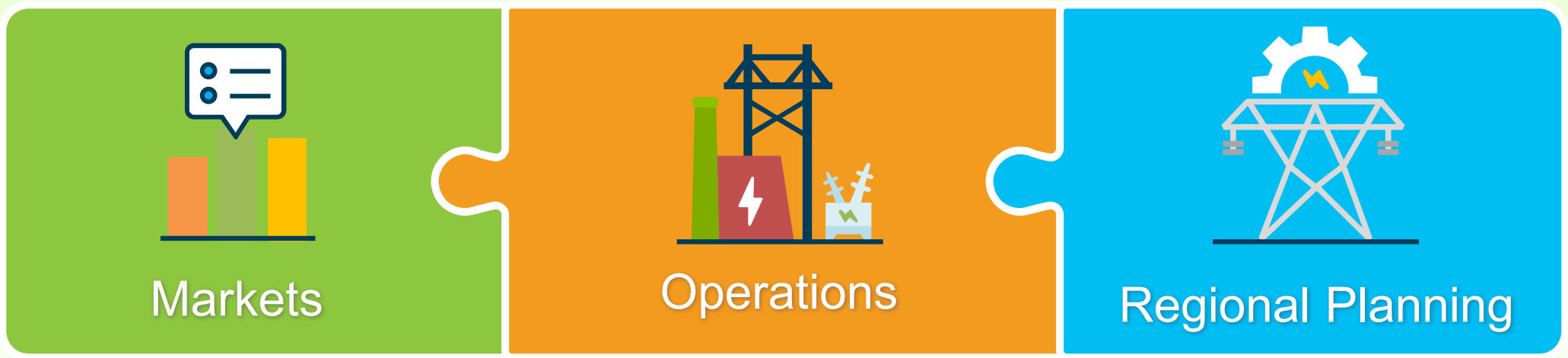
PJM Overview

Coal Institute- Summer Trade Seminar

PJM's Role as a Regional Transmission Organization

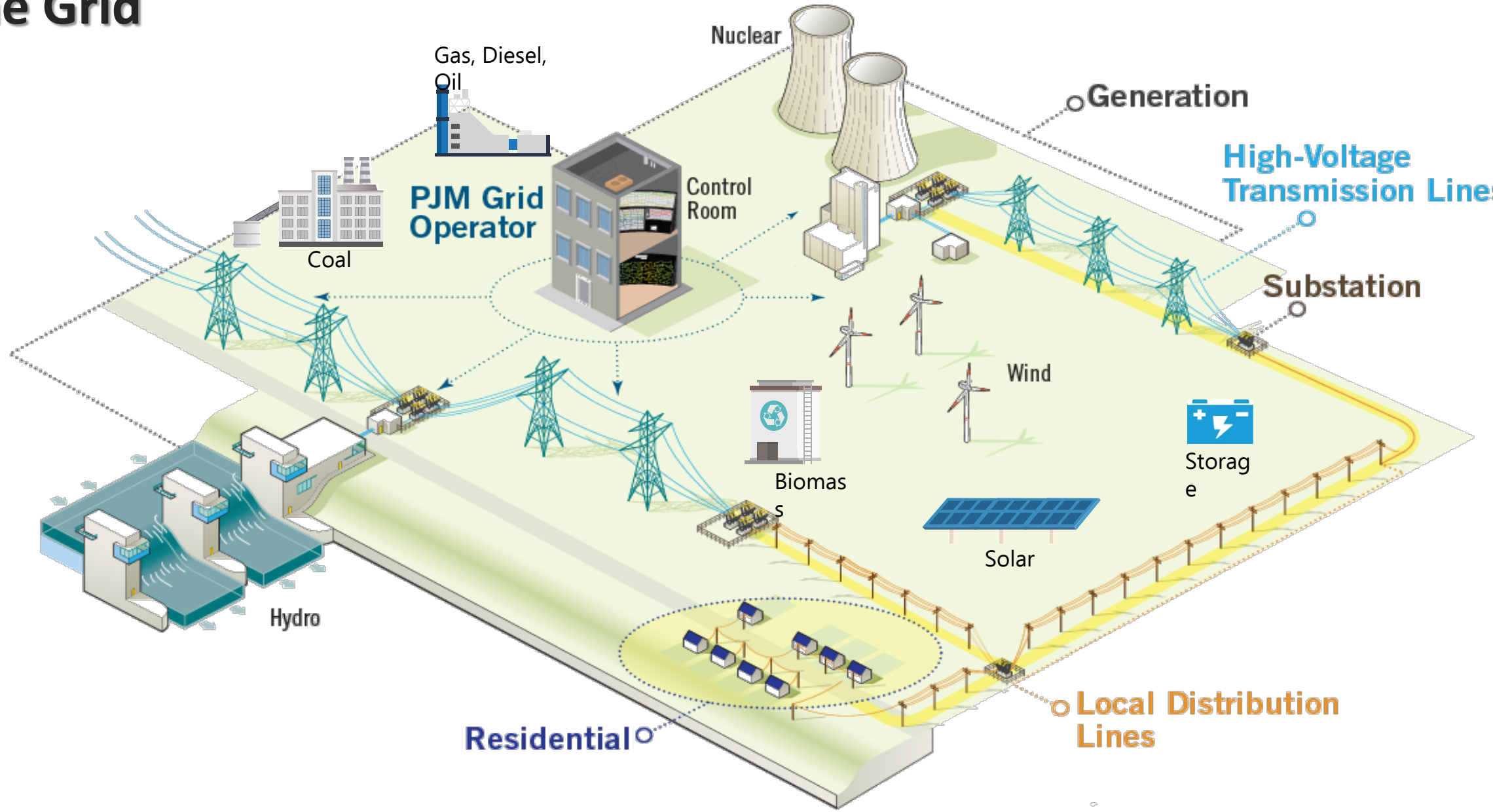
PJM – Primary Focus

RELIABILITY



Markets	Operations	Regional Planning
Energy	Grid Operations	15-Year Outlook
Capacity	Supply/Demand Balance	
Ancillary Services	Transmission Monitoring	

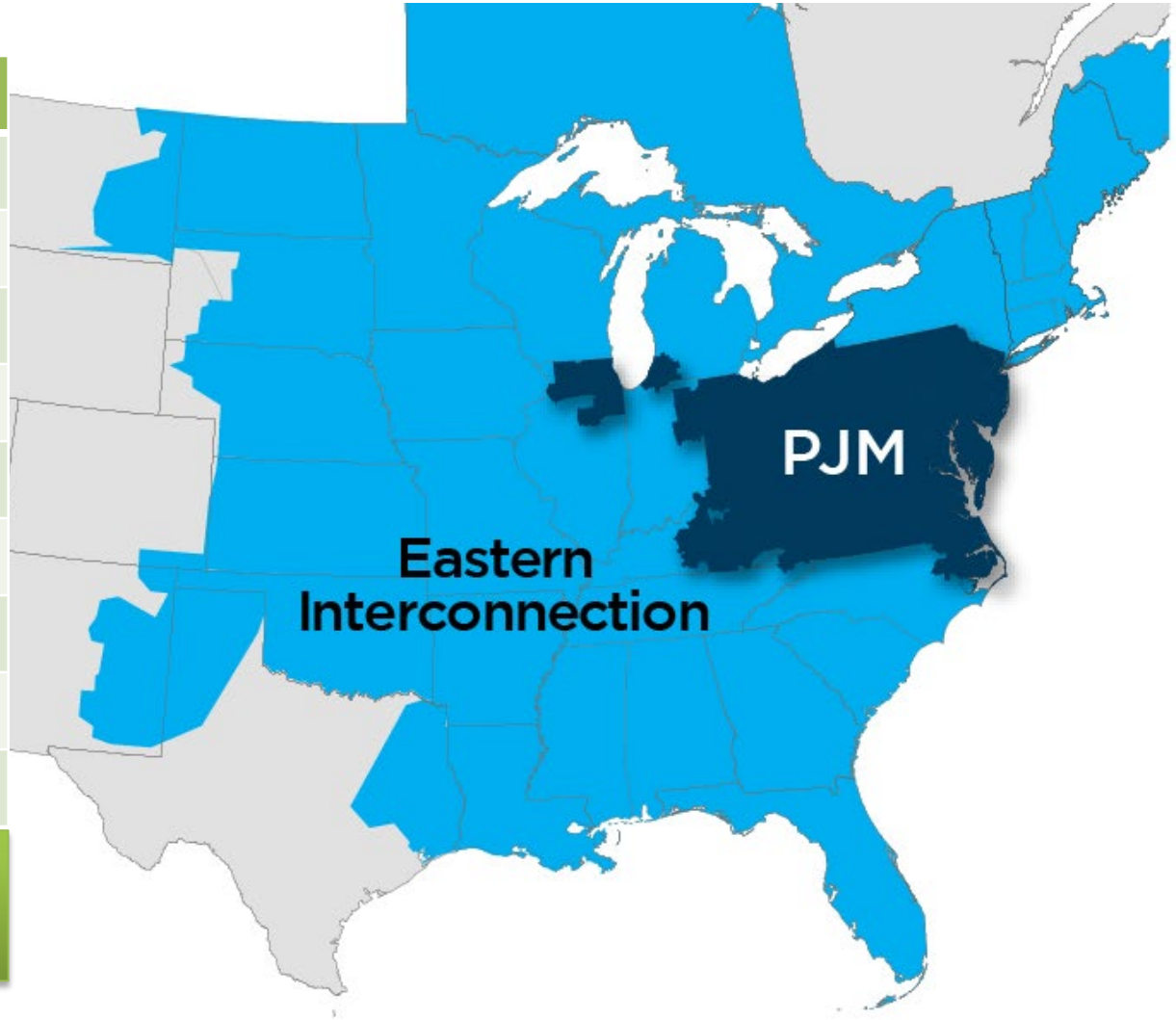
The Grid


Nuclear
Gas, Diesel, Oil
Generation
High-Voltage Transmission Lines
PJM Grid Operator
Control Room
Coal
Substation
Wind
Biomass
Storage
Solar
Hydro
Residential
Local Distribution Lines

PJM as Part of the Eastern Interconnection

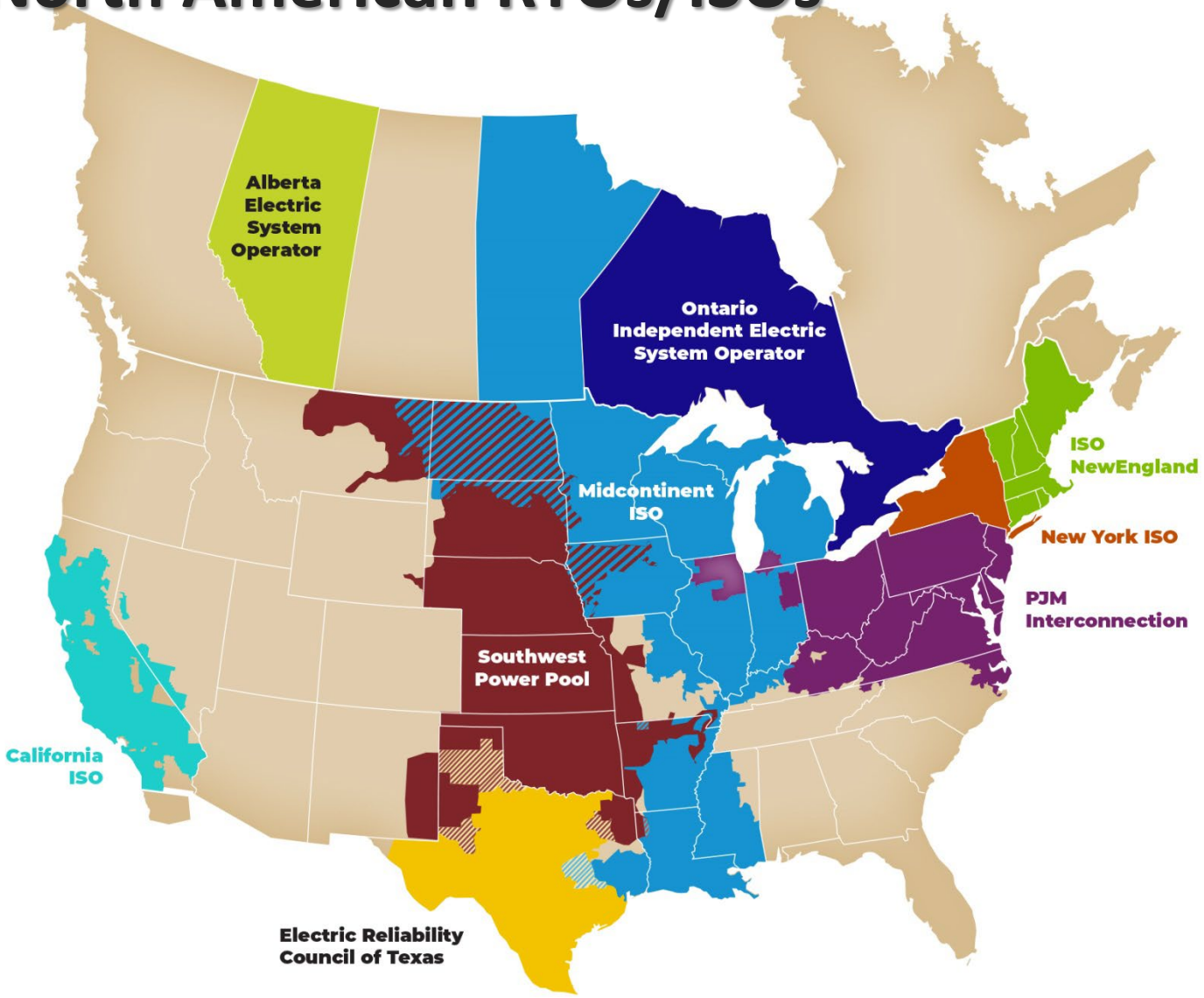
Key Statistics	
Member companies	1,110
Millions of people served	67+
Peak load in megawatts	165,563
Megawatts of generating capacity	182,036
Miles of transmission lines (BES)	88,333
Gigawatt hours of annual energy	800,004
Generation sources	1,486
Square miles of territory	369,054
States served	13 + DC

- 27% of generation in Eastern Interconnection
- 24% of load in Eastern Interconnection



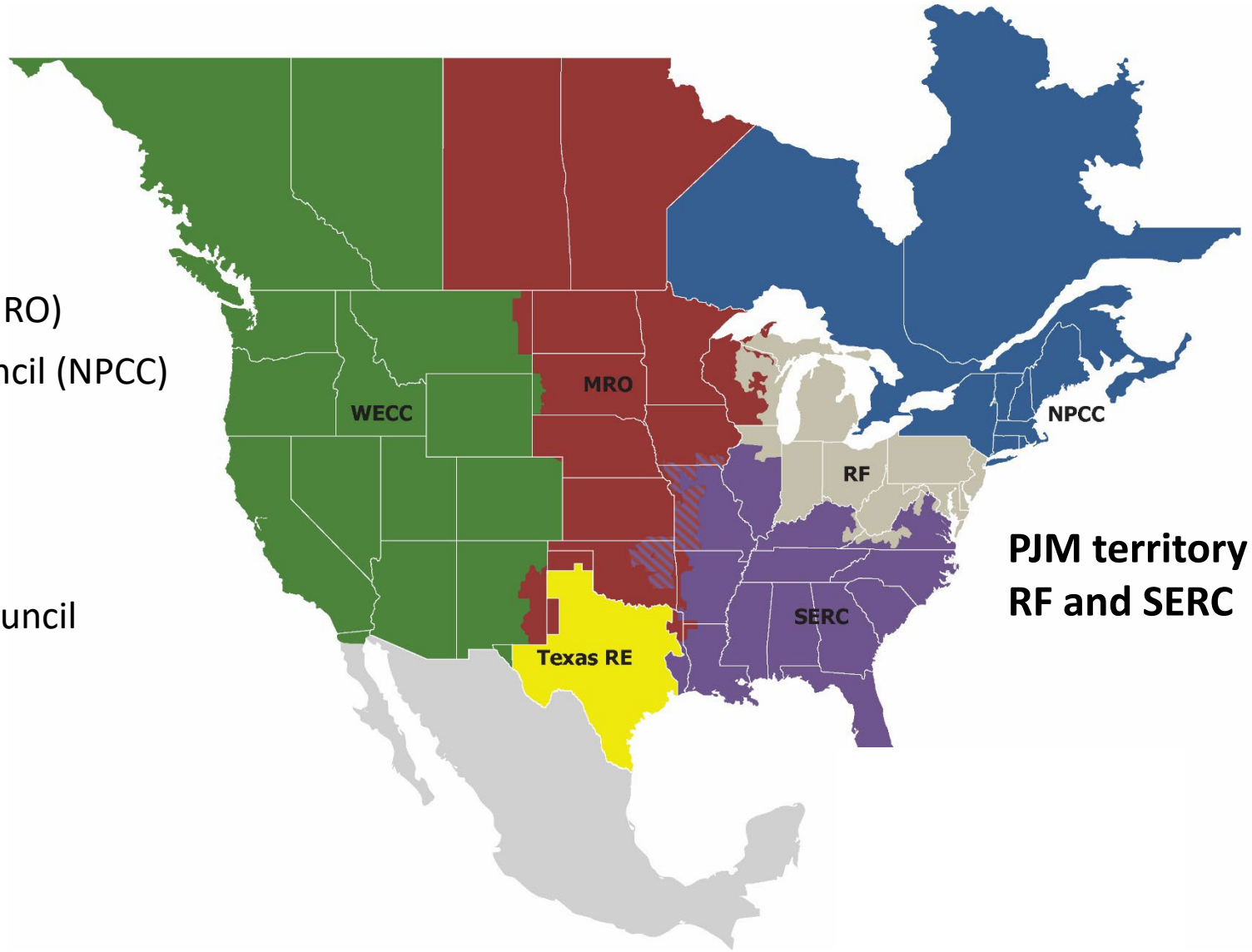
As of 2/2025

Nine Major North American RTOs/ISOs



NERC Regions

- Midwest Reliability Organization (MRO)
- Northeast Power Coordinating Council (NPCC)
- Reliability First (RF)
- SERC Reliability Corporation (SERC)
- Texas Reliability Entity (Texas RE)
- Western Electricity Coordinating Council (WECC)



PJM territory within RF and SERC

How is PJM Different From Other Utility Companies?

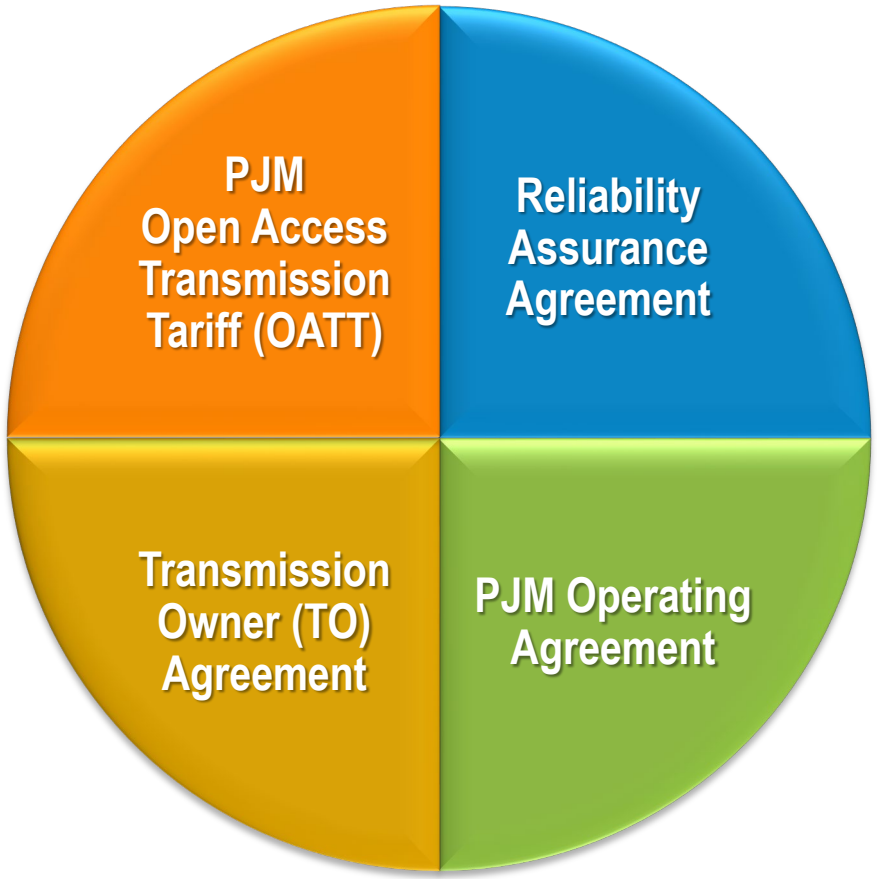
PJM Does:

- Direct operation of the transmission system
- Remain profit-neutral
- Maintain independence from PJM members
- Coordinate maintenance of grid facilities

PJM Does *NOT:*

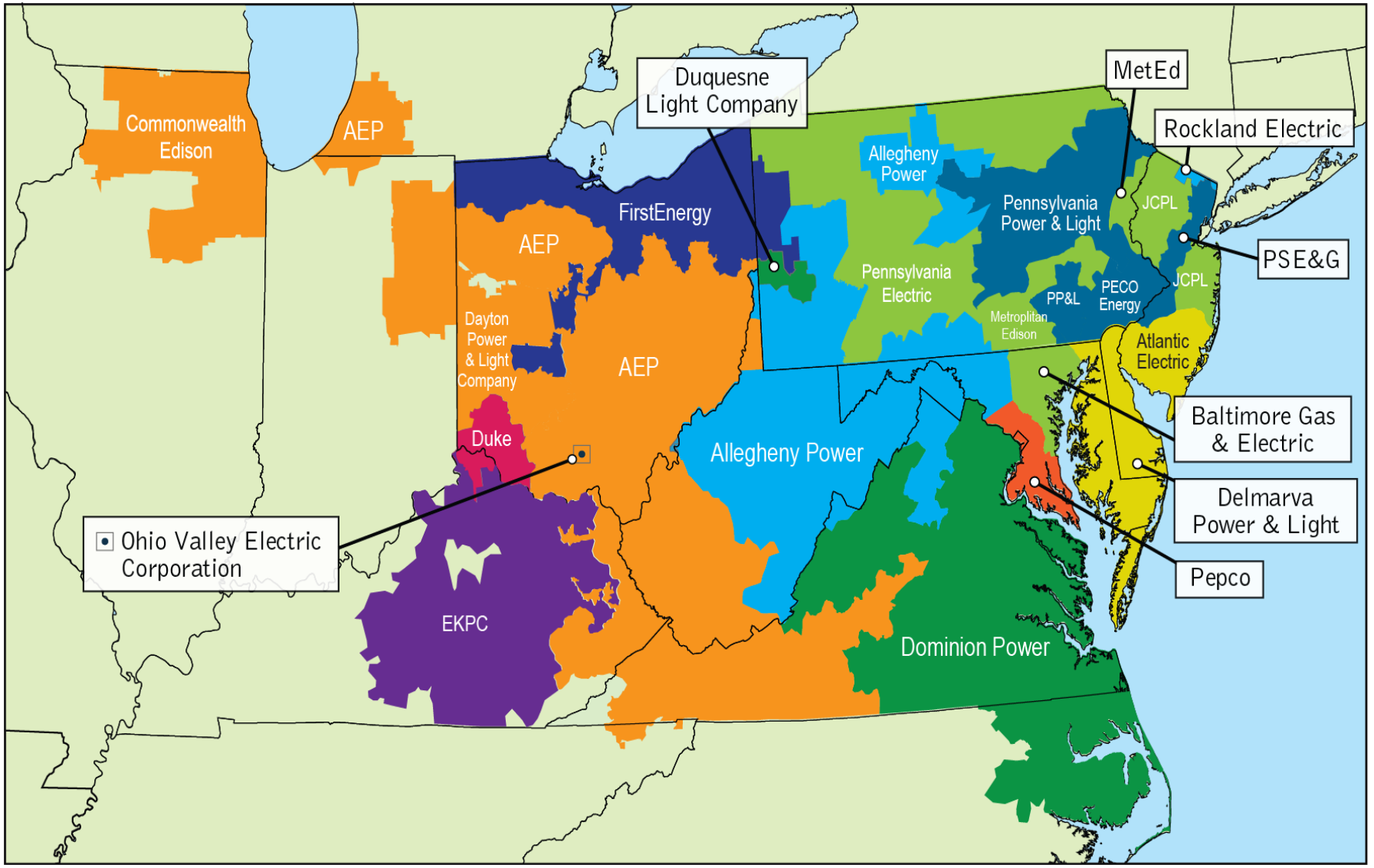
- Own any transmission or generation assets
- Function as a publicly-traded company
- Take ownership of the system's energy
- Perform maintenance on generators or transmission systems (e.g. repair power lines)
- Serve or direct any end-use customers (retail)

PJM Authority Provided by Contract



Growth of PJM

- Joined in 1927
- Joined in 1956
- Joined in 1965
- Joined in 1981
- Joined in 2002
- Joined in 2004
- Joined in 2005
- Joined in 2011
- Joined in 2012
- Joined in 2013
- Joined in 2018

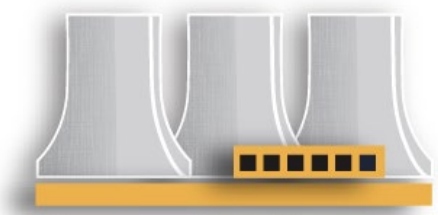


Independence and Governance Process

Independent Board of Managers

Market Monitor

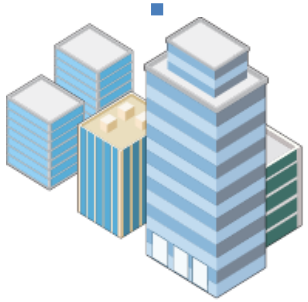
Members Committee



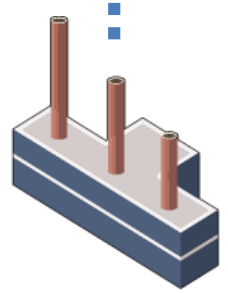
Generation Owners

Transmission Owners

Competitive Retail Companies & Trading Companies



Utility Electric Distributor & Retail Business



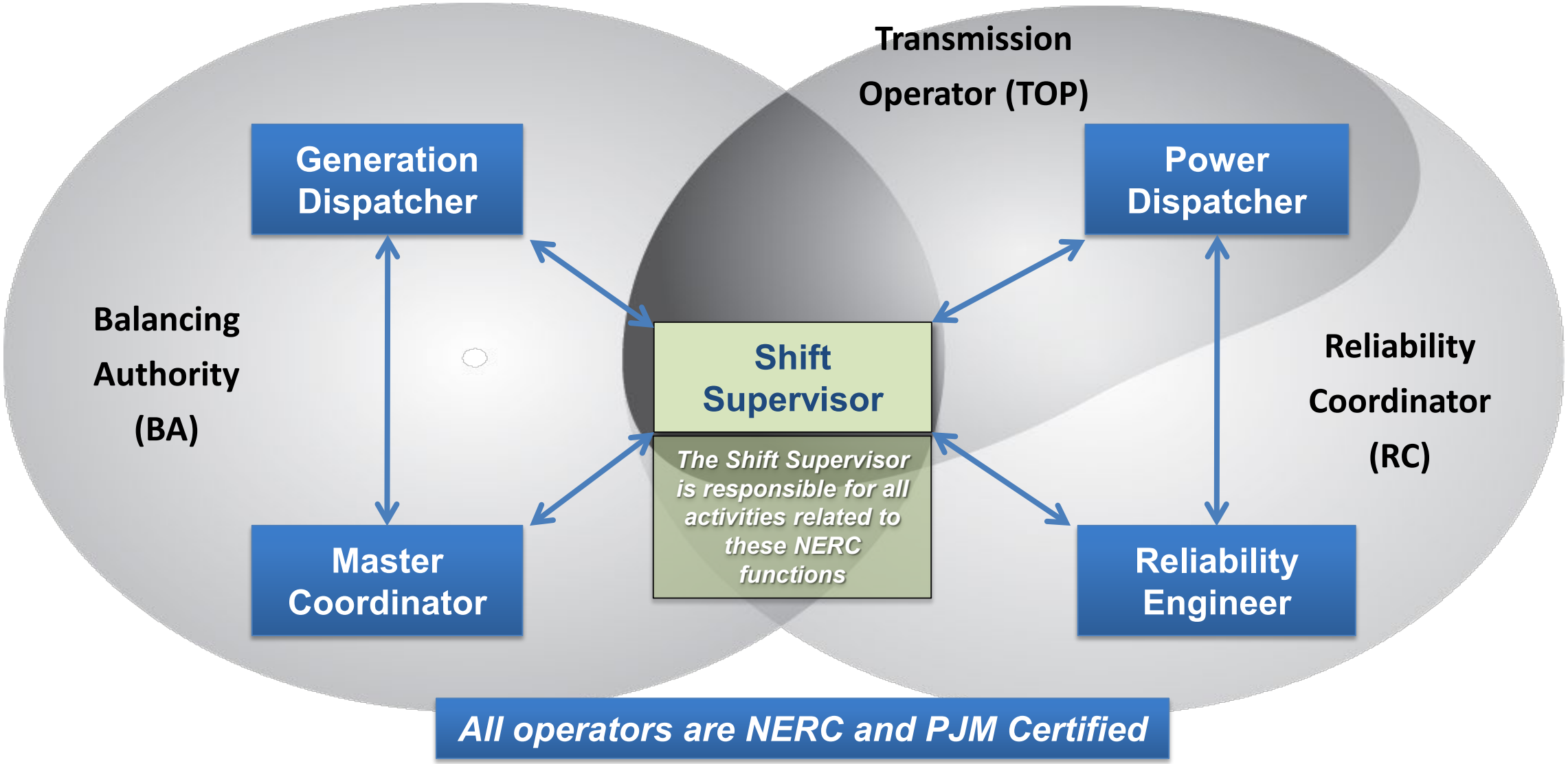
Wholesale End Use Customers (Industrial)

- Independent Board of Managers
- Stakeholder process – provide balanced stakeholder input
- Established process for discussion of market evolution

PJM Control Room Overview


3/21/2024 10:38:36 AM
Time Error
0.3112
Frequency
60.020
DELL

PJM Control Room Positions and NERC Responsibilities

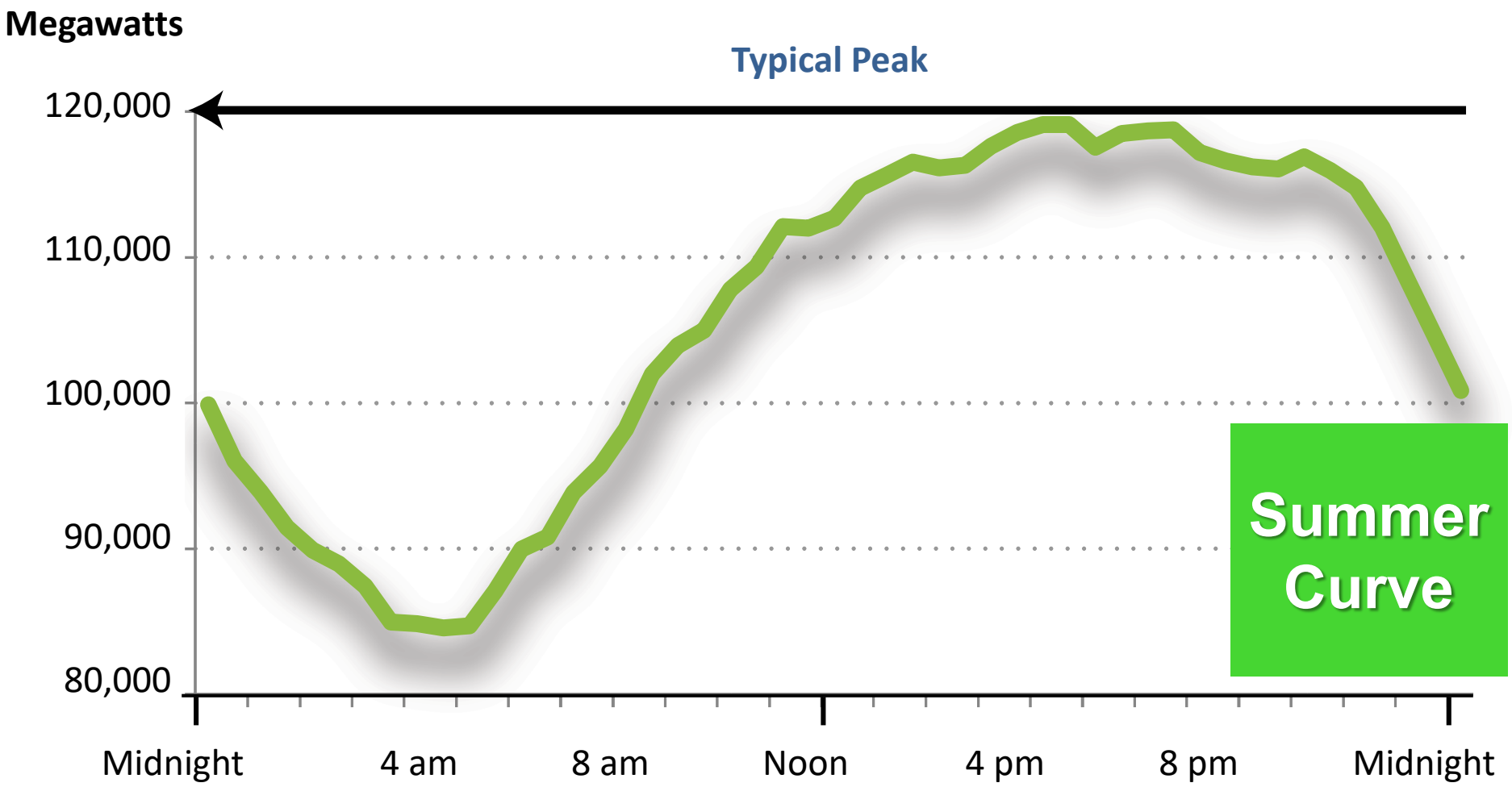


Load Forecasting

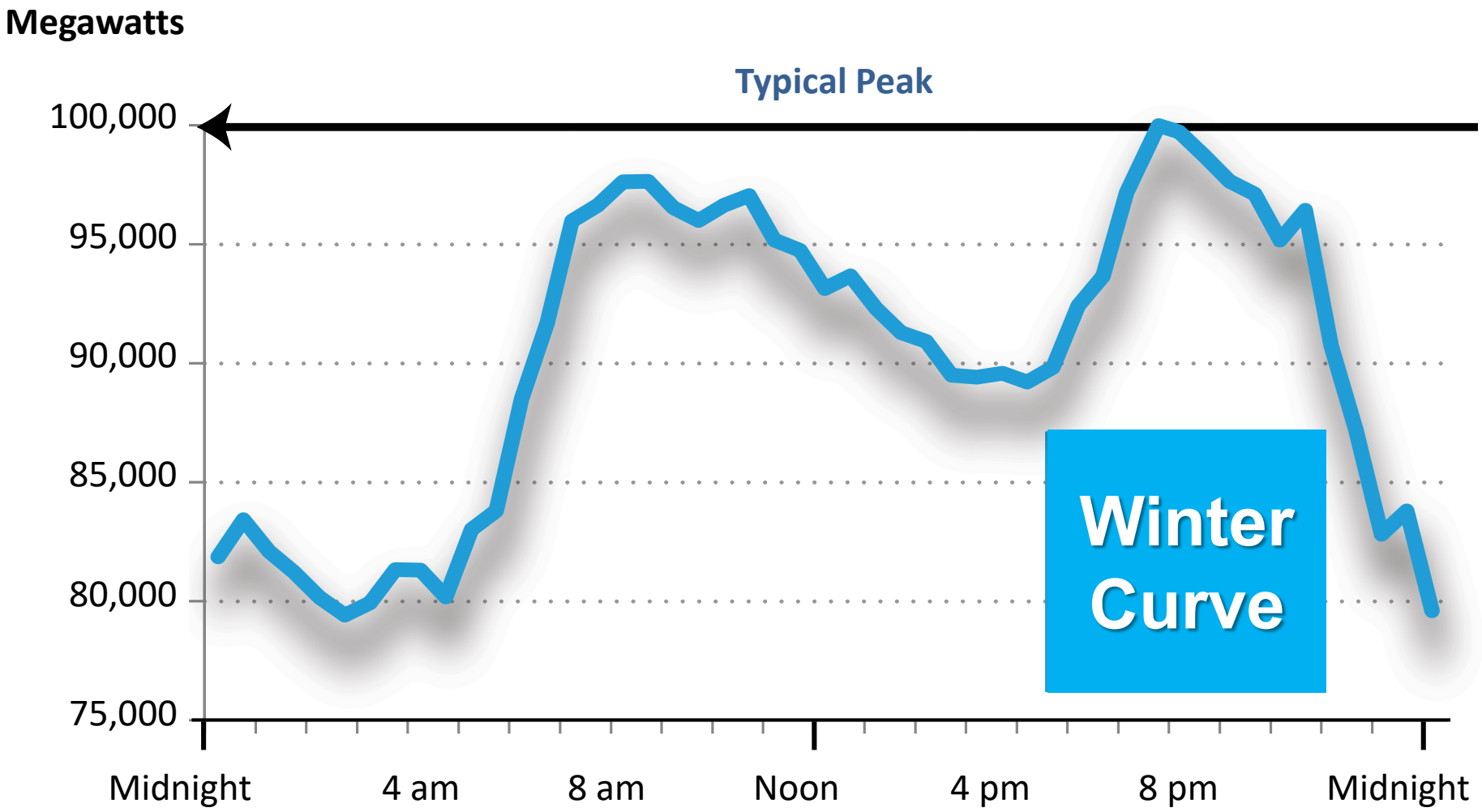
What Affects Load (Customer Demand)?

- Weather
  - Temperature
  - Dew point
  - Wind speed
  - Clouds
  - Time of day
- Season
  - Fall, Winter, Spring, Summer
- Human behavior

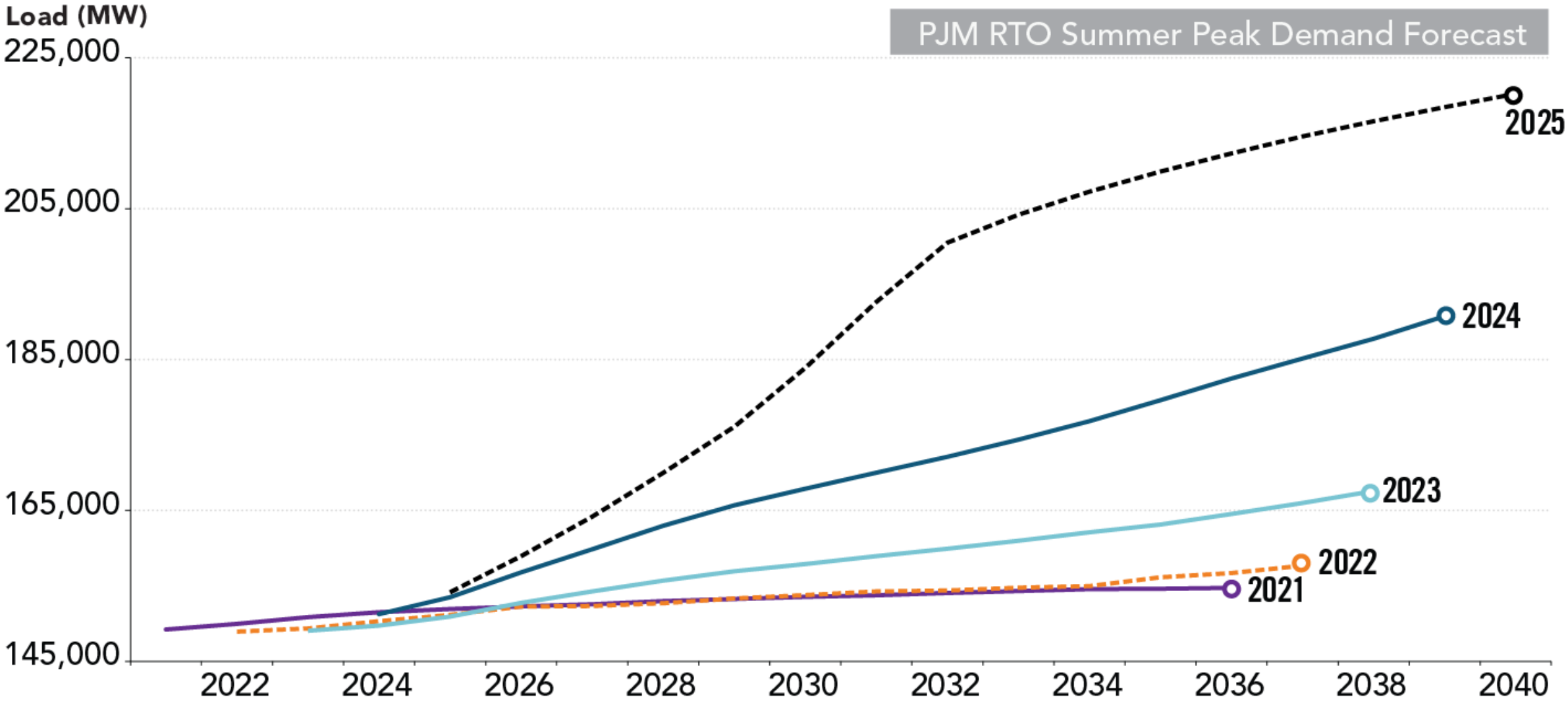
Summer Load Curve



Winter Load Curve



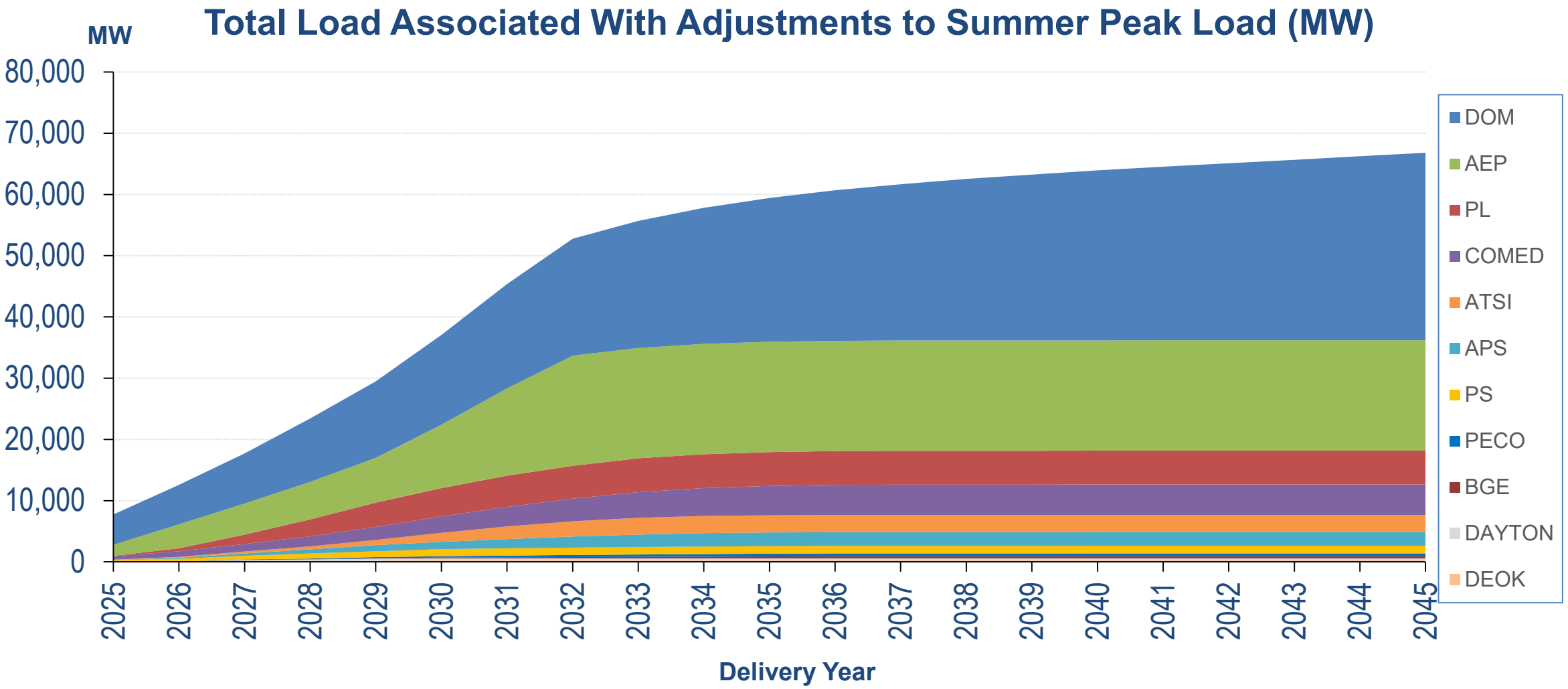
Electricity Demand Growth (2021-2025)



Forecast Adjustments

- Load Adjustments:
  - Data Centers (AEP, APS, ATSI, BGE, Comed, Dayton, PECO,PL, PS, Dominion);
  - Industrial (AEP)
  - EV Battery Manufacturing (COMED);
  - Steel Facility (Duke);
  - Port Electrification (PS);
  - Voltage Optimization (Dominion);
  - NRBTMG (ATSI, Dominion);
  - Peak Shaving Adjustment (EKPC)

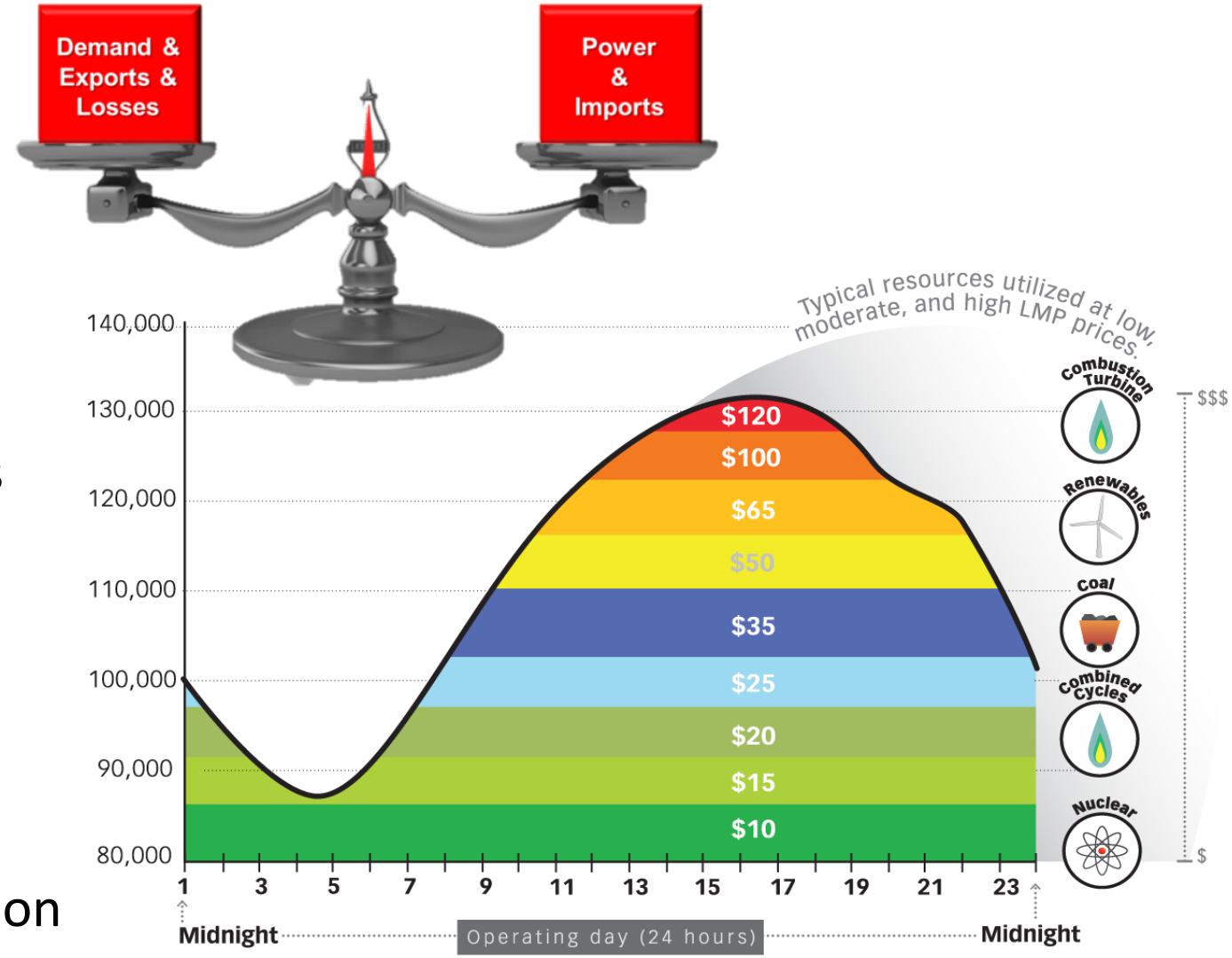
Forecast Adjustments



Real-Time

Generation Dispatch Operations

- Maintain System Control
  - Generation / Demand balance
- Maintain Adequate Reserves
  - Operate on contingency basis
- Implement Emergency Procedures
  - To keep the lights on!
- Synchronized Reserve/ Regulation Market
  - Clear Market
  - Administer real-time optimization

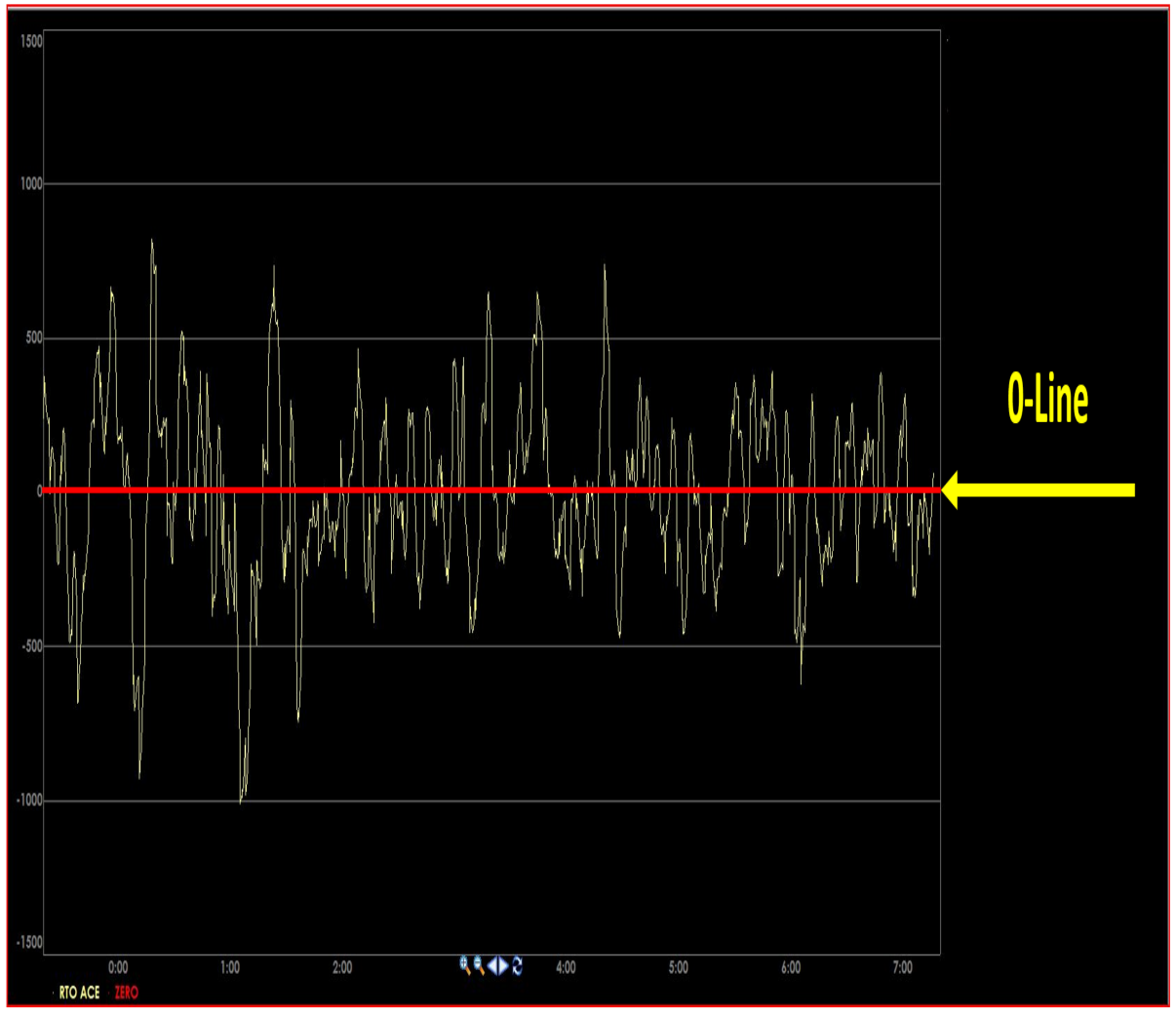


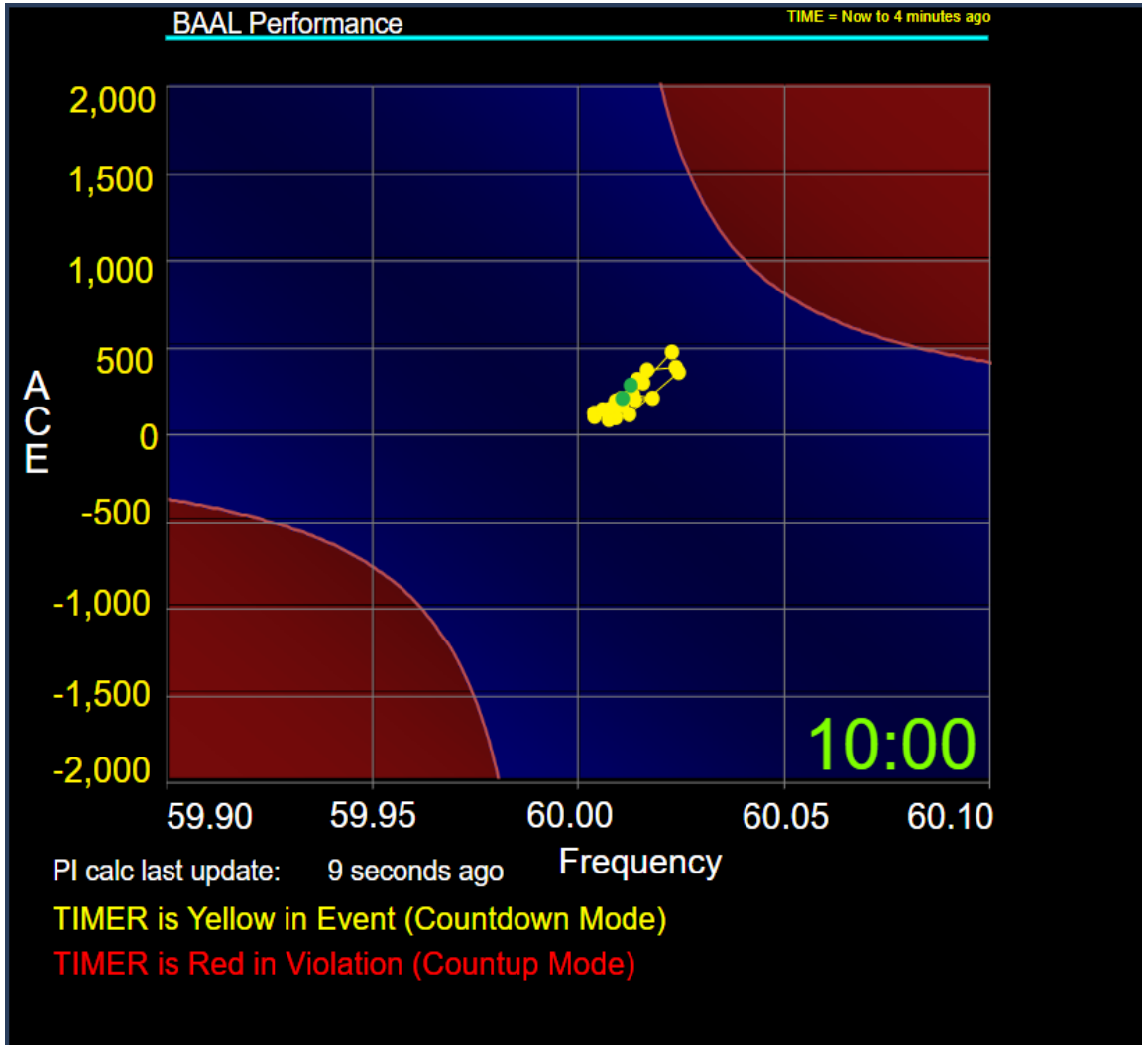
Economic Generation Control

- Purpose is to ensure that the least cost generation is used to satisfy demand
- Enables power system to follow load as it moves from valley, to peak, to valley over a 24-hour period
- Adjustments are allocated to generating units to optimize economy

Resources Scheduled to Meet Demand

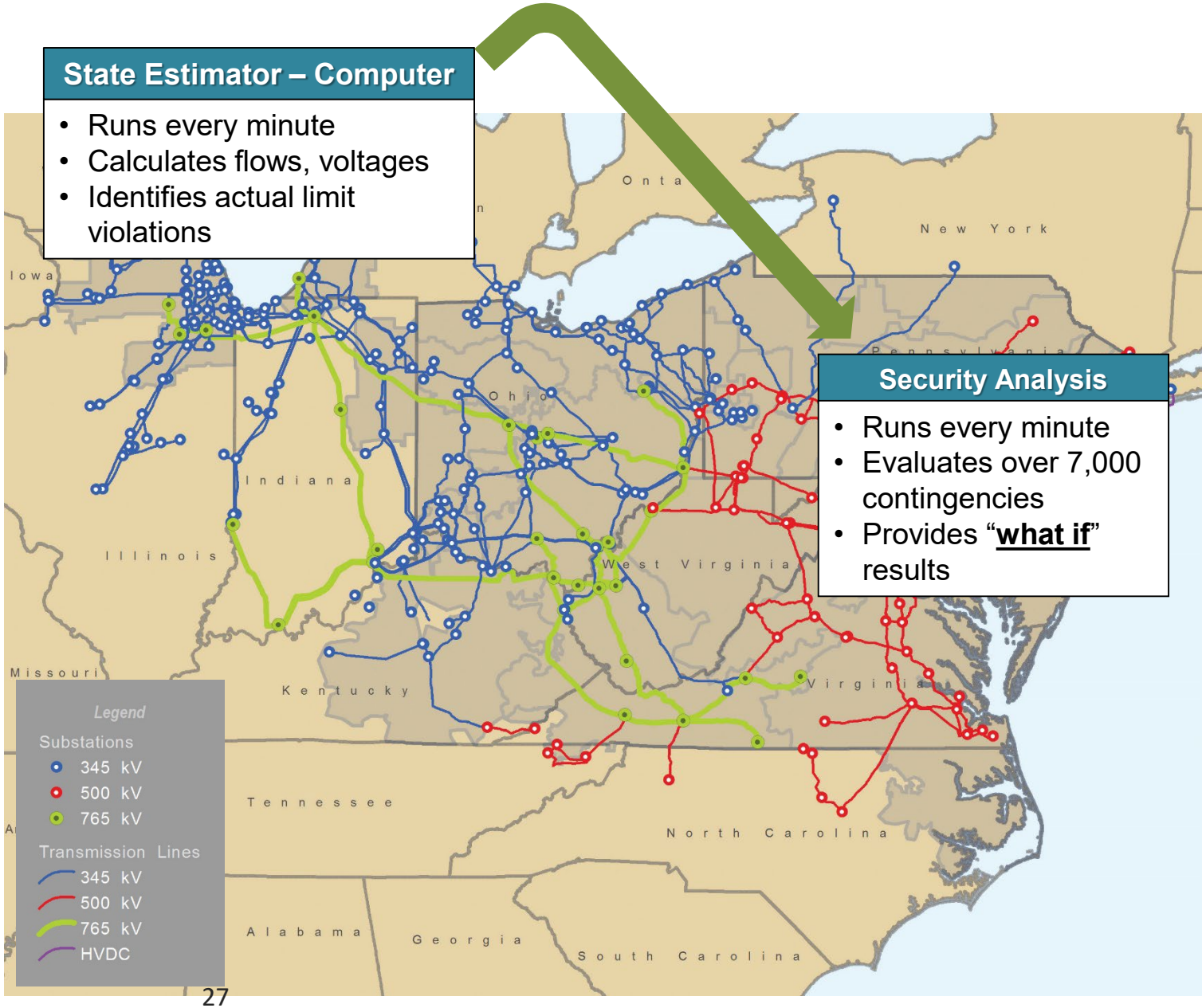
ACE and BAAL monitor Supply and Demand





Transmission System Operations

- Ensure Security of the Transmission System
  - Monitor transfer limitations (IROL)
  - Monitor thermal constraints
- Contingency Analysis
- Direct Emergency Operations
- Direct Off-Cost Operations
  - Generation shifts
  - Contract curtailments
- Coordinate Switching

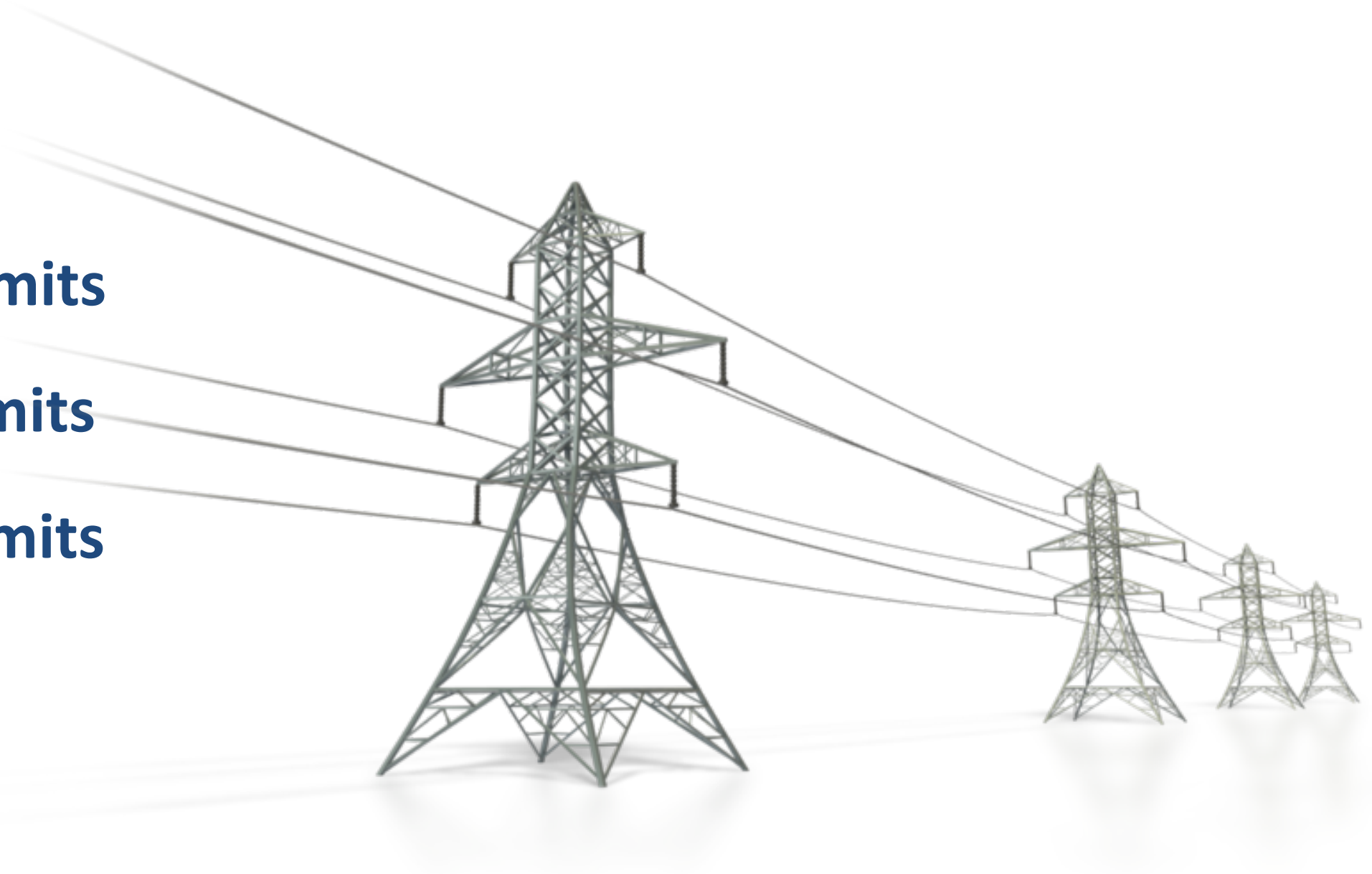


Power Transfer Limits

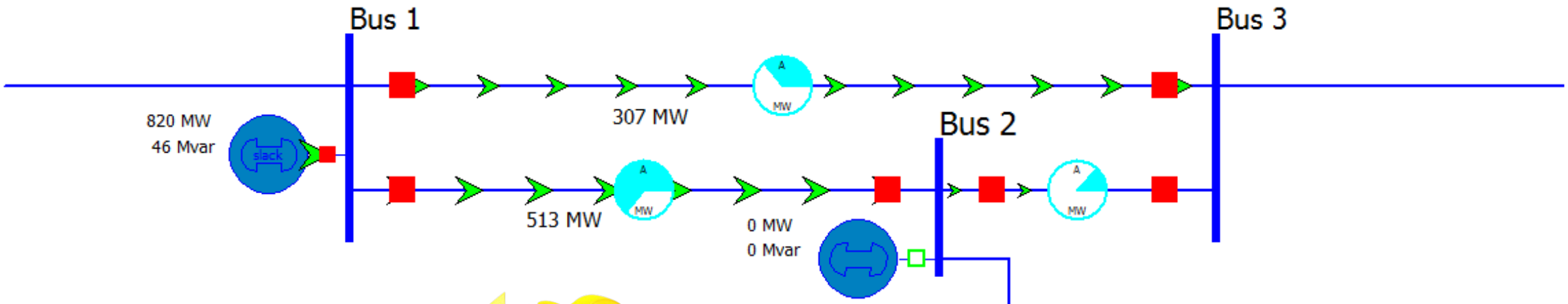
Thermal Limits

Voltage Limits

Stability Limits



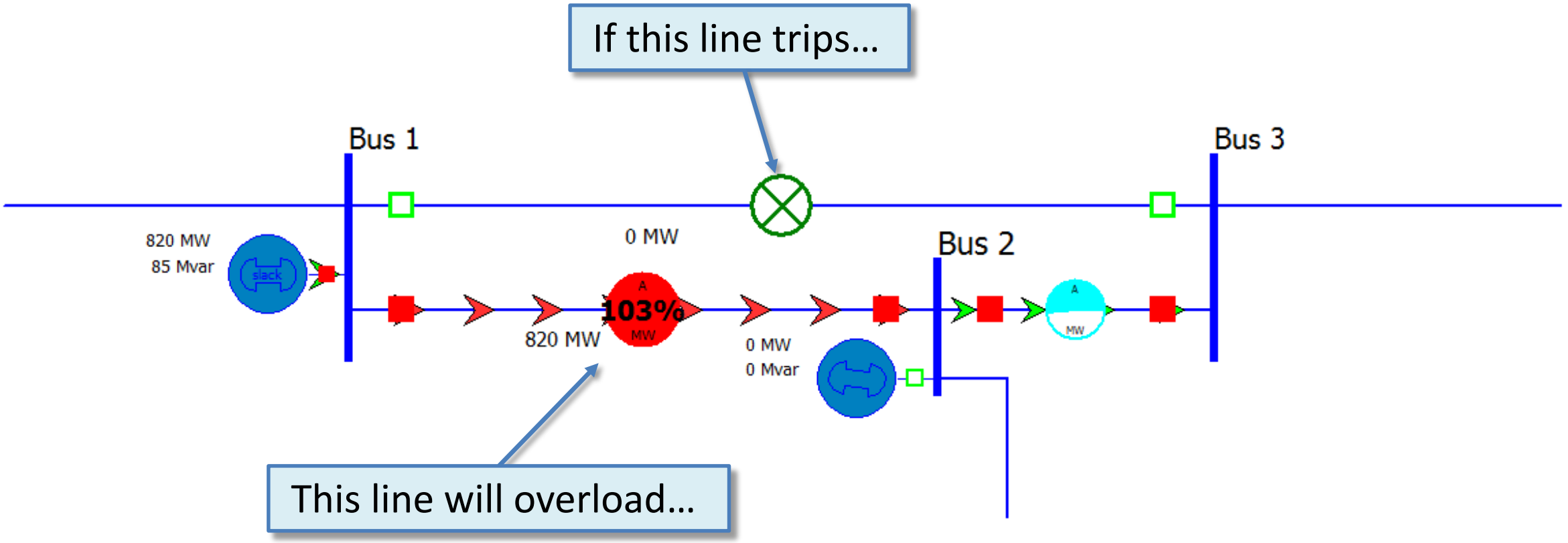
Control Actions for Contingencies



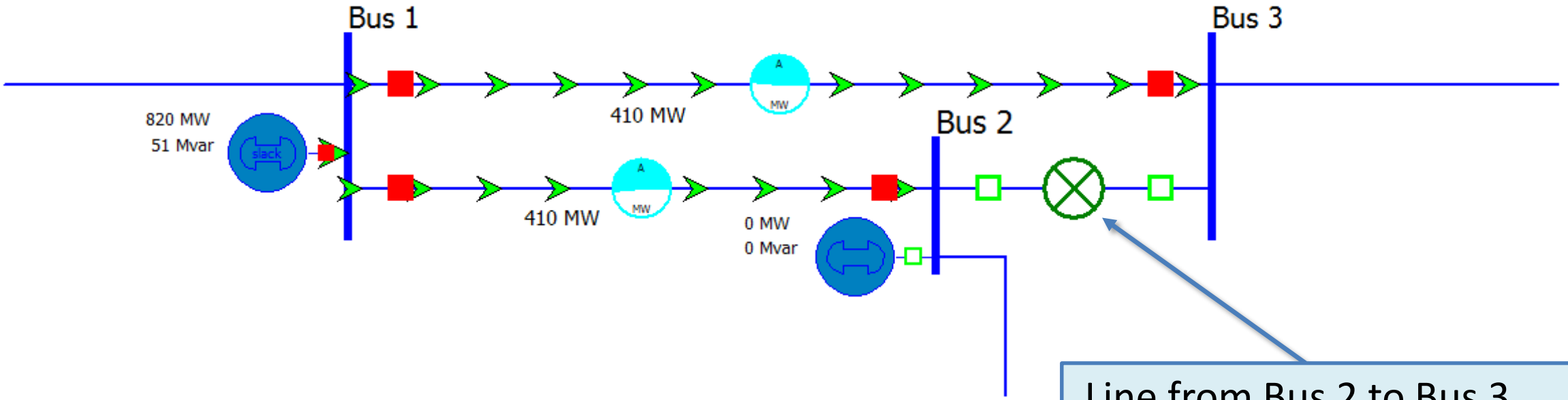
- System Reconfiguration
- Transaction Curtailments
- Generation Re-Dispatch

EMS Identifies a Potential Problem

PJM EMS does *"What If" analysis*



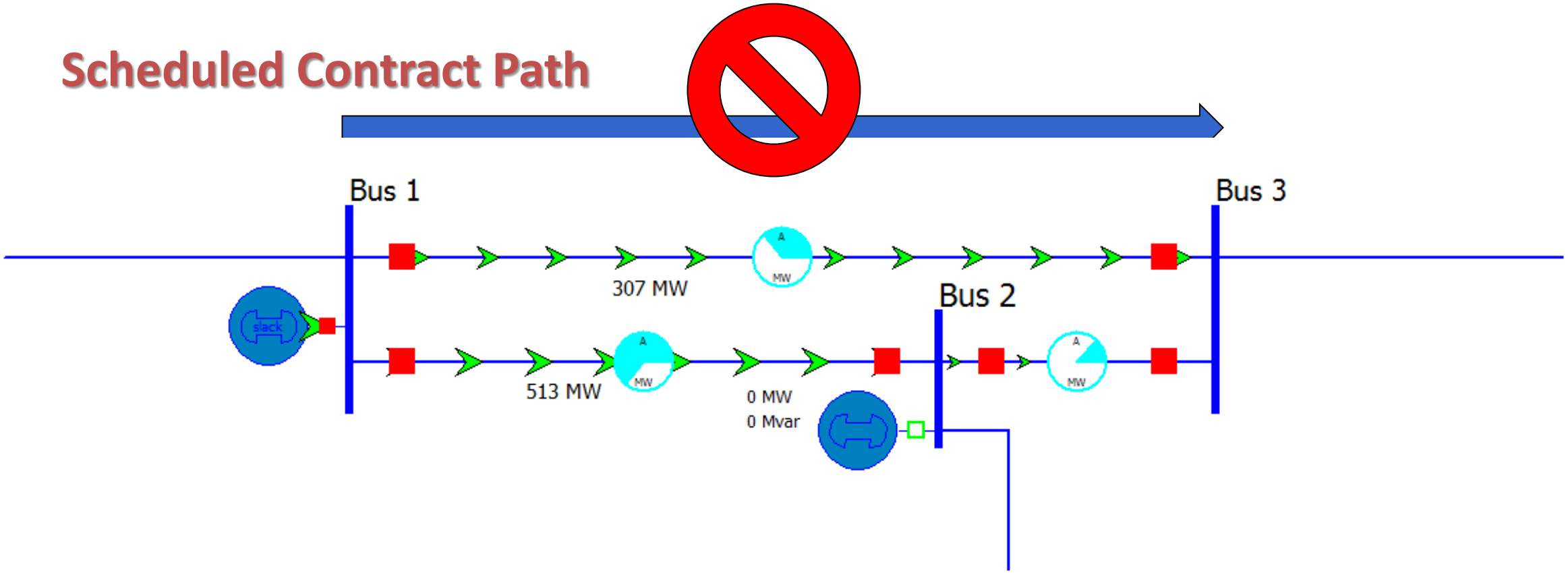
System Reconfiguration



Line from Bus 2 to Bus 3 switched out to prevent overload

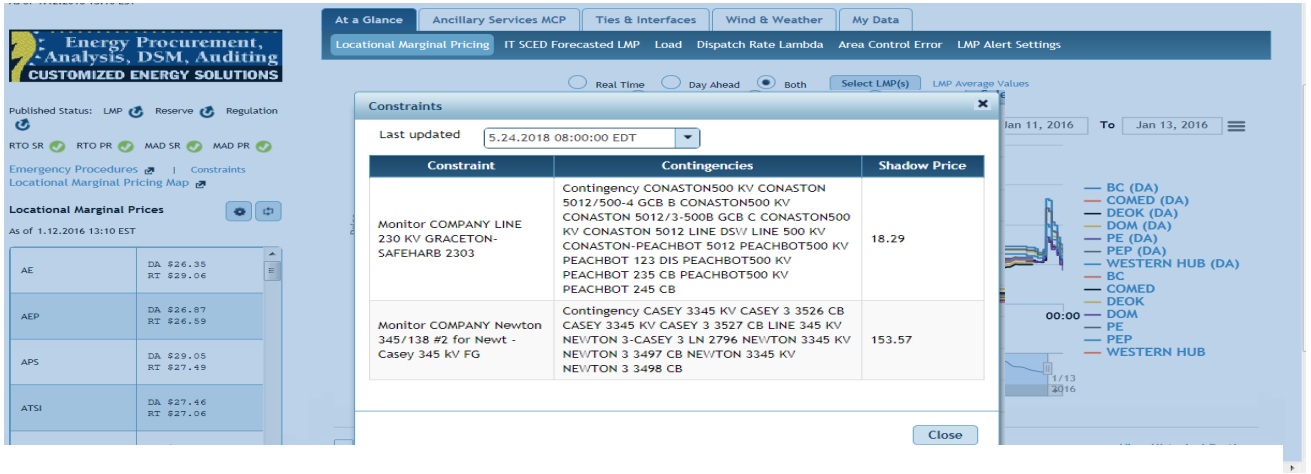
Contract Curtailments

Scheduled Contract Path

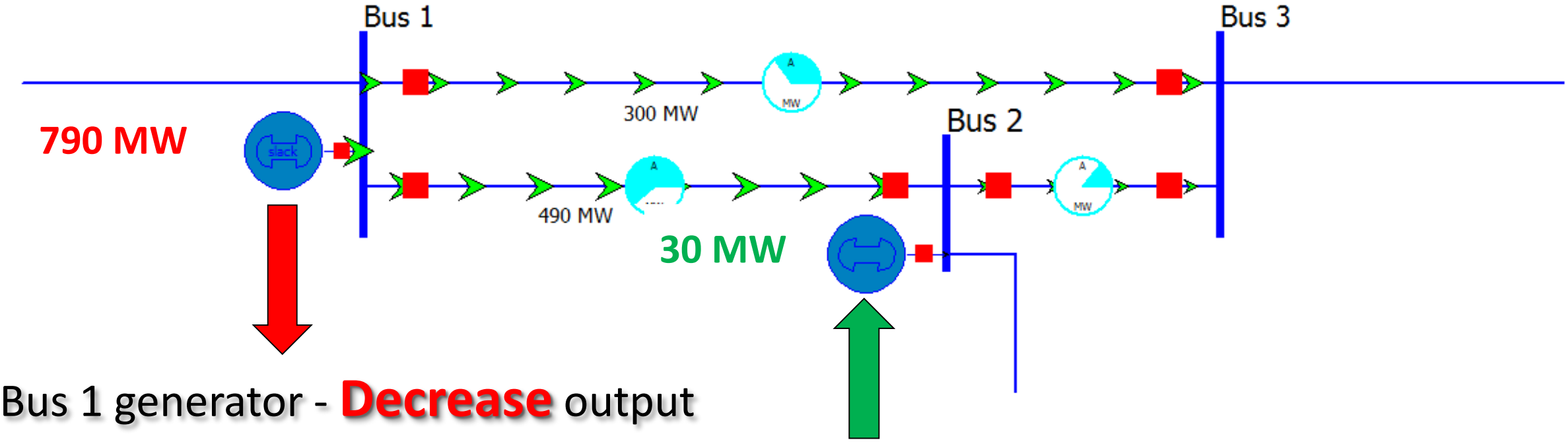


Curtailing contract could fix problem……

Generation Re-Dispatch



Total Supply = Demand = 820 MW

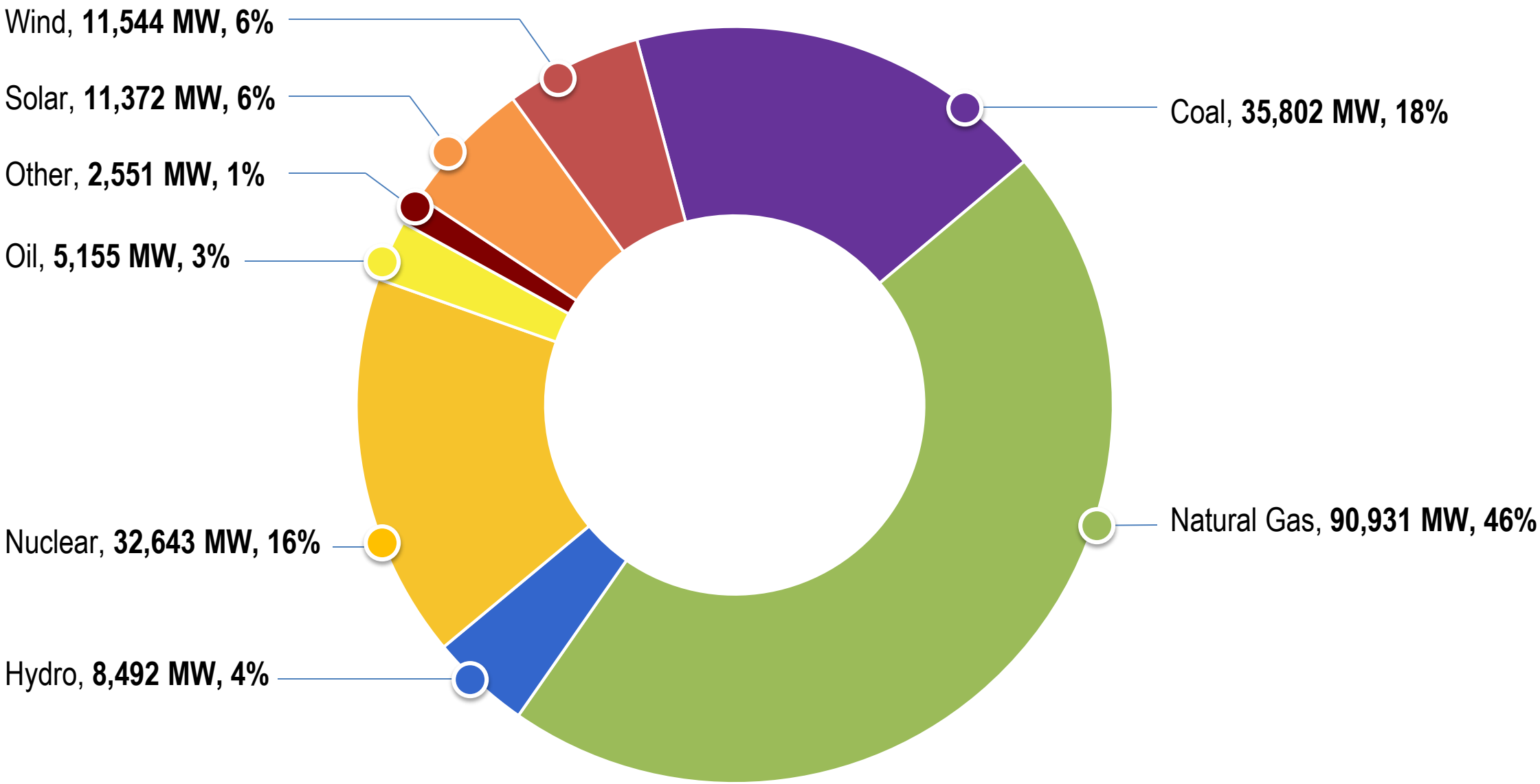


Bus 1 generator - **Decrease** output

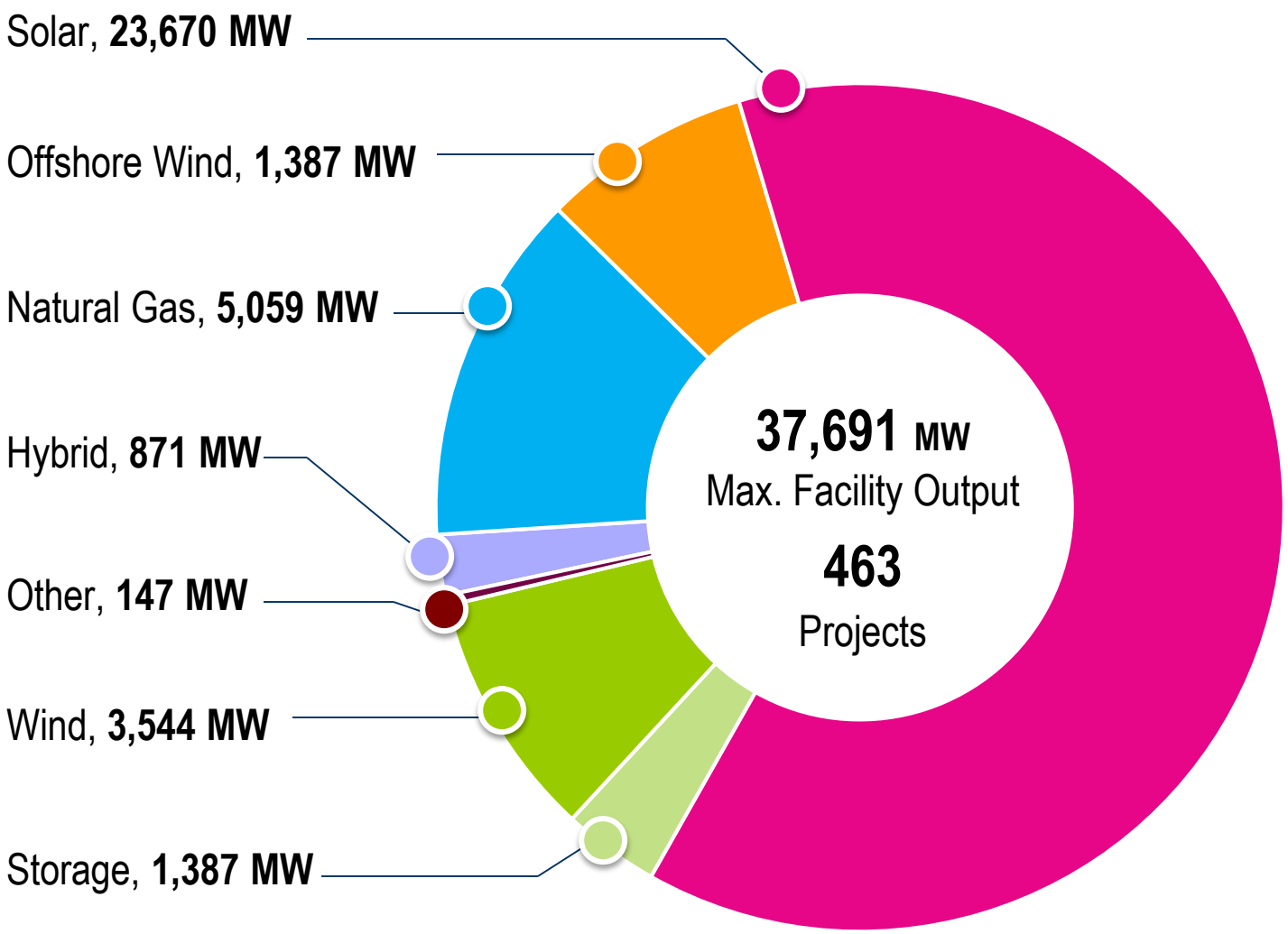
Bus 2 generator - **Increase** output

Current Resource Mix and Future Projects

Current MFO Resource Mix in PJM Footprint



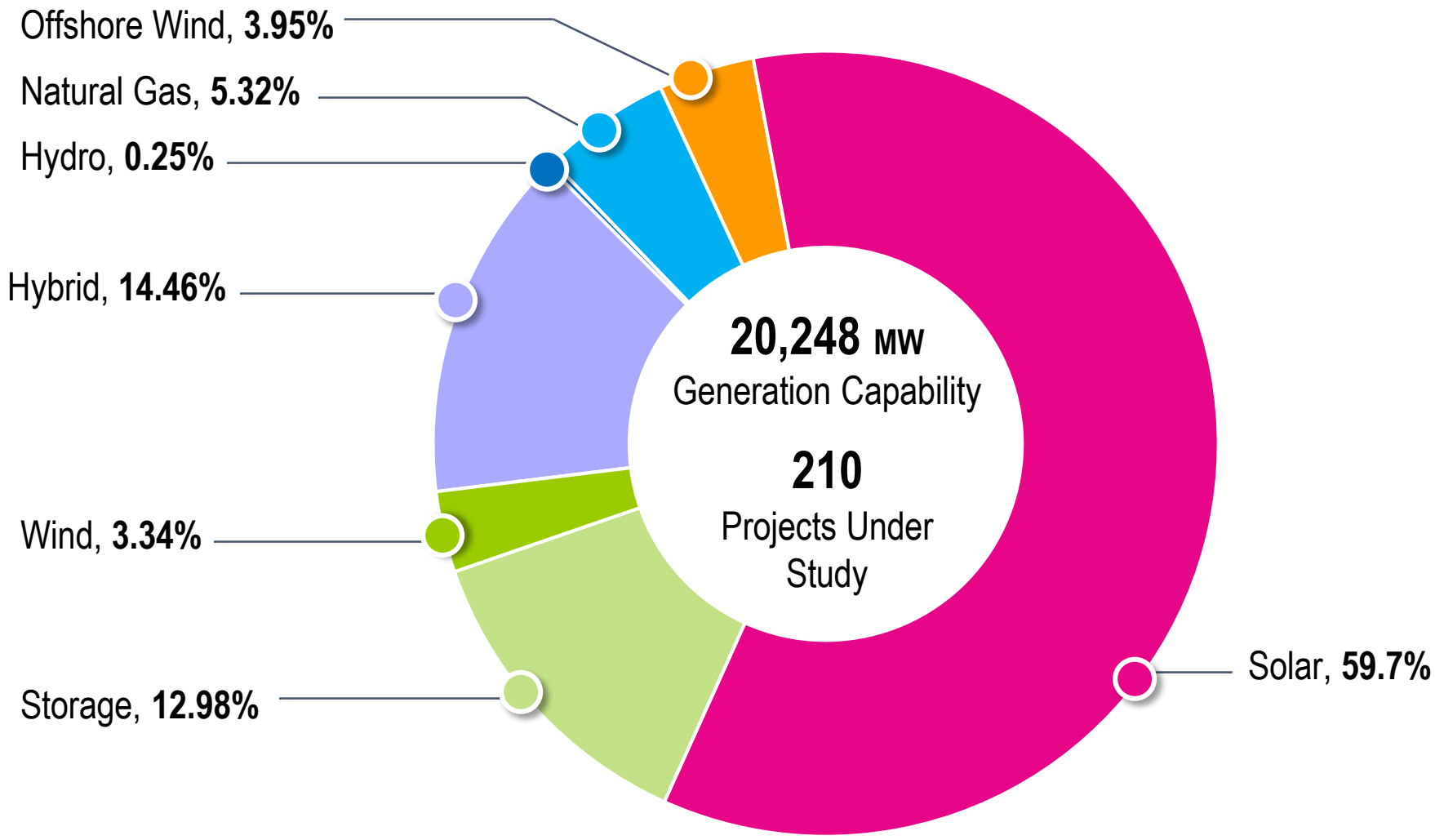
PJM Projects With Executed Final Agreements



Fuel Type	# of Projects	% Of Generation
Hybrid	28	2%
Natural Gas	14	14%
Wind	19	9%
Offshore Wind	7	4%
Solar	357	63%
Storage	31	4%
Other	7	>1%

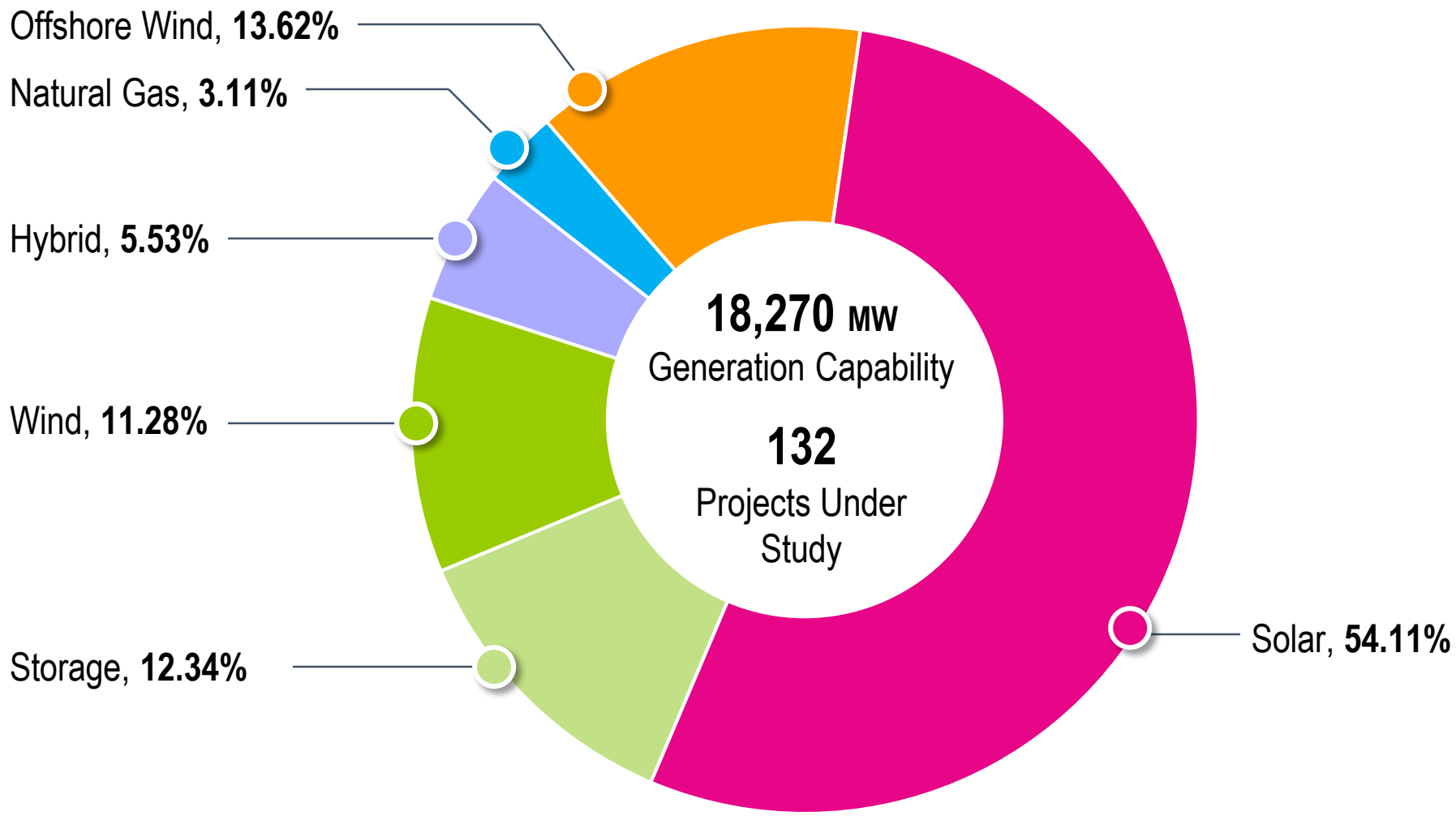
Active PJM Generation Interconnection Requests

Fast Lane – As of Feb. 7, 2025



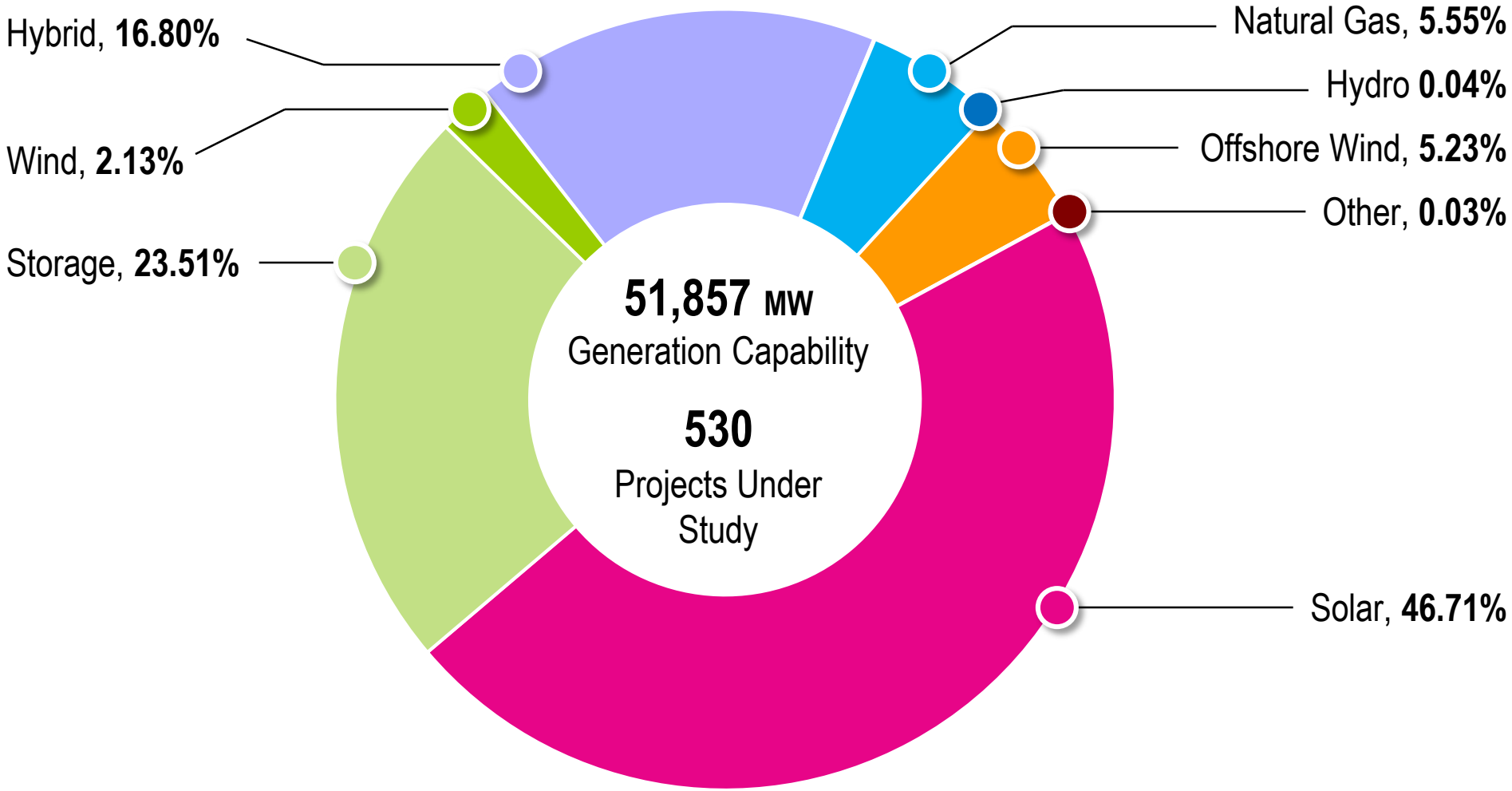
Active PJM Generation Interconnection Requests

Transition Cycle 1 – As of Feb. 7, 2025



Active PJM Generation Interconnection Requests

Transition Cycle 2 – As of Feb. 7, 2025



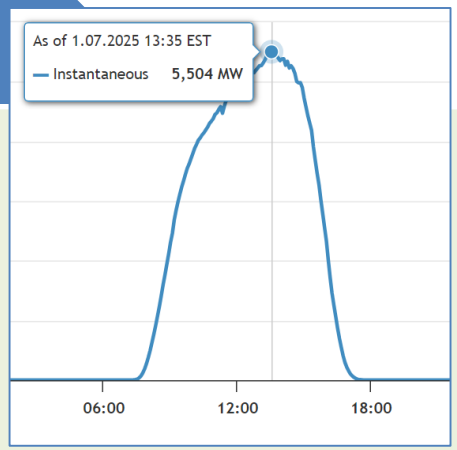
Differences Between IBRs and Synchronous Generation

Inverter-Based Resources	Synchronous Generation
Driven by power electronics and software	Driven by physical machine properties
No (or little) inertia	Large rotating inertia
Very low fault current	High fault current
Sensitive power electronic switches	Rugged equipment tolerant to extremes
Very fast and flexible ramping	Slower ramping
Very fast frequency control	Inherent inertial response
Minimal plant auxiliary equipment prone to tripping	Sensitive auxiliary plant equipment
Dispatchable based on available power	Fully dispatchable
Can provide essential reliability services	Can provide essential reliability services

IBR Effect on PJM Real-Time Operations

Proactivity

Day-Ahead Reports



Bridged Constraints

Questions?

PJM Client Management & Services

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Toll Free Telephone: (866) 400-8980

Website: www.pjm.com

The Member Community is PJM's self-service portal for members to search for answers to their questions or to track and/or open cases with Client Management & Services