Got Gas?

Low-load Home Solutions with Combustion Equipment
with Bruce Manclark OR Dan Wildenhaus
Your presenters...

- Dan Wildenhaus
  - 20 something years in industry
  - Recovering Auditor and Contractor
  - Building Science Manager
  - CLEAResult

- Bruce Manclark
  - 30 something years in industry
  - Director of Training
  - Director of Special Projects
  - Self appointed historian
  - CLEAResult
Agenda
What we HOPE to cover today

- Why we care
- What’s the cool stuff NOW?
- What’s coming down the pike (or pipe if you prefer)?
- What are YOU into?
- Wrap up and resources
Does Gas Equipment fit into low load homes?

- NOT a call to use gas
- Recognition of prevalence and preference for gas
Yeah, but...
What’s happening now?
Current and immediate solutions
Let’s imagine a house to start with...

☐ New Townhome, what range of gas space and water heating should we expect?
☐ Space = $125 to $300 per year
☐ Water = $80 to $200 per year

☐ Existing two story home built in the 60’s, what might we expect?
☐ Space = $200 to $750 per year
☐ Water = $135 to $250 per year

It’s a frame of reference. We are talking about annual savings that range from 5 to 150 bucks per year per measure.
GTI researched and proposed and the market is adopting...
Energy savings from equipment:

- All models are 95–97 percent AFUE
- Limited study shows ~7% lower energy use, due to decreased number of cycles and slightly higher efficiency of unit from industry standard

Micro gas furnaces

Image courtesy of IBACOS
Energy savings from duct and equipment location:

- 15–20 percent savings associated with “ducts inside”
- Much easier and cost effective to run ducts inside the envelope
3 Story Townhome
Above code
End unit
Eugene, OR
96 AFUE Dettson
14 SEER AC
0.57 EF 50 gal tank
All ducts inside

What impact do we think this will have on the estimated heating consumption?

What do we attribute the estimated savings to?
Can a fireplace heat a whole home?
Yeah, but...
Romance vs Heating

What’s the primary reason for having a gas fireplace?
More guestimates

- 3 Story Townhome
- Above code
- End unit
- Located in Eugene, OR
- 92 AFUE gas furnace
- 14 SEER AC
- 0.57 EF 50 gal tank
- Gas FP as back up

- If we assume that the Gas FP works on 20% of the heating load or less, do we expect much of an impact to estimated consumption?

- Would we expect much of a change in annual heating cost?
More guestimates

- 3 Story Townhome
- Above code
- End unit
- Located in Eugene, OR
- 92 AFUE gas furnace
- 14 SEER AC
- 0.57 EF 50 gal tank
- Condensing gas FP as back up

- Let’s assume we put in a fancy condensing gas FP, at 20% of load or less, much consumption impact?
- Much annual cost impact?
- How much of load would need to be addressed in order to see big changes in consumption?
Urban development craze
Combi-boiler radiant systems
Will it save energy and dollars?

- If we changed from a standard furnace to a radiant system, we’ve now removed ducts outside...what type of impact is that?

- BUT, we went from a 90+ furnace to an 80% boiler...what type of impact is that?

- BUT, we improved the water heater from .62 to .80...what type of impact is that?
Boosting existing equipment performance and savings
Boosting existing equipment performance and savings
### Table 2. Relative Costs of Operating Standard and Alternative Distribution Systems

<table>
<thead>
<tr>
<th>Standard Distribution System</th>
<th>Water and Wastewater</th>
<th>Natural Gas</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Annual Cost for Hot Water Including Waste</td>
<td>$116</td>
<td>$250</td>
<td>$465</td>
</tr>
<tr>
<td>Annual Cost Associated with the Wasted Water</td>
<td>$(36)</td>
<td>$(84)</td>
<td>$(156)</td>
</tr>
<tr>
<td>Annual Cost Associated with Intended Water Use</td>
<td>$80</td>
<td>$166</td>
<td>$309</td>
</tr>
</tbody>
</table>

#### Additional Energy Costs to Operate Recirculation System

<table>
<thead>
<tr>
<th>Additional Energy Costs to Operate Recirculation System</th>
<th>Water and Wastewater</th>
<th>Natural Gas</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermosyphon (24 hours per day, gravity, 5F temperature drop)</td>
<td>$336</td>
<td>$619</td>
<td></td>
</tr>
<tr>
<td>Continuous Pump (24 hours per day, 5F temperature drop)</td>
<td>$366</td>
<td>$649</td>
<td></td>
</tr>
<tr>
<td>Timer-Controlled Pump (16 hours per day, 5F temperature drop)</td>
<td>$244</td>
<td>$433</td>
<td></td>
</tr>
<tr>
<td>Temperature-Controlled Pump (12 hours per day, 5F temperature drop)</td>
<td>$183</td>
<td>$325</td>
<td></td>
</tr>
<tr>
<td>Timer and Temperature-Controlled Pump (8 hours per day, 5F temperature drop)</td>
<td>$122</td>
<td>$216</td>
<td></td>
</tr>
<tr>
<td>Demand-Controlled Pump (10 minutes per day)</td>
<td>$15</td>
<td>$27</td>
<td></td>
</tr>
</tbody>
</table>

#### Additional Costs Associated with Residual Wasted Water

<table>
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<tr>
<th>Additional Costs Associated with Residual Wasted Water</th>
<th>Water and Wastewater</th>
<th>Natural Gas</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manifold Systems (approximately 25% reduction)</td>
<td>$27</td>
<td>$63</td>
<td>$117</td>
</tr>
<tr>
<td>Heat Trace (approximately 90% reduction)</td>
<td>$4</td>
<td>$284</td>
<td>$284</td>
</tr>
<tr>
<td>All 6 Recirculation alternatives (approximately 80% reduction)</td>
<td>$7</td>
<td>$17</td>
<td>$31</td>
</tr>
</tbody>
</table>

Notes: Water and wastewater costs are $0.05 per gallon combined. Natural gas costs are $0.92 per therm. Electricity costs are $0.087 per kWh. Heat trace is only operated with electricity. The costs are the same whether the water heating fuel is natural gas or electricity.

Source: Gary Klein
We already know about most of this stuff...what else?
Pilots and Research
SmartPlug®
Instant Hot Water Control

The patented SmartPlug lets you upgrade any hot water recirculation pump with a power cord to "Smart" operation.

Using a sensor that mounts to the hot water supply pipe, the SmartPlug will record the daily hot water usage pattern in a home and adjust the circulator run time automatically. Hot water will always be available when needed.

Potential energy savings:
- Basic operational savings
- M and V/QA of installs
- Energy audits of homes
- **Potentially improve cost effectiveness of measures and programs**

Coming around the bend...
What’s next?
Gas driven heat pump technologies?

<table>
<thead>
<tr>
<th></th>
<th>Absorption</th>
<th>Adsorption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>Assimilation of molecular species throughout the bulk of the solid or liquid is termed as absorption.</td>
<td>Accumulation of the molecular species at the surface rather than in the bulk of the solid or liquid is termed as adsorption.</td>
</tr>
<tr>
<td><strong>Phenomenon</strong></td>
<td>It is a bulk phenomenon</td>
<td>It is a surface phenomenon.</td>
</tr>
<tr>
<td><strong>Heat exchange</strong></td>
<td><strong>Endothermic</strong> process</td>
<td><strong>Exothermic</strong> process</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>It is not affected by temperature</td>
<td>It is favoured by low temperature</td>
</tr>
<tr>
<td><strong>Rate of reaction</strong></td>
<td>It occurs at a uniform rate.</td>
<td>It steadily increases and reaches equilibrium</td>
</tr>
<tr>
<td><strong>Concentration</strong></td>
<td>It is same throughout the material.</td>
<td>Concentration on the surface of adsorbent is different from that in the bulk</td>
</tr>
</tbody>
</table>
Gas driven heat pump technologies?

Absorption

- The process in which a fluid is dissolved by a liquid or a solid (absorbent).
- Absorption involves the entire volume of the absorbing substance.
- Used for heat pumps that can heat or cool.

Adsorption

- The process in which atoms, ions or molecules from a substance (it could be gas, liquid or dissolved solid) adhere to a surface of the adsorbent.
- Adsorption is a surface-based process where a film of adsorbate is created on the surface.
- Primarily used for chillers.

www.diffen.com
How do they work?
GF-HPWH
How they work

Images from energy.gov
Absorption water heaters

Potential energy savings:

- Goal is energy factor (EF) of 1.0–1.3
  - 40 percent savings over current standard .62 EF tank
- Commercial units testing beta prototype
- Residential units struggling with costs and performance

Image and data courtesy of: Oak Ridge National Lab and DOE
Gas-driven heat pumps

**Air to air**

*Image courtesy of: Department of Energy*

**Potential energy savings:**

- “Air to air” provides:
  - Cooling with COP 1.3
  - Heating with COP 1.5
  - Waste heat for water heating

- Challenges with sizing for residential and manufacturing cost make this “almost there” for increased applications
Gas-driven heat pumps – part 2

Potential energy savings:

- System used as gas-driven heat pump water heater
- The more systems included, the better the savings over traditional systems
  - ~55 percent estimated savings when performing space and water heating
  - Savings go up with pool heaters
For more terrific information:

- Gas Technologies Institute
- Department of Energy
- NEEA


Image and data courtesy of: UTD
Winning Strategies
For Space heating, come to terms with cooling becoming the norm nationally.

Did you know, those Dettson’s have a HE HP that can supplement heat and deliver AC?

For water heating, great appliances are good.

But we can see real savings and improved HERS scores with OnDemand recirc, insulated plumbing, and WaterSense fixtures.
Do what it takes to get rid of ducts or move them inside!

And consider simplified zone heating
Thank You!!

Dan Wildenhaus
20 something years in industry
Recovering Auditor and Contractor
Building Science Manager
CLEAResult

Bruce Manclark
30 something years in industry
Director of Training
Director of Special Projects
Self appointed historian
CLEAResult