or outages to the facility. Further:

- The offer price in the price-quantity pair (excluding the first 10% of the available capacity of a wind generation facility) must be no less than -\$3/MWh, and
- The offer price in the price-quantity pair corresponding to the first 10% of the available capacity of a wind generation facility must be no less than -\$15/MWh.

As well, a variable generator can currently submit a daily energy limit, representing the maximum amount of energy that can be scheduled by the IESO from that registered facility over a dispatch day.

None of these rules will be changing in the renewed market.

¹ For more information on market registration, please see Market Manual 1.5, Market Registration Procedures, Market Rules Chapter 2: Participation, Chapter 7 System Operations, Physical Markets, Appendix 7.8: Market Power Mitigation, market manual 14.2: Reference Level and Reference Quantity Procedures and the [Reference Levels and Reference Quantities Workbooks](#) available on the IESO website.

New with the renewed market, variable generators will be able to enter their own forecast of their resource's real-time output into the DAM, rather than the IESO's forecast automatically being used as is the case currently with the Day-Ahead Commitment Process. The submitted variable generation forecast quantity can replace any or all hours of the IESO forecast for use in the DAM. This allows the market participant flexibility to have their forecast used as the basis of day-ahead calculations which will set their resource's financially binding schedule and day-ahead prices.

Another change is that variable generators will be able to enter a daily energy ramp rate which can be different than their submitted hourly energy ramp rate. The daily energy ramp rate will be used to determine allowable schedule changes from one hour to the next in the DAM and pre-dispatch. The submitted hourly ramp rate will continue to be used in the real-time market's five-minute calculations.

Lastly, the current market's requirement that a day-ahead availability declaration envelope (ADE)² be established will continue. However, market participants will be allowed to submit offer changes post-DAM which exceed the ADE by the lesser of 15% of the ADE or 10 MW without IESO approval being required. This is an increase from the current limit of the lesser of 2% of the ADE or 10 MW.

IESO Manual Forecast Overrides

In order for the IESO's centralized variable generation forecast to better reflect observed production trends, the IESO can currently apply overrides or persistence. Overrides supersede the forecast, whereas persistence increases the accuracy of the centralized forecast by blending it with actual telemetered output from each variable generation resource. With the renewed market, there will be some changes to how these adjustments are applied. In the current market, overrides can be applied either zonally or globally. In the renewed market, the IESO will apply overrides on a zonal basis to ensure that variable generation forecasts in each zone reflect conditions in that zone. Global overrides will only be used to address reliability concerns when timeframes do not permit the application of zonal overrides. Persistence is currently applied globally to all variable generation resources. In the future, the IESO will have the ability to apply persistence on a zonal basis as well.

Dispatch

An obligation indicator is a piece of text information that accompanies dispatch instructions and release notifications sent through the IESO automated dispatch systems. The value of the obligation indicator is either "mandatory," denoting a dispatch instruction that must be followed, or "release," denoting a release notification.

Similar to current practice, the IESO will issue dispatch instructions to a variable generator when there is a change in the obligation indicator to a mandatory dispatch instruction or a release notification relative to the last dispatch instruction issued.

Unlike today, the determination of dispatch instructions will include consideration of dynamic loss penalty factors. Loss penalty factors account for the transmission losses associated with a

² The Availability Declaration Envelope will be defined as the most recent maximum quantity of energy included in an offer submitted in the day-ahead market. This is effectively the same as the current definition, just taking the existence of a DAM into consideration.

dispatchable resource. Currently, static uniform losses are used for determining variable generation dispatch. This is unlike dispatch for other resources, which includes consideration of individualized loss factors. This is acceptable while a uniform settlement price is being used. With the implementation of locational marginal pricing, however, static losses are no longer viable since their continued use would drive unfair LMP differences between neighbouring resources. As such, loss penalty factors for variable generation will be determined and applied by the calculation engines in the same manner as those for other dispatchable supply resources.

The IESO will determine a tie-breaking daily dispatch order for variable generation in the same manner as today. This tie-breaking logic, however, will be applied in all three timeframes – the DAM, pre-dispatch and real-time – in the renewed market. On a monthly basis, the IESO will continue to randomly determine a daily dispatch order for variable generation resources for each day of the month. This daily dispatch order will be used to decide which variable generation resource will be scheduled when two or more have energy offers that create no difference in the cost to the market. Tie-breaking is expected to be applied much less often in the renewed market, though, since dispatch will include consideration of individualized loss penalty factors.

Market Settlements

As dispatchable resources, variable generation will be settled using a two-settlement process. Put simply, this means they will be compensated for the energy scheduled day-ahead at DAM locational marginal prices. Differences between day-ahead schedules and actual real-time injections will be settled at real-time prices. The formula for energy settlement is:

$$\text{Day-ahead scheduled quantity} \times \text{Day-ahead LMP} + \\ (\text{Quantity injected in real-time} - \text{Day-ahead scheduled quantity}) \times \text{Real-time LMP}$$

For example, assume a variable generation resource offered 15 MW into the DAM at \$0/MWh. In the DAM, their LMP was \$10/MWh, and they were scheduled to 15 MW. In real-time, they delivered 11 MW and their LMP was \$8/MWh. In this scenario, their total settlement would be:

$$\begin{aligned} & (15 \text{ MW} \times \$10) + (11 \text{ MW} - 15 \text{ MW}) \times \$8 \\ &= \$150 + -\$32 \\ &= \$118 \end{aligned}$$

The \$150 represents the resource's DAM settlement, while the negative thirty-two dollars represents the cost to buy replacement energy for the four megawatts not delivered in real-time.

The processes for market settlement will not be changing, but the statements themselves will be modified as a result of the renewed market. For example, preliminary and final settlement statements will continue to use settlement-ready meter data to determine settlements for a trade day. They will still be available 10 and 20 business days after each trade date respectively. In the renewed market,

however, settlement statements will contain both the first and second settlement for a given day - that is settlement of both the day-ahead and real-time markets.³

Market Power Mitigation

Variable generation will be subject to market power mitigation⁴. Market power refers to the ability of a market participant, in the presence of restricted competition, to raise prices and to maintain them above the level that would prevail under competition. This can lead to inefficient market outcomes and increased costs for consumers.

Market power mitigation refers to actions taken to prevent market participants from exercising market power. The renewed market will have four types of market power mitigation applicable to variable generation:

1) Validation of dispatch data submissions against non-financial Reference Levels

For variable generators, submitted ramp rates will be validated against the established reference level ramp rates. Submitted energy ramp rates will be rejected if they are lower than 50% of the reference level.

2) Ex-ante (before-the-fact) mitigation of offer prices

Ex-ante market power mitigation is conducted as part of the operations of the DAM and pre-dispatch calculation engines. The DAM will:

- Determine if constrained system conditions resulted in the market participant having market power;
- If a constrained condition did apply, perform a conduct test;
- If the conduct test is failed, perform an impact test to determine if their energy offer materially affected prices;
- If the impact test is failed, replace submitted offers with reference level prices for the purposes of pricing and scheduling.

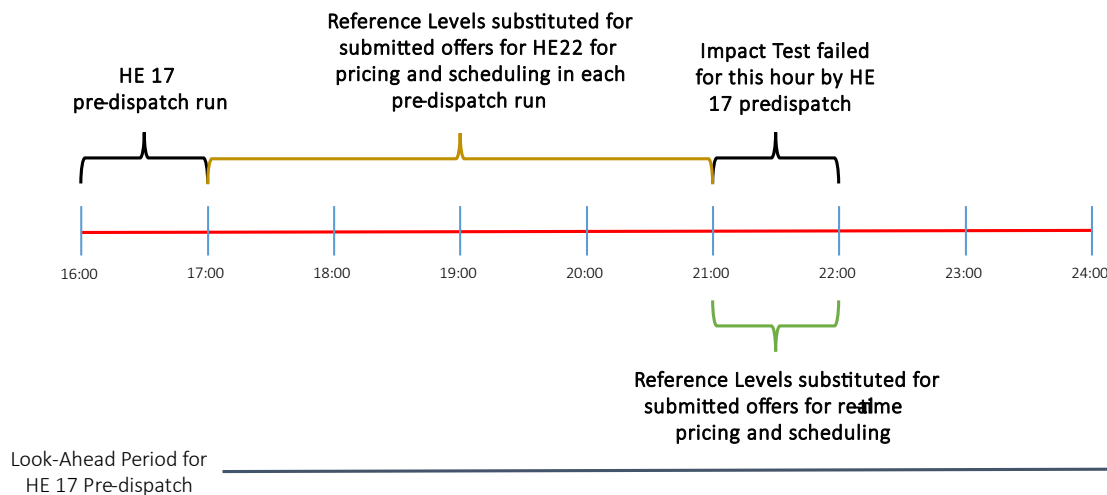
Pre-dispatch's process is similar. However, if the impact test is failed in a pre-dispatch run for an hour in its look-ahead period, this information is passed to the next and subsequent pre-dispatch runs, as appropriate, where the submitted offers are replaced with reference levels for scheduling and pricing. Reference Levels are also then passed to the real-time processes for the hour for which the impact test was failed.

Let's look at an example. In the illustration below, offers submitted for Hour Ending (HE) 22 failed the impact test during the HE 17 pre-dispatch run. This information would be passed next to the HE

³ For more information on settlements, please see Market Rules Chapter 9: Settlements and Billing, Chapter 9: Appendices, and market manuals 5.7: Settlement Process, 5.8: Settlement Invoicing and 5.9: Settlement Disagreements.

⁴ For more information on market power mitigation, see market manuals 14.1: Market Power Mitigation Procedures, 14.2: Reference Level and Reference Quantity Procedures and Market Rules Chapter 3: Administration, Supervision and Enforcement, Chapter 7: System Operations and Physical Markets, Chapter 9: Market Settlements, Billing and Funds Administration, and Chapter 9: Market Settlements, Billing and Funds Administration Appendices.

18 pre-dispatch run where the submitted offers for that resource would be replaced for scheduling and pricing purposes by Reference Levels. This would continue for subsequent pre-dispatch runs until HE 21. Reference Levels will also be used by real-time scheduling and pricing processes in HE 22.



Please note that if updated offers for the same resource are submitted subsequent to an impact test failure, these new offers will be evaluated by the next pre-dispatch run. If they pass during this run, these newly submitted offers will be used going forward in any subsequent pre-dispatch runs and in real-time. If they fail, Reference Levels will continue to be used.

3) Ex-post (after-the-fact) mitigation for physical withholding

Ex-post analyses are done after the trade day to determine if there was physical withholding in either the day-ahead or real-time markets. This is done by first determining if there was restricted competition and then, if so, by performing a conduct test and an impact test for each relevant dispatch hour. If a market participant fails these tests, the IESO may apply a settlement charge.

Recall that a registration requirement was to designate a Market Control Entity for Physical Withholding. When assessing potential physical withholding, the capabilities, market behaviour and constrained area conditions are considered for both the individual resource and resources which share the same Market Control Entity for Physical Withholding. The same resource may be tested on the basis of both resource-specific thresholds and Market Control Entity for Physical Withholding - specific thresholds, if applicable.

The reference quantity used for determining market power mitigation for variable generators will be equal to the IESO's centralized day-ahead forecast for that resource, or will be equal to the market participant's forecast, if submitted. The reference quantity will be adjusted by the IESO for completed outages and derates in an after-the-fact process.

4) Mitigation of make-whole payments

Make-whole payments can be required in the settlement of both the day-ahead and real-time markets. These are intended to compensate market participants who have been scheduled uneconomically by the IESO, in most cases in order to maintain the reliability of the grid. Mitigation

can be necessary because calculation of these payments is in part based on a resource's offer price. As such, when competition is restricted it is possible for the exercise of market power to increase these payments so they exceed the reimbursement of actual costs. If the resource fails the applicable conduct and impact tests, the IESO will determine the applicable settlement payments using reference levels in place of the submitted dispatch data.