



NYSERDA

Clean Heating & Cooling (Heat Pumps) Land Use Training Institute

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Scott Smith

Why is the Topic of Clean Heating & Cooling Relevant to NY State

- HVAC accounts for around **a third** of NY 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 summer peak)
 2. Replacing fossil heating with heat pump heating, resulting in:
 - Increased grid utilization in the winter months
 - Significant carbon savings even at current grid carbon intensity
 - Further carbon savings in future as power generation decarbonizes further
 - Energy bill savings in homes heated with fuel oil and propane
 - Increased health benefits with no carbon monoxide produced on site
 - Some areas of NYS are experiencing gas constraints

Heat Pump Technologies

Heat Pumps:

- Move heat rather than generate heat, heat pumps can provide equivalent space conditioning at as little as one quarter of the cost of operating conventional heating or cooling appliances

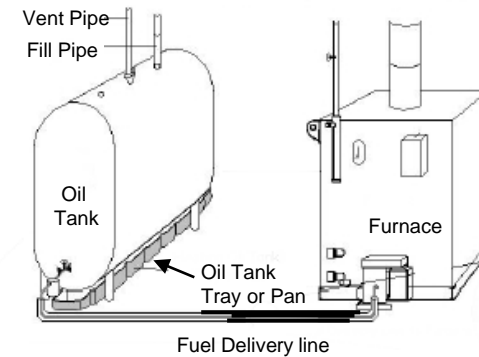
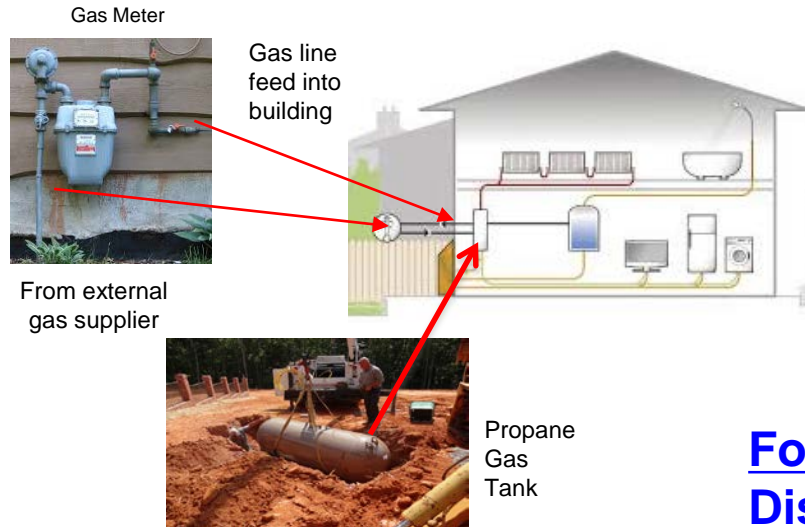
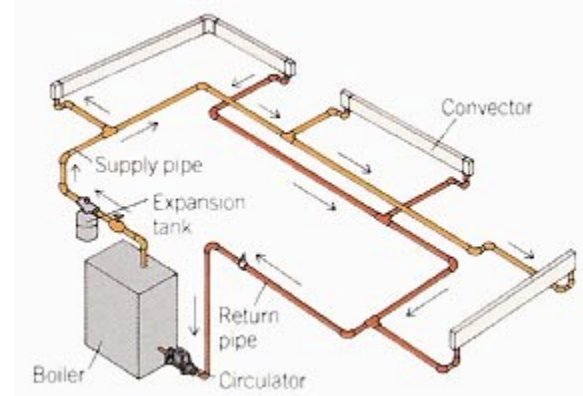
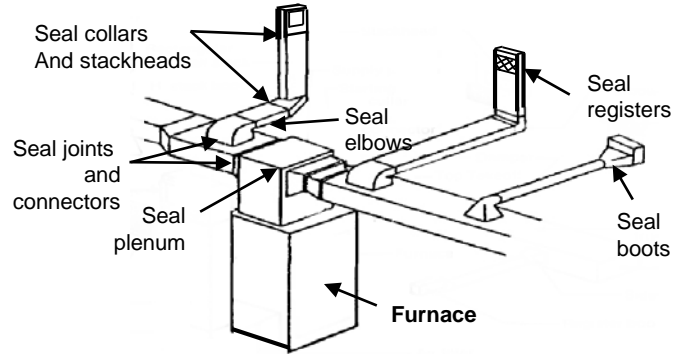
Geothermal (ground-source or water-source) Heat Pumps (GSHP) :

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

Air Source Heat Pumps (ASHP):

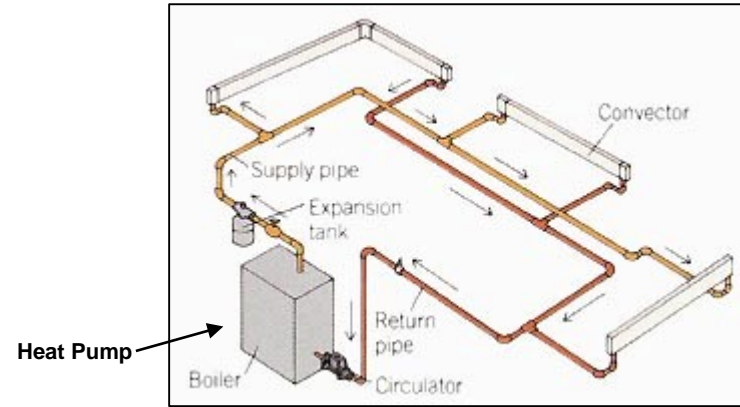
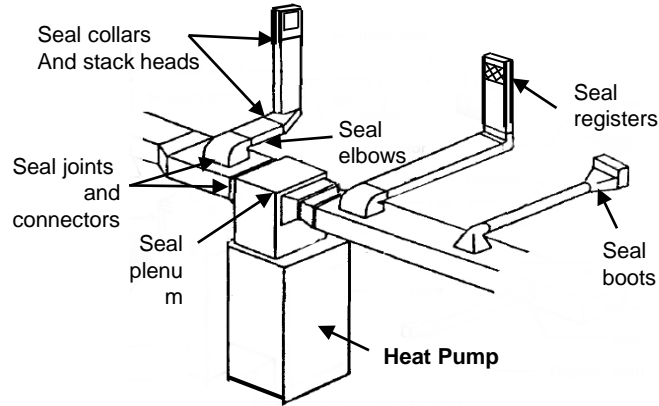
- Transfers heat between your house and the outside air

This diagram illustrates the different fossil fuels used to heat homes and buildings. Once the fuel is burned in the furnace or boiler, internal distribution system is identical to what is used with a heat pump heating and cooling system.

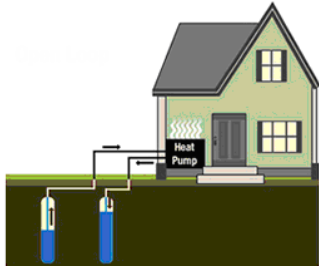


Fossil Fuel Heating Distribution Systems

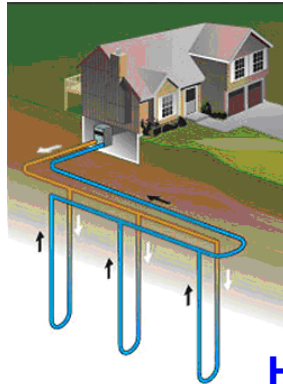
This diagram illustrates the different heat pump systems. Once the heat exchange takes place in the heat pump, with no greenhouse gas emissions on-site, the heating and cooling is distributed through the standard duct and ventilation system.



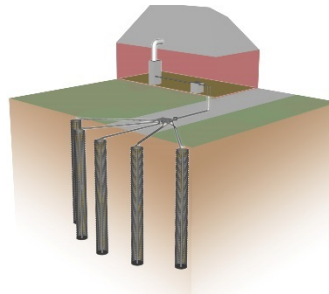
Open Loop System



Closed Loop System Vertical



Direct Exchange



Air Source Heat pump



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Geothermal Heat Pump Systems

Heat Pump Heating & Cooling Distribution Systems

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



Central Ducted



Ductless Mini-Split

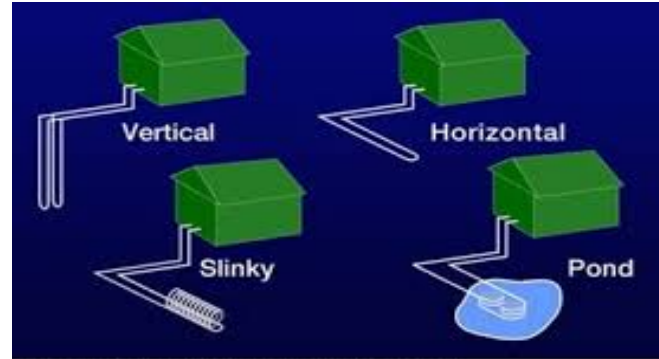
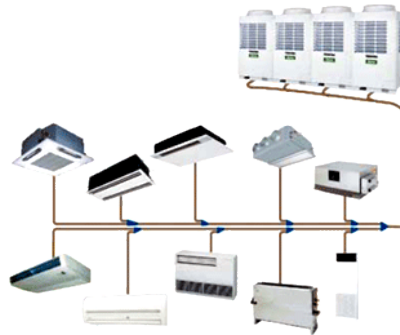


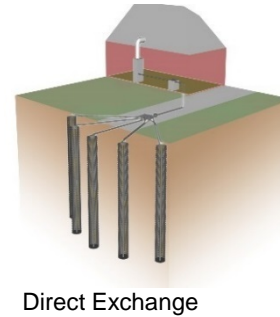
Figure 1 - Types of Closed-Loop Geothermal Systems



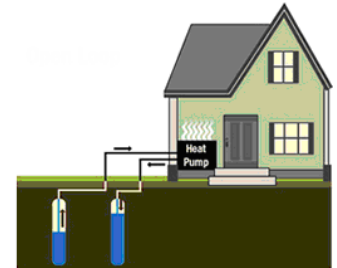
Heat Pump
Water Heater



Variable Refrigerant Flow (VRF)



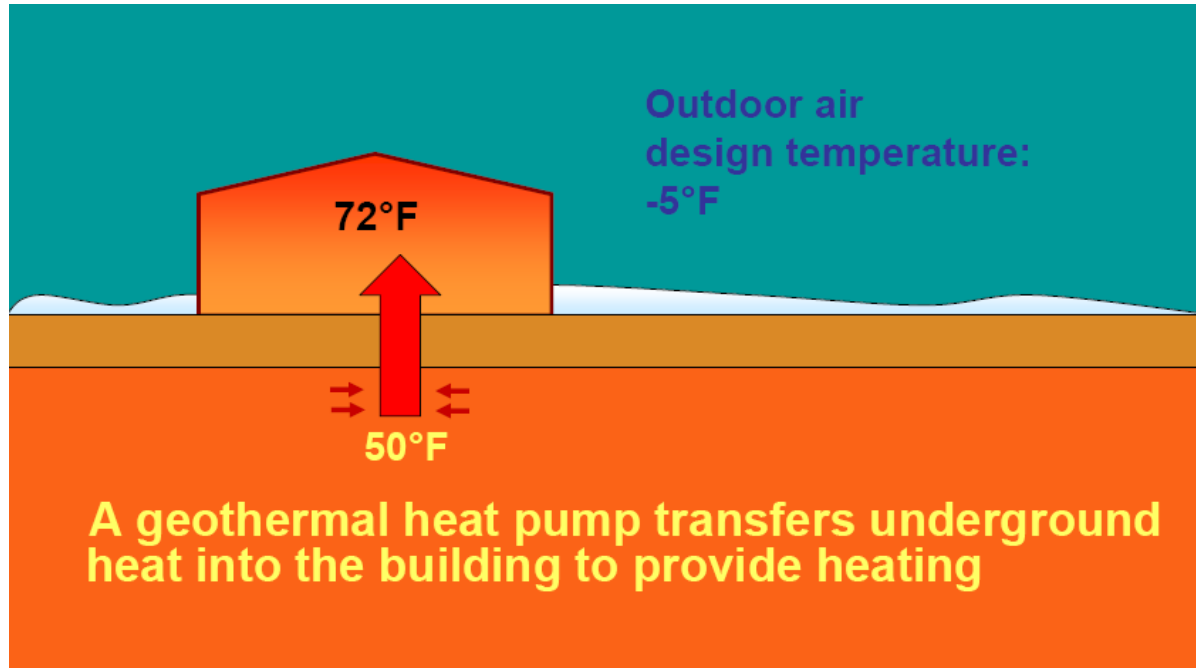
Direct Exchange



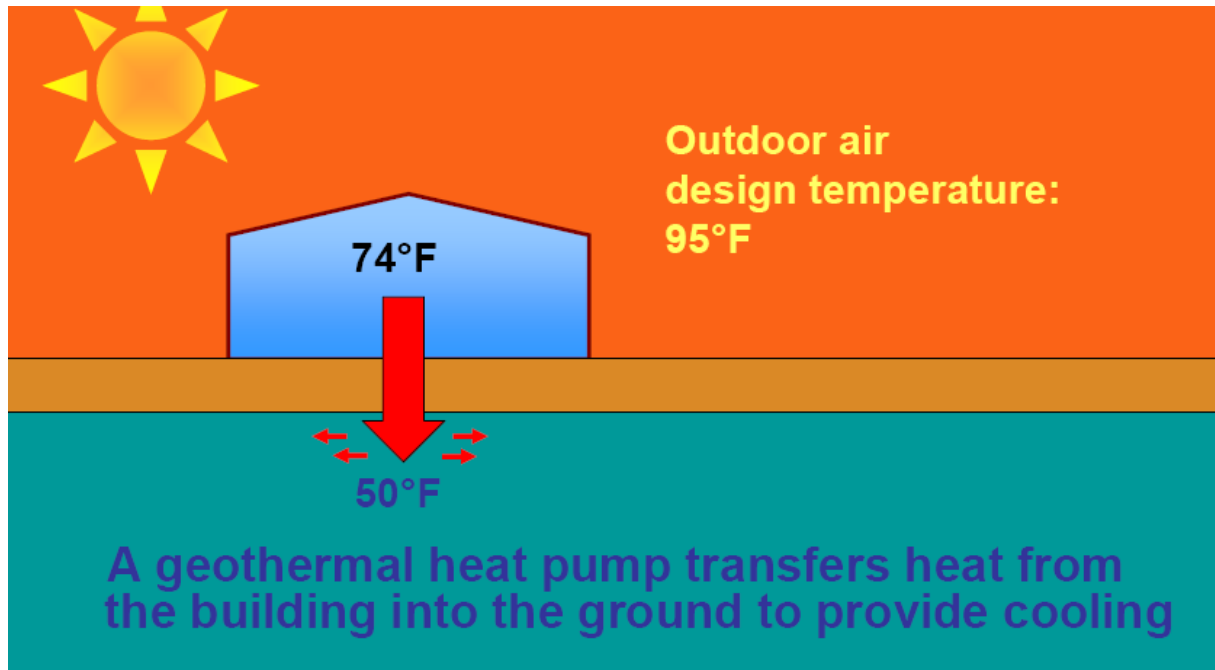
Open Loop
System

Geothermal Heat Pumps

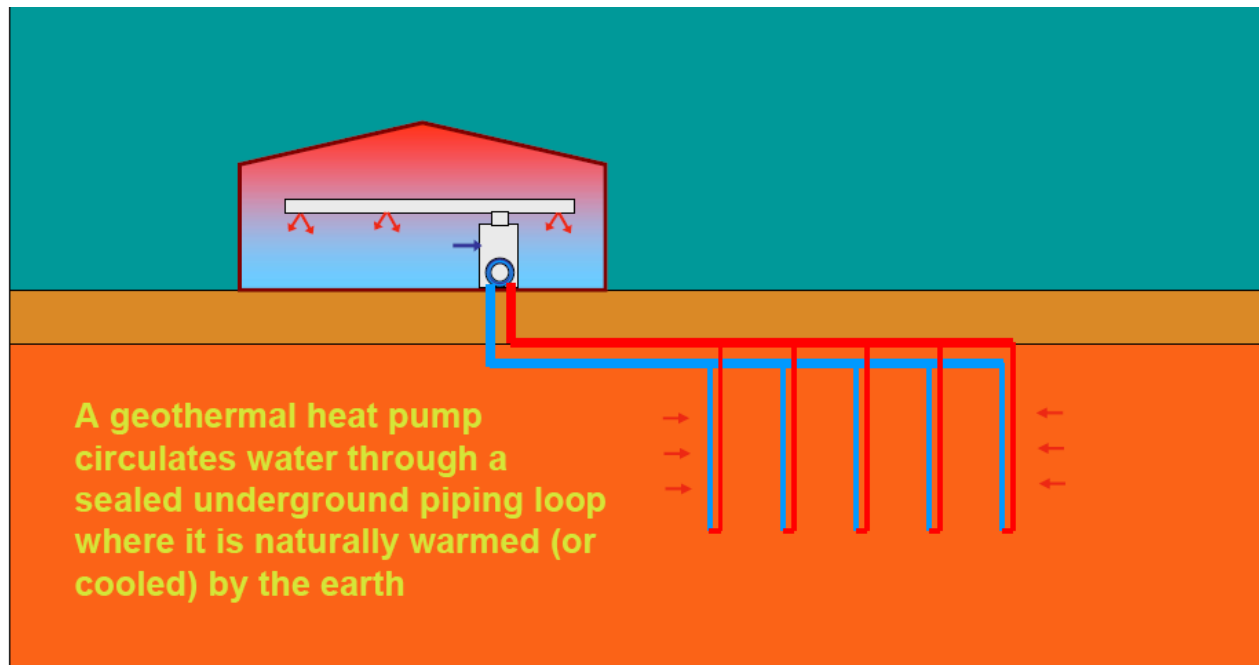
The Earth is a Source of Heat in the Winter



...and an Efficient Place to Reject Heat in Summer



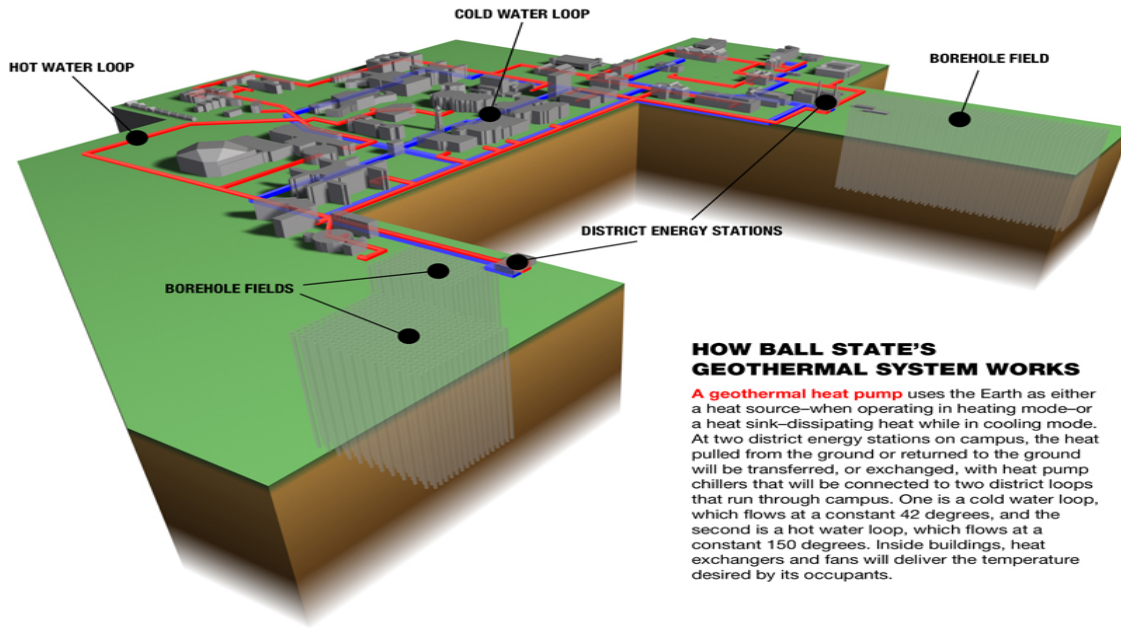
...using Heat Pump Technology



Commercial Application



Campus Geothermal System

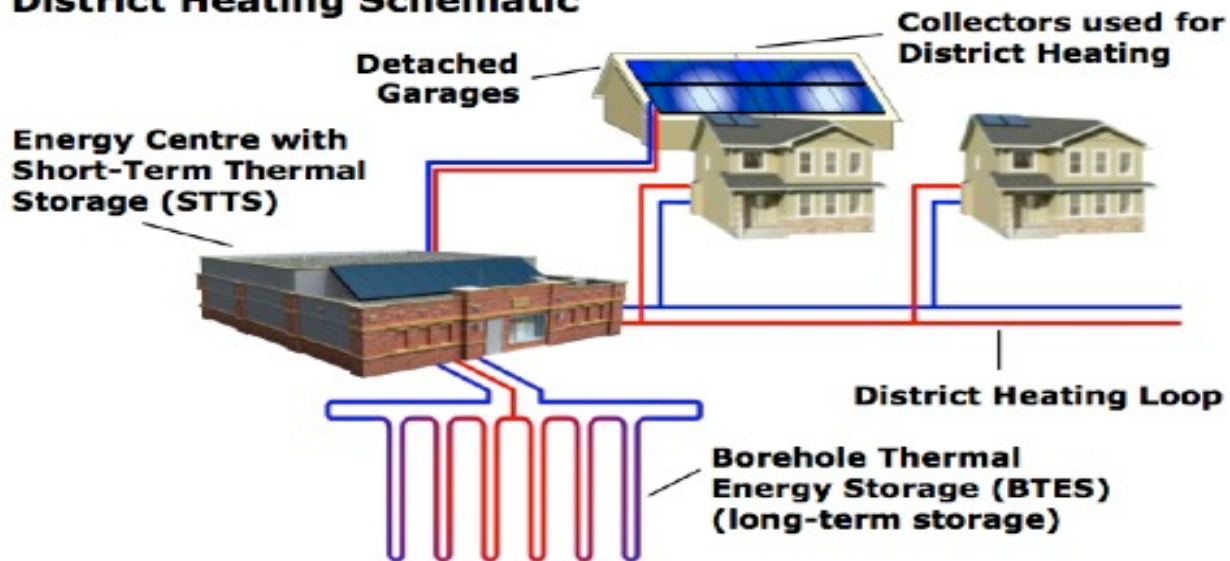


HOW BALL STATE'S GEOTHERMAL SYSTEM WORKS

A **geothermal heat pump** uses the Earth as either a heat source—when operating in heating mode—or a heat sink—dissipating heat while in cooling mode. At two district energy stations on campus, the heat pulled from the ground or returned to the ground will be transferred, or exchanged, with heat pump chillers that will be connected to two district loops that run through campus. One is a cold water loop, which flows at a constant 42 degrees, and the second is a hot water loop, which flows at a constant 150 degrees. Inside buildings, heat exchangers and fans will deliver the temperature desired by its occupants.

District Geothermal System

District Heating Schematic



NYSERDA GSHP Video

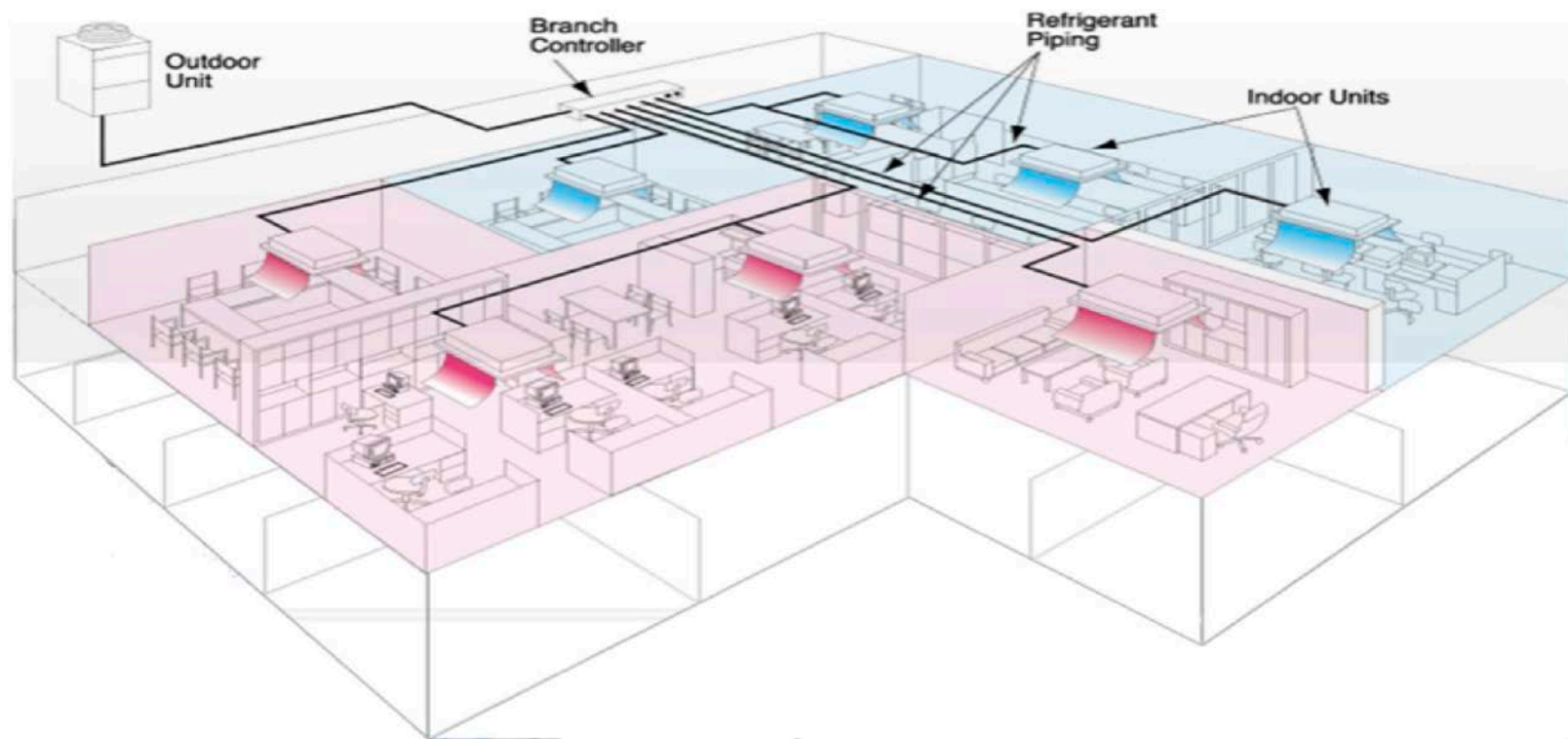
- https://www.youtube.com/watch?v=f8GcqW_4KVg&feature=youtu.be

Variable Refrigerant Flow (VRF)

Variable Refrigerant Flow (VRF)

- The simplest explanation of VRF is to describe it as a large-scale ductless HVAC system that can perform at a high capacity.
- In general, VRF technology provides the ability for multiple indoor units or zones to operate on the same system. VRF systems can either be a heat pump system or a heat recovery system, which provides simultaneous heating and cooling.





VRF Video

- https://youtu.be/hzFOCuAho_4

Air Source Heat Pumps

ASHP's

Ductless Mini Split ASHP



Central Ducted ASHP



Types of Air-Source Heat Pumps

- **Ductless vs. Ducted vs. Short-Run Ducted**

- Ductless applications require minimal construction as only a three-inch hole through the wall is required to connect the outdoor condenser and the indoor heads. Ductless systems are often installed in additions.
- Ducted systems simply use ductwork. If your home already has a ventilation system or the home will be a new construction, you might consider this system.
- Short-run ducted is traditional large ductwork that only runs through a small section of the house. Short-run ducted is often complemented by other ductless units for the remainder of the house.

- **Split vs. Packaged**

- Most heat pumps are split-systems—that is, they have one coil inside and one outside. Supply and return ducts connect to the indoor central fan.
- Packaged systems usually have both coils and the fan outdoors. Heated or cooled air is delivered to the interior from ductwork that passes through a wall or roof.

- **Multi-Zone vs. Single-Zone**

- Single-zone systems are designed for a single room with one outdoor condenser matched to one indoor head.
- Multi-zone installations can have two or more indoor heads connected to one outdoor condenser. Multi-zone indoor heads vary by size and style and each creates its own "zone" of comfort, allowing you to heat or cool individual rooms, hallways, and open spaces. This distinction may also be referred to as "multi-head vs. single-head" and "multi-port vs. single-port."

NYSERDA CH&C Initiatives and Programs

CH&C Heat Pump Incentive Programs

NYSERDA	ASHP Air Source Heat Pump	GSHP Ground Source Heat Pump
Program Funds	\$10.95 M	\$15 M
Incentive Level	\$500 per outdoor unit	\$1200 - \$1500 per thermal ton
Applicant	Approved Contractor	Approved Contractor, Designer, Driller
Paid to	Contractor	Contractor to Customer
Eligible Project	NYS, Electric System Benefit Charge	NYS, Electric System Benefit Charge
Eligible Site	Residential Single family & Multi family	Residential, Multi family, Commercial
Eligible Equipment	Northeast Energy Efficiency Partnership (NEEP): Cold Climate Specification List	Air conditioning, Heating & Refrigeration Institute (AHRI): Efficiency Standard
Quality Assurance	Completed Commissioning Check List	Site Inspections
Financing	Green Jobs Green NY (GJGNY) in Q4 2018	Green Jobs Green NY (GJGNY)
End Date (or until funds are exhausted)	December 2020	June 2019
Program Performance to date		
Contractors to date	234 Contractors	77 Contractors, 21 Drillers
Projects to date	4,175 Projects (average 2 units/project)	709 Applications 506 Completed projects



CH&C Community Campaigns

- **Program size:** \$3.3 million to date
- **Target:** locally organized community efforts at the county, city, borough, or regional level
- **Objective:** for communities to increase customer awareness of CH&C technologies, reduce installed costs, and jump-start the market by implementing multi-year outreach & education campaigns focused on CH&C
- Encouraging installations in low-to-moderate income residents
- NYSERDA funded technical assistance to run effective campaigns

Round 1: Active CH&C Campaigns

Communities	Campaign Organizer
Sullivan and Ulster Counties	Catskill Mountainkeeper
Cayuga, Cortland, Madison, Onondaga and Oswego Counties	CNY Regional Planning and Development Board
Tioga, Broome, Chenango, and Delaware Counties	Binghamton Regional Sustainability Coalition
Orange County	Energy Improvement Corporation
Otsego County	Otsego County Conservation Association
City of Rochester	City of Rochester
Tompkins County (& bordering areas in contiguous counties)	Solar Tompkins
Westchester County	Sustainable Westchester

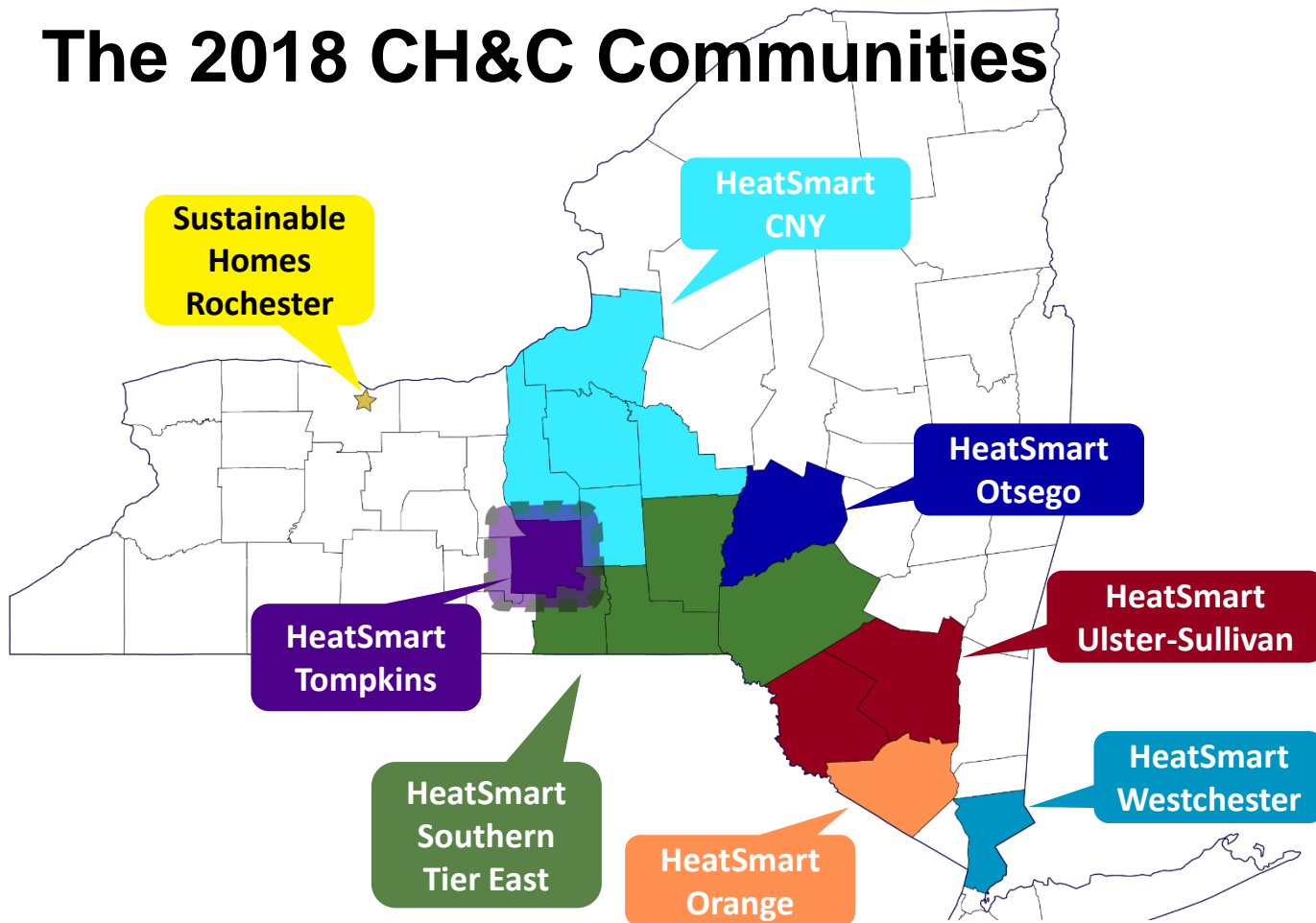
Round 2: Announcement coming soon

Round 3: Released Q2



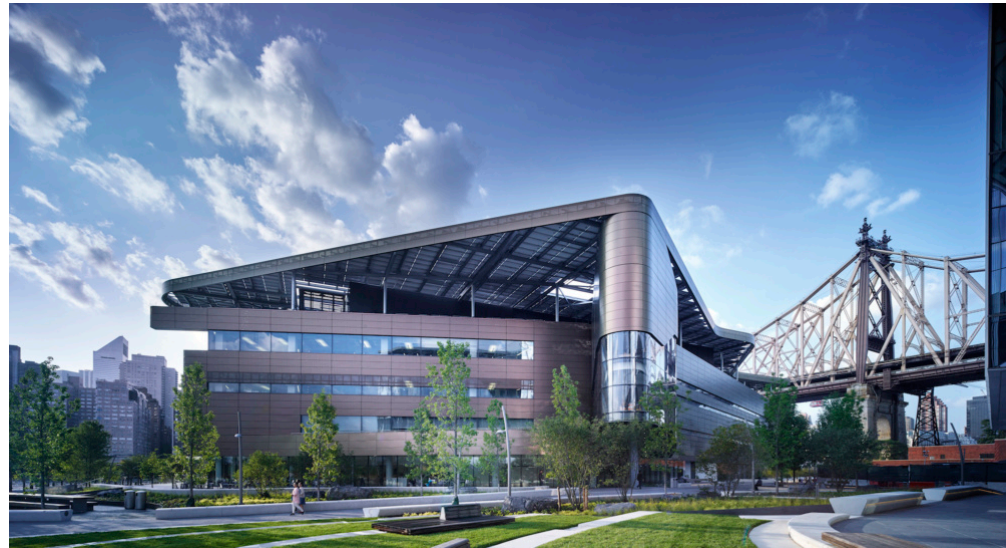
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The 2018 CH&C Communities



Cornell Bloomberg Center

- Roosevelt Island – 2017
- 150,000 SF
- \$105M
 - \$504K incr. cost exclud. GSHP, Solar
- Island-unique geothermal
 - Test wells revealed river-linked rock fissure
 - EUI = 30.9 (baseline 36.8)
 - Net EUI \approx 10 (assume 67% from PV)



Cornell Bloomberg Center photo credit Matthew Carbone for Morphosis

Thank You

Scott Smith

Scott.smith@nyserda.ny.gov

518-862-1090 ext. 3344



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