Introduction to Virtual Trading

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AN IESO MARKETPLACE TRAINING PUBLICATION

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1. Introduction

1.1 Purpose

This guide provides an overview of key concepts related to a virtual trader's participation in the IESO-administered market. This document may be used to assist you in understanding the basics of registering and participating as a virtual trader.

1.2 Background

Virtual traders help price convergence between the Day-Ahead Market (DAM) and the Real-Time Market (RTM) and increase liquidity in the DAM, enhancing the financial and operational certainty that the DAM provides. Virtual traders participate in the DAM with bids and/or offers similar to physical resources. However, unlike physical resources, virtual traders do not participate in the real-time market (RTM), nor do they deliver or consume energy. Virtual traders, instead, are settled on the difference between day-ahead and real-time prices.

2. Authorization and Registration

Prospective virtual traders register with the IESO as a virtual trader class of market participant.

To become authorized, new market participants must follow the authorization process, as described on the IESO's website, and detailed in Market Manual 1.5. When completing *Part 2 – Active Organization Evidence: Intent of Registration* section of the online application form, select the "Virtual Trader" option. Prospective market participants must also pay the market registration application fee.

Once your organization receives access to Online IESO, prospective virtual traders must follow the steps detailed in Market Manual 1.5 to complete their authorization. This includes:

- Submitting banking information,
- Assigning contact role(s),
- Confirming system access role(s),
- Providing prudential support, and
- Providing market control entity information.

If your organization is only participating as a virtual trader, you are not required to be licensed by the Ontario Energy Board (OEB) nor to have a National Energy Board Permit. Furthermore, virtual traders are not required to register any facilities or equipment with the IESO or submit an emergency preparedness plan. Once you have completed all applicable requirements, the IESO will send a Registration Authorization Notice (RAN) through Online IESO to your organization.

Existing market participants, since their organizations are already registered in the market, only need to fulfill the requirements for registering as a virtual trader.

3. Prudential Support

Virtual traders must provide collateral called "prudential support" to cover funds that might be owed if their organization is unable to pay costs owed to the market. Virtual traders must post their required amount of prudential support through Online IESO.

Existing market participants with prudential support obligations may need to provide separate prudential support applicable to their virtual transactions. The methodology of how prudential support obligations are calculated for virtual traders is outlined in Market Manual 5.4. The IESO will inform organizations who are interested in becoming virtual traders of their new or updated prudential support obligation.

4. Submitting Bids and Offers

Authorized virtual traders can submit bids and offers in the DAM in any of the nine virtual trading zones. The nine zones are based on the existing Ontario electrical zones, with the Bruce area being added to the Southwest.

Table 1: Virtual Trading Zones

Virtual Zone Name		Electrical Zone Mapping
East	→	East
Essa	→	Essa
Niagara	→	Niagara
Northeast	→	Northeast
Northwest	→	Northwest
Ottawa	→	Ottawa
Southwest	→	Southwest & Bruce
Toronto	→	Toronto
West	→	West

Virtual bids and offers must be at least 1 MW each. Virtual traders may offer into multiple trading zones for the same period. One bid and one offer per zone per hour by each registered trader is allowed. Market participants can use the IESO's Energy Market Interface (EMI) or an Application Programing Interface (API) that is connected to the Market Information Management (MIM) system to submit bids and offers. To communicate with the IESO through an API, the Rights Administrator must request access through Online IESO.

Offers and bids are to be submitted a day prior to the dispatch day between 06:00 and 10:00 EPT[1]. Changes after 10:00 EPT and during the DAM restricted window must be approved by the IESO. DAM results are expected to be published by 13:30 EPT. However, should there be a delay, the IESO may publish results up to 15:30 EPT.

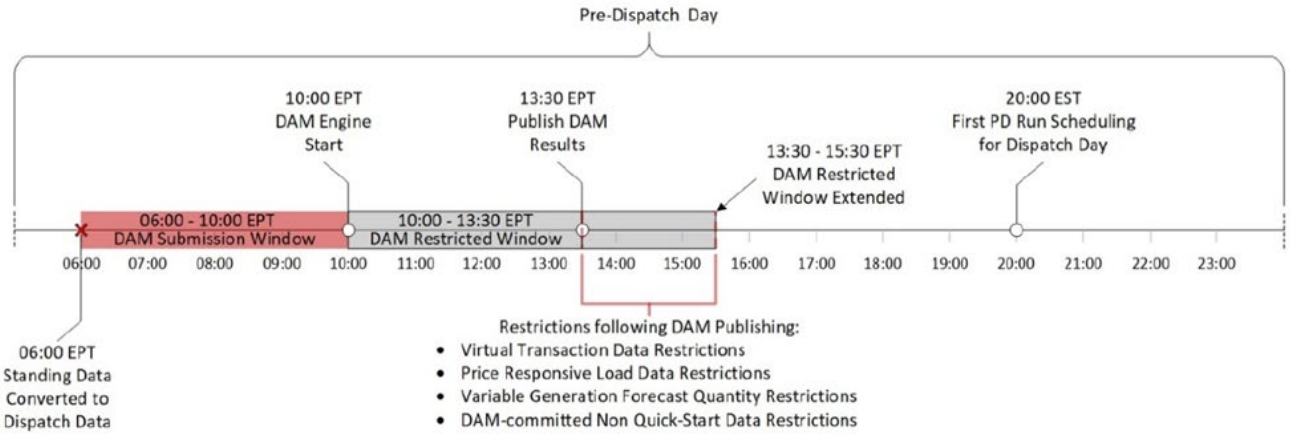

Figure 2 | DAM Timeline

Virtual transactions present a unique risk for the market. Since they do not represent actual supply or consumption, virtual transaction quantities are not bound by any physical capacity limitation. As such, a virtual trader could submit large quantities for purchase or sale thereby exposing themselves to unexpected price movements between DAM and real-time. Should the market participant have a loss too large for them to be covered by their prudential support obligation plus other payments, the market as a whole would be at risk through the default levy.

In order to limit potential issues, the IESO screens virtual bids and offers and may reject them if certain parameters are exceeded. If bids or offers are rejected, the market participant is able to submit acceptable bids and offers prior to the DAM submission window closing.

First, the IESO screens virtual bids and offers for submitted but not cleared exposure to ensure that the resulting cumulative dollar exposure does not exceed the virtual trader's trading limit. The IESO-estimated daily cumulative submitted but not cleared dollar exposure for each virtual trader is calculated by:

a) Multiplying the maximum quantity submitted for each virtual transaction for the dispatch day by the IESO-determined price delta for the associated virtual transaction zone;

b) Multiplying the maximum quantity submitted for each virtual transaction for the dispatch day by the virtual transaction uplift estimation; then

c) Taking the sum of (a) and (b).

[1] EPT or Eastern Prevailing Time means the current time. Therefore, e.g., the DAM submission window opens at 6:00 Eastern Standard Time or Daylight Savings Time depending on which is currently in effect.

Energy lamination volume limits are also be applied. In total, across a 24-hour day, market participants' virtual trades are limited to 2,160 price/quantity pairs. This limit is needed because without it, virtual traders could each enter up to 20 price/quantity pairs per transaction (sell and buy) in each of nine zones for a total of 360 price-quantity pairs per hour for each of 24 hours. This would amount to 8,640 price/quantity pairs. Having this volume of additional offer and bid laminations could present issues for calculation engine processing times.

Lastly, there is also a maximum MW quantity limit per transaction per market participant. Specific limits are applied to each zone. Setting such a limit is intended to limit the quantities potentially offered or bid, especially in more transmission restricted zones, to avoid adverse impacts on the calculation engine's power flow solution. The limits are as follows:

Table 2: Maximum Quantity Limits per Virtual Trading Zone

Virtual Trading Zone	Limit (MW)
East	85
Essa	100
Niagara	55
Ottawa	100
Southwest	315
Toronto	580
West	190
Northeast	50
Northwest	0

Maximum quantity limits will be periodically reviewed and are subject to change. For current limits, please see the report 'TxLimitsAllInService0to34Days' on the IESO Public Reports site.

5. DAM Scheduling and Pricing

DAM energy schedules for virtual transactions are produced for every hour of the dispatch day. Corresponding virtual zonal prices for energy are also produced hourly. These are the load-weighted average of all non-dispatchable load locational marginal prices (LMPs) within a virtual zone.

The example below demonstrates how virtual transactions are scheduled and priced in the Day-Ahead Market.

5.1 Step 1: DAM Virtual Scheduling and Pricing

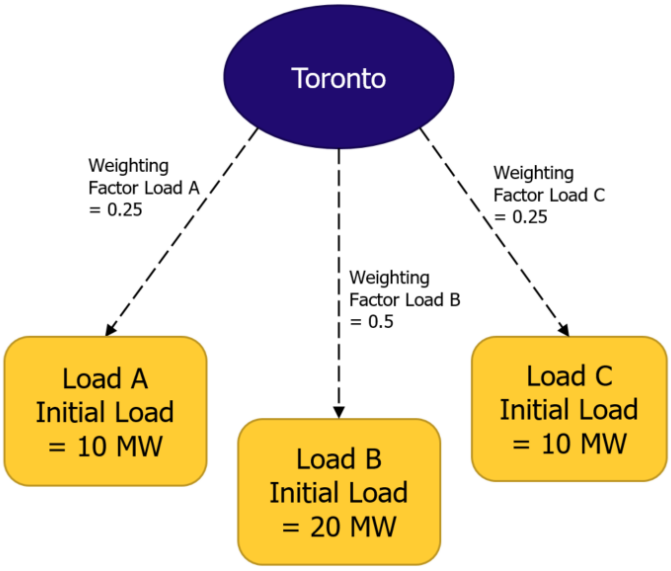

Figure 3 | Weighting Factors Example

In this example, assume the Toronto virtual transaction zone has three load resources. To determine virtual zonal prices, weighting factors are calculated within the engine.

Weighting Factor Load A = Load A Initial Load ÷ Total Load in the Virtual Zone
= 10 MW ÷ 40 MW
= 0.25

Weighting Factor Load B = Load B Initial Load ÷ Total Load in the Virtual Zone
= 20 MW ÷ 40 MW
= 0.50

Weighting Factor Load C = Load C Initial Load ÷ Total Load in the Virtual Zone
= 10 MW ÷ 40 MW
= 0.25

5.2 Step 2: DAM Scheduling Outcomes

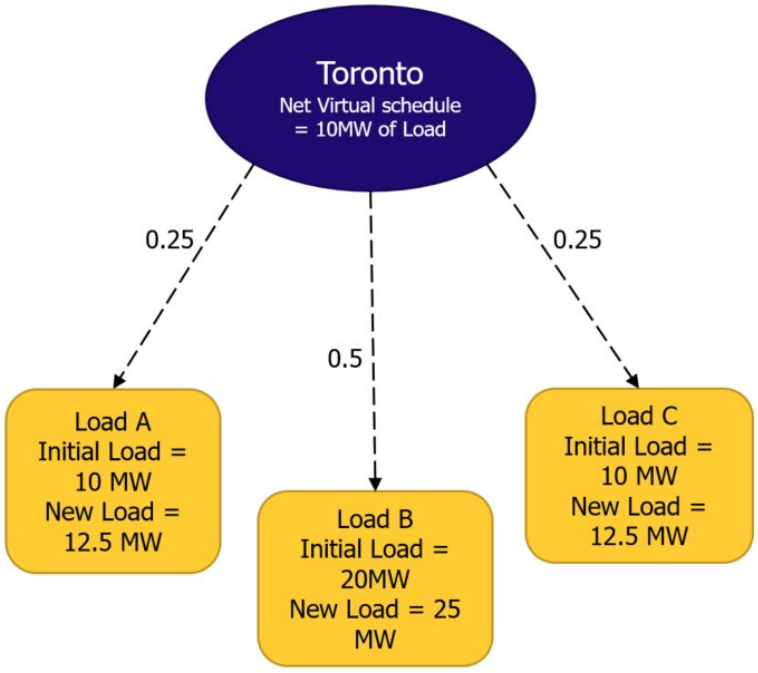

Figure 4 | Load Distributed to Load A, Load B and Load C

Assume the following virtual transactions have been scheduled for Toronto:

- TORONTO_OFFER:HUB = 20 MW (Supply)
- TORONTO_BID:HUB = 30 MW (Load)
- Net Virtual Schedule = 10 MW of Load

To calculate the load to be distributed to each of the load resources, the net virtual schedule of the virtual zone is multiplied by the weighting factors calculated under Step 1. The initial load is then added.

Load Distribution for Load A = 10 MW * 0.25 + 10 MW
= 12.5 MW

Load Distribution for Load B = 10 MW * 0.5 + 20 MW
= 25 MW

Load Distribution for Load C = 10 MW*0.25 + 10 MW
= 12.5 MW

5.3 Step 3: DAM Pricing Outcomes

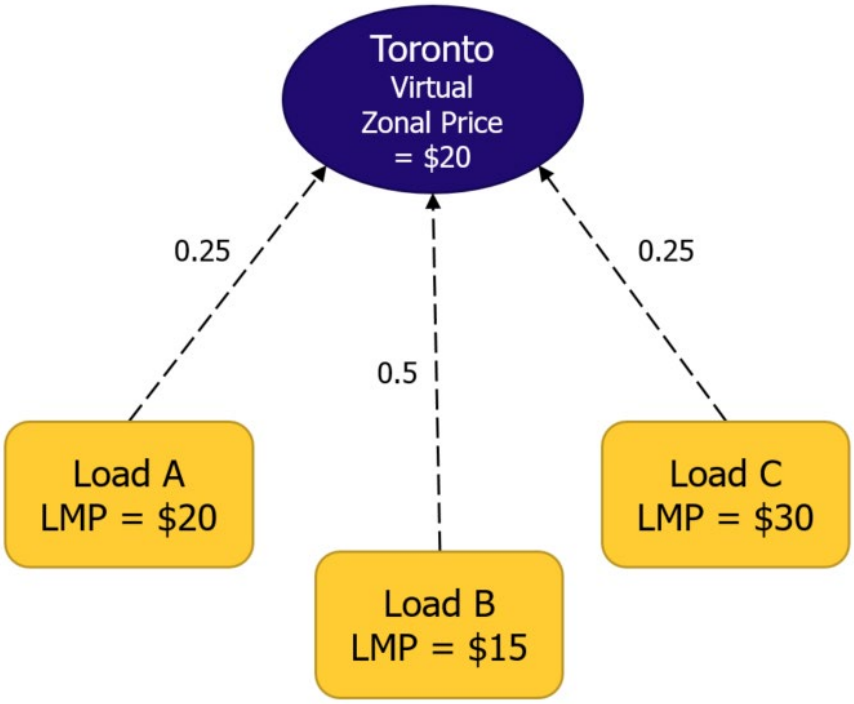

Figure 5 | Load Distributed to Load A, Load B and Load C

Corresponding virtual zonal prices for energy are produced hourly as the load-weighted average of the non-dispatchable load locational marginal prices (LMPs) for each load location within the virtual zone.

Using the example above, the virtual zonal price for Toronto is calculated as follows:

Virtual Zonal Price = ($20*0.25) + ($15*0.5) + ($30*0.25)

= $20

6. Settlements

The renewed market uses a two-settlement system. Under this system, the DAM and RTM are settled separately.

For the day-ahead market, settlement is based on the virtual bid or offer quantity scheduled for each hour. The applicable hourly DAM virtual zonal price for each transaction is then applied. A simplified formula for DAM settlement is:

(Day-ahead Virtual Transaction Quantity x Day-ahead Virtual Zonal Price)

Real-time settlement occurs on a five-minute basis using the applicable real-time virtual zonal price. A simplified formula for real-time settlement is:

(Real-time Virtual Transaction Quantity – Day-ahead Virtual Transaction Quantity) x Real-time Virtual Zonal Price

Because the same quantity as transacted in the DAM is settled in real-time, the formula can be simplified to:

Day-ahead Virtual Transaction Quantity x
(Day-ahead Virtual Zonal Price - Real-time Virtual Zonal Price)

6.1 Settlement Examples for Scheduled Offers

Virtual offers scheduled in the DAM benefit when the day-ahead price is greater than the real-time price. Virtual bids scheduled in the DAM benefit when the day-ahead price is less than the real-time price. The examples below illustrate this concept.

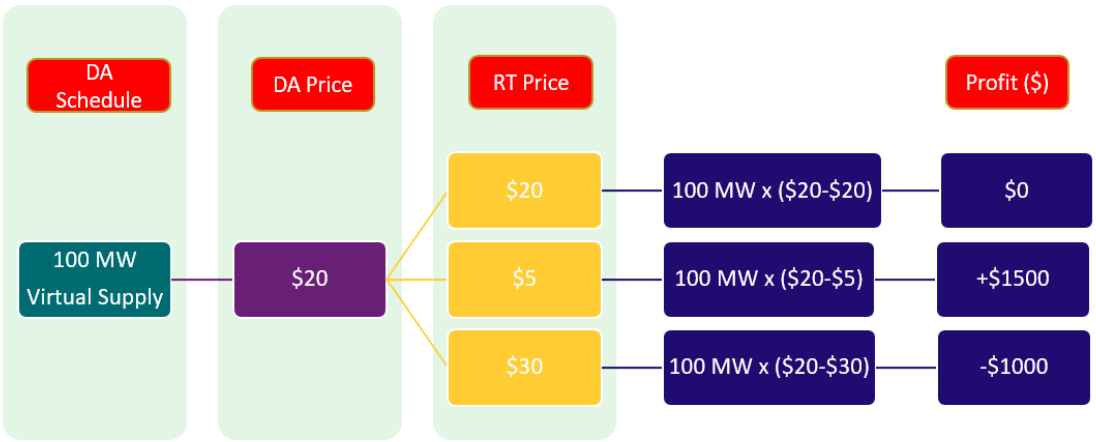

Figure 7 | Settlement Examples for Scheduled Virtual Offers

Three scenarios are illustrated. In each, a virtual trader has had a 100MW offer scheduled in the DAM and the DAM price cleared at $20.

In the first scenario, the real-time price also clears at $20. Because there is no difference between the DAM price and the RTM price, there is no profit or loss to the virtual trader.

In the second scenario, the real-time price is $5, which is less than the DAM price; therefore, the virtual trader receives $1500.

In the last scenario, the real-time price is $30, which is more than the DAM price; therefore, the virtual trader must pay $1000.

6.2 Settlement Examples for Scheduled Bids

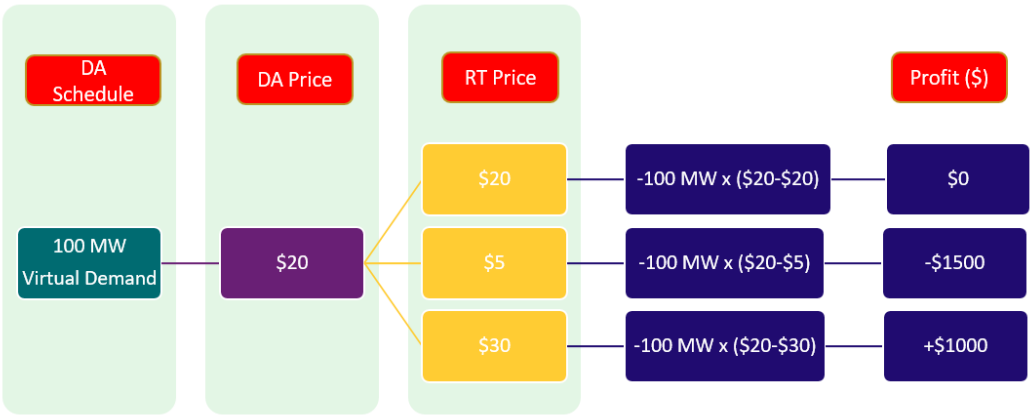

Figure 8 | Profit/Loss Examples for Scheduled Virtual Bids

Three scenarios are illustrated. In each, a virtual trader has had a 100MW bid scheduled in the DAM and the DAM price cleared at $20.

In the first scenario, the real-time price also clears at $20. Because there is no difference between the DAM price and the RTM price, there is no profit or loss to the virtual trader.

In the second scenario, the RTM price is $5, which is less than the DAM price; therefore, the virtual trader must pay $1500.

In the last scenario, the real-time price is $30, which is more than the DAM price; therefore, the virtual trader receives $1000.

6.3 Settlement Charge Types for Virtual Traders

Virtual Transactions are settled for their virtual transactions under the following charge types:

- CT 1106 – Day-Ahead Market Settlement Amounts for Virtual Transaction to Sell
- CT 1107 – Real-Time Market Settlement Amounts for Virtual Transaction to Sell
- CT 1108 – Day-Ahead Market Settlement Amounts for Virtual Transaction to Buy
- CT 1109 – Real-Time Market Settlement Amounts for Virtual Transaction to Buy

Virtual transactions to sell in the DAM may also be charged 1852 – Day-Ahead Market Reliability Scheduling Uplift – Virtual Transactions to Sell (or 'DRSU"). This charge type allocates a portion of the cost incurred as a result of the day-ahead market calculation engine committing additional physical resources to replace virtual supply so that sufficient actual supply is available in real-time to meet peak demand. The DRSU will be distributed daily first to day-ahead selling virtual zonal resources. The allocation will be based on their proportion of the total energy scheduled for all virtual zonal resources with day-ahead market schedules to inject energy and the quantity of energy that was over-forecast by the calculation engine for non-dispatchable loads to meet actual real-time energy demand. The remaining portion of the DRSU will be allocated proportionally to all real-time loads and exports.

More information regarding these charge types can be found in the IESO Charge Types and Equations document.

7. IESO Reports and Settlement Files

Market participants receive their settlement statement and data files through the private reports section of the IESO Reports Site. The IESO publishes a number of public reports that virtual traders may use to inform their market activity:

Table 3 | Day-Ahead, Pre-Dispatch and Real-Time Market Reports

Report	Public or Private	Description
Day-Ahead Schedule Report	Private	Hourly DAM energy schedules issued after DAM completion.
Dispatch Data Report for DAM Scheduling Process	Private	Daily confirmation of an MP's daily and hourly dispatch data submitted into the DAM, issued after DAM completion
Day-Ahead Virtual Transactions Report	Public	Aggregated sums of virtual energy offers and bids submitted and cleared by virtual transaction zone and hour, issued after DAM completion.
Day-Ahead Hourly Virtual Zonal Energy Price Report	Public	Hourly virtual zonal price for each virtual transaction zone, issued after DAM
Pre-Dispatch Hourly Virtual Zonal Energy Price Report	Public	Hourly virtual zonal price for each virtual transaction zone, issued on an hourly basis.
Real-Time Five-Minute Virtual Zonal Energy Price Report	Public	5-minute virtual zonal price for each virtual transaction zone, issued every 5 minutes.

Additional Information

Market Rules:

- Chapter 7: System Operations and Physical Markets
- Chapter 9: Markets Settlement, Markets Billing and Fund Administration

Market Manuals:

- 1.5: Market Registration Procedures
- 4.1: Submitting Dispatch Data in the Physical Markets
- 4.2: Operation of the Day-Ahead Market
- 5.5: IESO-Administered Market Settlement Amounts

Training Materials:

- Introduction to Ontario's Physical Markets
- Guide to Prudentials at the IESO
- Virtual Transactions eLearning

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