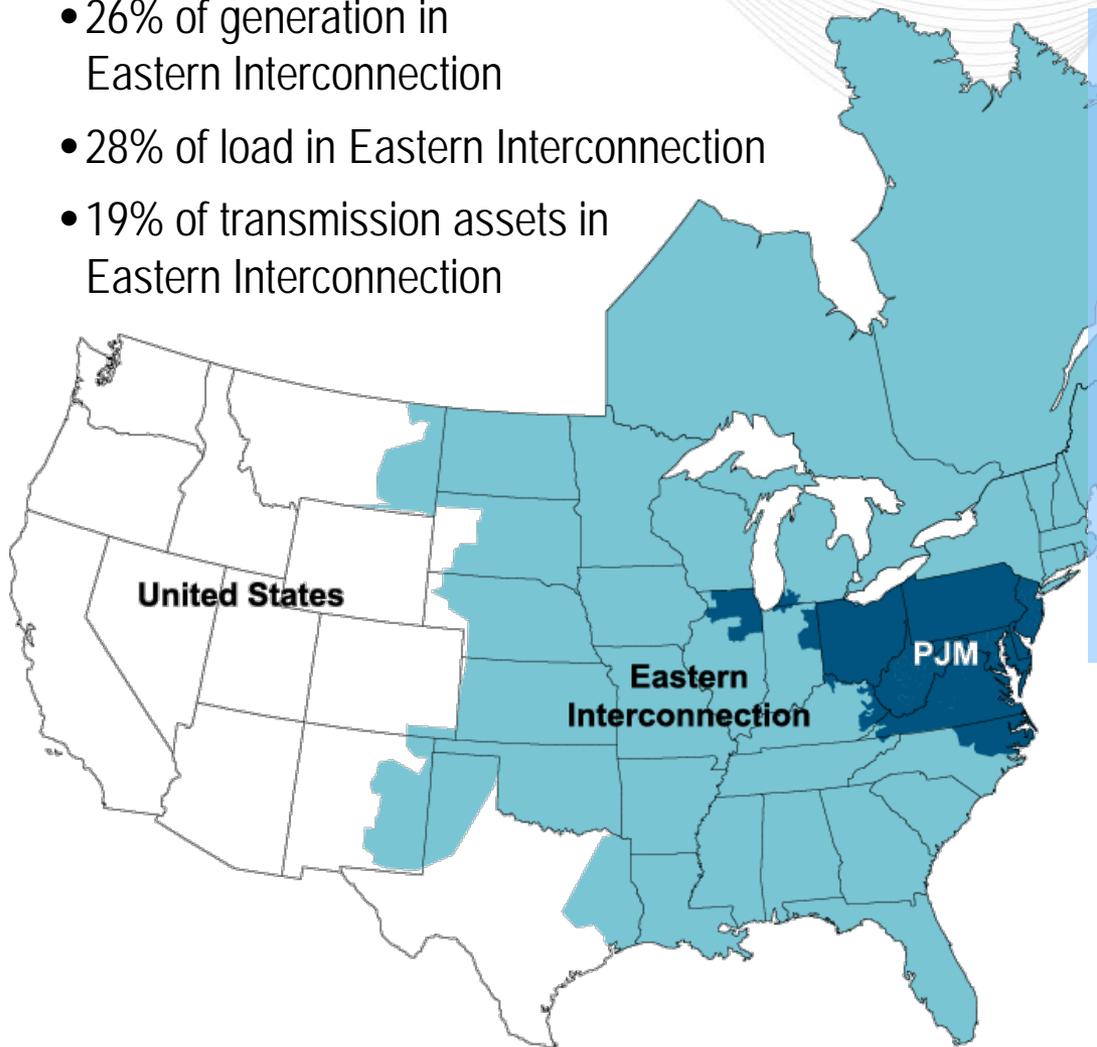




Renewable Integration in PJM: Wholesale Market Developments

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PJM Interconnection

- 26% of generation in Eastern Interconnection
- 28% of load in Eastern Interconnection
- 19% of transmission assets in Eastern Interconnection



KEY STATISTICS

PJM member companies	750+
millions of people served	60
peak load in megawatts	163,848
MWs of generating capacity	185,600
miles of transmission lines	65,441
GWh of annual energy generation	832,331
sources	1,365
square miles of territory	214,000
area served	13 states + DC
Internal/external tie lines	142

**21% of U.S. GDP
produced in PJM**

As of 1/4/2012

State Renewable Portfolio Standards (RPS) require suppliers to utilize wind and other renewable resources to serve an increasing percentage of total demand.

State RPS Targets:

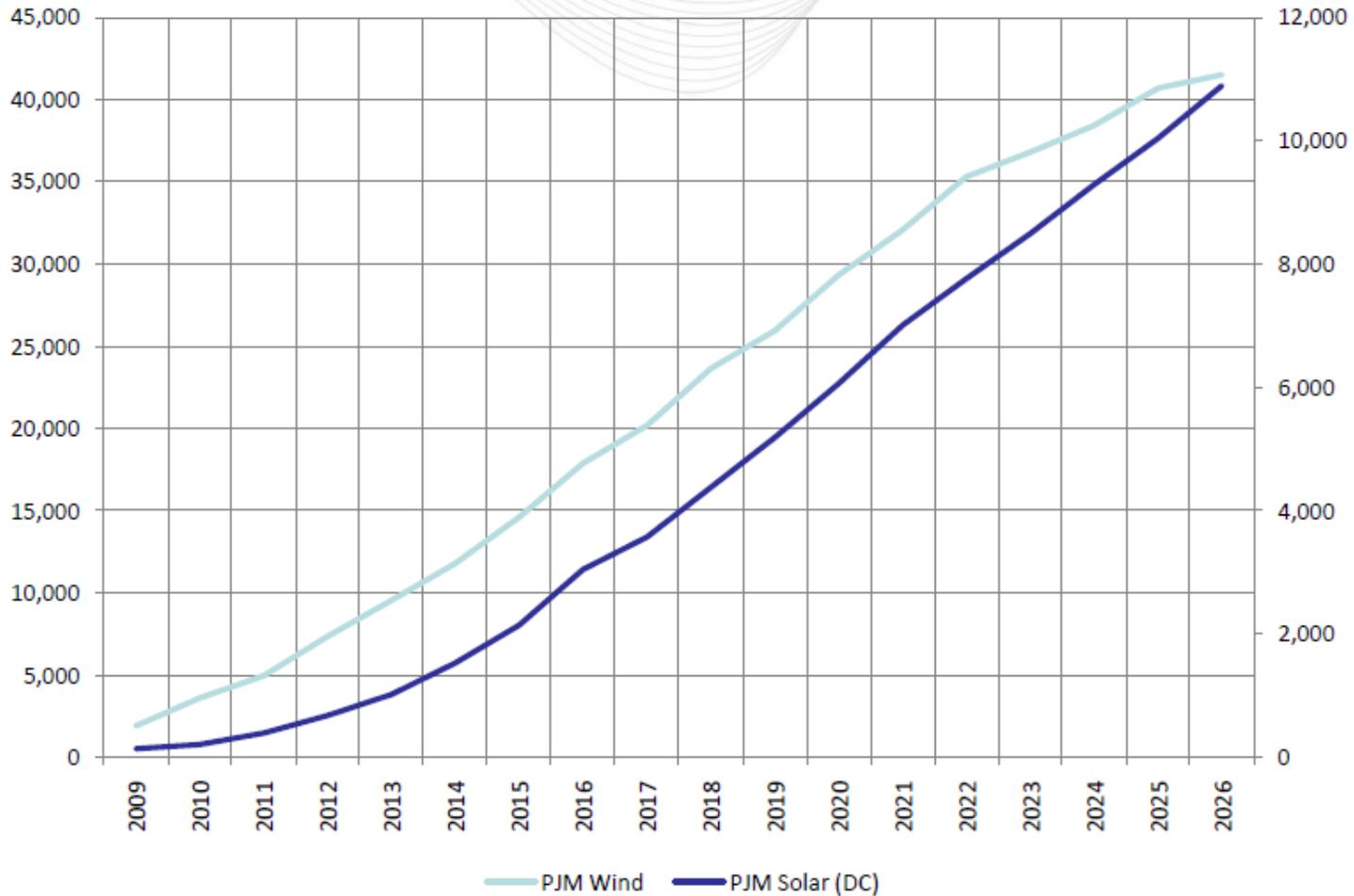


- ☀ NJ: 22.5% by 2021
- ☀ MD: 20% by 2022
- ☀ DE: 25% by 2026
- ☀ DC: 20% by 2020
- ☀ PA: 18%** by 2020
- ☀ IL: 25% by 2025
- ☀ OH: 25%** by 2025
- ☀ NC: 12.5% by 2021 (IOUs)
- MI: 10% + 1,100 MW by 2015
- VA: 15% by 2025
- WV: 25%** by 2025

☀ Minimum solar requirement

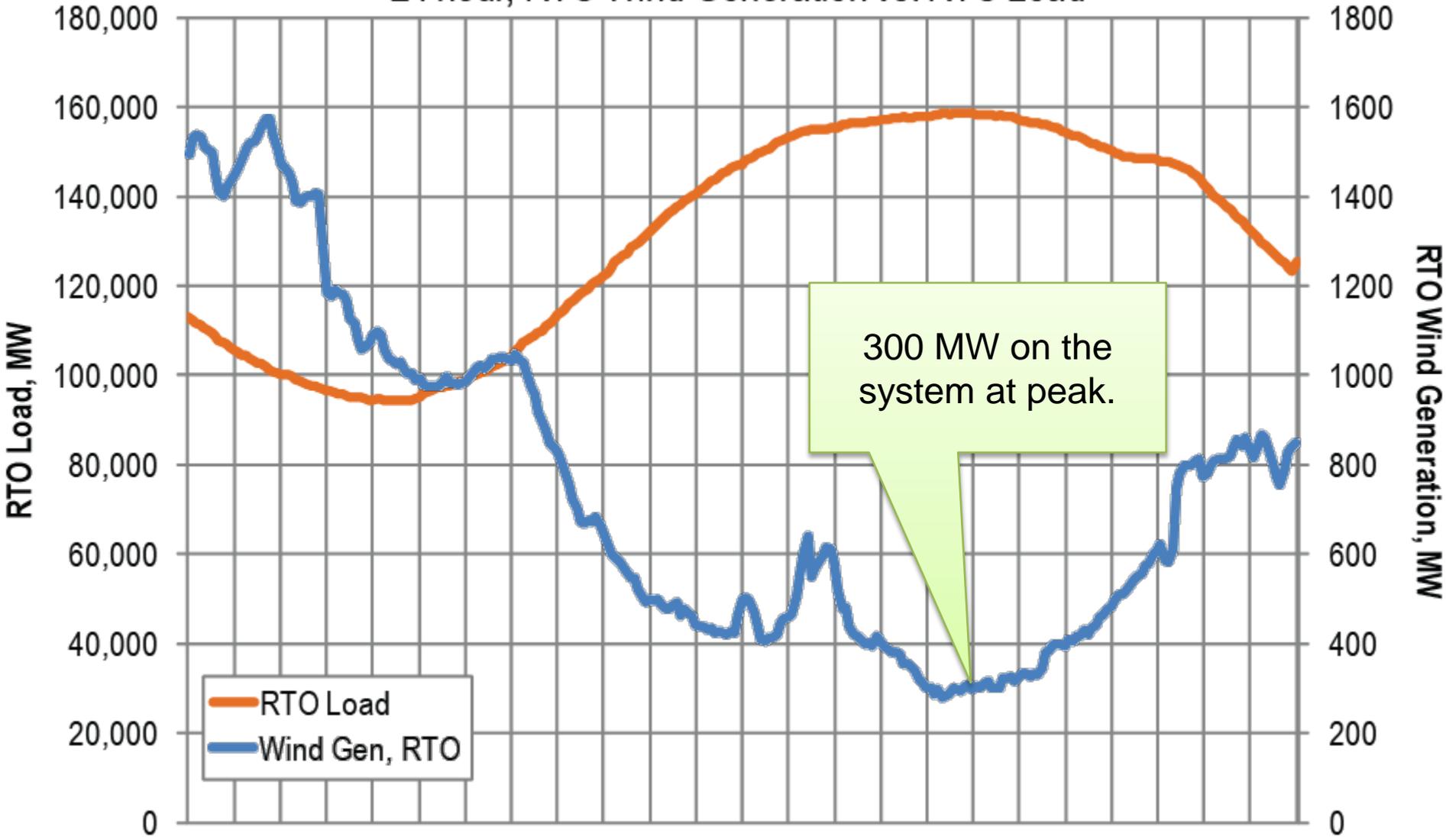
** Includes separate tier of "alternative" energy resources

Wind and Solar Requirements in PJM (MW)



Assumes a 30% cap factor for wind
Assumes a 12% cap factor for solar

24 hour, RTO Wind Generation vs. RTO Load

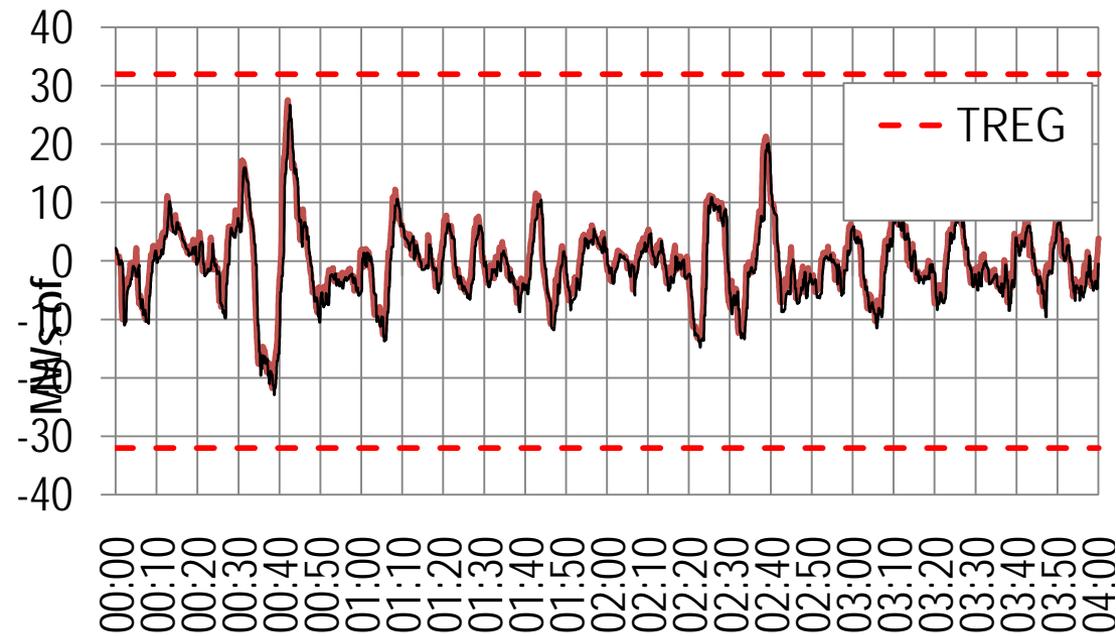


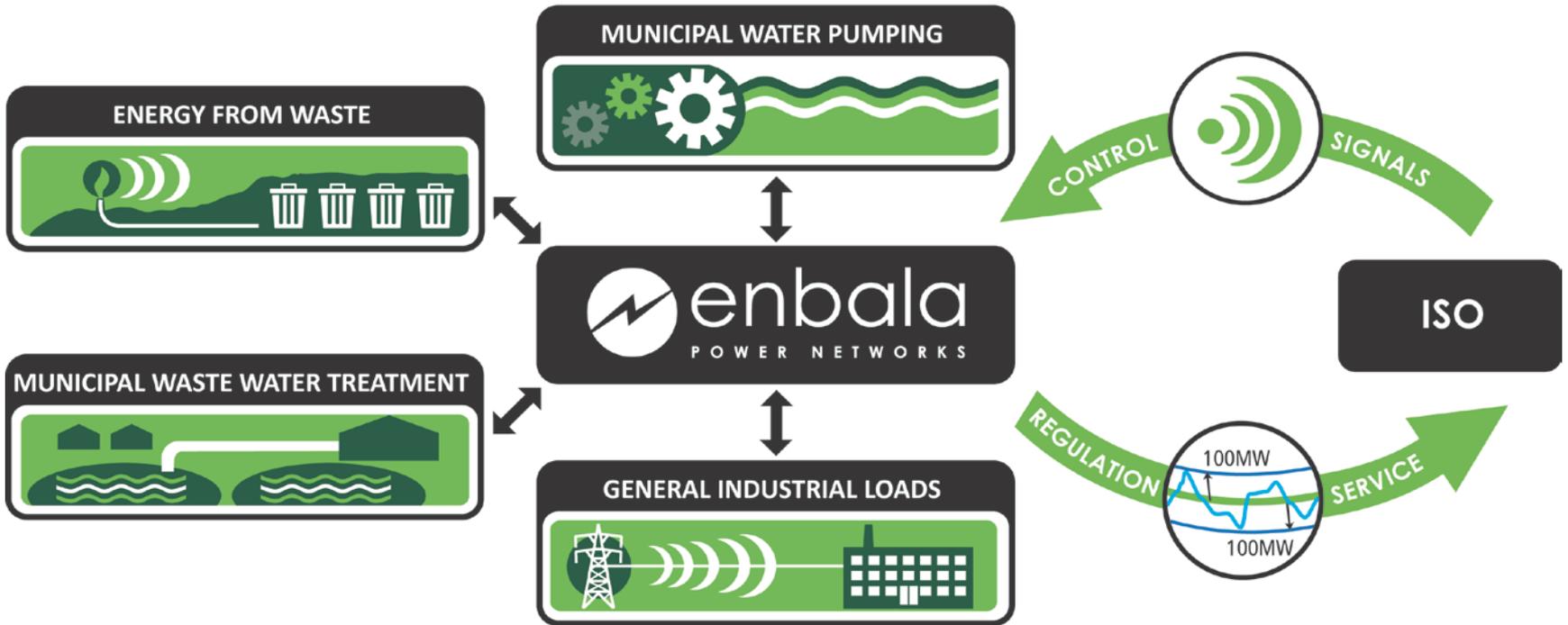
REGULATION MARKET CHANGES

- **Renewable Integration**
 - By 2026, 14% of PJM's energy comes from non-dispatchable, variable resources
 - Increase stochastic operating parameters, increase the need for primary reserves
- **Market Efficiency**
 - Increase competition; increase system control with less MWs
- **The transition to cost-effective storage...**

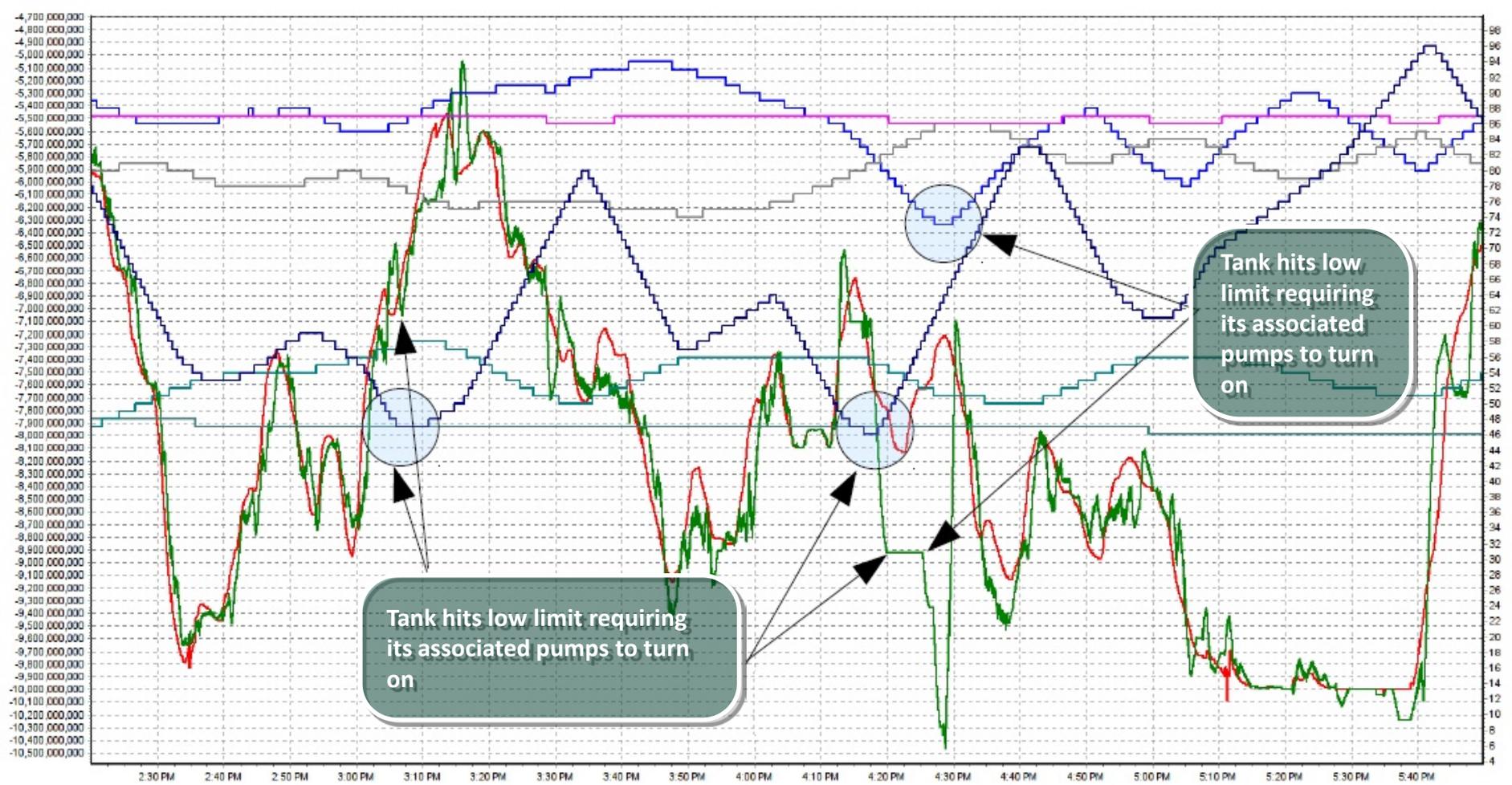
- **New “Dynamic Regulation” signal**
 - Based on total ACE but calculated to be energy neutral on average and highly correlated to system frequency
- **Performance-based Regulation**
 - Alignment of compensation with benefit to system control
- **Lower Regulation capacity requirement**
 - 1 MW > 500 kW > 100 kW
- **Sub-metering for DR Regulation**
- **New CSP Registration – “Regulation Only”**
 - Allows flexible market participation with same DR site

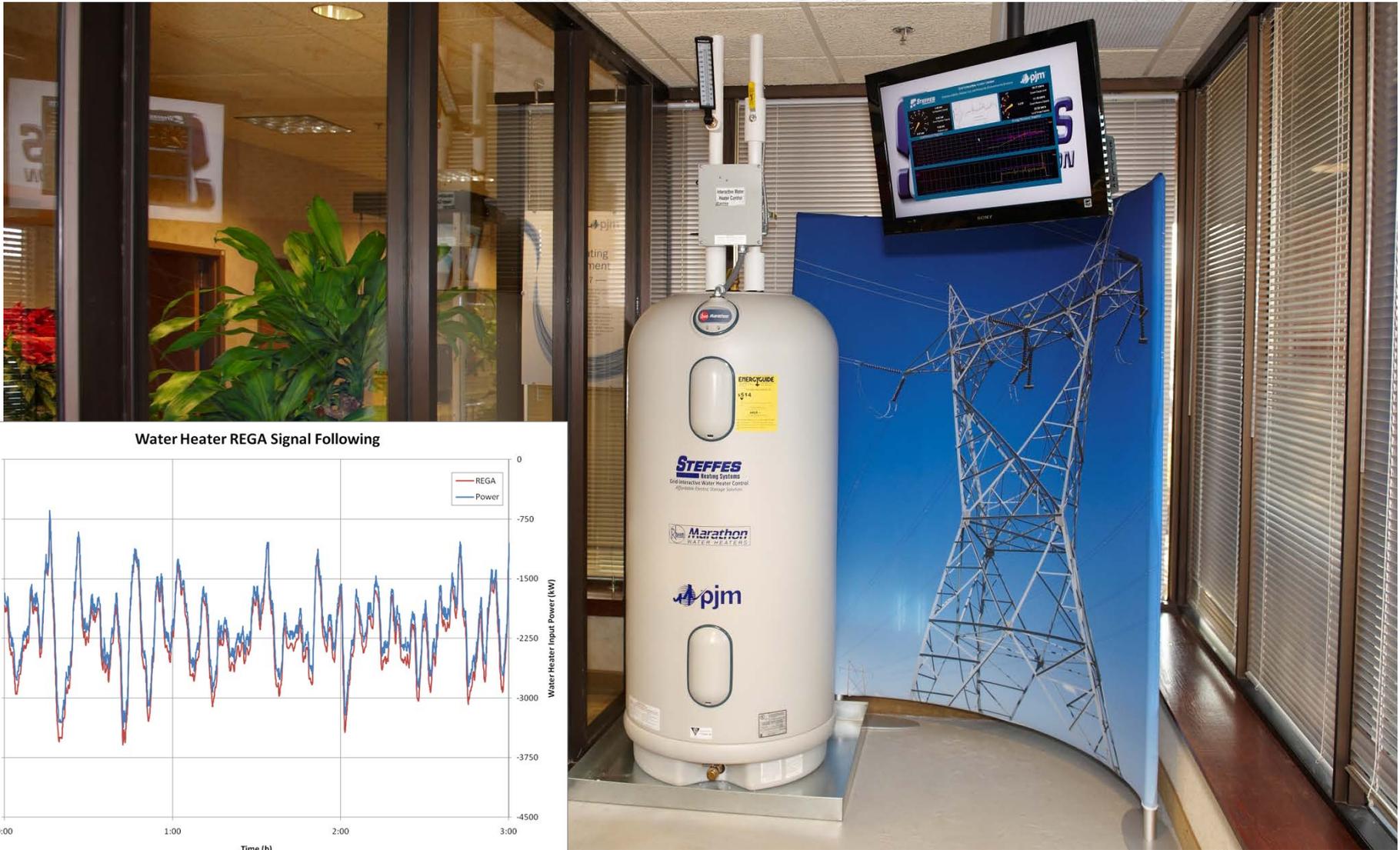
- AES Laurel Mtn.
 - 98 MW wind, 32 MW (8 MWh) battery



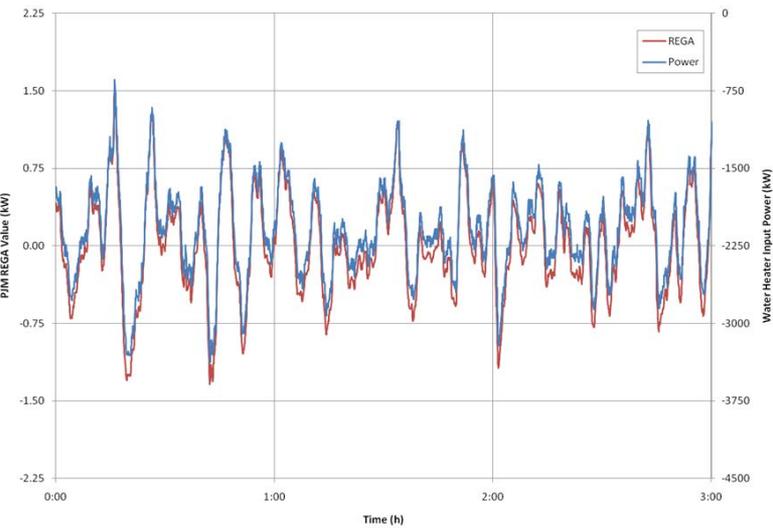


ENBALA's Power Network (EPN)





Water Heater REGA Signal Following





- Vehicle-to-Grid
- Distributed *and* mobile

