Integrating Hydrogen to Gas Infrastructure

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AGA 2020 RNG Workshop
75-year+ History of Turning Raw Technology into Practical Energy Solutions

FOR A BETTER ECONOMY AND A BETTER ENVIRONMENT

SUPPLY  ►  CONVERSION  ►  DELIVERY  ►  UTILIZATION

RESEARCH & DEVELOPMENT  ►  PROGRAM MANAGEMENT  ►  TECHNICAL/ANALYTICAL  ►  CONSULTING  ►  TRAINING  ►  COMMERCIALIZATION

400+ EMPLOYEES
GTI envisions a carbon-managed future in which integrated energy systems leverage low-carbon fuels, gases and infrastructure to limit global temperature rise.
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Hydrogen - A Path Towards Decarbonization

Research and Technology Development to Enable the Hydrogen Economy

Low-carbon Production
- Compact Hydrogen Generator
- Biomass gasification
- Hydrogen power generation

Use in Industry and Buildings
- End-use equipment testing
- Codes and standards

Compatibility with Natural Gas Delivery Infrastructure
- Material impacts of blending
- Operational impacts
- Blending technology and standards

Use in Transportation
- California Fuel Cell Partnership
- Fueling station technology
- RNG-to-hydrogen fueling
Demonstration and Strategic Planning for Hydrogen Networks

Project Partners
ONEH2, Texas Gas Service, SoCal Gas, Toyota Motor North America, Shell, Mitsubishi Heavy Industries, Air Liquide, PowerCell Sweden AB
Assessing Hydrogen Compatibility with Natural Gas Delivery Infrastructure

- Evaluated effects of a 5% hydrogen-natural gas blend on non-metallic material properties and operational safety
- Determine hydrogen blend impacts on elastomer materials
- Modeling of H2 Blending Impacts on Leak Rates and Pipeline Components
- Develop engineering tools to allow an integrity assessment and a safety margin determination of hydrogen blended gas use
- Determine operational impacts of a hydrogen blend in pipelines, such as leak detection, surveys, emergency response

Factors on Hydrogen Embrittlement Susceptibility

Environmental Factors
Role of Microstructure
Hydrogen Traps
Inclusions and Precipitates
Texture and Grain Boundary
Effects of Alloying Elements
Material Properties most affected by HE
Toughness
Reduction in Area
Crack Growth Resistance
Enabling Hydrogen Use for Residential/Commercial Applications

- Demonstrate solutions to utilize high hydrogen blends in residential and commercial combustion equipment
- Performance testing of appliances with varying hydrogen blends
- Quantify the ability of appliances to retain normal operations (emissions, efficiency, cycling)
- Hydrogen sensor development for “behind the meter” applications and in-situ sensing

### Feature | Possible Equipment Issues
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Flame Temperature | Flame burns hotter, can lead to uneven heat transfer and material degradation
Flame Speed | Can lead to flame stability issues, ignition problems and flashback
Flammability Range | H₂ portion can ignite prematurely in rich pockets of fuel/air mixture, leading to pre-ignition
By Products | Flue gas dew point will be higher, leading to unwanted condensation/corrosion, also many products are calibrated to stack CO₂ which will be off
Visibility / Ionization | Safety equipment to detect flame (flame rod, etc.) and technicians/operators will updating/training
Demonstrate performance of key technologies and processes and identify potential improvements

Inform stakeholders and the public about technology options and economy-wide decarbonization pathways

Identify and accelerate commercialization of promising technologies and support scaling up existing technologies

Enabling the Pathway to Economy-Wide Decarbonization
LCRI’s research areas will include key components of the low-carbon resource value chain.

Additional considerations will include integration of energy systems, cross-cutting technologies, and safety and environmental aspects.
GTI envisions a carbon-managed future in which integrated energy systems leverage low-carbon fuels, gases, and infrastructure to limit global temperature rise.

By deploying hydrogen, carbon-neutral fuels, and chemicals in ways that build on existing infrastructure and systems, we can reduce costs, lower risk, and provide pathways to economy-wide deep decarbonization that supports growing economies worldwide.
Questions?

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