



NYSERDA

Clean Heating & Cooling Advanced Energy Conference 2018

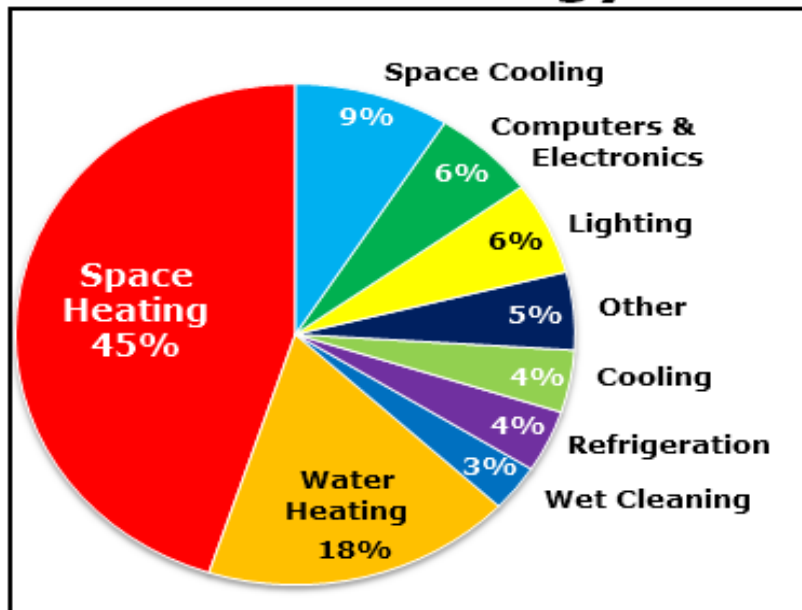
March 28, 2018

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Residential Energy Consumption

(Heat pumps are a renewable solution for the biggest portion of residential energy consumption) “space heating ,space cooling, and water heating 72%”

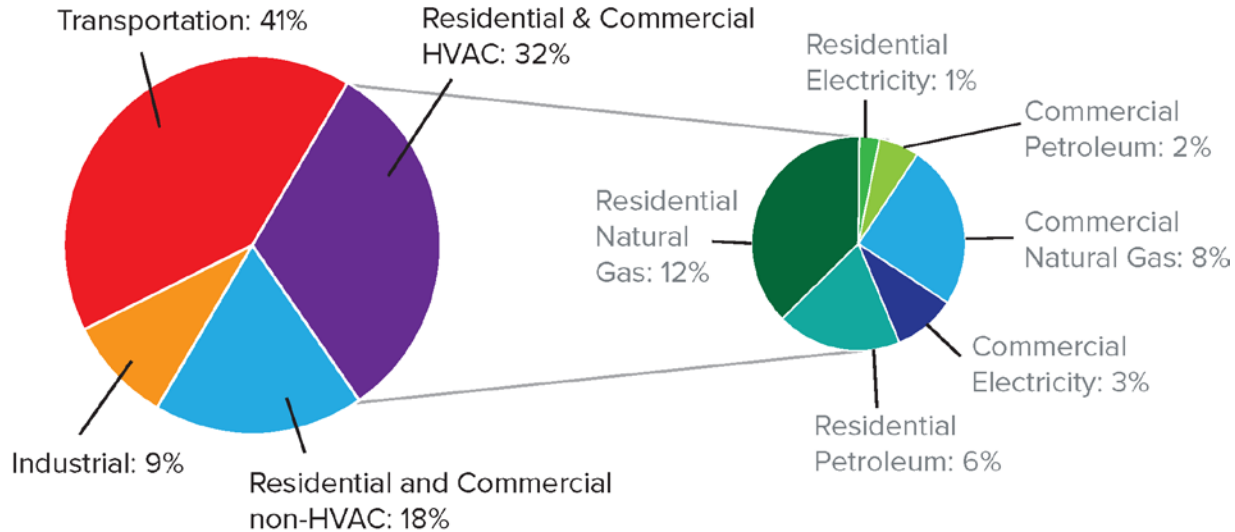
Household Energy Use



Source: US Dept. of Energy

Clean Heating & Cooling Benefits

Estimated 2014 NYS GHG Emissions from Fuel Combustion



Total 2014 New York State GHG Emissions from Fuel Combustion: 181 MMtCO₂e

Heating and cooling is responsible for about 1/3 of GHG emissions

- RH&C can also provide other benefits including: bill savings, improved comfort, electricity grid benefits

Why is the topic of Clean Heating & Cooling relevant to NY State

- HVAC accounts for around **a third** of NY energy consumption and carbon emissions.
- “**Beneficial electrification**”: heat pumps can help decarbonize the heating and cooling sector by:
 1. Cooling at greater efficiency than air-conditioning (thus reducing electricity use)
 2. Replacing fossil heating by heat pump heating, resulting in:
 - Significant carbon savings even at current grid carbon intensity; and
 - Further carbon savings in future as power generation decarbonizes further.
- Achieving REV goal of 40% greenhouse gas reduction by 2030 will likely require **heat pump sales to exceed 50% by 2030** as a % of end of life HVAC sales.
- Currently heat pumps occupy a niche position with a sales rate of **only ~1%**.

Why is the topic of Clean Heating & Cooling relevant to NY State cont.

- Lack of cost effectiveness (from the customer's point of view) is the key adoption barrier. In addition to pursuing cost reductions, both grid and carbon value of heat pumps would need to be monetized as a prerequisite to increasing uptake
- The annual end-of-life HVAC replacement market in NY totals >200,000 residential installations a year, equating to a market value of around \$8B/y in the residential sector alone if met entirely by GSHP or \$3B if met by ASHP; the non-residential HVAC market equals almost twice that size
- Approximately 7.3 million NYS Housing units of which 2.8 million or 38% of total homes use fuel oil, propane, or electric resistance for heating

Clean Heating & Cooling Technologies

Heat Pumps:

- An electrical device that extracts heat from one place and transfers it to another
- Heat pumps can provide equivalent space conditioning at as little as one quarter of the cost of operating conventional heating or cooling appliances

Air - Source (air-to-air or air-to-water) Heat Pumps (ASHPs):

- Air source heat pumps draw heat from the outside air during the heating season and reject heat outside during the summer cooling season

Heat Pump Water Heaters (HPWHs):

- use the same technology as refrigerators—but in reverse. Instead of removing heat from inside the refrigerator and releasing it into the room, heat pump water heaters move heat from the air into the water tank.

Geothermal (ground-source or water-source) Heat Pumps (GSHPs) :

- Achieve higher efficiencies by transferring heat between your house and the ground or a nearby water source

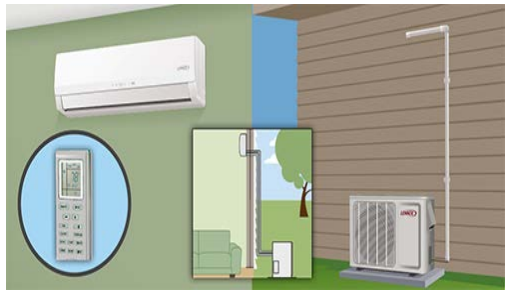
Variable Refrigerant Flow (VRF):

- Can heat and cool buildings simultaneously
- Can be air or water source
- Good solution for commercial buildings in densely populated areas

Air Source Heat Pumps Clean Heating & Cooling Technologies Ground/Water Source Heat Pump Systems



Central Ducted



Ductless Mini-Split

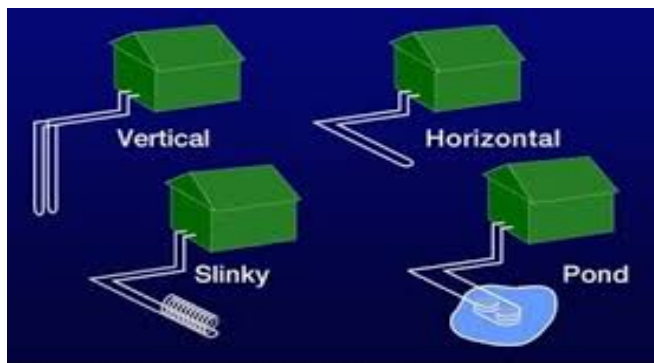
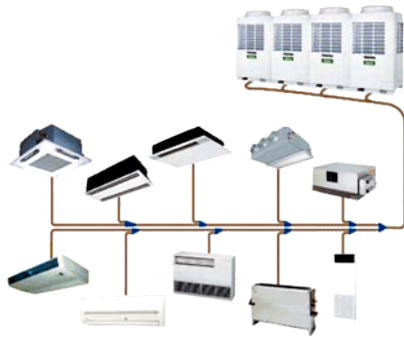


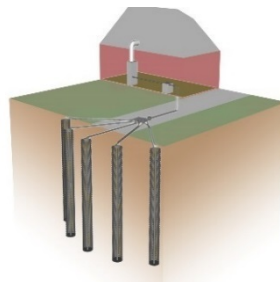
Figure 1 - Types of Closed-Loop Geothermal Systems



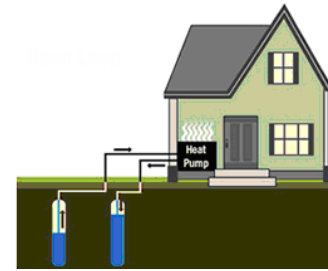
Heat Pump Water Heater



Variable Refrigerant Flow (VRF)



Direct Exchange



Open Loop System

Thank You

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