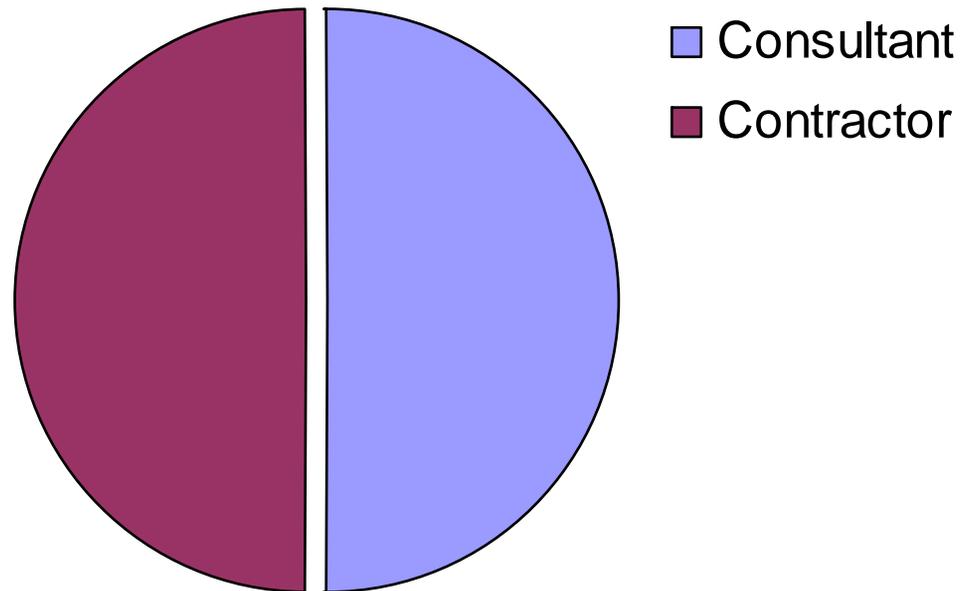

Ductless Heat Pumps

BPA Brown Bag Presentation

By Jeffrey R. Pratt, Inc. on behalf of the Northwest Energy Efficiency Alliance

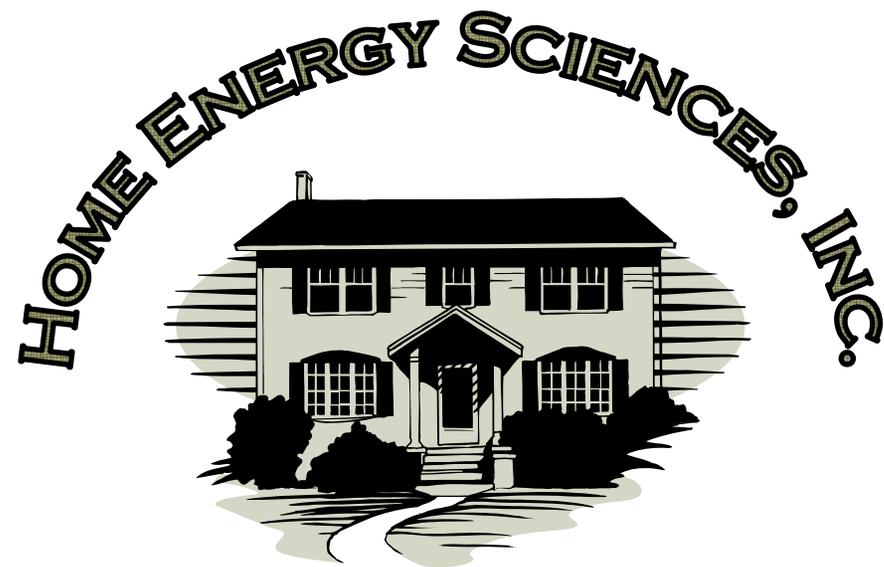
Jeff Pratt Who?





STRATEGIC ENERGY EFFICIENCY PROGRAMS





DUCTLESS HEATING AND COOLING SPECIALISTS

ccb # 177229

Ductless Heat Pumps What?

- ❑ Mitsubishi developed the ductless “mini-split” heat pump over 30 years ago to efficiently serve the Japanese housing market
 - ❑ Since then, DHPs have evolved greatly, both technically and in terms of products and applications
 - ❑ Modern DHPs are **inverter-driven, variable speed**, and have ultra-high efficiencies (SEER16-21+; HSPF 8.5-11.0)
 - ❑ DHPs have become the preferred heating and cooling systems in Asia and much of Europe
-

-
- About 30 manufacturers that build (or have built) DHPs currently operate in the US including:

Amcor
Americare
Carrier
Daikin
DeLonghi
EML/RetroAire
Fedders
Friedrich
Fujitsu
General Electric
Goodman
Haier
Heil
Hitachi

LG
Mitsubishi
Pace Air
Panasonic
Samsung
Sanyo
Single Zone
Soleus
Thermal Zone
Toshiba
Trane/US Standard
Unionaire
York

“That’s nice, but what are Ductless Heat Pumps?”

□ **Ductless Heat Pumps are heat pumps**

- Heat pumps transfer heat from a source to a thermal end-use using a refrigerant vapor compression cycle.
- Your refrigerator is a heat pump of sorts. Air conditioners are one-way heat pumps. Heat pumps are reversible, 2-way heat pumps.

□ **Ductless Heat Pumps are ductless**

- Air duct distribution systems are complicated, expensive, and very difficult to get right. Not getting them right results in significant efficiency penalties.
-

















Retrofitting DHPs in existing high-use homes to displace electric resistance heat is an enormous energy efficiency opportunity in the Northwest.

Energy Savings Theory

Existing Condition: Baseboard Heating System



Energy Savings Theory

Retrofit Condition: Ductless Heat Pump in Living Room, Baseboards Remain in Place



Here's why:

- ❑ Electric heat is a major end-use with large efficiency resource potential
 - ❑ DHPs are a potent, market-ready measure
 - ❑ DHPs supplement/complement the existing zonal systems; existing systems can remain as back up
 - ❑ Existing systems continue to address secondary zones which allows cost-optimized DHP systems (i.e., single zone)
 - ❑ DHPs address growing air conditioning market (responsibly)
 - ❑ DHPs provide significant energy savings and value to customers (making significant co-payment plausible)
 - ❑ DHPs provide significant efficiency resource value to utility (making incentives and investment more likely ;-)
-

Electric Heat

- There are more than 20 million homes in the United States with electric resistance heating:
 - baseboards
 - wall units (radiant)
 - wall units (w/fans)
 - ceiling cables, and
 - other (incl. forced air ducted furnaces, space heaters, and ranges ;-)



Electric Heat

- ❑ There are approximately 1.6 million homes in the Northwest with electric resistance heating as their primary heat source
 - Most built when electricity was inexpensive
 - But now, consumer electricity bills are increasing
 - Consumer demand for air conditioning is increasing
 - Installation of central AC or ducted heat pumps either not possible or way too expensive
-

Electric Heat

- ❑ Many of these consumers feel “stuck with electric heat” and undersized, noisy room air conditioners
 - Most are very unhappy with the high cost of operation
 - Most live with compromised comfort
 - Most assume “gas costs less”
-

Heating System Operating Cost Comparison

	Gas Furnace	Electric Furnace	Electric Resistance	Ductless Heat Pump
Fuel cost	\$1.10 per therm	\$0.07 per kWh	\$0.07 per kWh	\$0.07 per kWh
Heat content of fuel	100,000 per therm	3,414 Btu/kWh	3,414 Btu/kWh	3,414 Btu/kWh
Conversion efficiency	92% (0.92 AFUE)	100%	100%	250% (8.5 HSPF)
Distribution efficiency	0.80 (20% duct loss)	0.80 (20% duct loss)	1.0 (no ducts)	1.0 (no ducts)
Delivered heat per fuel unit	73,600 Btu/therm	2,731 Btu/kWh	3,414 Btu/kWh	8,535 Btu/kWh
Fuel units required for 100,000 Btu	1.36 therms	36.61 kWh	29.29 kWh	11.72 kWh
Cost per 100,000 Btu	\$ 1.49	\$ 2.56	\$ 2.05	\$ 0.82

Typical DHP Installation Costs:

\$3,500 - \$ 4,500

- Installation cost represents a large single zone DHP. Other DHP configurations may be appropriate or required.
 - Actual installation costs are likely to range from \$3,000 to \$5,000 or more.
 - These are only initial estimates. Market economics will ultimately determine price.
 - DHP installations may be eligible for rebates and tax credits depending on the jurisdiction.
-

Estimated DHP Energy Savings:

3,500 - 4,500 kWh

- Estimates are annual savings compared to electric resistance heat for high-use customers.
 - 3,500 kWh is the deemed savings estimate by the Regional Technical Forum (RTF).
 - These are only initial estimates. Savings will vary by home, climate zone, occupancy patterns, consumer behavior, and the installed system type (along with other factors).
 - Regional metering studies and data analysis are planned.
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The Northwest Energy Efficiency Alliance is working with BPA and other regional stakeholders to provide and coordinate program elements to foster installations of DHPs to displace electric resistance heat.

... stay tuned.



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