Manual 11 Wind and Solar Dispatch in Real-Time Market Clearing Engines | Summary of Changes

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November 18, 2026

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M-11 Wind and Solar Dispatch

Action Required	Deadline	Who May Be Affected
Review changes prior to endorsement.	**11/04/2026**	Market Buyers, Market Sellers, CSPs
Communicate to staff about changes to Manual 11 prior to go-live.	**2/1/2027**	Market Buyers, Market Sellers, CSPs







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Background

- Introduced Problem Statement and Issue Charge at June 3, 2024 DISRS meeting
- Completed Key Work Activities:
  - Education, Interests, Solution Options
  - Published paper on renewable dispatch in market clearing engines October, 2024
- One joint proposal with PJM and several stakeholders endorsed at September 2025 MRC.
- FERC accepted the proposal on February 20, 2026.

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Overview

- The proposal creates a concept of an “Effective Economic Maximum” (Effective EcoMax).
- The formulation of Effective EcoMax will be driven based on how the resources was dispatched in the previously approved RTSCED case (M11 section 2.5.3.6)
- If resource was not previously curtailed, a non-curtailment period, the Effective EcoMax will be equal to the State Estimator solution value (Dispatchable range).
- If resource was previously curtailed, a curtailment period, the Effective EcoMax will be the maximum of solved SE value, PJM forecast value or the Bid-In EcoMax value
  - This formula will be in place for 2 consecutive non-curtailment period before the SE value is reflected as the Effective EcoMax.

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Overview

- To help minimize volatility, resources will limit ramp rates no greater than 20% ICAP value per minute for wind and solar resources.
- Effective EcoMax will be utilized in both the dispatch and pricing runs
- No changes to market settlement or intra-day offer rules.
  - Make whole / deviation charges remain status quo and will be based on Bid-in EcoMax.

Reminder: All dispatchable (Economic or Must-run) resources are expected to submit accurate bid-in parameters, including ramp rates, and follow PJM's dispatch signal for target time as closely as possible

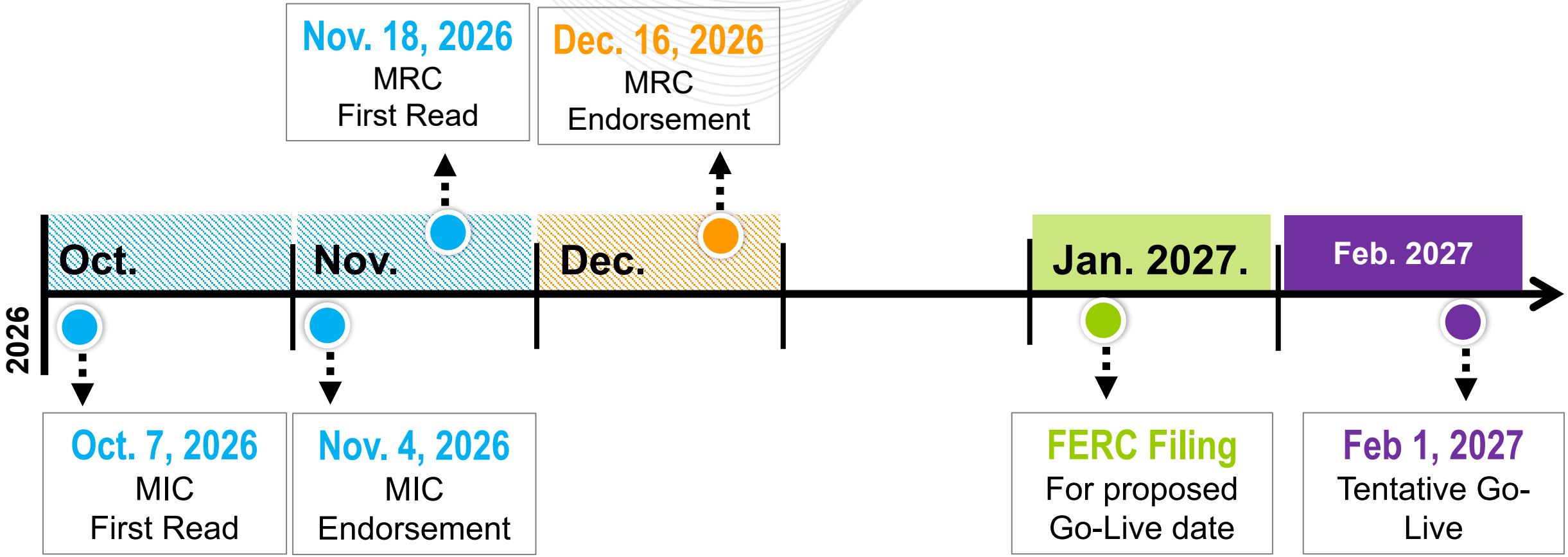
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Summary of M11 Changes

Section	Description
2.3.12	New section provides summary of Market Participant expectations for resource parameters.
2.5.3.6	New section describes the formulation of Effective Economic Maximum and how it is applied to Wind and Solar resources in Real-Time SCED.
2.6	Updated that the State Estimator solution may be used in determining the Effective Economic Maximum.
2.7.1	Effective Economic Maximum will be used for Fast Start Pricing where applicable.
4.2.3	Effective Economic Maximum will be used for any approved Wind and Solar resources to determine their capability for Ancillary Services.

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Review/Endorsement Timeline



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Appendix

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Terminology for Examples

Name	Type	Description
Interval		Each row represents one hypothetical RTSCED case solution.
SE MW	Input	Solved State Estimator solution value, which is treated as the initial MW for each RTSCED case.
Curtailment Flag	Input	Proposed resource specific flag, used to determine the Effective Economic Max that should be use for the current interval. This is based on previously approved RTSCED case solution.
Forecast MW	Input	PJM forecast MW data.
Bid-in EcoMax	Input	Resource Bid-In Economic Maximum MW.
Effective EcoMax	Input	Proposed dispatchable range, up to effective EcoMax. In this option, the Effective EcoMax would be based on the formula: Effective EcoMax = Max (SE, Forecast, Bid in EcoMax) when resource is previously curtailed.
Calculated Basepoint	Output	Based on RTSCED solution would be the proposed, calculated output based on the effective EcoMax formula and economics of the unit and case.
Curtailment Flag	Output	Calculated based on RTSCED case solution, based on the effective EcoMax and economics of the unit and case.
Description		Interpretation of the case solution.

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Example 1 - Unit Operating Above Bid-In EcoMax

Interval	SE (MW)	Curtailed	Forecast MW	Bid-In EcoMax (MW)	Effective EcoMax (MW)	Calculated Base Point	Curtailed	Description
Type	Input	Input	Input	Input	Input	Output	Output	
1	0	0	0	100	0	0	0	Unit is offline
2	50	0	75	100	50	50	0	Unit is online, dispatchable up to Effective EcoMax, which is equal to the SE value because the unit was not curtailed in the previous interval.
3	110	0	75	100	110	110	0	Unit continues to produce more MWs, since it was not curtailed in the previous interval, continues to be dispatchable up to effective EcoMax, which is the SE value at this point.
4	95	0	95	100	95	95	0	Effective EcoMax continues to be based on the solved SE value since it was not curtailed in the previous interval.

*Since unit is not curtailed, Effective EcoMax = SE Value.

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Example 2 – Transition Period

Interval	SE (MW)	Curtailed	Forecast MW	Bid-In EcoMax (MW)	Effective EcoMax (MW)	Calculated Base Point	Curtailed	Description
Type	Input	Input	Input	Input	Input	Output	Output	
1	110	0	75	100	110	85	1	1)Unit providing above bid-in EcoMax. 2)Assume constraint binds and SCED needs to move the unit down to 85MW. 3) Unit was not previously curtailed. Effective EcoMax would be up to 110MW.
2	90	1	95	100	100	85	1	1) Constraint continues to bind. 2) Unit moves down but not enough. 2) Resources continues to be dispatched to 85 MW. 3) Unit continues to be curtailed since it is not dispatched up to Effective EcoMax (assuming economic would have allowed it to be).
3	85	1	95	100	100	100	0	1) Unit moves down to 85 MWs, constraint no longer active. 2)Effective EcoMax formula in place because resource was previously curtailed within 2 RTSCED cases. 3) Resource dispatched up to calculated EcoMax, 100MW 4) **Transition period.**
4	90	0	95	100	100	100	0	1) Constraint no longer active. 2) Effective EcoMax formula in place because resource was previously curtailed within 2 RTSCED cases. 3) Resource dispatched up to calculated EcoMax, 100MW 4) **Transition period.**
5	110	0	95	100	110	110	0	1) Constraint no longer active. 2) Effective EcoMax formula changes to reflect SE is no longer curtailed for 2 consecutive approved RTSCED cases. 3) Resource is dispatched up to SE MW, 110MW.

When previously curtailed* = Effective EcoMax = Max (SE, Forecast, Bid-in EcoMax)

***This formula will be in place for 2 consecutive non-curtailment period.**

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Settlements Impact of Proposal

- The approved changes are to effectively update the bid-in Economic Max value considered in RTSCED for Solar and Wind resources.
- No settlements changes were included in the proposal, which means bid-in Economic Max, rather than the Effective Economic Max will be used in settlements.
- The bid-in Economic Max influences several key calculations in Operating Reserve Settlements.
- The following slide illustrates impacts of continuing to use bid-in Economic Max in Settlements.

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Status Quo and Use of Eco Max in Operating Reserves

Desired MW Type	Status Quo	Proposal (use of Effective Eco Max) absent any Settlement Changes	Impacts
Ramp-limited Desired (RLD)	Output level that a resource should have achieved *between* Dispatch Signals. The Dispatch Signal is a direct input. The calculated RLD is capped at bid-in Economic Max in Settlements.	Because the dispatch signals are proposed to use the Effective Eco Max, the Effective Eco Max is inherently used in calculating the RLD MW. The RLD will continue to be capped at bid-in Economic Max in Settlements.	The cost of the MWs produced above bid-in Eco Max may not be compensated through make whole or LOC. *This is the same as how it works today.*
Dispatch signal MW or Basepoint MW	Output level requested via the dispatch basepoint bound by bid-in Eco Min and Eco Max. This value is issued by PJM's real-time dispatch tools. The Dispatch signal is capped at bid-in Economic Max in Settlements.	Because the dispatch signals are proposed to use the Effective Eco Max, the dispatch basepoint will be bound by the bid-in Eco Min and Effective Eco Max. The Dispatch signal will continue to be capped at bid-in Economic Max in Settlements.	The cost of the MWs produced above bid-in Eco Max may not be compensated through make whole or LOC. *This is the same as how it works today.*
Dispatch LMP Desired	Output level based on the dispatch run LMP and the incremental offer curve. This value is not ramp limited. The Dispatch LMP Desired is capped at bid-in Economic Max in Settlements.	The Dispatch LMP Desired will continue to be capped at bid-in Economic Max in Settlements.	The cost of the MWs produced above bid-in Eco Max may not be compensated through make whole or LOC. *This is the same as how it works today.*

Any settlement impacts of the change to use Effective Eco Max in SCED can be minimized by updating the bid-in Economic Maximum to reflect real-time operating conditions.

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