



POWER GRID

NORTHEAST REGION

AGENDA

- Generation
- Transmission
- Distribution
- New Topics in the Power Industry
 - Energy Storage
 - Drones
- Discussion, Q&A

GENERATION

- Large electricity generators in the NE are becoming more reliant on natural gas
- Concern over pipeline capacity into the region since natural gas is a major fuel for the heating season
 - Think of the cold winters of 2012-13 and natural gas price fluctuations
- New England Power Generators Association (NEPGA) is a trade association for all NE generators
 - Represent 26,000 Megawatts (MW) generation

POWER PLANTS

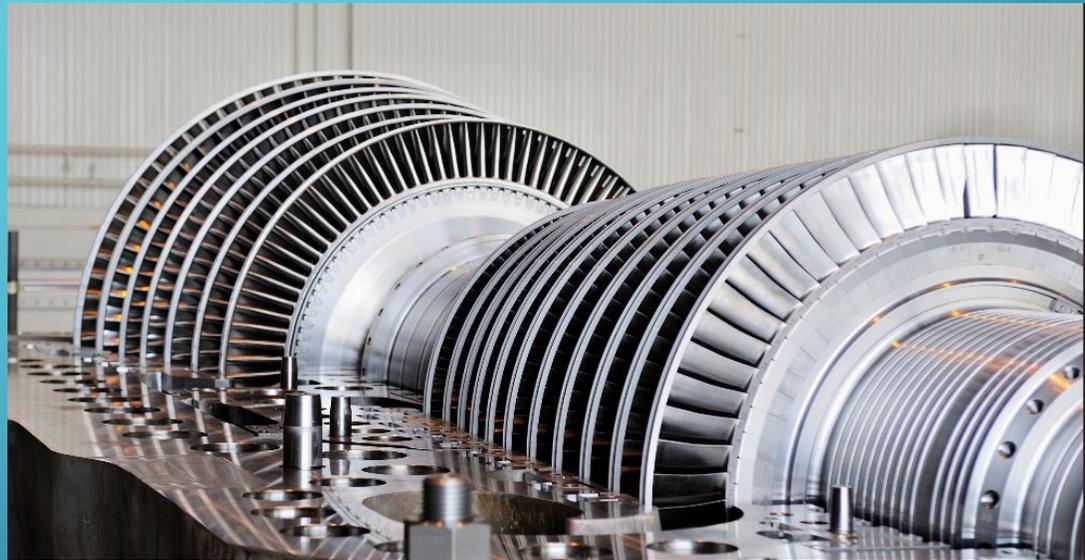
- Some large generators in the NE Region
 - Exelon
 - Mystic Station in Everett
 - Combined Cycle Plant
 - Entergy
 - Pilgrim Nuclear Power Station
 - Soon to close in 2020
 - PSE&G
 - January Bankruptcy Filing due to fires in CA
- Renewable Ventures
 - Block Island Wind
 - Energy Storage – Martha's Vineyard



Trivia – 1st generating station in the US was Pearl Street Station in Lower Manhattan in 1882, steam engine technology

WHAT IS THE POWER PLANT?

- Power Plant consists of:
 - Fuel
 - Furnace
 - Boiler
 - Turbine
 - Generator



Power Turbine with its hood off – looks new

TRANSMISSION

- Transmission System is governed by the Federal Energy Regulatory Commission, the FERC
 - Federal Agency that regulates the transmission and whole sale of electricity and natural gas in interstate commerce and transportation
- NE Region Transmission Operators are:
 - Independent System Operators
 - ISO-NE
 - NY-ISO
 - “Keeping the lights on in New England”
 - Grid Operation, Market Administration, Power System Planning
- System usually rated at 67kW and above

WHAT IS A TRANSMISSION SYSTEM?

- Transmission consists of what?
 - Transmission system is the electricity highway from the powerplant to a Substation
 - Cable
 - Substation
 - Transformer
 - Steps down the electricity for the Distribution System

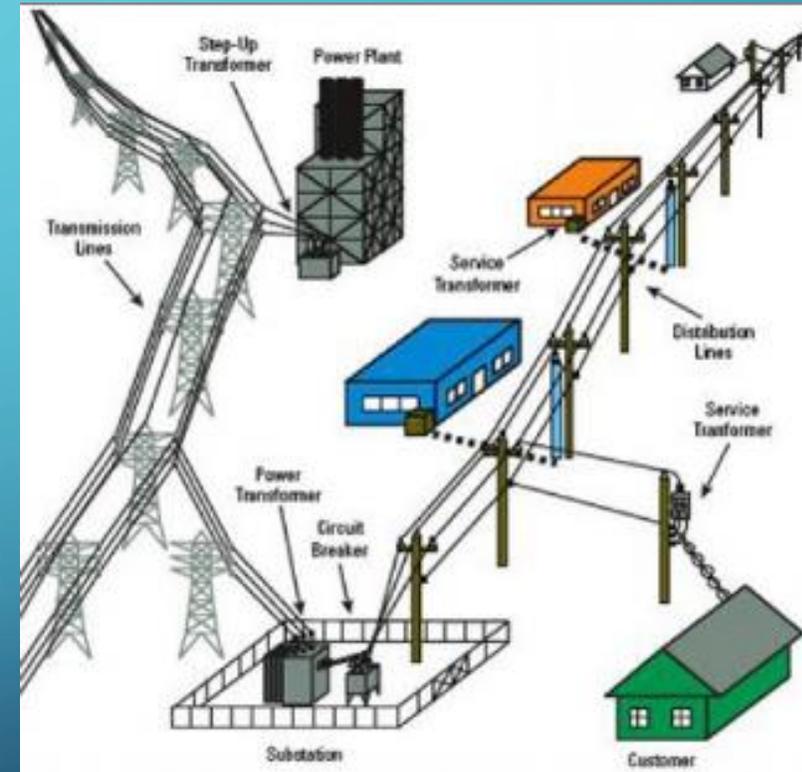
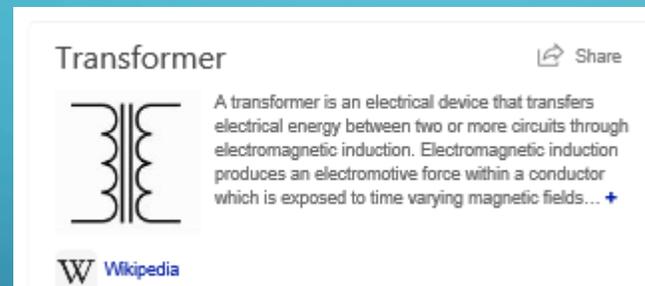


Transmission pylons

Trivia - 450,000 miles of high voltage power lines in US feeding another 160,000 miles of overhead Transmission across the US

SUBSTATION

- Substations can be distribution or transmission
 - Function is to step down or up voltage
 - Consists of
 - Building
 - Transformer
 - Cable
 - Wire
 - Circuit Breakers



DISTRIBUTION SYSTEM

- Distribution System is the final stage to the delivery of electricity to your house or business
 - Consists of
 - Cable
 - Wire
 - Transformers
 - Manholes
 - Poles
 - Build out in US began in the 1880s
 - 1st installations supported lighting systems



WHAT'S NEW?

- Rise of Natural Gas
- Cleaner Energy Incentives
- Energy Storage Technologies
 - Capture energy produced today and use it tomorrow
 - Important to the Grid
 - Balance Load
 - Bridge Power
 - Power Quality Management
 - Peak Shaving
 - Mangle Peak Demand and pricing fluctuations
 - More information on projects
 - DOE Global Energy Storage Database
 - Technology Types
 - Mechanical, Electrochemical, Other Chemical, Electrical

WHAT IS SMART GRID?

- Current electrical grid was started in the 1890's
 - Consists of 9,200 generating units
 - 1,000,000 MW generation capacity
 - Improved by technology developments
 - Stretching its capacity to support 21st demands
- Digital technology will
 - Increase 2 way communication between the utility and its customers
 - Sense and transmit information on equipment performance and condition
 - Increase Reliability, Availability and Efficiency
 - Programs like smart switch technology and distribution automation in utilities

RESTORATION

- How does restoration occur:
 - Equipment system intelligence from the operating centers
 - Customer outage calls
 - Damage assessment teams
 - Restoration model
 - Generating units
 - Transmission system
 - Substations
 - Distribution
 - Large and critical customers first
 - Large residential outages (bring as many people back as possible w/ 1 fix)
 - Smaller outages (until the final customer out)

DRONES

- Possible \$10 billion industry
- Cut operation and maintenance costs
- Increase worker safety
- Little fuel use
- Little environmental impact
- Uses
 - Inspections
 - Equipment & ROW assessments
 - Construction
 - Repairs
 - Restoration Intelligence
- Concerns in using
 - Privacy
 - Communication
 - New technology



DISCUSSION

- Lots of
 - Technology changes and challenges in the Power Grid
 - Challenges with public policies and regulators
 - Customers can become informed and participate in the discussions
 - Information on the web – amazing
- Questions?
- Thank you for your patience!