IEEE PES Transmission and Distribution Conference *and* Exposition

Working with Customers to Control Electrical Pollution

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National Grid US Evolution

- **2000 – Acquisition of New England Electric and Eastern Utilities**
- **2002 – Acquisition of Niagara Mohawk**
- **2006 - Acquisition of Rhode Island Gas Co**
- **2007 – Acquisition of KeySpan**

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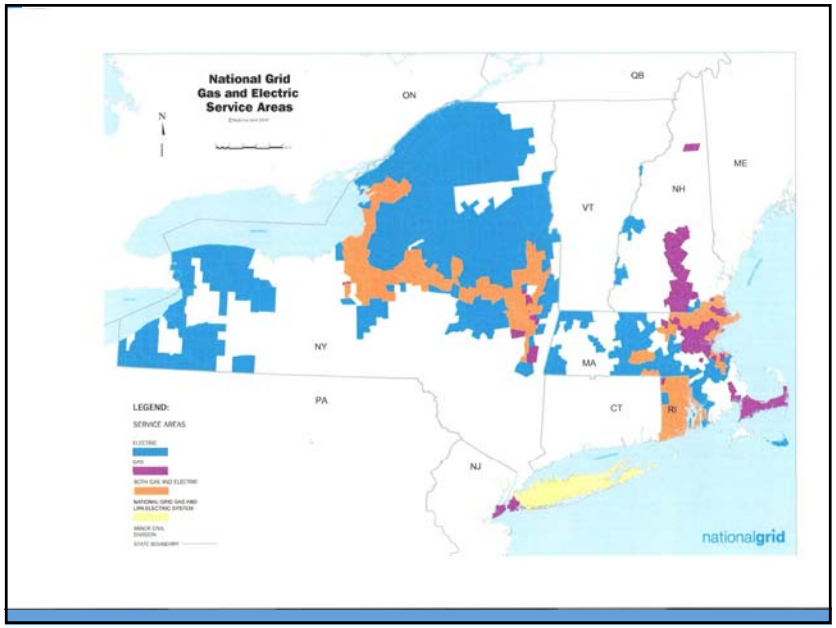

National Grid in the US

U.S. Facts

- 2nd Largest US utility
- Distributes electricity to 3.3M customers
- Services the 1.1M customers of LIPA
- 3.4M gas distribution customers
- Owns 7000 MW of electric generation on Long Island
- 10,000 miles of electric transmission assets
- 32,000 miles of gas transmission and distribution
- 18,000 US employees

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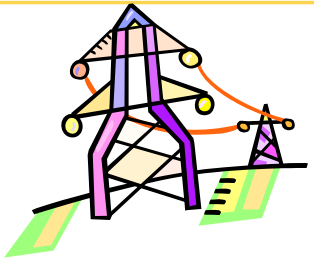
Customers' expectation of Utility

- Reliability



- Cost

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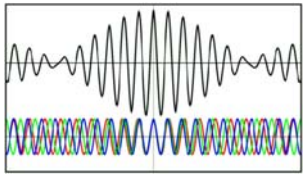
Customer Reliability Concerns

- Momentary disturbances (< second)
- Short duration disturbances (seconds)
- Long duration disturbances (minutes)



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Sources of Disturbances

- **Unavoidable sources**
  - Storms, Unexpected equipment failure, animal contact, Motor vehicle accidents
- **Avoidable sources**
  - Across-the-line Motor starting, Lack of maintenance, incompatible equipment, border line voltage delivery

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Cost saving & productivity enhancements: resulting in power pollution

- **Electronic ballasts**
- **ASD**
- **Computers**
- **HVAC equipment**
- **Non-linear plug-in loads**

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Energy efficiency and non-linear loads

- Increased interest in Energy Efficiency: increased proliferation of non-linear loads
- Utility energy efficiency programs: offsetting cost of non-linear loads
- Government efficiency programs and initiatives: creating demand for non-linear loads

Money Isn't All You're Saving

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Typical utility side problems

- Nuisance fuse failure on capacitor banks
- Overheating of transformers
- Excessive current at 180 Hz on system neutral
- Station breaker tripping on high ground currents
- Elevated neutral to earth voltages

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Typical customer side problems

- ASD tripping off line
- Frequent UPS switching to battery
- Nuisance malfunctioning of production equipment
- False startup of emergency generators
- Inaccurate operation of medical imaging devices

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National Grid and its customer

- Educate customers on the benefits of energy saving devices
- Educate customers on ramification of energy saving devices
- Present to customers power pollution solutions when utilizing energy saving devices

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Requirements for service

- Number of starts per hour
- Maximum locked rotor current based on voltage and HP
- Maximum Harmonic current distortion limits
- Maximum harmonic voltage distortion limits

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Set and put into effect limits

- Set limits for across the line motor startup sizes
- Set limits for flicker generating equipment
- Set limits for Harmonic distortion

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Energy efficiency: a mean to reduce electrical pollution

- **Stick and carrot approach**
  - Customer interested in the financial incentives
  - Equipment supplier interested winning the sale
- **Utility opportunities**
  - Opportunity to interact and educate customers
  - Opportunity to interact with and educate equipment vendors

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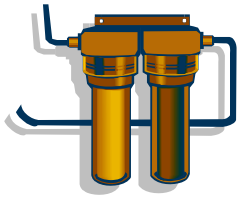
National Grid's requirements: through energy efficiency programs

- **Harmonic Snap shot before and after installing nonlinear loads**
- **Line reactors at the input side of ASDs**
- **Harmonic filters if limits are exceeded**



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Power pollution control through collaboration

- Involve customer in the solution – often willing to help
- Alert equipment manufacturers about the societal consequences of polluting equipment
- Encourage regulators to set fair regulations regarding polluting devices

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Challenges

- Customers with existing polluting devices: no recourse
- Nonlinear loads integrated in large machinery or manufacturing equipment: difficult to control
- Large customers that keep utilities out off the loop: end up with many problems
- Residential customers: major contributor to third harmonics

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National Grid's approach

- Help in harmonic measurements before and after the installation of large non-linear loads
- Offer an incentive to reduce electrical pollution if polluting devices installed through energy efficiency program
- Provide diagnostics and recommendations
- Conduct training seminars

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Conclusion

- Electrical pollution is constantly rising and inescapable
- Rules and guidelines must be set and adhered to
- Assist customer in understanding the ramifications of electrical pollution
- Customers and equipment vendors have a lot to gain in a non-polluting environment
- use energy efficiency programs to attain the energy savings through a non-polluting strategies
- Delivery system of the past is not compatible with today's challenges

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