

the Energy to Lead

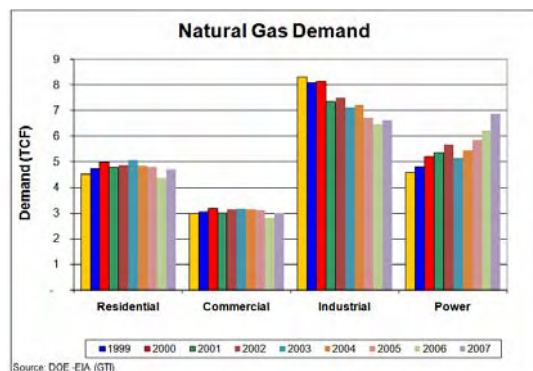
Residential, Commercial, and Industrial RD&D

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Natural Gas Demand Trends

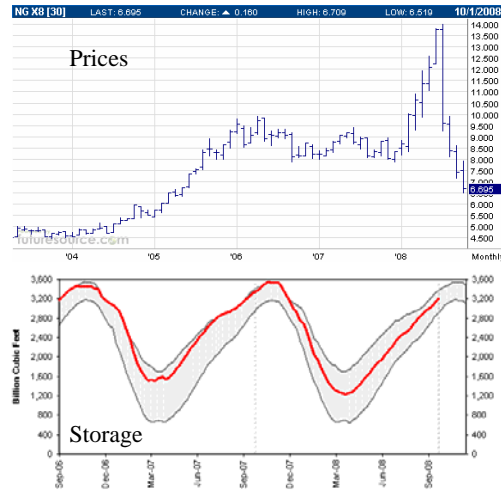
- > Residential: Per home efficiency gains dampen total demand
- > Flat commercial demand
- > Industrial efficiency and “demand destruction”
- > Strong power gen growth



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Natural Gas Prices

- > New domestic supplies are helping drive down US natural gas prices
- > Storage levels are slightly above 5 year average
- > Likely to see period of more moderate gas prices over next several years



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Gas Revenue Decoupling

STATES WITH NATURAL GAS REVENUE DECOUPLING TARIFFS



26 utilities -- 13 states with decoupling tariffs
8 cases pending, 3 generic proceedings

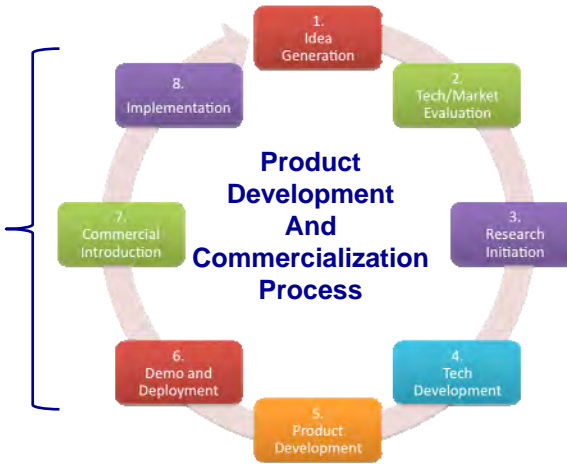
Source: AGA Natural Gas Rate Roundup July 2008

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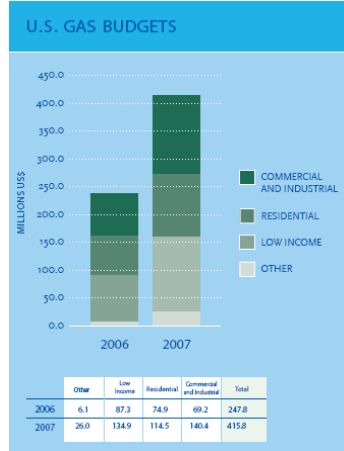
Energy Efficiency Programs

- > Natural gas and electric utility EE programs growing rapidly across North America
- > Can help bridge gap between RD&D and commercialization
 - Demonstration
 - Deployment
 - Communication, education, outreach, training, codes and standards support → facilitate new product introduction

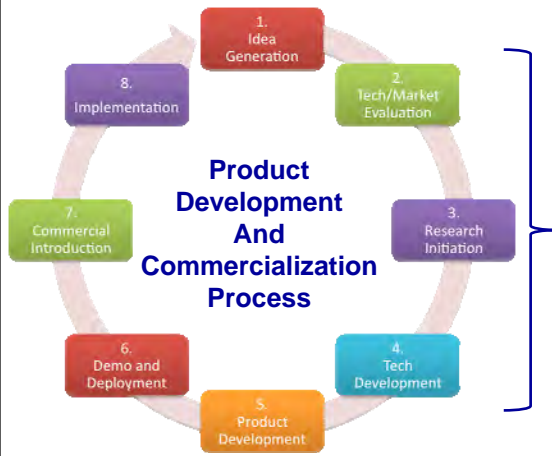


| 2007 Energy Efficiency Budgets | | | | | | |
|--------------------------------|-------------|-------------------------|------------|-----------------|-------|---------|
| | Residential | Commercial / Industrial | Low Income | Load Management | Other | Total |
| Natural Gas | 115 | 140 | 135 | 0 | 25.9 | 415.9 |
| Electric | 638 | 1,029 | 303 | 536 | 216.8 | 2,722.8 |
| | 753 | 1,169 | 438 | 536 | 242.7 | 3,138.7 |

Source: Consortium for Energy Efficiency



Natural Gas Industry Collaborative RD&D Programs

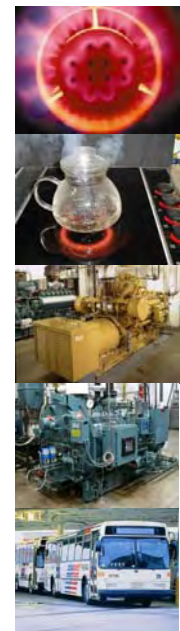


- > **Sustaining Membership Program (SMP)** focused mainly on Stages 1-4
- > **Utilization Technology Development (UTD)** focused mainly on Stages 4-6
- > Efforts leveraged with Federal, State, and manufacturer cofunding
- > Work with Energy Solutions Center (ESC) and partners for Stages 6-8

GTI End Use Solutions

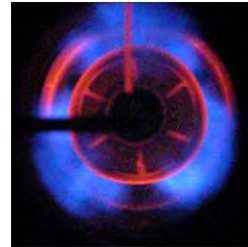
> Develop clean, efficient and cost-effective technology & products with value-added benefits to our partners and stakeholders

| | |
|--|--|
| <p>Industrial Processes</p> <p>Metals, glass, petrochemicals, paper, food, others</p> | <p>Power and Steam Generation</p> <p>Industrial boilers Engines, turbines, fuel cells</p> |
| <p>Residential/Commercial</p> <p>Building systems and appliances</p> | <p>Transportation</p> <p>Alternative fuel vehicles & infrastructure</p> |



Industrial RD&D

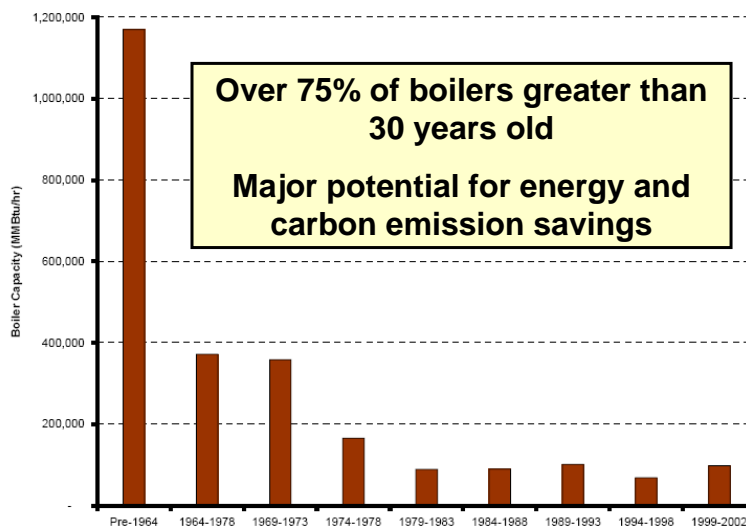
- > GTI has a focused effort on energy intensive industrial process sectors
 - Steel, aluminum, glass, petrochemicals, forest products, food processing
- > Process heating
- > Power and steam generation
- > Heat recovery and energy efficiency methods
- > Use of alternative and renewable fuel choices



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Boiler Age (Over 10 MMBTU/hr)



Source: EEA/ORNL (2005)

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Super Boiler Technology

- > Maximizes steam generation efficiency
 - Working with USDOE and other partners
 - Over 94% fuel to steam efficiency
 - 20% makeup water savings
 - 5 ppmv NOx option
 - Retrofittable and scaleable
 - Target is less than 2 year payback
 - Multiple field test demonstrations underway



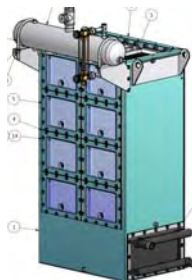
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Transport Membrane Condenser (TMC)

TMC Module

- Tubes with nano-porous membrane that selectively removes water through low-pressure-drop capillary condensation
- **Simultaneously captures waste heat and pure water** (from combustion products)
- Applicable to wide range of combustion applications
 - Industrial and commercial boilers
 - Steam power plants, engines and turbines
 - Industrial drying and dewatering processes



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Submerged Combustion Melter

- > Developing and deploying revolutionary new melter technology
- > Major improvements in capital cost, efficiency, productivity
- > Many applications
 - Waste material treatment
 - > EAF dust (new plant)
 - > Fiberglass recycling
 - Sodium silicate production
 - Glass production

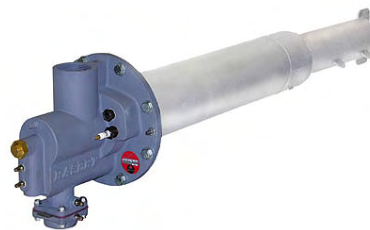


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RASERT Technology

- > Improved radiant tubes for indirect heating
- > Benefits:
 - Higher heat transfer rates and productivity
 - Higher efficiency
 - Lower temperature differential → longer tube life
 - Reduced maintenance and downtime
 - Lower NOx



Licensed to North American
Manufacturing Co.

www.namfg.com/prod-rasert.htm

US Patent No. 6,321,743

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RASERT Field Tests

- > California Steel Industries
 - Continuous galvanizing line
 - Supported by UTD, CEC, and other partners
 - Validating efficiency, production, other benefits
- > Akron Steel Heat Treating
 - Batch heat treating
 - USDOE STAC, Energy Solutions Center, GTI SMP program funding



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Direct-Fired Drum Dryer

- > Working with GL&V, UTD, and California Energy Commission
- > Direct-gas-fired drum dryer for food processing in California
- > Direct-fired drum dryer provides increases in production, energy efficiency, and lower NO_x (compared to conventional steam-fired drums)



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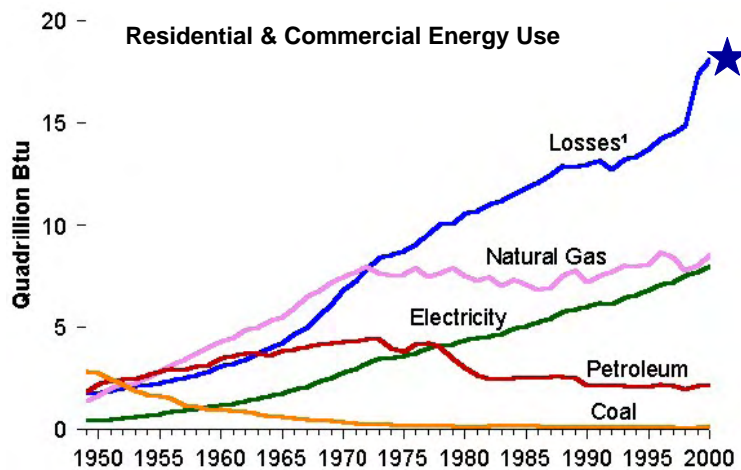
Residential/Commercial

- > GTI has an active residential and commercial program focused on:
 - New appliance technology
 - Commercial food service technology
 - Distributed generation/CHP
 - Building systems integration and community planning
 - Solar thermal/natural gas hybrid systems
 - Carbon management solutions

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Energy Use (and Losses) in Buildings

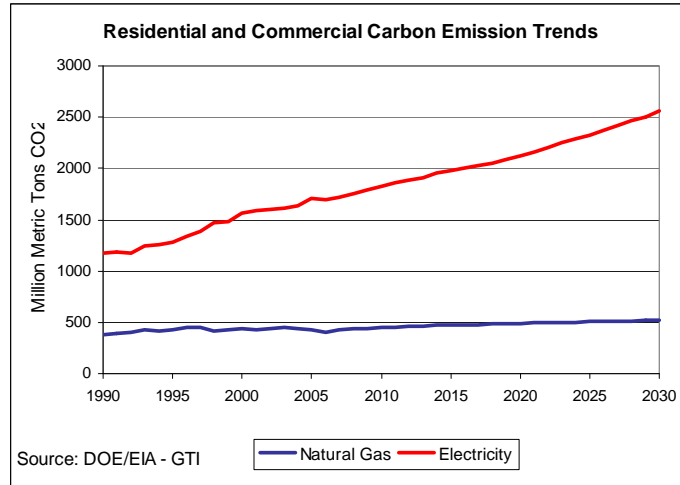


(1) Energy lost during generation, transmission, and distribution of electricity
Source: DOE EIA

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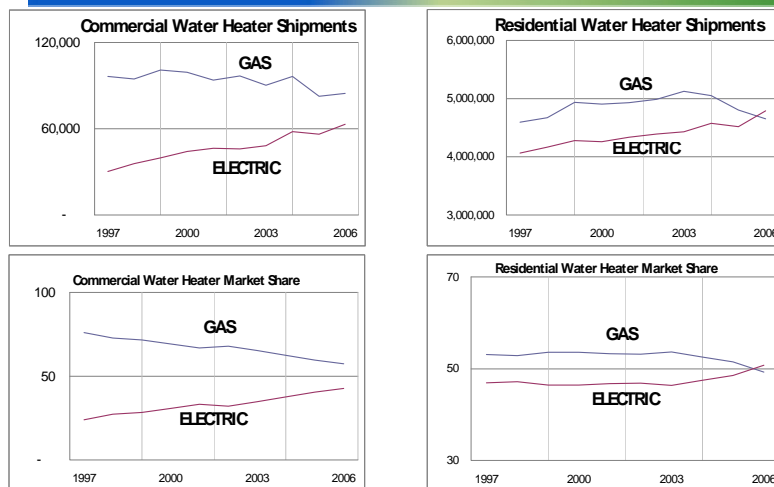
Gas and Electric CO2 Emission Trends for Res/Com Sectors



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And Yet, Electric Water Heater Market Share is Growing

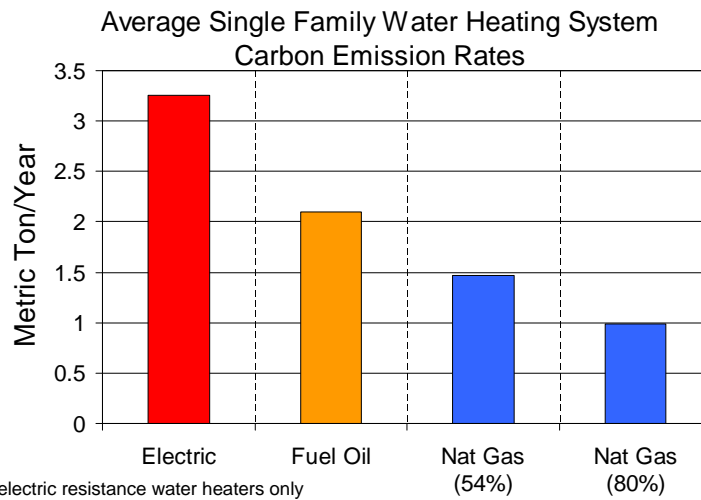


Source: GAMA

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Water Heating Full Fuel Cycle CO2 Emissions



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Water Heating Market Situation

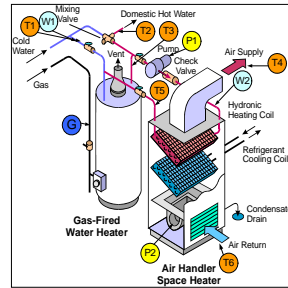
- > Significant changes in the water heater market
 - Technology
 - Market players and channels
- > For natural gas, new higher-efficiency combo tank system and tankless products
 - Concerns over cost and other factors
- > New electric products such as heat pump water heaters coming into play
- > Increasing interest in solar thermal/natural gas hybrid solutions

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Combination Space/Water Heater Field Test

- > A.O. Smith Vertex technology
 - Can be used for water and space heating
- > Field test at 29 sites across US and Canada
 - Varying household size and ages, five climatic heating-design zones
- > Product adoption slowed by higher first cost

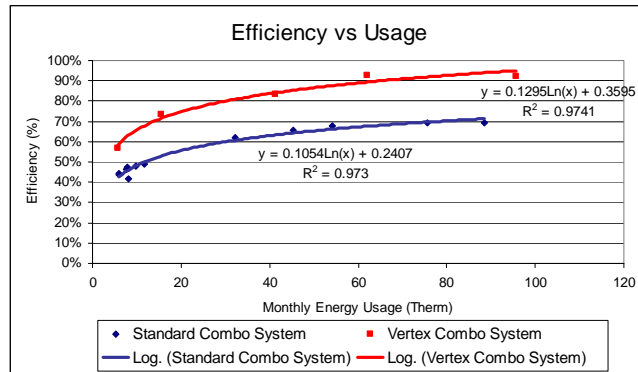


- (W) Water Flow Rate
- (G) Gas Usage
- (T) Temperature
- (P) Power/On/Off



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Birmingham Alabama Site

- > 20 to 25 percent energy savings for water heating
- > 15 percent energy savings for space heating over a standard furnace

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Condensing Tankless Water Heater



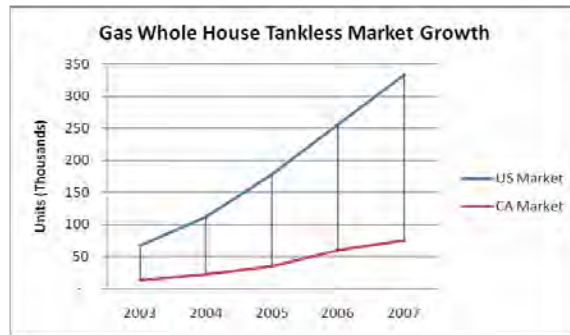
| Item | | CR-180, CR-180A, CC-180, CC-180A | CR-210, CR-210A, CC-210, CC-210A | CR-240, CR-240A, CC-240, CC-240A |
|-----------------------|-------------|---|---|---|
| Heat Capacity (Input) | Natural Gas | Min: 15,000 Btu/h Max: 150,000 Btu/h | Min: 17,000 Btu/h Max: 175,000 Btu/h | Min: 17,000 Btu/h Max: 199,000 Btu/h |
| | LP Gas | Min: 15,000 Btu/h Max: 150,000 Btu/h | Min: 17,000 Btu/h Max: 175,000 Btu/h | Min: 17,000 Btu/h Max: 199,000 Btu/h |
| Thermal Efficiency | | 98.8 % | 97.8 % | 97.3 % |
| Energy Factor (DOE) | | 0.98 | 0.95 | 0.95 |
| Dimensions | | W17" x H28" x D10" | W17" x H28" x D12" | W17" x H28" x D12" |
| Weight | CR/CC-A | 77 lbs | 86 lbs | 86 lbs |
| | CR/CC | 67 lbs | 77 lbs | 77 lbs |

www.navienamerica.com

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Natural Gas Tankless Water Heaters Growing



Expect 5% market share in 2008
Strong markets – CA, TX, Warm belt states

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Tankless Water Heaters



More efficient...and increasing market share, but:
Cost (total installed cost) is major point of concern for residential customers

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Instantaneous Storage Hybrid Water Heater

> Problem Addressed

- Storage water heaters: Standby losses, inadequate for large total draws, take up more space
- Instantaneous water heaters: Variable temperatures at large peak, intermittent, and very low flow rates
 - > Reduced temperature rise for simultaneous draws
 - > 10 second ignition delay, 5 seconds for heat exchange
 - > 0.5 gpm minimum flow rate to start burner
 - > Incompatible with recirculated water systems
 - > Sophisticated controls required for modulation
 - > Increased gas line size

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Solar Thermal/Natural Gas Hybrid Energy Systems

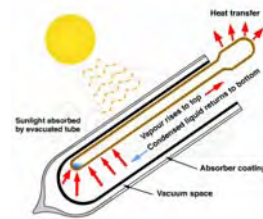
> Integrated solar thermal/natural gas energy systems

- Residential and Commercial buildings
- Hospitals, Universities
- Industrial plants



> Use next-generation technology (including higher-temperature concentrated solar)

- Hot water, steam generation, absorption cooling, process heating



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Nearly Commercialized

> Low Cost Combi Oven

- In Beta Testing

> Convection Oven

- In Final Testing

> Low Oil Volume Fryer

- Pitco and Frymaster
- Energy Star technology that helps address shift to trans fat free oils



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Nearly Commercialized

- > Wok
 - Efficiency improvement from 12% to 28% (working to go even higher)
 - Being installed for in-restaurant testing
- > Falling Film Steam Generator
 - Technology incorporated into new foodservice steam cooker
- > Gas-fired Warewasher
 - Final designed complete



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Distributed Generation/CHP Systems

- > Light-Commercial CHP System
- > GTI is working with Yanmar and a consortium of natural gas utilities looking at the commercial introduction of 10-30 kW packaged gas engine combined heat and power systems
- > Leveraging a product platform that is widely used in Japan.
- > Initial market applications are targeted for the Northeast U.S.



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Building and Community Energy Analysis and Planning

- > GTI energy analysis tools and capabilities
- > Helps identify range of energy efficiency opportunities in buildings and communities
- > Active in community planning for Chula Vista, CA



For more information: www.interenergysoftware.com

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Bio-Gas to Clean Power



- > Gills Onions
 - Convert onion processing byproduct into clean biogas energy
 - Avoid costs and emissions associated with disposal
 - Demonstrate digester gas to clean fuel cell power
 - > Lower energy costs through cogeneration w/renewable biomass waste
 - > Achieve strict gas quality specifications

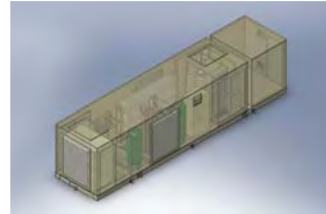


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Hydrogen Fueling Stations & Fuel Cell Vehicles

- > Working with partners to develop and demonstrate:
 - Integrated hydrogen fuel stations (fuel reformers or electrolyzers)
 - Specialty fuel cell vehicles
- > TX, CA, MO, SC, IL



Hybrid hydrogen fuel cell/battery shuttle bus



Factory packaged natural gas to high-pressure hydrogen fuel station

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Summary

- > GTI is active in a range of end use technology developments
 - Residential, commercial, industrial, and transportation
 - Emphasis on energy efficiency, low ambient air and carbon emissions, alternative fuels, and renewable energy (biogas and solar thermal)
- > Work with a wide range of partners and stakeholders
 - Federal and state government, energy industry, manufacturers, and others

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