# Planning for Distributed Resources

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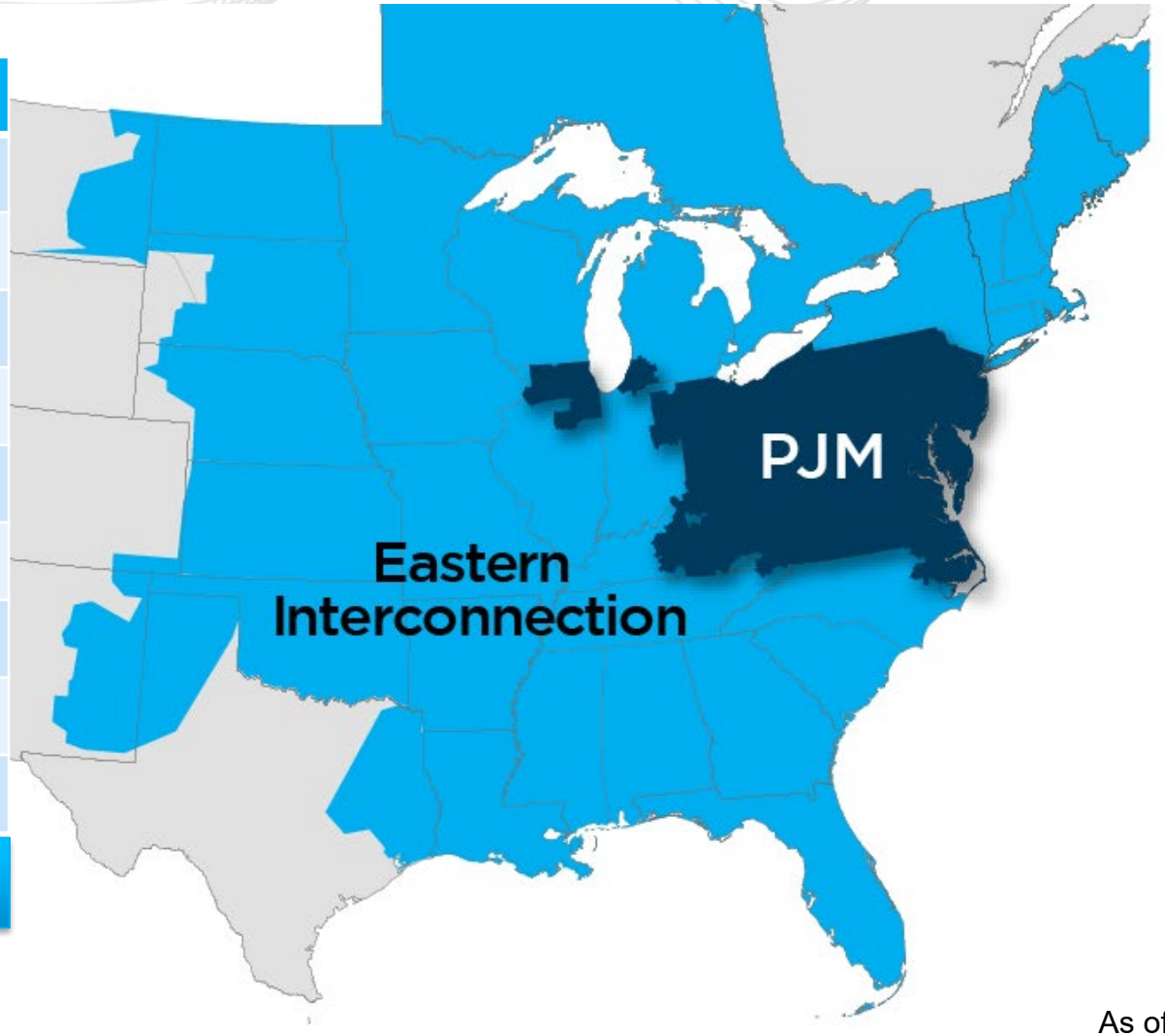
# PJM as Part of the Eastern Interconnection

| Key Statistics | |
|---|---|
| Member companies | 1,040+ |
| Millions of people served | 65 |
| Peak load in megawatts | 165,563 |
| Megawatts of generating capacity | 185,378 |
| Miles of transmission lines | 85,103 |
| 2020 gigawatt hours of annual energy | 757,284 |
| Generation sources | 1,424 |
| Square miles of territory | 369,089 |
| States served | 13 + DC |

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




As of 2/2021

# PJM's Role as a Regional Transmission Organization

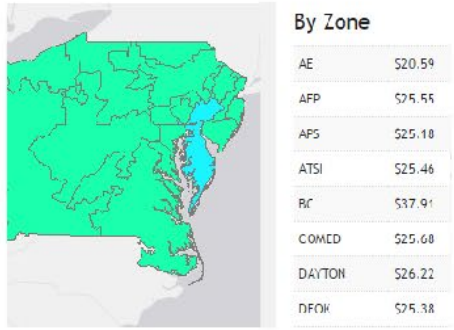
## PLANNING

Planning for the future like...


## OPERATIONS

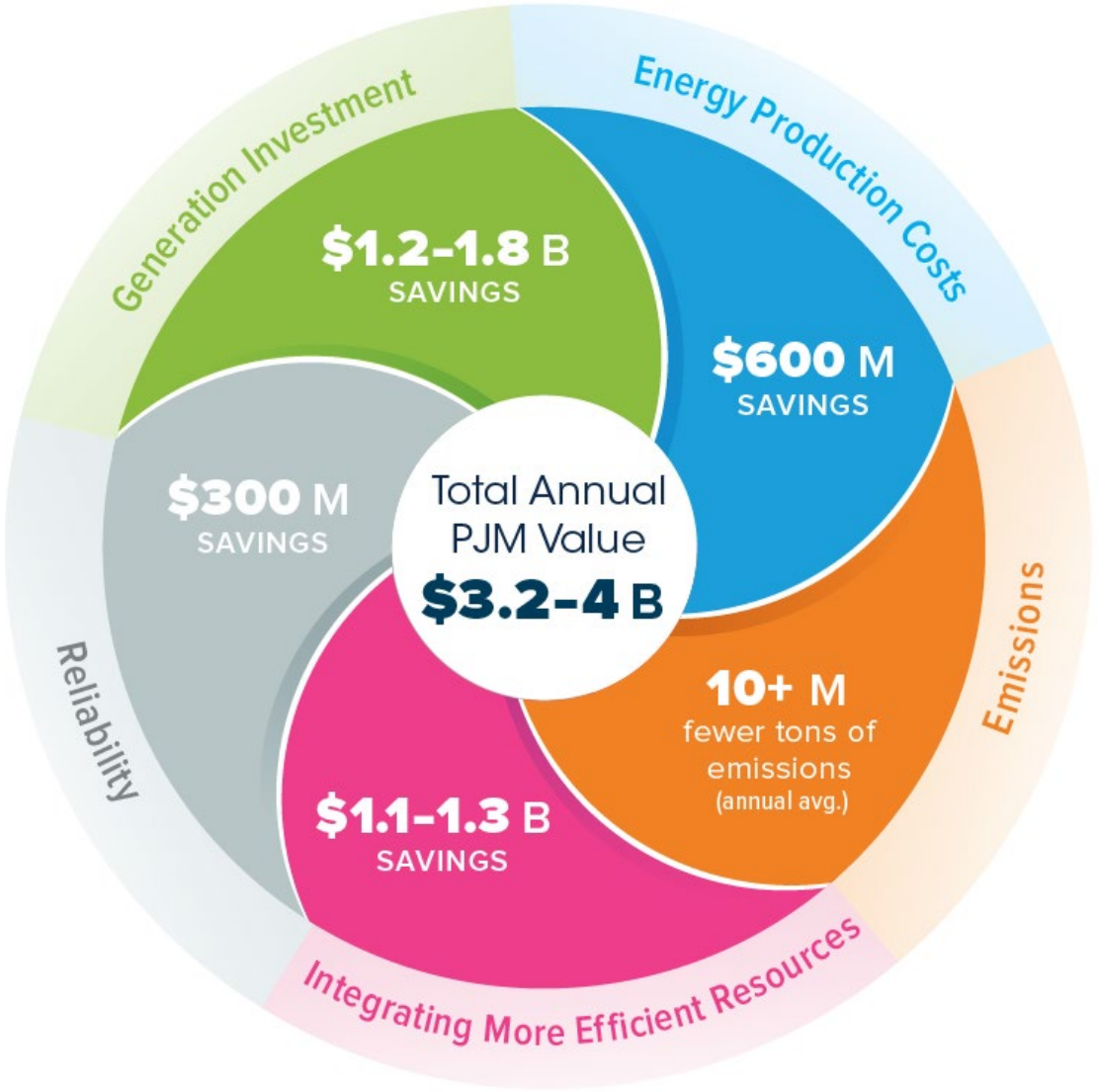
Matches supply with demand like...


## MARKETS



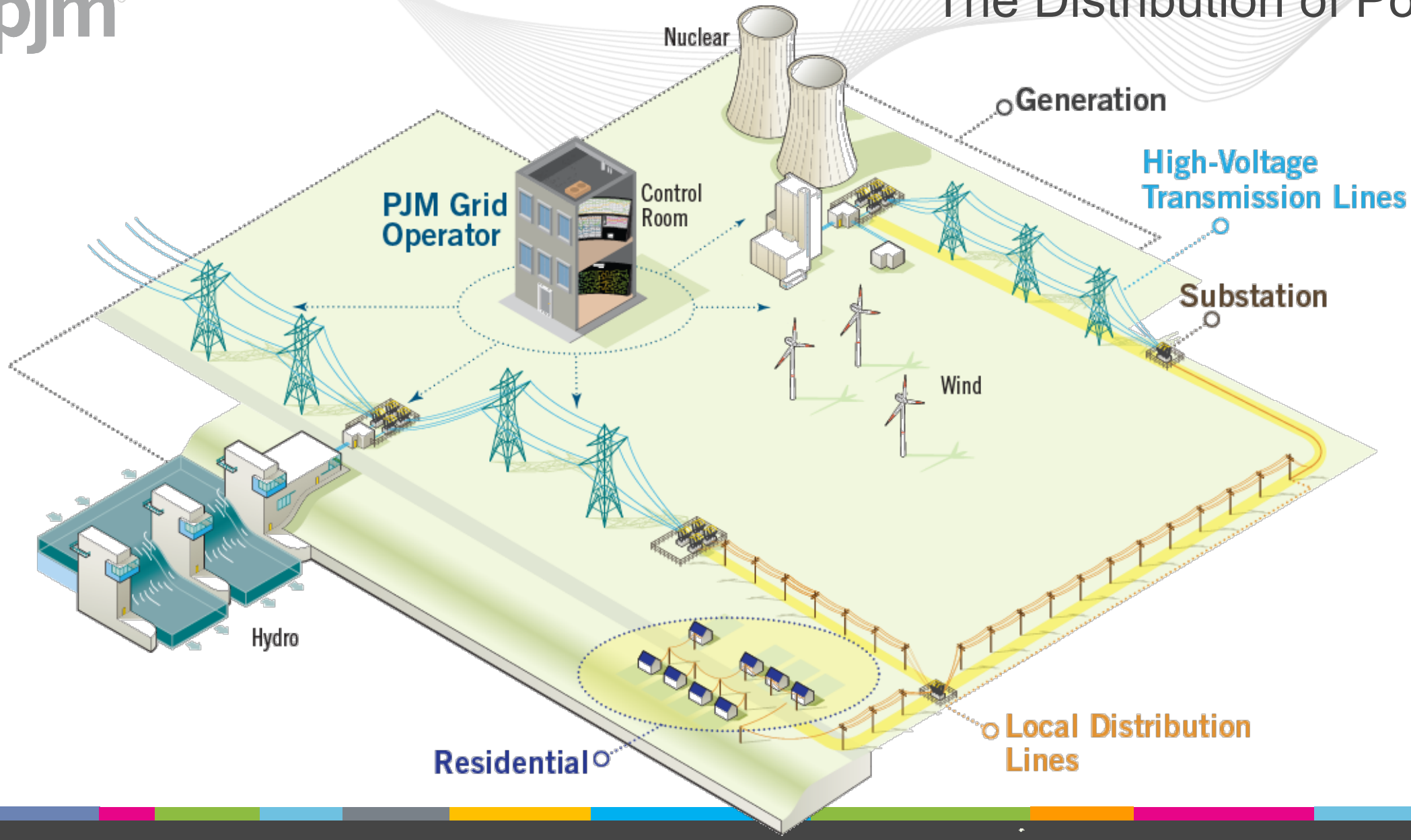

Energy Market Pricing like...

# Value Proposition

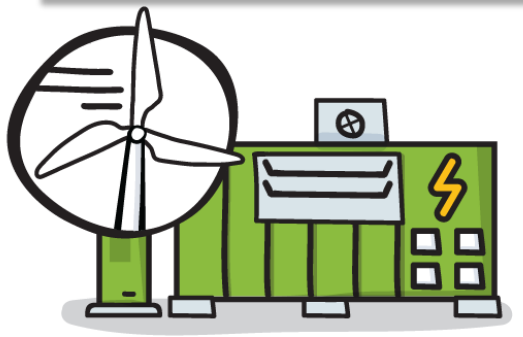



*All numbers are estimates.*

# The Distribution of Power



# Unprecedented number of changes in the power industry

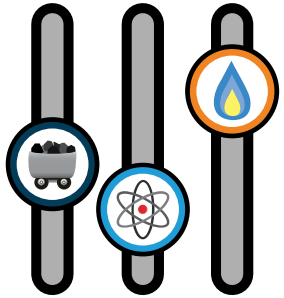


Storage and renewables

Distributed energy resources

Energy efficiency

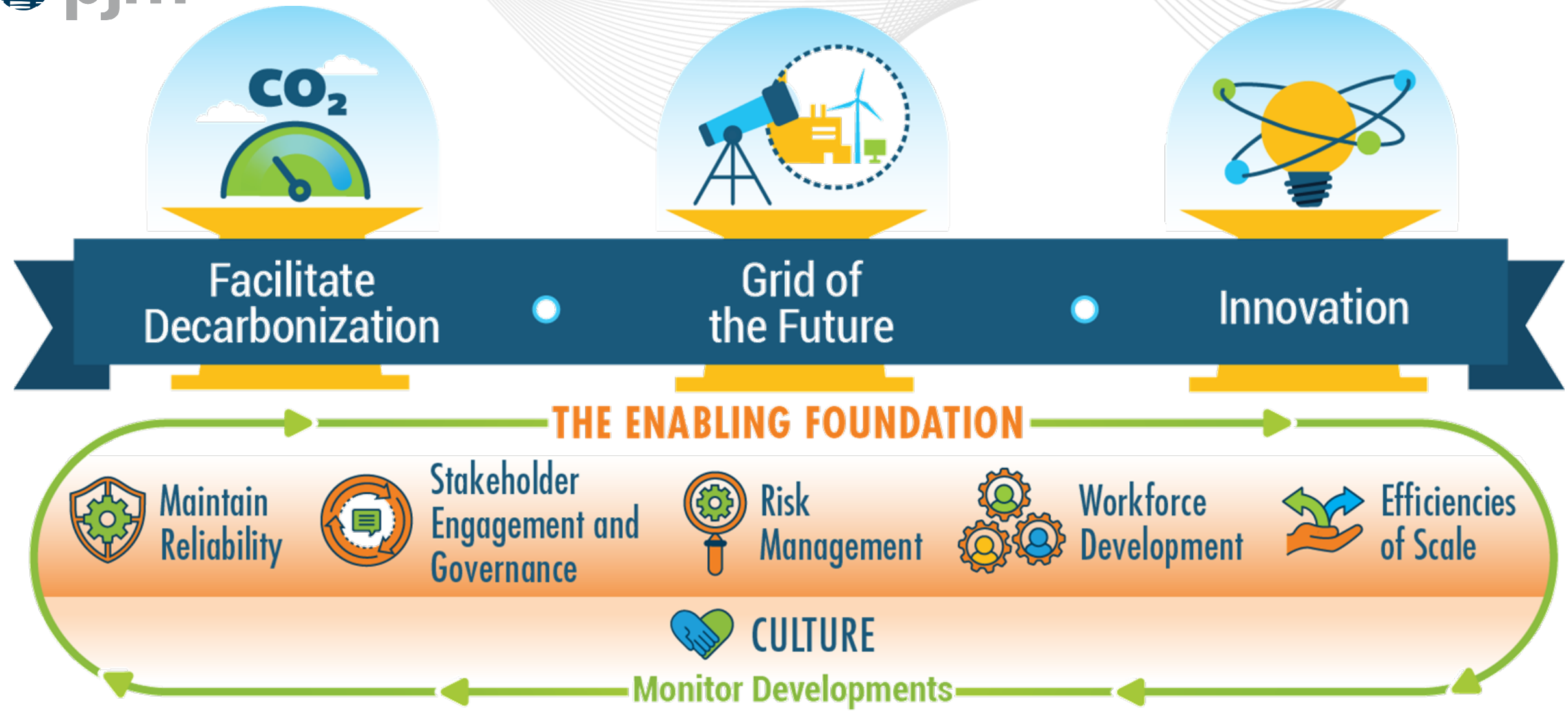
Alternative technologies



Fuel swap

Customer behavior and choice

# Strategic Pillars



# Accounting for DERs Today

# Snapshot of DER in PJM Today

## Wholesale DER

### 1 GW
### Demand Response

**Customer-sited generation:**
Offers into capacity, energy and/or ancillary services markets

| 84% | 15% | 1% |
|---|---|---|
| **Diesel** | **Natural Gas** | **Other** |

Remaining ~8 GW of DR is load modification without any generation
(e.g., industrial process management)

### ~2 GW
### Generator

**Front-of-the-meter generation:** Offers into capacity, energy and/or ancillary services markets

Can be sited at customers

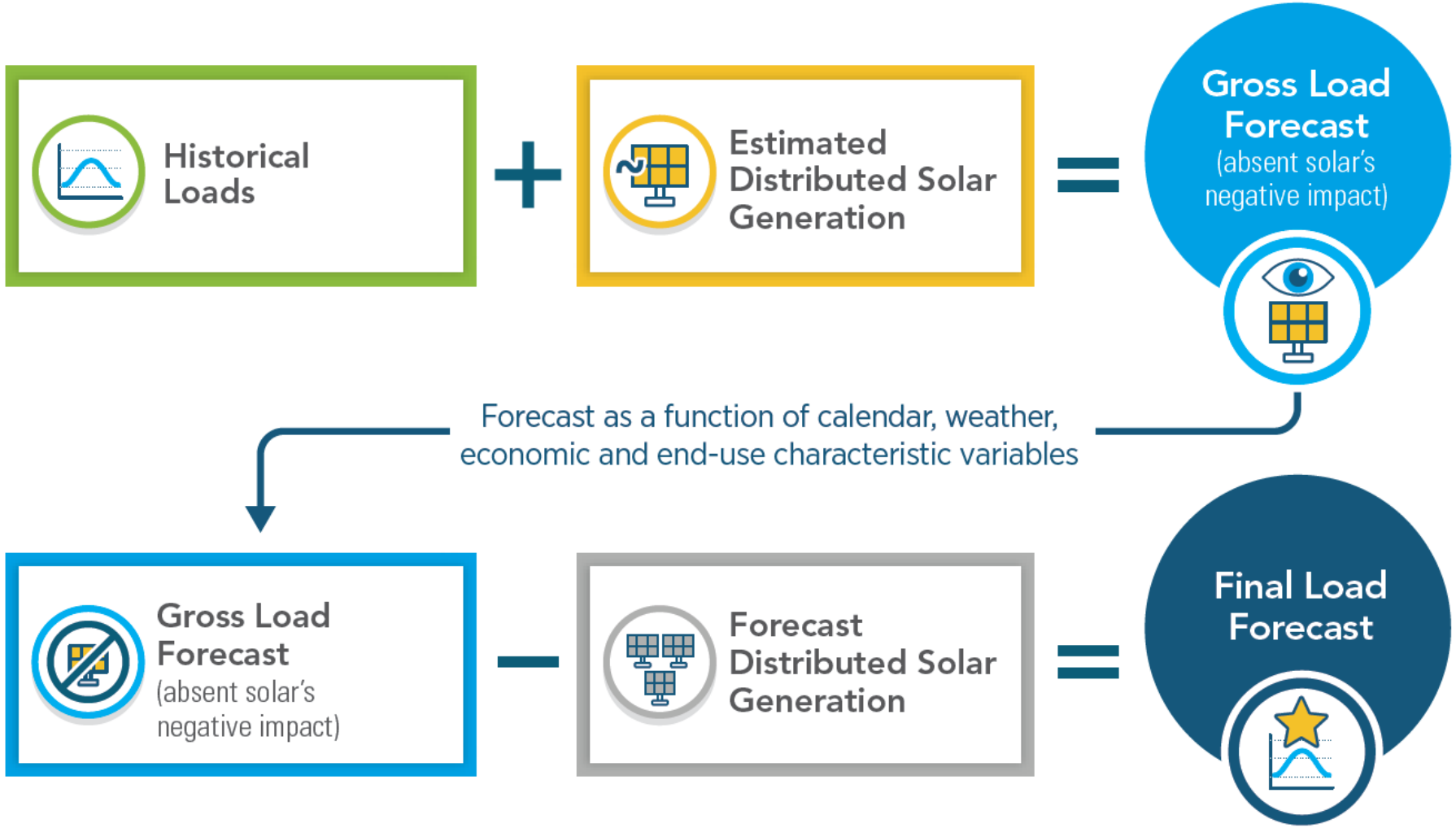
**Mostly solar but also other fuels**

## Non-Wholesale DER

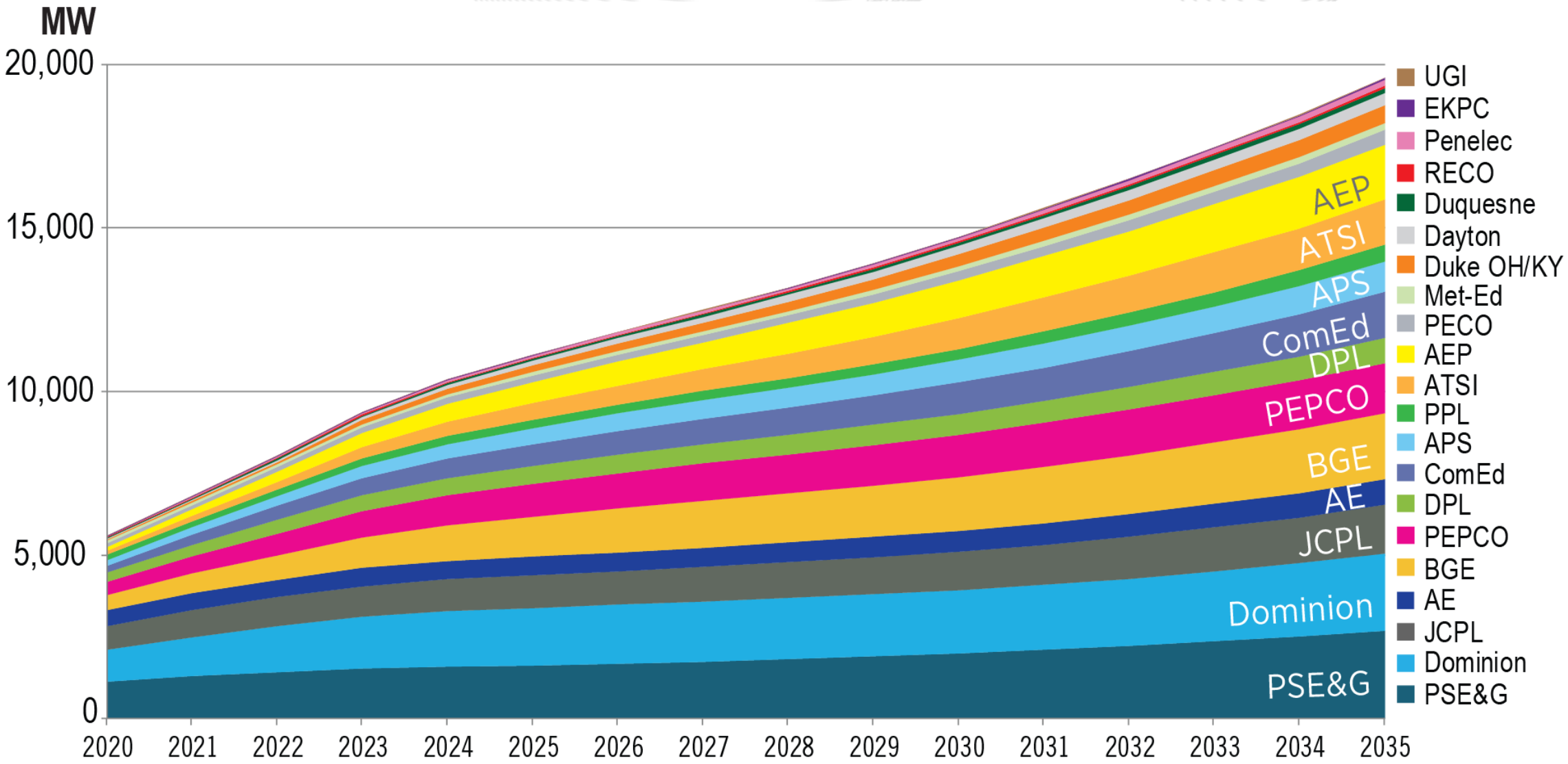
### ~10 GW
### DER

- **Solar PV DER:** Retail/rooftop solar
- **Municipal DER:** Municipal electric company distribution-level generators
- **Process DER:** Industrial generators, combined heat and power
- **Resilience DER:** Emergency backup
- **Qualified Facilities:** Direct sales to distribution utilities

# Accounting for Distributed Solar Generation



# Forecasted Non-Wholesale Solar



# Accounting for DERs in the Future

# Order 2222 directs changes to allow aggregations of Distributed Energy Resources (DERs) to participate in PJM wholesale markets.

| Jurisdiction & Interconnection | Operations | Market Design | Settlements | Coordination |
|---|---|---|---|---|
| Addressing State and FERC Jurisdiction over DERs and DER aggregations for Interconnection, Operations and Market participation. | Ensuring the operational viability of DER aggregations in the wholesale market; taking into account locational, sizing and data requirements to uphold reliability. | Allowing DER aggregations to participate in the wholesale markets (Capacity, Energy & Ancillary Services), where technically capable. | Accounting for settlement of DER aggregations providing both retail and wholesale services and preventing any "double counting" activities. | Defining a coordination framework between PJM, utilities and RERRA; managing distribution and transmission safety & reliability |

# High-level questions regarding additional reliability services

1. Is there a need to explicitly procure/compensate/maintain additional reliability services (frequency response, ramping, etc.)?

2. Which services are needed and how much?

3. At what point in the future does maintaining the current market/compensation structure create reliability concerns?

4. Where is the is the best place to require/incentivize these services? Capacity market? Real-time ancillary services?

# Conclusion

- Industry is changing
- PJM must evaluate its existing processes to assess reasonable and balanced modifications, where appropriate
- Emergence of DERs represent one example
  - DERs have modest interaction today in PJM's markets and planning
  - Order 2222 both fuels and helps facilitate change
  - Fuel mix reliability attributes of bulk power system generation must be regularly curated