

Incorporation of Embedded Generation in Ontario

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- Embedded Generation (EG) are typically small scale (up to 10 MW) power producers
- EG technologies may include combined heat and power, biomass, solar, wind, gas and hydroelectric
- “Embedded” generation is defined as connected to a distribution system or “behind the meter” within Connected Wholesale Customer (CWC) complexes
- IESO estimates there are approximately 1,400 MW of embedded generation in Ontario, capacity factor unknown

- The OPA manages a Renewable Energy Standard Offer Program (RESOP) and will launch a Clean Energy Standard Offer Program (CESOP)
- A second Combined Heat and Power (CHP) RFP is also planned
- Through the RESOP, OPA has signed contracts for about 915 MW of embedded generation, a little over 25 MW currently in service
- OPA demand response programs may present challenges similar to EG as aggregation of embedded demand response increases in penetration

- At a low penetration level, EG nets the load on the distribution system
 - Can optimize existing infrastructure when planned properly
 - Size of EG, location on distribution system and technology are important factors
 - Can supply local capacity
 - Can promote efficiency when EG runs when required for system needs, respecting distribution capability
 - Resources can be brought into service relatively quickly depending on technology

- At a high penetration level, EG could create significant generation injection on the distribution and transmission systems. Requires additional considerations to manage.
 - Requires assessment of potential reliability or system impacts from an area perspective
 - Could include need for distribution studies
 - Potential impact on customers
 - Power quality – voltage regulation issues
 - Short circuit levels
 - Distribution feeder capacity
 - Protection operations
 - Potential impact on marketplace
 - Congestion
 - Losses
 - Inefficient market outcomes
 - Ancillary service requirements
 - Costs to distributors and transmitters to meet IESO standards

Why is the IESO interested?

- IESO is responsible for:
 - Directing the operation and maintaining reliability of the IESO Controlled Grid (>50 kV)
 - Operating Ontario's wholesale electricity markets
- “Prime objective” – Balance load and generation efficiently
 - Done by clearing the market, assessing system security, and dispatching generation every five minutes, based on offers/bids from participants

Why is the IESO interested?

- Current process is reliable and efficient when:
 - There are plenty of ‘manoeuvrable’ resources within the market to balance load and generation
 - Distribution systems function as load supply conduits and not ‘invisible’ large generation centres
- System changes are affecting both of these domains
 - Increase in intermittent and self-scheduled resources (wind, combined cycle gas)
 - Standard offer programs generating large concentrations of EG projects

Current Requirements for Embedded Generators who are not Wholesale Market Participants

Revenue Metering	As per applicable per OEB retail standards (Ontario Energy Board Distribution System Code section 5)
Modelling Data	Can be requested through connected host for generators greater than 10 MVA.
Connection Assessment	Each embedded generation facility must apply for a connection assessment.
Performance Standards	Chapter 4 Appendix 4.2 applies to embedded generators greater than 10 MVA or facilities greater than 50 MVA. (Market Rules Chapter 4, Section 3.1.3)
Telemetry	May require telemetry such as MW, MVA _r , unit and breaker status for reliability purposes.
Report Outages	LDCs or host entities must report changes in status to customer equipment that result in a change to average demand or supply
Synchronization Procedures	No requirements
Direct Output Up/Down	Market Rules Chapter 5, Section 3.7.14
Voice Communication	No requirements
Dispatch Data Submission	No requirements
Long Term Forecast Data	LDC or host submissions incorporate load displacement generators in their long term forecasts.
IESO Reliability Compliance Program	Some requirements on embedded generators carried out via host LDCs or connected wholesale customers.
Market Assessment and Compliance	SOP generators are obliged to follow the market rules but enforcement is handled by OEB.

- **Performance Standards**
 - effectiveness of existing standards at coordinating requirements for embedded generation and their host connected load facilities
- **Connection Assessment Processes**
 - review and revise requirements and rules, trigger levels for system impact assessments due to accumulated embedded generation, and allocation of study costs
- **Visibility**
 - develop effective and inexpensive means of providing real time visibility of embedded generators for effective market and system operation