Emerging Technology Program (ETP)

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Gas Technology Institute

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GTI Overview

> Not-for-profit RD&D organization with 70 year history

> Facilities
  - 18 acre campus near Chicago
  - 200,000 ft², 28 specialized labs
  - Other sites in Alabama, D.C, Texas Massachusetts, California

> Staff of 250
  - 170 engineers, scientists covering all fields
Positioned to help utilities and their end use customers

ETP helps companies assess the benefits of new energy efficiency products and integrated solutions for use in near- to mid-term energy efficiency program implementation.

ETP encompasses a variety of new manufacturer technology/product offerings.

Established in 1985

SMP builds a strong technology base for new technologies, product concepts, and related solutions through the “proof of concept” stage for gas utility members and their customers.

Established in 2004

UTD and its 16 members serve over 20 million gas consumers in 25 states and Canada. These companies work together on technology developments that meet their end-use customer energy efficiency and environmental needs.

ETP efforts will work with a range of manufacturers and end use customers, including major national accounts.
Emerging Technologies

> GTI has been active in the “emerging technology space” for many years
  
  — Not a new concept
  
  — Typically $1-5 million annually from gas industry and government partners
  
  — Expanding industry interest, driven in part by energy efficiency programs
    
    > For example, new three-year, $4 million ETP effort being launched with Nicor Gas
  
  — Opportunity for industry collaboration to leverage resources and increase market impact
ETP Scope

Emerging technologies are new, energy efficient technologies, systems or practices that have significant energy savings potential but have not yet achieved sufficient market share to be considered self-sustaining or commercially validated within a given region or state.

- GTI is working with industry partners to develop a **national collaborative** (U.S. and Canada)
- Targeting **residential, commercial and industrial** solutions
- ETP is designed to **create value for member companies**, their ratepayers and related stakeholders
- ETP’s principle goal is to **accelerate** the **market acceptance** of emerging technologies for inclusion in the utility’s mainstream energy efficiency programs
Significant scale makes the program attractive to commercial partners as a vehicle to expedite the market introduction and acceptance of new efficient products.

Funders drive agenda and influence product/process deployments and evaluations to address the needs of their company, rate payers and the industry.

Leverages collective funding, intelligence and experience of program members to efficiently resolve technical and market barriers.

Provides opportunity for field demonstrations within your service territory, enabling a better understanding by utility personnel, customers, channel partners, trade allies and regulators.

Accelerates measure availability and energy efficiency program savings.

Positions companies to drive new technologies into the market.
Program Activities

> Key activities may include:

  > **Product/process assessments**
    > Characterizing energy use, costs, benefits, market opportunities, energy savings potential and barriers

  > **Demonstrations**
    > Validate performance, efficiency, reliability
    > Enabling market development
    > Target unknowns, build program data

  > **Training, education and outreach**

  > **Develop robust work/white papers**

### What Does ETP Do?

ETP is designed to help members identify and evaluate the most promising products and integrated solutions, assess their suitability for future use in utility energy efficiency programs, and deliver comprehensive program guidelines for successful full scale deployment.
ETP Projects/Demos

> GTI and its partners develop project proposals including scope, timeline and budget

> Collaborative project initiatives are expected to include:

  ─ In territory and/or regional demonstrations
  ─ Detailed technical and human data collection for full-scale program design and implementation guidelines
  ─ Market development including increasing contractor capacity and customer awareness
<table>
<thead>
<tr>
<th>Energy Efficiency Opportunity</th>
<th>Market Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Space/Water Heater Systems</td>
<td>Residential/Commercial</td>
</tr>
<tr>
<td>High-Efficiency Gas Heating Rooftop Package</td>
<td>Commercial</td>
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<tr>
<td>High-Efficiency Boilers, Ultramizer Deployment</td>
<td>Commercial/Industrial</td>
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Residential Integrated HVAC and Water Heat: The Basics

- High efficiency tank or tankless water heater (90 EF+), combined with hydronic air handler

- Technology ‘concept’ has been around for years, but only recently have major manufacturers begun manufacturing truly integrated systems at cost-competitive prices

- For purpose components, DHW prioritization

- Currently available in marketplace, few takers

- New systems offer better capacity for larger homes
Residential Integrated HVAC and Water Heat: EE Programs

- DOE Direct Final Rule to require Northern Regions to raise the AFUE for non-weatherized gas furnaces from 80% to 90%
  - Full effect in 2013
- Condensing furnaces represent 68% of Northern Climate furnace shipments
- Decreasing opportunity for gas savings
- High efficiency water heating programs face challenging economics (e.g. TRC), especially with low gas prices
  - Improves utility/customer value proposition for water heating by piggy-backing on larger space heating load
Residential Integrated HVAC and Water Heat: The Customer

- Opportunity for significant energy savings (> 200 Therms annually)
- Improved payback, using one high efficiency device for two end use loads
- Direct vent, eliminating cost to reline chimney when customers ‘orphan’ water heater by upgrading to condensing furnace while retaining atmospherically-vented storage water heater (common in colder climates).
- New, pre-engineered systems supported by major manufacturers offer improved reliability and cost-effectiveness while reducing system design and installation errors
High-Efficiency Rooftop Packages & Unit Heaters for Comm/Ind Buildings

> GTI is working with public-private partners to expand the availability and adoption of high-efficiency:
  
  ─ Rooftop space conditioning units
    > Packaged space heating and air conditioning units (Gas PACs)
    > Dedicated outdoor air systems (DOAS)
  
  ─ Unit space heaters
  
  ─ Achieving greater than 90% efficiency
    > Compared to conventional ~80% efficient products
Gas PAC Market Attributes

> Gas PAC equipment used extensively in commercial and industrial building segments

343 Trillion Btu of energy
465,000 commercial buildings
- Office
- Foodservice
Dedicated Outdoor Air Systems (DOAS)

> ASHRAE requirements point to need for fresh air supply to commercial buildings

> Dedicated outdoor air systems, or DOAS, provide a “neutral” source of fresh air
Commercial Heating Feedback
GTI National Account (NA) Interviews

> One-on-one discussions with several major NA’s

  ─ None specifying condensing heating equipment (no gas PACs available but high efficiency unit heaters in market)
  ─ Many use a combination of gas rooftop and unit heater equipment in the same retail building (e.g., SuperCenter)
  ─ DOAS coupled w/to outside air (OA) gas PACs have most promising net operating cost savings
  ─ Large numbers of HVAC retrofits peaking in next few years yields opportunity for cost effective, high efficiency heating entry
Gas PAC Field Monitoring

> GTI Conventional Gas PAC Field Monitoring
  — Over 105 gas PAC units in 11 Chicago area commercial buildings
  — Ranging in size from 2,000 to 200,000 sq ft
  — 1 small office
  — 3 quick service restaurants
  — 3 drug/convenience stores
  — 3 clothing/home goods stores
  — 1 retail “super” store
Sample Rooftop Monitoring Results

- Social Security Admin
  12,500 sq ft bldg with 6 RTUs

- Preliminary results
  10/29/10 - 2/23/11

- Great diversity in total RTU runtime: perimeter >> core

- Average heating cycle times range from 4-12 minutes

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<tr>
<th>RTU #</th>
<th>LO/HI MBH</th>
<th>LO/HI Runtime Hrs</th>
<th>Total Gas Usage Therms</th>
<th>#Cycles/Avg Time Mins</th>
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Commercial & Industrial Boilers

- Large population of outdated commercial/industrial boilers
- New options for improved efficiency

Over 75% of larger commercial and industrial boilers greater than 30 years old

Source: EEA/ORNL (2005)
Steam Systems and EE Improvement Opportunities

- Steam losses to atmosphere, 7.4%
- Steam leaks, 6.5%
- Poor, missing insulation, 4.4%
- Condensate losses, 3.8%
- Steam trap failures, 3.6%
- Blowdown losses, 1.5%
- Other, 0.7%
- Boiler Flue Gases, 16.4%

Useful Steam, 55.7%
Steam System Losses, 44.3%
Example Boiler Efficiency Improvement Options

High and low temperature economizers may be made of carbon or stainless steel.

Condensing economizers often use stainless steel to resist corrosion.
Simultaneous Sensible & Latent Heat Recovery & Water Separation

> GTI-developed Transport Membrane Condenser (TMC) technology

> TMC uses a robust nanoporous membrane to selectively remove pure water from natural gas combustion byproducts
  — Saves water and avoids corrosive condensation problem

> Successfully developed for C&I boilers with Cannon Boiler Works
  — Retrofit or new units

TMC tubes in a bundle assembly
Ultra-High Efficiency Boiler
Advanced Heat Recovery at Baxter Healthcare

> Field test of TMC-based heat recovery systems
> 13-15% energy and carbon savings
  — Total efficiency ~92.5%
> Over $40,000 annual savings at Baxter
  — Over $80,000 at higher hours & firing rates
> More than 250,000 gallons saved yearly
ETP Summary: A Critical Role to Achieve Market Impact

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Next Steps

> Program kick-off slated for Q2 2012
  – Base program activities including working group development
  – Discuss and select high priority ETP projects

> Continued program development activities
  – Grow membership
  – Support regulatory filings
  – Identify increased funding alternatives
Thanks, Questions?

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