Electric Power Industry Conference
University of Pittsburgh

The Impact of Microgrid Developments on Power T&D Planning and Operations

FirstEnergy - Pennsylvania

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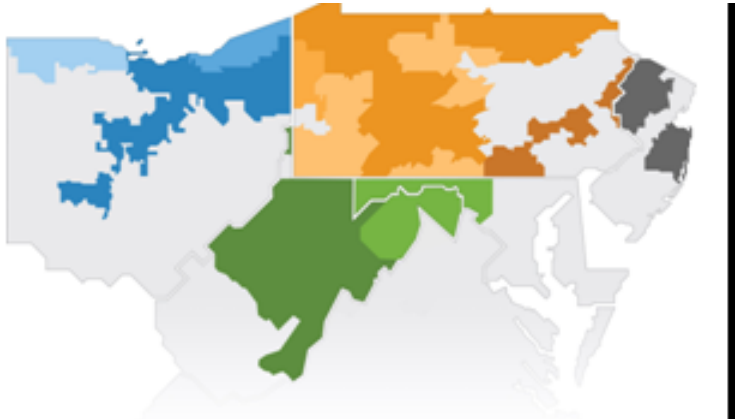
FirstEnergy Profile



- Headquartered in Akron, Ohio
- One of the largest investor-owned electric system in U.S. based on 6 million customers served
- 65,000-square-mile service area stretching from Ohio-Indiana border to New Jersey shore
- 10 utility operating companies
- More than 18,000 megawatts (MW) of generating capacity
- More than 16,000 employees

Role of the Electric Utility

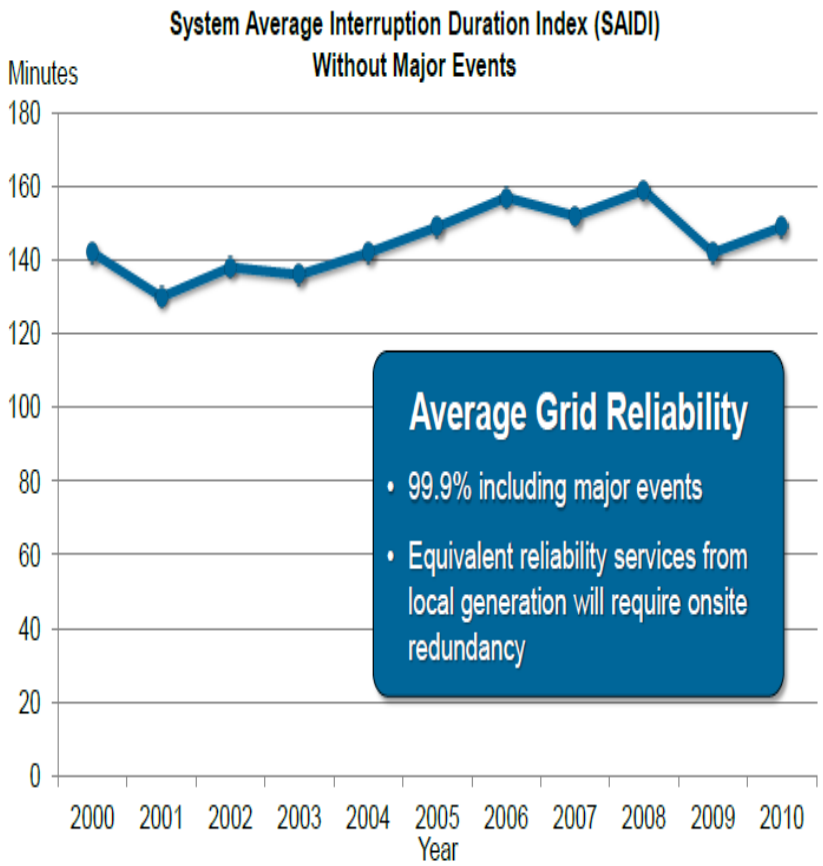
- **Deliver Electrical Energy to meet customer need**
- **Safely & Reliably**
- **Environmentally Sound**
- **Promote a healthy economy, good communities, and a benefit to society**

Typical American Home Has ~ 25 Types of Electrical Devices

However, Utility infrastructure provides much more than kwh –

The Utility Grid provides:

Grid Provides Reliability Service



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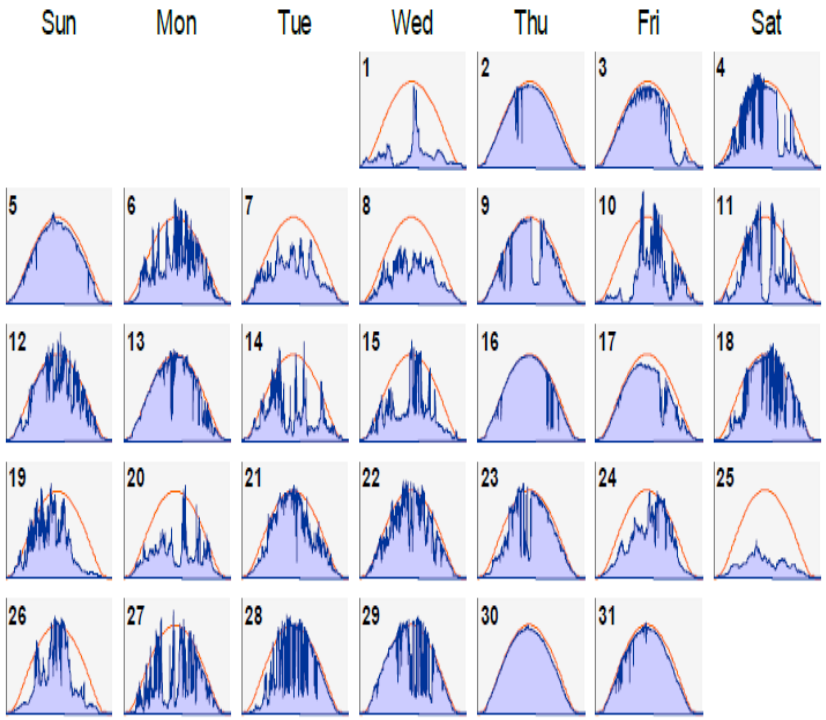
Grid Delivers Balancing Resource

Solar resource calendar for August 2012 shows irradiance profiles in NJ



Blue area: measured irradiance

Orange line: calculated clear sky irradiance

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What is a Microgrid?

- **DOE Definition:**
  - A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid that connects and disconnects from such grid to enable it to operate in both grid-connected or “island” mode.
- **Concept is not new - interconnected and dispersed generation**
  - Municipal Electrical Systems, Military Bases, University Campuses, Prisons, and Industrial Facilities.
- **New Claims yet to be validated:**
  - Improved Reliability?
  - Resilience to outages and Extreme Weather Events?
  - Cost Savings?
  - Environmental?
  - Energy Independence?
  - Energy Efficiency?

Changing Conditions

Markets & Public Policy

- Public Policy
  - Various incentives for distributed generation, combined heat and power, and lower emissions are favoring local generation options

A combination of factors are making microgrids look much more attractive in the near future

Technical & Operational Challenges

Accommodate configurations changing between normal synchronized operation and islanded configuration including;

- Interconnection
- Bi-directional flow
- Fault contribution
- Adaptive protection
- Balancing generation & load
- Voltage and VAR management
- Distributed Generation technologies are costly and with uncertain lifetimes
- Dynamic impacts on utility T&D Grid
- Ongoing Research Needed for infrastructure

Thank You

Questions & Answers