

The IESO published draft design principles to provide a foundation for the renewable integration stakeholder engagement. These principles were posted for stakeholder comment on December 9. In response to the stakeholder feedback received the IESO has made a number of changes to the design principles and has clarified the intent of the draft principles and supporting information provided in the draft paper. The IESO has also provided a comparison table (in a separate document) outlining related requirements in similar jurisdictions.

## Revisions to Design Principles

### Principle 1:

The IESO will implement a centralized forecast for wind and solar resources directly connected to the IESO-Controlled Grid and for wind and solar resources with an installed capacity of 5MW or greater connected to a distribution system. Centralized forecasting will be expanded to include other variable resources as their aggregate installed capacity becomes material.

*(Original text: The IESO will implement a centralized forecast for wind resources directly connected to the IESO-Controlled Grid and for wind resources with an installed capacity of 5MW or greater connected to a distribution system. Centralized forecasting will be expanded to include other variable resources such as solar as their aggregate installed capacity becomes material.)*

### Principle 2:

Real-time forecast data will be used for variable generation dispatch and actual real-time data will be used for calculating foregone energy to support OPA contract settlement.

*(Original text: A real-time forecast will provide the information to allow for renewables dispatch and OPA contract settlement.)*

### Principle 3:

The costs paid to the centralized forecast service providers will be treated as procured service charges and will be recovered from consumers through existing procurement market recovery mechanisms.

### Principle 4:

All variable resources subject to centralized forecasting will provide static plant information and data.

*(Original text: All wind based resources subject to centralized forecasting will provide static plant information and data. Solar or other variable generation requirements will be developed as these resources are incorporated into centralized forecasting.)*

Principle 5:

**All variable resources subject to centralized forecasting will provide dynamic data (real-time telemetry).**  
(Original text: All wind based resources subject to centralized forecasting will provide dynamic data (real-time telemetry). Solar and other variable generation requirements will be developed as these resources are incorporated into centralized forecasting.)

Principle 6:

**All forecasts of facility output will be publicly available.**  
(Original text: All meteorological data and forecasts will be publicly available.)

Principle 7:

**Actively dispatch all variable resources connected to the IESO-Controlled Grid, or embedded variable resources that are registered market participants, on a five-minute economic basis.**  
(Original text: Actively dispatch all variable resources connected to the IESO-Controlled Grid on a five-minute economic basis.)

Principle 8:

**Variable generators will operate within a compliance deadband when ambient conditions offer sufficient fuel.**  
(Original text: Variable generators should operate within a compliance deadband when ambient conditions offer sufficient fuel.)

Principle 9:

Variable generators will be entitled to Congestion Management Settlement Credit (CMSC) payments.

Principle 10:

**The IESO may establish various floor prices for offers from baseload generators (e.g. wind, must-run hydro, nuclear, etc.) to ensure efficient dispatches during periods of local and/or global surplus baseload generation (SBG) events.**  
(Original text: The IESO may establish various floor prices for offers from baseload generators, i.e. wind, must-run hydro and nuclear, to ensure efficient dispatches during periods of local and/or global surplus baseload generation (SBG) events.)

Principle 11:

Directly connected variable resources (or embedded resources that are market participants) will be eligible to participate in Operating Reserve and ancillary markets where technically feasible. (Such integration will be considered on a cost benefit basis and is not likely to be addressed in the near term)

## **IESO Response to Common Themes Identified in Stakeholder Feedback**

The IESO found that many of the stakeholder comments could be grouped into similar themes. The following questions and answers are in response to these themes. The individual comments each question is intended to represent are referenced in the summary document outlining all of the feedback received (see Appendix 1).

### **Question 1: Other Jurisdictions**

What do other jurisdictions require of variable generators with respect to data requirements (static and dynamic) and dispatchability?

IESO Response:

Dynamic data (including real-time wind turbine power output, availability, and meteorological information) and static data (including turbine locations, meteorological tower, cut-in and cut-out speed information) is critical for accuracy of wind power forecasting. Dynamic data requirements such as outage and availability information is not only important for centralized forecasting and incorporating forecasts into operations but this information is also necessary for IESO to make operating decisions to accommodate VG in actual Day-Ahead and Real-time operations.

NERC Integrating Variable Generation Task Force (IVGTF) in its report titled: “Variable Generation Power Forecasting for Operations” has recommended that a standard requirement for wind power forecasting information should include meteorological information, power output, wind availability and plant curtailment information.

The IESO again reviewed the static and dynamic data requirements employed in various other jurisdictions in North America. A comparison matrix of available information is provided in Appendix 2. Independent System Operators in North America have converged to a similar set of static and dynamic data requirements to those proposed by the IESO’s. At the same time, many system operators have or are transitioning renewable resources into their real-time dispatch. The IESO will be discussing more details of these requirements as part of specific technical working group activities. These requirements are intended for both wind and solar resources where applicable.

### **Question 2: Dispatch Interval**

How has the IESO developed the 5-minute interval for the purpose of real-time dispatch of variable generators?

IESO Response:

Variable resources will soon comprise a significant portion of Ontario’s installed capacity. At times, these resources will produce energy at a scale equal to or greater than traditional dispatchable resources, such as hydro, nuclear, gas or coal. As a mainstream resource, variable generators directly connected to the ICG or participating in the IESO Administered Markets need to be incorporated into the five-minute economic dispatch process in order to produce reliable and efficient dispatch outcomes. At this time, the

IESO does not intend to dispatch embedded variable generators that are not registered market participants.

Those market jurisdictions in North America with substantial proportions of variable resources are integrating those resources into their real-time dispatch or are transitioning to this point. NYISO and ERCOT are currently dispatching variable resources in their five-minute security constrained economic dispatch. Other jurisdictions, such as CAISO, have established proposals and stakeholder groups to move variable resources into their real-time dispatch. The IESO's principle is consistent with this emerging best practice.

### **Question 3: Solar Generation**

How will the IESO address the need to incorporate solar generation alongside wind generation in the design principles?

IESO Response:

The design principles are not limited in scope to wind generators. For clarity, design principles 1, 4, 5 and 10 have been rephrased (see above).

### **Question 4: Grandfathering**

How will the IESO treat facilities that were designed and built before the publishing of the design principles and may have technical difficulties in meeting these requirements?

IESO Response:

The IESO expects all existing and future wind farms to adhere to the market rules that result from the implementation of the design principles. Stakeholders are invited to participate in the detailed design stakeholdering activities relating to the design principles in order to aid the IESO in identifying the technical barriers to their implementation.

Once the market rules are introduced, facility limitations that cannot be accommodated in the registration process may request an exemption from one or more specific obligations or standards imposed on the facility pursuant to the market rules, market manuals or from any standard, policy or procedure established by the IESO pursuant to the market rules. The exemption process takes into account technical capability and the associated costs to achieve that capability and the impact of not meeting the set out obligation when determining whether or not an exemption is granted.

Further information on the exemption process can be found on the IESO's website at:

<http://www.ieso.ca/imoweb/exemptions/exemptions.asp>

### **Question 5: Confidentiality**

How will the IESO protect market participant confidentiality when collecting static and dynamic data and publishing forecast data?

IESO Response:

The IESO has received feedback from stakeholders expressing a concern over the publishing of site-specific meteorological data and forecast facility output data. The IESO sees forecast data as an indication of the available capacity of a wind or solar farm and, as this information is published for other resources in the IESO-administered markets, intends to publish this data for variable generation resources that are subject to centralized forecasting. However, recognizing the concern of stakeholders over the publishing of meteorological information on a site-specific basis, the IESO proposes to amend principle 5 (see above).

### **Question 6: Cost Recovery of Forecasting Costs**

What is the IESO's rationale for assigning costs to loads when it previously planned to assign them to variable generators?

IESO Response:

The rationale for assigning costs to loads is consistent with the expectation that centralized forecasting will produce more accurate variable generation forecasts which will improve market efficiency, through improved unit commitments, import/export scheduling, transmission and ramp management thus reducing costs to the market overall. The value of centralized forecasting is well documented through NERC's Integrating Variable Generation Task Force and validated by the experience of other North American Independent System Operators (ISO). This overall benefit to the market is implicit in the cost recovery methods employed by ISOs in the U.S.A., whereby all ISOs pay for all or a portion of the cost for centralized forecasting:

- NYISO charges fixed monthly charge of \$500 plus \$7.50/MW on installed capacity to generators. NYISO covers the balance of costs not recovered through generators;
- CAISO – fee of \$0.10/MWh to wind generators. CAISO covers the balance of costs not recovered through generators;
- PJM, ERCOT, MISO – these three ISOs pay for the full costs of centralized forecasting

Other factors involved in the recommendation for assigning costs to loads include:

- As discussed in the "Integrating Renewable Resources - Design Principles" paper, this treatment is consistent with other market mechanisms or programs to integrate specific generation types into the market (example: generator cost guarantee program for gas);
- There are other examples of the IESO procuring third party services to maintain system reliability and efficiency while absorbing the cost of the service (which is borne by consumers), such as specific weather information regarding severe weather and lightning strikes, which is procured from a weather service provider;
- Simplified administration – no changes will be required to the IESO's current billing system: a generator funded model would require the added complexity of billing embedded generators and the creation of a prudential framework to deal with the risk of non-payments from non-

market participants. The IESO would be required to bill hundreds of generators monthly, including non-market participants for invoices as little as \$200, for which there is no existing process;

- Based on anticipated market load and centralized forecasting costs the charge to loads is expected to be immaterial: approximately 0.0002 to 0.0003 cents per kWh.

Some comments suggested that a generator funded model for Ontario is a logical extension of the current practice where wind generators are responsible for providing their own forecasts. However, the IESO believes that there are more benefits associated with a market funded model. Assigning costs to loads via an uplift charge (i.e. a non-hourly wholesale market service charge) versus an indirect charge through a renegotiated contract, will provide further transparency for market participants.

### **Question 7: Market Rule and Implementation Timelines**

What are the IESO's timelines for market rule amendments as they relate to the design principles?

IESO Response:

The "Integrating Renewable Resources - Design Principles" paper will form the basis for market rule development. Pending the final wording of the design principles, design details and market rules that address immediate needs will be developed first and subsequent design details and amendments will follow. Due to the long lead times involved in the market rule amendment process, the centralized forecasting market rule amendment submission was introduced to the Technical Panel on February 15, 2011. The individual components of the centralized forecasting rules package may be split into separate market rule amendment proposals with different implementation dates, based on immediate needs and finalization of details through SE-91 working group sessions. The target for IESO Board approval of the initial components of centralized forecasting is June 2011.

Market rule timelines for other components of SE-91 will be shared with stakeholders as they are developed, and will be coordinated with the scheduling of future working group sessions.

### **Question 8: Performance Measures on Forecasting**

How will the IESO report on the accuracy of the centralized forecasting service?

IESO Response:

The IESO intends to publish performance metrics. Timeframes for the publishing of performance statistics will be established as part of the detailed design.

### **Question 9: Market Participant Forecasting**

Will the IESO allow market participants to continue to submit forecasts where they believe them to be more accurate than those developed by the centralized forecaster?

IESO Response:

The IESO is moving away from a decentralized approach to forecasting and will rely upon the information provided by the centralized forecasting service provider for use in day-ahead, pre-dispatch and real-time scheduling. Experience in other jurisdictions has shown that central forecasting produces significantly better forecasts, with the additional benefits of supporting ramp event forecasting and probabilistic forecast parameters. Actual real-time data will be used in the calculation of foregone energy for settlement purposes.

Variable generation owners may continue to develop their own forecasts for their own purposes; however they will not be used by the IESO for the activities described above. Through the SE-57 stakeholder engagement initiative, the IESO has published the aggregate forecasting accuracy of existing intermittent generation facilities and, once centralized forecasting is implemented, will measure and publish the forecast accuracy of the centralized forecasting service provider to provide an ongoing assessment of performance.

### **Question 10: Met Tower Requirements**

How did the IESO develop the 5km requirement for the placement of meteorological towers?

IESO Response:

In the Design Principles document the IESO pointed to industry reports that establish meteorological data that accurately reflects ambient conditions across a wind farm as essential for the purposes of state of the art forecasting.

For wind farms that span large regions or occupy regions of varying topography, the collection of meteorological data from multiple points is required to achieve accurate forecasts. Jurisdictions with centralized forecasting, NYISO and CAISO for example, often recommend collecting meteorological data from multiple locations within a wind farm. As centralized forecasting practices evolve so too are the data requirements, which are increasingly becoming more stringent.

Stand alone meteorological towers provide the highest quality data because measurements are undisturbed by the presence of the turbine blades and hub.

The IESO established the 5km requirement as a starting point for discussion with stakeholders, based on similar provisions in other jurisdictions. The IESO will consult with stakeholders in the working groups to understand their rationale for adjusting this requirement. The IESO will establish a requirement that is functional for all wind farms and will be applied uniformly to achieve consistent data quality.

The IESO recognizes that meteorological tower requirements have implications for installation and maintenance costs, siting issues and Renewable Energy Approval issues. However, appropriate data inputs are required for the benefits of state of the art forecasting to be realized.

**Question 11: Floor Prices**

How will floor prices be established for baseload generators?

IESO Response:

In the Design Principles document under Principle 10, the IESO stated that it may establish various floor prices for baseload generators to ensure efficient dispatch. Based on observation of dispatch instructions in real-time during periods of surplus baseload generation, the IESO believes that current dispatch instructions can be inefficient. If a nuclear unit shutdown is used to manage surplus baseload generation for example, it may result in environmental impacts, increased consumer costs and increased asset risk. The principle proposes a solution to achieve an efficient dispatch by establishing one or more floor prices for baseload generators. The floor prices themselves are a detailed design issue that will be established based on achieving efficient dispatch. Stakeholders will have the opportunity to provide input through a technical working group.

**Question 12: Cost Benefit Analysis**

How will the IESO ensure that the costs incurred by generators and loads are sufficiently justified by the benefits expected by implementing the design principles?

IESO Response:

The Renewable Integration Initiative was started by the IESO to address the challenges of accommodating an influx of variable generation. Recent experience of system operation in Ontario and observations of emerging trends in other North American jurisdictions have convinced the IESO that current practices would not be adequate to manage the expected volume of variable generation. That view is reinforced by experience in other jurisdictions and emerging industry best practices for managing significant quantities of variable generation. Given these circumstances, the IESO is not proposing, or see a need for, a formal cost benefit analysis.

The scope of the Renewables Integration Initiative does not extend to a market redesign, such as moving away from five-minute dispatch. These broader market discussions are more appropriately addressed in the IESO's Market Roadmap where all generation resources would be considered, and not just variable generation resources.

## IESO Response to General Stakeholder Feedback

The following are stakeholder comments the IESO has identified as general feedback not directed at any one principle and the IESO response to these individual comments. The original comment can be found in the summary document outlining the feedback received (see Appendix 1).

“At what level will the IESO consider the aggregated capacity of solar to have a material impact?”

IESO Response: Consistent with the revised principles the IESO is considering equivalent treatment of wind and solar in the development of the renewable integration design details.

“The IESO specifies that wind resources with an installed capacity of 5MW or greater would be the subject of centralized forecasting. Would the same capacity threshold be used for solar projects? Will the IESO consider the AC or DC capacity of the solar facility?”

IESO Response: Consistent with the revised principles the IESO is considering equivalent treatment of wind and solar in the development of the renewable integration design details. The IESO will consider the AC capacity of the solar facility.

“How many "day-light" hours of surplus baseload generation were experienced since 2009? Does the IESO expect solar resources will contribute significantly to surplus baseload generation in the future?”

IESO Response: The IESO is investigating the number of "day-light" hours of Surplus Baseload Generation (SBG) and will report these values. The IESO has identified SBG as concern and is developing procedures to use all resources available to manage SBG.

“At what point will the IESO deem the uptake of embedded facilities materially significant to require active dispatch?”

IESO Response: At this time the IESO does not have an established level of materiality. The dispatch of embedded generation is outside the scope of the design activities outlined in the Renewable Integration Initiative. The IESO will continue to assess the impact of embedded variable generation resources on the IESO controlled grid.

“Renewable Integration is of interest to many stakeholders. Local distribution companies, generators of all types (particularly wind and solar generators), energy agencies, and employees in the electricity industry, will have the most interest in this discussion paper and its policies, standards, and market rule changes.” “Your discussion paper envisages the costs associated with this as the responsibility of the ratepayers yet the aforementioned description of Stakeholders fails to even mention us! Hopefully this is just an oversight of a “Plan” rushed to market?”

IESO Response: The Stakeholder Plan has been revised to reflect this comment.

## **IESO Response to Stakeholder Feedback on Specific Design Principles**

**The following are stakeholder comments the IESO has identified as feedback directed at a specific principle and the IESO response to these individual comments. The original comment can be found in the summary document outlining all of the feedback received (see Appendix 1).**

### **Principle 1**

“For purposes of the proposed centralized forecast for energy generated from wind resources, why has a 5 MW lower threshold been proposed for inclusion of affected generation? The Consortium supports IESO centralized forecasts but wishes to better understand to what extent the IESO will forecast generation output for distribution-connection generation facilities.”

IESO Response: The 5MW threshold is consistent with the design of OPA contracts and is considered a threshold which represents a material level of generation.

“To what extent will the IESO expand the forecasting beyond the day ahead for use in SAA reports and near term outage evaluation?”

IESO Response: Design details will be stakeholdered through a technical working group – part of the IESO SE-91 consultation initiative.

### **Principle 2**

“This principle implies that forecasts will lead to schedules applicable to variable energy generators. Will schedules based on forecasts be used in any way to settle variable generation (either within the IESO-Administered Markets and/or applicable OPA contracts)? To the extent that schedules based on forecasts are used for settlement purposes within the IESO-Administered Markets and/or OPA contracts, any such schedules should nevertheless be secondary to actual energy production so that the result is no lost revenue to the applicable generation facilities. Therefore, the Consortium proposes additional language to this principle stating that, “A real-time forecast will provide the information to allow for schedules and renewable dispatch, and OPA contract settlement will not result in lost revenue for applicable generators.””

IESO Response: Forecast data will not be used for settlement purposes. The best available actual data will be used for settlement. The IESO has revised the principle to reflect this. The methodology for calculating foregone energy and real-time forecasting will be developed as part of the detailed design.

### **Principle 4**

“Does the IESO plan to request real-time SCADA access? If so, the Consortium is concerned why the IESO needs this data and what the data will be used for.”

IESO Response: The IESO is seeking real-time telemetry but not access to participant SCADA systems. Real-time telemetry will be used to support IESO forecast and dispatch of variable generators.

### **Principle 8**

“How will the deadband be determined? Will the deadband be static?”

IESO Response: Design details will be stakeholdered through a technical working group – part of the IESO SE-91 consultation initiative.

“What compliance measures (e.g., penalties, sanctions) will be applied? How will they be developed?”

IESO Response: Design details will be stakeholdered through a technical working group – part of the IESO SE-91 consultation initiative.

“Principle 8 should be changed so that it reads that variable generators “must” rather than “should” operate within a compliance deadband when ambient conditions offer sufficient fuel when they are dispatched.”

IESO Response: The principle has been revised to reflect this comment.

### **Principle 9**

“Variable generators subject to dispatch instructions must be entitled to CMSC payments – both constrained-on and constrained-off payments (i.e., compensation for curtailment).”

IESO Response: For the purpose of equitable treatment of variable generators relative to other dispatchable facilities, variable generators dispatched by the IESO will be entitled to Congestion Management Settlement Credits.

“This looks good in principle, and will need a lot of careful consideration. For example, how will wind be represented in the unconstrained dispatch, if it is always on a zero ramp persistence basis unless specifically dispatched down?”

IESO Response: Design details will be stakeholdered through a technical working group – part of the IESO SE-91 consultation initiative.

“Contrary to Principle 9 which unconditionally entitles variable generation to CMSC payments, the PWU recommends that variable generators should only be entitled to the CMSC payment once they are no longer compensated under the FIT contract, or a similar replacement contract.”

IESO Response: For the purpose of equitable treatment of variable generators relative to other dispatchable facilities, variable generators dispatched by the IESO will be entitled to Congestion Management Settlement Credits.

### **Principle 11**

“Are other jurisdictions permitting variable generation to participate in ancillary service markets? If so, which ones and what are the applicable rules (including revenues and settlement)? Can the IESO provide a summary of what's being done in other jurisdictions? This should be a next-generation issue. There aren't any significant ancillary service markets in which wind generators participate in the US, and it would be a distraction to focus on those issues at the outset in Ontario.”

IESO Response: This initiative will not be undertaken until other Renewable Integration work is substantially complete.