



Heat Pumps:

The Heart of Clean Heating & Cooling

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Aztech Geothermal, LLC



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 - Locally Owned & Operated
 - 400+ Heat Pump Customers
 - Design by Engineers & Geologists
 - Focus on Residential / Small Comm.
 - Monitoring / Maintenance
 - Incentive and Financing Options
 - Consult on Large Project Development or Repair



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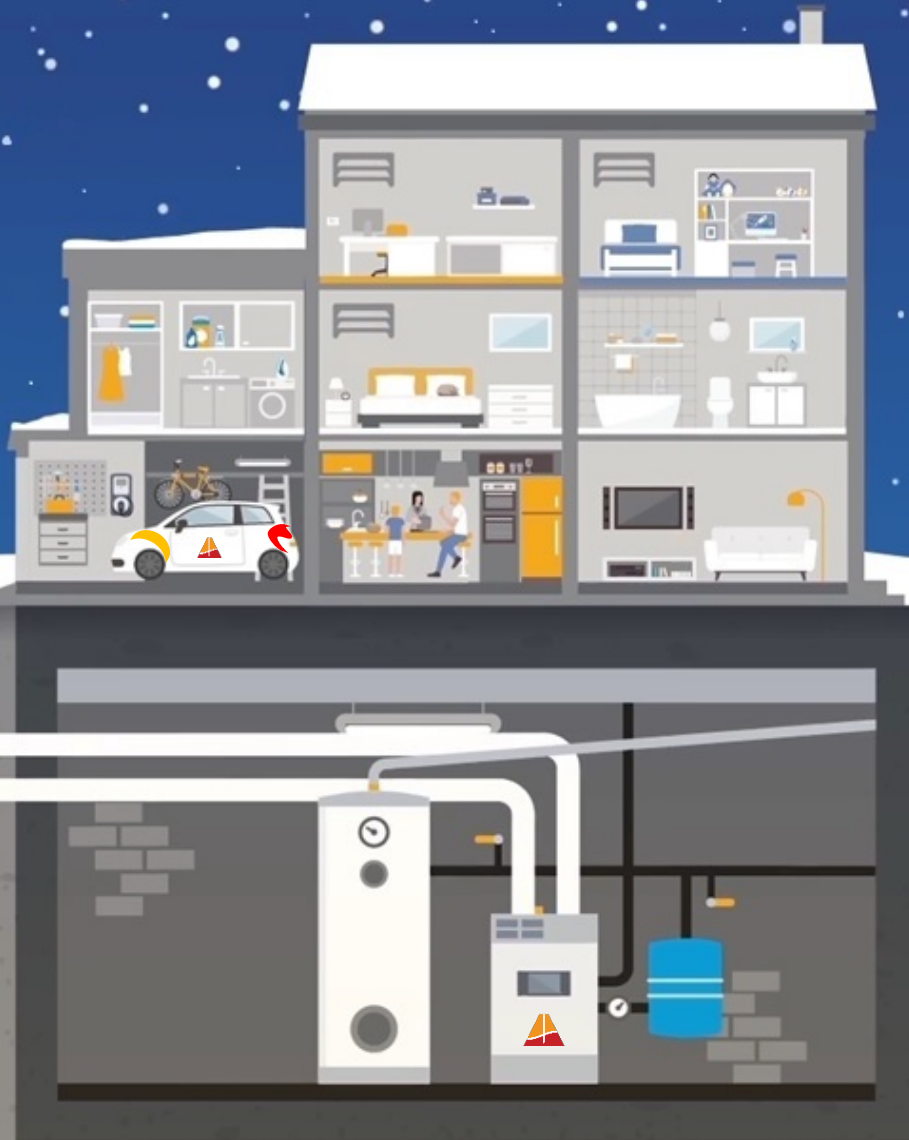
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WARMER.
COOLER.
CHEAPER.
CLEANER.



**A BETTER Way to
Heat and Cool
Your Home.**

Ground Source Heat
Pump (GSHP) System



NYS Energy Policy & Heat Pumps



That's Todd!

April
NY-G
River

2015 NYS Energy Plan: Goals by 2030

40% Reduction
in GHG emissions from 1990 levels

Reducing greenhouse gas (GHG) emissions from the energy sector—power generation, industry, buildings, and transportation—is critical to protecting the health and welfare of New Yorkers and reaching the longer term goal of decreasing total carbon emissions 80% by 2050.

50% Generation
of electricity must come from renewable energy sources

Renewable energy sources, including solar, wind, hydropower, and biomass, will play a vital role in reducing electricity price volatility and curbing carbon emissions.

23% Decrease
in energy consumption in buildings from 2012 levels

Energy efficiency results in lower energy bills and is the single most cost-effective tool in achieving energy objectives. 600 trillion British thermal units (TBtu) in energy efficiency gains equates to 23% reduction in energy consumption by buildings.

Heat Pumps Can
Play a Big Role in
These Areas

Main Sources Of Greenhouse Gases in NYS

New York's goal is to reduce these emissions 80% by 2050



TRANSPORTATION
34%



BUILDINGS
32%



ELECTRICITY
20%



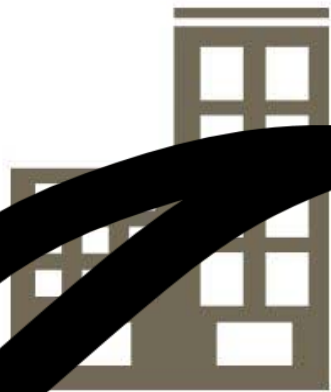
WASTE & OTHER
8%



INDUSTRY
6%



TRANSPORTATION
34%



BUILDINGS
32%



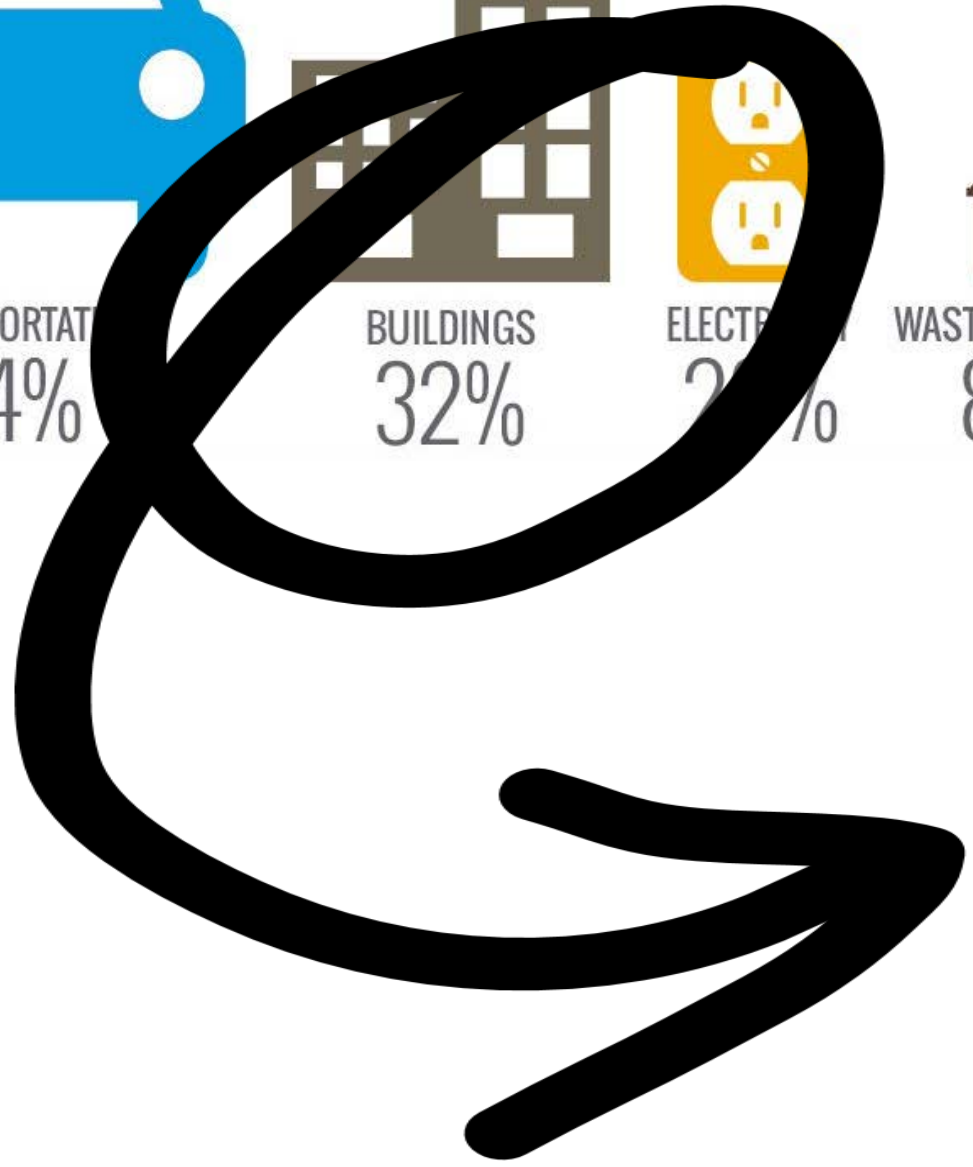
ELECTRICITY
28%



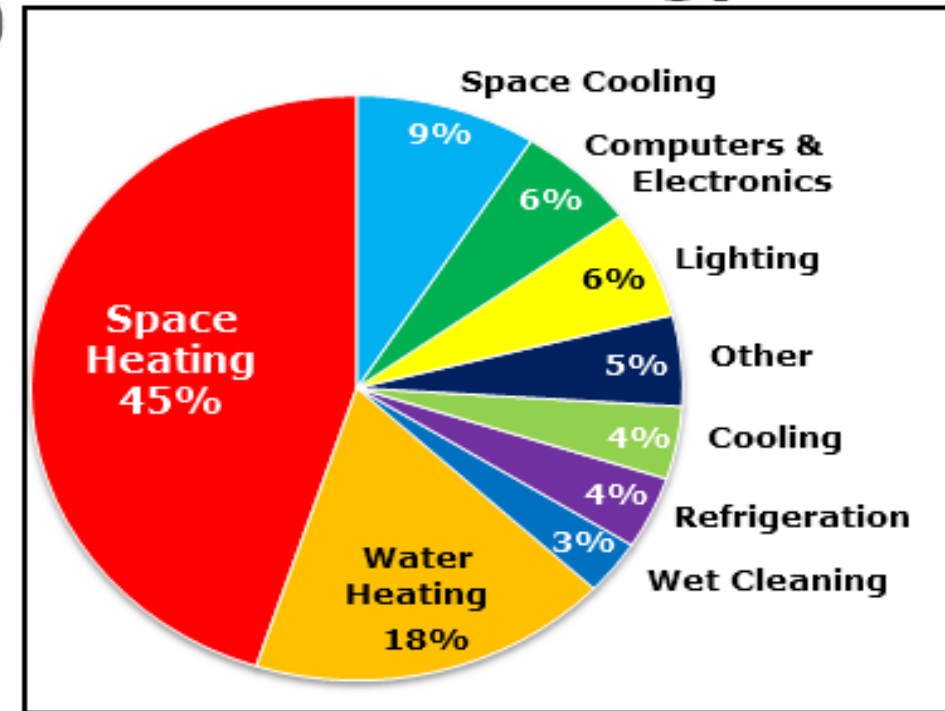
WASTE & OTHER
8%



INDUSTRY
6%



Household Energy Use



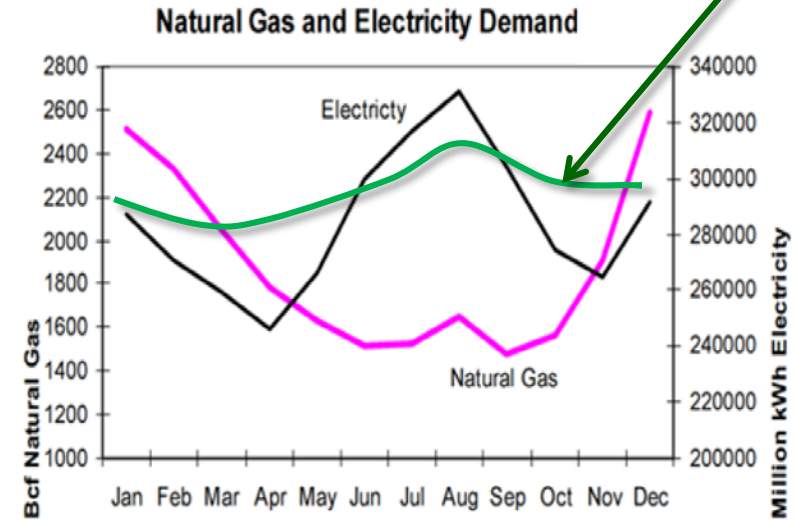
Source: US Dept. of Energy

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Benefits of GSHP Listed by National Grid

- Highly efficient heating and cooling systems.
- Potentially a cost-effective option to defer capital commitment for utility gas and electric infrastructure.
- Reduces electric peak demand, improves load factor and improves the efficiency of the electric delivery system.
- Gas peak load reductions.
- One single-family geothermal unit results in a carbon offset equivalent to 20 cars off the road for a year.



Ref: Gas Technology Institute, GRI 03/0173



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



Heat Pump Types

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



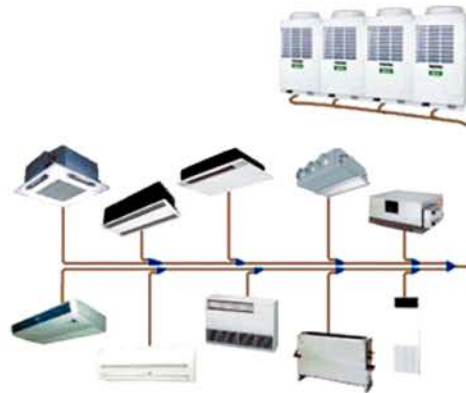
Central Ducted



Ductless Mini-Split



Heat Pump
Water Heater



Variable Refrigerant Flow (VRF)

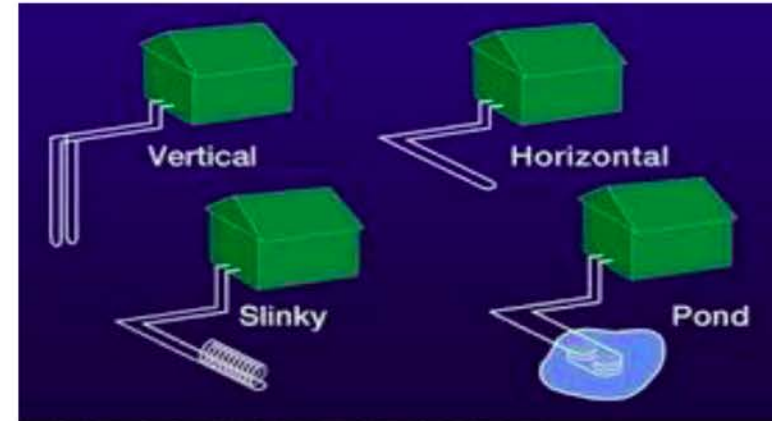
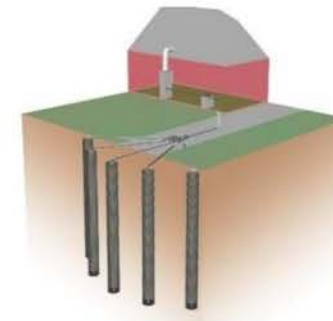
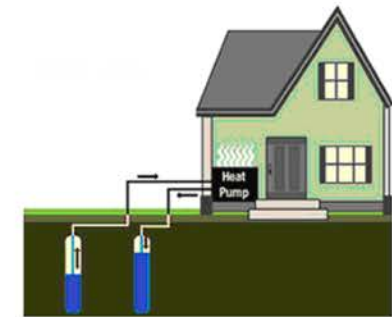


Figure 1 - Types of Closed-Loop Geothermal Systems



Direct Exchange



Open Loop
System

Source:



Heat Pump Equipment



Packaged Systems
[water-to-air]

Heat Pumps' Role in the Transition Away from Fossil Fuels



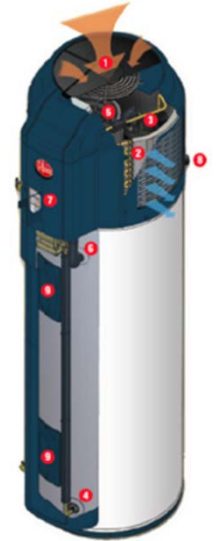
Water-to-Water



Split Systems



Air Source Heat Pumps
(ASHP)
[air-to-air]



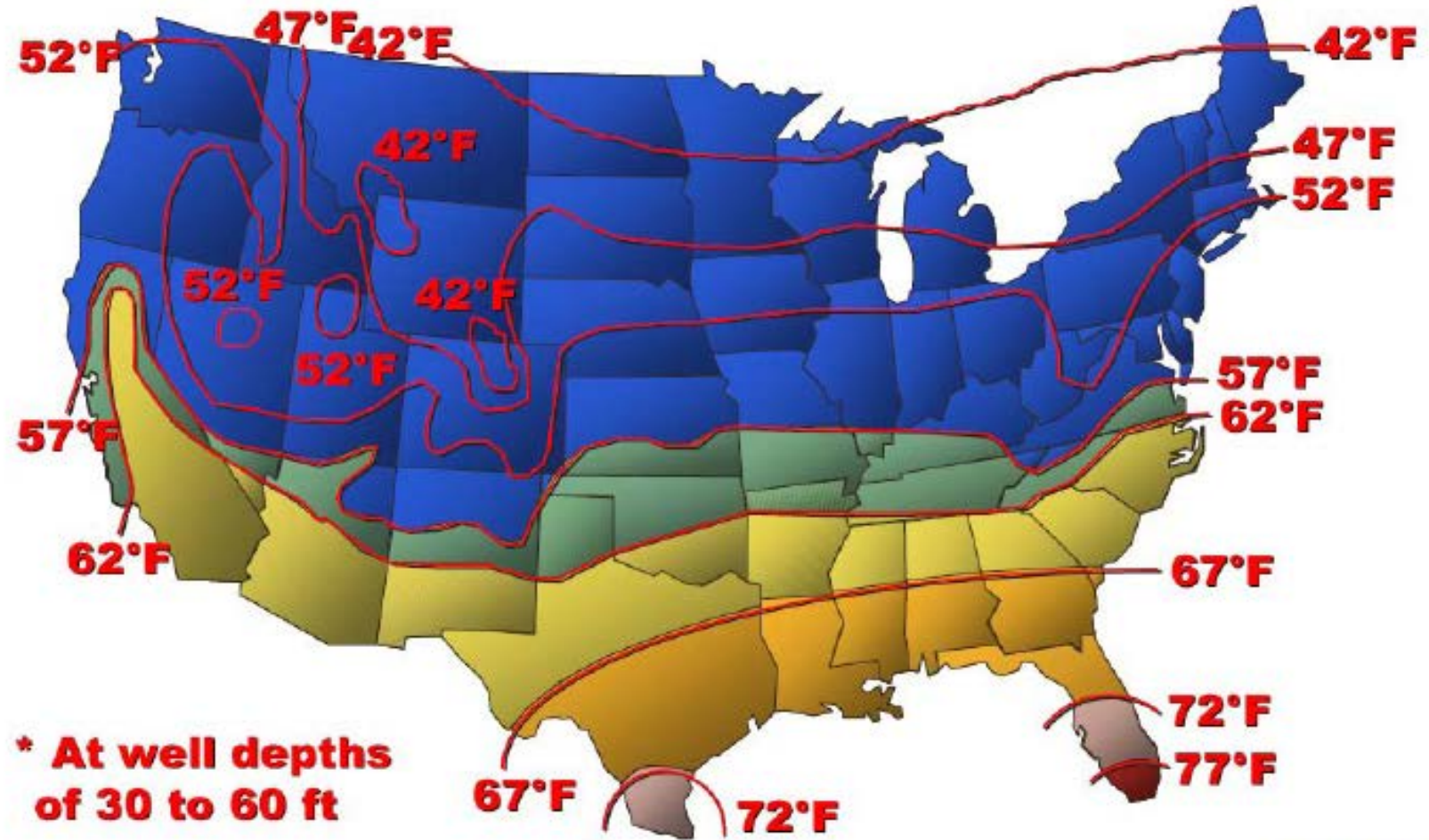
ASHP
[air-to-water]

John P. Ciovacco

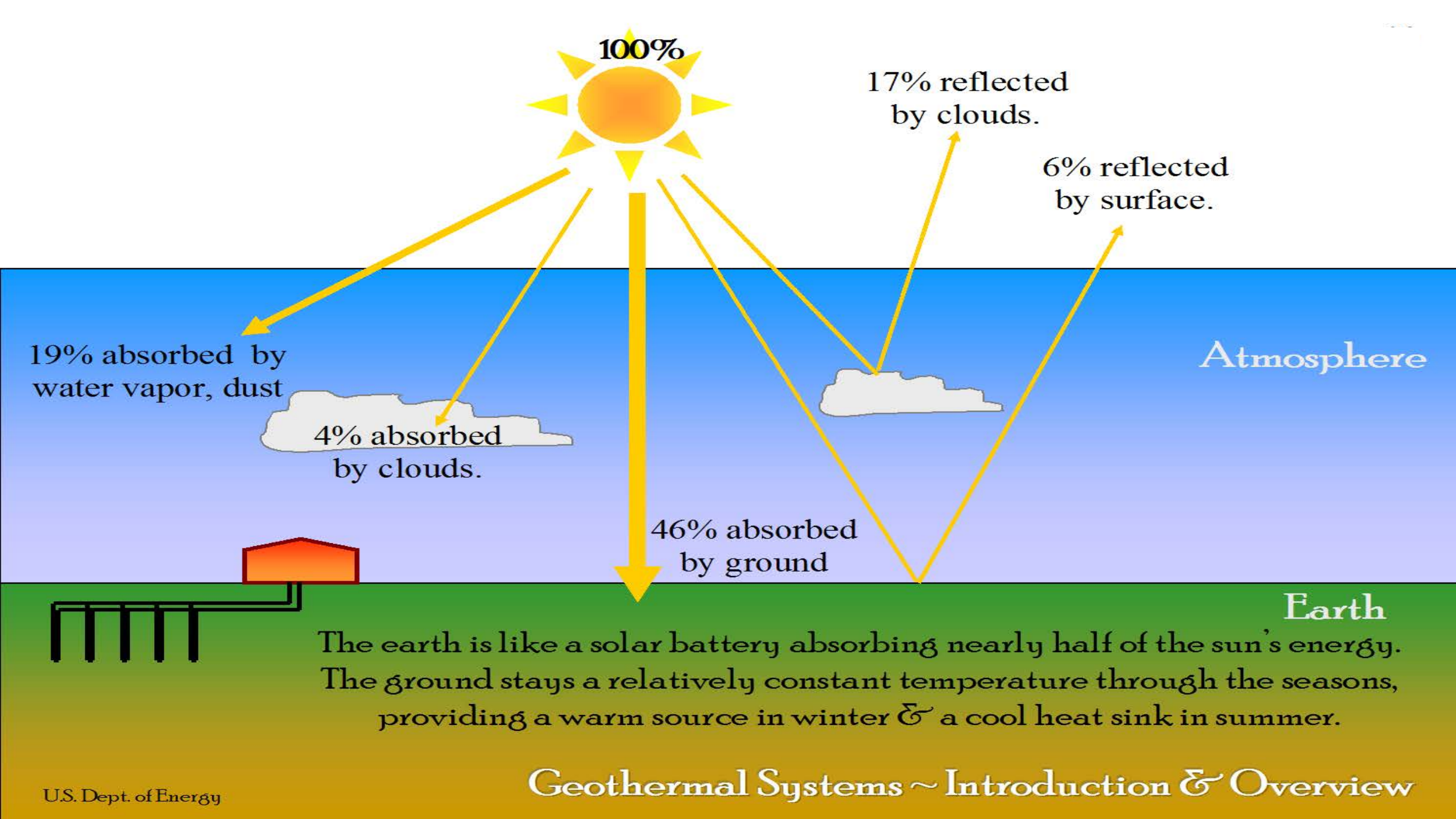
Basic Principles & Operation of Heat Pumps

Ground Source Heat Pump - US Ground Temperatures

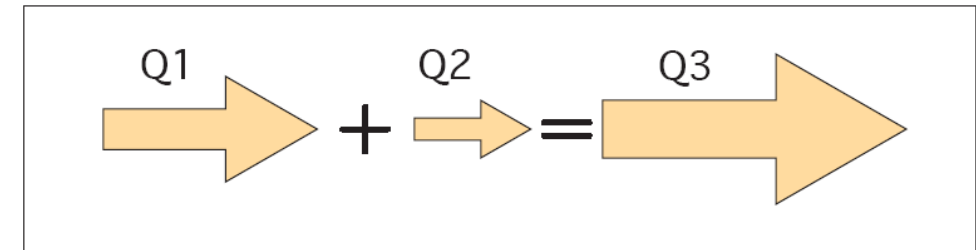
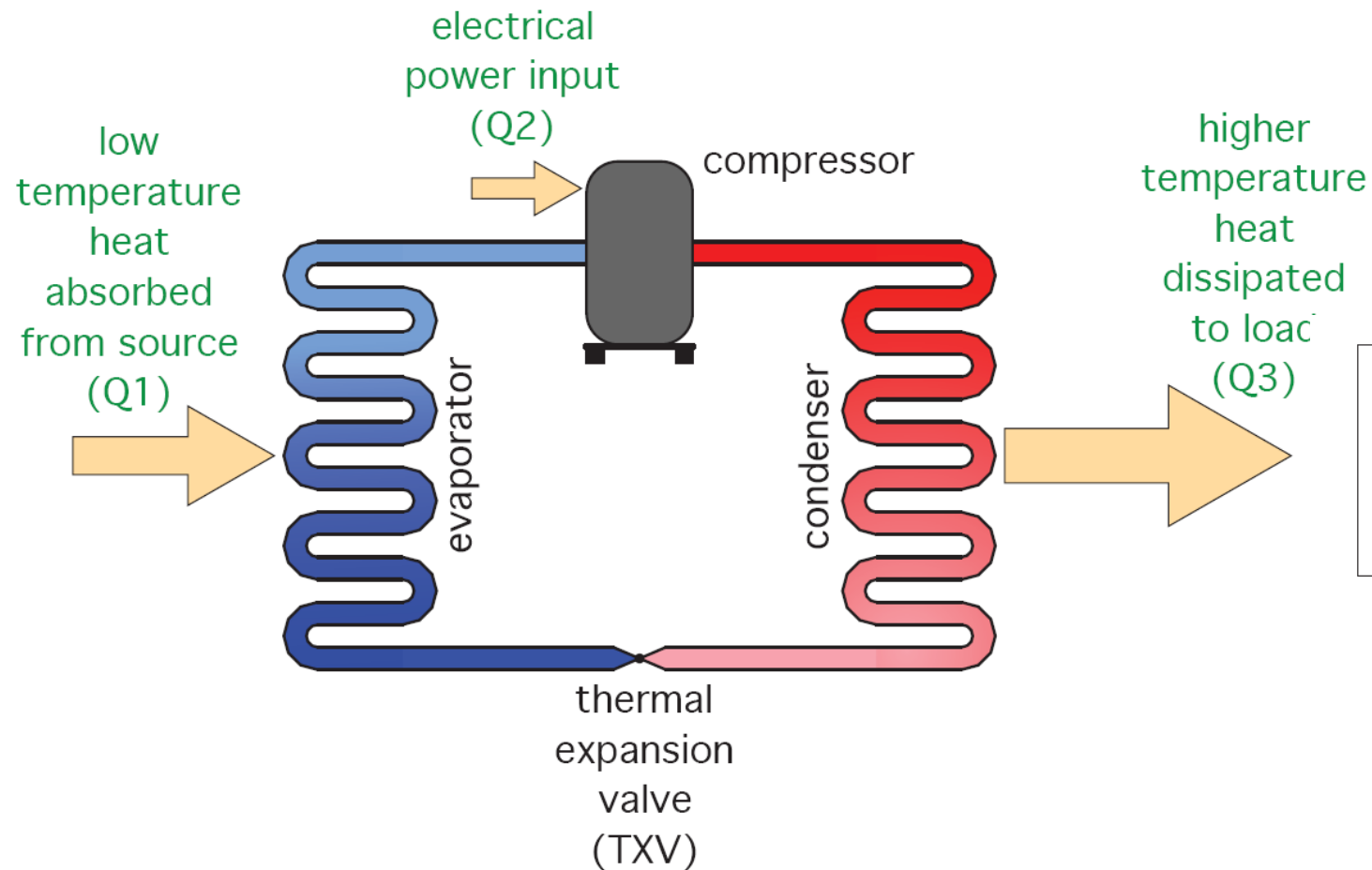
This is
the
GSHP Map.



© DPCE 2002



Heat Pump Basics



Coefficient of Performance (COP)

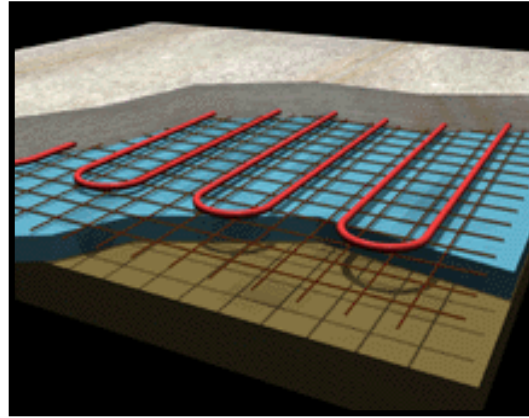
$$\text{COP} = \frac{\text{power output } (Q3)}{\text{power input } (Q2)}$$

Source: idronics™ Journal by Caleffi Hydronic Solutions

Distribution Systems for Lower Temp Heat



Hot Water Baseboard



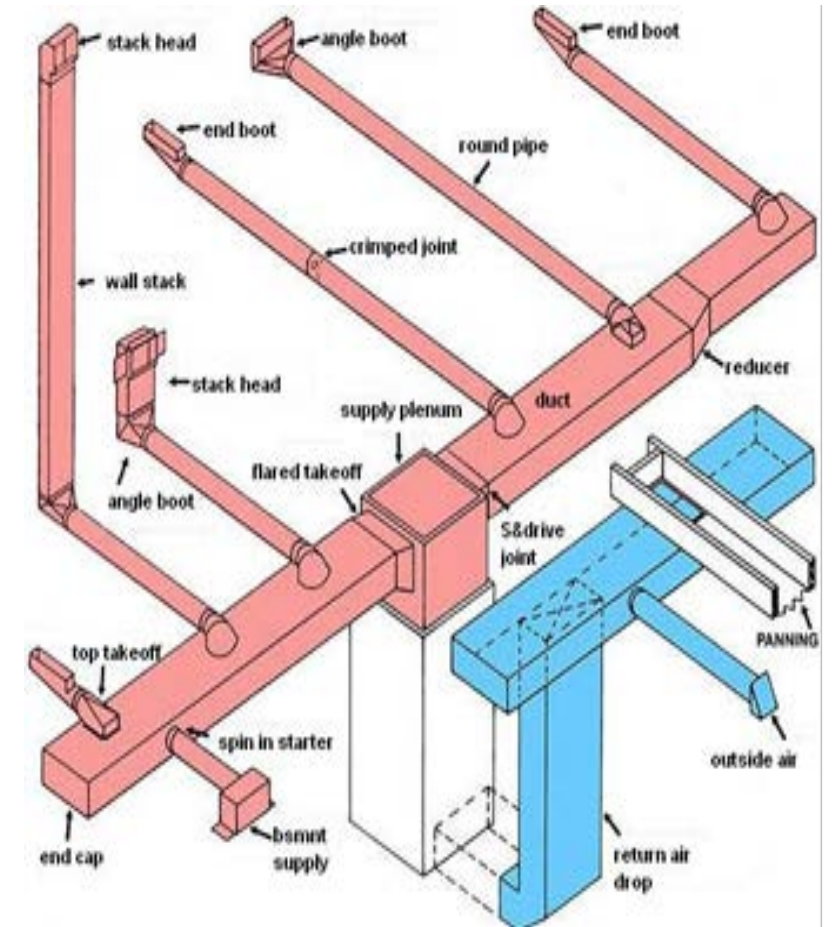
Radiant



Radiant Panels
(aka – low temp radiators)



Ductless



Ductwork



Symphony
Internet
Gateway

Geothermal
Heat Pump

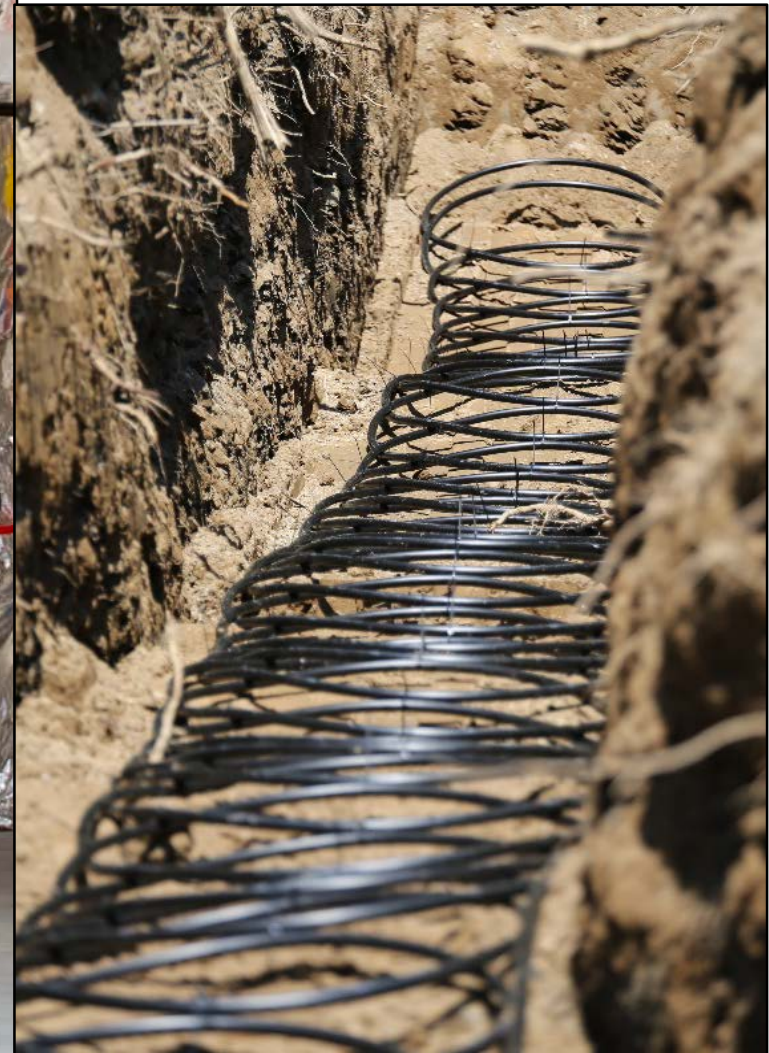
Humidifier

Zone
Control
Panel

Ground
Loop
Water OUT

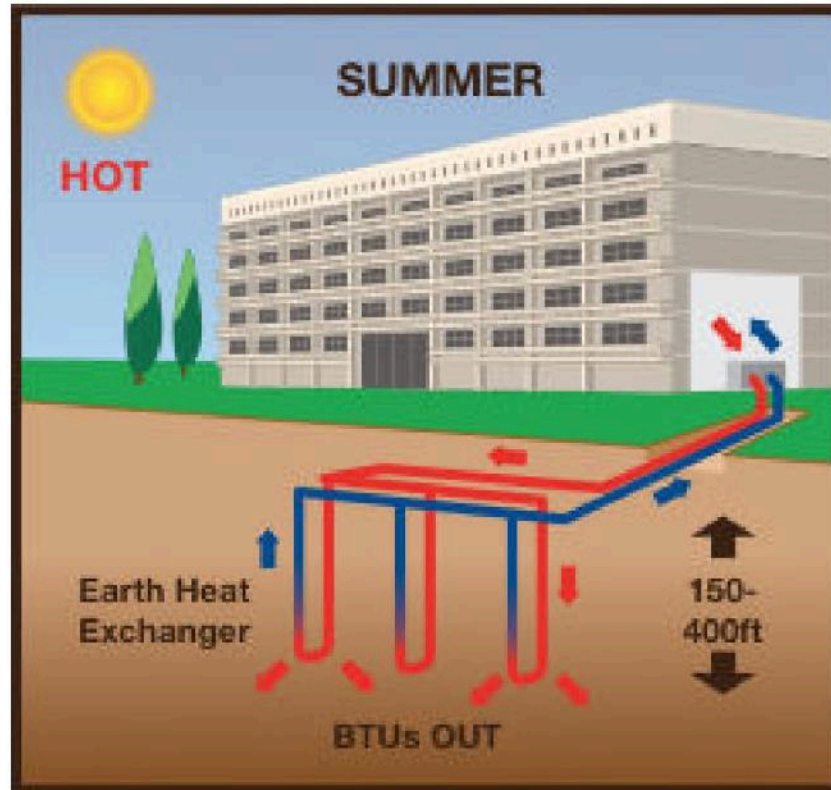
Ground
Loop
Water IN

Flow Center -
Ground Loop
Circulator

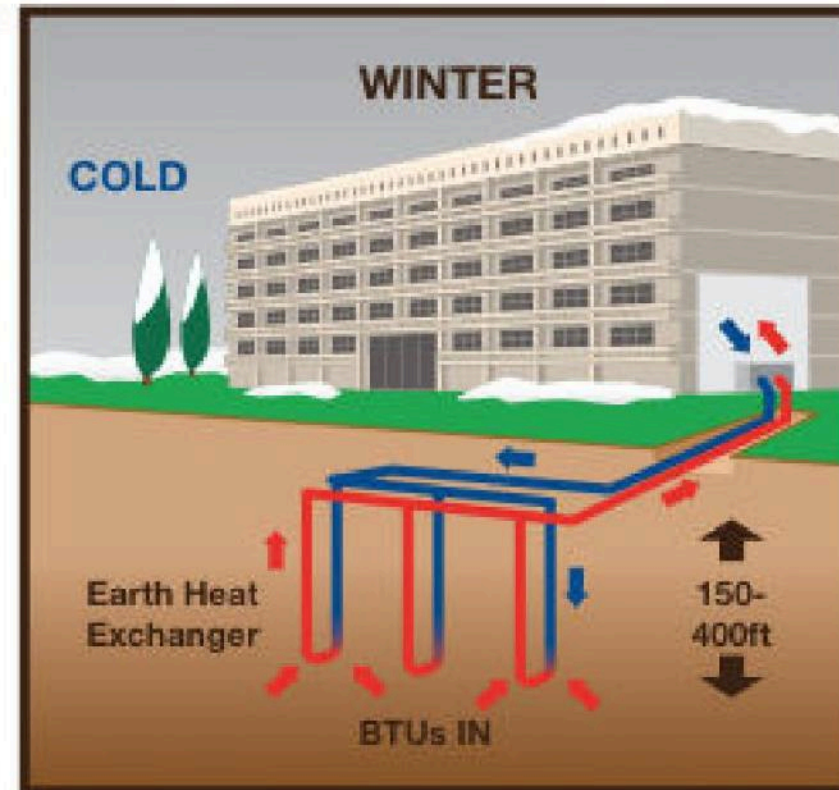


GHP Systems are Reversible

Sink for Heat in
the Summer

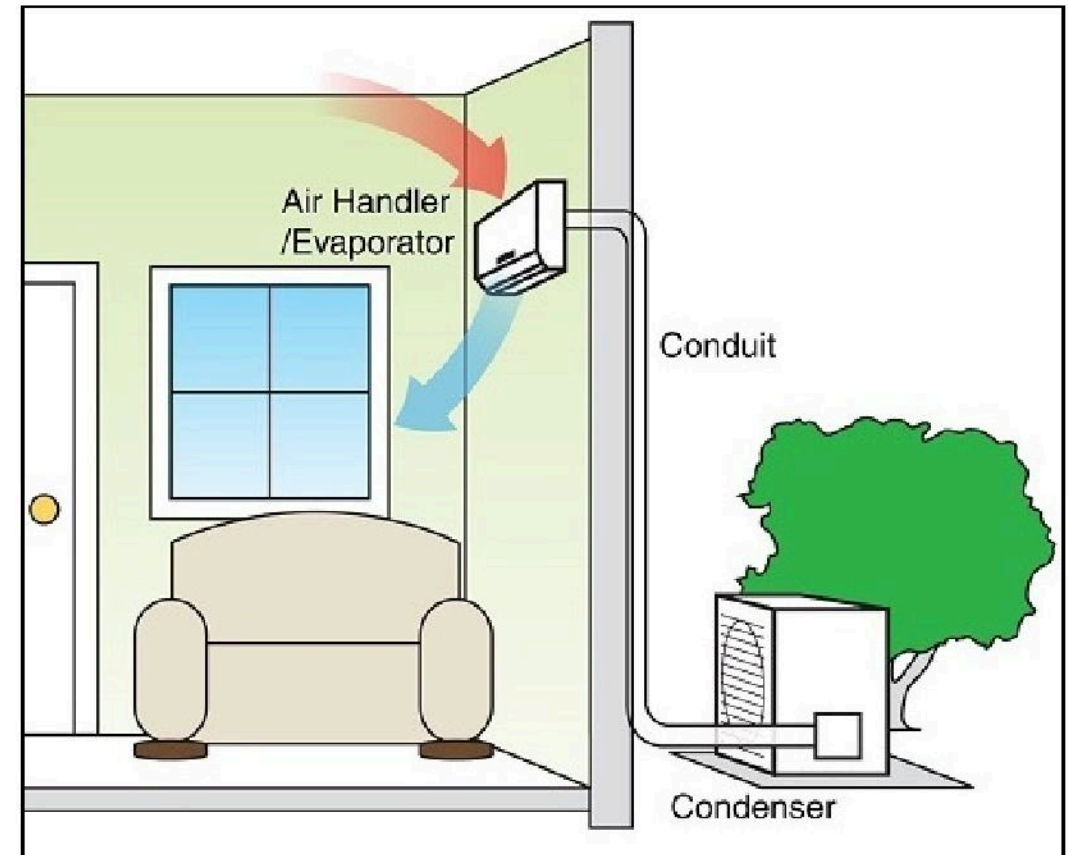


Source of Heat
in the Winter



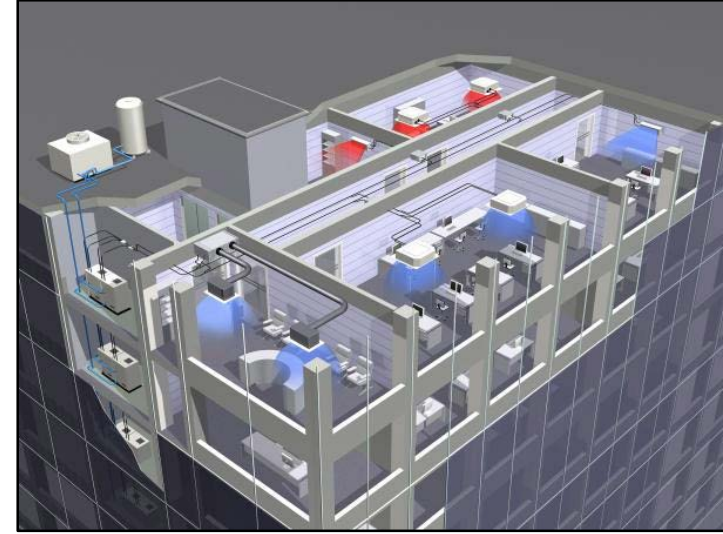
Ductless Mini-Split Heat Pumps

- Heating & AC
- Ductless with conditioned air delivered directly
- Inverter / variable speed compressors increase part-load efficiency
- Current technology maintains operation to -13 F



Variable Refrigerant Flow (VRF) Systems

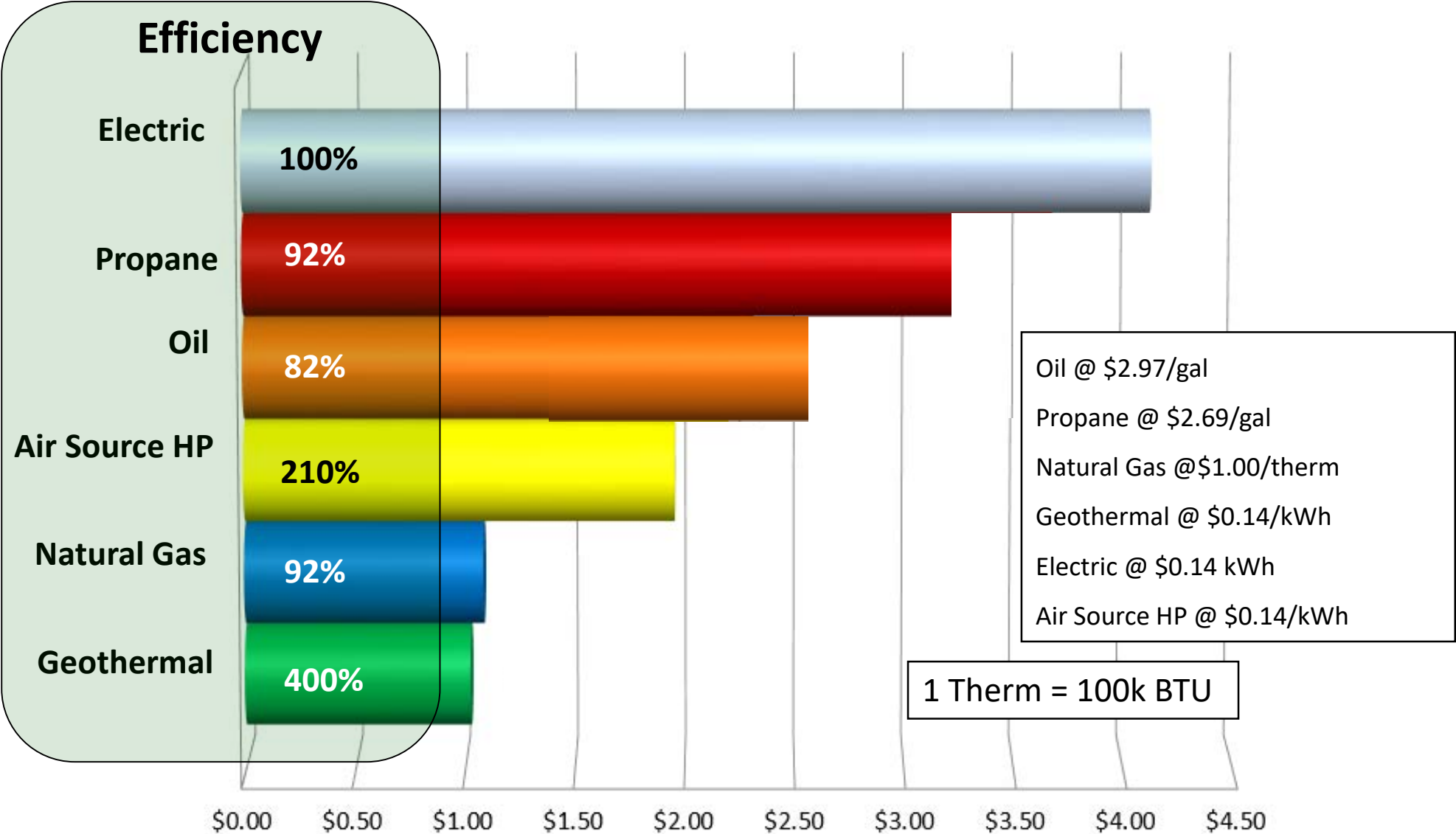
- Centrally located driven compressors
- Multiple “evaporators” from single “condensing unit”
- Simultaneous heating & cooling
- Small diameter refrigerant distribution in building
- Expanded range of ground loop temperature (23F – 113F) –reduced field sizes



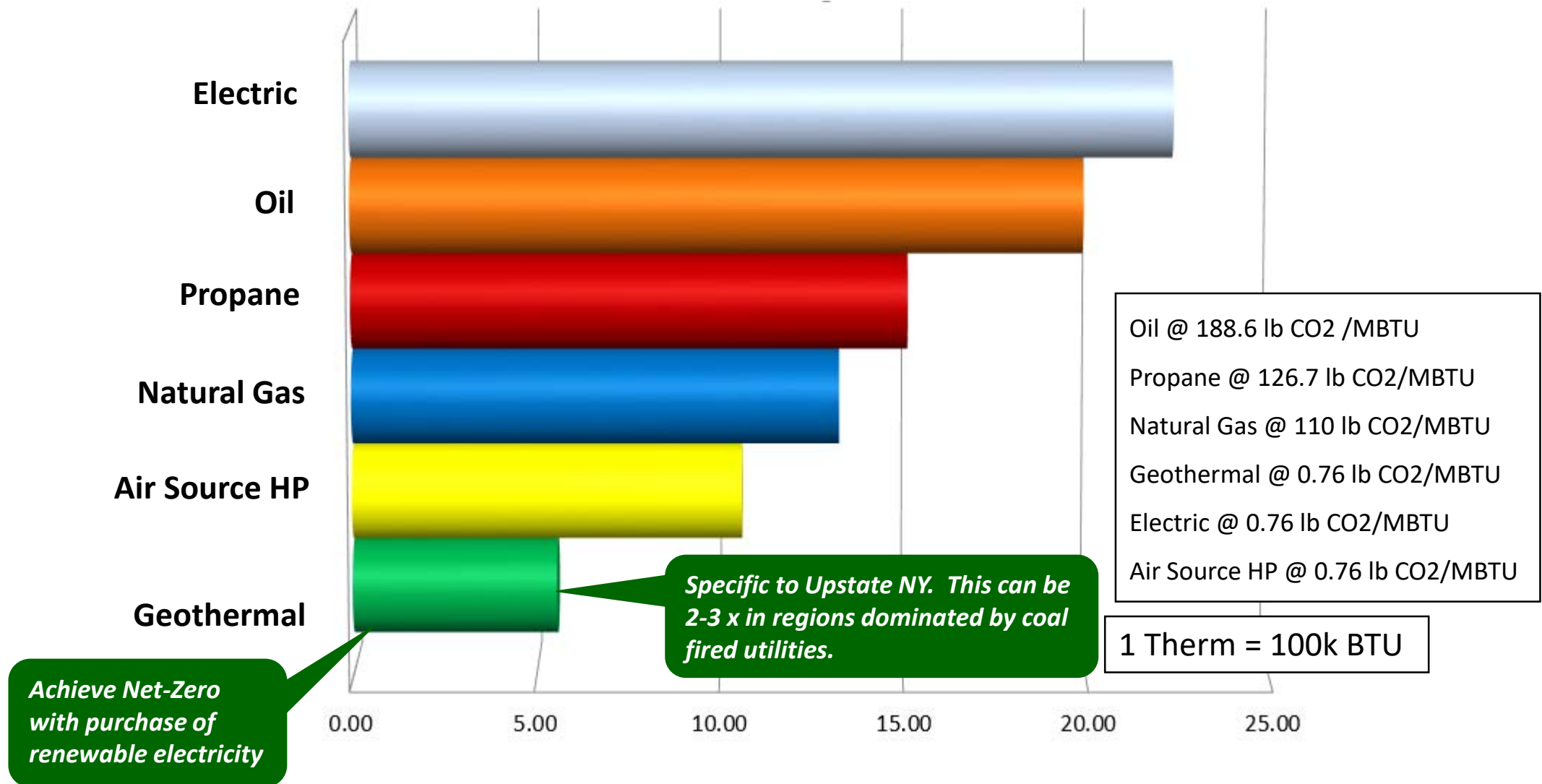
Mitsubishi Electric



Cost of Heat per Therm NYS



Pounds of CO2 per Therm



Electric Heat Pumps: Air Source and Ground Source

	Geothermal Heat Pump	Air Source Heat Pump
Seasonal Heating Efficiency (Climate Zones 5 & 6)	<ul style="list-style-type: none">• 300% - 500% Efficient• COP 3.5 to 5	<ul style="list-style-type: none">• 200% - 250% Efficient• COP 2 to 2.5
Operating Cost (Heating)	<ul style="list-style-type: none">• Similar to Natural Gas• About ½ the cost of Propane or Oil	<ul style="list-style-type: none">• Often lower than Oil and Propane – depends on price/gallon
Operating Cost (AC)	<ul style="list-style-type: none">• ~1/2 the cost of AC	<ul style="list-style-type: none">• About the same cost as AC
Installation Cost for 2,500 SF	<ul style="list-style-type: none">• \$25K - \$40K+	<ul style="list-style-type: none">• \$6K to \$25K+ – large range
Typical Product Form	Whole house central systems covering 100% of heating and cooling needs	Distributed distribution heads covering a large room or area, existing heating system remains in place
Shut off Temperature	Will not shut off due to cold temperatures	Range from 5F to -17F depending on model

Barriers to Adoption

- **High first costs**
- **Limited training available for installers, designers, project managers, architects, and engineers**
- **Lack of consumer knowledge and awareness**

NYSERDA CH&C Programs

(Reducing Costs and Lowering Barriers)

- **Air Source Heat Pumps (ASHP) Program [PON 3635 \$10.95M]**
 - NYSERDA will provide up to \$10.95 million in incentives to participating installers for the installation of program qualified ASHP systems in residential sites to include single-family and multifamily buildings through 2020. Incentives of \$500 per installed program qualified ASHP system are available only to participating installers on a first-come, first-served basis, up to \$500,000 per participating installer.
 - <https://www.nyserda.ny.gov/All-Programs/Programs/Air-Source-Heat-Pump-Program>
- **Ground Source Heat Pumps (GSHP) Rebate Program [PON 3620 \$15M]**
 - Offers \$15 million to support the installation of ground source heat pump systems at residential, commercial, institutional, and industrial buildings. Funding is available only to eligible designers and installers of renewable heating and cooling systems that have been approved by NYSERDA through June 2019. ***Program will be extended to 12/31/2019***
 - <https://www.nyserda.ny.gov/All-Programs/Programs/Ground-Source-Heat-Pump-Rebate>

NYSERDA CH&C Programs

(Reducing Costs and Lowering Barriers)

Clean Heating & Cooling Communities Campaigns [PON 3723]

- Support for communities to increase customer awareness of CH&C technologies, reduce installed costs, and jump-start the market by implementing multi-year campaigns consisting of community-based outreach and education focused on CH&C.
- NYSERDA will provide technical assistance to run effective programs
- Encouraging installations in low-to-moderate income residents
- <https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Heating-and-Cooling-Communities>

Cooperative Advertising and Training for HVAC Partners [PON 3694 / \$1.5 Million]

- NYSERDA has made \$1.5 million available to support advertising, special promotions and/or events, including training, for eligible HVAC technologies. NYSERDA's Cooperative Advertising and Promotion Program for HVAC Partners offers incentives up to 50 percent of the total cost for educational and marketing promotion opportunities to eligible HVAC participants, such as HVAC manufacturers, HVAC distributors/vendors and HVAC installers participating in PON 3653: Air-Source Heat Pump Program or PON 3620: Ground-Source Heat Pump Rebate.
- [https://portal.nyserda.ny.gov/CORE Solicitation Detail Page?SolicitationId=a0rt000000AH0ZZAA1](https://portal.nyserda.ny.gov/CORE_Solicitation_Detail_Page?SolicitationId=a0rt000000AH0ZZAA1)

Incentive Programs for Heat Pumps – Capital District

GSHP Incentives Summary - Capital District

	Residential	Commercial: (for profit)	Commercial (not for profit)
Federal Tax Credit	30% Unlimited	10% Unlimited	N/A
Depreciation	N/A	5 Year MACRS	N/A
NYSERDA Rebate	\$1,500/ton, \$15K cap	\$1,200/ton, \$500K cap	\$1,200/ton, \$500K cap
National Grid Rebate Two Efficiency Levels	\$200 to \$400/ton, \$1.5K cap	Custom	Custom
NYSEG Rebate (2019)	TBD	Custom	Custom
Central Hudson G&E	\$264 Rate Impact Credit	N/A	N/A

ASHP Incentives Summary - Capital District

	Residential	Commercial
NYSERDA Rebate	Mini-Split \$500/system	TBD
	Central \$1,000/ton cap TBD	TBD
National Grid Rebate (Style & Effec. Levels)	\$200 to \$375/ton, \$1.1K cap	Custom
NYSEG Rebate (2019)	\$200 to \$300/unit, cap TBD	Custom
Central Hudson G&E	\$50 to \$300/unit	\$50 to \$300/ton

ASHP Water Heater Incentives Summary - Capital District

	Residential	Commercial (not for profit)
National Grid Rebate	\$300/unit	N/A
Central Hudson G&E	\$125 to \$750/unit	N/A

Changes to Look for in 2020+

Utilities to Take Over Heat Pump Incentives

- New Efficiency New York – PSC Order
- NYSERDA Heat Pump Analysis

New Electric Rates Available

- Proposed a Beneficial Electrification (BE) Rate
 - Demand based on delivery
 - Time of Use (TOU) on supply

Gas Constrained Areas – More Incentives

- E.g., Westchester Clean Energy Action Plan

nationalgrid





Thank You, and Any Questions?

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