Residential Applications of Air-Source Heat Pumps

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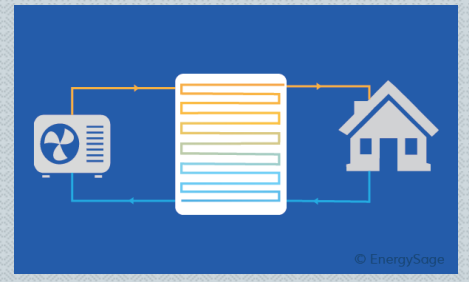


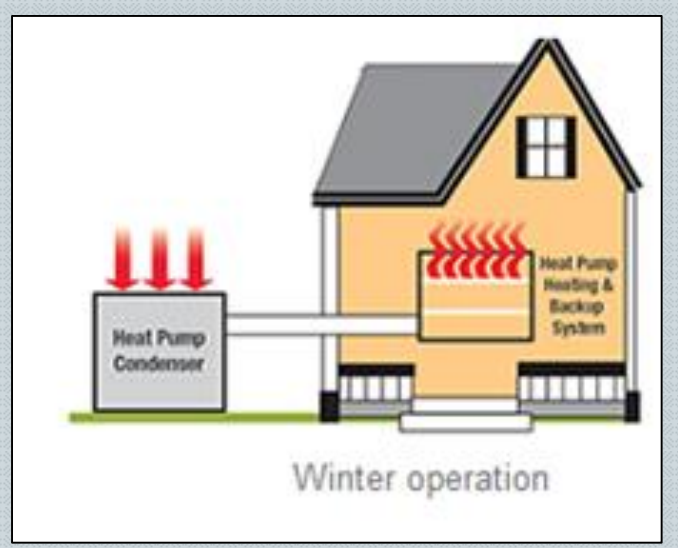
Air-source Heat Pumps (ASHPs)

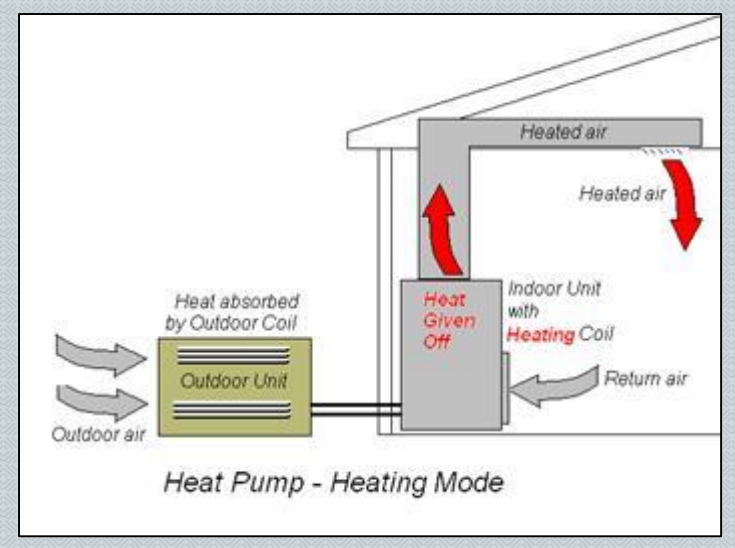
In this presentation we will review:

- What is an Air-source Heat Pump (ASHP)?
- How does an ASHP work?
- How does an ASHP reduce Greenhouse Gas Emissions (GHG's) ?
- How can you use and apply ASHPs in your home?

What is an ASHP ?

•An **air source** heat pump (ASHP) is a system which transfers heat from outside air to the inside of a building (*ref. Wikipedia)*





What is an ASHP ?

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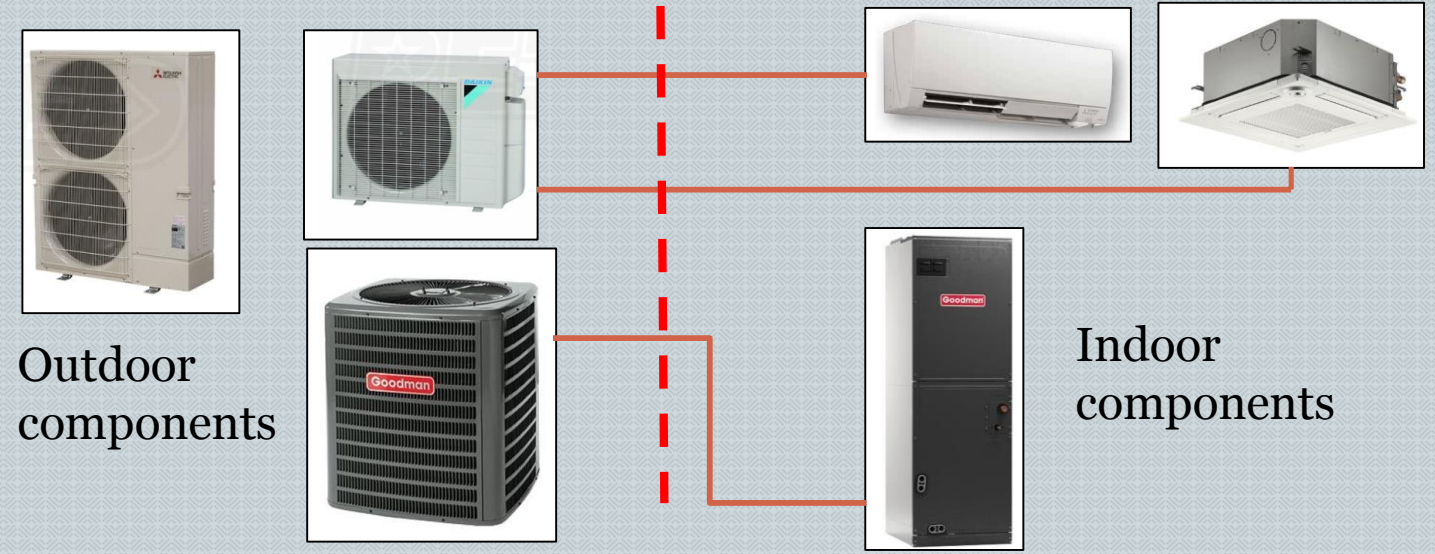
- Examples of common heat pumps include: ductless mini-splits, cassette types, conventional central units with a ducted indoor air handler. They look just like your central AC unit:



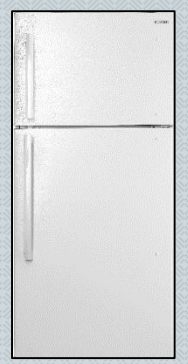
Outdoor components

Indoor components

How does the ASHP Work?

- A refrigerant fluid moves heat between outdoor air and indoor air.
- It uses the same technology (vapor-compression cycle) as other household devices such as a window or central AC unit, refrigerator, or ice-maker.
- While electricity drives the compressor; most of the energy instead comes from 'free heat' that exists in the outdoor air, despite its temperature.

That's the same principal that these use:



How does the ASHP Work?

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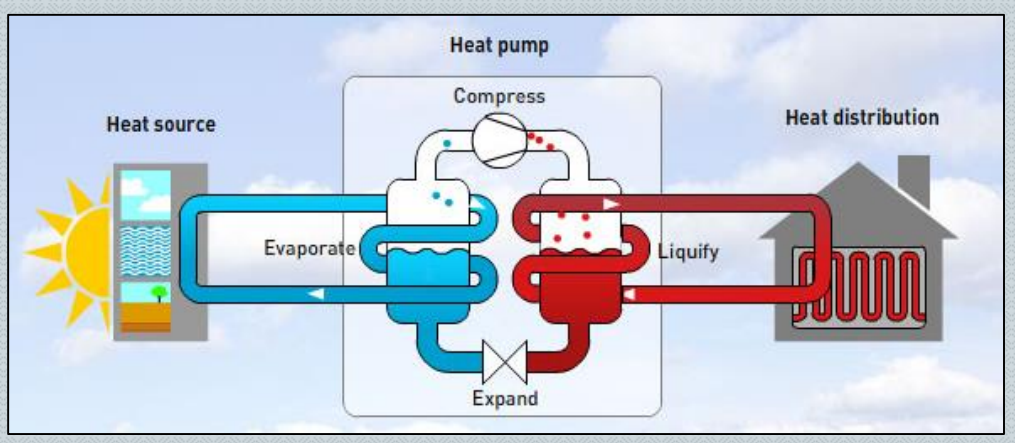
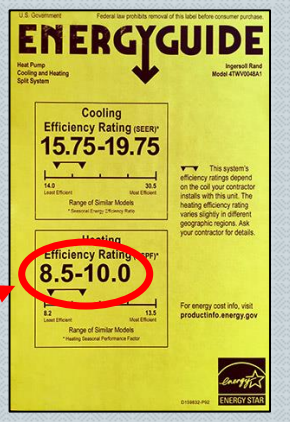
- 75% of the Heating Energy comes from the cold outside air.
- Cold air evaporates the low pressure (and very cold) refrigerant
- The compressor pressurizes the refrigerant, which makes it hotter.
- Hot refrigerant warms the inside air that is circulated by an indoor fan.



How does an ASHP Reduce Greenhouse Gas (GHG) Emissions?

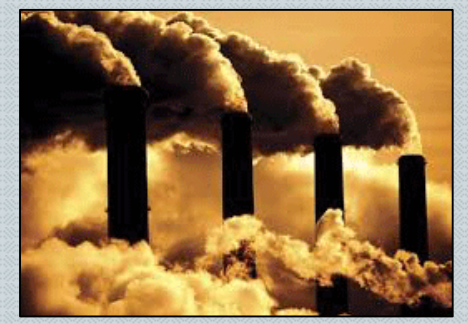
- When they burn oil or gas, boilers and furnaces emit CO2. Most home heating systems are about 75% - 80% efficient. Newer condensing gas boilers may be 90%+ efficient.
- The efficiency of an ASHPs is called a Coefficient of Performance (COP), or Heating Season Perf. Factor (HSPF)
- COP = Energy Output / Energy Input = 2.9 or 290% Efficient!
- HSPF = Energy Output in Btu per hr / Energy input in Watts
- Typical HSPF values range of **9.0** to as high as **13.6**
- HSPF of **10** = 293% Efficiency.



How does an ASHP Reduce Greenhouse Gas (GHG) Emissions?

For **each 1000 BTUs** of heat energy output, here is each source's GHG:

- Gas Boiler or Furnace at 80% Efficient: **0.146** lbs CO_2
- Oil Boiler or Furnace at 80% Efficient: **0.205** lbs CO_2
- Electric ASHP with HSPF of 10 (290% efficient): **0.0598** lbs CO_2 (based on local power emission factor)
- For the heat they provide, ASHPs could cut your GHG emissions by ~60%.



- For a typical home, that's a drop of 3.6 to 4.1 metric tons of CO_2 per year.

How to Apply an ASHP In Your Home

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- If you have forced hot air or central AC, an ASHP will directly replace it.
- But hot water or steam baseboard systems would need to be replaced, or act as supplements to room-based ASHPs, which also serve as AC units.
- *There are some air-to-water heat pumps , but they have limitations.*
- Caution: Not all ASHPs are 'cold-climate' capable. Others may have electric resistance auxiliary heaters. Cold climate units may cost $1,000 - $2,000 more.




How to Apply an ASHP In Your Home

- Design Considerations:
  - Wall mounted, cassette, or ducted type indoor units.
  - Avoid installing ducted ASHP in vented attics and crawlspaces.
  - In existing homes, keep the boiler as back-up or auxiliary heat.
  - True cold-climate ASHPs maintain 100% capacity down to 5°F.
  - To make hot water, also consider an ASHP water heater.

How to Apply an ASHP In Your Home

- While your electric bill will rise, ASHPs usually save money against oil heat, but not necessarily against gas heat. Various factors (current heating system, fuel oil/gas/power pricing, heat pump COP) need to be weighed.
- ASHPs may cost as little as ~$4,000 per room, or ~$18,000 for a fully ducted central system. Be sure to take full advantage of any utility or other incentives.
- Not all ASHPs have 'very' cold-climate ability. Review the proposed equipment carefully. Look for trade-names such as 'hyper-heat' and 'Low-ambient' operation.
- Note that ASHP's need to 'defrost' between heating cycles. All ASHPs have this limitation, and can cause short interruptions in heating.

Installations In Hudson Valley

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