the Energy to Lead

Energy Delivery and the Smart Grid

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Delivery Sector

GTI's Delivery Sector addresses the strategic and tactical concerns of domestic gas storage, transmission and distribution infrastructure

U.S. Gas Infrastructure at a Glance

- 11,000 Delivery Points
- 305,000 Miles of Transmission Pipelines
- 5,000 Receipt Points
- 1,400 Interconnects
- 400 Gas Storage Fields
- >2,000,000 Miles of Distribution Pipelines
- Carrying 22,000,000,000,000 cu. feet of gas annually

500 Electric Generation Plants
6 TCF

5,000,000 Commercial Businesses 3 TCF

2,000 Industrial Plants
7 TCF

63,000,000 Homes
6 TCF

Industry Research Drivers

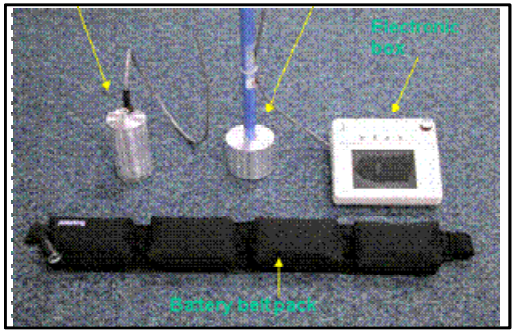
- Aging infrastructure
- Increasing regulatory requirements
- Financial pressures
- Risk reduction
- Knowledge transfer
- Green initiatives
- Safety
- Interchange of new fuels

Delivery Sector Technology Focus

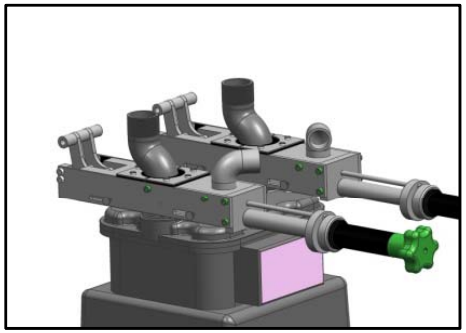
> Program Areas:
  - Infrastructure Rehabilitation and Improvements
  - Environmental Matters, Renewable Gas, and Gas Quality
  - Data and Integrity Management
  - High Tech Sensors and Automation

> A2LA-Accredited Testing Laboratories

UV Cure – CIP Lining



Handheld Acoustic Pipe Detector



Non-interrupt Meter Change Out

Keyhole Technology

Program Areas

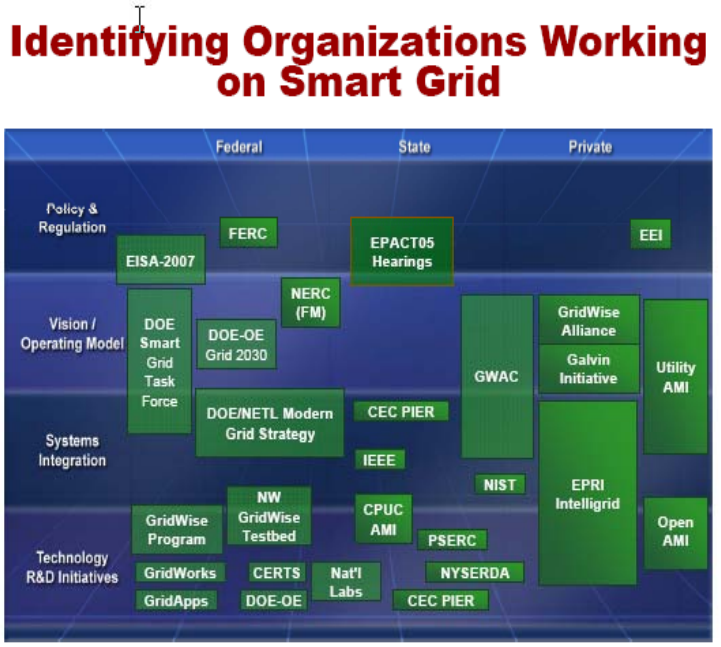
- **Infrastructure Rehab and Improvement**
  - Next Generation Materials
  - Operations Efficiencies
  - Rehab Techniques
  - Construction Innovations
    - Process
    - Tools/Equipment
    - Workers
- **Environmental, Renewables and Quality**
  - Environmental Compliance
  - Fugitive GHGs
  - Biomethane
  - Remediation
  - Interchangeability
  - Carbon Reduction

Program Areas

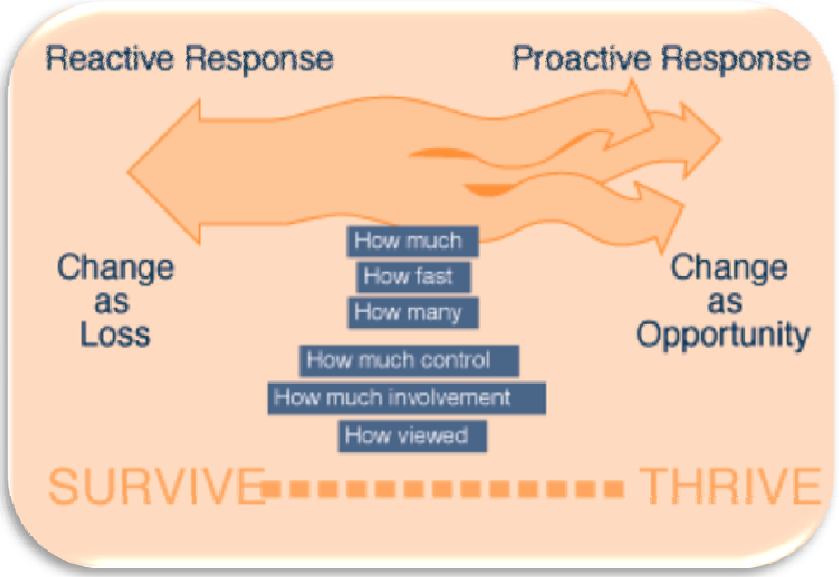
- **Data and Integrity Management**
  - Pipeline integrity
  - Distribution integrity
  - GIS/GPS integration
  - Asset ID and tracking
  - Modeling
- **Sensors and Automation**
  - Leak detection
  - Pipe location
  - Internal inspection
  - Damage prevention
  - Non-destructive exam
  - Smart sensors

Why Is Everyone Getting Smart?

- Electric Smart Grid is happening
  - On-going DOE program
  - Stimulus bill provides $4.5 B
  - Multi-billion dollar state programs
- Drivers include:
  - Energy efficiency – real-time information for customers
  - Integrate renewables and alternative energy options
  - Reduce T&D infrastructure investment and address reliability through microgrids
  - Ultimately facilitates new business models, including managing energy for customer by going “beyond the meter”



Smart Grid Changes the Game



- Opportunity or Threat?
  - Should we move to an all-electric future?
- Electric vs. *Energy* Grid?
  - How should we use natural gas in a carbon-constrained future?
  - Who should manage energy?
    - Customers?
    - Utilities?
    - Google?
- What value can we create?
  - Is this a zero-sum game or are there more opportunities to be discovered?

Value of a Holistic Smart *Energy* Grid?

Japanese View of Integrated Energy Grid

- Cost/Benefit for incorporating natural gas in Smart Grid
  - Double the O&M information for modest increase in cost?
  - Increase reliability by ensuring status of most reliable back-up power option?
  - Provide expanded option for consumers?
  - Provide new business offerings for utilities?

Our Thoughts and Actions about the Smart Energy Grid

- Raising the awareness of the gas utilities
- Defining the valuable functionality for utility stakeholders
- Cultivating new utility offerings for customers
- Providing new business opportunities for systems and components providers
- Understanding the potential implications of the available customer and system data
- Developing a strategic plan for the inclusion of natural gas
- Informing DOE of the need to think beyond electricity