Transforming the Market with Efficient Gas Technologies

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Northwest Energy Efficiency Alliance

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Northwest Gas Association and the Alliance of Western Energy Consumers 19th Annual Energy Conference

The Alliance

EST.
1996

140+
UTILITIES

13M
ENERGY CONSUMERS

ENERGY SAVED = ENOUGH TO POWER
985K+
HOMES EACH YEAR

Who We Work With

Manufacturers

SAMSUNG

DAIKIN

MITSUBISHI

GE

AO Smith

Retailers

BEST BUY

THE HOME DEPOT

TARGET

nationwide marketing group

COSTCO WHOLESALE

National Orgs

ENERGY STAR

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

U.S. GREEN BUILDING COUNCIL LEED USGBC

CEE SM Working Together, Advancing Efficiency

ACEEE

Other

Northwest Power and Conservation Council

SEEA

SWEEP SOUTHWEST ENERGY EFFICIENCY PROJECT

MEEA MIDWEST ENERGY EFFICIENCY ALLIANCE

NW Energy Coalition

Efficient Rooftop Units

Evolution of Efficient RTU Initiative

- Initial field studies focused on condensing units.
  - Residential condensing units have had more success than commercial condensing units.
- Focus later shifted to a combination of energy-saving features including:
  - Increased insulation
  - Better damper
  - Energy recovery

Efficient Gas Rooftop Units

System Requirements

Path	Tier 1	Tier 2
Prescriptive Path	• Thermal Efficiency • Insulation • Outdoor and Return-Air Mixing Dampers	• Tier 1 Requirements AND • Condensing heat exchanger OR • Heat or Energy Recovery Unit
Performance Path (Draft)	$TCOP_{HS} > 0.70$	$TCOP_{HS} > 0.80$

Program Development

Completed Work:

- Completed NGTC lab tests
- Developed regulatory roadmap
- Building manufacturer relationships
- Started field studies
- Completed energy modeling

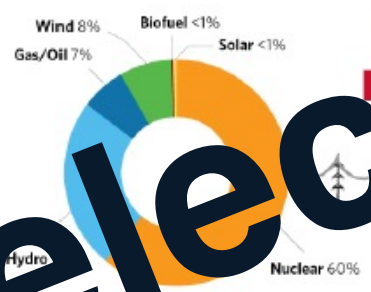
Future Work:

- Update spec
- Continue building manufacturer relationships.
- Launch program in 2022

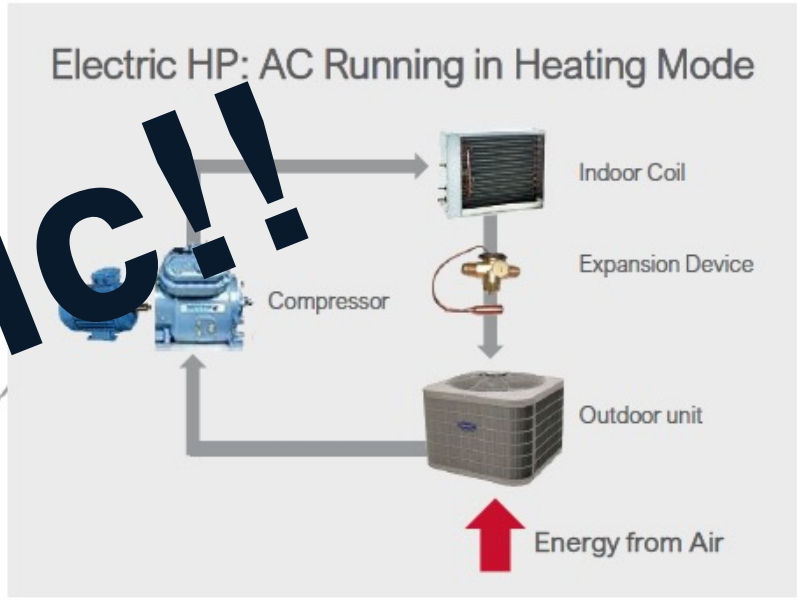
Gas Heat Pump HVAC

What is a heat pump

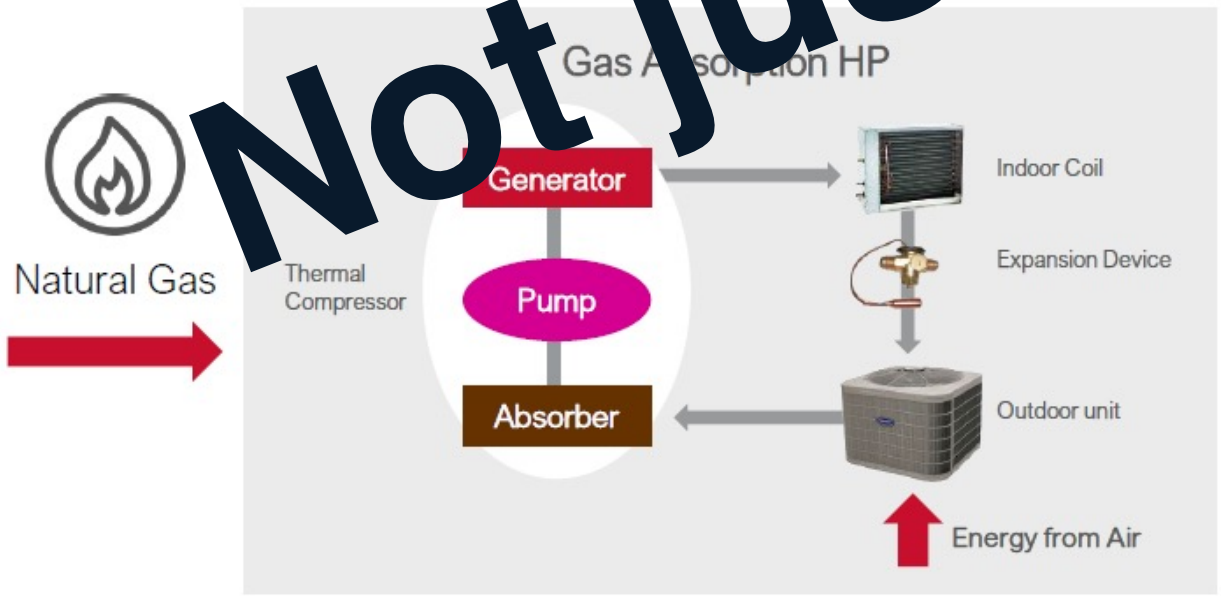
- HVAC equipment that moves heat from a cold source (e.g. outdoor air, ground) and delivers it to heat sink (space heating and/or domestic water heating)
- Electric HP uses electricity generated from various sources including nuclear, hydro, gas, solar and wind
  - Marginal seasonal electricity generation efficiency needs to be taken into consideration while evaluating EHP performance and overall GHG emissions
- In a natural GHP, the electric compressor is replaced with either a natural gas engine driven or thermally driven compression that uses natural gas

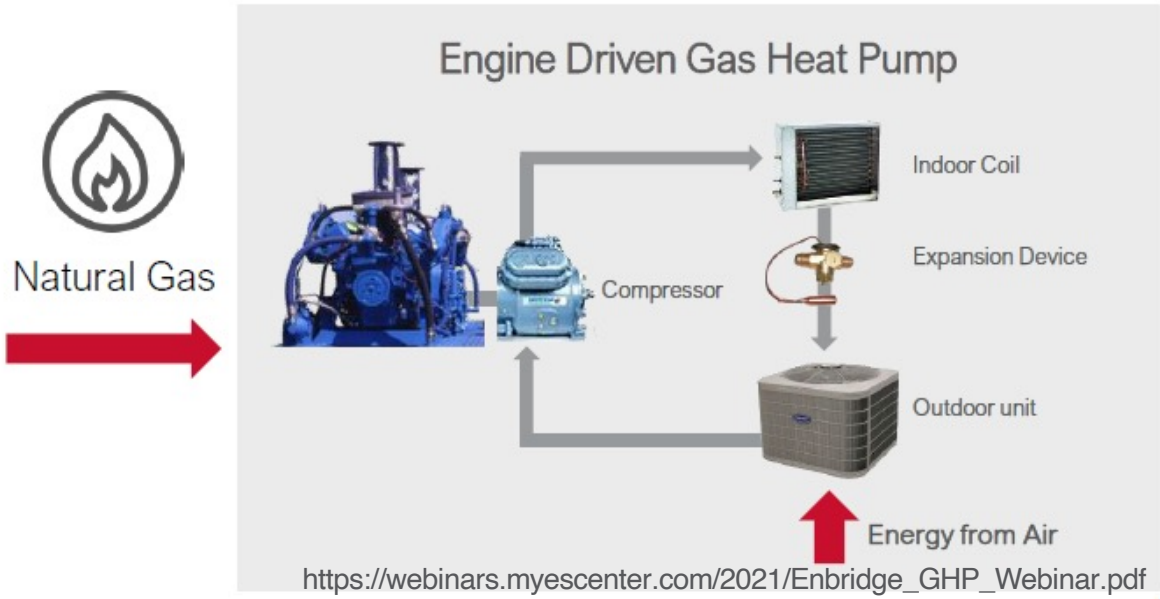


Electricity



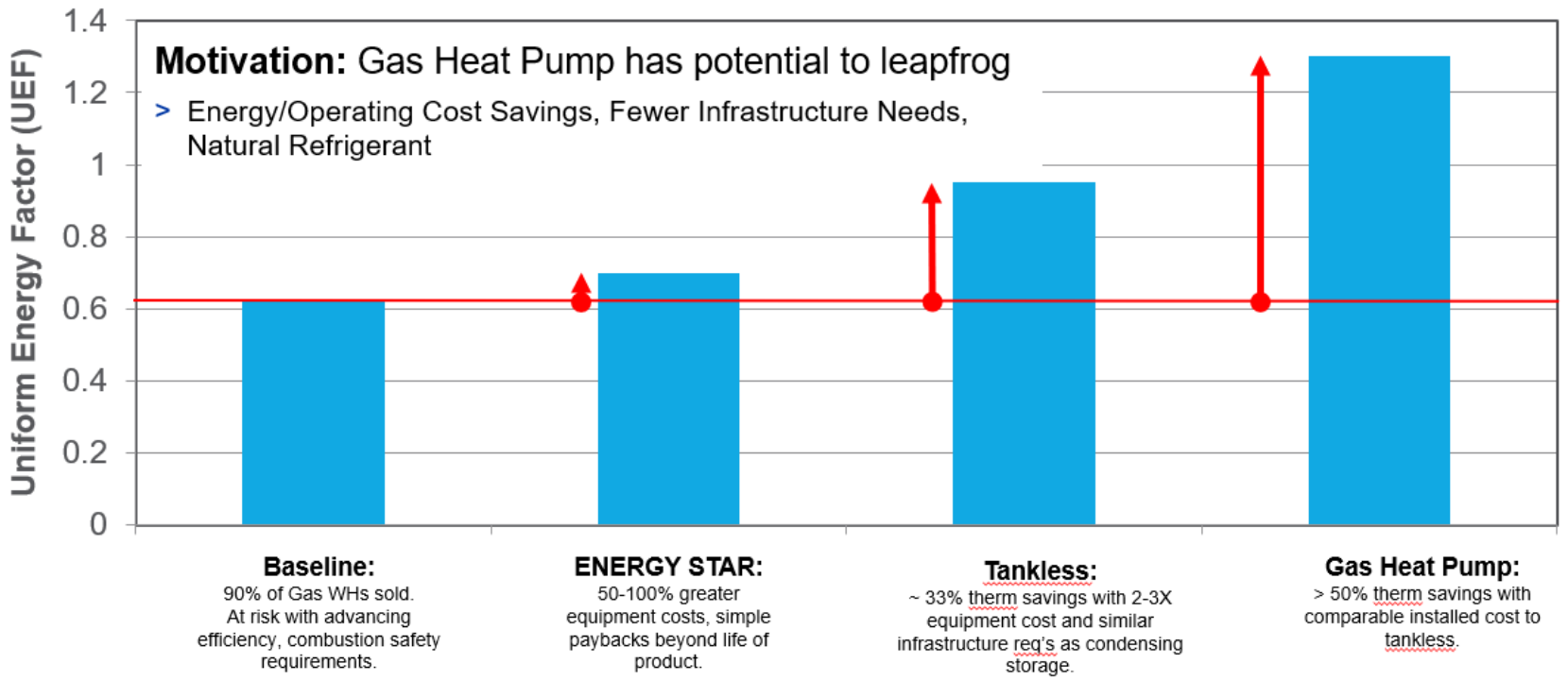
Not just electric!!





https://webinars.myescenter.com/2021/Enbridge_GHP_Webinar.pdf

Efficiency Opportunity



Source Material: GTI

Performance: Exceeding 100% Efficiency

Demonstration Highlights:

Residential

Water Heater (>1.20 UEF)
- **54% energy savings**[1]

Space and Water Heating/"Combi" (>140% AFUE)
- **45% energy savings**, including operation at -30ºF w/o backup heat[2]

Commercial

Hot Water/Boiler (>130% TE)
- **53% therm savings** (hot water) *and* 14% kwh savings w/A/C[3]

Internal combustion engine driven VRF (>1.50 $COP_{heating}$ >1.40 $COP_{cooling}$)
- Successful operation in both warm and cold climates[4]

Rooftop Unit (>1.30 $COP_{heating}$ @ 47ºF)
- Cold-climate testing indicates only 5% capacity reduction at 5ºF[4]

For more information: 1) Glanville, P.et al. (2020) Integrated Gas-fired Heat Pump Water Heaters for Homes: Results of Field Demonstrations and System Modeling, ASHRAE Transactions; Vol. 126 325-332.; 2) Glanville, P. et al. (2019) Demonstration and Simulation of Gas Heat Pump-Driven Residential Combination Space and Water Heating System Performance, ASHRAE Transactions; Vol. 125 264-272.; 3) Glanville, P. Innovative Applications of Thermal Heat Pumps in Multifamily Buildings and Restaurants, Presented at the ACEEE 2020 Hot Water Forum.; 4) GTI & Brio, Gas Heat Pump Technology and Market Roadmap, 2019.

Source Material: GTI

NEEA Field Demonstration - Robur

- Two commercially available GHP units installed to work in tandem with existing boilers
- Providing space heating and DHW
- 10-story, 185,000 sf care facility in Salem, Oregon

NEEA Field Demonstration - Robur

Robur GAHP-A Annual COP_{gas} (2-unit configuration)	1.06	
Robur GAHP-A @ 30°F Ambient (2-unit configuration)	245,080	Btu/hr
Robur GAHP-A Capacity @ 60°F Ambient (2-unit configuration)	281,820	Btu/hr
Total Installed Cost	$46,710	
Annual Natural Gas Savings	5,134	Therms
Annual Avoided cost of Natural Gas	$2,933	$/year
Percent Reduction in Natural Gas Consumption	18	%

https://neea.org/resources/robur-heat-pump-field-trial

"In summary, the Robur gas absorption heat pumps have a positive outlook. Its reasonable first cost, ease of installation, efficient operation, reliability, and low maintenance operation result in a viable solution for achieving natural gas savings."

Market Transformation: GHP technology readiness

GHP technology readiness for NA market

Green: Commercial sector ready now.

Manufacturer	Type	Primary Sectors	Primary Applications	Technology Readiness for North America
ROBUR	Absorption	• Commercial • Residential	• Space heating • DWH heating • Cooling	• Commercial size unit commercially available • Residential unit at lab testing and field trials stage
YANMAR	Engine driven	• Commercial	• Space heating • Space cooling	• Commercially available
SMTI	Absorption	• Residential • Small commercial	• Space heating • DHW heating	• Field trials and pilots underway
ThermoLift	Thermal compression	• Residential • Small commercial	• Space heating • DHW heating • Cooling	• Lab testing and field trials underway
VICOT	Absorption	• Commercial • Residential	• Space heating • DHW heating	• Commercially available in China • Lab testing and field trials in NA
Rinnai	Absorption	• Residential	• DHW heating	• Lab testing and field trials planned
HeatAmp	Adsorption	• Residential	• DHW heating	• Lab testing in Europe

Source: Enbridge/NEEA updates

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