Got Gas?

Low-load Home Solutions with Combustion Equipment

with Preston Kuckuck and Dan Wildenhaus

Your presenters…

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

- Preston Kuckuck
- A decade plus experience
- Director of Energy Services
- Director of Sales
- Self appointed conference guy
- Performance Insulation

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…

Preference

*Warning – most of these stats are for homes **with a preference***

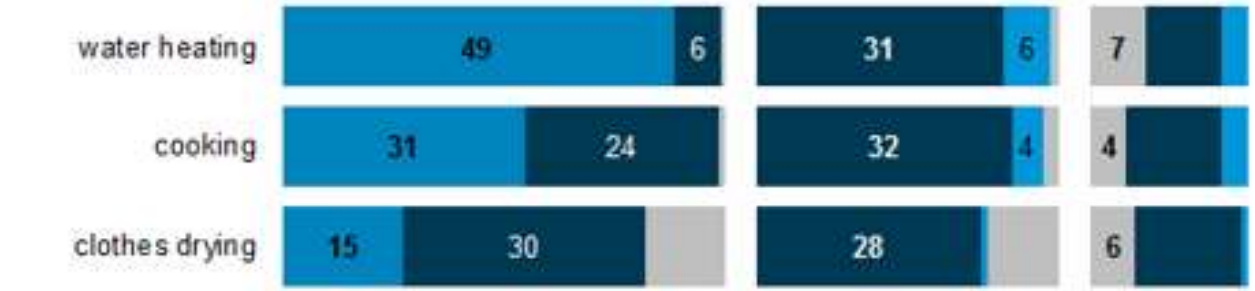
- Heating systems - 83 percent opted for natural gas
- Water heating - 92 percent opted for natural gas
- Cook tops – 95 percent opted for natural gas
- Fire places – 95 percent opted for natural gas

https://www.socalgas.com/for-your-business/builder-services/visions-home-preference-survey#-

Prevalence

Main space heating fuel used
millions of households

Main fuel used for other uses
millions of households



Source: U.S. Energy Information Administration, Residential Energy Consumption Survey 2009

Cost of ownership

- Equipment cost
- Fuel cost
- Maintenance cost
- Life of appliances

Furnace + AC and HE Heat Pumps show ***similar to slight benefit to natural gas in combined cost***

https://www.washingtongas.com/home-owners/savings/cost-savings

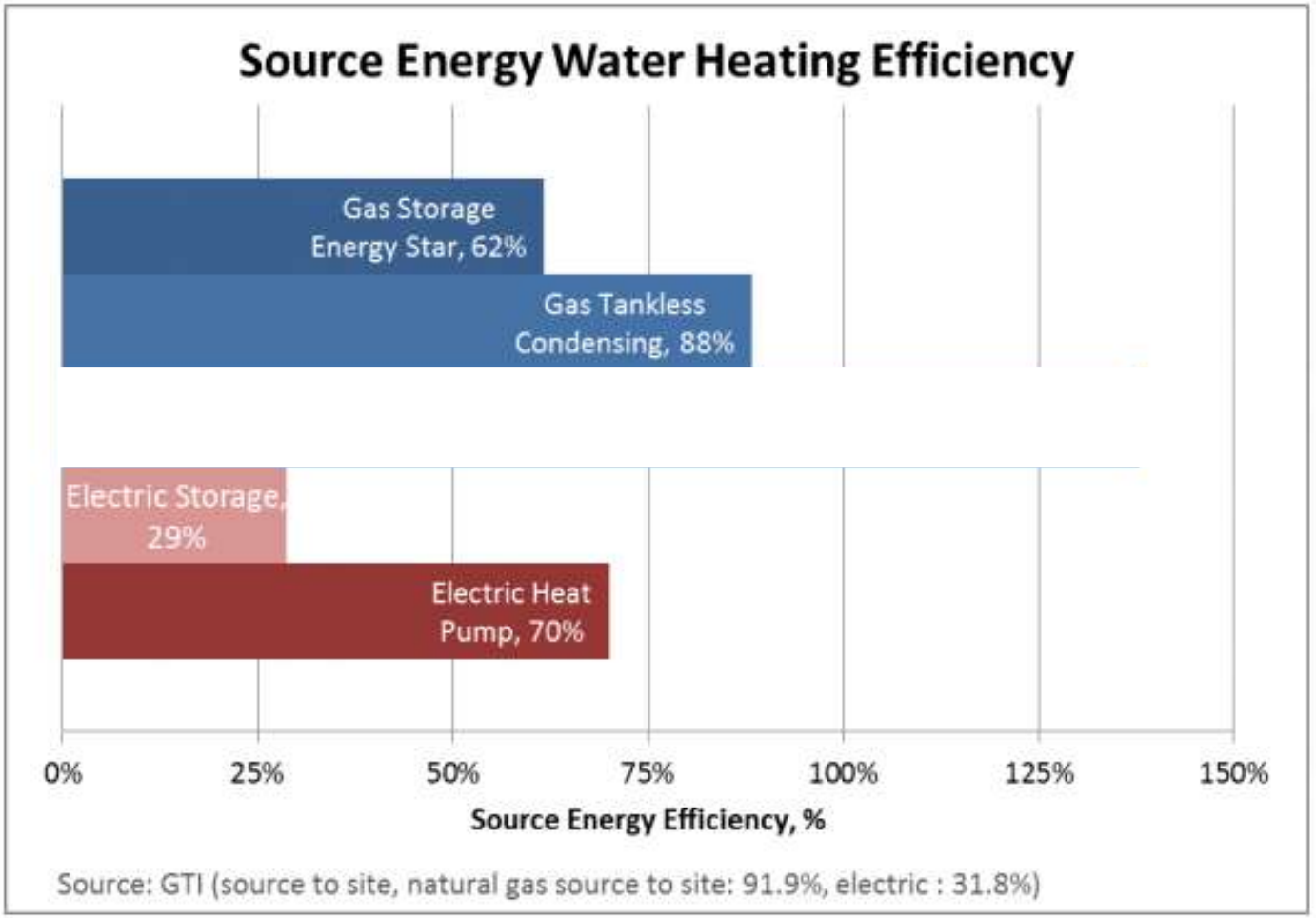
Source and TDV energy argument

- Time Dependent Valuation
  - ZNE Simulation Study in CA shows 5-15% lower TDV consumption
- Natural Gas source vs site
  - Source 35-54%
  - Site 78-97.5%

http://aceee.org/files/proceedings/2016/data/papers/10_1100.pdf

https://energy.gov/fe/how-gas-turbine-power-plants-work

Gas Source Efficiency stuff



What's happening now?

Current and immediate solutions

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Desi[illegible]
Heating	11.5	3.4
Cooling	13.8	[illegible]
Water Heating	13.1	5.7
Lights and Appliances	21.5	25.0
Total	59.9	49.3

HERS Index of Reference Design Home	**75**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**75**	**49 ERS Index**
Size Adjustment Factor	**1.00**	

ENERGY STAR v3.0 Mandatory Requirements

This Design Home fails to meet ENERGY STAR due to the following reasons

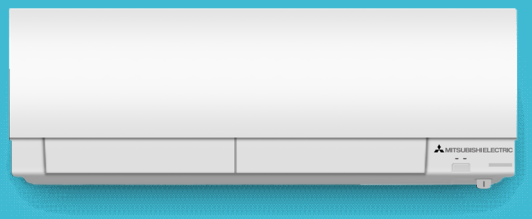
One or more envelope components has insulation Installation Quality that is neither Grade I, nor Grade II with insulated sheathing. Check that all envelope components are Grade I, or
- Grade II with R-3 continuous insulation for Climate Zones 1-4, or
- Grade II with R-5 continuous insulation for Climate Zones 5-8.

If any of your envelope components is using the path/layer construction, make sure the Quick Fill view shows Grade I.

Windows do not meet the 2009 IECC requirements. Check the windows and make sure they have the correct values.

The required checklists for ENERGY STAR v3/3.1 have not been completed. Please go to the Mandatory Requirements Summary screen and verify the checklists are complete.

Always use Mini Splits?



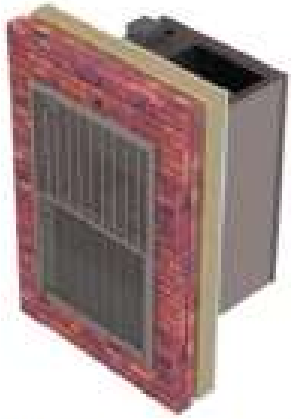
The go to solution has been for a lot of markets Mini Splits –

- usually multiple heads / one in each room

On the horizon we think could be more solutions like this

- This happens to be Panasonic and AireShare
- Can be used with multiple system configurations

GTI researched and proposed and the market is adopting



Through wall packaged heating, cooling systems

Combined Space and Water Systems

Low capacity 'right-sized' furnace

Hearth products with enhanced distribution

Micro gas furnaces

Image courtesy of IBACOS

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

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

Dettson

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Des
Heating	11.4	2.7
Cooling	13.7	13.8
Water Heating	13.1	5.7
Lights and Appliances	21.5	25.0
Total	59.7	47.2

HERS Index of Reference Design Home	**75**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**75**	**47 HERS Index**
Size Adjustment Factor	**1.00**	

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Can a fireplace heat a whole home?

864 TRV & CF	864 HO	864 ST	4237 CF
38-1/4" (TRV), 44-3/4" (CF)	47-3/4"	38-1/4"	53-3/4"
41" (TRV), 42-3/4" (CF)	41"	44"	59-1/4"
20-3/4", 22" (CF)	22-1/4"	27"	29-1/4"
8" Rear or 8" Top (Top can be reduced to 6 5/8")	8" Rear or 8" Top (Top can be reduced to 6")	8" (Top vent can be reduced to 6")	8"
205 lbs. (TRV) 205 lbs. (CF)	225 lbs.	310 lbs.	555 lbs.
Dancing-Fyre™	Ember-Fyre™	Dancing-Fyre™	Dancing-Fyre™
34-1/2" W x 22-1/4" H	34-1/2" W x 22-1/4" H	Each side 34-1/2" W x 22-1/4" H	Each side 42" W x 37" H
YES - 180 CFM (Optional on TRV, Standard on CF)	YES - 260 CFM (Standard)	YES - 130 CFM (Optional)	YES - Twin 130 CFM (Standard)
YES (One)	YES (Two)	YES (One)	YES (Two)
vary depending on vent configuration a atmospheric conditions. Contact local building or fire officials about restrictions and installation requirements in your area.			
Up to 1,400 Sq. Ft.	Up to 2,500 Sq. Ft.	Up to 1,500 Sq. Ft.	Up to 3,000 Sq. Ft.
31,000 - 10,000 (68% Turnd	46,700 - 12,500 (73% Turn Down)	37,500 - 14,700 (61% Turndown)	60,000 - 32,089 (% Turndown)
31,000 - 8,000 (75% Turndo	46,700 - 9,000 (81% Turn Down)	37,500 - 10,000 (73% Turndown)	60,000 - 30,887 (% Turndown)
68.36% (NG) 67.79% (LP)	71.57% (NG) 72.2% (LP)	70.77% (NG) 70.71%(LP)	62.76% NG, 63.87% LP
80.38% (NG) 81.21% (LP)	82.13% (NG) 83.25% (LP)	83.07% (NG) 85.92% (LP)	67.93% NG, 69.44% LP
73.8% (NG) 73.5% (LP)	75.6% (NG) 75.7% (LP)	75.4% (NG) 72.9% (LP)	63.79% NG, 65.15% LP
information is available at your local FireplaceX® dealer or on our website at www.fireplacex.com			
A = 40-3/4" to 48-3/4"TRV* 44-3/4" CF* (measured from base of fireplace)	A = 47-3/4" to 52-3/4"* (measured from base of fireplace)	A = 37-1/4"* (measured from base of fireplace)	A = 54 "* (measured from base of fireplace)
B = 0"	B = 7 3/4"	B = 0"	B = 0"
C = 1"	C = 5"	C = 3-1/4" from glass frame	C = 0"
D = 0"	D = 0"	D = 2-1/8"	D = 5/8"
E = None Required	E = None Required	E = None Required	E = None Required
F = None Required	F = None Required	F = None Required	F = None Required
*Will vary depending mantel depth. 0" to 12" maximum mantel depth. See Owner's manual for details Note: Each face plate design varies in dim. MINIMUM FRAMING HEIGHT Height 38-1/2" TRV 44-3/4" CF Width 41-1/4" TRV 42-3/4" CF Depth 20-3/4" TRV 22" CF	*Will vary depending mantel depth. 0" to 12" maximum mantel depth. See Owner's manual for details Note: Each face plate design varies in dim. MINIMUM FRAMING HEIGHT Height 48" Width 41-1/4" Depth 22-3/4" TV 21-3/4" RV	*Will vary depending mantel depth. 0" to 12" maximum mantel depth. See Owner's manual for details Note: Each face plate design varies in dim. MINIMUM FRAMING HEIGHT Height 38-1/2" Width 44" Depth 26"	*Will vary depending mantel depth. 0" to 12" maximum mantel depth. See Owner's manual for details Note: Each face plate design varies in dim. MINIMUM FRAMING HEIGHT Height 53-3/4" Width 59-1/4" Depth 29-1/4" Flush, 28-3/4" Standard

NOTE: Improper installation of your gas appliance or failure to operate it in accordance to the guidelines detailed in the Owner's Manual may negate your warranty and endanger your home and family. Installation information is available on our website at www.fireplacex.com. We recommend all FireplaceX® appliances be installed, and maintained on an annual basis by your Specialty Hearth Retailer.

HEAT&GLO

POWERFLOW™ HEAT MANAGEMENT TECHNOLOGY

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Desi
Heating	16.9	6.4
Cooling	17.4	
Water Heating	13.1	5.2
Lights and Appliances	28.6	
Total	76.0	62.3

HERS Index of Reference Design Home	**67**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**67**	**46** **ERS Index**
Size Adjustment Factor	**1.00**	

ENERGY STAR v3.0 Mandatory Requirements

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- Grade II with R-3 continuous insulation for Climate Zones 1-4, or
- Grade II with R-5 continuous insulation for Climate Zones 5-8.

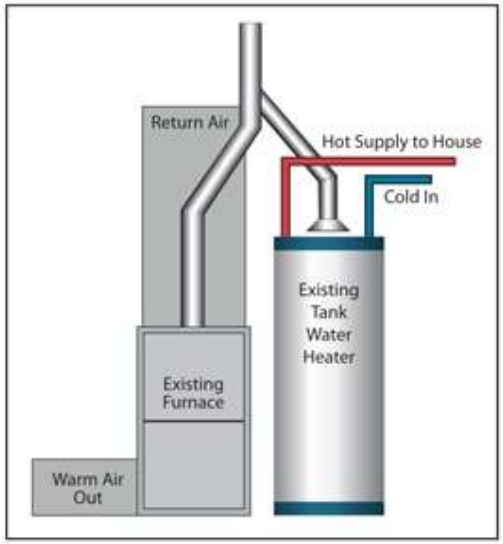
If any of your envelope components is using the path/layer construction, make sure the Quick Fill view shows Grade I.

Windows do not meet the 2009 IECC requirements. Check the windows and make sure they have the correct values.

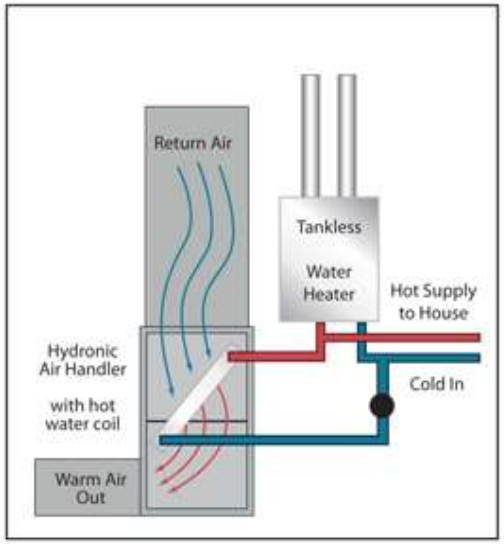
The required checklists for ENERGY STAR v3/3.1 have not been completed. Please go to the Mandatory Requirements Summary screen and verify the checklists are complete

Urban development craze

PSE PUGET SOUND ENERGY



Existing Low Efficiency System



New High Efficiency System

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Desi
Heating	16.4	7.7
Cooling	17.4	
Water Heating	12.2	2.3
Lights and Appliances	28.6	
Total	74.6	60.7

HERS Index of Reference Design Home	**65**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**65**	**44 ERS Index**
Size Adjustment Factor	**1.00**	

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Windows do not meet the 2009 IECC requirements. Check the windows and make sure they have the correct values.

The required checklists for ENERGY STAR v3/3.1 have not been completed. Please go to the Mandatory Requirements Summary screen and verify the checklists are complete.

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Desi
Heating	16.4	6.5
Cooling	17.4	
Water Heating	12.2	1.6
Lights and Appliances	28.6	
Total	74.6	58.8

HERS Index of Reference Design Home	**65**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**65**	**43 ERS Index**
Size Adjustment Factor	**1.00**	

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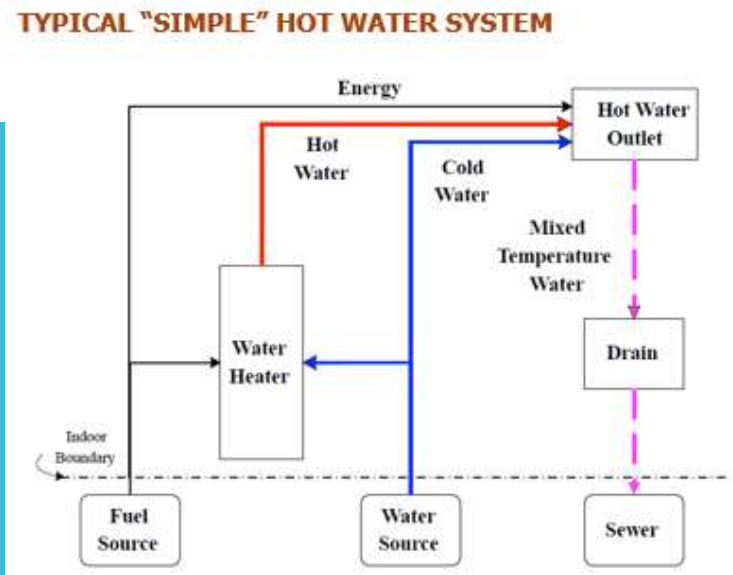
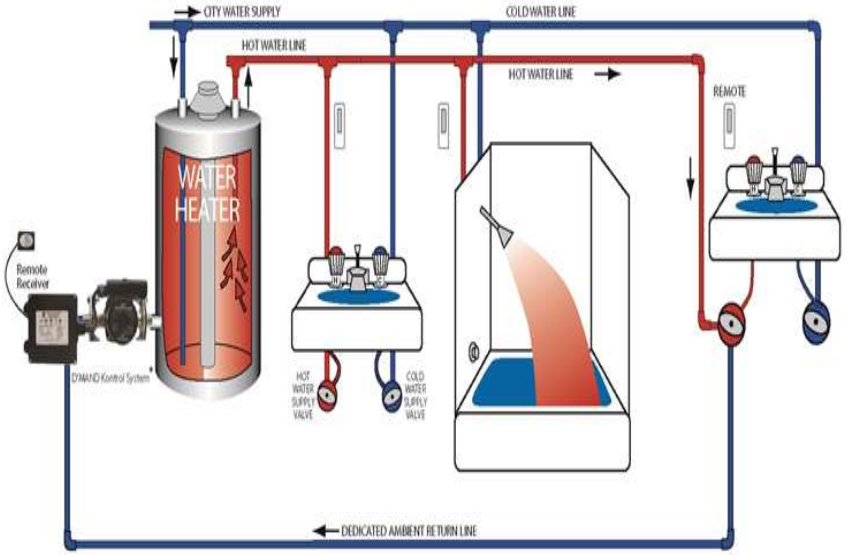
Boosting existing equipment performance and savings





On Demand recirculation

Table 2. *Relative Costs of Operating Standard and Alternative Distribution Systems*

Standard Distribution System	Water and Wastewater	Natural Gas	Electricity
Total Annual Cost for Hot Water Including Waste	$116	$250	$465
Annual Cost Associated with the Wasted Water	($36)	($84)	($156)
Annual Cost Associated with Intended Water Use	$80	$166	$309
Additional Energy Costs to Operate Recirculation System			
Thermosyphon (24 hours per day, gravity, 5F temperature drop)		$336	$619
Continuous Pump (24 hours per day, 5F temperature drop)		$366	$649
Timer-Controlled Pump (16 hours per day, 5F temperature drop)		$244	$433
Temperature-Controlled Pump (12 hours per day, 5F temperature drop)		$183	$325
Timer and Temperature-Controlled Pump (8 hours per day, 5F temperature drop)		$122	$216
Demand-Controlled Pump (10 minutes per day)		$15	$27
Additional Costs Associated with Residual Wasted Water			
Manifold Systems (approximately 25% reduction)	$27	$63	$117
Heat Trace (approximately 90% reduction)	$4	$284	$284
All 6 Recirculation alternatives (approximately 80% reduction)	$7	$17	$31
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

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Desi
Heating	16.9	6.3
Cooling	17.4	
Water Heating	13.1	4.6
Lights and Appliances	28.6	
Total	76.0	61.5

HERS Index of Reference Design Home	**67**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**67**	**45 ERS Index**
Size Adjustment Factor	**1.00**	

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We already know about most of this stuff…what else?

Pilots and Research

Try me category

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.

http://www.taco-hvac.com/press.html?action=d&art_id=44

Smart thermostats in gas programs

Potential energy savings:

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

https://www.clearesult.com/insights/whitepapers/guide-to-smart-thermostats/

Coming around the bend…

What's next?

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

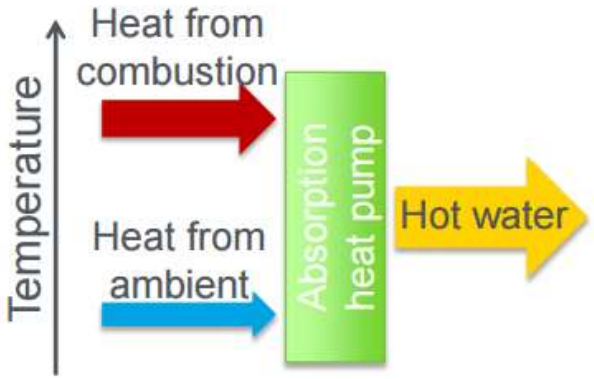
Adsorption

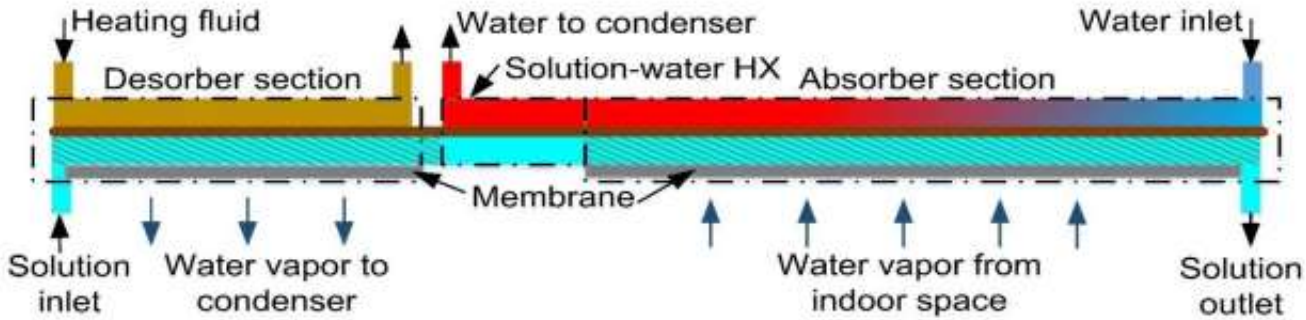
- The process in which atoms, ions or molecules from a substance (it could be gas, liquid or dissolved solid) adhere to a surface of the adsorbent.
- Adsorption is a surface-based process where a film of adsorbate is created on the surface
- Used for chillers

www.diffen.com

How do they work?

GHPWH
How they work





Images from energy.gov

Absorption water heaters

Image and data courtesy of: Oak Ridge National Lab and DOE

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

Highly faked…

Projected Rating: Based on Plans - Field Confirmation Required.

Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Designed
Heating	10.4	4.1
Cooling	15.3	15.7
Water Heating	13.1	0.9
Lights and Appliances	21.5	
Total	60.3	45.6

HERS Index of Reference Design Home	76	RS Index w/o PV
HERS Index Target (SAF Adjusted)	76	46 HERS Index
Size Adjustment Factor	1.00	

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Gas-driven heat pumps

Air to air

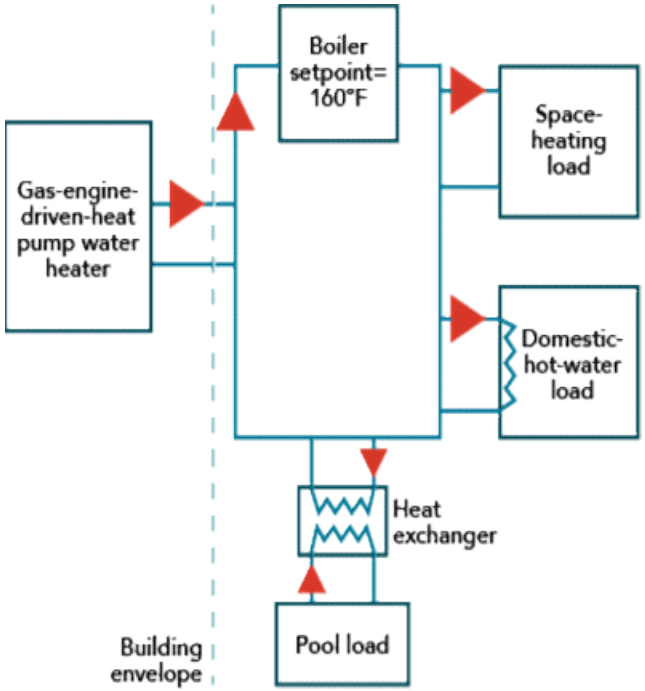
Image courtesy of: Department of Energy

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

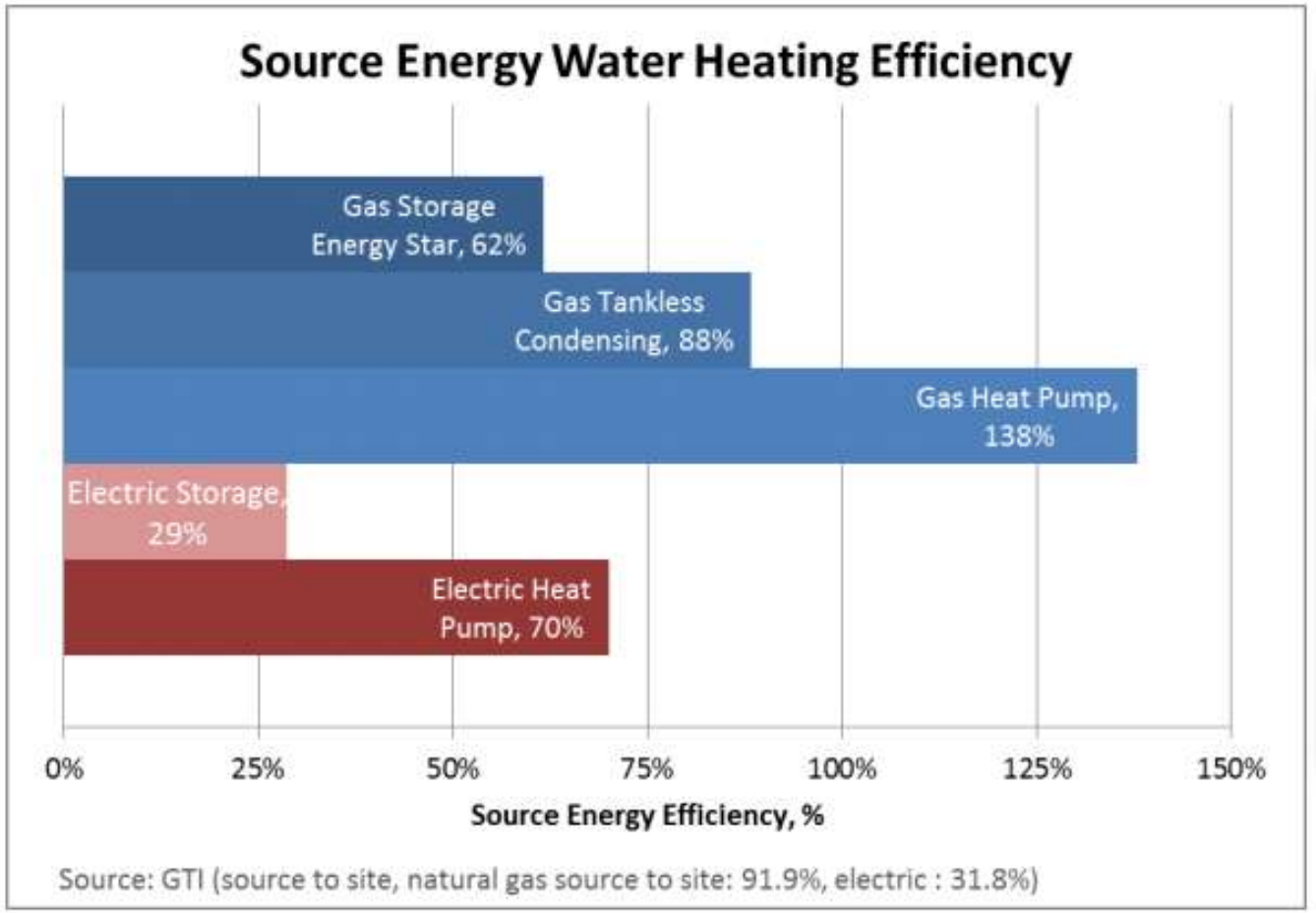
Air to water



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

Remember this slide?



Resources

Image and data courtesy of: UTD

For more terrific information:

- Gas Technologies Institute
- Department of Energy
- NEEA

- https://www.utd-co.org/Documents/UTD-Annual-Report-Project-Summaries-2015-2016.pdf

Winning Strategies

Space heating equipment

Water heating equipment

Optimizing systems

Onsite generation?

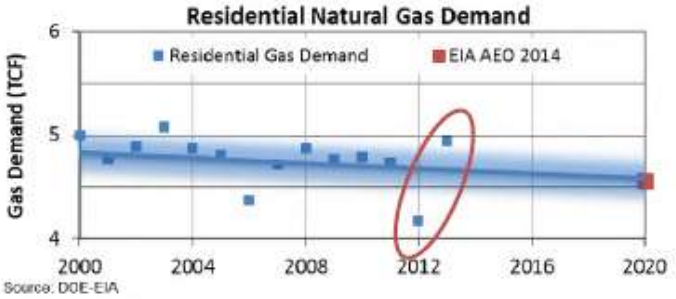
- For Space heating, come to terms with cooling becoming the norm nationally
- Did you know, those Dettson's have a HE HP that can supplement heat and deliver AC?
- For water heating, great appliances are good.
- But we can see real savings and improved HERS scores with OnDemand recirc, insulated plumbing, and WaterSense fixtures

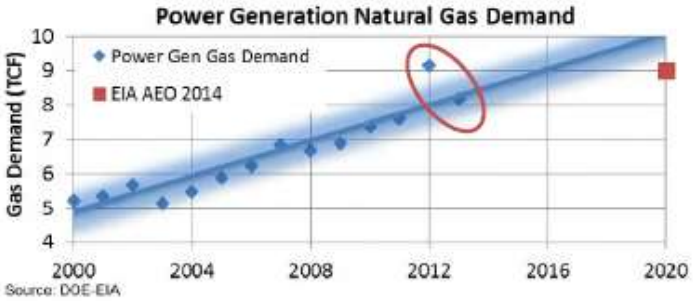
Same old advice…

Do what it takes to get rid of ducts or move them inside!

And consider simplified zone heating

FINALLY





ENERGY STAR Emerging Technology Award

The EPA gave its prestigious award for our ecopower® microCHP. Marathon Engine Systems was one of two companies nationwide to win this award in 2011 and 2012.

Visit the new ecopower® microCHP product website at
ecopowermicrochp.com

CARB Certification

freewatt

Thank You!!

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

- Preston Kuckuck
- A decade plus experience
- Director of Energy Services
- Director of Sales
- Self appointed conference guy
- Performance Insulation