

the Energy to Lead

Nicor Gas Emerging Technology Program Webinar

March 14, 2013



Energy Efficiency Program

Ryan Kerr, Emerging Technologies Manager
Gas Technology Institute

E: ryan.kerr@gastechnology.org

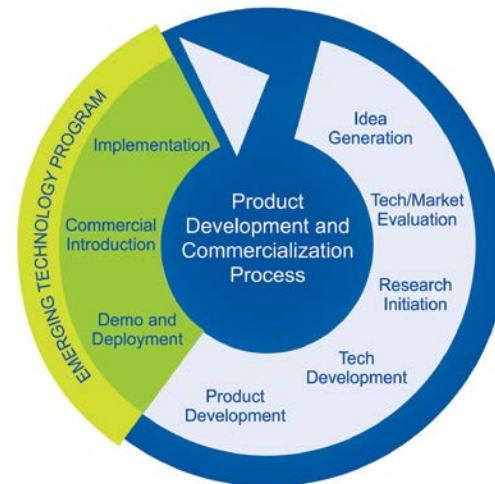
P: 224.735.0264



Nicor Gas ETP Webinar – Agenda



- > Role Call
- > Background (GTI, GTI North American ETP)
- > Nicor Gas Emerging Technology Program
 - Overview
 - How it Works
 - > Ready, Set, Go!
 - Status
 - Highlighted projects
- > Next Steps
- > Questions, Discussion



GTI Overview

- > Not-for-profit (501c3) RD&D organization with 70 year history
- > Facilities
 - 18 acre campus near Chicago
 - 200,000 ft², 28 specialized labs
 - Other sites in California, D.C., Texas, Alabama, Massachusetts
- > Staff
 - Approximately 250
 - 170 engineers, scientists covering all fields



CHP and Renewable Energy Lab



Residential & Commercial Lab



Flex-Fuel Test Facility

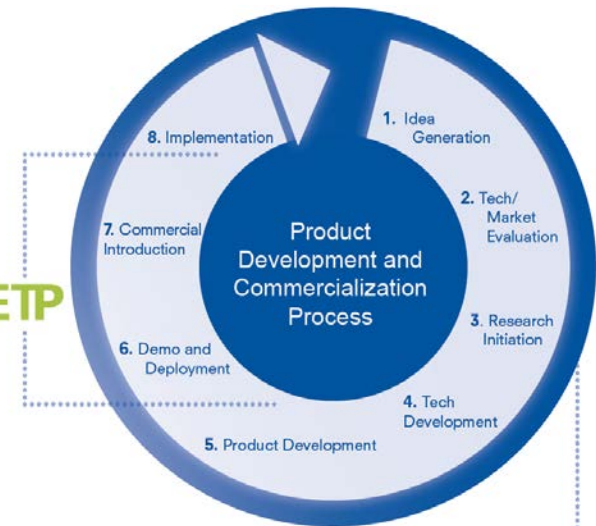


Natural Gas Industry Collaboration

Emerging Technology Program



- > Gas Technology Institute led, utility supported, **North American collaborative** targeting **residential, commercial and industrial** solutions
- > ETP's principle goal is to **accelerate** the **market acceptance** of emerging gas technologies



ETP activities are “beyond development” stage: Field Testing, Demonstration, Pilot Programs, and Deployment – a focused effort to ensure market acceptance of next-generation emerging technologies

ETP Scope & Direction



ETP Mission

Accelerate the market acceptance of energy efficient gas technologies

ETP Activities

Identify and demonstrate technologies to **(1) collect and analyze** enabling program and technical **data** while **(2) developing marketplace** through consumer awareness and **infrastructure** improvement.

ETP Results

As gas programs, regulations, and markets mature, low hanging fruit disappears. ETP helps **deliver a pipeline of new technologies** and program solutions enabling utilities to meet tomorrow's energy efficiency goals **with less risk and more certainty.**

Examples: Existing and New ET Program Activities

- California- Roughly 2.5% of total IOU EE and DSM budgets under 2010-2012 Portfolios
- New York- (NYSERDA) Roughly 5% of total program budget
- Pacific Northwest (NEEA)- 10% of total budget 2010-2014
- Illinois- 3% of Gas EE and DSM Program Revenue
- Canadian ETIC

National Collaborative Concept



- > **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 through (1) collaborative projects and (2) coordinated efforts
- > Provides **opportunity for field demonstrations within member's 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 members to **drive new technologies into the market**


2012 Deliverables

ETP Technology Snapshots: 2012

- > EcoFac home's and other
- > Commercial Air has applied efficient
- > ASE is energy feedback control
- > Showers are the integr as a co
- > Opp Feed Reside consum efficient
- > Micro plant v genera
- > Inte Califor Facilita heating efficien Califor



ETP CONFIDENTIAL



TECHNOLOGY SNAPSHOT

Residential feedback refers to programs or technologies that increase consumer understanding of their home energy use leading to energy efficiency through changes in consumer behavior or capital investments.

MARKET SITUATION

Baseline

- Residences without feedback

Opportunity

- Energy efficiency, natural gas, electricity, and water savings
- Market potential: rebirth of existing systems and for new installations

Segment

- Residential
- New construction and retrofits

Status

- Preliminary research was performed and three (3) post feedback options have been identified

Next Steps

- Further research and demonstration projects for:
 1. Enhanced Billing
 2. Smart Thermostats
 3. Advanced Metering Infrastructure



Opportunities for Residential Natural Gas Feedback

Description

Energy use is largely invisible to most consumers – they may notice when lights are on, but they are far less likely to be aware of how much natural gas their water heater is consuming at any given time. Energy monitoring devices are able to transform the invisible to the visible by providing consumers with a more comprehensive and nuanced understanding of their usage patterns. This meaningful boost in knowledge enables consumers to make more informed short- and long-term decisions about their energy use – from highlighting the importance of shutting off lights to showing the value of replacing an old furnace with a new higher efficiency model.

Residential energy feedback has growing interest among consumers, utilities, and researchers as a way to save energy, save money, and increase consumer understanding of their home energy use. Providing more detailed information about how – and possibly when – a consumer uses energy in their home can help identify opportunities for energy efficiency upgrades.

Feedback can be categorized as direct (real-time) or indirect (post fact), and existing research has demonstrated that these two types achieve different levels of savings. Direct feedback can achieve whole home energy savings averaging about 5 to 15 percent while indirect feedback generally yields savings averaging about 4 to 6 percent.





Figure 1: Enhanced Billing, Smart Thermostats, & Advanced Metering

Residential Natural Gas Feedback

Priority Gas Option 2: Advanced Thermostats

Smart or advanced thermostats have been an area of increased development, though there is as of yet no industry definition of "smart." Generally, smart thermostats incorporate an internet connection that allows users to remotely access the device, and have the potential for two-way communication between the consumer and the utility in the future.

Though not strictly a feedback device, as the central control for the largest gas load in the home – space heating – they are a naturally promising integration point for gas feedback. By leveraging the existing regular use of the thermostat, the incorporation of advanced controls and feedback could be a reliable means of maintaining consumer engagement and having the greatest impact by presenting feedback right at the moment that a consumer is making a decision about gas use (i.e. when to turn the thermostat up or down).

There have been recent efforts to develop next-generation thermostat designs that show early offerings of feedback, as evidenced by the Nest learning thermostat. Given the recent increased emphasis on good, user friendly thermostat design, this is a ripe development environment for advanced thermostats, which could provide users with increased control, energy use feedback, remote access capabilities, and overall energy savings.


- **Key Advantages of Smart Thermostats**
 - Potential to reach large residential market
 - Potentially large energy savings
 - Can incorporate HVAC controls
 - Strong market pull for a more user friendly, better designed thermostat

- **Historical Challenges to Smart Thermostats**
 - Potential and persistent design challenges to user friendliness
 - Body of research large but inconsistent on energy savings potential
 - New smart thermostat designs require new research efforts regarding savings potential to better gauge their unique features (two-way communication, Wi-Fi capabilities, etc.)


Advanced thermostats can range in cost from about \$100 up to \$500 depending on the functionality and optional technological add-ons incorporated.

ETP Active Projects: 2012

- > EcoFac home's and other
- > Commercial Air has applied efficient
- > ASE is energy feedback control
- > Showers are the integr as a co
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- > Micro plant v genera
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Combined Space and Water

Water temperature throughout the range of common flow rates and use patterns, consistent condensing operation, filter cleaning intervals due to excessive mineral scale and galvanic corrosion, and feasibility of adding solar preheat.

Beyond the technical uncertainties market adoption is expected to be impeded by both contractor and code official lack of familiarity with these types of combo systems. GTI is currently pursuing both laboratory testing and demonstration projects to more thoroughly evaluate combo system performance. Major goals to improve familiarity with these systems in the field.

Building America Lab Work

Major water heater manufacturers are now developing or are currently marketing pre-engineered forced air combos. These emerging combo technologies offered the opportunity to conduct meaningful tests, which highlighted key operations, that differentiated the performance of the various packaged equipment configurations being offered.

Standardized testing for combo systems requires the air handler to be tested against space heating loads and the water heater to be tested separately against water heating loads. The laboratory tests conducted by GTI for Building America subjected the combined air handler and water heater (combo system) to realistic and coincidental space and domestic hot water loads. The results highlight the attributes of combo technologies that use traditional storage water heaters and tankless water heaters as their thermal engines. Some important differences were observed including:

Tankless	Storage
• 84%-93% average daily efficiency	• 81%-91% average daily efficiency
• 10 seconds to 115 °F	• <10 seconds to 120 °F set point
• Stable space heating temperatures	• Tank stratification leads to unstable space heating temperatures

The tankless combo system that was tested consistently achieved better daily efficiencies (i.e. 84%-93%) than the storage combo system (i.e. 81%- 91%) when the air handler was sized adequately and the water flows and water heater temperature set points were adjusted properly to achieve significant condensing operation. A key finding of this work is that condensing operation during space heating is inconsistent. This occurs in both tankless and storage combo systems. The air handlers that are currently used in these systems return water to the unit at too high of a temperature for condensing operation. Also, the burners operate at between six and twenty percent excess air making the exhaust drier and condensing operation more difficult to achieve.

To achieve more consistent condensing operation, it was necessary to minimize the return water temperatures from the air handler by adjusting the water heater set point down and reducing the water flow. These adjustments were governed by comfort in terms of air temperature and air flow delivered. When condensing operation was not achieved, the tankless and storage systems performed with lower

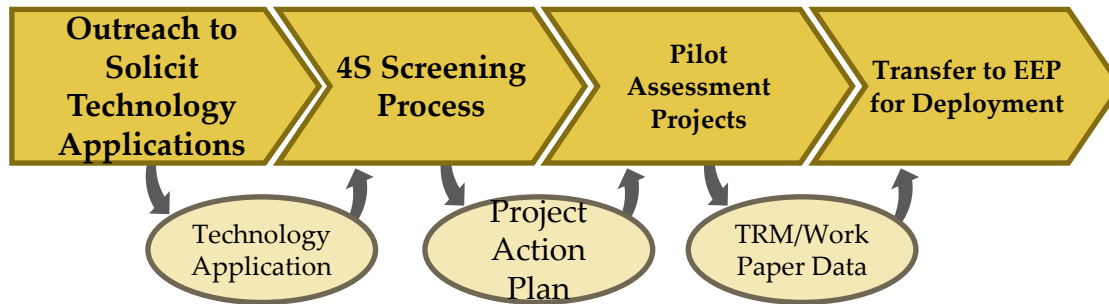
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PROJECT UPDATE 2 - 5

Nicor Gas ETP: The Basics



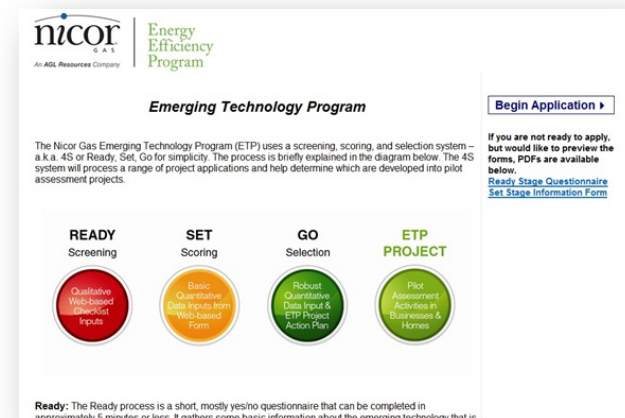
- > GTI is implementation contractor (IC) for Nicor Gas ETP
- > The goal of ETP is to accelerate the arrival of the latest energy efficient technologies and practices to the Nicor Gas EEP. This could be enhancements for existing programs or new programs or measures
- > Key activities include determining whether new products or practices are reliable, serviceable, and provide cost-effective energy savings compared to alternatives
- > Key outcomes include data (energy savings, installed costs) and program design metrics and guidelines for program and regulatory stakeholders
- > Close collaboration with key stakeholders is an essential part of process (e.g. implementation contractors, manufacturers).

Nicor Gas ETP: How it Works



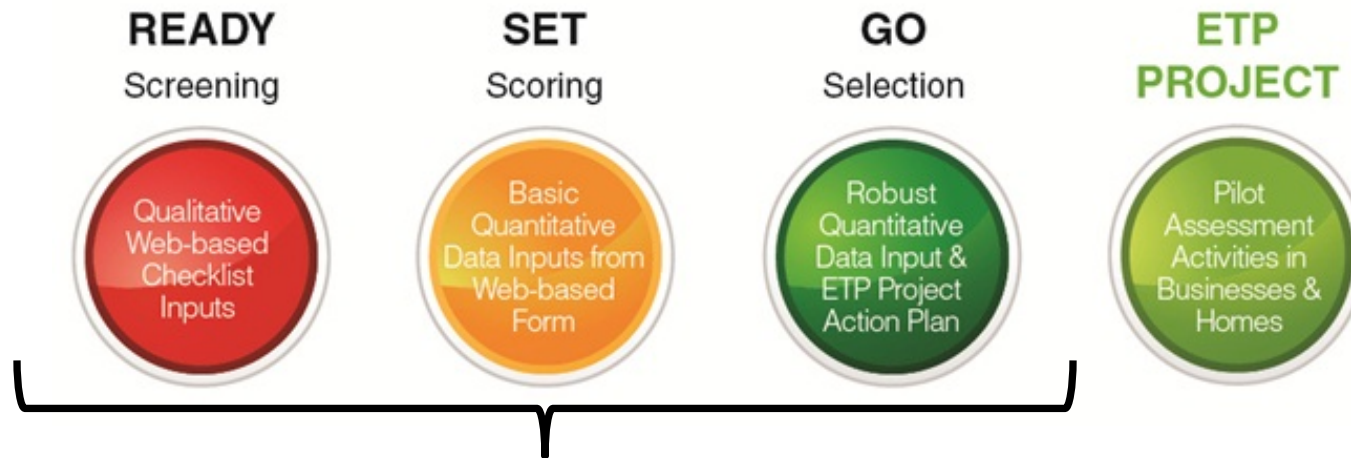
ETP is to EEP as the minor leagues is to the major leagues

> One of the key principles behind the Nicor Gas ETP is to foster an open, transparent process for soliciting new measures and program concepts...



Ready, Set, Go!

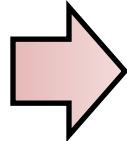
- > Designed to identify the most promising technologies and program concepts, *Ready, Set, Go!* uses three increasingly rigorous evaluation stages to ensure only the applications with the most likelihood of success and impact become ETP projects.



Ready, Set, Go! Stages

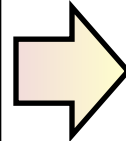
READY (SCREENING)

Qualitative
Web Based
Checklist
Inputs



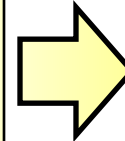
SET (SCORING)

BASIC
Quantitative
Data Inputs
from Web
Based Form



GO (SELECTION)

ROBUST
Quantitative
Data Input &
ETP Project
Action Plan



ETP Project

Pilot
Assessment
Activities in
Businesses and
Homes

- yes/no queries with immediate response
- establish minimal qualifications, such as market availability

- custom response to applicant in weeks 2-4
- ETP staff & applicant interactions on data to meet project criteria
- 25% to Go stage per preliminary score/rank

- custom response to applicant in weeks 8-12
- ETP staff make project recommendations to:
 - Technical Review Committee, with Ad Hoc Tech Support (Trade Ally)

- team approach:
 - GTI (or other PI)
 - Nicor/WECC
 - cognizant EEP IC
 - equipment mnfrs
 - contractors
 - end users

Application Scoring

- > Seven key criteria evaluated at Set and Go stages:
 1. Cost-effectiveness
 2. Gas savings potential
 3. Value to Nicor Gas portfolio
 4. Non-energy benefits
 5. Support/distribution in Nicor Gas service territory
 6. Technological maturity
 7. Ease of implementation/market adoption
- > Criteria are scored on a scale of 0-5
- > Different weights are applied to each criterion
- > Scores are totaled out of a possible 100 points

Moving Beyond Go...

- > Once confirmed by the Nicor Gas Technical Review Committee, ETP will begin to implement the Action Plan for the pilot assessment.
- > Pilot assessments are designed to validate gas savings potential and provide critical information for Work Paper development by other ICs as well as develop critical experience with new measures to ensure they are right for rate payers and can be successfully delivered through an existing or new EEP.

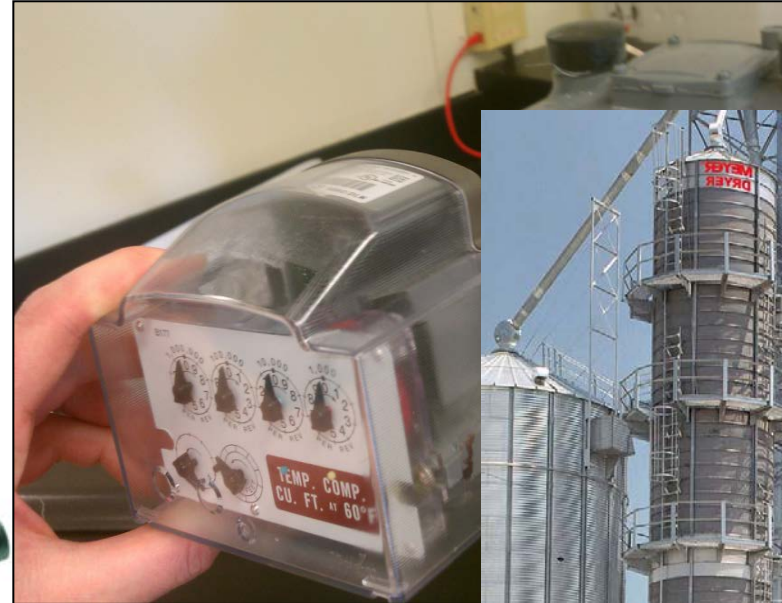


Application/Project Status



- > 45 applications received
 - Mix of residential, commercial, and industrial sector
- > 9 ETP projects underway, each project is different because each technology/program concept has its own set of barriers to EEP entry
 - Data Barriers
 - > Moving from custom to prescriptive (ozone laundry, air barriers)
 - > What about gas? (behavior programs, EcoFactor)
 - Market Barriers
 - > Identifying and addressing the impacts of 'disruptive' technologies (condensing HE RTUs, combined space and water heat systems)
 - > Awareness and education (boiler heat recovery workshop)

A few ETP applications...



Boiler Controls – Greffen M2G

MARKET SITUATION

Baseline

- Conventional closed loop hot water boilers

Opportunity

- Natural gas savings
- Electricity savings

Segment

- Commercial
- Multi-family
- New construction and retrofits

Status

- Technology is mature, and readily available off the shelf

Next Steps

- Further data on cost savings in a variety of markets



Annual Profile of Dry Cycling.

> Technology

- The M2G is an advanced intelligent boiler control that optimizes the heating efficiency of hot water boilers and significantly reduces energy consumption through elimination of wasteful burner firing and effectively spreading the system loading demand over the number of installed boilers.

> Savings Potential

- 10-20% gas savings



> ETP Activity

- Nicor Gas ETP is coordinating with GTI's North American ETP and the Partnership for Advanced Residential Retrofit to better understand the gas savings and cost-effectiveness of the Greffen M2G Controller technology on typical applications

EcoFactor Home Energy Management

MARKET SITUATION

Baseline

- Conventional and programmable thermostat
- Home Energy Management (HEM)

Opportunity

- Natural gas savings
- Electricity savings

Segment

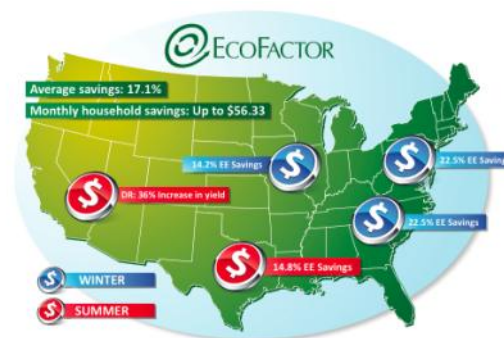
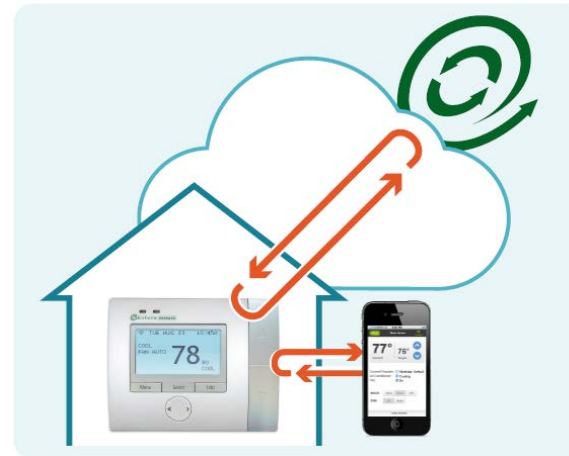
- Residential (single and multi-family)
- Commercial
- New construction and retrofits

Status

- Technology is mature, and readily available through certain programs

Next Steps

- Program metrics needed
- Large-scale pilot activity underway to better understand delivery channel approach, energy savings, costs (first, ongoing)



> Technology

- EcoFactor EMS pairs a wireless, programmable thermostat with internet-based software to make continual small adjustments to control the HVAC operation based on weather data and other information, including home occupancy status to reduce energy use while maintaining comfort

> Savings Potential

- **Significant** HVAC energy savings are possible from combination of savings from automated energy efficiency and personalized schedules
- Gas savings not yet tested

> ETP Activity

- The Nicor Gas Emerging Technology Program is partnering with EcoFactor to install and monitor **100 systems**

Status of Host Site Recruitment



- > Multiple recruitment avenues being pursued:
 - EEP Friends and Family recruiting began 1/25
 - Eblast to 1,900+ past EEP participants released on 2/1
 - Tile on NicorGas.com went live 2/14
 - Employee recruitment email pending

> First batch of applications passed 3-stage QA/QC process and have been moved to EcoFactor to schedule installations.

> Second batch of applications have been received and are currently moving through QA/QC.



Welcome Homeowners – Let's Start Saving!

The Nicor Gas Energy Efficiency Program is partnering with EcoFactor to install and evaluate a home energy management system in the Nicor Gas service territory.

A smart and efficient home!

The EcoFactor home energy management system pairs a wireless, programmable thermostat with Internet-based software to increase the energy efficiency of your home's heating and cooling system. For our homeowners it provides:

- **Energy savings** - Continual small adjustments to the thermostat temperature settings help to lower heating and cooling costs while maintaining comfort in your home.
- **Simple setup** - Enter your heating and cooling preferences online and then EcoFactor does the rest by "learning" your ideal comfort level preferences over time.
- **Easy access** - You can choose to override any adjustments via the Internet using a computer, tablet, or smart phone. You can also go online to see how much energy you've saved.

What do I get?

This pilot program will provide qualified, selected homeowners with:

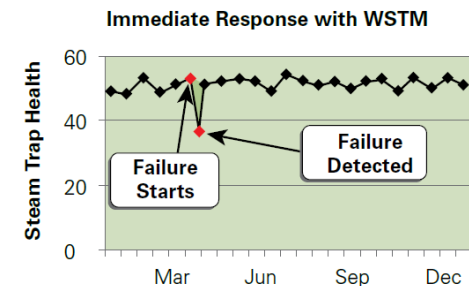
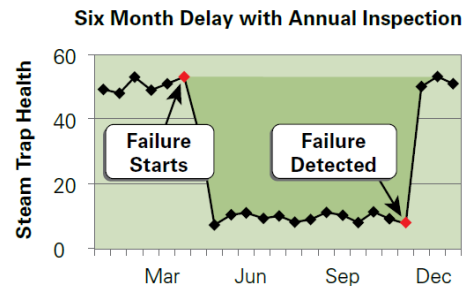
- **Free thermostat(s)** – up to three wireless thermostats using EcoFactor's energy-efficient software.
- **Free gateway** to connect the thermostat to the internet-based software.
- **Free installation** of thermostat and gateway by experienced professionals.
- **Free first 12 months** of online service with an optional online service for a \$9.95 monthly fee after the pilot program. Customers also have the option to revert the thermostat to standard programmable capability.

When the pilot program ends, you get to keep the thermostat and gateway!



Cypress Steam Trap Monitor

- > It is estimated that 25% of steam traps fail every year, half of them open
- > Industries using medium and high pressure steam see the highest losses
- > Steam trap monitors alert the user to trap failure immediately



Cypress Steam Trap Monitor– *Project Approach*



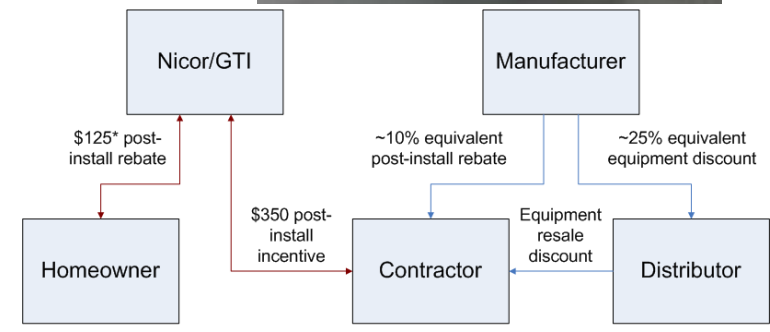
- > Identify a single site using medium to high pressure steam – 80 psi and up
 - Locate a branch line, wing, etc. with approximately 200 traps
 - Site needs routine trap maintenance plan to confirm monitor operation and to repair faulty traps promptly
- > Utilize past years gas consumption as baseline
- > Coordinate through GTI ETP with SoCal



ETP National Pilot Residential HE Combo Systems



- 94 EF condensing tankless water heater + hydronic air handler (Rheem pictured)
 - Improves utility/customer value proposition for water heating by piggy-backing on larger space heating load
- Multi-unit demonstrations/pilots in IL, NY, CA
 - At least 20 residencies with full data acquisition systems
- Measured field performance, energy savings, cost analysis, and customer reaction
- Contractor technical/sales training, consumer messaging, rebate program pilot



← Administered under ETP Participation Agreements
 *Monitored homes = \$350, Non-monitored homes = \$125

Marketing Tools and Training



EMERGING TECHNOLOGY PROGRAM

COMBINATION SPACE AND WATER HEATING SYSTEMS

The Emerging Technology Program helps introduce new energy efficiency technologies by selecting and demonstrating promising new products and practices that have the potential to realize gas savings for Nicor Gas customers.

Program participation benefits:

- Assessment and engineering consulting.
- Customer incentives for equipment and installation.
- Monitoring and data collection to demonstrate savings.
- Summary of project results when the pilot assessment is complete.

How can I participate?

If you are interested in installing a high-efficiency combination space and water heating system, please contact your Emerging Technology Program contractor representative at the address below. More information about the system can also be found at Rheem.com/products/Integrated_Systems.

Place Contractor Contact Info Here - Dealer or Business Card

Integrated Heating & Water Heating System
Powered by Tankless Technology

Integrated System Benefits

- One source for home heating and water heating, installed by a Rheem-trained contractor.
- The Rheem tankless water heater serves two purposes in the hydronic system. It provides continuous hot water for use throughout the home and, when a call for heat exists, the tankless water heater also acts as the heat source for an air handler, eliminating both hot water and heating for the home structure's energy needs.
- Efficiency rating of up to 94%
- Energy cost savings
- Continuous hot water
- 30-yr water heater warranty
- Hydronic air handler features a hydronic heating coil in place of a traditional heating element or gas-fired furnace. When in heating mode, the hot-piping circulates hot water between the tankless water heater and the hydronic coil.
- Integrated home comfort
- One of up to 4 on market
- Compact design
- Exp. on handler warranty

Cost and Energy Savings Example

Typical Chicago-area single family 2,500 sq ft two-story unretrofit home with 3 bedrooms and 2 bathrooms

Baseline water use: 0.99 GPD/42 gal	Baseline furnace: 50% AFUE
Integrated system: 94% thermal eff.	

Estimated annual savings

Energy: 137 kWh
Gas cost: \$125

Equipment Pricing*

Through a limited-time offer, Rheem is providing a dealer discount on Rheem integrated systems that allows participating contractors to offer the following equipment pricing to consumers.

Tankless Water Heater

Rheem Model: RTD105-DUAL, \$1183.82

Hydronic Air Handler

Rheem Model: RHD105-001/MSDA, \$888.02
 Rheem Model: RHD105-001/MSDA, \$888.02
 Rheem Model: RHD105-001/MSDA, \$889.28
 Rheem Model: RHD105-001/MSDA, \$887.75

Program Incentives*

Also through a limited-time offer, the same program is providing cash incentives directly to participating homeowners.

Homeowners will receive \$100 for gas-line participation and must enter into an agreement with Gas Technology Institute (program administration).

Participation includes allowing the gas utility to show 3 and 4' prior, and 2 years of post-homeowner gas performance after system, and access to the home to verify installation if necessary.

*Equipment pricing and program incentives are offered under a limited-time and service basis.

Ferguson Heating & Cooling Presents
Rheem Tankless Pilot Program

Nicor Gas Emerging Technology Program is partnering with Rheem to offer a Pilot Program for a number of combination space and water heating systems. The system will utilize the Rheem Hydronic Air Handler powered by a Rheem Tankless Water Heater. You have been selected for an opportunity to participate in this Pilot Program. The program features lower first cost for equipment and incentives to you and your customers offered by Rheem and Nicor.

If you are interested in participating, you must attend our Pilot Meeting on October 18th. This meeting will include full details of the Pilot Program as well as training on the tankless water heater and air handler.

West Branch
Thursday, October 18th
4:00 p.m. to 7:00 p.m.
Light dinner included
515 Factory Rd.
Addison, IL 60101
please register by 9/28

Registration is required by September 28, 2012
Fax form below to (773) 279-2973

FERGUSON
Heating & Cooling

Rheem

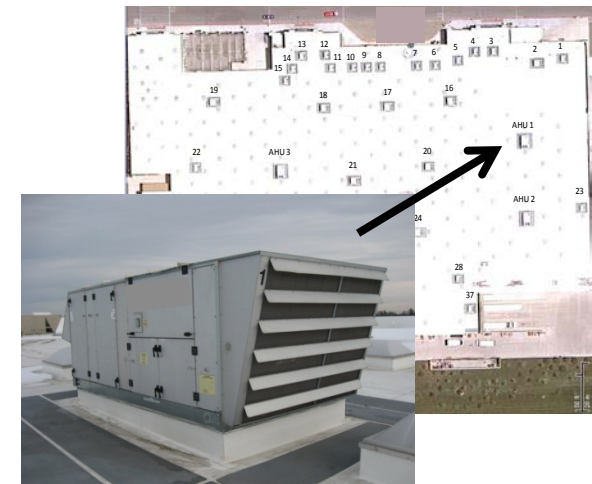
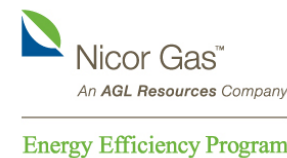
Yes, I will attend the Tankless Pilot Program Meeting on October 18th.
 No, we are not interested

Company: _____
 Participant(s): _____
 Phone: _____ Email: _____
 Salesman: _____ Fax: _____

Field Assessment High Efficiency Gas PACs- RTUs



- Collaboration with NREL, DOE, **manufacturers, national accounts**, and utilities
- Large-scale monitoring shows **diverse runtimes for RTUs** and more therm use than energy models suggested
- **Dedicated outside air systems (DOAS) provide** high efficiency **market entry point** application
 - “big box” retail accounts with established DOAS vendors
 - high heating degree day (HDD)/heating load locations
 - 24/7 retail stores
- Retail partner projected \$4,400 premium, = 4.1 years ROI @ 90%TE
- Northern climates see up to 3,000 therms/saved per year per unit!



Nicor Gas ETP Walmart Pilot Project

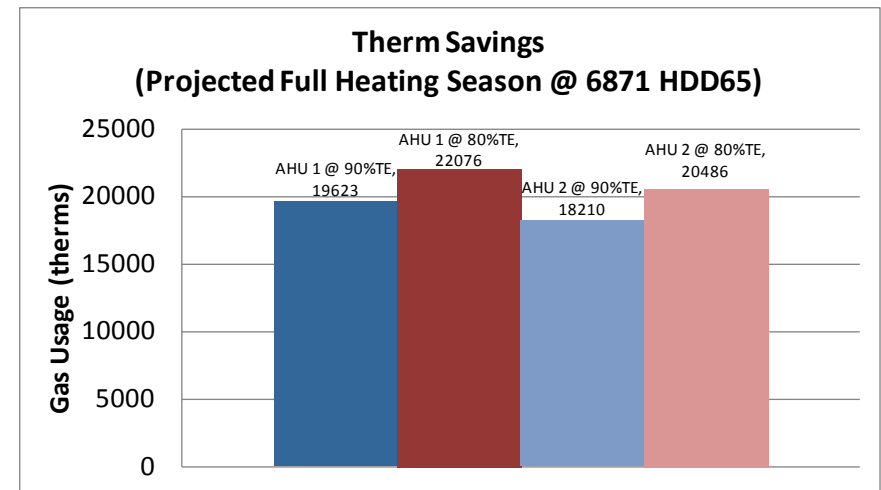
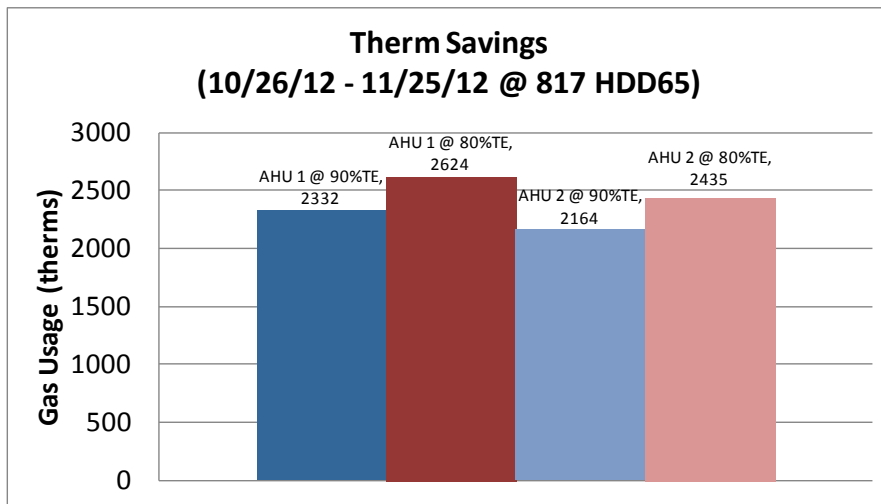
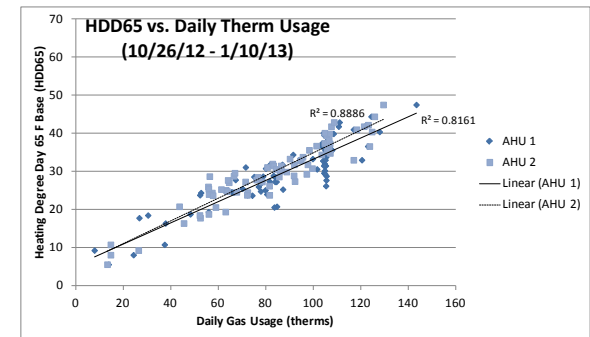
- > 3 step condensing heating module retrofit process over late September through mid-October
 1. Installation of condensate piping with neutralizer
 2. Replacement of non-condensing heating modules
 3. Completion of data acquisition system



Walmart Pilot Project - results to date

> Therm savings to date can be projected with statistical confidence to a full heating season

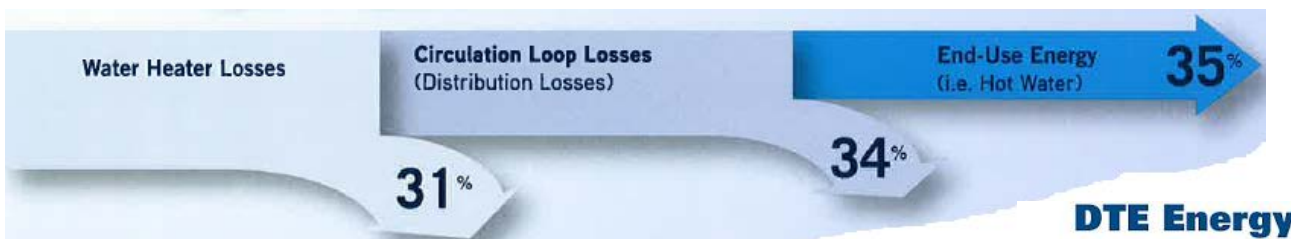
- AHU 1 – 2453 therms saved per year
- AHU 2 – 2276 therms saved per year



Field Assessment Multi-family Demand DHW Controls



- Demand pump for central domestic hot water systems
- System operates only when there is demand, energy savings from reduced thermal losses in recirculation loop (generally 1 - 3 years ROI)
- Nicor Gas supporting two demos in Chicago area with complete monitoring, collaborative demos in DTE territory, ETIC territory
- Project goal is to develop qualitative and quantitative data to support prescriptive program
- Nicor Gas, DTE, ETIC, and existing empirical data will contribute significantly to reliable savings numbers for cold weather DSM programs



DTE Energy



Next Steps



> Now that we know each other, let's find ways to collaborate

- Work with Gary Cushman (Nicor Gas), Douglas Kosar (GTI), and Merry Tondro (GTI) on existing or new opportunities within existing EEP cycle
- Continue discussion with Jim Jerozal and Ryan Kerr on opportunities for PY4-6 cycle, there are several compelling reasons to find ways to work together!

ETP Contacts



- Douglas Kosar
 - Nicor Gas ET Program Manager
 - Douglas.Kosar@gastechnology.org
 - 847.768.0725



- Merry Tondro
 - Nicor Gas ETP Analyst
 - Merry.Tondro@gastechnology.org
 - 847.768.0895



- Ryan Kerr
 - GTI ET Manager
 - Ryan.Kerr@gastechnology.org
 - 224.735.0264

Comments, Questions



Ryan Kerr

Emerging Technologies Manager, End Use Solutions
Gas Technology Institute
1700 S Mount Prospect Road
Des Plaines, IL 60018

Email: ryan.kerr@gastechnology.org

Phone: 847.768.0941

Mobile: 224.735.0264

Website: www.gastechnology.org/ETP



gti.

Emerging Technology Program (ETP)

Addressing implementation barriers and associated risks related to market acceptance and adoption of emerging technologies.



Improved energy efficiency is a shared policy goal around the world; it is often the most economic and readily available means of improving energy security and reducing carbon emissions. New technology is essential to further energy efficiency improvements and to move toward a cleaner, more sustainable energy future.

Emerging Technology Program (ETP) — A newly established collaborative program managed by Gas Technology Institute (GTI) — is focused on accelerating the commercialization and adoption of the latest energy efficient technologies. The program is designed to help companies identify and evaluate the most promising products and integrated solutions and assess their suitability for future use in utility energy efficiency programs.

GTI's industry-leading expertise provides the information and resources required to help advance market acceptance of emerging technologies for near- to mid-term implementation. ETP strives to create market pull by deployment of natural gas solutions at a desired scale, leading to self-sustaining commercial viability and impact.

Effective Industry Collaboration

Collaborative ETP initiatives provide an opportunity for companies to share insights, leverage energy efficiency funds and help increase the transfer of technology between upstream innovators and the marketplace.

ETP also offers access to GTI services and capabilities for energy efficiency program planning, implementation and assessment. GTI and its partners can work with your company to tailor or modify initiatives to address company or regionally specific needs and opportunities. We can also support a regulatory submission for ETP authorization. GTI has a long history of working collaboratively with utility companies, regulatory agencies, local state/federal government, non-government organizations, manufacturers, channel partners, trade allies and other stakeholders to reduce the time and cost of getting new technology to market.

