Renewal Dispatch in Market Clearing Engines: Paper Summary

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Overview

- PJM has posted a paper to support the Renewable Dispatch effort at the Distributed Resource Subcommittee (DISRS)
- Purpose of the paper:
  - provide background on the limitations of PJM's current dispatch logic for renewable resources, specifically wind and solar resources
  - Provide a summary of other ISO/RTO dispatch practices for wind and solar resources
  - provide potential options that can be considered for PJM's Real-time Market Clearing Engines (MCE) to improve the dispatch of wind and solar resources
- The following slides summarize the key points of the paper

Key Point: *Physical Characteristics of Renewable Resources Present Unique Challenges to PJM Dispatch*

Unlimited ramp capability

- Fast moving resources can lead to large MW swings from interval to interval
- Results in constraint volatility, potential ACE swings

Inconsistent bid-in parameters

- Resources operating outside their economic parameters creates discrepancies between SCED solution and reality
- Can lead to out-of-market actions

Key Point: *There are limitations in RT SCED that prevent the optimal dispatch of Wind and Solar Resources*

IMW Solution

- Co-optimization of energy and reserves utilizing the latest SE solution, ramp, and load forecast values
- Assumes all resources reach basepoint at target time

IGD MW (Basepoint) Solution

- Economic basepoints are determined in a post process, based on the IMW solution LMPs
- Must respect bid-in economic parameters

Based on this current logic, SCED solutions and Basepoint signals diverge when resources are operating outside of their bid-in parameters.

RTOs/ISOs Comparison

	Use of Wind and Solar Forecast
PJM	Solar forecast used in ITSCED only
CAISO	Utilize forecast to determine effective economic maximum used in MCE
ERCOT	
ISO NE	
MISO	
SPP	

Disclaimer: PJM has compiled this information from publicly available data and documents (i.e. business manuals, governing documents, FERC filing materials, etc.) in Q3 2024. As such, PJM cannot guarantee the perfect accuracy of the information in this presentation. All information is included here for discussion and education purposes only.

	Ramp Rate Restriction
PJM	No ramp rate restrictions. Utilize Market Participant bid-in ramp rates.
CAISO	No ramp rate restrictions. Utilize Market Participant bid-in ramp rates.
ERCOT	Ramp rate restrictions applied. 20% per min of nameplate rating applied during curtailment instruction.
ISO NE	Ramp rate restrictions applied only when the resource is responding to or released from a curtailment instruction.
MISO	No ramp rate restrictions. Utilize Market Participant bid-in ramp rates.
SPP	Submitted ramp rates must not exceed 40 MW in a five-minute interval (8 MW/min) if resource EmerMax is less than 200 MW. If the resource EmerMax is >= 200 MW, then the ramp rate must be limited to no more than 20% of the EmerMax in a five-minute interval.

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	Real-Time Dispatch Logic / Curtailment Flag
PJM	No special calculation logic. PJM provides a curtailment flag for wind resources, expected to retired by end of 2024.
CAISO	No special calculation logic. A flag is provided with the dispatch basepoint to indicate whether to produce to their full capability or not.
ERCOT	Special curtailment logic exists. Wind and Solar resources that impact transmission constraints are issued a curtailment instruction and expected to generate at or below their SCED issued basepoint.
ISO NE	Do Not Exceed (DNE) Dispatch megawatt points are calculated and communicated electronically at least every five minutes.
MISO	No special calculation logic or curtailment flag.
SPP	SPP will provide a dispatchable flag to the renewable resource indicating whether or not the resource should “follow” or “ignore” its set point instruction

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Solution Areas

- The solution options outlined in this paper are narrowly focused on the following:
  - Reducing the volatility that renewable resources can have on constraint control
  - Improving input data PJM's SCED system uses to dispatch these resources (to improve overall system dispatch).
  - Improving SCED ability to dispatch these resources, thus improving system dispatch and reliability.

Design Concepts for Consideration

Design	Description
Use of Wind and Solar Forecast	Replacement of solar and wind resources' bid-in economic maximum value with forecast value
Use of Dfax/Sensitivity Filters	Dfax Filter on wind or solar resources to identify "effective" resources, which will then be used to determine if a resource should be dispatched for constraint control
Limiting Ramp Rate	Implement a limit on how much ramp capability a wind and solar resource can offer into the market during all periods and/or congested periods
Calculation of a Do Not Exceed (DNE) MW limit	The DNE limit represents the maximum amount of economical wind generation that the system can safely accommodate. This calculation can be performed as an additional optimization solve in the real time dispatch engine after the dispatch basepoint has been determined or by a separate application.

Appendix

Review Key Terminologies

- Security Constraint Economic Dispatch (SCED)
- Look Ahead / Target Time
- Achievable Target MW
- Ramp Rates vs. Capability
- Bid-In Parameters
- Constraints Binding (Shadow Price / Marginal Value)
- Raise Help vs Lower Help (DFAX)

Education: RTSCED and 5 Minute Dispatch

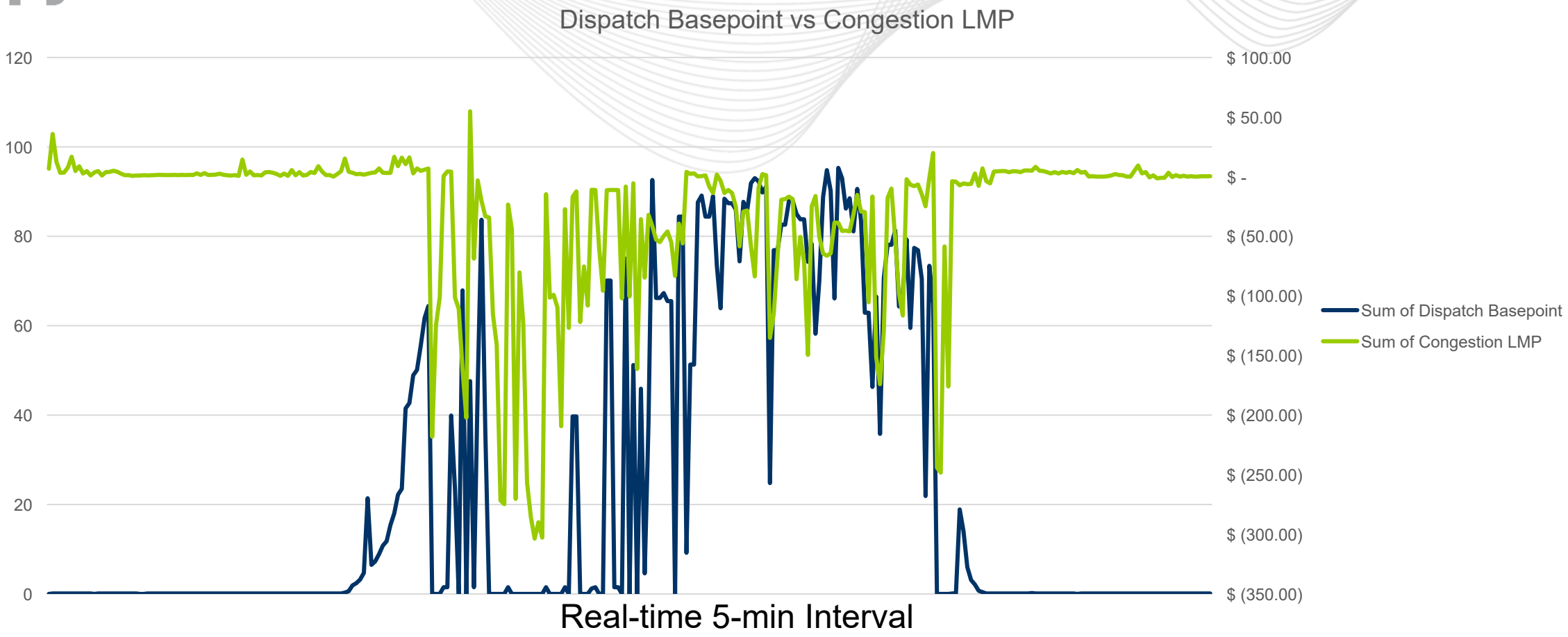
Misalignment of iMW and IGD MW Example

- Both resources operating above their bid-in ecomax

Wind Unit	MARGINAL COST	LMP	SE MW	iMW	IGD MW	ECONOMIC MIN BID IN	ECONOMIC MAX BID IN
A	$0	$10	150	150	90	0	90
B	$0	$10	125	125	100	0	100

Key takeaway: SCED Basepoint is limited by economic parameters. Outdated values can lead to out of market, manual actions by PJM Dispatch.

Example: Dispatch Basepoint vs Congestion LMP



Key takeaway: Existing SCED dispatch logic and input parameters create volatile RT pricing and control issues for PJM Dispatch. This pattern on a larger scale can lead to ACE swings.

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