

SEPTEMBER 28, 2023

Market Renewal Program Implementation

Market Rules and Market Manuals: Market and System Operations

Q&A Session for Virtual Traders

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Disclaimer

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- Ways to interact in today's webinar:
 - Questions encouraged at any point during the presentation
 - Raise your hand (click the "Raise hand" button in the top right corner) to let the host know you'd like to verbally ask a question or make a comment. The host will let you know when to unmute
 - Enter a written question/comment in the chat. The host will read it out for you
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Meeting Purpose

To provide stakeholders looking to participate in Ontario's energy markets as virtual traders with an overview of their participation in the future day-ahead market (DAM) in accordance with the Market and System Operations (MSO) and Calculation Engines batches of market rule and market manual amendments

Engagement Timeline

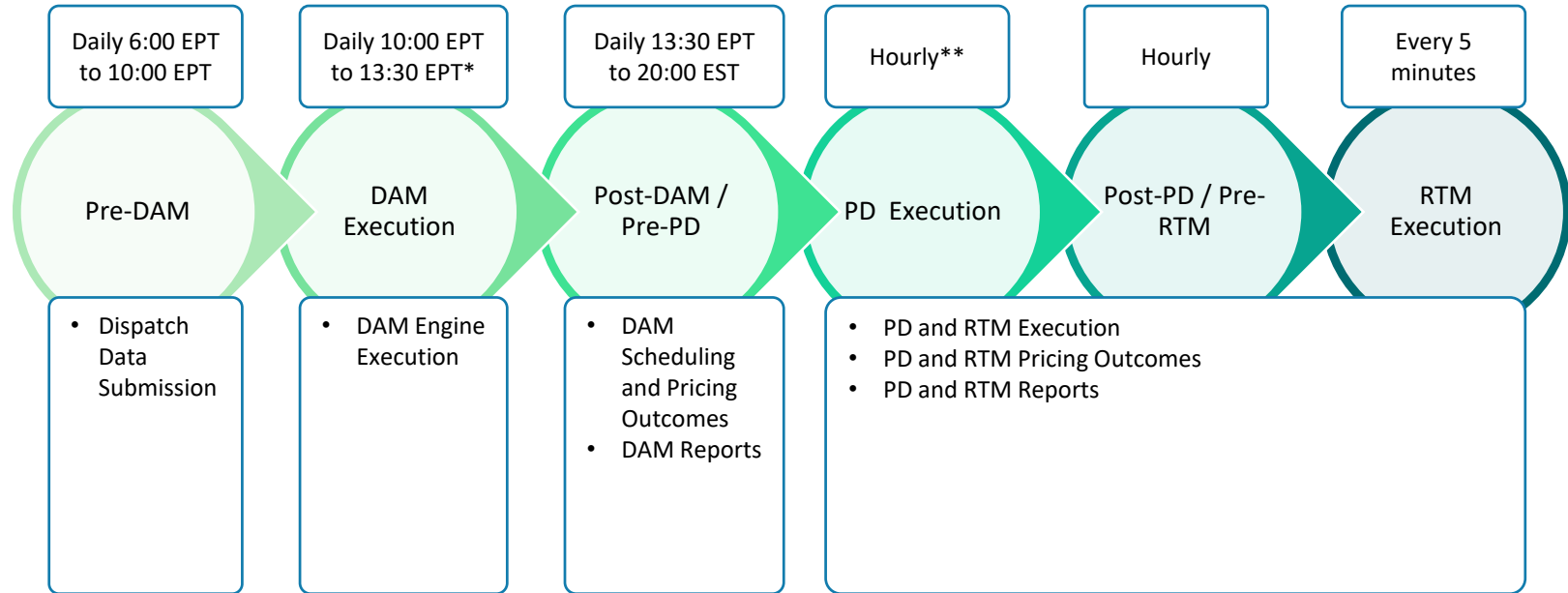
July 14: Draft MSO batch of market rule and market manual amendments published for stakeholder review

July 27 & 28: Webinars conducted to prepare market participants for their review of the MSO batch content

Today: Q & A session that focuses on virtual traders navigating dispatch data submission and scheduling/pricing outcomes from day-ahead to real time

November 8: Feedback on MSO batch market rule and market manual amendments due to the IESO

Q&A Session Scope for Virtual Traders



* DAM execution can be extended until 15:30 EPT

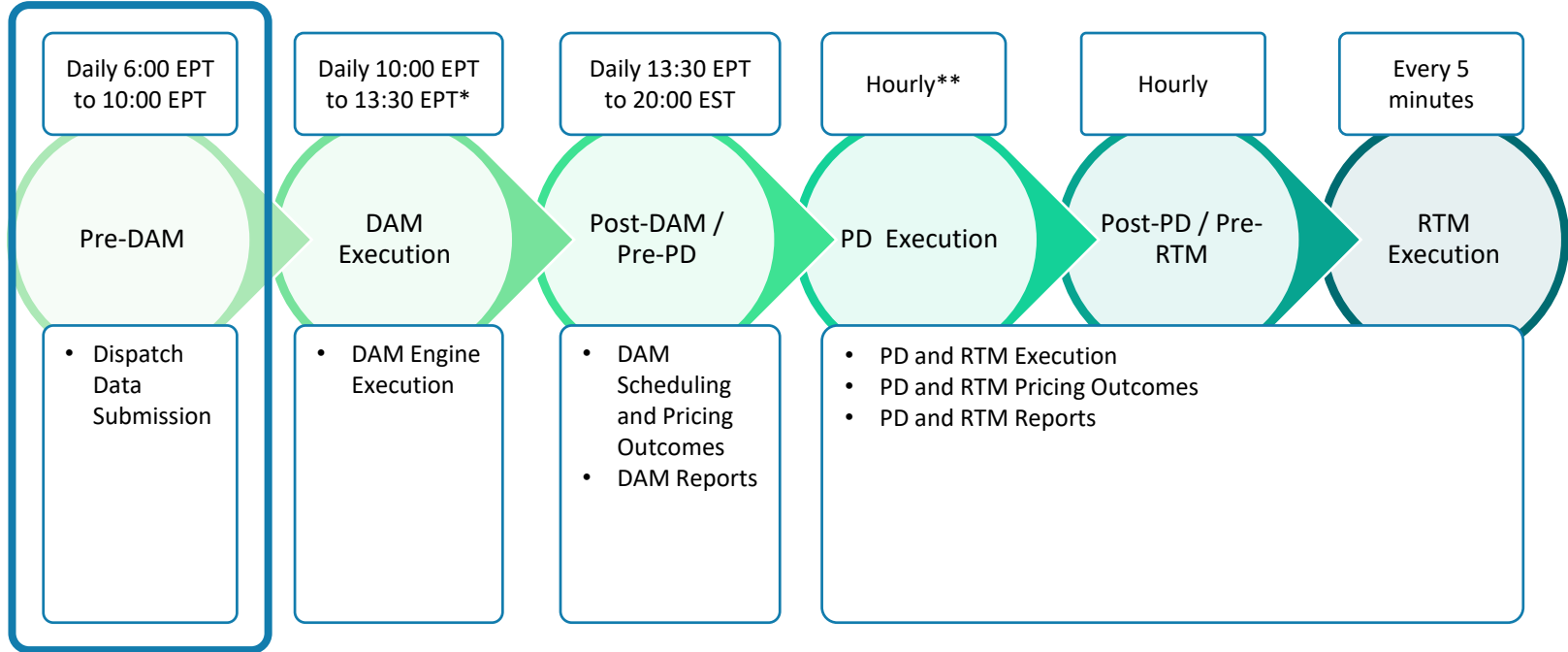
** PD execution occurs hourly on rolling basis with first run starting 20:00 EST on the day prior to the dispatch day and the last run starting at 19:00 EST of the dispatch day

Assumptions

Stakeholders are already familiar with:

- the relevant MSO batch materials that pertain to the participation of virtual traders in the future DAM
- the future authorization, registration and settlement market rules and manuals that pertain to virtual traders
- the timelines and general mechanics of the future DAM, PD and RTM engines
- the dispatch data applicable to virtual traders, what it represents and the purpose it serves (as described in the Offers, Bids and Data Inputs Detailed Design)

Pre-DAM



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Dispatch Data Submission Considerations

Virtual traders should be mindful of the following when submitting dispatch data:

- Dispatch data parameters and their applicability within each engine
- Virtual transaction zones and their associated offer/bid framework
- Dispatch data validations
- Pre-DAM reports

Dispatch Data and Engine Applicability

Dispatch Data Type	Dispatch Data Parameter ¹	New or Existing	Virtual Transaction Type					
			Supply			Load		
			DAM	PD	RTM	DAM	PD	RTM
Hourly	Energy offer	Existing	x					
Hourly	Energy bid	Existing				x		
Hourly	Virtual Zone Name	New	x			x		

x = dispatch data is required

¹ virtual traders are not required to remove their submitted bids/offers after DAM

Virtual Transaction Zones and Offer/Bid Framework

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

- Each virtual zone has two resources for virtual traders to submit on:
 - A resource to offer/sell energy
e.g., EAST_OFFER:HUB
 - A resource to bid/buy energy
e.g., EAST_BID:HUB

Dispatch Data Validations

- Dispatch data submissions must adhere to several rules documented within the MSO batch to be accepted as valid. Examples include:

Validation	Description	Examples for Virtual Transactions
General	Dispatch data format aligns with how the engines read the data	<ul style="list-style-type: none">Virtual transaction offer laminations must be monotonically increasing while bid laminations must be monotonically decreasingEach virtual trader may only submit one virtual transaction at a timeVirtual transaction bid/offer cap validation and virtual transactions energy lamination volume limit
Registration	Dispatch data submissions adhere to registered values	Daily bid/offer quantity screening and daily dollar exposure screening
MPM	Dispatch data submissions are within permissible reference level thresholds	N/A for virtual transactions

- If one or more validations fail, error will be issued, and resubmission required

Example: Daily Bid and Offer Quantity Screening

Description

Limits the total quantity of virtual offers and bids submitted by a virtual trader for a dispatch day to the maximum daily trading limit quantity set by the virtual trader during registration

Submission Order	Submitted Quantity
1 – Ottawa	50 MWh offer
2 – Essa	80 MWh offer
3 – Northwest	100 MWh bid
4 – Toronto	100 MWh offer
Total MWh Submitted	330 MWh

Assuming the Max Daily Trading Limit for a given virtual trader is 250 MWh:

- Limit is applied against all transactions submitted by a virtual trader for all zones and hours of a given dispatch day
- A bid or offer will be rejected once:
$$\text{Total MWh Quantity Submitted} > \text{Max Daily Trading Limit}$$
- In this case, the offer for Toronto will be rejected since it puts the sum of the submitted quantities above the Max Daily Trading Limit

Example: Virtual Transaction Bid/Offer Cap

Description

Limits the maximum quantity that can be submitted for an offer or bid for a dispatch hour in a virtual transaction zone to an amount defined by the IESO. If limits are required they will be determined prior to go-live and can change post go-live as required

Virtual Trader Submission	Submitted Quantity
MP 1 – Niagara	15 MWh offer
MP 2 – Niagara	18 MWh offer
MP 3 – Niagara	5 MWh bid
MP 4 – Niagara	35 MWh offer

Assuming the bid/offer cap for any transaction for a given hour for the Niagara virtual transaction zone is 15 MWh:

- Limit is applied against all transactions submitted for each individual zone and hour
- A bid or offer will be rejected when:

$$\text{Submitted Quantity} > \text{Bid/Offer Cap}$$

- In this case, the submissions by MP 2 and MP 4 will be rejected since their offer quantity is higher than the Bid/Offer Cap

Example: Daily Dollar Exposure Screening

Description

Limits the total estimated dollar value from the virtual offers and bids submitted by a virtual trader for a dispatch day to less than the trading limit margin. Trading limit margin is the difference between a virtual trader's registered trading limit and their actual exposure

- Assuming a registered trading limit of \$10,000 and an actual exposure accumulated from previous days' DAM schedules for the current billing period of \$6,000, implying a trading limit margin of \$4,000; and
- A daily dollar exposure, i.e., the dollar value of all DAM submitted offers and bids, of \$5,000:
 - Bids or offers will be rejected when:

Daily Dollar Exposure (\$5,000) > Trading Limit Margin (\$4,000)

Example: Energy Lamination Volume Limit

Description

Limits the number of price-quantity pairs that a virtual trader can submit across all virtual zones for a dispatch day to an amount defined by the IESO. If limits are required they will be determined prior to go-live and can change post go-live as required

Submission Order	# PQ Pairs
1 – Ottawa	30
2 – Essa	70
3 – Northwest	10
4 – Toronto	90
Total	200

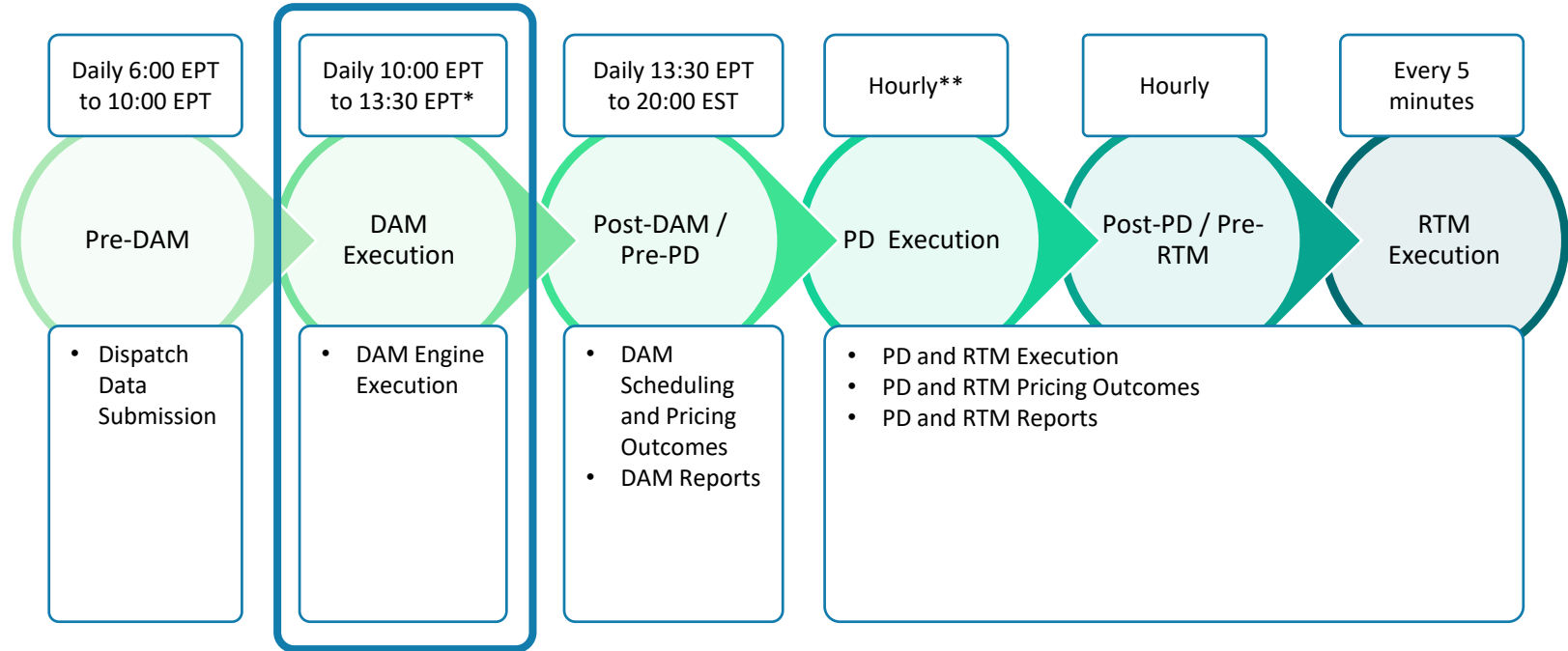
Assuming the IESO determined energy lamination volume limit for a given dispatch day is 120 laminations:

- Limit is uniformly applied to each virtual trader for all transactions submitted across all zones and hours
- A bid or offer will be rejected when:
$$\text{Total \# PQ Pairs} > \text{Energy Lamination Volume Limit}$$
- In this case, the offer for Toronto will be rejected as the sum of all PQ pairs will exceed the Energy Lamination Volume Limit

Pre-DAM Reports

Report Name	New or Existing	Public or Private	Description
Adequacy Report	Existing	Public	Provides overall system conditions including any expected surplus/shortfalls, published at varies times throughout the day-ahead and pre-dispatch timeframes

DAM Execution



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DAM Engine Execution Overview

Pass 1: Market Commitment and Market Power Mitigation

- Determines an initial set of schedules and prices to meet average demand
- Includes evaluation of virtual transactions

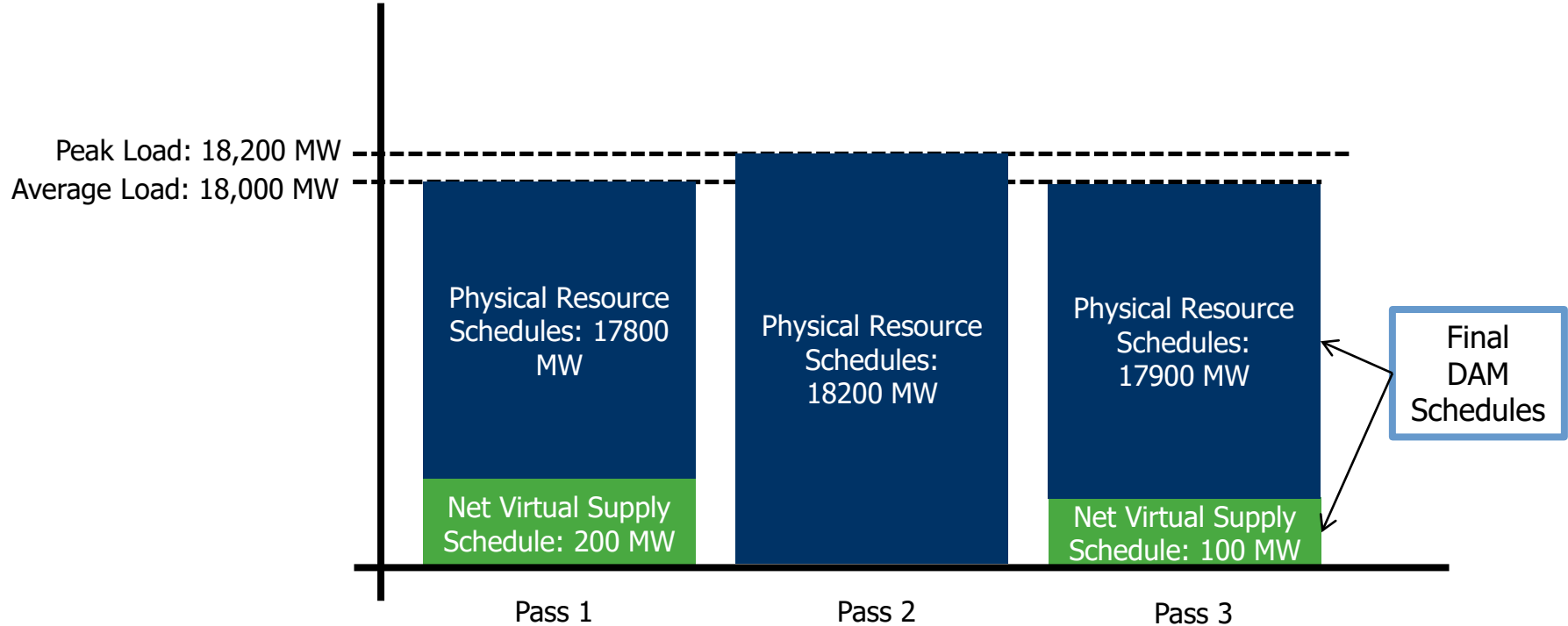
Pass 2: Reliability Scheduling and Commitment

- Determines whether additional eligible non-quick start (NQS) resources need to be committed to meet peak demand
- Virtual transactions are not evaluated, including those scheduled in Pass 1

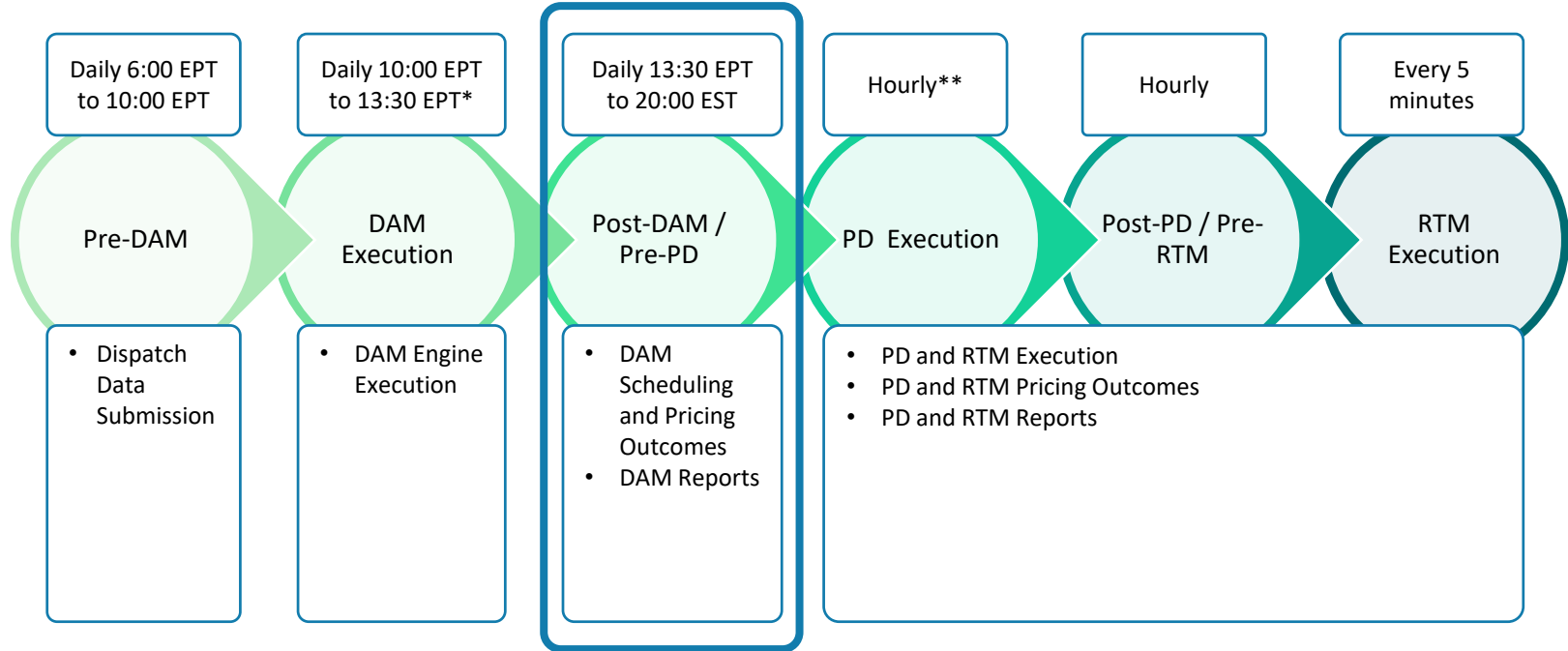
Pass 3: Day-Ahead Market Scheduling and Pricing

- Determines a final set of schedules and prices to meet average demand
- Includes evaluation of virtual transactions

Example: Evaluation of Virtual Transactions in DAM



Post DAM / Pre-PD



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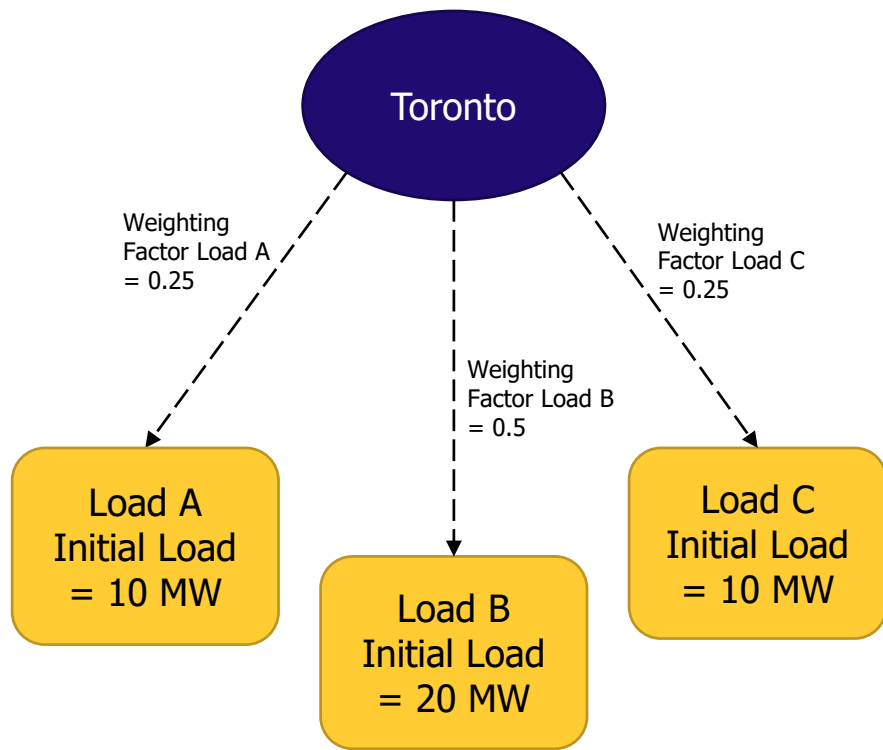
DAM Scheduling and Pricing Outcomes

- DAM energy schedules for virtual transactions are produced hourly, a new outcome from today's DACP
- Corresponding virtual zonal prices for energy are produced hourly as a weighted average of the locational marginal prices (LMPs) for each load location within each virtual zone
- Other key input factors that may influence differences in scheduling and pricing outcomes relative to DACP include:
 - Evaluation of dispatch data for various resources, for example hydroelectric and GOG-eligible NQS (discussed at future Q & A sessions)
 - Constraint violation prices
- DAM schedules and corresponding virtual zonal prices are used for settlement

DAM Scheduling and Pricing Outcomes (cont'd)

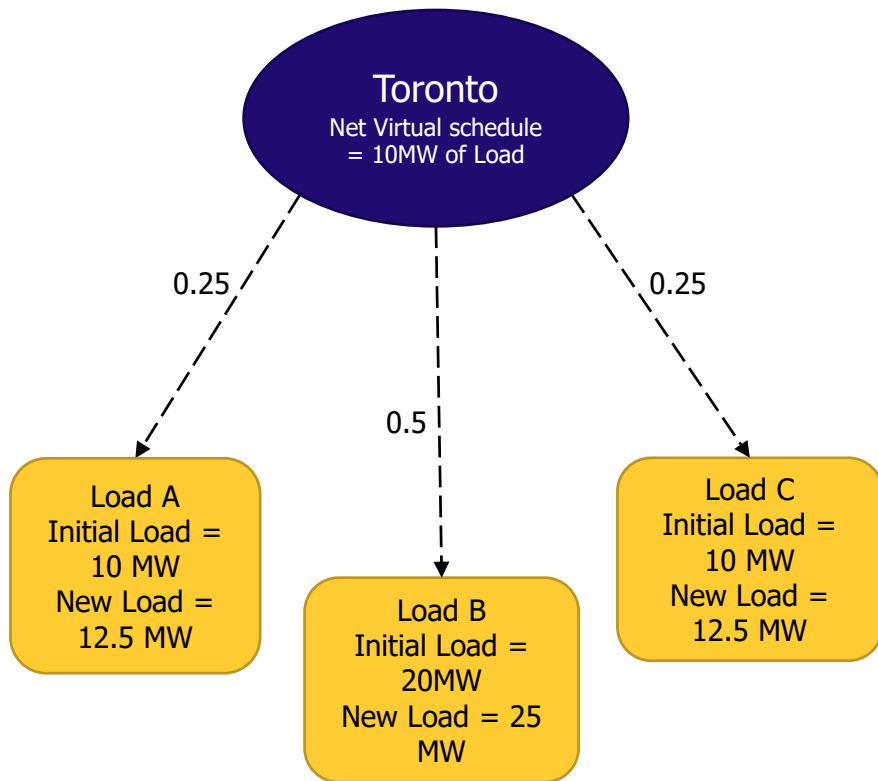
DAM Hourly Schedule	Outcomes	Virtual Transactions
Energy	Schedule produced	x
	Virtual zonal price produced	x
	Subject to ex-ante offer mitigation	
	Schedule + virtual zonal price used for settlement	x
Operating reserve	Schedule produced	
	Virtual zonal price produced	
	Subject to ex-ante offer mitigation	
	Schedule + virtual zonal price used for settlement	

Example: DAM Virtual Scheduling and Pricing (Step 1)



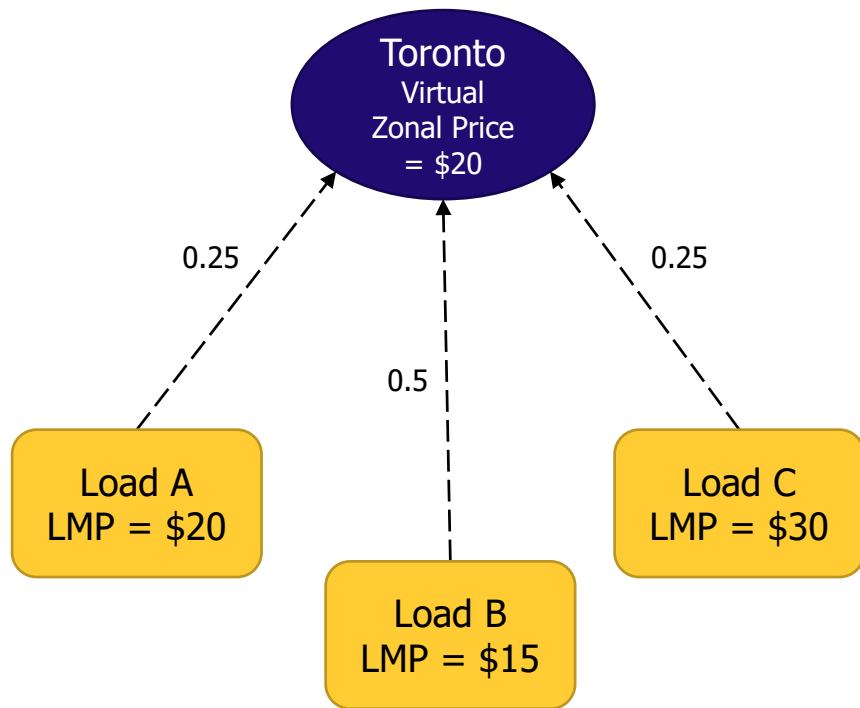
- In this example, assume the Virtual Transaction Zone Toronto has three load locations
- To determine virtual zonal prices and the distribution of the net schedules for each virtual transaction zone, weighting factors are calculated within the engine
- Example: $\text{Weighting Factor Load A} = 10 \text{ MW} \div 40 \text{ MW (total load in zone)} = 0.25$

Example: DAM Scheduling Outcomes (Step 2)



- Virtual transactions scheduled at Toronto
 - TORONTO_OFFER:HUB = 20 MW (Supply)
 - TORONTO_BID:HUB = 30 MW (Load)
 - Net Virtual Schedule = 10 MW of Load
- Load distribution to the loads are:
 - Load A = $10 \text{ MW} \times 0.25 + 10 \text{ MW} = \mathbf{12.5 \text{ MW}}$
 - Load B = $10 \text{ MW} \times 0.5 + 20 \text{ MW} = \mathbf{25 \text{ MW}}$
 - Load C = $10 \text{ MW} \times 0.25 + 10 \text{ MW} = \mathbf{12.5 \text{ MW}}$

Example: DAM Pricing Outcomes (Step 3)

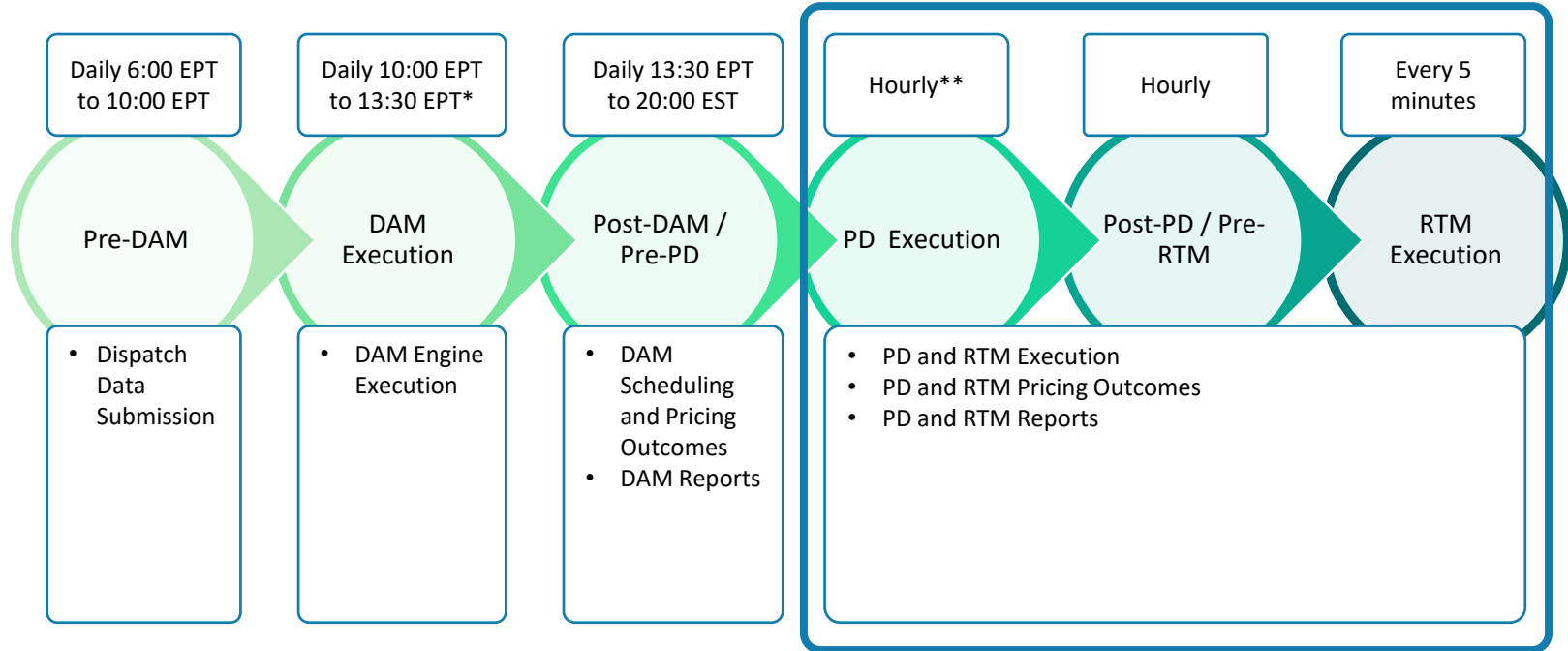


- Assume the following LMPs are calculated for each Load:
 - Load A = \$20
 - Load B = \$15
 - Load C = \$30
- The virtual zonal price is the weighted average of the LMPs:
 - $= (\$20 \times 0.25) + (\$15 \times 0.5) + (\$30 \times 0.25)$
 - $= \mathbf{\$20}$ virtual zonal price

DAM Reports

Report Name	New or Existing	Public or Private	Description
Day-Ahead Schedule Report	Existing	Private	Hourly DAM energy schedules for virtual transactions, issued after DAM completion.
Dispatch Data Report for DAM Scheduling Process	New	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	New	Public	Aggregated sums of virtual energy offers and bids submitted and cleared by virtual transaction zone and hour, issued after DAM completion.
Day-Ahead Market Energy Virtual Zonal Price Report	New	Public	Hourly virtual zonal price for each virtual transaction zone, issued after DAM.

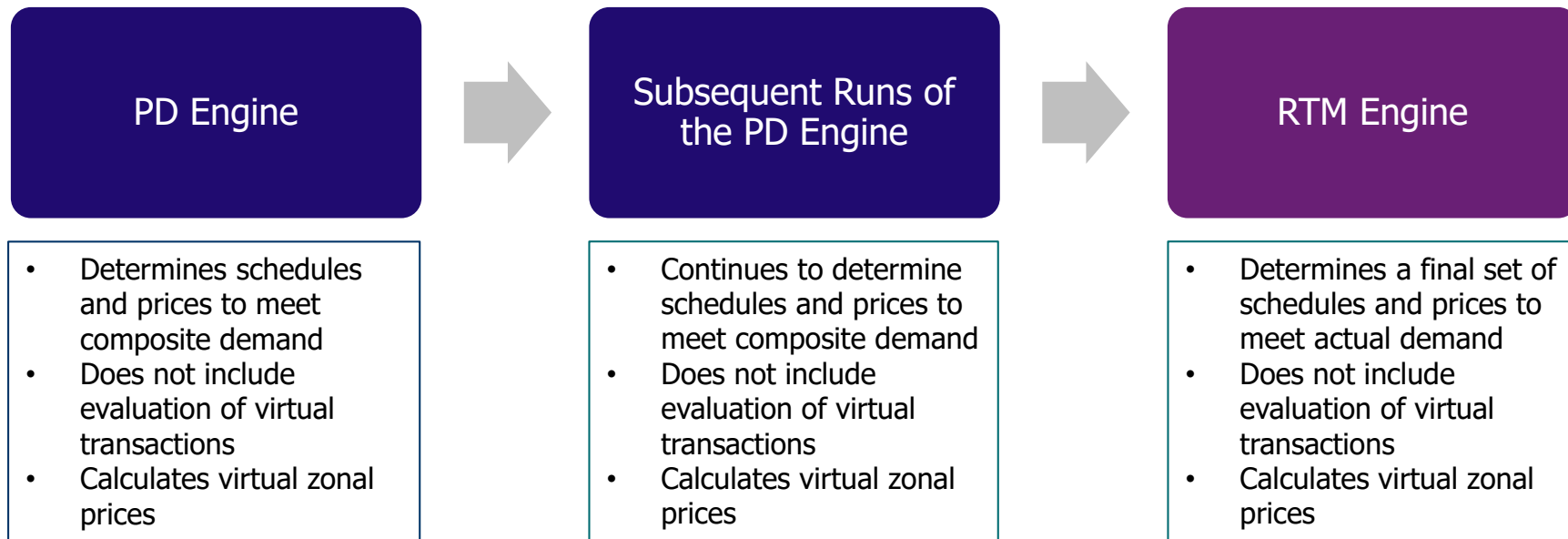
PD to RTM Execution



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PD and RTM Engine Execution Overview



PD and RTM Pricing Outcomes

- PD and RTM energy schedules are NOT produced for virtual transactions since they are only applicable in the DAM
- Virtual zonal prices for energy are produced hourly in PD and every five-minutes in the RTM as a weighted average of the LMPs for each load location within each virtual zone
- RTM virtual zonal prices are used for settlement (only informational for PD)
- The same key input factors noted for DAM may influence differences in PD and RTM pricing for virtual transactions relative to today, namely:
 - New dispatch data for various resources, for example hydroelectric and GOG-eligible NQS (discussed at future Q & A sessions)
 - Constraint violation prices

PD & RTM Pricing Outcomes (cont'd)

Market Product	Outcomes	Virtual Transaction	
		PD Hourly	RTM 5-Minute
Energy	Schedule produced		
	Virtual zonal price produced	x	x
	Subject to ex-ante offer mitigation		
	Schedule + virtual zonal price used for settlement		Virtual zonal price only
Operating reserve	Schedule produced		
	Virtual zonal price produced		
	Subject to ex-ante offer mitigation		
	Schedule + virtual zonal price used for settlement		

PD and RTM Reports

Report Name	New or Existing	Public or Private	Description
Pre-Dispatch Hourly Energy Virtual Zonal Price Report	New	Public	Hourly virtual zonal price for each virtual transaction zone, issued on an hourly basis.
Real-Time Five-Minute Energy Virtual Zonal Price Report	New	Public	5-minute virtual zonal price for each virtual transaction zone, issued every 5 minutes.

Summary of Today's Discussion

- Relevant dispatch data parameters and their applicability within each engine
- Virtual transaction zones and their bid/offer submission framework
- Dispatch data validations relevant to virtual transactions
- Overview of DAM, PD and RTM engine functionality and relevant scheduling and pricing outcomes for virtual transactions
- Applicable DAM, PD and RTM reports

Next Steps

- Additional Q&A sessions for other resource types are scheduled for the coming days
- Should any further clarifications be necessary to support stakeholder's review of the MSO batch, please contact engagement@ieso.ca
- **November 8:** Written stakeholder feedback due on the MSO batch market rules and market manuals can be submitted to engagement@ieso.ca

Thank You

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