FEBRUARY 1, 2024

Long-Term 2 RFP Stakeholder Engagement

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Purpose

As a follow up to the LT2 RFP stakeholder engagement in December 2023, this session will provide:

1. Examples of the Enhanced Power Purchase Agreement (E-PPA) revenue model across various scenarios
2. Overview of the deliverability considerations for the LT2 RFP
3. Additional details on other procurement design considerations

The IESO intends to use any relevant feedback received after this webinar to help form its report back to government in March 2024.

Agenda

1. E-PPA Revenue Model
2. Deliverability Considerations
3. Other Design Considerations:
    - DER Participation
    - Incremental Capacity Needs
    - Re-powering Opportunities
    - Medium Term 2 RFP and Bridging Considerations
    - Long Lead Time Resources
4. Next Steps

Proposed LT2 Procurement Timeline

Dec 2023
Engagement kick-off

March 2024
Report back to government

Q3 2024
Draft RFP & Contract

Q4 2024
Final RFP & Contract

Mid 2025
Proponent Proposal Submission Deadline

2030
Resource In-Service

On-going engagement

Enhanced Power Purchase Agreement (E-PPA) Revenue Model

Overview

The revenue model is intended to provide revenue certainty for suppliers, while also encouraging contracted resources to provide power to the IESO when it is most needed (and valuable).

The model **does not** require suppliers to estimate the risk of curtailment. The E-PPA leverages wholesale market signals to manage curtailment, ensuring suppliers are appropriately incented to generate or curtail in accordance with market signals.

Settlement examples on subsequent slides help illustrate the interaction between the E-PPA and the renewed market, under a variety of market conditions.

The IESO will also address some early stakeholder feedback that sought clarity on specific elements of the revenue model and provided alternative design options.

Re-cap: How it Works (1)

Step 1: Suppliers will offer three bid parameters to the IESO as part of their proposal price submission:

- A **proposal price** expressed in $/MWh;
- a **contract capacity** expressed in MW;
- an **energy production factor** which is the average expected production as a percentage of the contract capacity across a calendar year.
  - NOTE: This value does **NOT** need to include any assumptions regarding energy curtailments resulting from market conditions. However, proponents should consider fuel availability (wind availability, solar irradiance) at their location to inform their actual expected production when establishing this value.

Together these three bid parameters establish the **revenue requirement** for the facility and will drive the deeming mechanism inherent to the model design.

Re-cap: How it Works (2)

Step 2a: the facility participates in the IESO administered market and earns revenues associated with their production. **All energy market revenues, including make whole payments, will remain with the supplier.**

Step 2b: Using the contract capacity, the energy production factor and the resource's own Day-Ahead locational marginal price (LMP), the IESO will deem the energy market revenues that the facility ought to have earned. These are known as **deemed revenues** (for clarity negative priced hours will be treated as $0).

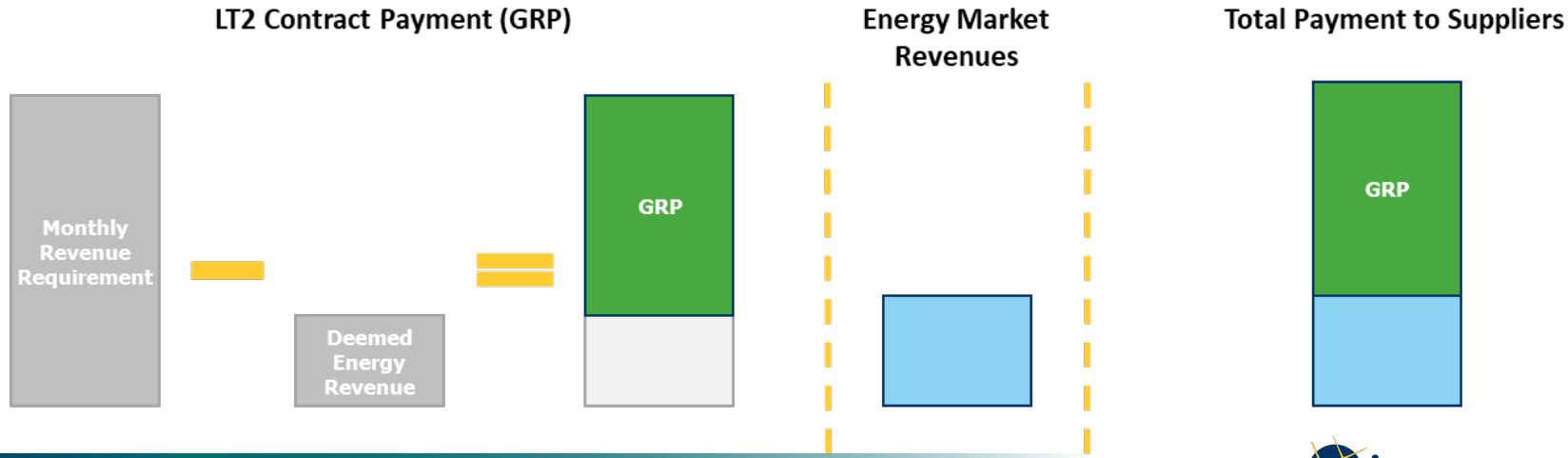
Step 3: Contract payment (known as a Grid Reliability Payment) is paid by the IESO to the supplier (if/when necessary) to meet the facility's revenue requirements. The Grid Reliability Payment is based on the difference between deemed energy revenues and the supplier's monthly revenue requirement.

Total revenues for Suppliers are the **Grid Reliability Payment** + all **Energy Market Revenues.**

Re-cap: Illustrative Example

The IESO will deem monthly energy revenues (on the DA-LMP) for a resource and determine if and how much of a **Grid Reliability Payment** is required to meet monthly revenue requirements.

Suppliers operate in the energy markets and keep all revenues earned there.



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Re-cap: Total Monthly Revenue

- **Submitted values as part of proposal**
- **Values calculated as part of settlement**

Revenue Requirement	**= Proposal Price * Production Factor * Contract Capacity * # of hours**
Deemed Energy Market Revenue	= DA LMP * Production Factor * Contract Capacity * # of hours
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue
Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity – DA Quantity)]
Total Monthly Revenue	**Grid Reliability Payment + Energy Market Revenue**

- **Submitted values as part of proposal**
- **Values calculated as part of settlement**

Re-cap: Proposal Price Formation

The Proposal Price submitted by proponents is expected to account for the facility's **contract capacity and production factor**; representing their monthly revenue requirement on an effective / MWh basis.

- For example (assuming 720 hours/month):

Proposal Price ($/MWh)	✖	**Contract Capacity (MW)**	✖	**Production Factor (%)**	✖	Hours per month	=	Monthly Revenue Requirement
$100		**50**		**30%**		720		$ 1,080,000

- Proposal prices enable the IESO to rank proposals and pick the lowest priced proposal.

Proposal Formation and Ranking: Illustrated

Proposal Formation and Ranking				
Proposal Rank	**Contract Capacity (MW)**	Monthly Revenue Requirement	**Production Factor**	**Proposal Price ($/MWh)**
1	**100**	$ 2,000,000.00	**40%**	**$ 69.44**
2	**100**	$ 2,000,000.00	**30%**	**$ 92.59**
3	**100**	$ 2,000,000.00	**20%**	**$ 138.89**
4	**100**	$ 2,000,000.00	**10%**	**$ 277.78**

- Assuming all else is equal, 4 proponents proposing 100 MW facilities, with the same monthly revenue requirement, could elect to structure their bids in a way that increases their market exposure via **more deemed revenues and a lower GRP** (higher production factor) or decreases it via **less deemed revenues and a higher GRP** (lower production factor)
- Proponents should reflect their market exposure and expected production in their **proposal price** allowing the IESO to rank the proposals accordingly

- **Submitted values as part of proposal**
- **Values calculated as part of settlement**

Revenue Model: Clarification and Discussion

Feedback from stakeholders on the revenue model was concentrated on four main areas. This feedback offers an opportunity for the IESO to clarify the model and to discuss the potential solutions identified in the feedback documents.

Curtailment
Clarity on how curtailment is addressed in the revenue model

Production
Understanding how the difference between day-ahead and real-time quantities is treated

Deemed Price
Impacts on using a simple average price that might not be aligned with production of the resource

Production Factor
Value of using an annual vs more granular production factor

Note: The IESO is considering further performance obligations in the contract to ensure that facilities contribute to energy needs through the life of the contract.

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Overview of Curtailment Considerations

Stakeholders raised concerns with building curtailment estimates into the production factor submitted by suppliers to the IESO.

- For clarity, unlike a traditional PPA, **suppliers do not need to incorporate curtailment into their production factor with the enhanced PPA revenue model.** In hours where there is no energy scheduled from the resource (i.e. they are curtailed), the day-ahead energy market pricing will reflect that curtailment. The deemed energy revenue will reflect that curtailment and the resource will earn no less than its revenue requirement in that hour via its **GRP**.
- Day-in-the-life examples later in the deck aim to demonstrate the interaction between the new DAM and RT market under MRP, and how curtailment is managed by the revenue model.

Curtailment Scenarios (1)

The E-PPA has been designed to provide certainty to suppliers that their revenue requirement will not be impacted due to curtailments requested by the IESO.

There are three main ways that the IESO curtails output from energy producers. The E-PPA will keep the resource whole to its revenue requirement in the instances when the market signals that the facility needs to be curtailed and does not provide the appropriate payment.

1. **Local Congestion**

   If a resource is not scheduled in day-ahead due to local transmission constraints the price at its location will reflect that condition. If this situation occurs in the day-ahead, the day-Ahead local price will be $0 and the **deemed revenues will be $0.**

   For congestion occurring only in the real-time market, the resource will be curtailed but still receive its day-ahead revenues.

Curtailment Scenarios (2)

2. **Global Oversupply**

   In a global oversupply situation, the resource should not be getting a day-ahead schedule and price will reflect that condition. In this situation, the day-ahead market price will be no more than $0 and the **deemed revenues will be $0.**

   For oversupply occurring only in the real-time market, the resource will be curtailed but still receive its day-ahead revenues.

3. **Manual curtailments**

   There can be times when the IESO's control room operators manually request that a resource reduce its output to address reliability concerns. In such a situation, the resource will be **paid a make-whole payment equal to the revenues it would have earned absent the manual constraint.**

Revenue Model: Clarification and Discussion

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Value of using an annual vs more granular production factor

Feedback on DA ->RT Production

A concern raised by some stakeholders is that variable generation resources (especially those without storage) do not have full certainty that they can deliver their day-ahead schedule in real-time due to the actual wind/sun conditions. The concern is that deeming revenues based on day-ahead prices would not reflect the risk of having to buy out of the day ahead

- E.g. If a resource is committed for 15MW day-ahead but is only able to deliver 5 MW in real-time, that resource will need to balance their position by paying a potentially higher RT price multiplied by the difference of 10 MW.

*An example of this situation is illustrated on slide 56; Scenario 6

Considerations

- The IESO understands the risk identified but believes that a market participant has a number of ways to mitigate the risk. An option would be to utilize their own forecast that could be more conservative than the IESO's forecast. Suppliers could also choose a lower production factor in their proposal than what the facility is capable of. A lower production factor will signal a need for a higher Grid Reliability Payment from the IESO and less exposure to the market.
- A suggestion for was made for a design alternative that would alleviate this issue. The suggestion is to **deem energy market revenues based on real-time market prices (not those day-ahead)**. The IESO is evaluating this option and looks forward to further discussions on it with stakeholders.

Revenue Model: Clarification and Discussion

Curtailment
Clarity on how curtailment is addressed in the revenue model

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Understanding how the difference between day-ahead and real-time quantities is treated

Deemed Price
Impacts on using a simple average price that might not be aligned with production of the resource

Production Factor
Value of using an annual vs more granular production factor

Overview of Deemed Energy Price Feedback

- Some stakeholders highlighted that given variable generation resources' inability to control the hours when they produce, the initial proposal of using a simple average Day-Ahead LMP to calculate deemed revenues may result in a significant difference between actual and deemed revenues.
- To address this concern, a number of stakeholders have proposed that the Enhanced PPA should calculate deemed revenues using a **weighted average price** (instead of using the simple average price). This weighted price would only consider deemed revenues during the hours that the resource was scheduled day-ahead in a given month. The IESO is considering this feedback.

Revenue Model: Clarification and Discussion

Curtailment
Clarity on how curtailment is addressed in the revenue model

Production
Understanding how the difference between day-ahead and real-time quantities is treated

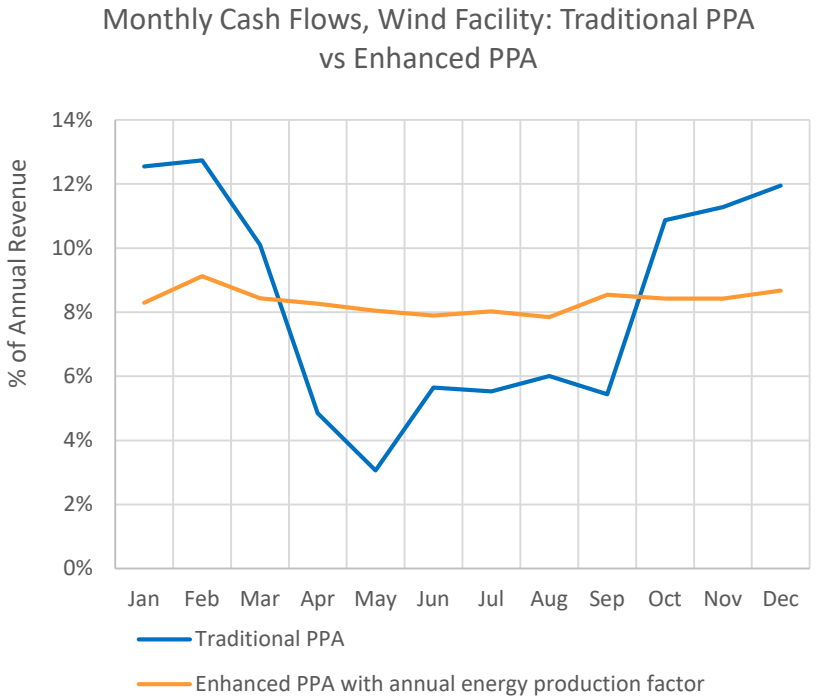
Deemed Price
Impacts on using a simple average price that might not be aligned with production of the resource

Production Factor
Value of using an annual vs more granular production factor

Overview of Energy Production Factor Feedback (1)

The IESO proposed using an **annual energy production factor** to provide revenue certainty for suppliers through consistent monthly cash flows.

Some stakeholders highlighted that an annual energy production factor may not be granular enough for renewable generators to reflect their daily and seasonal variations in production and can lead to a misalignment between deemed and actual energy market revenues.



Overview of Energy Production Factor Feedback (2)

To address these concerns, some stakeholders have indicated that an annual energy production factor should be replaced with monthly energy production factors.

One suggestion is to allow Suppliers to reflect the seasonality in their facility's output by **deeming energy market revenues by using monthly energy production factors** that collectively average out to the annual energy production factor.

The IESO is open to this and other options for more granular production factors and looks forward to further discussions on it with stakeholders.

Market Renewal Program (MRP)

LT2 and the Market Renewal Program (MRP)

- The IESO is currently renewing its energy market through the Market Renewal Program (MRP), which is currently in the implementation phase and slated to go-live in 2025.
- Successful Proponents in the LT2 and future long-term RFPs will be authorized as Market Participants under the IESO's renewed energy market and will have their resources scheduled and dispatched as per the IESO's updated Market Rules and Market Manuals.
- This section provides a background on MRP to provide a high-level overview for how the renewed market will apply to variable generators.

MRP Considerations (1)

While MRP design elements are not new to most electricity markets, it will **introduce a day-ahead market with locational pricing** to Ontario:

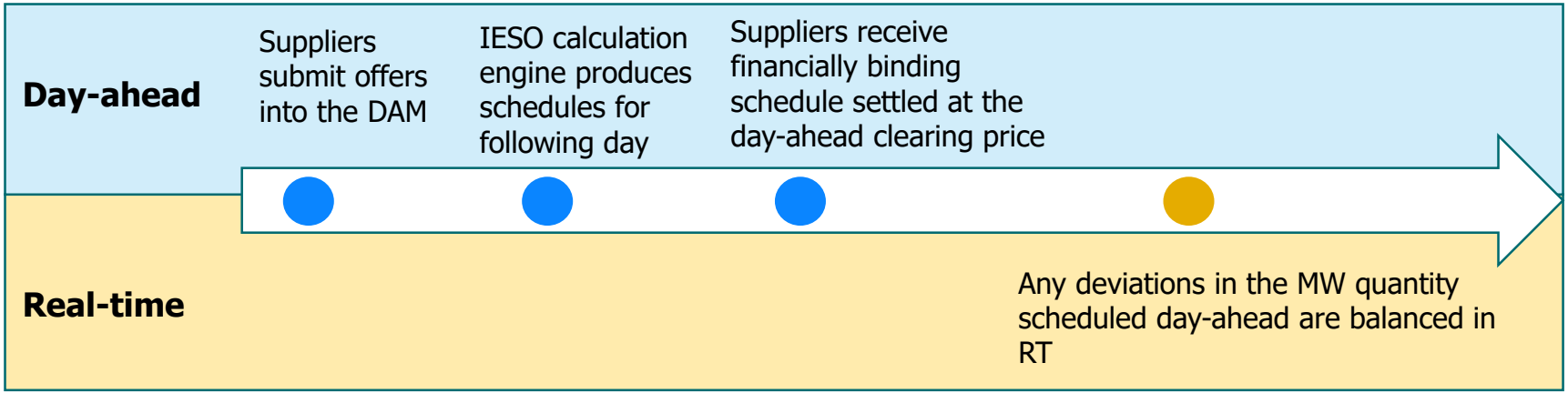
Day-Ahead Market (DAM): the DAM will schedule supply to meet forecasted demand one day before the actual delivery day. All resources will be paid the relevant day-ahead locational marginal price (LMP) for their resource for supply scheduled in the DAM.

Real-Time: the real-time market in Ontario will shift from being the main settlement market with a uniform price to a **balancing market** with LMPs that settle variations in demand and supply from day-ahead to balance the grid in real-time.

Examples of how the day-ahead and real-time markets interact with the revenue model are provided later in this presentation.

MRP Considerations (2)

High-level interaction between the DAM and RT



MRP Day-in-the-Life of a Variable Generator (1)

Day-Ahead Market (DAM) timeframe

1. Suppliers will submit the following information to the IESO:
   - **Price**, which is reflective of the marginal cost of the resource,
   - **Quantity**, which is reflective of its maximum production,
   - For variable generation suppliers, their **choice of forecast**, being the IESO's centralized forecast, or their own forecast
2. The DAM runs each day and produces schedules and LMPs for each hour of the following day. Suppliers earn revenues according to their day-ahead market schedules and day-ahead locational prices.

MRP Day-in-the-Life of a Variable Generator (2)

Real-Time Market (RTM) timeframe

Resources that receive a DAM schedule, should generate in accordance with that schedule in real-time.

- This may not always be possible, especially for some intermittent resources. When all of a resource's scheduled production is not available in real-time, it can **balance its position** by purchasing any MW shortfall at the RTM price
- In addition, resources that have more MW available in RT than what was scheduled in the DAM are incented to earn **additional revenue** by selling that excess production, if possible, at the RTM price.

Day-Ahead to Real Time - Additional Insights

- The IESO's DAM will function very similar to those in other markets
- The DAM allows buyers and sellers of electricity to hedge against price volatility that may be prevalent in the RTM by locking in schedules and prices before the operating day
- Despite the potential of conditions changing from DA to RT, the participation of Virtual Traders will drive price convergence between the DAM and RTM
- Stakeholders unfamiliar with day ahead energy markets are encouraged to familiarize themselves with the IESO's proposed design as well as the key role that virtual traders can play in ensuring price convergence in these markets

MRP Day-in-the-Life Example: DAM Timeframe

This example examines a wind resource that is operating as a merchant generator in the renewed market.

Wind resource submits Dispatch Data into the DAM for HE07 of the next day

An offer of $0/MWh and 50 MW, reflective of the resource's economics and size, is submitted in the form of price-quantity pairs.

The resource elects to submit its own forecast of 30 MW for HE07.

Optimization of DAM Calculation Engine

In each hour, the engine will schedule the wind resource up to the most limiting value between its elected forecast quantity and maximum offer quantity.

Wind resource receives DAM schedule and settlement

At the location of the wind resource the DAM clears at +$30/MW in HE07 indicating a need for energy.

The resource is scheduled for its entire forecast of 30 MW at the DAM clearing price, receiving a DAM settlement of $900.

MRP Day-in-the-Life Example: RTM Timeframe

The example from the previous slide continues with the wind resource participating in the real-time market and receiving a balancing settlement for its day-ahead position.

Wind resource submits Dispatch Data into the RTM for HE07 of the next day

Up until two hours before real-time, wind resources are eligible to modify their offered PQ pairs.

In this example, the resource does not modify its DAM offer and submits an offer of $0/MWh and 50 MW.

Optimization of RTM Calculation Engine

The Engine optimizes to produce a schedule and price for the resource by estimating its output based on the IESO Centralized Forecast.

Wind resource receives RTM balancing settlement

At the location of the wind resource, the RTM clears at +$20/MW during HE07 indicating a continued need for energy. Wind conditions allow the resource to inject 40 MW into the grid.

The resource earns $200 in additional revenue for injecting 10 MW more than its DAM schedule.

E-PPA: Settlement Scenarios

E-PPA Settlement Scenarios

	Market Outcomes
Scenario 1: Positive Prices DA & RT	DA LMP > 0 ; RT LMP > 0
Scenario 2: Negative Prices DA & RT	DA LMP < 0 ; RT LMP < 0
Scenario 3: Demand Forecast Decreases between DA -> RT	DA LMP > 0 ; RT LMP = 0
Scenario 4: Demand Forecast Increases between DA->RT	DA LMP < 0; RT LMP > 0
	Forecast Uncertainty
Scenario 5: Wind Forecast Underestimates	DAQ < RTQ ; DA LMP = RT LMP
Scenario 6: Wind Forecast Overestimates	DAQ > RTQ ; DA LMP = RT LMP

Assumptions Across Scenarios

The following slides will examine market outcomes for a **hypothetical wind** resource under various scenarios; these scenarios will focus on **1-hour only.**

For simplicity, the following assumptions will remain constant across all scenarios:

Facility	**Market Behaviour**
Nameplate capacity: 50MW	**Price submitted into DAM:** $0/MWh
Proposal price: $100/MWh	**Quantity submitted into DAM:** Forecasted supply* is equal to 15MW for this particular resource.
Production factor: 0.3	

*Note: Supplier uses own forecast.

Scenario 1: Positive prices in DA and RT

- In Scenario 1 the facility is operating in a location *without* significant transmission congestion expected in the day-ahead market.
- In real time demand conditions align with what was expected day-ahead and the price remains the same.

Scenario 1: DA LMP > $0; RT-LMP > $0

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at $30/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	15MW
Day-ahead market schedule (cleared price X scheduled quantity)	$450

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$30/MWh
Quantity supplied in RT	15MW

The RT price of $30/MWh signals continued system need for injections and facility is able to deliver the exact day-ahead

5

Settlement	Value
Day-ahead market	$450
RT adjustments $30/MWh x (15 MW – 15 MW) x 1hr	$0

Scenario 1: Summary of Contract Settlement

Revenue Requirement	= Proposal Price * Production Factor * Contract Capacity * # of hours	= $100/MWh x 0.3 x 50MW x 1 hour **= $1,500** (see note below)
Deemed Energy Market Revenue*	= DA LMP * Production Factor * Contract Capacity * # of hours	= $30/MWh x 0.3 x 50MW x 1 hour **= $450**
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue	= $1,500 - $450 **= $1,050**
Actual Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity−DA Quantity)]	= [$30/MWh x 15MWh] + [$10 x (15 MWh – 15 MWh)] = **$450**
Total	**Grid Reliability Payment + Energy Market Revenue**	= $1,050 + $450 **= $1,500**

*Deemed energy revenues will be calculated over a monthly basis but for simplicity this example focuses on a single hour

Note: Revenue requirement is the same for every hour of contract life.

Scenario 2: Negative Prices DA & RT

- In Scenario 2 the facility is operating in a location *with* significant transmission congestion expected in the day-ahead market – the DA price clears at a negative value and the wind farm is not scheduled.
- In real time, these negative price conditions persist, and the facility does not deliver any energy.

Scenario 2: DA LMP < $0; RT-LMP < $0

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at $-3/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	0MW
Day-ahead market schedule (cleared price X scheduled quantity)	$0

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$-1/MWh
Quantity supplied in RT	0MW

The RT price of $-1/MWh signals to the market that the resource should continue to be curtailed in real-time.

5

Settlement	Value
Day-ahead market	$0
RT adjustments $-1/MWh x (0MW – 0MW) x 1 hr	$0

Scenario 2: Summary of Contract Settlement

Revenue Requirement	= Proposal Price * Production Factor * Contract Capacity * # of hours	= $100/MWh x 0.3 x 50MW x 1 hour **= $1,500**
Deemed Energy Market Revenue	= DA LMP * Production Factor * Contract Capacity * # of hours	= $0 (not deemed during negative hours) **= $0**
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue	= $1,500 - $0 **= $1,500**
Actual Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity – DA Quantity)]	= [-$3/MWh x 0MWh] + [-$1/MWh x 0MWh] = **$0**
Total	**Grid Reliability Payment + Energy Market Revenue**	= $1,500 + $0 **= $1,500**

*Deemed energy revenues will be calculated over a monthly basis but for simplicity this example focuses on a single hour

Scenario 3: Demand Forecast Decreases between DA -> RT

- In Scenario 3 the facility is operating in a location without congestion affecting the locational prices – thus the DA price clears with a higher cost resource on the margin.
- In real time, demand dynamics change such that variable generation resources become the price setting (marginal) resource - locational prices are $0/MWh.
- The facility will keep the market revenue they earned from their DA schedule.

Scenario 3: DA LMP > $0; RT-LMP =$0

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at $5/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	15MW
Day-ahead market schedule (cleared price X scheduled quantity)	$75

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$0/MWh
Quantity supplied in RT	0MW

The RT price of 0/MWh signals to the market that less energy than scheduled in DA is needed. The resource is **not scheduled to provide energy in real-time but will continue to receive its DA revenues.**

5

Settlement	Value
Day-ahead market	$75
RT adjustments $0/MWh x (0MW – 15MW) x 1hr	$0

Scenario 3: Summary of Contract Settlement

Revenue Requirement	= Proposal Price * Production Factor * Contract Capacity * # of hours	= $100/MWh x 0.3 x 50MW x 1 hour **= $1,500**
Deemed Energy Market Revenue	= DA LMP * Production Factor * Contract Capacity * # of hours	= $5/MWh x 0.3 x 50MW x 1 hour **= $75**
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue	= $1,500 - $75 **= $1,425**
Actual Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity – DA Quantity)]	= [$5 x 15MWh] + [$0 x (0MWh – 15 MWh)] = **$75**
Total	**Grid Reliability Payment + Energy Market Revenue**	= $1,425 + $75 **= $1,500**

*Deemed energy revenues will be calculated over a monthly basis but for simplicity this example focuses on a single hour

Scenario 4: Demand Forecast Increases between DA->RT

- In Scenario 4, we see the opposite of scenario 3. There is excess baseload supply to meet demand day-ahead – thus the DA price clears at a negative value and the wind farm is not scheduled.
- In real time, demand dynamics change and supply from the facility is now needed to meet demand in real-time.
- The facility can now earn additional revenue for delivered energy at the real time price.

Scenario 4: DA LMP < $0; RT-LMP > $0

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at -$10/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	0MW
Day-ahead market schedule (cleared price X scheduled quantity)	$0

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$12/MWh
Quantity supplied in RT	15MW

The RT price of $12/MWh signaling system need for additional resources. The wind resource is able to **inject 15MW @ $12/MWh**

5

Settlement	Value
Day-ahead market	$0
RT adjustments $12/MWh x (15MW – 0MW) x 1hr	$180

Scenario 5: Wind Forecast Underestimates

- In Scenario 5 the facility is operating in a location with positive day-ahead prices.
- In real time, demand conditions align with what was expected day-ahead and the price remains the same. However, wind conditions in real time are such that the facility is capable of offering 25MW rather than the forecast 15MW.
- The wind farm can now earn additional revenue on the incremental 10 MW at the real time price.

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time
DAQ= Day ahead Quantity
RTQ= Real time Quantity

Scenario 5: DAQ < RTQ, DA-LMP=RT-LMP

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at $30/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	15MW
Day-ahead market schedule (cleared price X scheduled quantity)	$450

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$40/MWh
Quantity supplied in RT	25MW

The quantity in the day-ahead market was under-forecasted. The wind resource is able to **inject an additional 10MW @ $40/MWh**

5

Settlement	Value
Day-ahead market	$450
RT adjustments $40/MWh x (25MW – 15MW) x 1hr	$400

Scenario 5: Summary of Contract Settlement

Revenue Requirement	= Proposal Price * Production Factor * Contract Capacity * # of hours	= $100/MWh x 0.3 x 50MW x 1 hour **= $1,500** (see note below)
Deemed Energy Market Revenue*	= DA LMP * Production Factor * Contract Capacity * # of hours	= $30/MWh x 0.3 x 50MW x 1 hour **= $450**
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue	= $1,500 - $450 **= $1,050**
Actual Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity – DA Quantity)]	= [$30 x 15MWh] + [$40 x (25 MWh – 15 MWh)] = **$850**
Total	**Grid Reliability Payment + Energy Market Revenue**	= $1,050 + $850 **= $1,900**

*Deemed energy revenues will be calculated over a monthly basis but for simplicity this example focuses on a single hour

Note: Revenue requirement is the same for every hour of contract life.

Scenario 6: Wind Forecast Overestimates

- In Scenario 6, the facility is again operating at a location with positive prices in the day-ahead and real-time.
- However, wind conditions in real time are such that the facility is only capable of providing 5MW rather than the forecasted 15MW.
- The facility must buy back the 10 MW shortfall at the real time price.

HE = Hour Ending
DAM = Day ahead Market
RT = Real Time
DAQ= Day ahead Quantity
RTQ= Real time Quantity

Scenario 6: DAQ > RTQ, DA LMP=RT-LMP

DAM Timeframe

1

DAM Offer submitted by resource for HE 7	Value
Offer Price	$0/MWh
Forecast Quantity	15MW

2 **DAM-LMP clears HE 7 at $30/MWh**

DAM Schedule (HE 7)	Value
3 Quantity scheduled for the following day	15MW
Day-ahead market schedule (cleared price X scheduled quantity)	$450

RT Timeframe

4

Market conditions in RT for HE 7	Value
RT Price	$40/MWh
Quantity supplied in RT	5MW

The quantity in the day-ahead market was over-forecasted. The wind resource must buy back the shortfall of 10MW at $40/MWh

5

Settlement	Value
Day-ahead market	$450
RT adjustments $40/MWh x (5MW – 15MW) x 1hr	$-400

Scenario 6: Summary of Contract Settlement

Revenue Requirement	= Proposal Price * Production Factor * Contract Capacity * # of hours	= $100/MWh x 0.3 x 50MW x 1 hour **= $1,500** (see note below)
Deemed Energy Market Revenue*	= DA LMP * Production Factor * Contract Capacity * # of hours	= $30/MWh x 0.3 x 50MW x 1 hour **= $450**
Grid Reliability Payment	= Revenue Requirement – Deemed Energy Market Revenue	= $1,500 - $450 **= $1,050**
Actual Energy Market Revenue	=[DA LMP * DA Quantity] + [RT Price * (RT Quantity – DA Quantity)]	= [$30 x 15MWh] + [$40 x (5 MWh – 15 MWh)] = **$50**
Total	**Grid Reliability Payment + Energy Market Revenue**	= $1,050 + $150 **= $1,100**

*Deemed energy revenues will be calculated over a monthly basis but for simplicity this example focuses on a single hour

Deliverability Considerations

LT2 Deliverability Process - Purpose

- Procured resources can only address Ontario's reliability needs (energy and capacity) if they are deliverable
- Deliverable means that there are no material transmission and/or distribution system constraints that would prevent a proposed project from effectively addressing the reliability needs, which is an energy need in the case of the LT2 RFP
- The LT2 evaluation process will have to include an assessment of deliverability to ensure transmission constraints are adequately considered in the procurement

LT2 Deliverability Process

- In the December 2023 webinar, the IESO discussed a Deliverability Process comprised of two steps:
  1. Provide early **system congestion information** ahead of proposal submission to help proponents determine if their preferred sites will meet the IESO's needs.
  2. Conduct a **deliverability evaluation** for projects submitted to the RFP as part of the Proposal Evaluation stage to assess whether the amount of energy expected to be curtailed is acceptable.
- Feedback from stakeholders after the December webinar indicated that they would like to know availability and congestion data on a zonal, circuit and bus basis in Ontario, as well as the deliverability assessment methodology
- The IESO has already started investigating what data can be made available to provide preliminary system congestion information by the end of March 2024

LT2 Deliverability – Early Energy Congestion Data

The IESO is considering providing all or part of the following data that would provide guidance that will help proponents selects sites that would meet the IESO's reliability needs:

- Zonal Data
  - Zonal Limits – MW limits of total capacity that could connect into each electrical zone before the level of congestion becomes unacceptable; different limits may apply for different resource types
  - Zonal Data – data that would allow developers to forecast energy congestion in each electrical zone, e.g., zonal demand, historical flows and transfer limits out of each zone, grid upgrades
- Line Data
  - Line limits - MW limits of total capacity that could connect to each line aimed to minimize local energy and capacity congestion

LT2 Deliverability – Early Reliability Data

The IESO is considering providing all or part of the following data that would provide guidance to avoid or minimize the negative reliability effects on the grid:

- Short-Circuit Limitations
  - Short-circuit restrictions in the grid to avoid equipment rating exceedances
- Invertor-Based Resource (IBR) Guidance
  - The IESO may need to impose certain restrictions or requirements to minimize the risk of IBR control instability
- Connection Specific Limitations
  - For example, a maximum number of connections may be permitted into each line, depending on voltage level, zone, protection restrictions and other factors

LT2 Deliverability – Other Considerations for Early Data

- Because of the limited amount of time to prepare data for the preliminary deliverability guidance (target end of March 2024), the IESO will provide system congestion data for the transmission system only
- The IESO has engaged with Hydro One to participate in the Deliverability Process. Mainly, Hydro One will support the process with equipment-related limitations
- Developers are encouraged to discuss with LDCs if they would like to connect to the distribution system

LT2 Deliverability – Evaluation Stage

- As part of the Proposal Evaluation stage, a deliverability assessment will be completed to confirm that the contracted projects can effectively contribute to meeting the reliability needs intended to be addressed by LT2 RFP
- Deliverability assessments will be performed for each project, in order of their Evaluated Price, until the procurement targets are reached
- These assessments will consider energy congestion and other system reliability limitations for the energy need procurement. For the capacity need procurement, the LT1 RFP methodology will likely be used
- The IESO is currently developing details of the deliverability test that considers stakeholder feedback. This approach will be shared with Proponents in upcoming engagements.

Deliverability Testing Summary

- For the LT2 RFP, the IESO will seek to pair a deliverability test at the proposal evaluation stage, with early information to help inform project siting
- Early information provided will help developers select sites of value, while the deliverability test at the proposal evaluation stage ensures that the IESO only selects projects able to contribute to energy needs
  - This test aims to minimize congestion and ensures competing projects are not being selected at locations where they limit each other's contributions to system needs
- Recognizing the unique nature of long-lead time resources (forward period, development timelines) and the nature of resources procured via any capacity stream, the IESO would utilize different deliverability testing in those situations

Other Design Considerations

Other Design Considerations

- The IESO recognizes stakeholder feedback on a number of outstanding design considerations for both the LT2 RFP and subsequent long and medium-term procurements, that requires additional conversation
- This applies to the exact timing of Medium-Term procurements, the status of existing facilities with the potential to repower and the unique timelines associated with long-lead time resources
- The following slides provide some additional detail on these topics where appropriate, while the IESO commits to continuing to explore these elements and invites additional one on one discussions with stakeholders

Other Design Considerations: DER Participation

Re-cap

Eligibility requirements for DERs

New-build DERs are expected to be enabled to participate in the LT2 RFP, provided they meet the following criteria:

- Market Participant - enabled in the IESO markets by the milestone date of commercial operation
- Non-emitting, in accordance with Government directive(s)
- Energy producing (injections only)
- At least 1MW in size or as enabled in the market

Alignment with Enabling Resources Program (1)

The Enabling Resources Program (ERP) has developed a design vision for a **Foundational Model** which provides a pathway for DERs to participate in the IESO-Administered Markets

Two pathways to participate

Standalone DERs: Energy producing resources at least 1MW that are able to become a market participant by the milestone COD

DER aggregations (DERa): Energy producing resources with an aggregation of at least 1MW behind a single node (connection point) with IESO accepted metering. Must also become a market participant by the milestone COD

Alignment with Enabling Resources Program (2)

Timelines

The Foundational Model is available for stakeholders to review and is expected to be codified in the IESO Market Rules within the 2026/2027 timeframe.

Further Information

Stakeholders seeking further information on the Foundational Model should follow the Enabling Resources Program webpage and stay tuned for a separate stakeholder engagement on that initiative, in the near future.

Other Design Considerations: Incremental Capacity Needs

Update on Capacity Needs

Beyond the 5 TWh energy need, the IESO is evaluating potential capacity needs that may need to be acquired through the LT2 RFP or subsequent procurements.

Determining the capacity target

The IESO is currently in the process of determining the magnitude of the additional capacity needed, which will be informed by the:

1. Outcome of the LT1 RFP, presently in the evaluation phase.
2. Updated capacity forecasts published in the latest Annual Planning Outlook (APO).

Mutiple Opportunities

In most cases Long-Term RFPs will need to procure both energy and capacity products, based on system needs. To facilitate this the IESO would propose offering separate contracts and evaluation processes for each type of grid service.

Energy Procurement

5 TWh (which translates to approximately 2,000 MW)

Enhanced PPA revenue model

Energy producing resources (i.e. hydro, wind, solar)

Capacity Procurement

TBD MW (As informed by APO)

Capacity Contract offered (LT1 Contract)

Non-emitting Capacity based resources, such as electricity storage

Other Design Considerations: Repowered Facilities

Repowered Facilities Feedback (1)

- The IESO has received significant feedback on the topic of repowering that largely points to the need for continued discussions to better understand all aspects that impact repowering.
- Feedback largely pushed back on the IESO's proposal to utilize a minimum installed capacity increase (e.g., +20%) to establish eligibility, instead advocating for proponents to rely on contractual obligations to manage operations for the life of a new contract.
- Stakeholders also identified a number of potential challenges to increasing installed capacity; while newer turbine technology would allow for higher contract capacities, suppliers would be constrained by connection limitations and permitting requirements specific to their existing site, for example.

Repowered Facilities Feedback (2)

- Stakeholders also pointed to the need to align repowering decisions with timelines for the MT2 RFP, to better inform decisions on repowering vs. continued operation
- Recognizing the unique challenges faced by different resources considering repowering, the IESO understands that additional, more targeted engagement on this topic is required, as well as alignment with MT2 RFP timing
- The IESO encourages additional feedback on the alignment between repowering, the MT2 RFP, timelines and considerations for bridging and is open to discussing these matters with stakeholders on a one-on-one basis
- This includes implications to asset owners seeking to repower, if the IESO were to advance the MT2 RFP to be run in parallel with the LT2 RFP

Other Design Considerations: Medium-Term 2 RFP and Bridging

MT2 RFP Considerations

The IESO is currently developing MT2 RFP timelines that will be shared in the coming months and is proposing the following based on stakeholder feedback.

Resource Eligibility: The IESO is proposing to extend eligibility to include generators* that are either off-contract prior to the MT2 RFP term commencement date or participating in the IESO's annual Capacity Auction.

Procurement Target: The IESO is exploring options that will ensure the MT2 RFP is able to meet system needs while maximizing competition to provide value for rate payers.

Timelines: The IESO recognizes the need to align MT2 RFP timelines with the broadest segment of eligible resources and is considering advancing MT2 RFP timelines (e.g., in line with the LT2 RFP). The IESO recognizes the linkage to the repowering considerations and is seeking additional stakeholder feedback on this topic.

 *note: Generators able to respond to RT dispatches (including wind and solar)

Contract Bridging Considerations

- The IESO has received initial feedback from stakeholders that supports a **flexible approach** should be used to bridge existing contracts with end dates that do not align with the IESO's acquisition commitment periods to the start of future MT RFP commitment periods.
- The IESO's goal remains increasing competition in both LT and MT procurements to the extent possible, by ensuring as many resources are able to participate
- The IESO is considering stakeholder feedback received on bridging, especially as it pertains to alignment with MT2 and LT2 RFP timelines (as previously discussed) in order to increase competition in those upcoming procurements and going forward

Other Design Considerations: Long Lead Time Resources

Enabling Long Lead-Time Resources

- The IESO is considering a **multi streamed approach** to the procurement where long lead-time resources (COD 2034) are evaluated separately from other resources with their own procurement target
- Feedback received was largely supportive of the IESO's bifurcated approach
- The IESO is currently only considering **Hydro and Long Duration Storage resources** for the Long Lead-Time stream
- Wind and Solar resources would not qualify under the Long Lead-Time stream
- The Long Lead-Time stream will allow the IESO to procure a more diverse supply in the LT2 RFP and subsequent long-term RFPs

Enabling Long Lead-Time Resources (2)

- The IESO is still examining an appropriate target for the Long Lead-Time stream that would maintain sufficient investment opportunities in future LT RFPs while enabling participation for long lead-time resources
- The IESO would lower the procurement **target** for the long-term procurement with the corresponding milestone COD by however many MWs were procured in the Long Lead-Time stream
- Recognizing the unique considerations for long lead-time assets the IESO is seeking feedback and engagement with the sector to increase competition in the long lead-time stream
- This entails better understanding project readiness for the LT2 RFP, appropriate forward period and unique deliverability testing elements

Next Steps

Next Steps

The IESO invites written feedback on the below items by **February 15.** All written feedback should be submitted to engagement@ieso.ca utilizing the provided IESO Feedback Form:

- Examples of the revenue model
- DER participation
- Considerations for acquiring additional capacity resources
- Early Deliverability Data and Evaluation Stage Deliverability
- Repowering participation
- Long lead time resources

The IESO will aim to hold a follow up engagement after the report back to government, which is due mid-March, and is open to 1:1 meetings throughout this process.

Thank You

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