

SEPTEMBER 26, 2023

Market Renewal Program Implementation

Market Rules and Market Manuals: Market and System Operations

Q&A Session for Nuclear, Variable Generation, Self-Scheduling

Generation and Electricity Storage Resources

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Disclaimer

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Webinar Participation

- 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 nuclear, variable generation (VG), self-scheduling generation (SSG) and electricity storage resources with an overview of their participation in the future day-ahead market (DAM), pre-dispatch (PD) and real-time market (RTM) in accordance with the Market and System Operations (MSO) and Calculation Engines batches of market rule and market manual amendments

Engagement Timeline

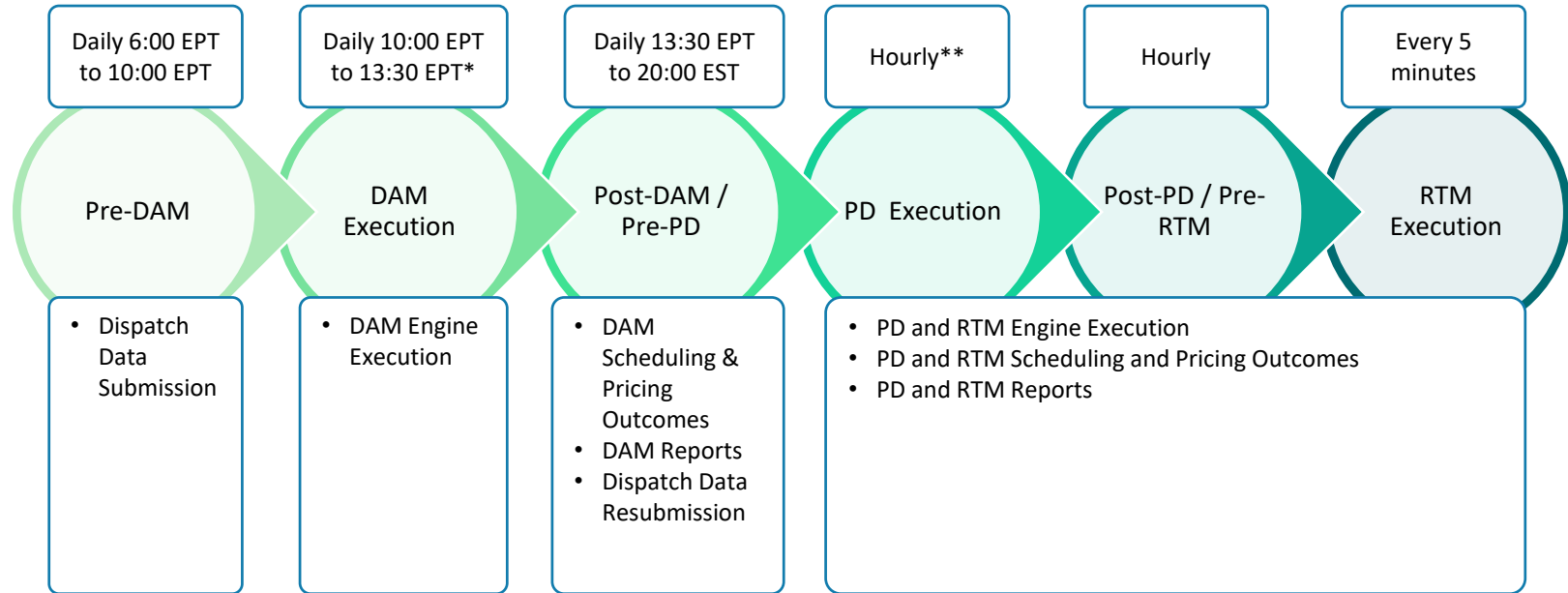
July 14: Draft MSO batch of market rule and market manual amendments published for stakeholder review

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

Today: Q & A session that focuses on nuclear, VG, SSG and storage resources navigating dispatch data submission and scheduling/pricing outcomes from day-ahead to real-time

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

Q&A Session Scope for Nuclear, VG, SSG and Storage



* DAM execution can be extended until 15:30 EPT

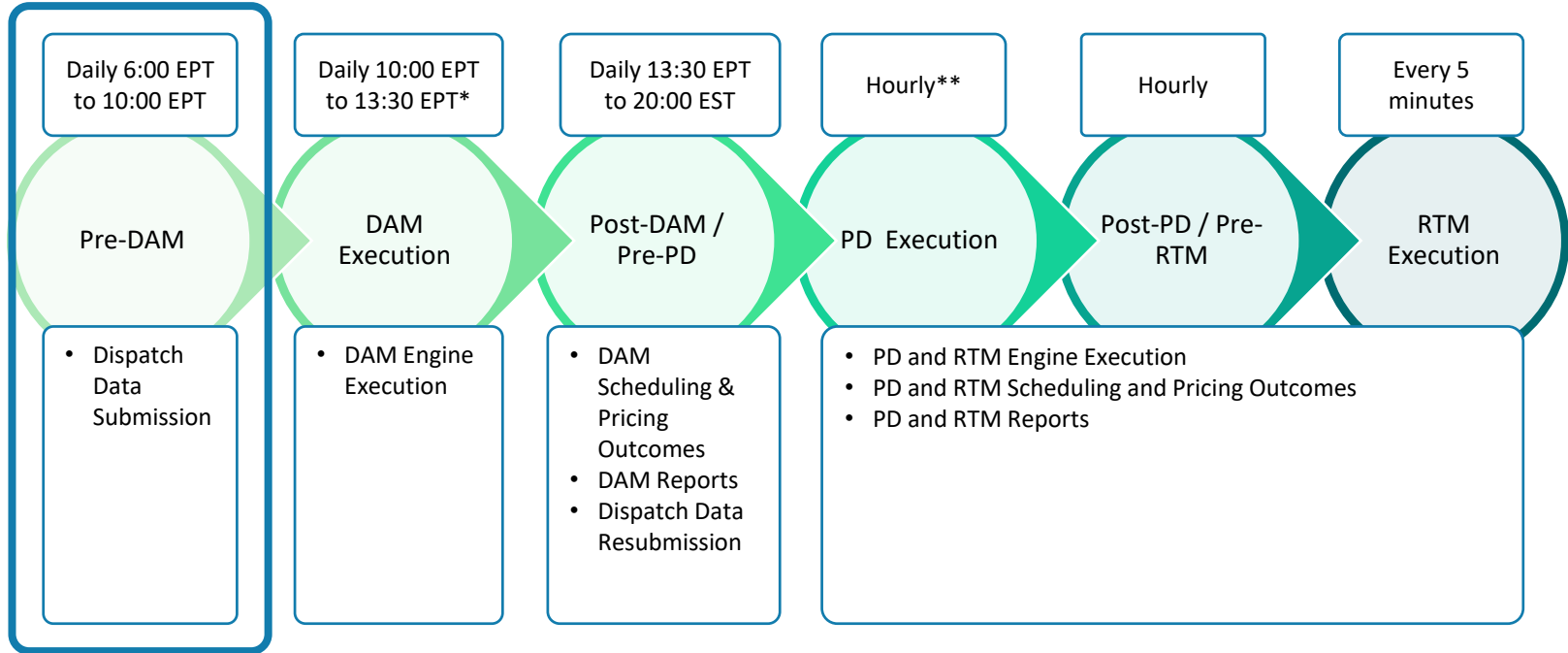
** PD execution occurs hourly on rolling basis with first run starting 20:00 EST on the day prior to the dispatch day and the last run starting at 19:00 EST of the dispatch day

Assumptions

Stakeholders are already familiar with:

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

Pre-DAM



* 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

Dispatch Data Submission Considerations

Market participants (MPs) should be mindful of the following when submitting dispatch data for their resources:

- Dispatch data parameters and their applicability within each engine
- Availability Declaration Envelope (ADE)
- New dispatch data for VG: DAM forecast quantity
- Additional submission rules for non-dispatchable storage resources
- Implications of ex-ante market power mitigation (MPM)
- Pre-DAM reports

Dispatch Data & Engine Applicability (Nuclear, VG, SSG)

Dispatch Data Type	Dispatch Data Parameter	New or Existing	Resource Type								
			Nuclear			VG			SSG		
			DA	PD	RT	DA	PD	RT	DA	PD	RT
Hourly	Energy offer	Existing	x	x	x	x	x	x			
Hourly	Energy self-schedule	Existing							x	x	
Hourly	VG forecast quantity	New				x					
Daily	Maximum daily energy limit	Existing				x	x				
Hourly	Hourly energy ramp rate	Existing			x			x			
Daily	Daily energy ramp rate	New	x	x		x	x				
Hourly	Operating reserve offers	Existing									
Hourly	Operating reserve ramp rate	Existing									
Hourly	Reserve loading point	Existing									

X = dispatch data is either required or optional

Dispatch Data & Engine Applicability (Storage)

Dispatch Data Type	Dispatch Data Parameter	New or Existing	Electricity Storage Resource Type											
			Dispatchable Storage						Self Scheduling Storage					
			As Gen			As DL			As SSG			As PRL		
			DA	PD	RT	DA	PD	RT	DA	PD	RT	DA	PD	RT
Hourly	Energy offer	Existing	x	x	x	x	x	x						
Hourly	Energy bid	Existing										x		
Hourly	Energy self-schedule	Existing							x	x				
Daily	Maximum daily energy limit	Existing	x	x										
Hourly	Hourly energy ramp rate	Existing			x			x						
Daily	Daily energy ramp rate	New	x	x		x	x							
Hourly	Operating reserve offers	Existing	x	x	x	x	x	x						
Hourly	Operating reserve ramp rate	Existing	x	x	x	x	x	x						
Hourly	Reserve loading point	Existing	x	x	x	x	x	x						

X = dispatch data is either required or optional

Availability Declaration Envelope (ADE)

For nuclear, VG and dispatchable storage resources:

- ADE continues to apply
- MPs must submit energy offers into the DAM for every hour they intend to participate in the RTM
- The allowance to expand the DAM established ADE in the RTM is being increased **from** the lesser of **2%** of the ADE or 10 MW **to** the lesser of **15%** of the ADE or 10 MW

For SSG and non-dispatchable storage resources:

- While ADE does not apply, MPs must submit for each hour in the DAM the expected amount of energy they intend to inject or consume in the RTM

VG Forecast Quantity

- Like DACP today, the DAM VG forecast quantity sets the maximum amount of energy that DAM engine passes 1 & 3 evaluates from the energy offered
- If an MP elects to submit their own forecast quantity for a given hour(s) into the DAM, such quantity will be used instead of the IESO's forecast quantity for that hour(s)

Example:

- MP offers 100 MW of energy for a given hour and submits a forecast quantity of 80 MW for the same hour
- IESO forecast quantity for the same hour is 90 MW
- DAM engine passes 1 and 3 will evaluate the energy offer of 100 MW only up to the MP submitted forecast quantity of 80 MW

Additional Rules for Self-Scheduling Storage

- MRP introduces a new requirement for self-scheduling storage to reflect their load consumption in the DAM:

Today's DACP	Future DAM
Load consumption for self-scheduling storage reflected in the IESO forecast as non-dispatchable load for all three passes of DACP	<ul style="list-style-type: none">• Self-scheduling storage submit expected load consumption for every hour of the DAM using the PRL bid framework• Used in DAM passes 1 and 3; IESO forecast only applies in Pass 2

- For PD and RTM, load consumption for self-scheduling storage continues to be reflected via the IESO forecast

Dispatch Data Validations

- Dispatch data submissions must adhere to a number of rules documented within the MSO batch in order to be accepted as valid. Examples include:

Validation	Description	Example
General	Dispatch data format aligns with how the engines read the data	Offer laminations must be monotonically increasing while bid laminations must be monotonically decreasing
Registration	Dispatch data submissions fall within registered quantities	Energy offer/bid quantity must be less than or equal the maximum registered generation/load capability
MPM	Dispatch data submissions are within permissible reference level thresholds	Operating reserve ramp rate must be greater than or equal to half of its registered reference level

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

Implications of Ex-Ante MPM

- Ex-ante MPM applies for energy and operating reserve offers in the DAM and PD engines, but only for dispatchable resources
 - Mitigation decisions from PD are carried forward into RTM
- MPs may submit energy and operating reserve offer prices above their registered reference levels with an understanding that such offer prices are subject to ex-ante mitigation by the DAM and PD engines (ex-ante MPM overview discussed next)

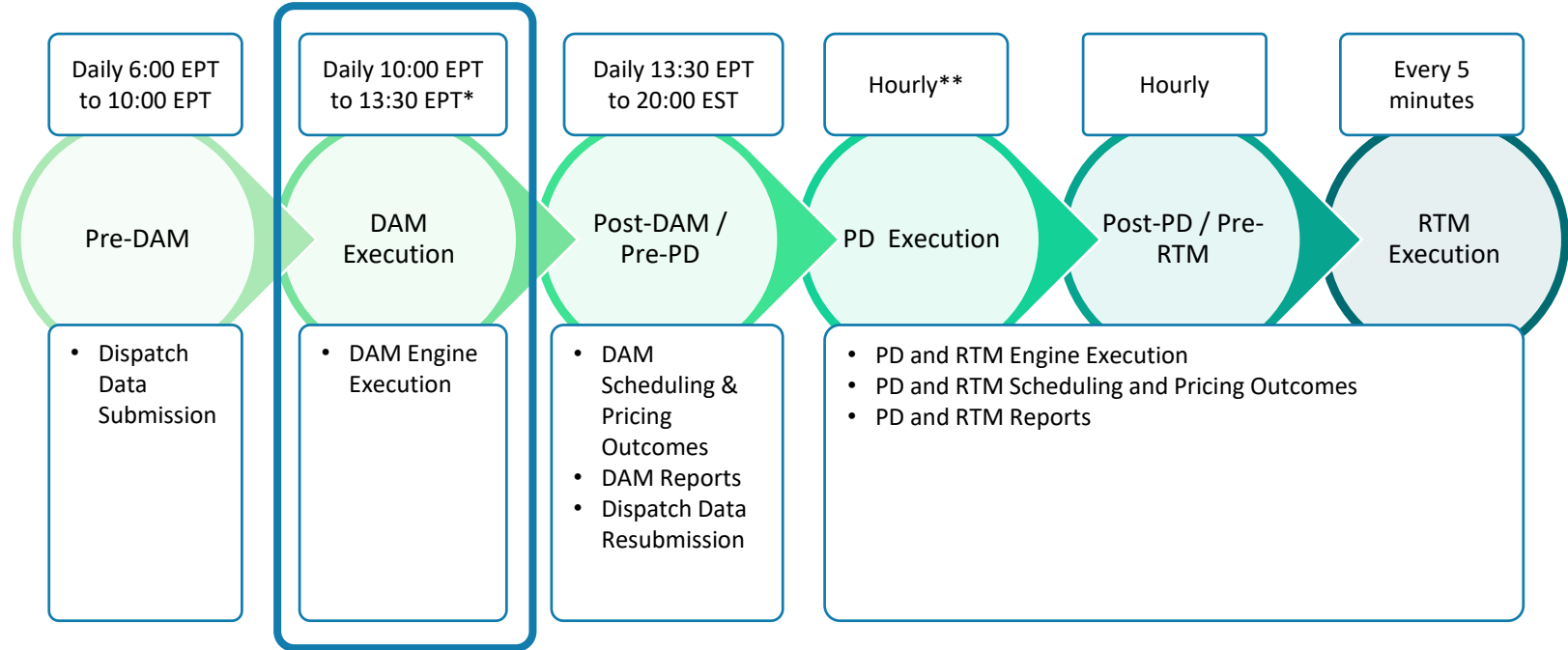
Overview of Ex-Ante Mitigation

- 1** Existence of any market power condition restricting competition
Ensures mitigation is only performed if required
- 2** **Conduct Test:** Check if submitted offer prices are within the acceptable tolerance
If 'pass': no mitigation is needed
If 'fail': submitted offers are replaced with reference levels for the impact test
- 3** **Price Impact Test:** Asses whether the difference between LMP calculated with submitted offer and the LMP calculated using reference levels is within acceptable tolerance
If 'pass': no mitigation is needed
If 'fail': the resulting LMPs and schedules are based on reference levels

Pre-DAM Reports

Report	New or Existing	Public or Private	Description
Day-Ahead Area Reserve Constraints Report	Existing	Public	Hourly maximum and minimum constraints for the area operating reserve regions expected to be used by the DAM engine, published daily at approximately 9:00 EPT
Day-Ahead Financial Reference Level Values Report	New	Private	Reference level values applicable for each resource to be used by the DAM engine, issued by approximately 6:00 EPT Updated at approximately 09:30 EPT, reflecting changes provided by the MP for the dispatch day

DAM Execution



* 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

DAM Engine Execution Overview

Pass 1: Market Commitment and Market Power Mitigation

- Determines an initial set of schedules and prices to meet average demand, including evaluation of PRL bids from self-scheduling storage
- Energy and operating reserve offers subject to ex-ante MPM, if required



Pass 2: Reliability Scheduling and Commitment

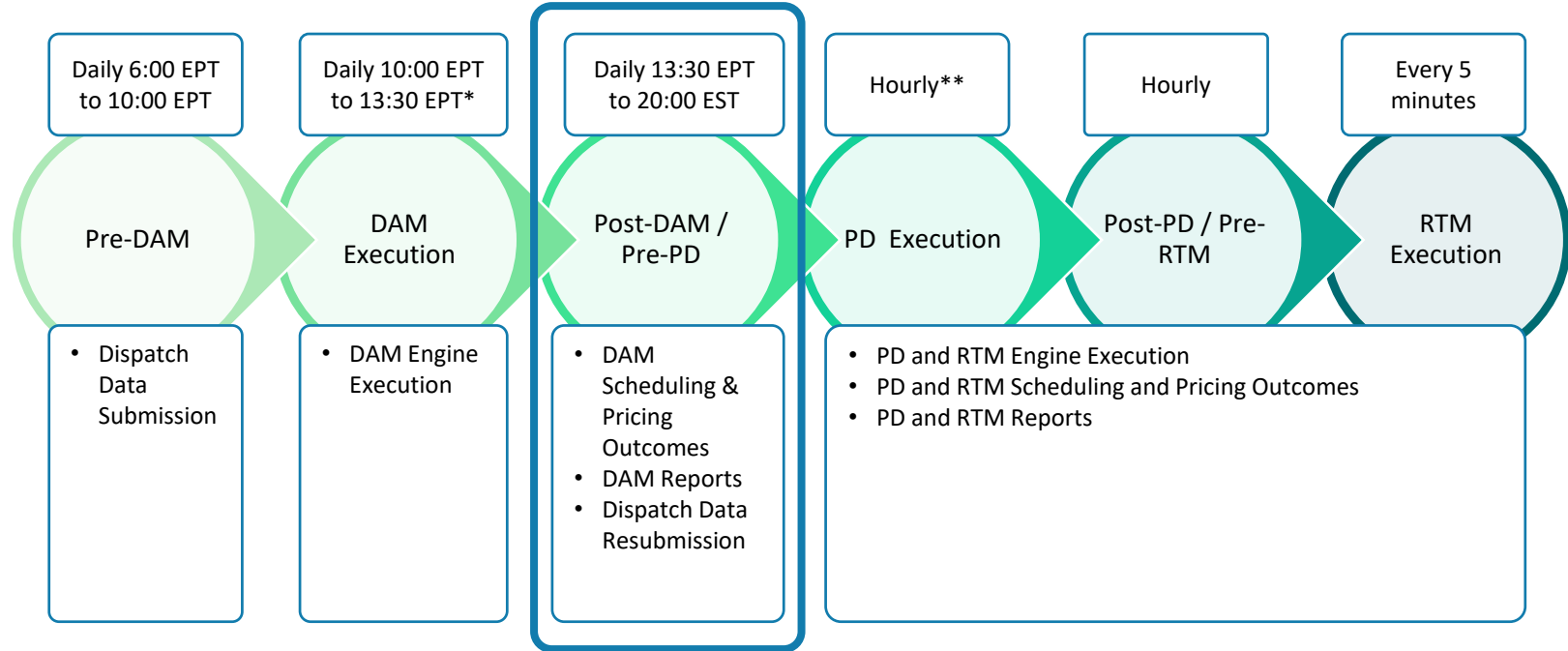
- Determines whether additional eligible non-quick start (NQS) resources need to be committed to meet peak demand
- PRL bids from self-scheduling storage are not evaluated
- Reference levels from Pass 1 used if mitigation applied



Pass 3: Day-Ahead Market Scheduling and Pricing

- Determines a final set of schedules and prices to meet average demand, including evaluation of PRL bids from self-scheduling storage
- Reference levels from Pass 1 used if mitigation applied

Post-DAM / Pre-PD



* 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

DAM Scheduling and Pricing Outcomes

- DAM energy and operating reserve schedules are produced hourly similar to today's DACP. Key input factors that may influence differences in scheduling and pricing outcomes relative to DACP include:
 - Evaluation of new dispatch data for various resources, for example hydroelectric and GOG-eligible NQS (discussed at future Q & A sessions)
 - Application of ex-ante MPM
 - Constraint violation prices
- Corresponding prices are produced hourly as locational marginal prices (LMPs) at each resource location (i.e. the same location as the schedule)
- DAM schedules and corresponding LMPs are used for settlement

DAM Scheduling and Pricing Outcomes (cont'd)

DAM Hourly Schedule	Outcomes	Nuclear	VG	SSG	Dispatchable Storage		Self-Scheduling Storage	
					As Gen	As DL	As SSG	As PRL
Energy	Schedule produced	X	X	X	X	X	X	X
	LMP produced	X	X	X	X	X	X	X
	Subject to ex-ante offer mitigation	X	X		X			
	Schedule + LMP used for settlement	X	X	X	X	X	X	X
Operating reserve	Schedule produced				X	X		
	LMP produced				X	X		
	Subject to ex-ante offer mitigation				X	X		
	Schedule + LMP used for settlement				X	X		

DAM Scheduling and Pricing Outcomes (cont'd)

- Constraint violation prices are currently used in DACP to determine schedules
- For MRP, a new and separate set of constraint violation prices will be used to determine LMPs

Constraint Violation Prices for DAM Scheduling	Constraint Violation Prices for DAM Pricing
<ul style="list-style-type: none">• Informational only• Constraint violation prices are used to prioritize which violations to resolve first where multiple constraints are violated and insufficient MP resources are available to resolve	<ul style="list-style-type: none">• Used for settlement• Used to determine LMPs that reflect the value of resolving a constraint violation where insufficient MP resources are available to do so

- The methodology for determining both sets of constraint violation prices are documented in the market manual 4.2 and 4.3 appendices. While the actual values used for scheduling are documented, the actual values to be used for pricing will be determined before go-live

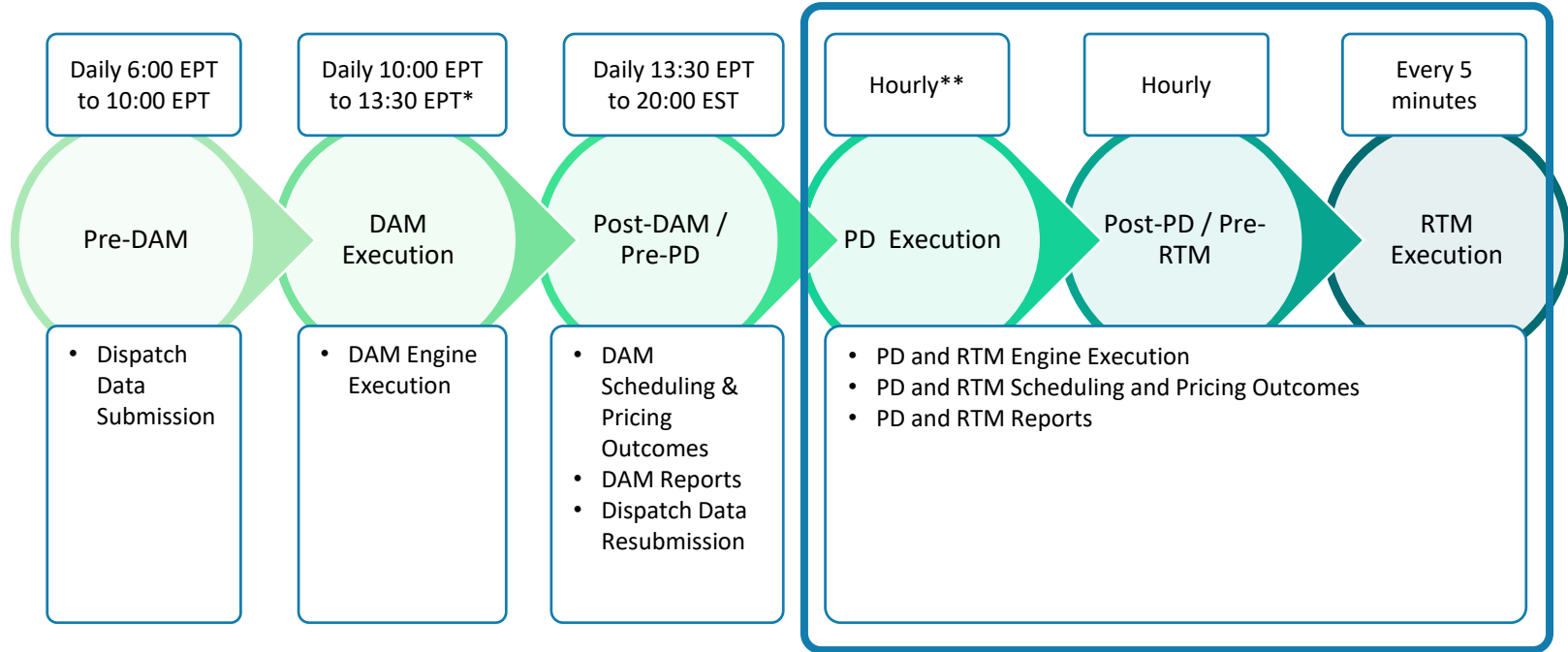
DAM Reports

Report	New or Existing	Public or Private	Description
Day-Ahead Area Reserve Constraints Report	Existing	Public	Hourly maximum and minimum constraints for the area operating reserve regions used by the DAM engine, published at approximately 13:30 EPT
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 Schedule Report	Existing	Private	Hourly DAM energy and operating reserve schedules, issued after DAM completion. Also indicates whether mitigation was applied and the relevant constrained area condition.
DAM Hourly Energy LMP Report	New	Public	LMPs for energy, including LMP components for all generator and load schedule locations, issued after DAM completion
DAM Hourly Operating Reserve LMP Report	New	Public	LMPs for operating reserve, including LMP components for all eligible generator and load schedule locations, issued after DAM completion
Real-time Financial Reference Level Values Report	New	Private	Reference level values to be used by the PD and RTM engines, issued daily at 14:00 EPT

Dispatch Data Resubmission

- All MPs are restricted from revising their submitted dispatch data during DAM engine execution (i.e., the DAM restricted window)
- After DAM completion, dispatch data may be revised ahead of the first PD run and subsequent PD runs, up until the same two-hour mandatory window that MPs are familiar with in today's market

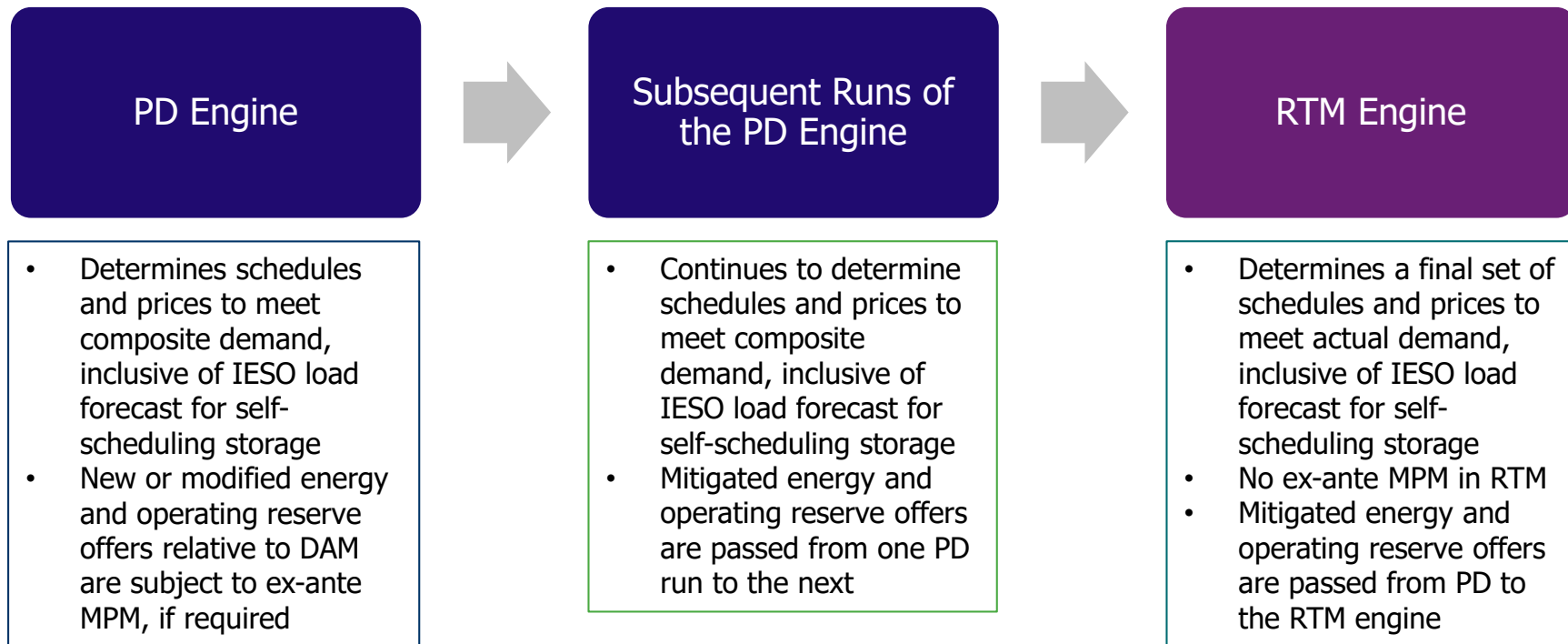
PD to RTM Execution



* 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

PD and RTM Engine Execution



PD and RTM Engine Execution (cont'd)

- If energy and/or operating reserve offers are mitigated by the PD engine, reference level values are used in lieu of offer values for all subsequent PD runs
- MPs may request updates to their reference level values between PD runs if their fuel costs change as per MPM market manual 14.2. Updated reference level value will be used by subsequent PD runs.
- Reminder: the RTM engine uses the reference level values passed from the last hourly PD engine run

PD Scheduling and Pricing Outcomes

- PD energy and operating reserve schedules are produced hourly similar to today. Key input factors that may influence differences in scheduling and pricing outcomes relative to today's PD include:
 - Evaluation of new dispatch data for various resources, for example hydroelectric and GOG-eligible NQS (discussed at future Q & A sessions)
 - Application of ex-ante MPM
 - Constraint violation prices
- Corresponding prices are produced hourly as LMPs at each resource location
- PD schedules and corresponding LMPs are NOT used for settlement

PD Scheduling and Pricing Outcomes (cont'd)

PD Hourly Schedule	Outcomes	Nuclear	VG	SSG	Dispatchable Storage		Self-Scheduling Storage	
					As Gen	As DL	As SSG	As PRL
Energy	Schedule produced	X	X	X	X	X	X	
	LMP produced	X	X	X	X	X	X	X
	Subject to ex-ante offer mitigation	X	X		X			
	Schedule + LMP used for settlement							
Operating reserve	Schedule produced				X	X		
	LMP produced				X	X		
	Subject to ex-ante offer mitigation				X	X		
	Schedule + LMP used for settlement							

RTM Scheduling and Pricing Outcomes

- RTM energy and operating reserve schedules are produced every 5 minutes similar to today (for energy, in the form of dispatch instructions). Key input factors that may influence differences relative to today's RTM include:
 - Evaluation of new dispatch data constraints passed from PD (discussed at future Q & A sessions)
 - Ex-ante MPM decisions passed from PD
 - Constraint violation prices
- Corresponding LMPs are produced every 5 minutes at each resource location
- Actual injection/consumption and corresponding LMPs are used for settlement

RTM Scheduling and Pricing Outcomes (cont'd)

RTM 5-min Schedule	Outcomes	Nuclear	VG	SSG	Dispatchable Storage		Self-Scheduling Storage	
					As Gen	As DL	As SSG	As PRL
Energy	Dispatch produced	X	X		X	X		
	LMP produced	X	X	X	X	X	X	X
	Subject to ex-ante MPM from PD	X	X		X			
	Actuals + LMP used for settlement	X	X	X	X	X	X	X
Operating reserve	Schedule produced				X	X		
	LMP produced				X	X		
	Subject to ex-ante MPM from PD				X	X		
	Schedule + LMP used for settlement				X	X		

PD and RTM Constraint Violation Prices

- The constraint violation prices discussed for DAM scheduling and pricing also apply to PD and RTM scheduling and pricing
- Key difference between PD and RTM is that the constraint violation prices used for PD pricing are informational only whereas for RTM pricing they are used for settlement

PD Reports

Report	New or Existing	Public or Private	Description
Pre-Dispatch Schedules Report	Existing	Private	Hourly energy and operating reserve schedules, issued approximately 30 minutes past each hour. Also indicates whether mitigation was applied and the relevant constrained area condition.
Pre-Dispatch Hourly Energy LMP Report	New	Public	LMPs for energy, including LMP components for all generator and load schedule locations, issued on an hourly basis
Pre-Dispatch Hourly Operating Reserve LMP Report	New	Public	LMPs for operating reserve, including LMP components for all eligible generator and load schedule locations, issued on an hourly basis
Real-time Financial Reference Level Values Report	New	Private	Updated reference level values used by the PD and RTM engines based on MP changes to their reference levels, issued as required

RTM Reports

Report	New or Existing	Public or Private	Description
Dispatch Data Report for Real Time Scheduling Processes	New	Private	Confirmation of an MP's daily and hourly dispatch data submitted into the RTM, issued daily at 6:00 EST following the dispatch day
Real-time Schedules	Existing	Private	5-minute energy and operating reserve dispatch instructions, issued on an hourly basis for all intervals in the previous dispatch hour
Real-Time 5-min Energy LMP Report	New	Public	LMPs for energy, including LMP components for all generator and load schedule locations, issued every 5-minutes
Real-Time 5-min Operating Reserve LMP Report	New	Public	LMPs for operating reserve, including LMP components for all eligible generator and load schedule locations, issued every 5 minutes

Summary of Today's Discussion

- Relevant dispatch data parameters and their applicability within each engine
- Additional features and rules for VG and storage dispatch data submission
- Overview of DAM, PD and RTM engine functionality and relevant scheduling and pricing outcomes
- Overview of ex-ante MPM applicability
- 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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