



Order 841: Straw Proposal



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Market Implementation Committee –
Electric Storage Resources
August 3, 2018

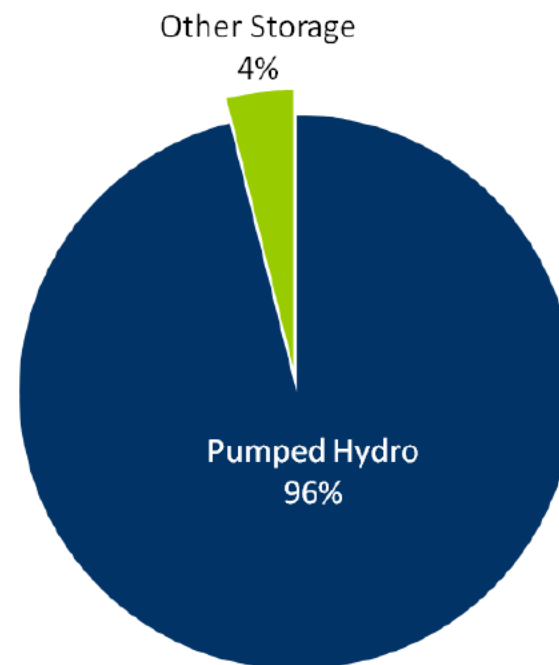
- November, 2016: FERC Notice of Proposed Rulemaking on Energy Storage and Distributed Energy Resources.
 - February, 2018: FERC [final rule on storage](#) ...
 - **Filing due Dec 3, 2018.**
 - Implementation due Dec 3, 2019.
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- » Order: <http://pjm.com/-/media/documents/ferc/orders/2018/20180215-rm16-23-000.ashx>
 - » PJM Request for Clarification: <http://pjm.com/-/media/documents/ferc/filings/2018/20180316-rm16-23-000-ad16-20-000.ashx>



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



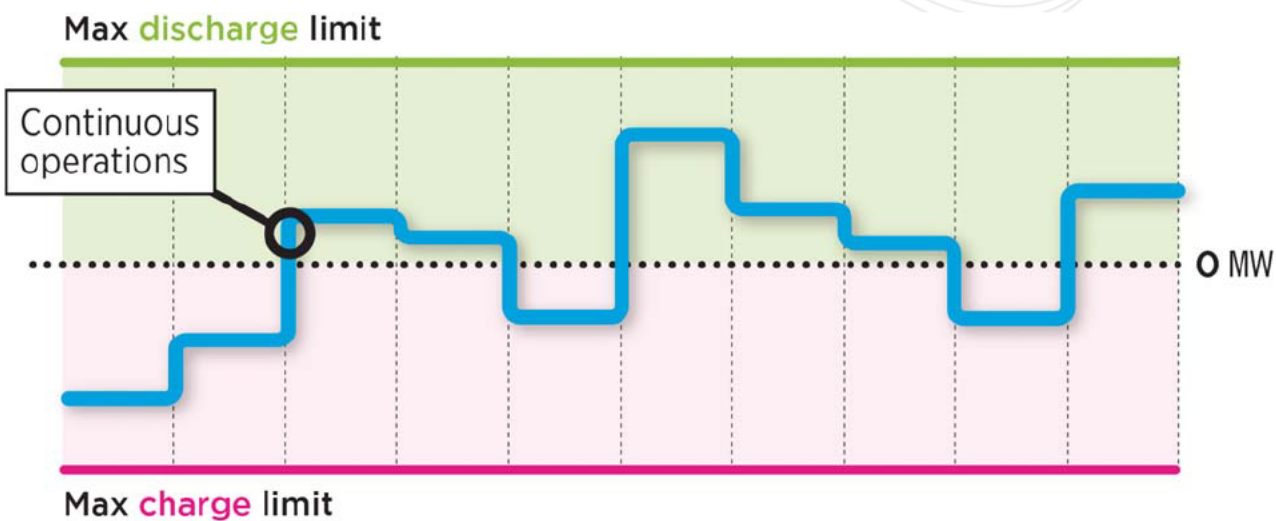
** Data taken from Generation Queue and EIA 860

	Major Change needed
1. Can sell* energy, <u>Capacity</u> , and A/S (incl. Black Start etc.) the resource is technically capable of providing	Must create a model for energy participation, clarify the duration requirements of capacity
2. <u>Dispatched</u> and <u>sets price</u> as seller and buyer	Develop rules around make whole, ensure engines can dispatch at negative
3. Bid parameters that account for ESR characteristics	An interesting issue to deal with without full optimization
4. Min market threshold is 100 kW	Difficult for modeling and telemetry
5. Stored MWh are billed at LMP as wholesale	Accounting, PowerMeter

* “Eligible to provide...”

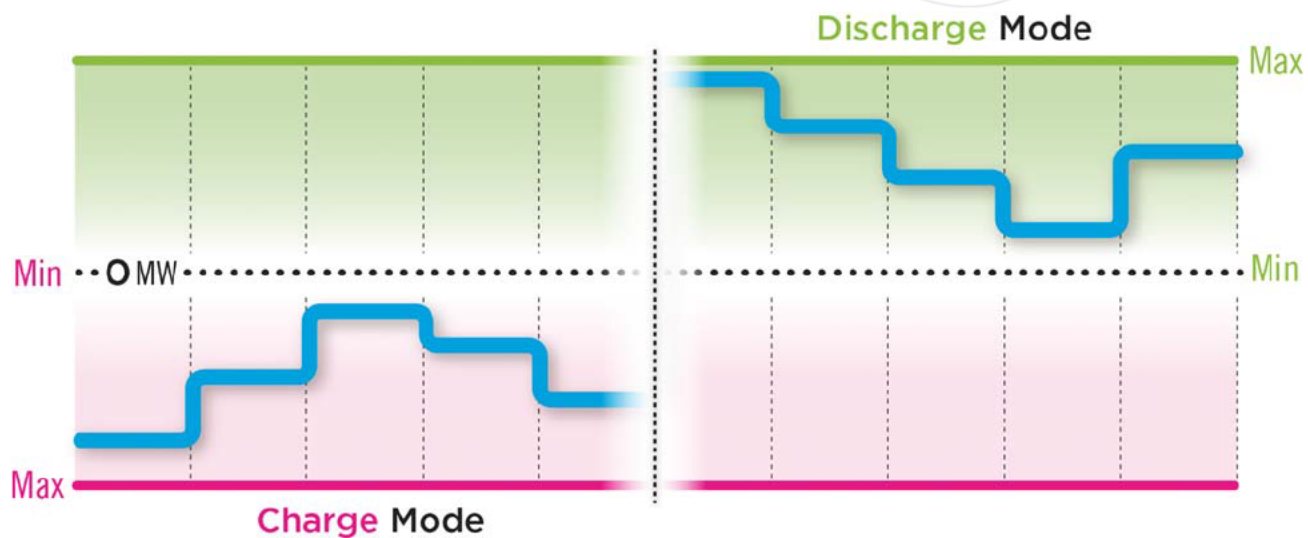
- ESRs will be modeled as one continuous resource
- PJM will not make commitment decisions in the ESR model and not manage state of charge
- 3 modes of operation:
 - Continuous, Charge & Discharge
- Parameters
 - Offered in through Markets Gateway
 - Max/Min charge/discharge, etc
 - Ramp considered infinite

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



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

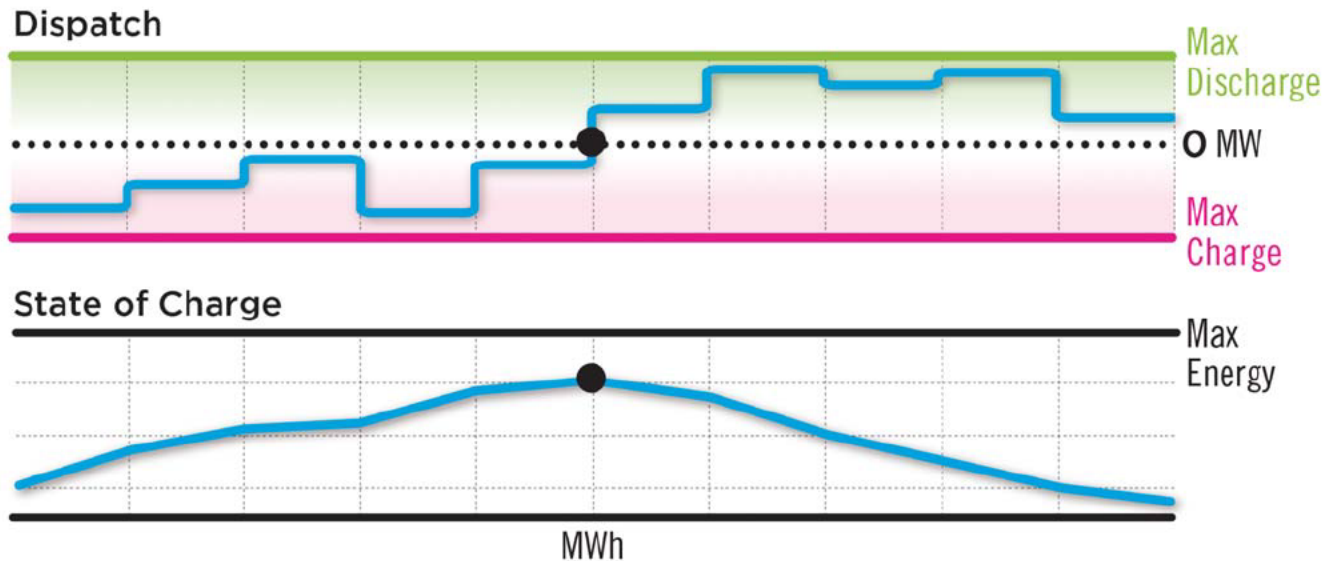
** State of charge telemetry may be needed in the future



Charge & Discharge mode - Minimum charge and discharge must be set to zero megawatts.



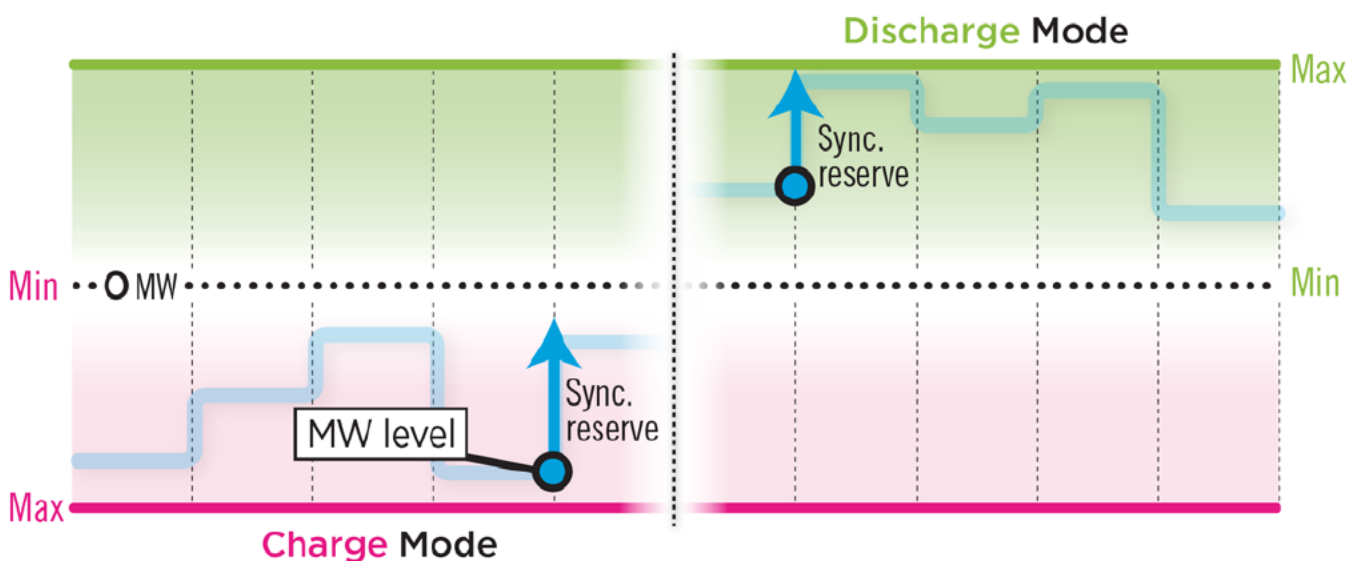
Asset Owners Manage SoC



ESR resources can manage their own state of charge through the different modes and updates to limits, as well as hourly price offers in DA. Self-schedule will be available for ESRs.

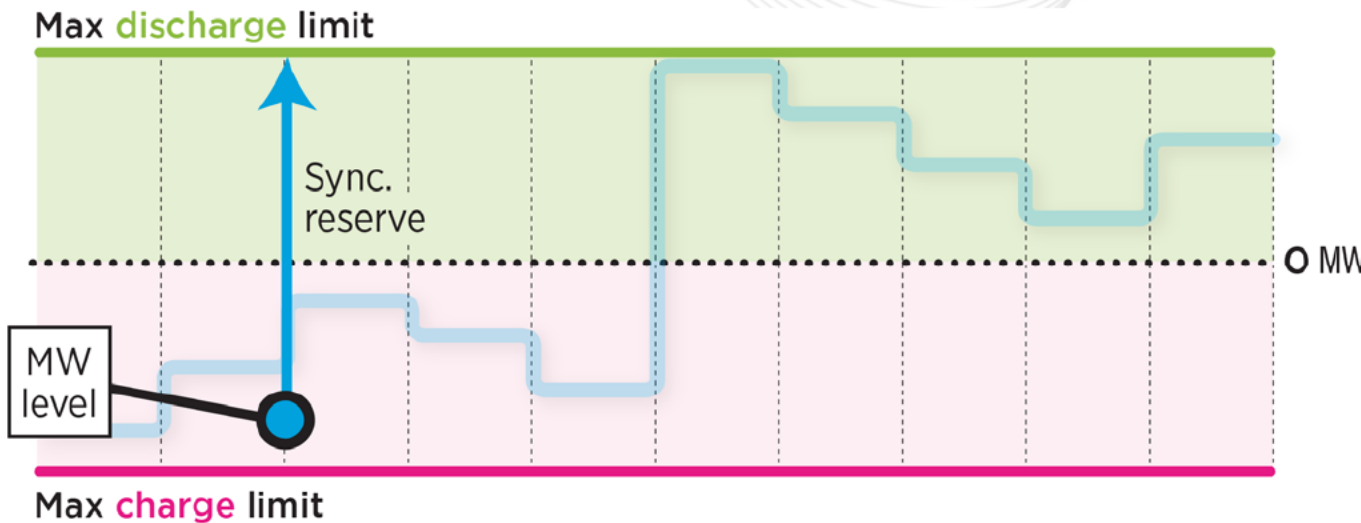
- Synchronized Reserve Amounts will need to be offered in and updated in RT.
- ESRs will opt-in for synchronized reserves
- Possible to offer synchronized reserve without energy offer (Similar to regulation)

Calculation of Synchronized Reserves



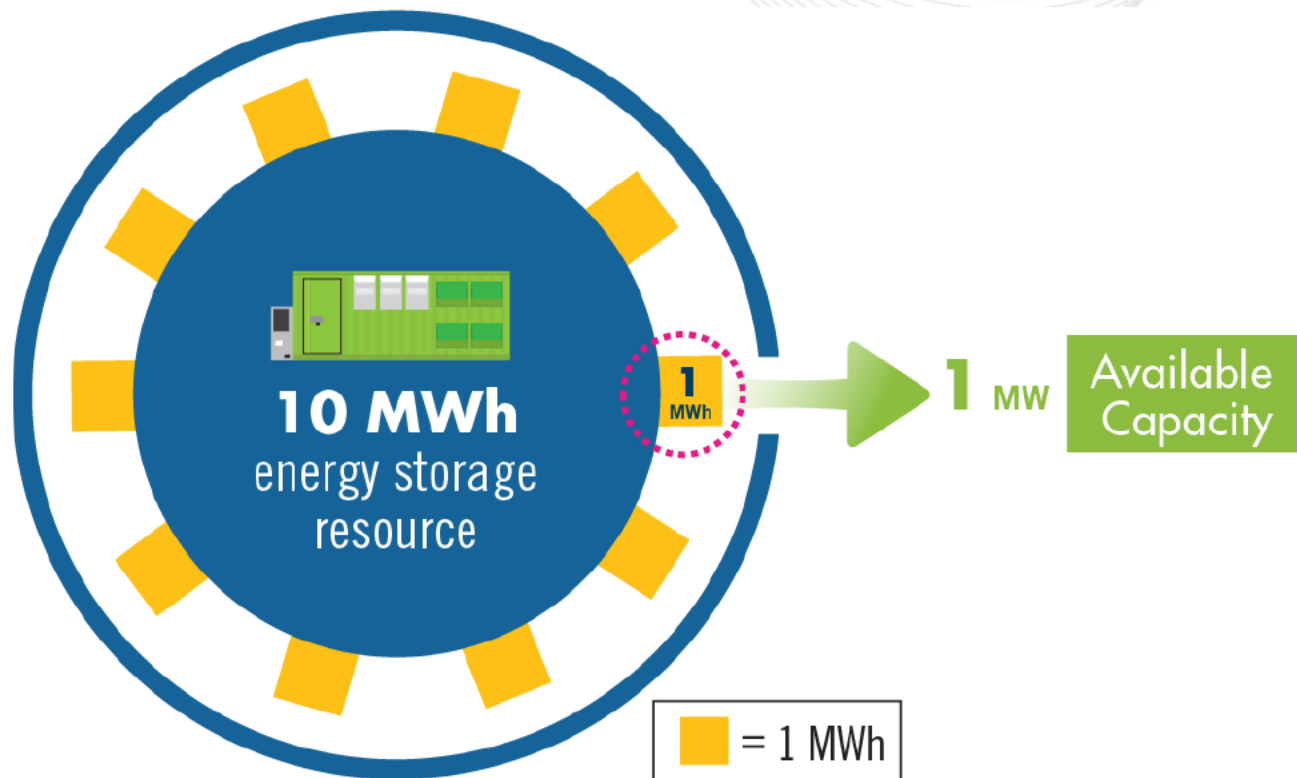
If an ESR opts into providing synchronized reserves, the amount calculated in charge mode will be to zero and in discharge mode the amount will be calculated to the maximum discharge amount.

Calculation of Synchronized Reserves (cont.)



When units are operating in continuous mode, the reserve amount will be to the maximum discharge limit.

In all modes, the amount of response provided during an event will determine compensation.



PJM proposes that status quo, per manual 21, of a minimum of 10 hour duration is maintained in the capacity market.

- DA must offer for capacity storage
 - If a 1 MW capacity obligation, does the unit need to schedule availability of 10 MWh in the Day-Ahead market?
- Criteria for using ESR model
- Make whole adjustments



After compliance filing

- Cost offer development
- Rules for emerging technologies
- Manual Rules

PJM can be contacted at esr@pjm.com

Last MIC Special Session: 09/14/2018 1-4 PM

Report out:

- OC: October 9, 2018
- PC: October 11, 2018
- MIC: October 14, 2018
- MRC: October 25, 2018