


FERC Order 841: Electric Storage Participation in Markets

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- November 4, 2016 [FERC NOPR on Energy Storage and Distributed Energy Resources.](#)
- February 15, 2018 [FERC Final rule Electric Storage Participation Markets](#)
- December 3, 2018
 - [PJM ESR Accounting Proposal filing](#)
 - [PJM ESR Markets and Operations Proposal](#)
- December 10, 2018 [PJM limited answer to ESR filing](#)
- March 5, 2019 [PJM responds to protests and comments](#)
- April 1, 2019 [FERC Request for Additional Information](#)
- May 1, 2019 [PJM Response to FERC Questions](#)
- May 16, 2019 [FERC Order on Rehearing and Clarification](#)
- May 14, 2019 [PJM submits additional answers](#)
- Dec 3, 2019 [Implementation Issue Tracking](#)

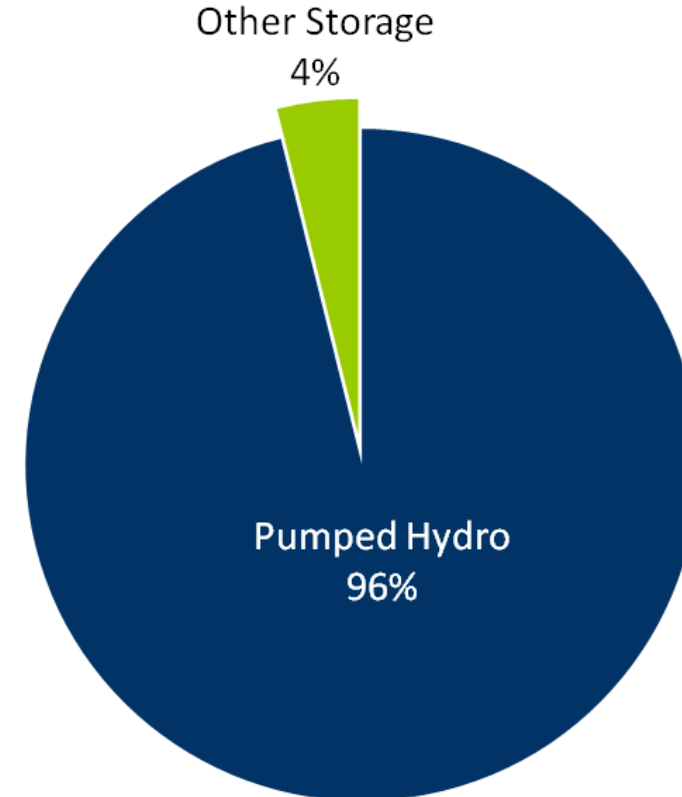
1. Can sell* energy, Capacity, and A/S (incl. Black Start etc.)
the resource is technically capable of providing
2. Dispatched and sets price as seller and buyer
3. Bid parameters that account for ESR characteristics
4. Min market threshold is 100 kW  = already in compliance
5. Stored MWh are billed at LMP as wholesale

* "Eligible to provide..."

Electric Storage Resource Definition

- Electric Storage Resource (**ESR**)= “a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid.”
- Connected at: transmission, distribution, or behind a customer meter.
 - PJM has ESR at both T and D today, none behind a meter **that inject.**
- Excludes demand response.
- Includes pumped hydro

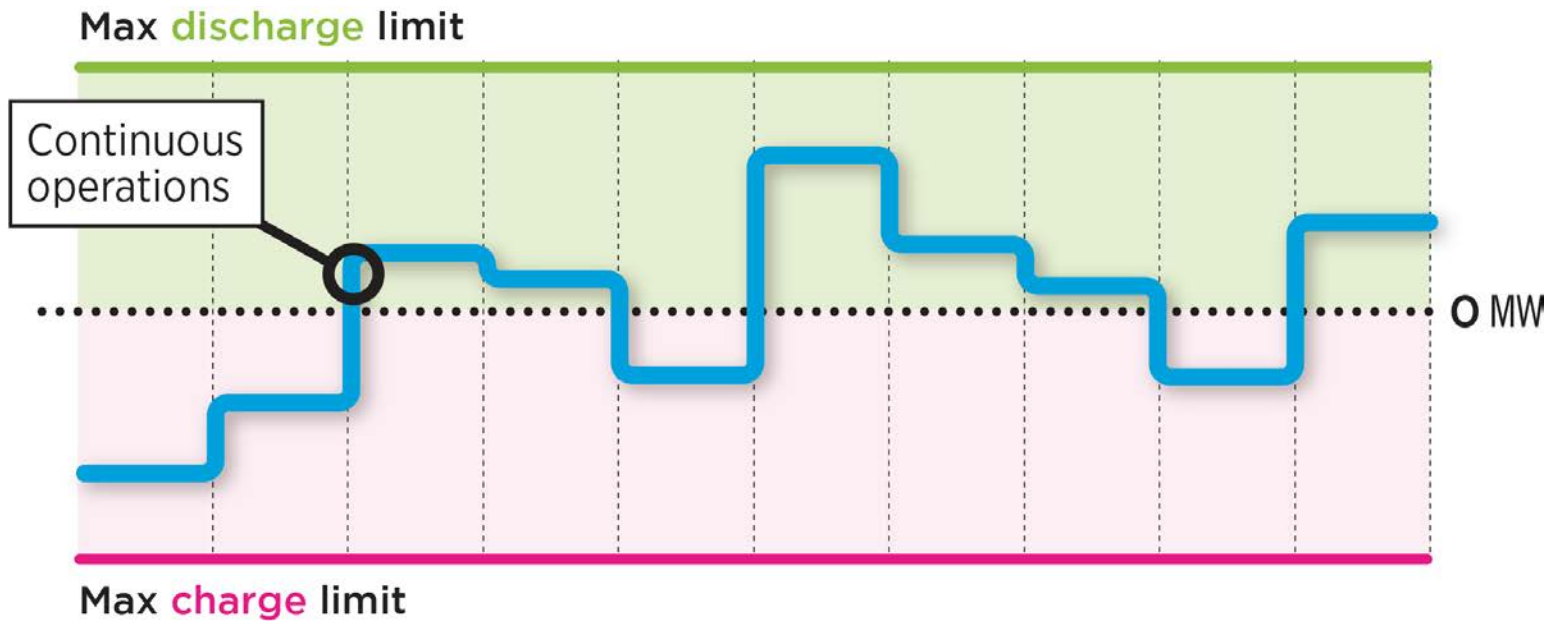
Over 5,300 MW of Electric Storage Resources currently in PJM



** Data taken from Generation Queue and EIA 860

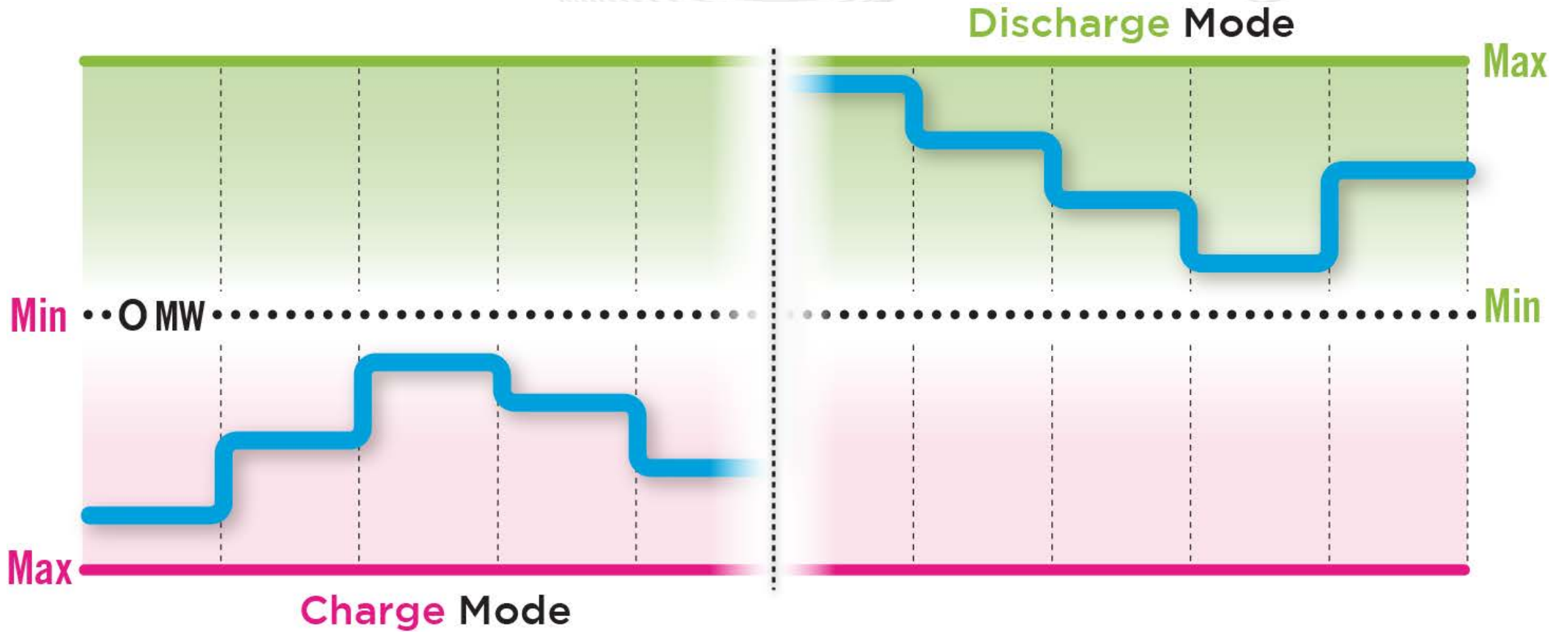
- ESRs will be modeled as one continuous resource
- PJM will not make commitment decisions in the ESR model
 - Start-up and no load cost will not be considered
- PJM will not manage state of charge
 - Resource owners use mode of operation, offers, and parameters
- 3 modes of operation:
 - Continuous, Charge & Discharge
- Parameters
 - Max/Min charge/discharge, etc
 - Ramp rate considered infinite only in continuous mode

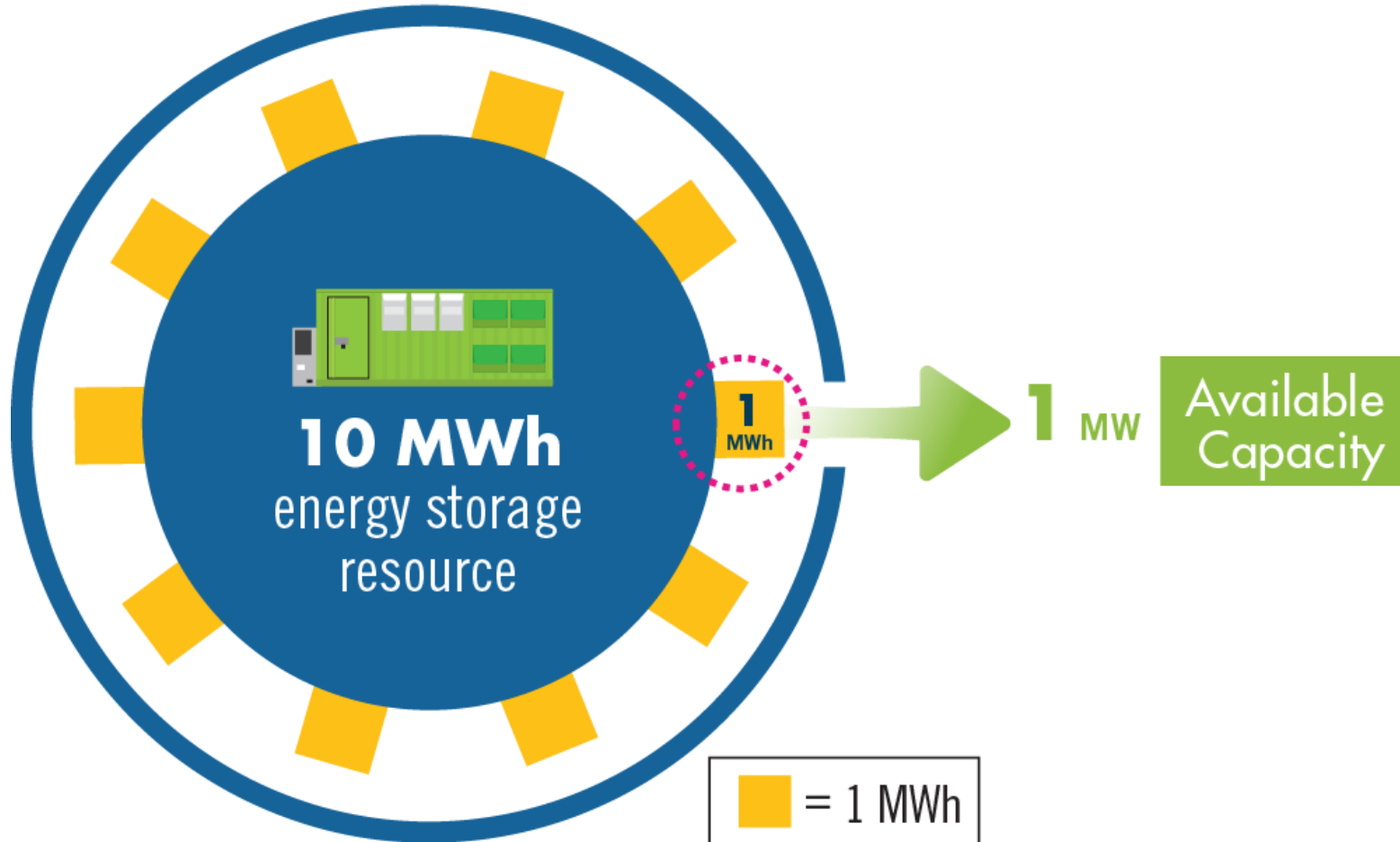
ESRs can update their max charge and discharge limits hourly in day-ahead, and more frequently in real-time.



Price	MW
\$ 10.00	20
\$ 9.00	15
\$ 8.00	10
\$ 7.00	5
\$ 6.00	0
\$ 5.00	0
\$ 4.00	0
\$ 3.00	-5
\$ 2.00	-10
\$ 1.00	-15

** State of charge telemetry will be requested for telemetered resources

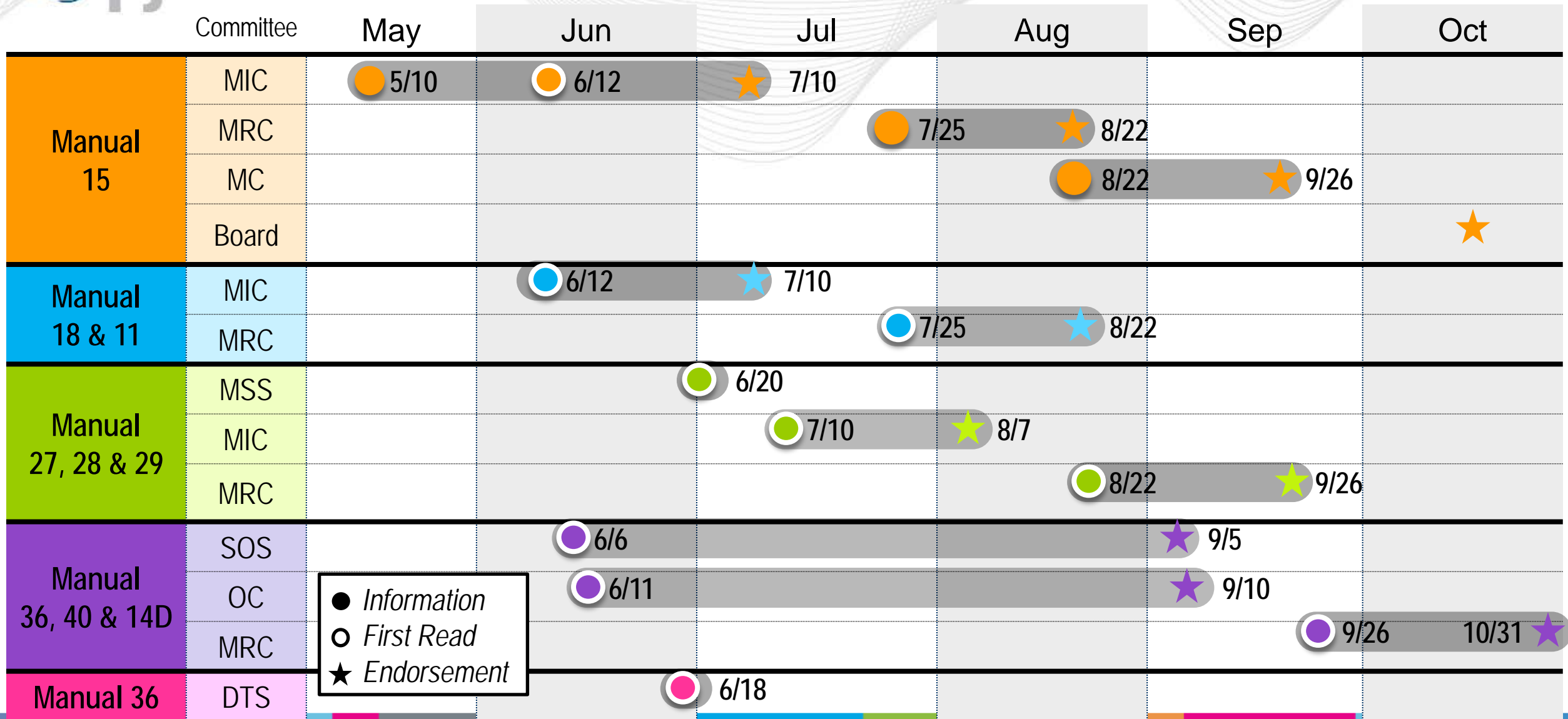




PJM maintaining the requirement, per manual 21, that capacity resources have a minimum 10 hour duration.

ESR capacity interconnection rights will be derated based on the total energy capability of the resource
- Total MWh/10h

2019 FERC 841 Manual Changes



- Questions: esr@pjm.com
- [Issue Tracking: Electric Storage Participation - FERC Order 841](#)