



**Vermont Community  
Energy & Climate Action Conference  
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**Strategic Heating & Cooling  
with Air-Source Heat Pumps**

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# ASHP - Fundamentals

## What's a heat pump?

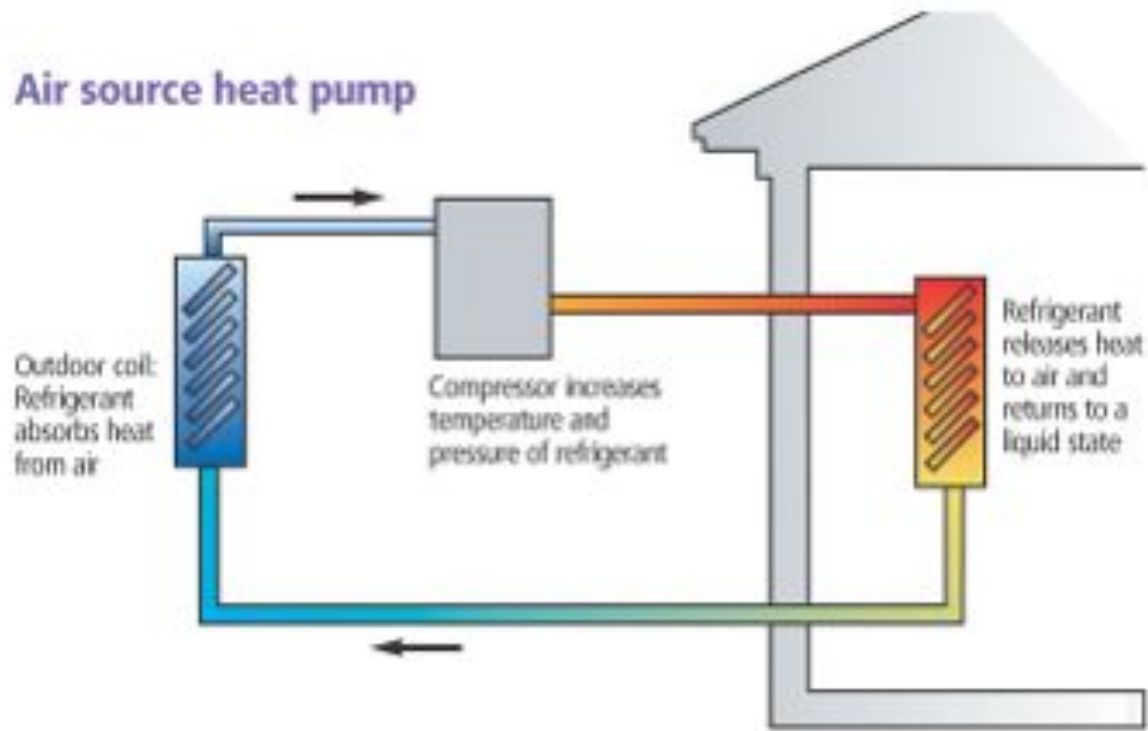
- Electromechanical Equipment
- Provides both heating and cooling

## How do they work?

- Transfer of heat energy – source to sink
- Refrigeration cycle

# Air Source Heat Pump

Air is the “source” of the energy



# How it works...



Look familiar?

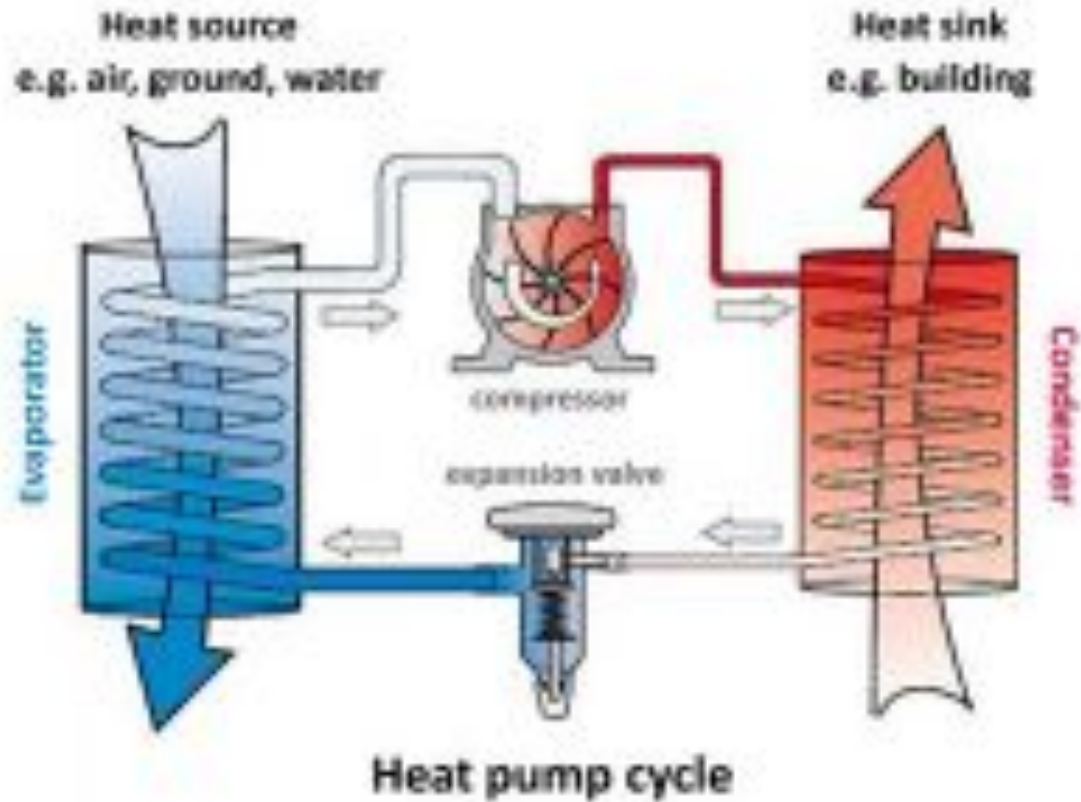


How about now?



or now?

# Heat Source → Heat Sink





Evaporator/Condenser Coil



Compressor



Expansion Valve

# Ductless Heat Pumps (Mini-Splits)





# World of Heat Pumps





# Heat Pump Water Heaters

## Considerations before you purchase and install

### Location

- Must be installed in a space where the temperature stays above 50°F to maximize energy savings.
- Because of their noise and cooling effect, heat pump water heaters are better suited to basements than living spaces.

### Space

- Provide at least 750 cubic feet of air space around the unit (about the size of a 10' x 10' room).
- Give the unit the manufacturer's recommended clearances from walls to ensure adequate circulation, and be sure the ceiling is high enough to accommodate the unit.

### Condensation Drain

- Installation requires water to be pumped outside or passively drained to a sink, washing machine drain, or floor drain lower than the heat pump condensate port.



# ASHP – Application Considerations

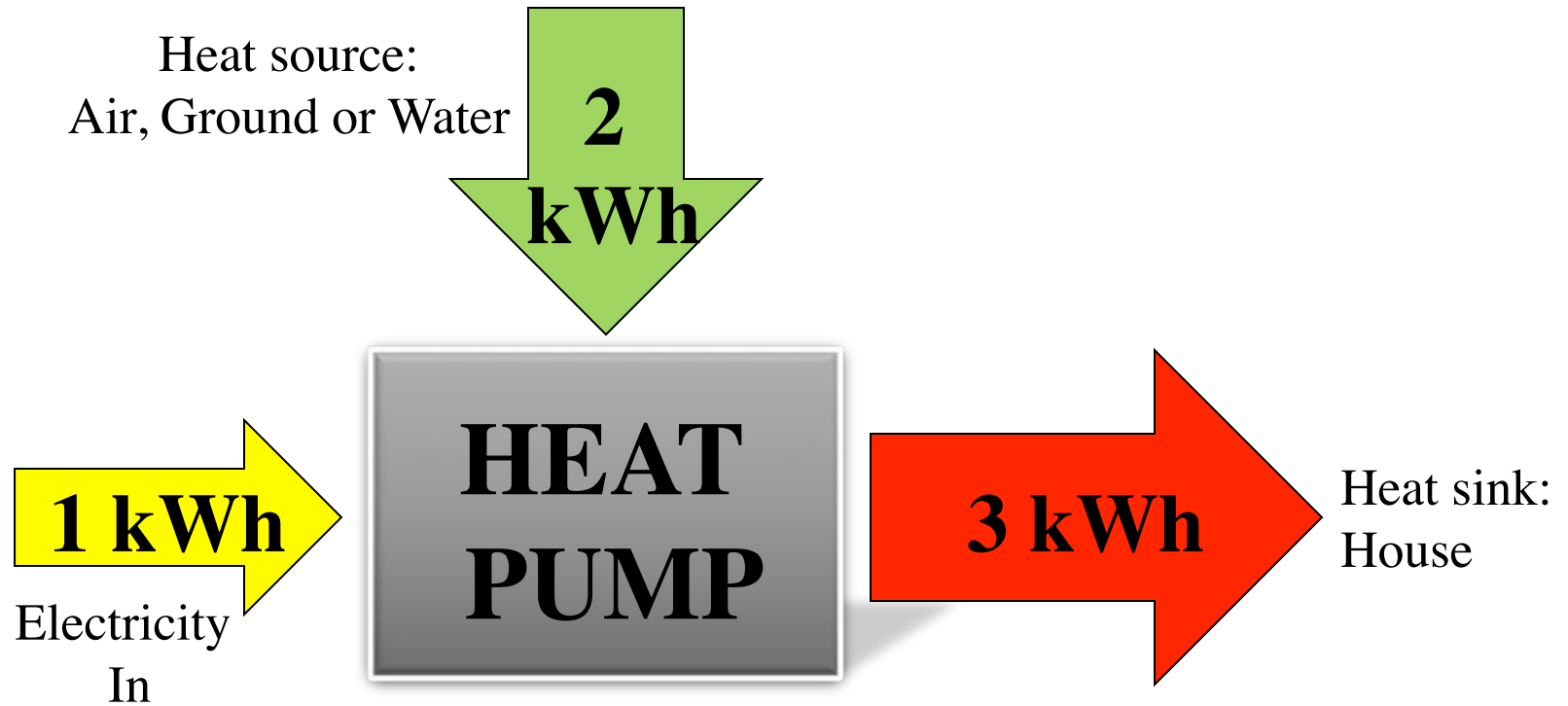
## Performance

- COP (Coefficient Of Performance) = Energy Out/Energy In
- COPs of 1.0-4.0+
- Like saying 100-400% efficient!

## How do they save money and energy?

- Efficiency - 1 in 3 out
- Savings
- Displacement of fossil fuel use
- Renewable?

# Performance: More Out than In?



# New England's Heating Fuel Competition (Retail)

Energy Type	Unit	Btu/Unit	Efficiency	\$/Unit	\$/MMBtu
Wood	Cord	22,000,000	60%	\$193.00	<b>\$14.62</b>
Natural Gas	Therm	100,000	90%	\$1.55	<b>\$17.22</b>
Pellets	Ton	16,400,000	80%	\$247.00	<b>\$18.83</b>
Fuel Oil	Gallon	138,200	90%	\$3.72	<b>\$29.91</b>
Kerosene	Gallon	136,600	90%	\$4.19	<b>\$34.08</b>
Propane	Gallon	91,600	90%	\$2.96	<b>\$35.90</b>
<b>Electricity</b>	<b>kWh</b>	<b>3,412</b>	<b>300%</b>	<b>\$0.15</b>	<b>\$14.65</b>

- Fuel Prices compete within 3 bands
- With heat pumps, electricity falls into the 1<sup>st</sup> band
- Is convective technology making combustion obsolete?

# Typical Residential Heating Fuel Costs (75 MMBtu/Yr)

Fuel	Volume	Unit	\$/Unit	\$/Yr
Wood (green)	5.7	Cords	\$190	\$1,080
Natural Gas	83	Therms	\$1.59	\$1,325
Pellets	5.7	Tons	\$247	\$1,412
Fuel Oil	603	Gallons	\$3.85	\$2,322
Kerosene	610	Gallons	\$4.26	\$2,599
Propane	910	Gallons	\$3.24	\$2,948
Electricity	21,981	kWh	\$0.17	\$3,737

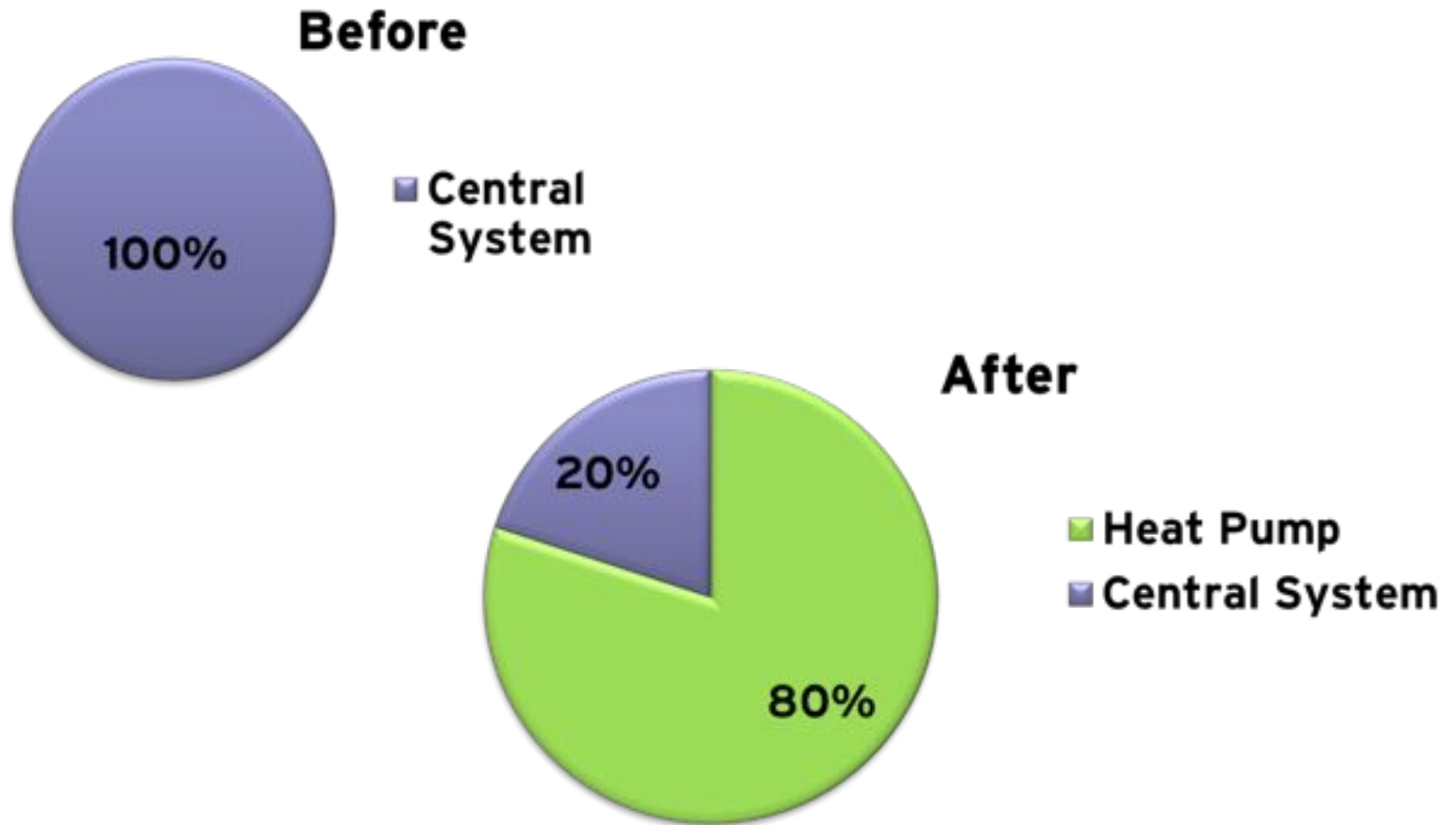
- Most residents pay \$2,000 - \$3,000 per year.

# Heating Fuel Cost Savings with an ASHP (COP 3.0)

Type of Energy	Unit	25 MMBtu/Yr	50 MMBtu/Yr	75 MMBtu/Yr	100 MMBtu/Yr
Wood (green)	Cord	\$(55)	\$(111)	\$(166)	\$(221)
Natural Gas	Therm	\$26	\$53	\$79	\$106
Pellets	Ton	\$55	\$111	\$166	\$222
Fuel Oil	Gallon	\$359	\$717	\$1,076	\$1,435
Kerosene	Gallon	\$451	\$902	\$1,353	\$1,804
Propane	Gallon	\$567	\$1,135	\$1,702	\$2,269
Electricity	kWh	\$830	\$1,661	\$2,491	\$3,322

- Most residents save \$1,000 - \$2,000 per year.

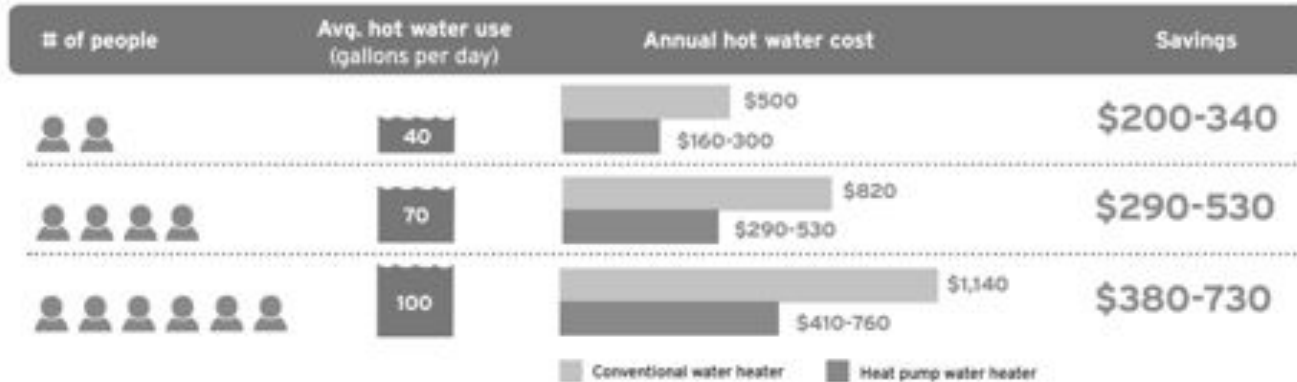
# Savings: The Displacement Model





# Savings: Heat Pump Water Heater

Save with a heat pump water heater



Is a heat pump water heater right for you? Here's the math!

Heat pump water heater		Conventional water heater	
\$1,200	heat pump water heater purchase	\$600	electric water heater purchase
<b>+</b> \$1,200	average installation cost	<b>+</b> \$400	average installation cost
<b>-</b> \$400	rebate from Efficiency Vermont	<b>-</b> \$0	rebate from Efficiency Vermont
<b>-</b> \$300	federal tax credit (expires 12/31/13)	<b>-</b> \$0	federal tax credit
<hr/>		<hr/>	
\$1,700	net installation cost	\$1,000	net installation cost
<b>\$3,900</b>	lifetime energy savings*	<b>\$0</b>	lifetime energy savings

The purchase and installation costs are higher, but when you factor in energy savings, the heat pump water heater comes out on top!

# Renewable?

Heat Pumps leverage electrical energy to MOVE heat but no more “renewable” than a refrigerator...

...when connected to the grid.



# Programs & Rebates

# Green Mountain Power CCHP Program



This program is available exclusively for GMP residential and business customers who are located in the former CVPS service territory.

## ELIGIBLE COLD-CLIMATE HEAT PUMP PRODUCTS

	DUCTLESS	CENTRAL
Definition	A split-system heat pump unit that heats (or cools) directly into the room without ducts	A split-system heat pump unit connected to whole house distribution systems
Capacity	100% of Nominal Capacity at 5°F	Maximum heating capacity at 5°F >50% rated capacity
Heating Efficiency	COP >1.75 @5°F maximum capacity rating; HSPF > 9	COP >1.75 @5°F maximum capacity rating
Cooling Efficiency	>20 SEER	>SEER 13

## Eligible Buildings—Commercial and Residential (Existing Buildings Only)

### Shell Efficiency: (Must meet 1 of the following 5 criteria)

- 30,000 Btu/ft<sup>2</sup>:** This minimum shell efficiency is based on fuel use records for past 2 years provided with reservation form.  
*(Verified by Efficiency Vermont)*
- Home Performance/Building Performance Project:** A comprehensive project was or will be completed (before heat pump installation).  
*(Verified by Efficiency Vermont)*
- Weatherization Assistance Program (WAP):** The existing building has been through low income Weatherization Assistance Program (WAP).  
*(Verified by Efficiency Vermont)*
- RBES or CBES Certificate:** A RBES or CBES code certificate exists for the eligible home or business facility.  
*(Verified by Efficiency Vermont via a copy of certificate provided with reservation form)*
- HERS Index of 85 or less:** The home or business facility has scored a HERS Index of 85 or less.  
*(Copy of document showing HERS Index provided with reservation form)*

## HOW TO GET STARTED AND NEXT STEPS



- The first step towards installing a Cold-Climate Heat Pump system is to contact Efficiency Vermont at **888-921-5990** to find an eligible contractor.
- After you have contacted and scheduled an eligible contractor, the contractor will help you determine via an on-site visit if you are eligible for financial incentives.
- Call Efficiency Vermont to confirm and reserve your incentive.
- The final step is to move forward with the Cold-Climate Heat Pump system installation by your contractor. Upon project completion, you will then send the incentive form with proper backup documentation (invoices) to Efficiency Vermont in order to receive your project incentive.

**CONGRATULATIONS!** You have successfully installed a cost effective heating and cooling system that will keep your home comfortable for years to come.

# Existing Home with Electric Resistance Heat

- Retrofit to Ductless ASHP
- Minimum thresholds of electrical use to qualify
- Incentive amount \$1,000 per household (1 time only)
- Must use qualified contractor
  - [http://www.encyvermont.com/for\\_my\\_home/ways-to-save-and-rebates/energy\\_improvements\\_for\\_your\\_home/Cold-climate-heat-pump/overview.aspx](http://www.encyvermont.com/for_my_home/ways-to-save-and-rebates/energy_improvements_for_your_home/Cold-climate-heat-pump/overview.aspx)
- Must install qualifying unit
- Contact Efficiency Vermont for more details
  - 888-921-5990

# Heat Pump Water Heaters

**Heat Pump  
Water Heater Rebate**





**\$400 off**

**ENERGY STAR® Certified  
Heat Pump Water Heaters**



#### The water heaters eligible for this rebate:

-  Can save you up to \$300 per year.
-  Reduce the need for air conditioning and dehumidification.
-  Are certified by ENERGY STAR.

#### Steps to receiving your \$400 rebate:

- 1) Confirm eligibility (see eligibility criteria below and terms & conditions at left).
- 2) Fill out this form completely. Incomplete information will delay or disqualify your rebate.
- 3) Mail signed rebate form with copies of your dated sales receipt and a recent electric bill to:

**EFF-VT ENERGY STAR Heat Pump Water Heater Rebate**  
40 Washington Street, Suite 2000  
Westborough, MA 01581

We will issue your rebate within 60 days.

#### Eligibility Criteria:

Rebate is only for purchases made 11/1/13 - 6/30/14.

Rebate does not apply if an Efficiency Vermont discount has already been received at a participating HVAC distributor's location.

Rebate is for Vermont electric utility customers who do not have a natural gas water heater.

For details on installation and qualified products, visit [www.efficiencyvermont.com/14PWH](http://www.efficiencyvermont.com/14PWH).

# THANK YOU!

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