

Energy Storage & the PJM Market



Scott Baker
Sr. Business Solutions Analyst
Applied Innovation
Scott.Baker@pjm.com

Unprecedented number of changes in the power industry



Storage technologies



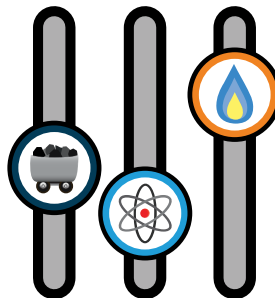
Distributed energy resources



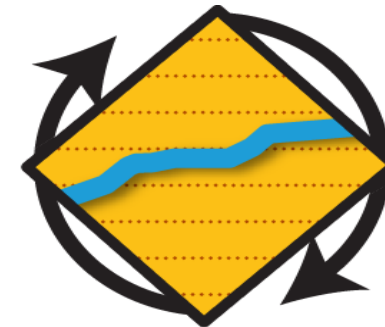
Intermittent renewables



Alternative technologies



Fuel Swap

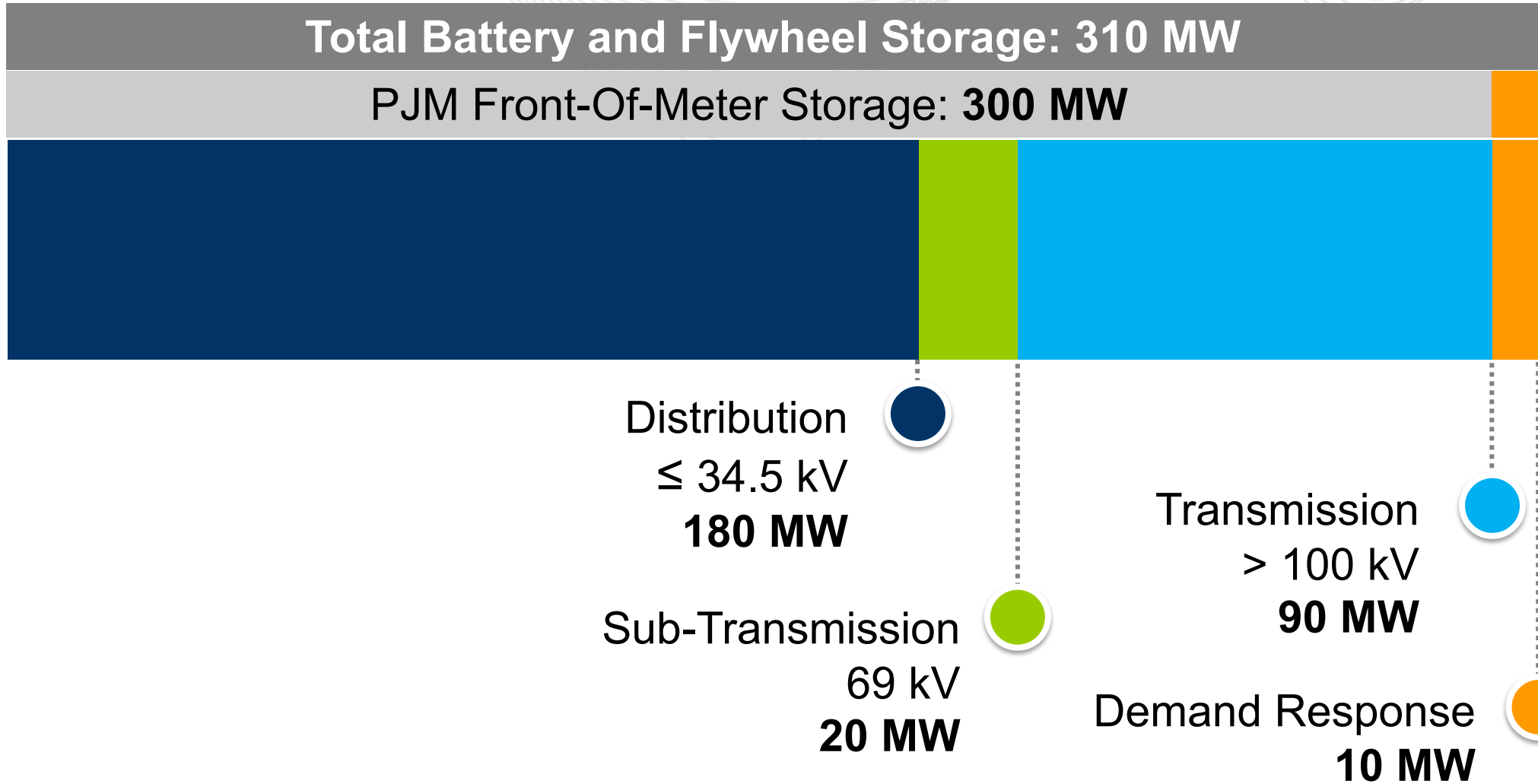


Customer behavior and choice

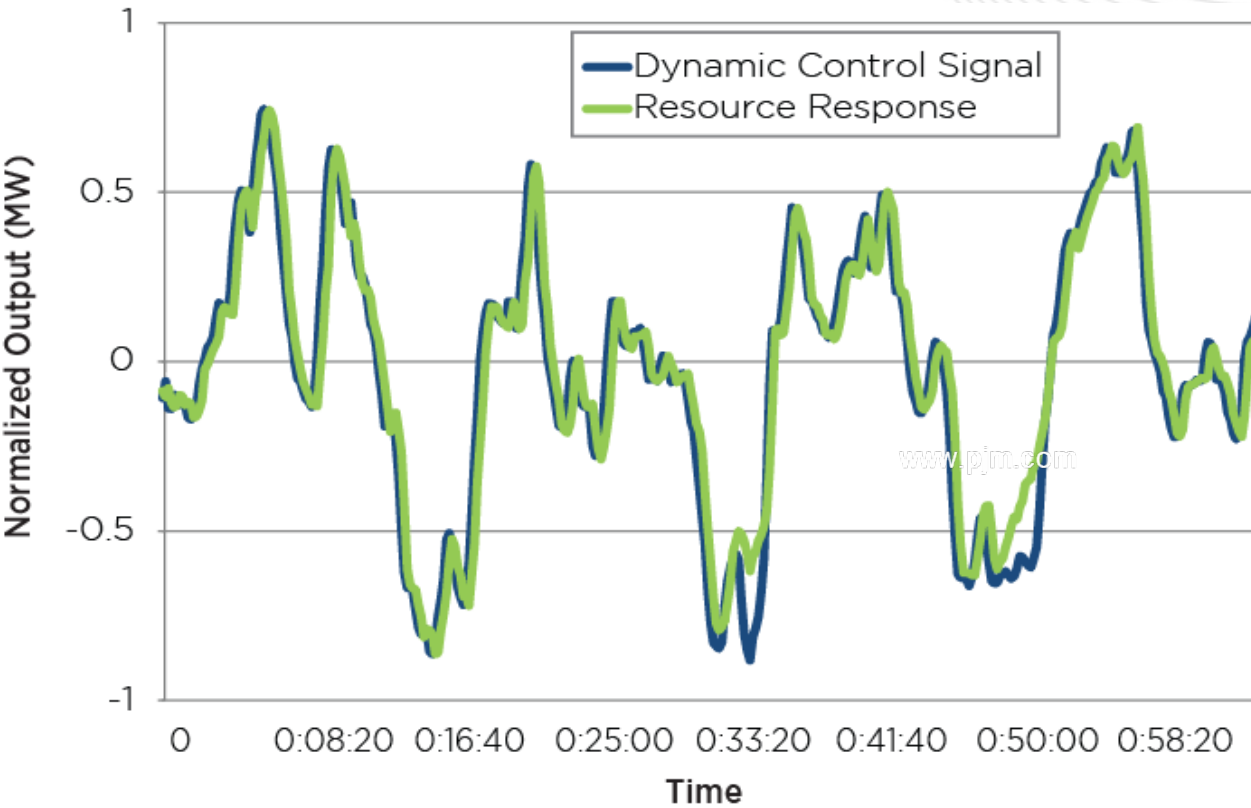
- “Fuel” Neutral Approach
- Advanced Technologies
- System Flexibility Needs



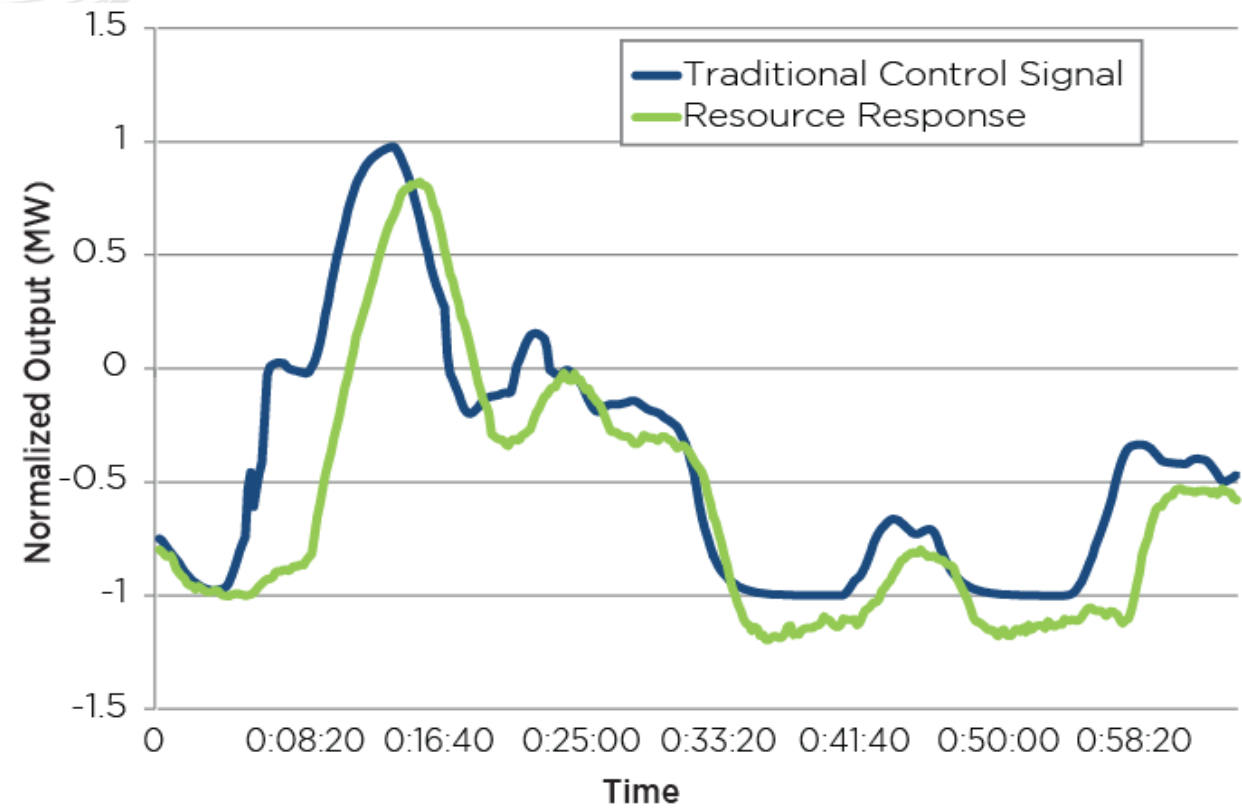
Battery Energy Storage in PJM Today



FERC Order 755 – Performance-based Regulation



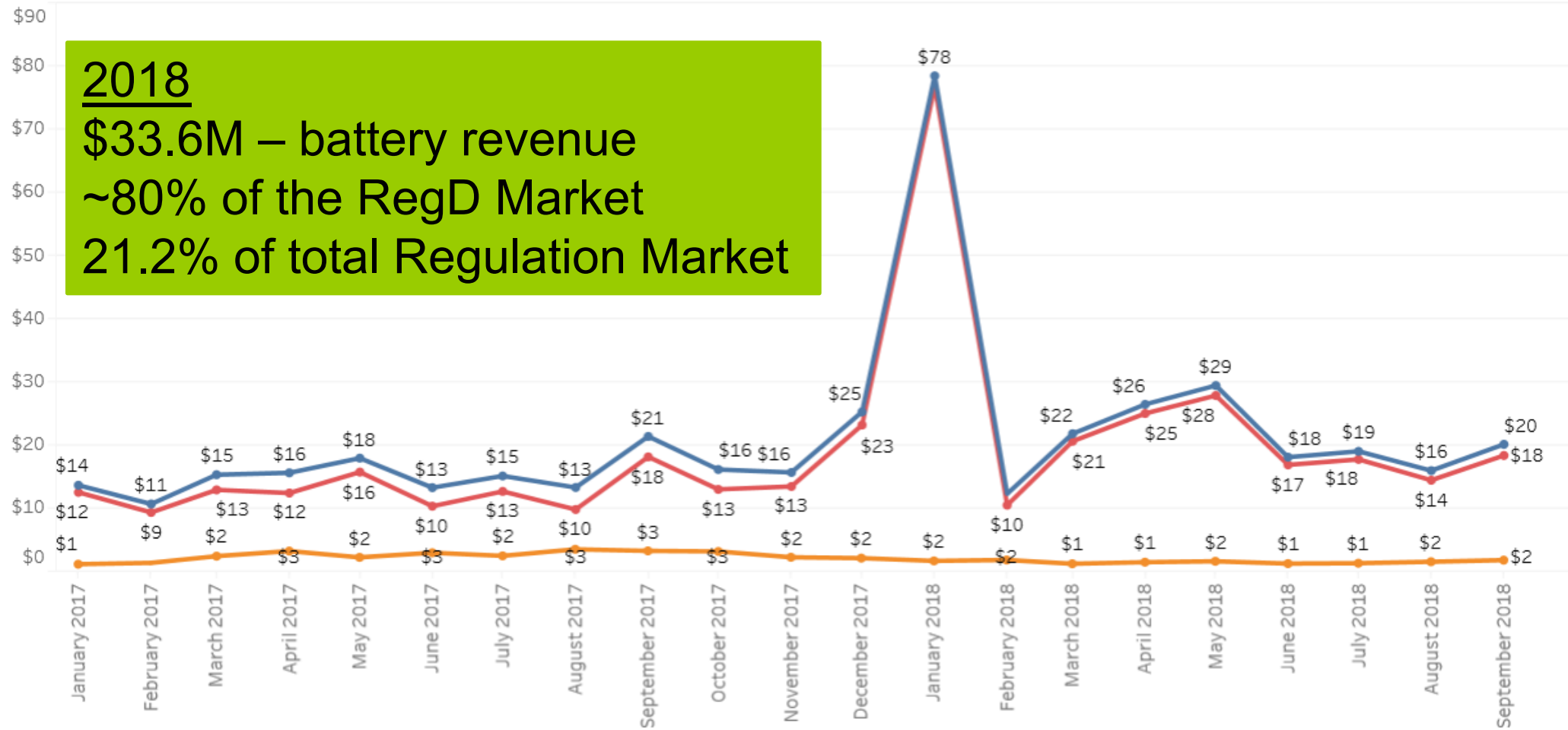
Battery Energy Storage



Steam Unit

Regulation Market: Clearing Prices and Battery Storage Revenue

Regulation Market Clearing Prices



*Data up to 10/1

Storage & Hybrids in the PJM Queue

**>2 GW of hybrid
renewables + storage
in the PJM queue**

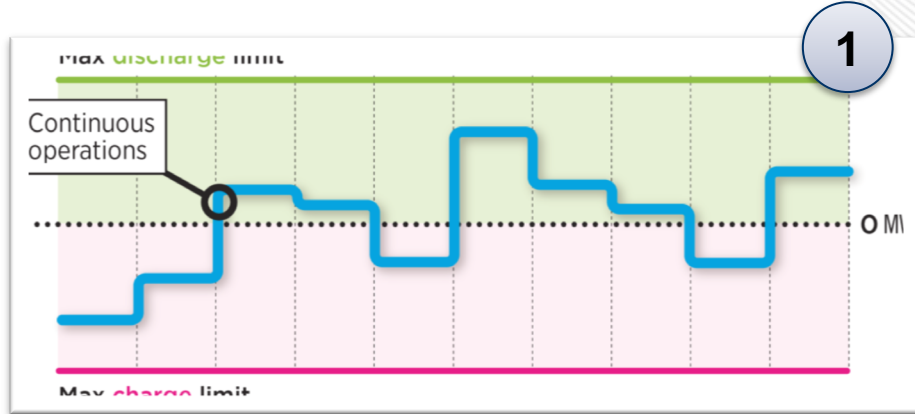
*Mostly >100 MW, several
<20 MW, and several
in between*

**>1 GW of
standalone
storage
in the PJM queue**

*Mostly <20 MW,
several >100 MW*

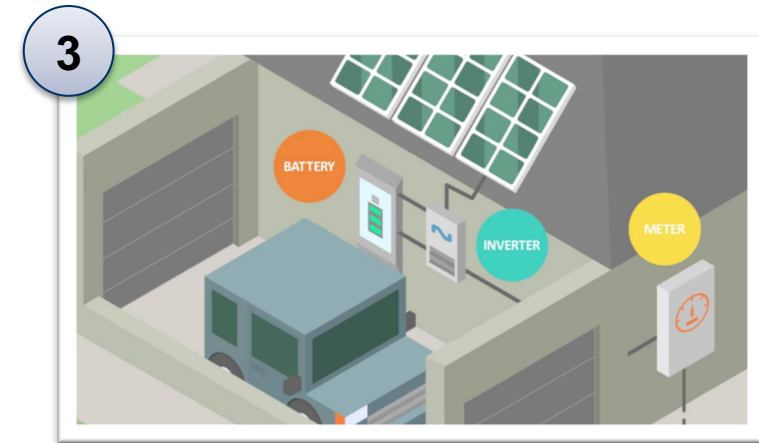
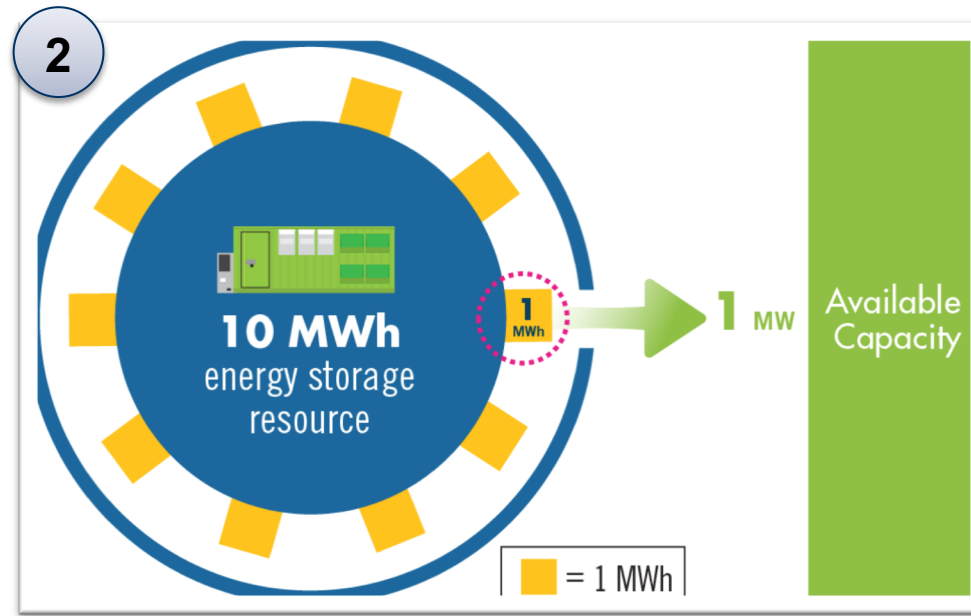
**Compare to >100 GW of gas and standalone
renewable resources in the PJM queue**

FERC Order 841: Important Aspects



1. Dispatch to negative MW; no state of charge management by PJM.
2. Capacity value based on 10-hour duration.
3. Behind-the-meter energy storage settlements.

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



N-1 Relief

- Power injection to support grid stability during contingency
- Increase operational capacity of existing line

Peak Load Relief

- Inject power downstream of thermal constraints during peak hours
- Avoids or defers new transmission to meet load

Congestion Management

- Injects power downstream of congested transmission facilities
- Reduces net load payment and other costs to customers

Adapted from Source: Fluence, a Siemens and AES Company

Storage as Transmission: Many Considerations

Reliability

Infrastructure
Planning

Stability

Proposal
Window Process

Interconnection
Process

Market Efficiency

Modeling

Rate Recovery &
Market Revenue

Operational
Control of Asset

DER Storage: Multi-Use and Wholesale Markets



Village of Minster, OH

- Peak Shaving
 - Capacity Charges
 - Transmission Charges
- Voltage Control
- Power Factor
- Regulation (PJM Market)