21% of U.S. GDP produced in PJM
The Distribution of Power

PJM Grid Operator

Control Room

Generation

Nuclear

High Voltage Transmission Lines

Substation

Wind

Hydro

Residential

Local Distribution Lines
Industry Paradigm Shift

Unprecedented number of changes in the power industry

- Storage technologies
- Distributed energy resources
- Intermittent renewables
- Fuel Swap
- Changes in customer expectations
- Alternative technologies
Snapshot of DER in PJM Today

**Wholesale DER**

1 GW Demand Response

- Customer-sited generation: Offers into capacity, energy and/or ancillary services markets
  - 74% Diesel
  - 24% Natural Gas
  - 2% 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**

~7 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

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DER in PJM in Perspective

- Big Generation: 96.0%
- 1 GW Wholesale DER: 0.5%
- 1 GW DER in Demand Response: 0.5%
- 7 GW Non-Wholesale DER: 3.0%
Ten Years of Renewable Growth in PJM

PJM Grid-Connected Solar

Behind-the-Meter Solar

Source: GATS
Ten Years of Renewable Growth in PJM

**PJM Grid-Connected Solar**

- Less than 0.01
- 0.01 to 0.09
- 0.1 to 0.99
- 1 to 9.9

**Behind-the-Meter Solar**

- 10 to 99
- Greater than 100

Source: GATS
Incorporating Solar in the Load Forecast

- **STEP 1:** Observe net load (gross load minus non-wholesale solar)
- **STEP 2:** Calculate gross load (obtained by adding-back backcasted solar to observed net load)
- **STEP 3:** Forecast the growth in gross load
- **STEP 4:** Forecast the growth in and output of non-wholesale solar
- **STEP 5:** Calculate final “net load” forecast (forecast gross minus non-wholesale solar growth)
Current and Future Challenges

- Microgrids
- Aggregation of DERs
- DER Ride Through Task Force
- Storage
- Plug-in EVs and Vehicle to Grid

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