

The Evolution of Wholesale Electricity Markets

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President & CEO

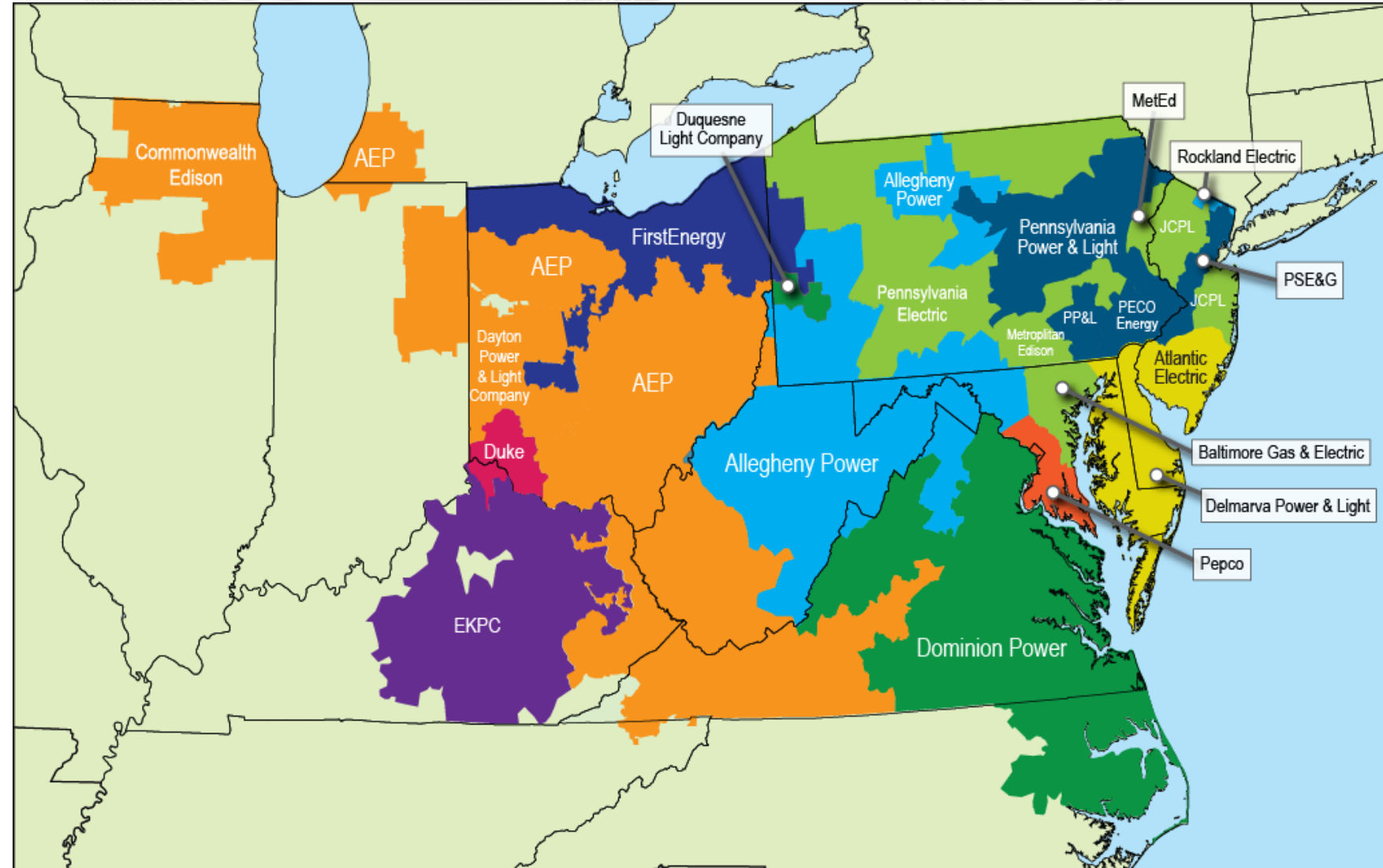
Kleinman Center for Energy Policy
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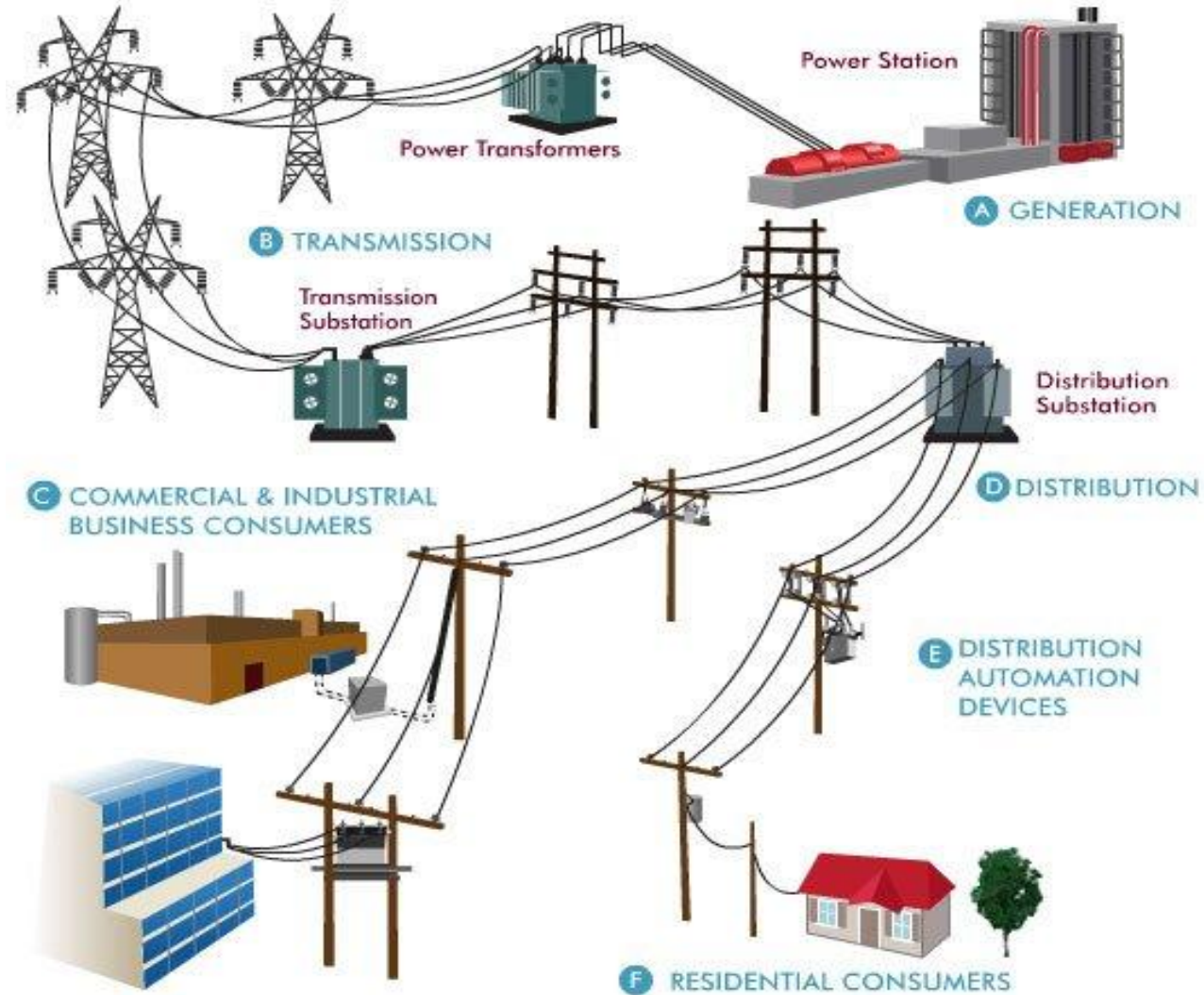
Key Statistics

Member companies	1,000+
Millions of people served	65
Peak load in megawatts	165,492
MW of generating capacity	176,569
Miles of transmission lines	82,546
2016 GWh of annual energy	792,314
Generation sources	1,304
Square miles of territory	243,417
States served	13 + DC

- 27% of generation in Eastern Interconnection
- 28% of load
- 20% of transmission assets

21% of U.S. GDP produced in PJM



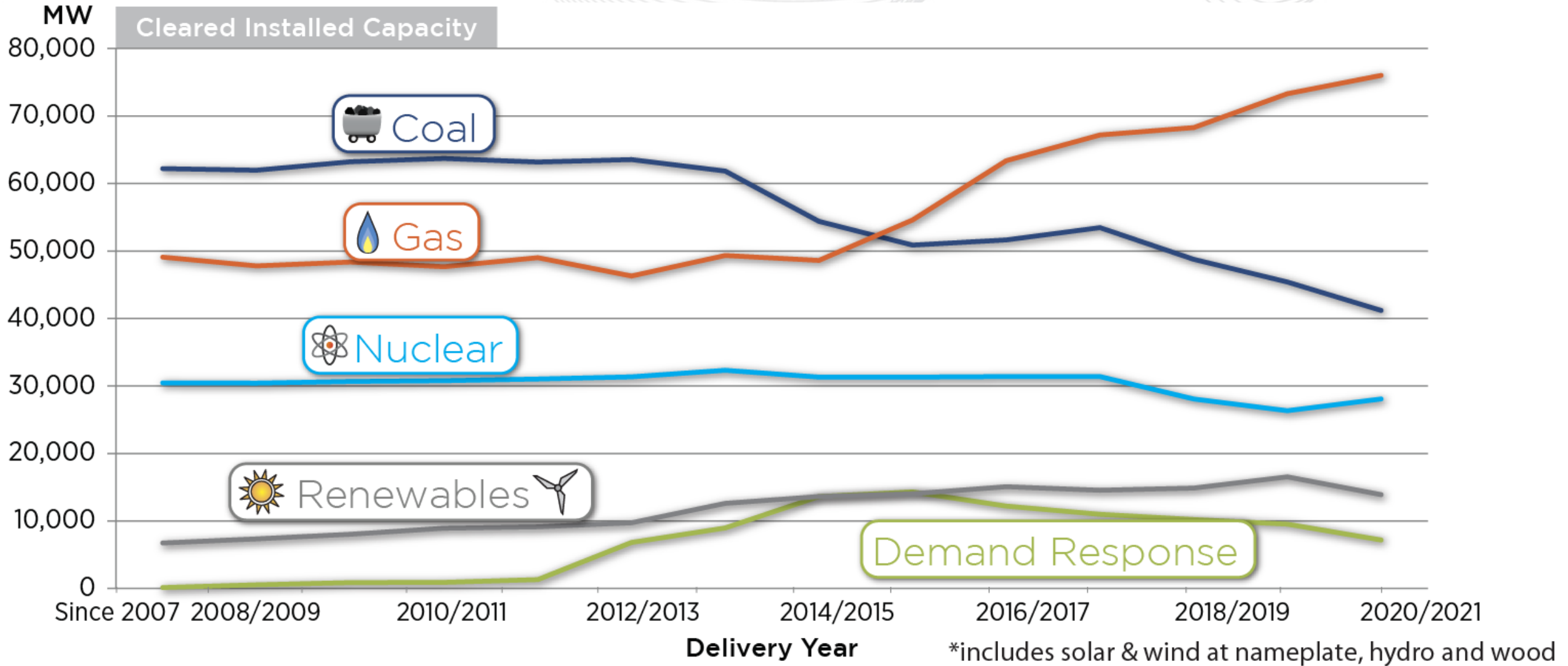


PJM's Role as a Regional Transmission Organization



Match Power Generation to Customer Needs

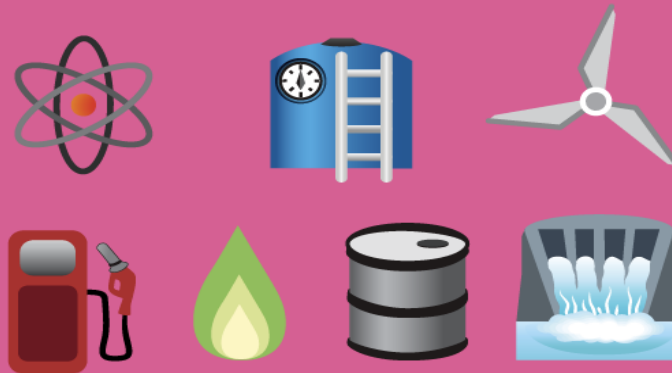




**Delivers Robust
Reliability**



**Delivers
Operational
Diversity**



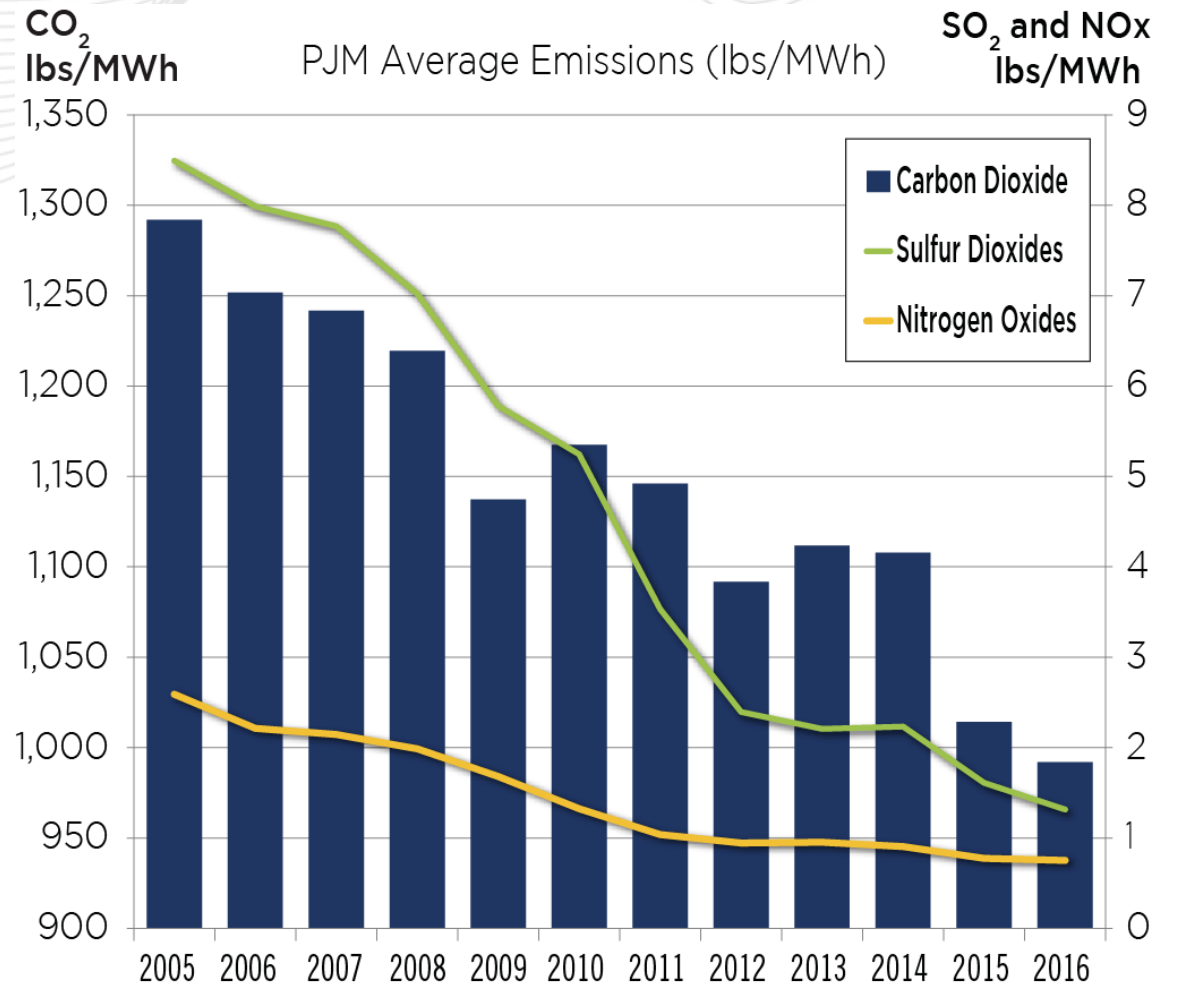
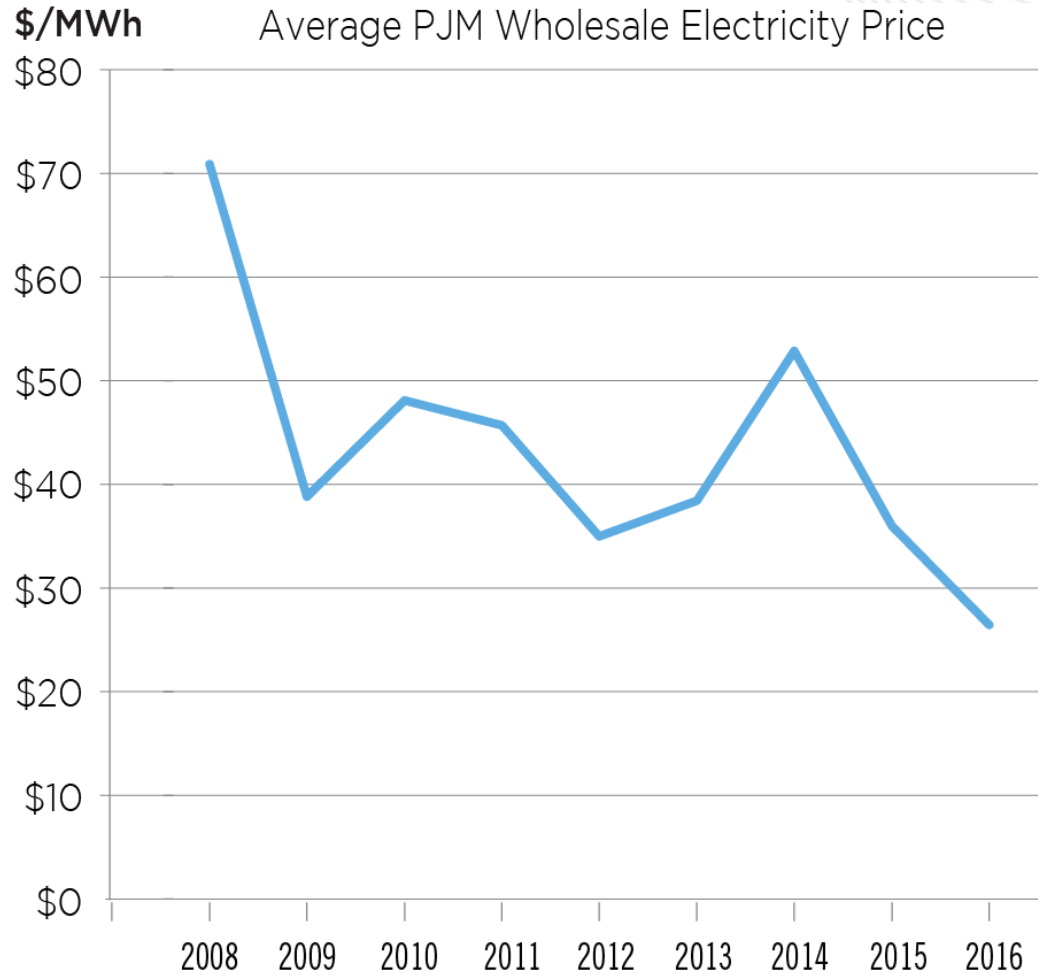
**Delivers Regional
Infrastructure
Planning**



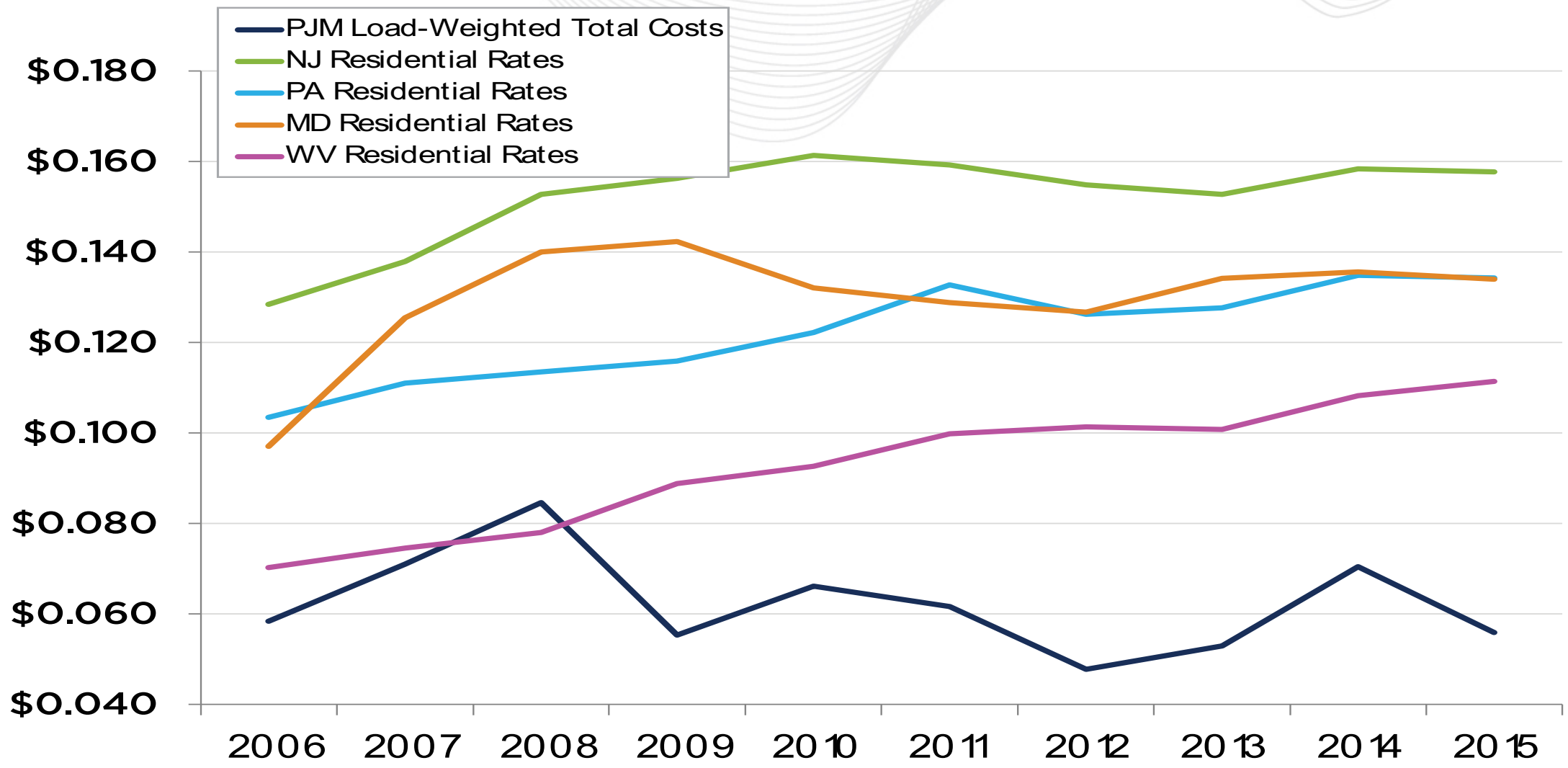
Sustained Reliability at Least Cost

... However, we must look at future trends.

Average Wholesale Cost Vs. Emissions

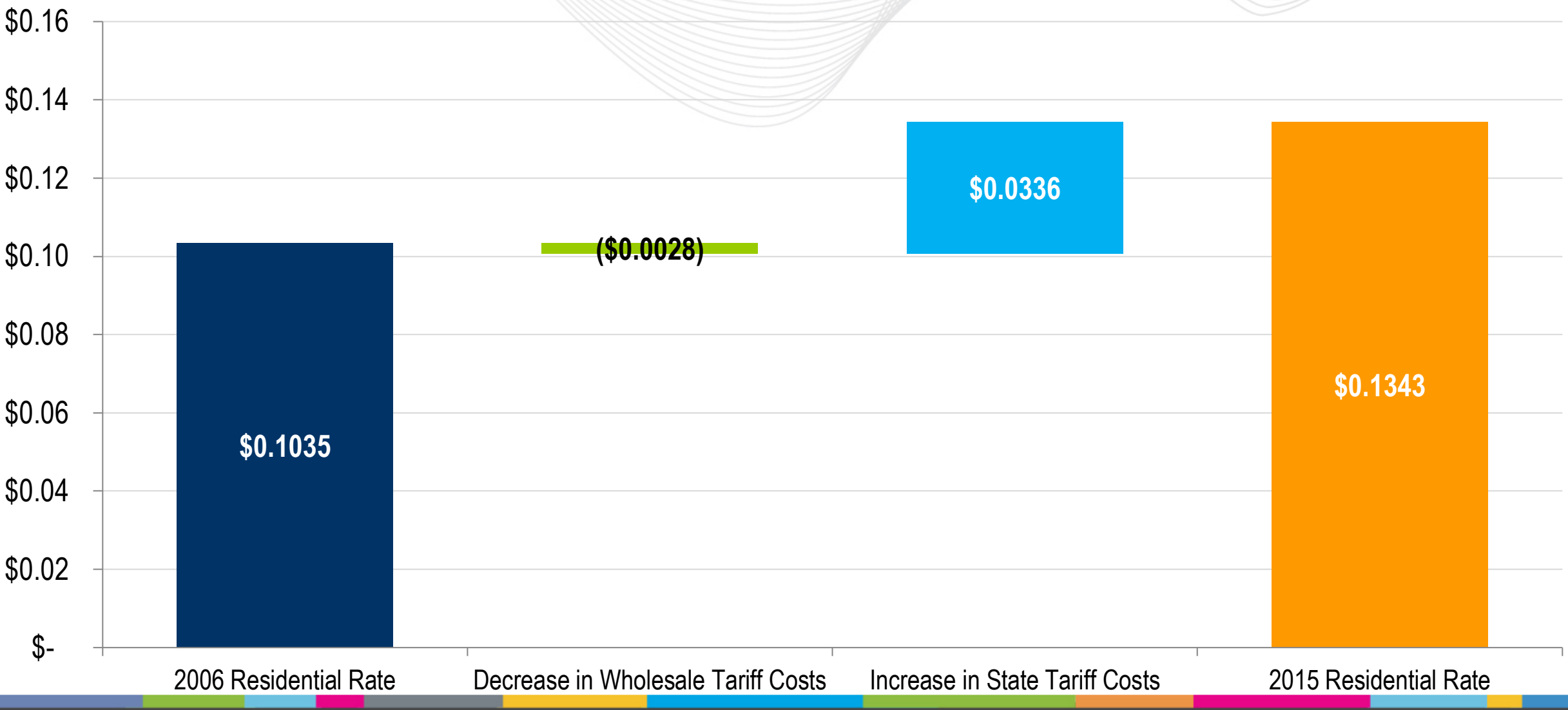


Residential and Wholesale Rate Trends





Drivers of ~30% Increase in Average PA Residential Rate from 2006 to 2015



Unprecedented number of changes in the power industry



Storage technologies



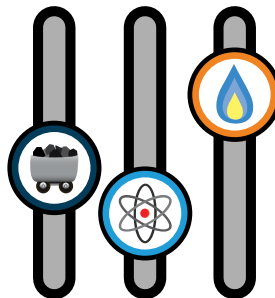
Distributed energy resources



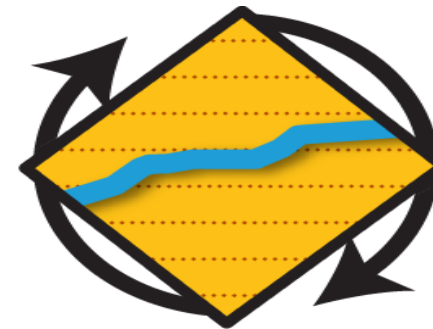
Intermittent renewables



Alternative technologies



Fuel swap



Changes in customer expectations

Frequency Regulation

262.4 MW of batteries
32 MW of demand-side resources

~ On average **27%**.
As high as **39%** of our regulation requirement is provided by alternative technologies.

Synchronized Reserves

444 MW of demand-side resources capable of providing synch reserve in 2017 YTD.

8.1% of synch reserve actually provided by Demand-Side Resources in 2017 YTD.



External Networks

- Fuel Security
- Pipeline Infrastructure
- Telecommunications

Power Grid

- Critical Grid Facilities
- Contingency Definitions

System Restoration

- Cranking Path Redundancy
- Critical Load Definition
- Partnerships

Drivers for Change: Microgrids Interacting Through Markets

- Enhanced Control Systems
- Distributed Storage Technology
- Flexible Consumption

