the Energy to Lead

# Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop

November 12-13, 2014

gti

the Energy to Lead

# Advanced Materials Manufacturing and Innovative Technologies for Natural Gas Pipeline Systems and Components Panel

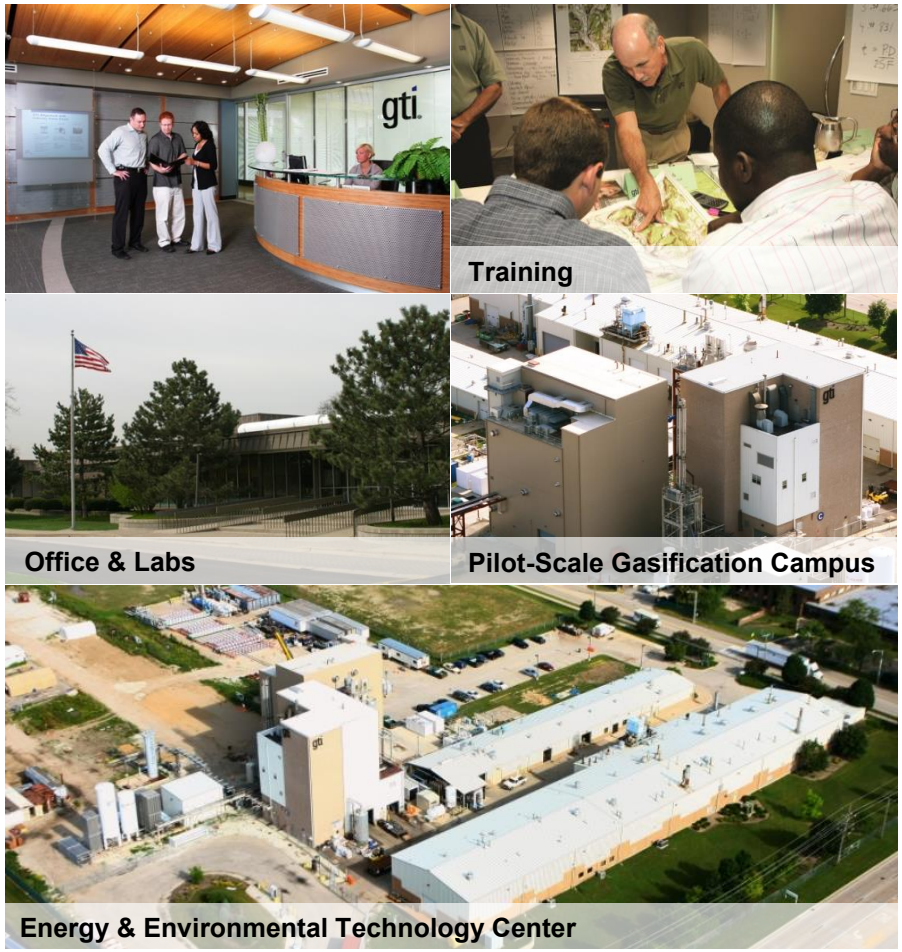
- November 12, 2014
- Pittsburgh, PA
- By Daniel Ersoy, GTI

gti

# GTI Company Overview

**Established in 1941**

- Independent, not-for-profit established by the natural gas industry
- Providing natural gas research, development and technology deployment services to industry and government clients
- Performing contract research, program management, consulting, and training
- Wellhead to the burner tip including energy conversion technologies



# Addressing Key Issues Across the Energy Value Chain


Expanding the supply of affordable energy

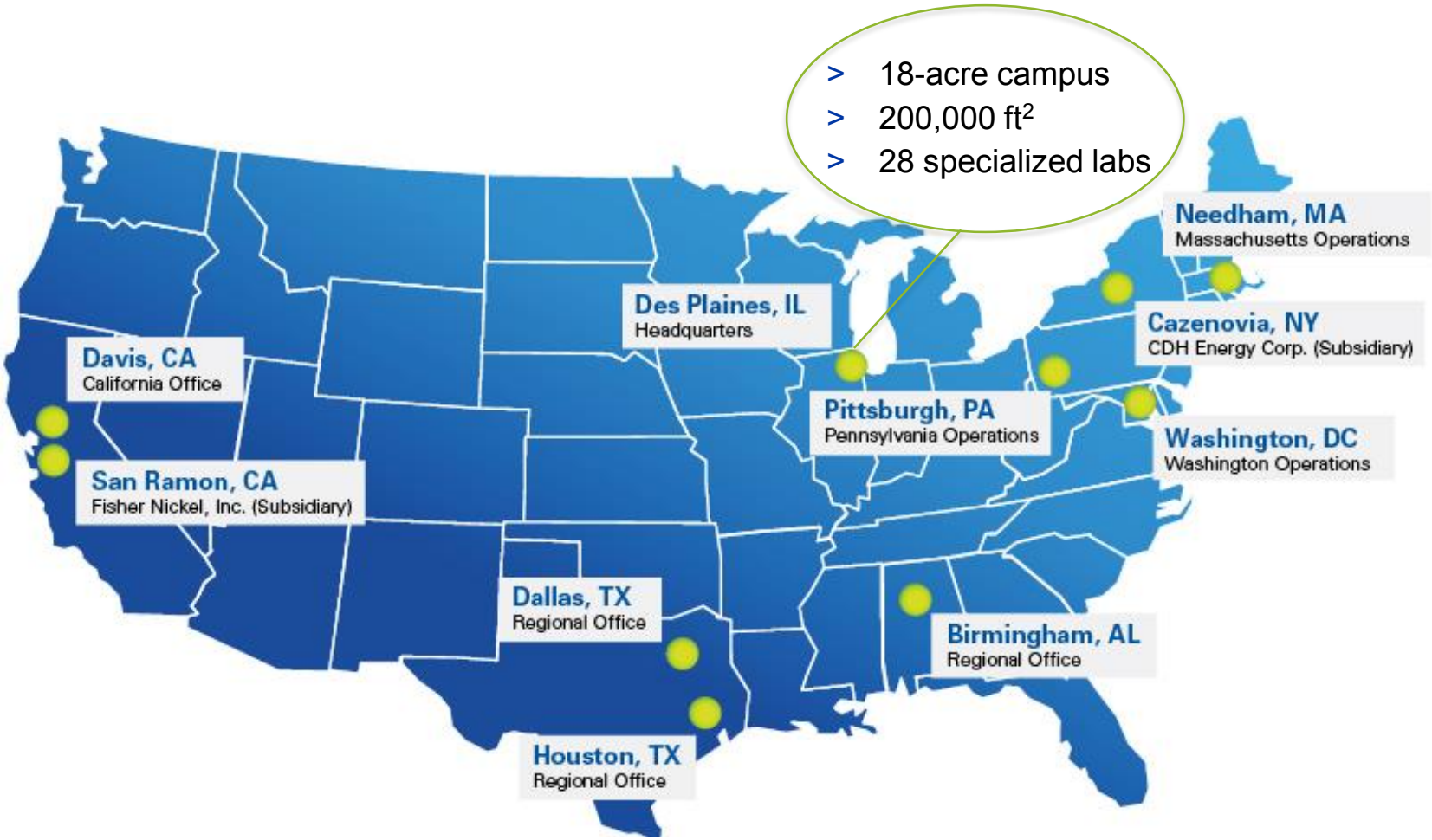
**Ensuring a safe and reliable energy delivery infrastructure**

Promoting the efficient use of energy resources

**Reducing carbon emissions to the environment**

**Supporting sustainable economic growth**

# GTI Locations



# Presentation Overview

| MATRIX OF R&D NEEDS | Legacy /Historic Items | Present Challenges | Future Targets |
|---|---|---|---|
| **Technology Development** | Understand Material Properties; Detect Defects | Mitigating Damage; Harden Infrastructure | Infrastructure Composites and New NDE Techniques |
| **Materials, Testing, and Manufacturing** | Additive Manufacturing; Legacy Risk Models | Damage Propagation Prediction; New Material Development | Multi-Physics w/ Strain-Based Sensors; Hydrogen Transport |
| **Data, Information, and Decisions** | Data Identification and Collection | Automation and Knowledge Development | Optimized Decision Making and Grid Interconnectivity |

# Legacy / Historic Drivers

- **Technology Development Needs**
  - Confirm maximum allowable operating pressure and system component integrity, grade, and strength
  - Nondestructive materials verification without system shutdown: yield strength, toughness, and chemistry; improved technology needed to identify defects and anomalies
- **Materials, Testing, and Manufacturing Needs**
  - Mains replacement programs represent >$10billion/yr. of capital outlay over the coming decades to replacing aging distribution infrastructure
  - Rehab needs for additive manufacturing, e.g., liners, cladding, coatings
  - Need vintage asset risk models, e.g., cast iron, bare/unprotected steel, and vintage plastics
- **Data, Information, and Decision Making Needs**
  - Overcoming data silos, identify data and information
  - Verify quality and traceability, aggregate
  - Store in an accessible and relational databases/GIS

# Present Challenges

- **Technology Development Needs**
  - Mitigating third party damage and corrosion and drive the reduction of ruptures, leaks, and emissions
  - Right of way encroachment detection, improved internal pipe inspection technology, and methods to harden the infrastructure
- **Materials, Testing, and Manufacturing Needs**
  - Understand hydrocarbon permeation of polymers and improve system chemical resistance
  - Develop improved cracking and other damage propagation models, followed by improved system materials and joining methods
- **Data, Information, and Decision Making Needs**
  - Big data overload, information upload backlogs, and quality issues
  - Asset lifecycle tracking to provide automation of data collection and upload, allowing system-wide tracking and traceability
  - Data mining and analytics for threat identification, interactions, and predictions; feeds risk assessment and management systems

# Future Targets

- **Technology Development Needs**
  - Composite pipe (corrosion resistant/proof and increased strength)
  - Self-healing coatings and polymer pipe that repair themselves
  - Develop and validated joining, tapping, and inspection technology for these next generation / smart materials
- **Materials, Testing, and Manufacturing Needs**
  - Interchangeable fuels – need materials that can reliably transport hydrogen and other fuel blends
  - Multi-physics modeling to account for interactions of stress, strain, chemical/electrochemical, and fluid-solid interfaces
  - Strain detection on buried assets - settlement, frost heave, internal and external component wall loss, earthquakes, super storms, and floods
- **Data, Information, and Decision Making Needs**
  - Optimize decisions by combining all data, information, analytics, and material and system operations models
  - Account for the interconnectivity of infrastructure assets and their operations including gas, electric, liquids, etc.



gti

# Summary

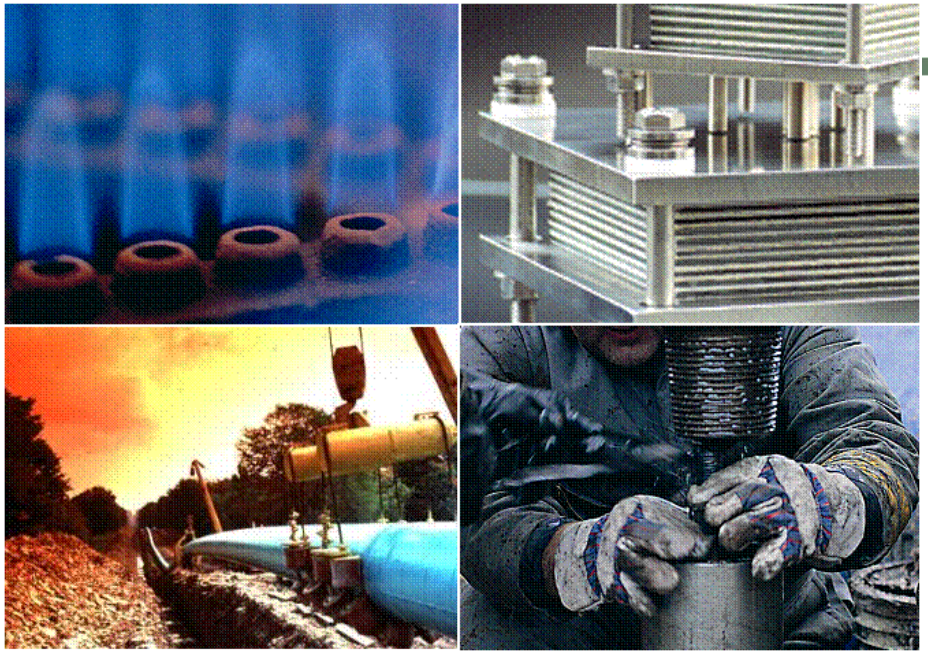
| MATRIX OF R&D NEEDS | Legacy /Historic Items | Present Challenges | Future Targets |
|---|---|---|---|
| **Technology Development** | Understand Material Properties; Detect Defects | Mitigating Damage; Harden Infrastructure | Infrastructure Composites and New NDE Techniques |
| **Materials, Testing, and Manufacturing** | Additive Manufacturing; Legacy Risk Models | Damage Propagation Prediction; New Material Development | Multi-Physics w/ Strain-Based Sensors; Hydrogen Transport |
| **Data, Information, and Decisions** | Data Identification and Collection | Automation and Knowledge Development | Optimized Decision Making and Grid Interconnectivity |

**Ultimate goal - increase safety, improve efficiency, provide sustainability and reliability of infrastructure systems**



gti

# GTI is a company that solves important energy changes, a company that truly has…



## …"the Energy to Lead"

**Contact information:**
Daniel Ersoy
Executive Director R&D, GTI
daniel.ersoy@gastechnology.org