

IEEE PES Transmission and Distribution Conference *and* Exposition

Working with Customers to Control
Electrical Pollution

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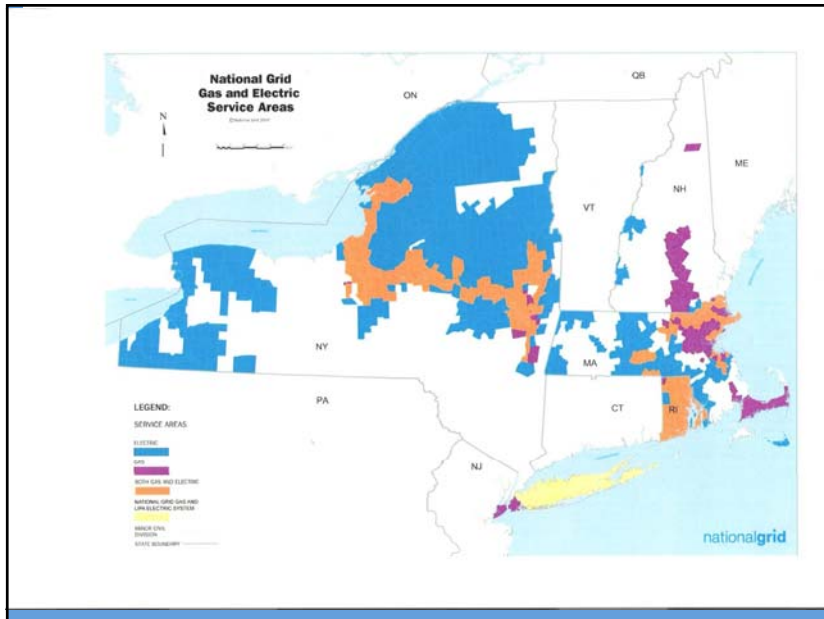


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National Grid US Evolution

- ♦ **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

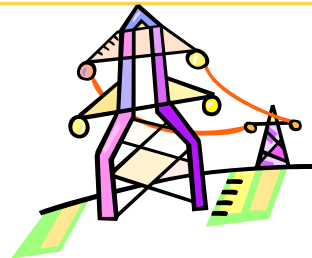
U.S. Facts

- 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

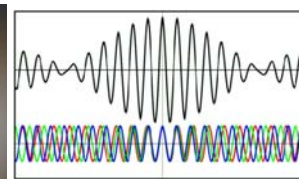


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Customer Reliability Concerns

- ◆ 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



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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

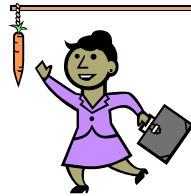
Set and put into effect limits

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



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

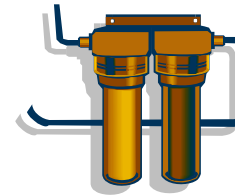


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National Grid's requirements: through energy efficiency programs

- ♦ **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**

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**