

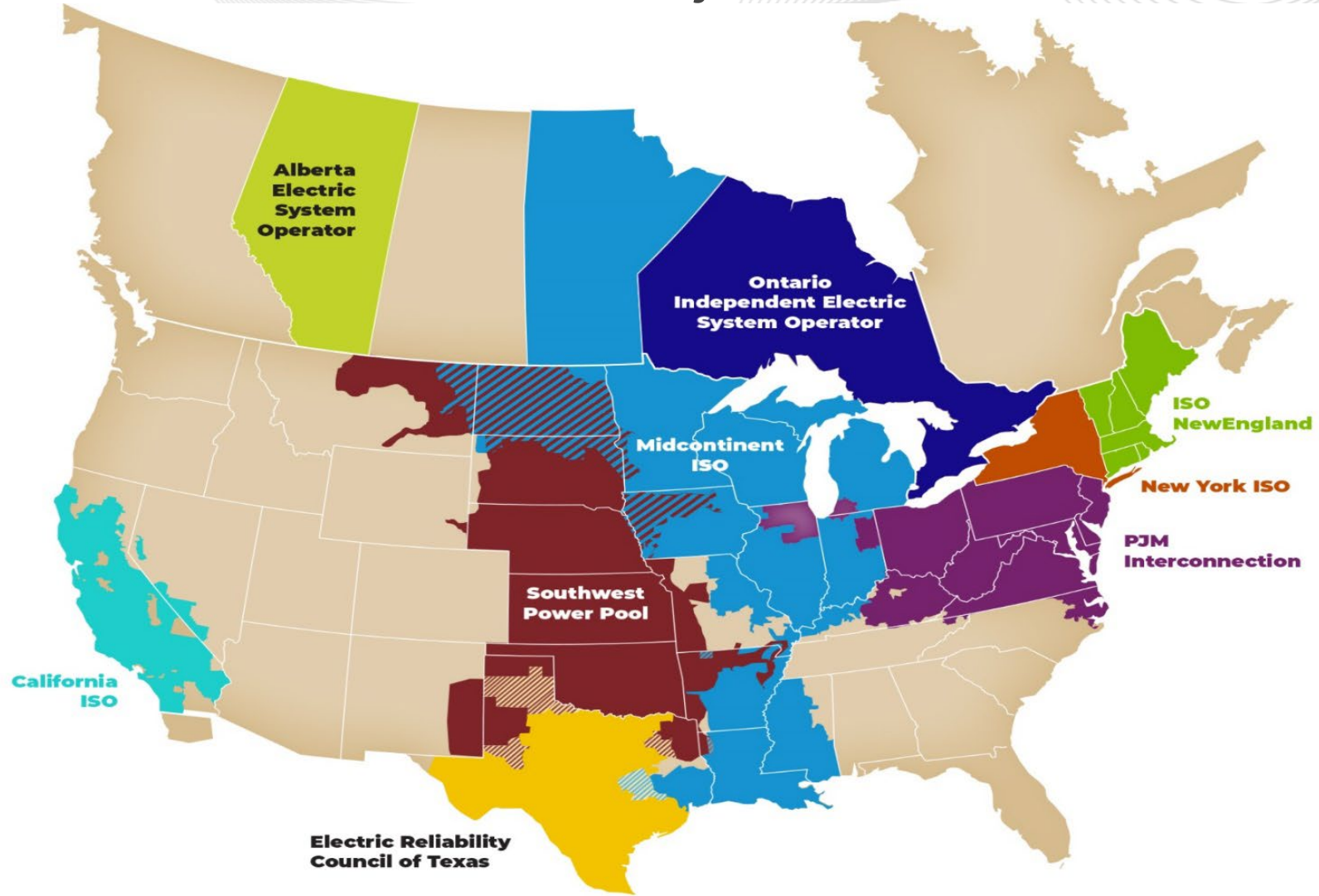


RTO Overview

Asim Haque
VP, State & Member Services
PJM Interconnection

August 25, 2020

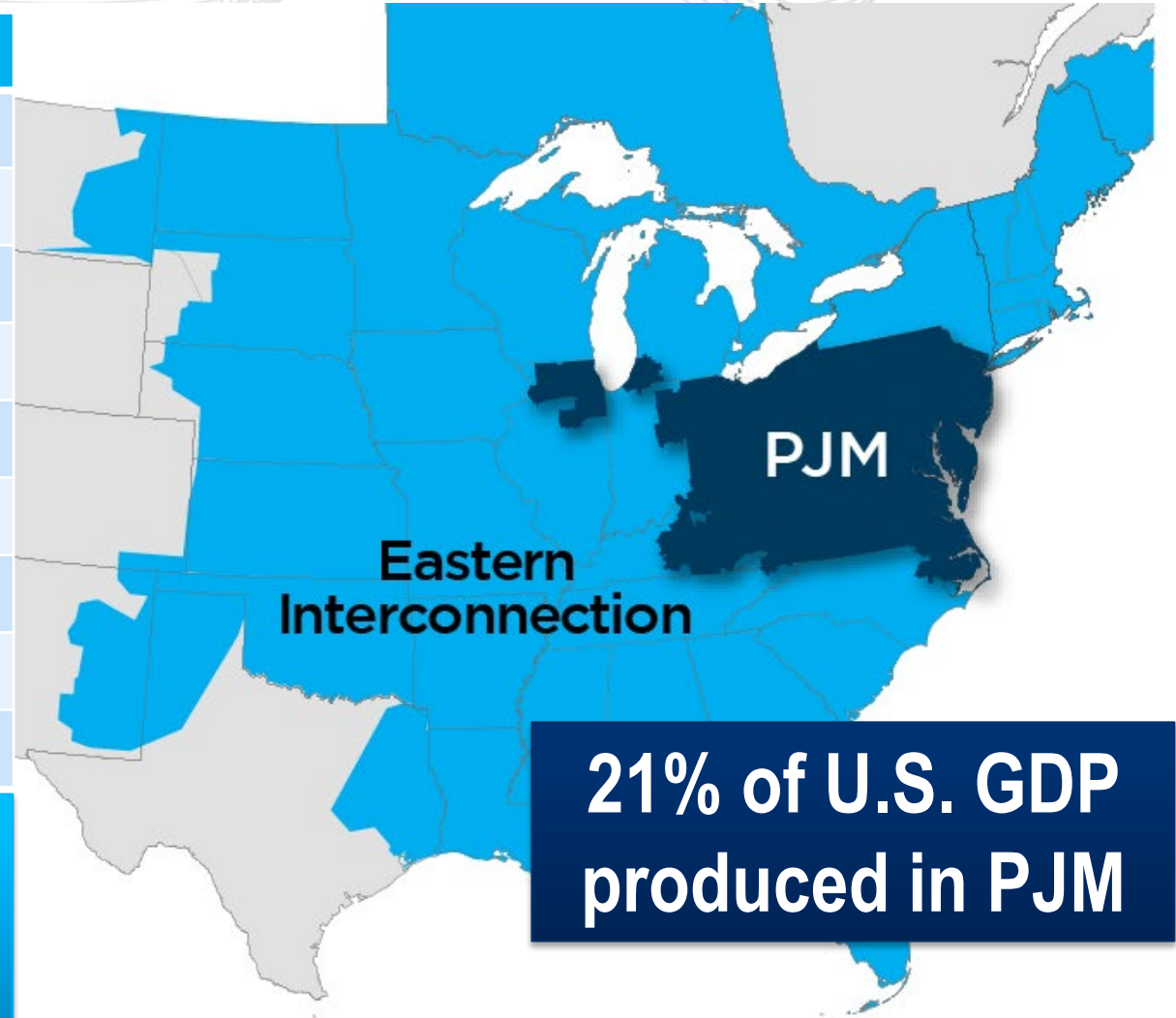
Nine Major North American RTOs/ISOs



Key Statistics

Member companies	1,040+
Millions of people served	65
Peak load in megawatts	165,563
MW of generating capacity	186,788
Miles of transmission lines	84,236
2019 GWh of annual energy	787,307
Generation sources	1,446
Square miles of territory	369,089
States served	13 + DC

- 27% of generation in Eastern Interconnection
- 26% of load in Eastern Interconnection
- 20% of transmission assets in Eastern Interconnection



As of 2/2020

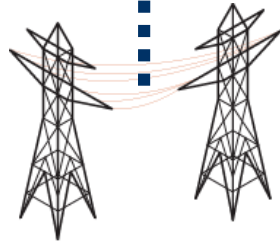
Independent Board of Managers

Market Monitor

Members Committee



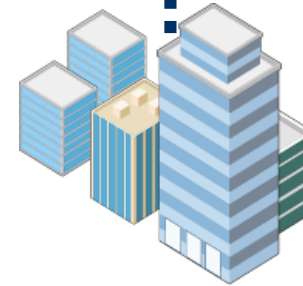
Generation Owners



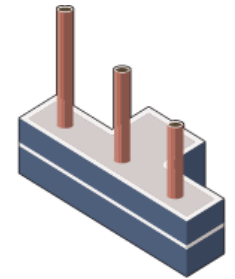
Transmission Owners



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
- ISO funding and startup

PLANNING



Planning for the future like...



OPERATIONS



Matches supply with demand like...



MARKETS

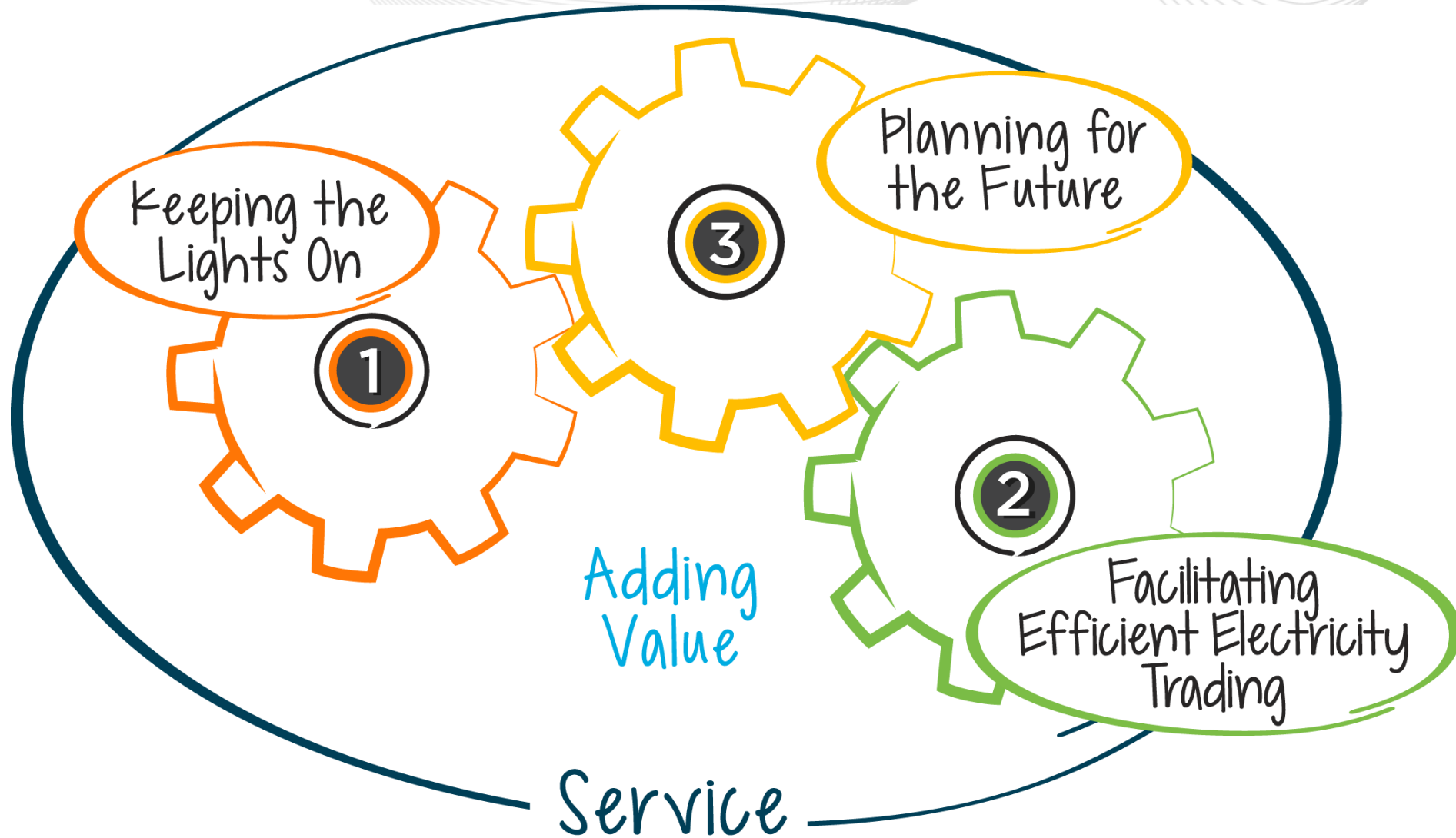


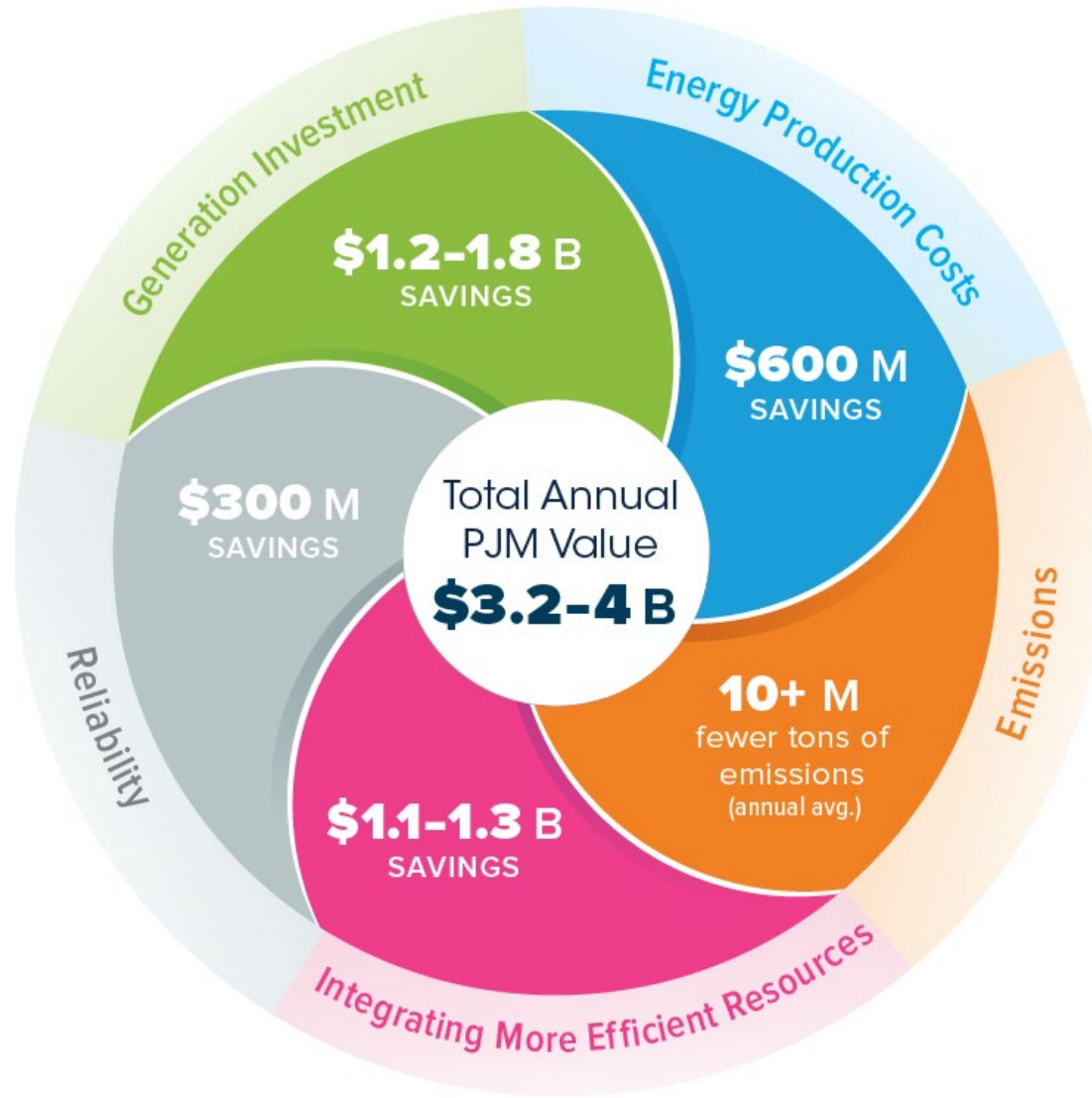
By Zone

AE	\$20.59
AFP	\$25.55
APS	\$25.10
ATSI	\$25.46
RC	\$37.91
COMED	\$25.60
DAYTON	\$26.22
DFOK	\$25.38

Energy Market Pricing like...







— All numbers are estimates. —

RTO Functions – Demand

- Load Forecast for reliability analysis
- Ensure adequate generation scheduled and dispatched to satisfy load forecast
- Accept demand bids in Day-Ahead Market
- Administer demand response
- Set operating reserve requirements
- Set installed capacity requirements

RTO Functions – Supply

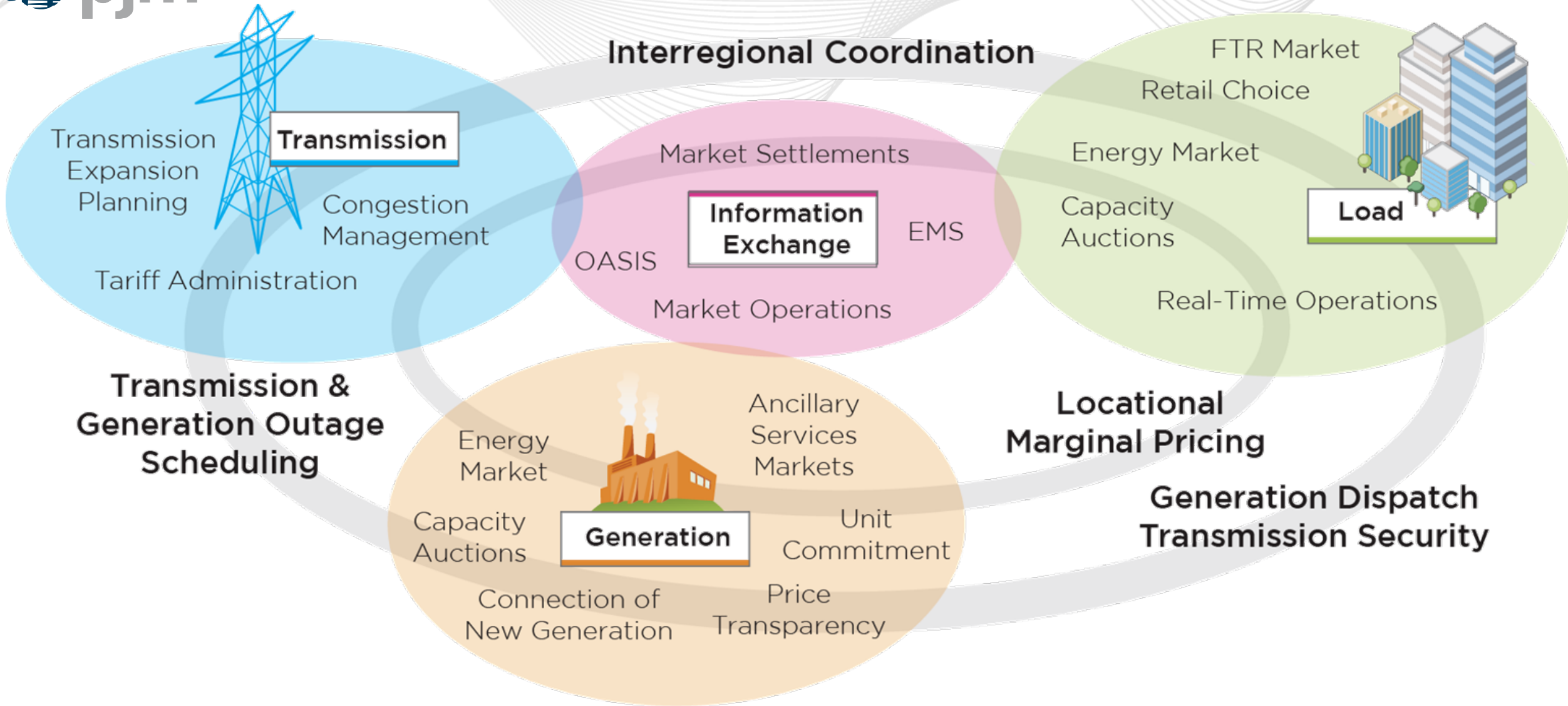
- Perform real-time generation dispatch
- Accept generation offers in Day-Ahead and Real-Time markets
- Unit commitment, generation scheduling
- Send generation control signals
 - Load following | Frequency control | Ancillary services
- Coordinate generation outage schedules
- Administer capacity market

Load Serving Entity

- Load forecast for commercial position
- Manage energy supply requirements
- Manage generation adequacy contracts
- Enter into hedging contracts
- Enter into contracts with wholesale / retail customers
- Interaction with state regulators

Generation Owner

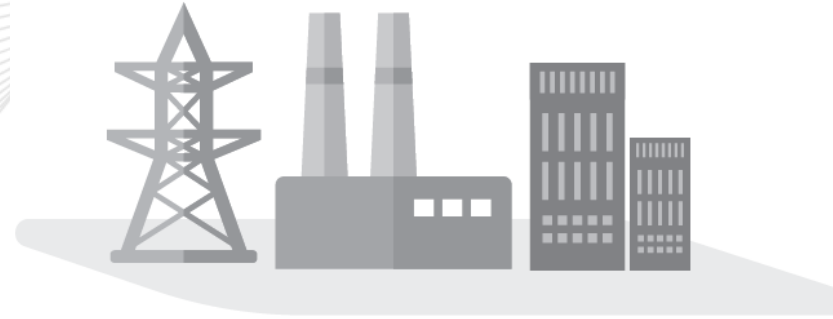
- Schedule generation outages
- Manage generator offer information
- Bilateral Contracts
- Operate generating plants, Maintain plants, etc.
- Offer various products (energy, capacity, regulation, spin, etc)
- Manage generation portfolio w/ three alternatives:
 - Self-schedule | Bilateral sale | Submit offer and follow RTO dispatch



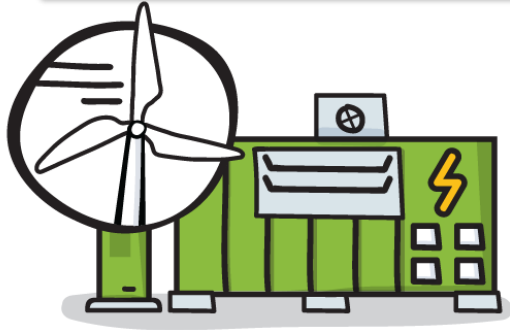
Today

- Ensuring reliability at least reasonable cost
- Valuation of resource attributes
- Market-based solutions to incent desired outcomes

10 YEARS AGO



Unprecedented number of changes in the power industry



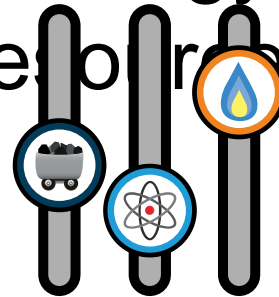
Storage
and
renewables



Alternative
technologies



Distributed
energy
resources



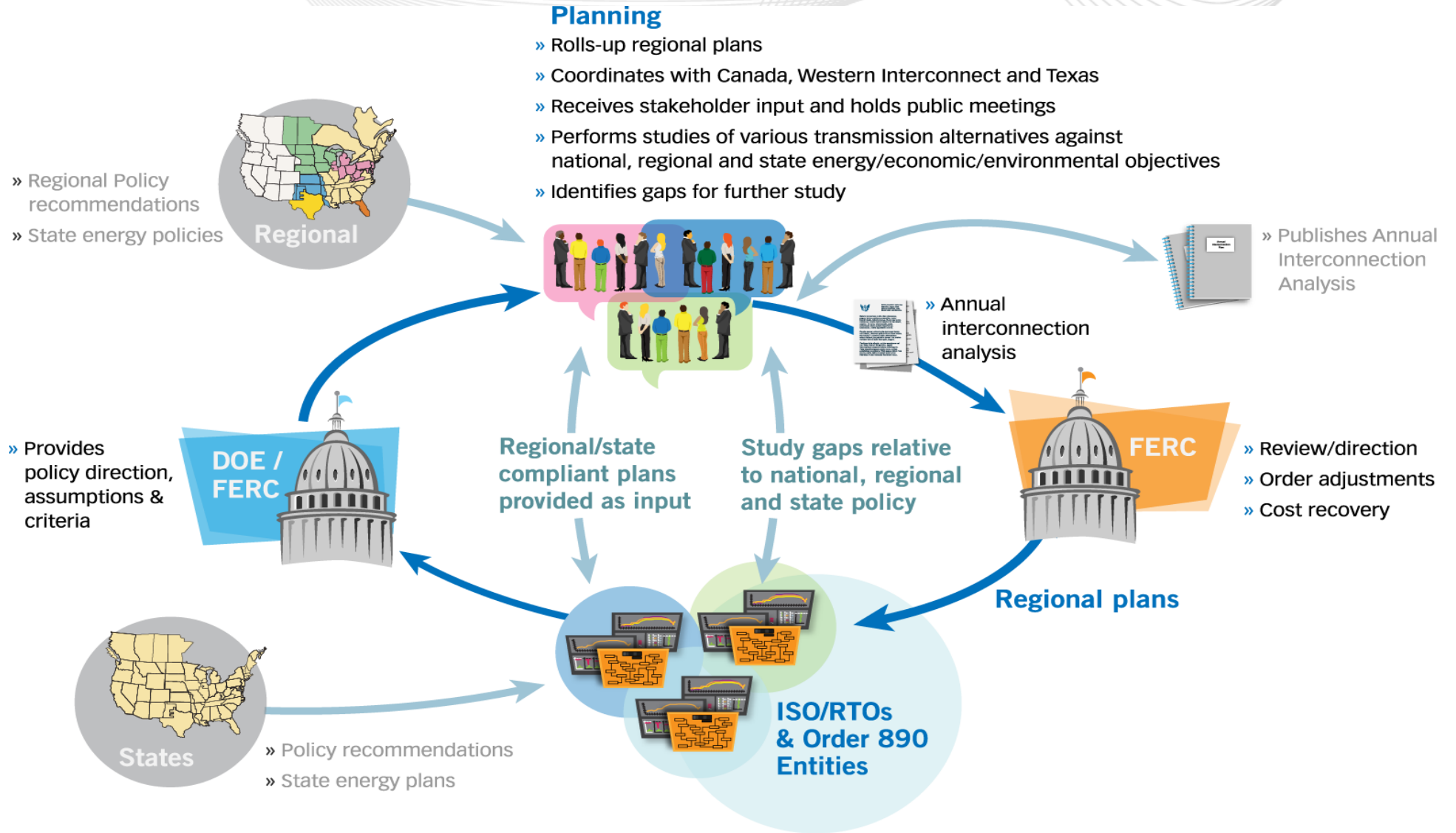
Fuel
Swap



Energy
Efficiency



Customer
behavior
and
demand



NERC

- Under the Energy Policy Act of 2005, the Federal Energy Regulatory Commission (FERC) was required to designate an Electric Reliability Organization (ERO) to enforce mandatory reliability standards for all participants in the North American bulk power system.
- NERC named the ERO in July 2006.

IRC

- An industry organization that includes the ten Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs)
- Delivers two-thirds of the electricity consumed in the United States to two-thirds of its population.
- Works collaboratively to develop effective processes, tools and standard methods for improving competitive electricity markets across North America