



Order 841: Updated Straw Proposal



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Electric Storage Resources
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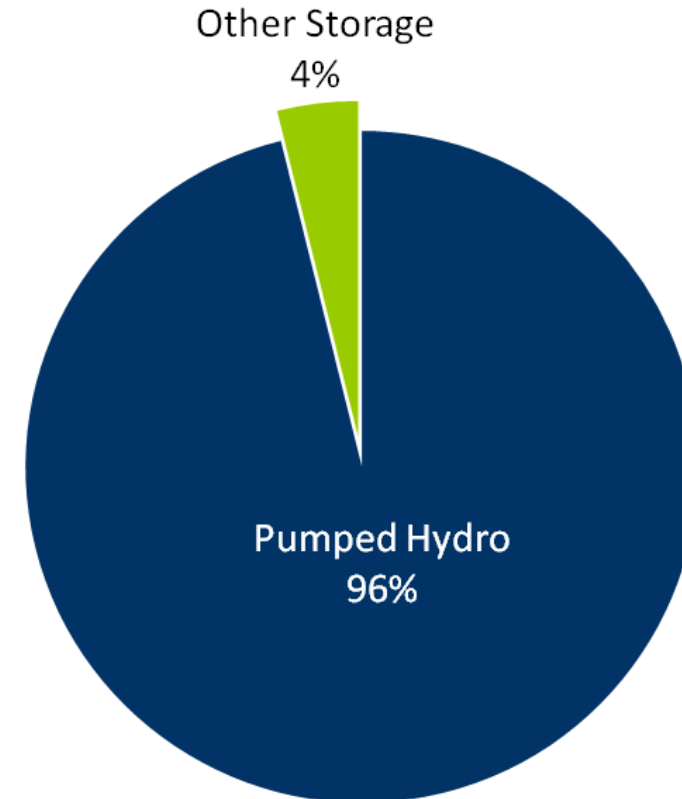
- **PJM is modifying the [Straw Proposal presented August 3, 2018](#)**
 - Ramp rates are not required to be 999 in charge and discharge but must reflect unit's ramp capability
 - Charge and Discharge modes can have minimum charge/discharge levels (not required to be zero)
 - Resource will telemeter state of charge to PJM for informational purposes only
 - DA must offer is status quo
 - Capacity Storage can self schedule to meet their must offer req

- 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.
 - » 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



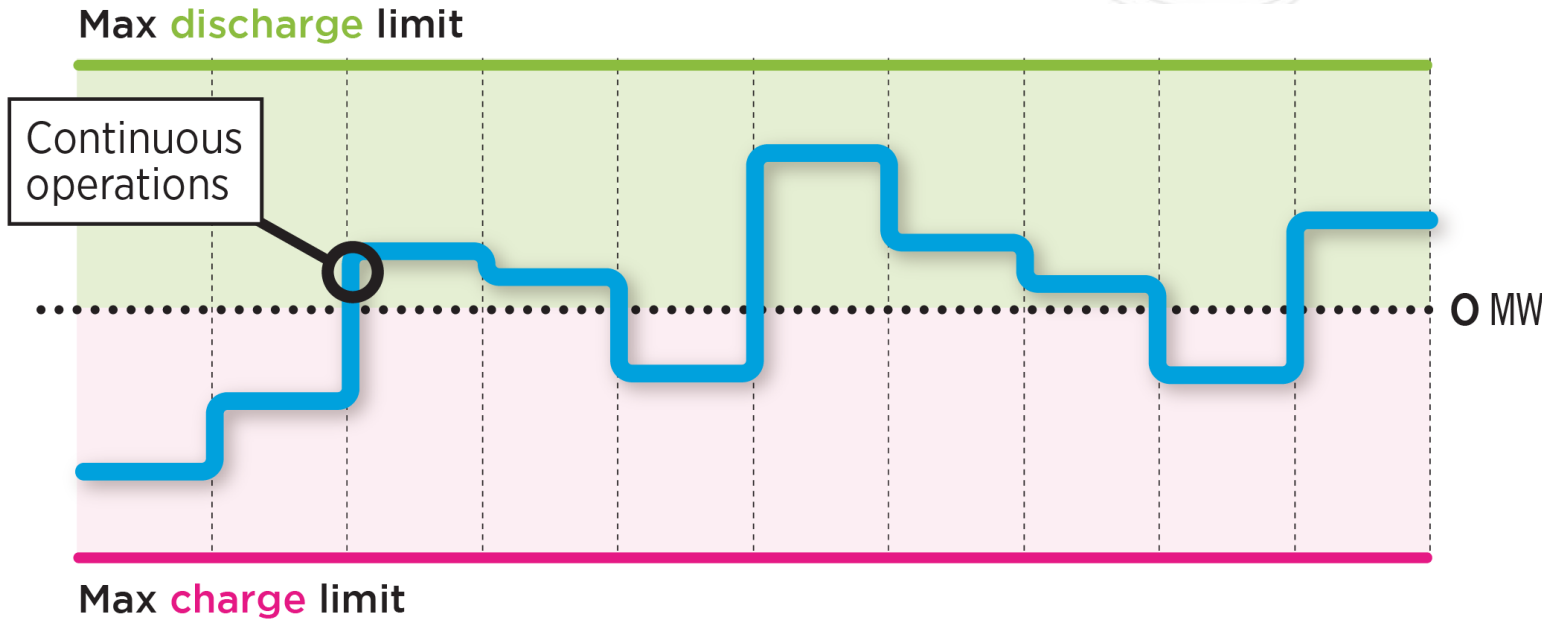
** Data taken from Generation Queue and EIA 860

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
5. Stored MWh are billed at LMP as wholesale

* *“Eligible to provide...”*

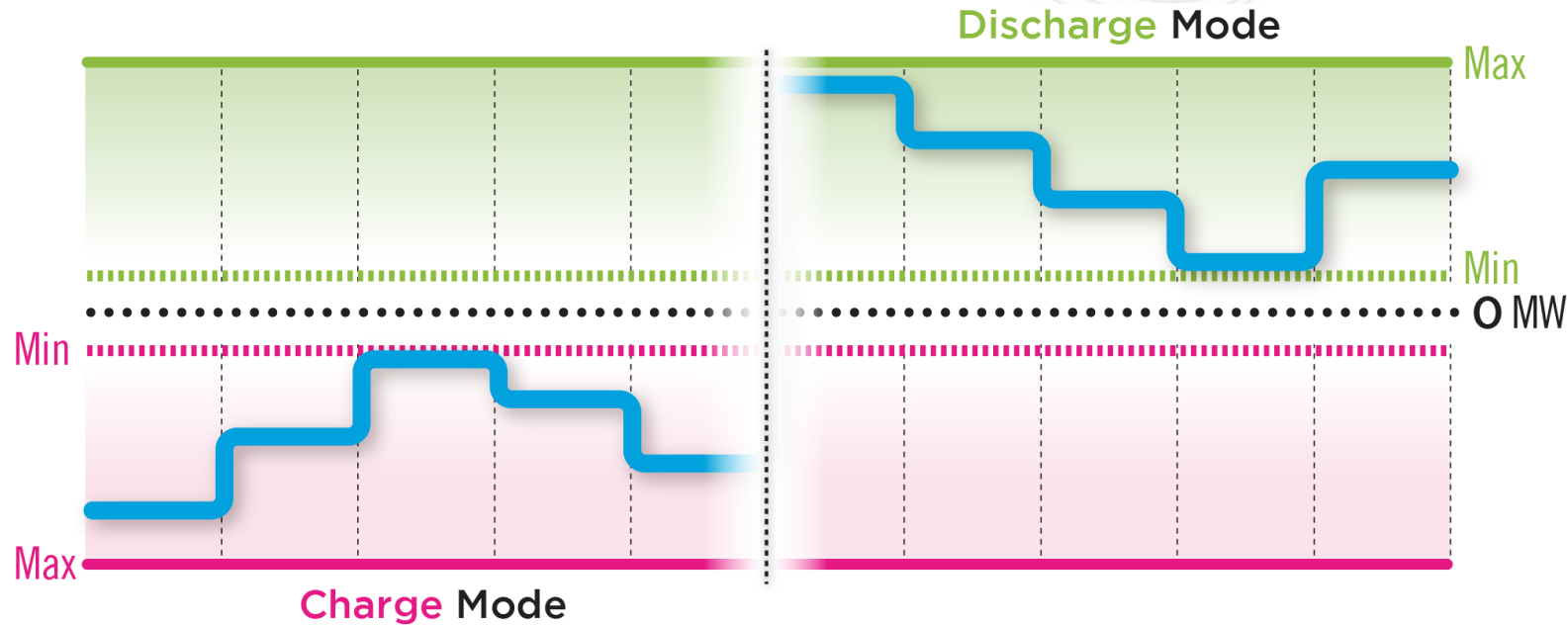
- ESRs will be modeled as one continuous resource
- PJM will not make commitment decisions in the ESR model and not manage state of charge
 - Start and no load cost will not be considered
- 3 modes of operation:
 - Continuous, Charge & Discharge
- Parameters
 - Offered in through Markets Gateway
 - Max/Min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

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

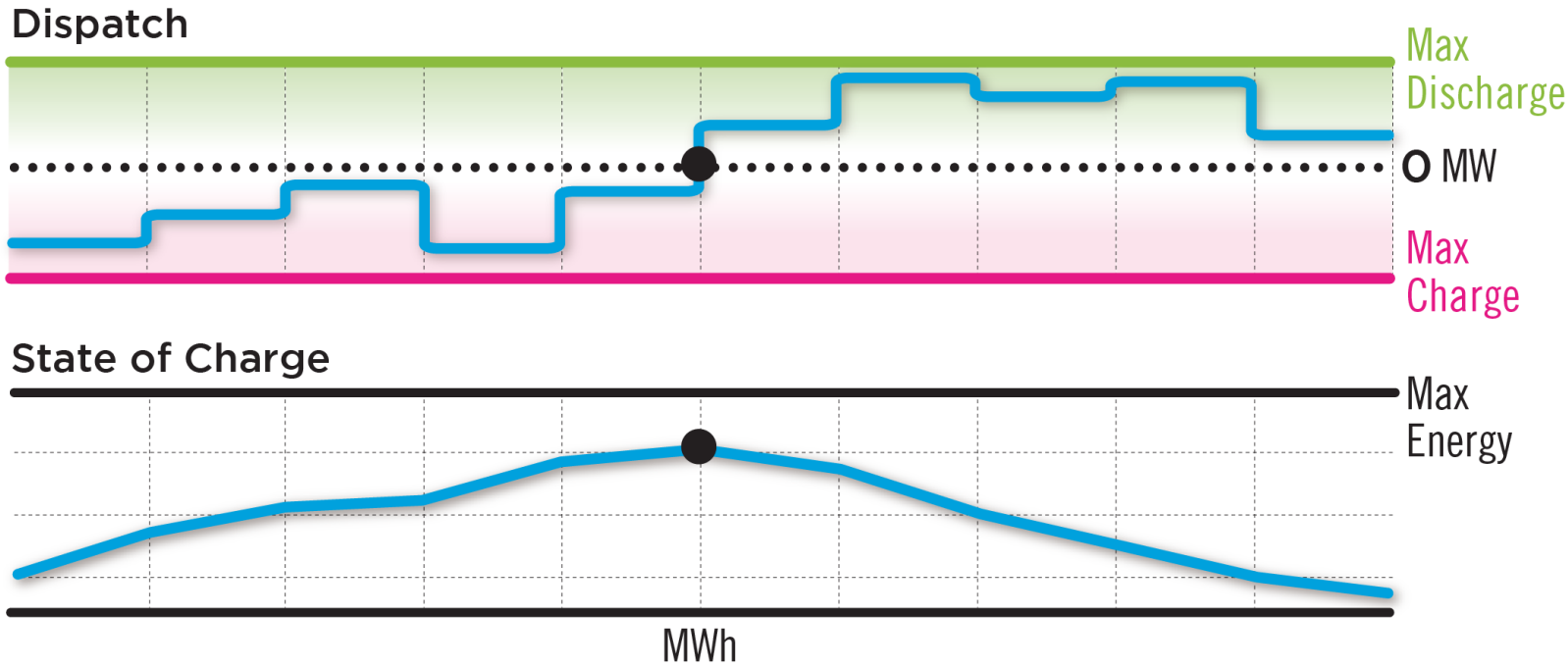


Continuous operation mode - ESRs can update their max charge and discharge limits hourly in day-ahead and more frequently in real-time.

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

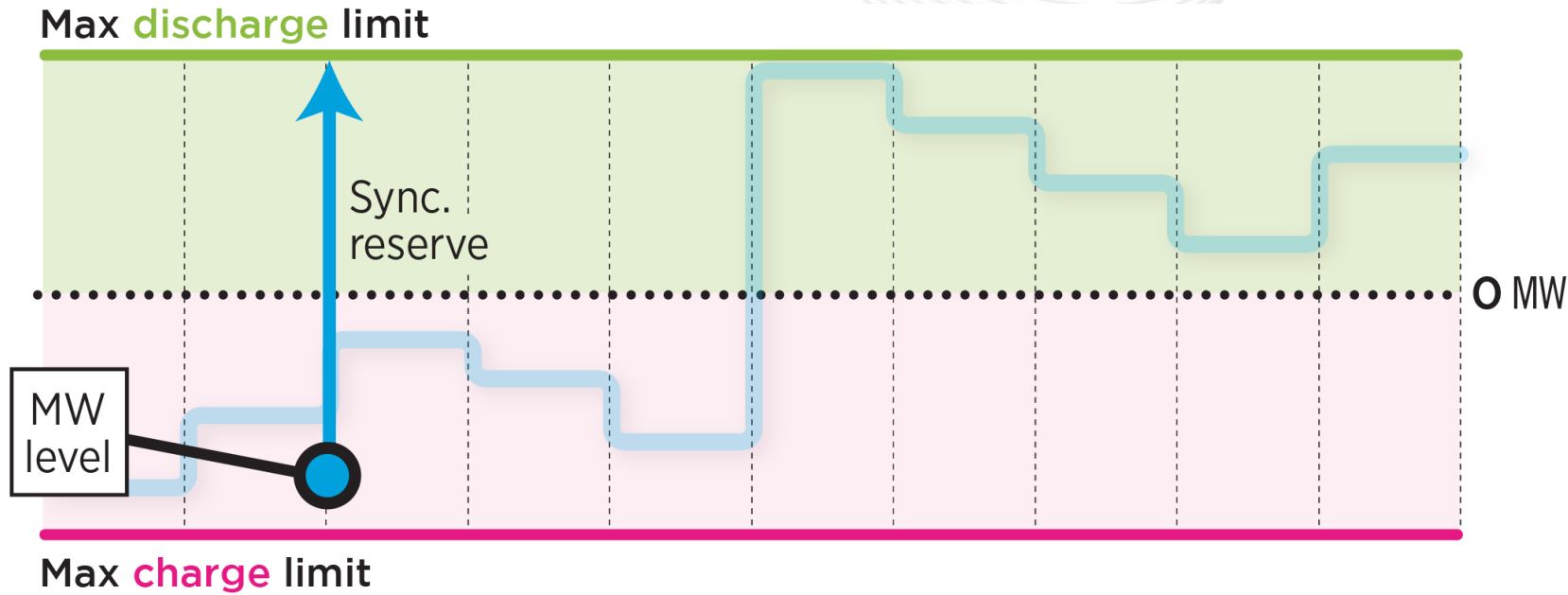


Charge & Discharge mode will be available to ESR resources in DA and RT



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.

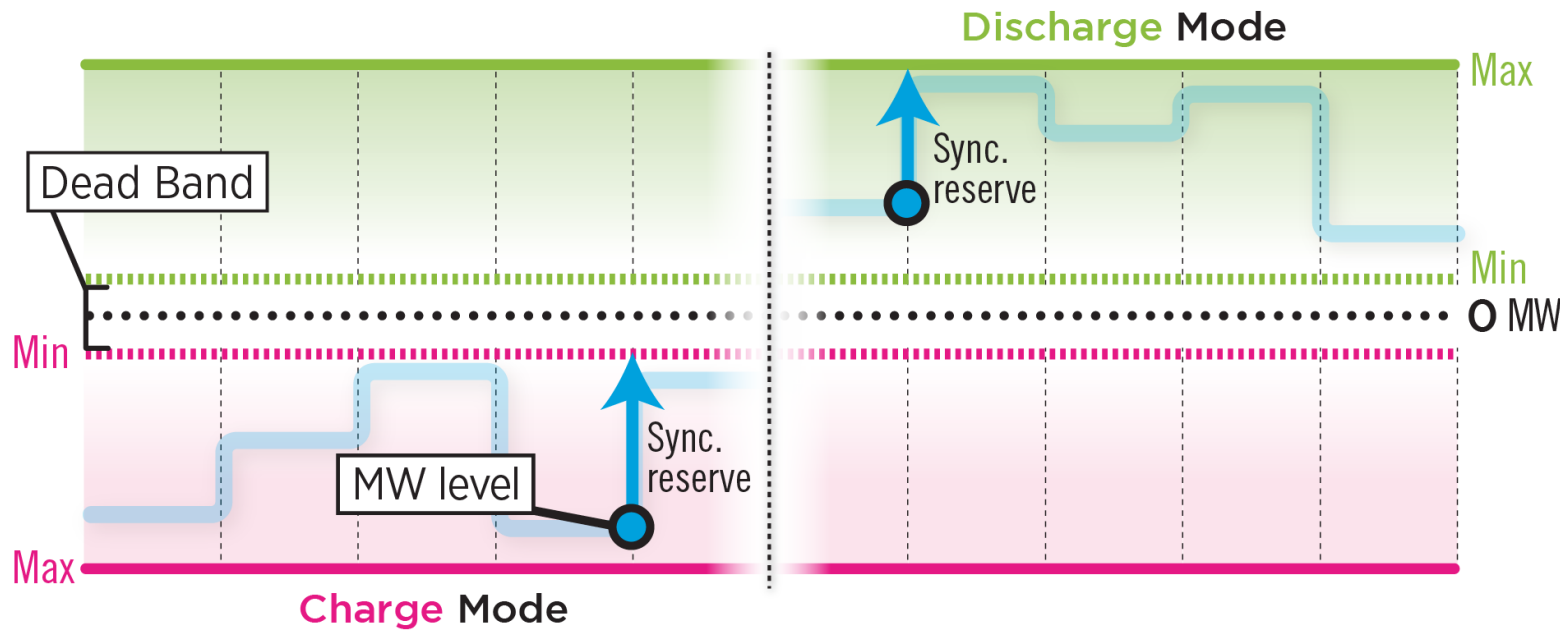
- Synchronized Reserve Amounts will need to be offered in and updated in RT.
- ESRs will opt-in for synchronized reserves
- Possible to offer synchronized reserve without energy offer (Similar to regulation)



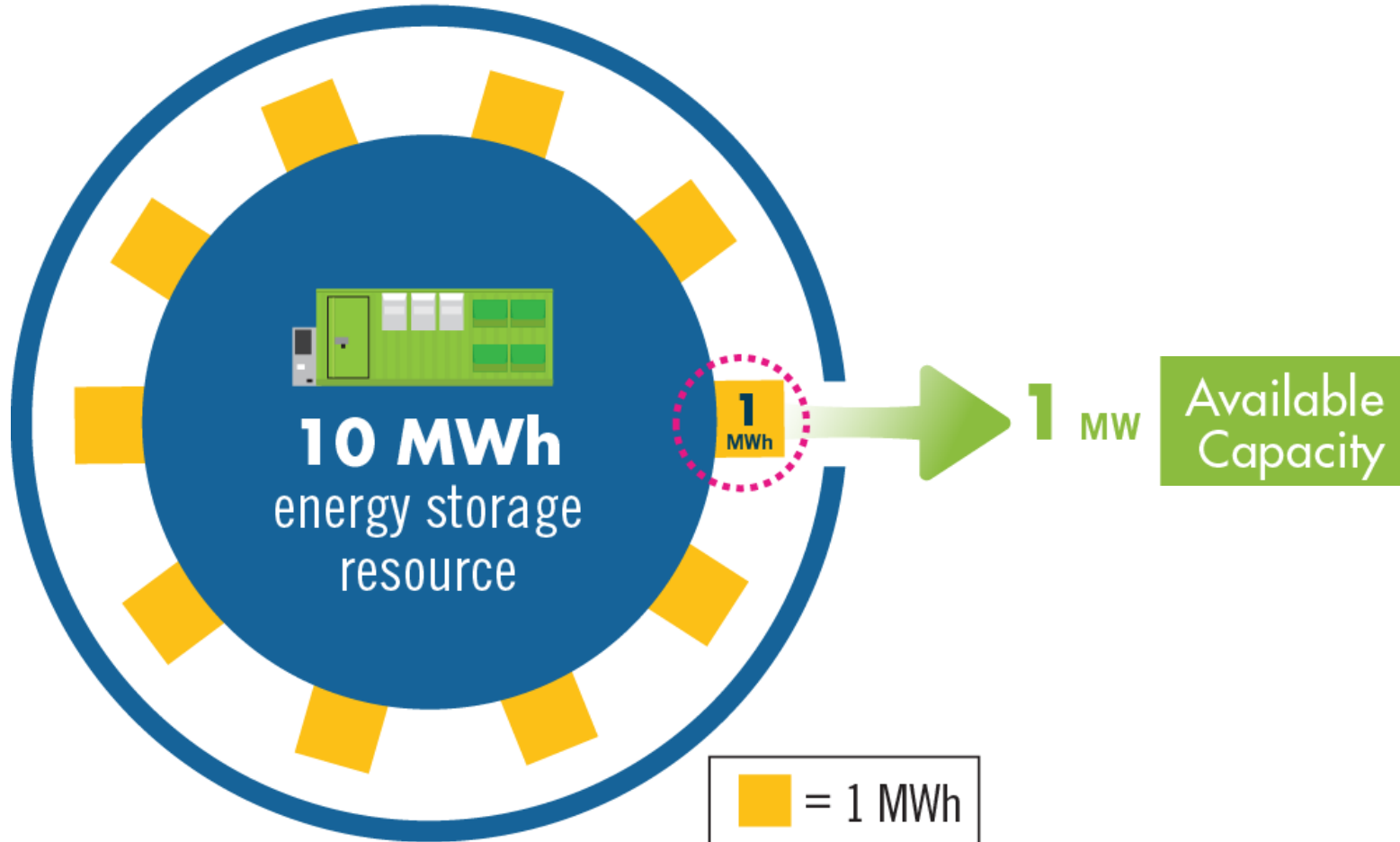
When units are operating in continuous mode, the reserve amount will be to the maximum discharge limit.

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

Calculation of Synchronized Reserves



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



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
 - Status quo: The hourly Day-ahead self-scheduled values for intermittent resources and Capacity Storage Resources may vary hour to hour from the capacity obligation value.

- Criteria for using ESR model
 - FERC definition – “a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid.”
- Make whole adjustments
 - Eligible for make whole during manual dispatch