NOVEMBER 26, 2020

Market Power Mitigation Reference Levels and Reference Quantities Hydroelectric Resources

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Agenda

1. Objectives
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3. Refresher: Reference Levels and Reference Quantities
4. Feedback Received
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1. Objectives

- Engage with Hydroelectric resources on the reference level and reference quantity methodologies
- Support Hydroelectric resources in their review of the draft written guide and workbooks
- Answer technical questions on the written guide with the *IESO's* engineering services provider (Hatch)

2. Update on Stakeholder Engagement Process

- Reference level and reference quantity stakeholder engagement kick-off meeting was conducted on August 27, 2020. This meeting provided stakeholders the opportunity to ask clarifying questions on the posted materials – written guide and technology-specific workbooks
- October 30, 2020 – Technology-specific meetings held with Dispatchable Load, Wind and Solar resources

2. Update on Stakeholder Engagement Process

- November, 2020 – Technology-specific meetings with Storage, Hydroelectric, Nuclear and Thermal resources
- Next steps in the reference level engagement:
    - Beginning in 2021: 1-on-1 consultation with *market participants* to establish resource-specific reference levels and quantities

3. Refresher: Reference Levels and Reference Quantities

- Reference levels and reference quantities play an important role in the Market Power Mitigation framework
- The Market Power Mitigation detailed design document introduced processes necessary to set, maintain and update reference levels
- Establishing appropriate reference levels is a high priority for both stakeholders and the *IESO*

3. Refresher: Reference Levels and Reference Quantities

Reference levels are *IESO*-approved values for a resource for what would have been offered by a *market participant* in the *energy* and *operating reserve markets* had they been subject to unrestricted competition. The *IESO* will approve reference levels for financial and non-financial *dispatch data* parameters of each resource

- An example of a financial *dispatch data* parameter is *energy offers* ($/MWh)
- An example of a non-financial *dispatch data* parameter is *energy* ramp rates (MW/min)

3. Refresher: Reference Levels and Reference Quantities

Reference quantities are *IESO*-approved values for the quantity of *energy* and *operating reserve* a *market participant* would be expected to offer had they been subject to unrestricted competition

These reference quantities can be modified by active *outages*, de-ratings, external factors such as ambient temperature, humidity, water flow conditions and other resource-specific considerations

4. Feedback Received

Reference Level Review: MPs require enhanced governance, decision-making, and recourse within IAM (especially applicable to the market power mitigation framework within MRP)

IESO response: The *IESO* will be engaging with market participants on the independent review process for reference levels and reference quantities in the future

4. Feedback Received

List Expansion - The list of accepted documentation in supporting costs and list of eligible maintenance costs provided by the *IESO* should be expanded

IESO Response: Eligibility of documentation developed by the relevant *market participant* will be evaluated on a case-by-case basis and the costs list included in the guideline are not exhaustive lists. *Market participants* may submit eligible costs and supporting documentation for review. In determining the eligibility of specific documentation, the *IESO* will consider the reasonableness of the content of the documentation. Section 2.3 of the written guide will be updated to reflect this approach for documentation developed by the relevant *market participant*

4. Feedback Received

Offer Obligation: The *IESO* should clarify expectations and obligations regarding the differences between the derived Reference Price levels and actual Market Participant offer behaviour in the markets. It is not explicitly clear if the IESO expects MPs to offer at the price levels specified in the workbooks

IESO Response: Market Power Mitigation does not introduce an obligation to offer at prices consistent with reference levels. The *IESO* will include clarifying language to the written guide to that effect

4. Feedback Received

Short-Run Marginal Costs: Hydroelectric generation facilities are very site specific regarding their costs and there maybe costs not listed in the guideline

IESO response: Costs that are eligible to be included in reference levels are those that vary with incremental supply of *energy* or *operating reserves*. The *IESO* welcomes comments regarding eligibility of specific costs and looks forward to discussing resource-specific characteristics in the one-on-one consultations with *market participants* starting in 2021

4. Feedback Received

Non-Dispatchable Resources: Self-scheduling and intermittent generators should be exempt from mitigation

IESO response: Dispatchable resources (including hydroelectric resources) are subject to Market Power Mitigation. Intermittent and self-scheduling generating resources are not subject to mitigation

4. Feedback Received

Maximum Number of Starts Per Day: What is the methodology being applied for hydro facilities to determine the *maximum number of starts per day*?

IESO response: The methodology for determining this non-financial reference level for hydro resources requires provision of supporting documentation in the form of: manufacturers data with relevant sections from operating and maintenance manuals, equipment specification from procurement of equipment, design basis, historical assessment of actual start and stops and opinion or condition assessment document from a reputable and qualified 3rd party

4. Feedback Received

Operating Reserve: There are incremental costs associated with providing operating reserve

IESO response: *Operating reserve* reference levels for 10-minute synchronized, 10-minute non-synchronized and 30-minute non-synchronized reserve are based on incremental costs associated with posturing a resource to be able to provide additional *energy*. Costs associated with the injection of additional *energy* are not eligible as they are covered by the relevant *energy* offer. The *IESO* welcomes comments regarding eligibility of specific costs and looks forward to discussing resource-specific characteristics in the one-on-one consultations

4. Feedback Received

Reference Quantities: The reference quantity methodologies may or may not be accurate indicators of actual energy production capability or actual capability to supply OR in real-time

IESO response: The reference quantities approach for each resource is updated as the sum of the minimum head-based capability across all *generation units* at that resource. Minimum head-based capability is the maximum production for each *generation unit* in each resource when the head is at its minimum operating level. Supporting documentation is required to demonstrate the minimum head-based capability for each *generation unit* in that resource

4. Feedback Received

Gross Revenue Charge: The proposed contribution from the Gross Revenue Charge (GRC) is lower than the marginal GRC rate paid by *market participants*. The marginal cost to generate will always be the highest GRC rate the resource qualifies for. The proposed methodology of averaging past GRC costs therefore does not capture the marginal cost for generators

<u>IESO response</u>: The GRC formula in the guide has been updated to make clear that the relevant value for GRC is the marginal rate based on historic production. Examples will be shown in later slides

5. Opportunity Costs

- The IESO has updated the opportunity cost methodology in response to stakeholder feedback

- Two Opportunity Costs:
  - Storage Horizon Opportunity Cost
  - Intraday Opportunity Cost

5. Opportunity Costs

Storage Horizon Opportunity Cost:

- Is applicable for resources that can store fuel across a multi-day storage horizon
- Calculates the expected future prices across the storage horizon

The approach looks at a resource's prices in the previous 28 days and projects future prices across the resource's storage horizon. A peak scalar and off-peak multiplier based on New York Zone A pricing hub are applied to the resource's forecasted prices. The storage horizon opportunity cost for the resource is the highest calculated LMP in the storage horizon

5. Opportunity Costs

Intraday Opportunity Cost:

- Is applicable for resources that are *energy-limited* below their maximum available capacity for each hour in the day within a 24-hour period
- Will be equal to the maximum of the highest DAM LMP for the resource and $0/MWh

5. Opportunity Costs

Additional Opportunity Costs:

- Where the provided opportunity costs do not address all relevant aspects of opportunity cost for a particular resource, *market participants* may request that the *IESO* add a resource-specific additional opportunity cost
- In order to do so, *market participants* are required to submit the proposed methodology for any additional opportunity cost, along with supporting materials

6. Example Workbooks

- Examples of hydroelectric resource workbooks, completed for illustrative purposes, are discussed in the following slides
- These example workbooks are for discussion purposes only. The numbers and content found there are not an indication of expected values

6. Example workbooks

- The *IESO* has provided two example workbooks for hydroelectric resources:
    - An example that shows a hydroelectric resource that is requesting a reference level and providing supporting materials
        - Short-run marginal costs relevant to this resource include GRCs, operating and maintenance costs, opportunity costs for *energy*-limited resources and costs to position the resource in offering *operating reserve*
    - An example that shows a pumped-storage hydroelectric resource that is requesting a reference level and providing supporting materials
    - Additional cost categories applicable to pumped storage hydro include pumping power cost and pumping efficiency

6. Example workbooks

Gross Revenue Charge Cost Component

	General Resource Information	I. Units of measurement/Formula Reference	II. Applicability - Resource Type	III. Time-Based Applicability - Seasonality	IV. Input	V. Supporting Documentation Reference	VI. Comments
(A)	Fuel Costs						
A.3	Gross Revenue Charges (Property Taxes and Water Rental Costs)	Marginal GRC ($/MWh) = [Property Tax Charge ($) + Water Rental Charge ($))] / Long Term Average Energy (MWh)	Hydro	Applicable in all time periods	5.6	-10 years of historical production data -estimated marginal tax rate based on historic production -estimated water rental charge based on historic production	Historic Energy = 200GWh Property Tax Charge @ marginal rate = 200 GWh * $40,000/GWh * 4.5% = $360,000 Water Rental Charge = 200 GWh * $40,000/GWh * 9.5% = $760,000 Marginal GRC = $1,120,000

6. Example workbooks

Major Maintenance Cost Component

	General Resource Information	I. Units of measurement/Formula Reference	II. Applicability - Resource Type	III. Time-Based Applicability - Seasonality	IV. Input	V. Supporting Documentation Reference	VI. Comments
(B)	Total O&M costs						
B.1	Major Maintenance ($/MWh)	Major Maintenance ($/MWh) = Annualized Maintenance Cost ($/Yr) / LT Average Energy (MWh/Yr)	Hydro	Applicable in all time periods	1.75	-40 year major maintenance plan -Long term average energy generation (MWh/year) -Backup information supporting costs in the major maintenance plan Calculations for costs on a $/MWh basis	$14 million over the next 40 years ($ 2020) > Annualized maintenance cost = $350,000 Long term average energy = 200,000 MWh/yr

6. Example workbooks

Unscheduled Maintenance Cost Component

	General Resource Information	I. Units of measurement/Formula Reference	II. Applicability - Resource Type	III. Time-Based Applicability - Seasonality	IV. Input	V. Supporting Documentation Reference	VI. Comments
(B)	Total O&M costs						
B.3	Unscheduled Maintenance Costs	Annual Expenditures averaged over the last 5 years, ($/MWh)	Hydro	Applicable in all time periods	1.75	-historical costs demonstrated by paid invoices for unplanned parts and labour -contract labour invoices	Unplanned labour = $200,000 Contract O&M costs = $100,000/year Unplanned parts cost = $50,000/year

6. Example workbooks

Non-Financial Dispatch Data Parameters

#	Non-Financial Reference Level	Unit	Description	Summer Value	Winter Value
1	***Energy Ramp Rate***	MW/min	The energy ramp rate profile across the dispatchable range that the resource expects to meet during normal operation.	20	25
2	***Operating Reserve Ramp Rate***	MW/min	The rate that a resource can respond to an operating reserve activation during normal operation.	20	25
3	***Maximum Number of Starts per Day***	Starts/day	The maximum number of times a generation unit can be started within a dispatch day	2	2

6. Example workbooks: Pumped Hydro

Pumped Hydro Pumping Efficiency

	General Resource Information	I. Units of measurement/Formula Reference	II. Applicability - Resource Type	III. Time-Based Applicability - Seasonality	IV. Input	V. Supporting Documentation Reference	VI. Comments
(A)	Fuel Costs						
A.1	Pumping Efficiency (PE) see fuel costs below	$Pumping\ Efficiency = (Annual\ Generation\ Produced\ (MWh))/(Annual\ Energy\ Consumed\ for\ Pumping\ (MWh))$	Pumped Storage	Applicable in all time periods Market Participants may propose seasonal efficiencies if needed	0.73	-Historic Annual Generation -Historic energy consumed for pumping	Historic annual energy generated = 200 GWh Historic annual energy consumed = 275 GWh

6. Example workbooks: Pumped Hydro

Pumped Hydro Pumping Efficiency

	General Resource Information	I. Units of measurement/Formula Reference	II. Applicability - Resource Type	III. Time-Based Applicability - Seasonality	IV. Input	V. Supporting Documentation Reference	VI. Comments
(A)	Fuel Costs						
A.2	Basic pumped storage fuel cost		Pumped Storage	Applicable in all time periods	61.875		Assume average pumping power withdrawal cost over previous week = $45/MWh Pumping power cost will be calculated in real time by IESO.

$$Pumping\ Power\ Cost\left(\frac{\$}{MWh}\right) = \frac{\sum_{168}^{1} Pumping\ Withdrawl\ Costs\left(\frac{\$}{MWh}\right) * Pumping\ Power\ (MWh)}{\sum_{168}^{1} Pumping\ Power\ (MWh)}$$

$$Pumped\ Storage\ Fuel\ Cost\left(\frac{\$}{MWh}\right) = \frac{Pumping\ Power\ Cost\ (\frac{\$}{MWh})}{Pumping\ Efficiency\ (\%)}$$

7. Next Steps

- **Feedback:** Stakeholders should submit written feedback on the presented materials to engagement@ieso.ca by **Friday, December 11**
- **December 2020:** IESO will post final written guide and workbooks based on stakeholder feedback received during technology-specific sessions
- **Q1 2021 onwards**: IESO will start 1-on-1 consultations with market participants to establish resource-specific reference levels and quantities

Questions?

Thank You

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