Heat Pumps:
The Heart of Clean Heating & Cooling
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Aztech Geothermal, LLC

- Full Service Heat Pump Provider
  - 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

www.aztechgeo.com
FOSSIL FUELS CRUSHING YOU?
BEST INCENTIVES EVER, CALL US NOW!

AztechGeotech.com | 518-309-2000
A BETTER Way to Heat and Cool Your Home.

Ground Source Heat Pump (GSHP) System

Warmer.
Cooler.
Cheaper.
Cleaner.

Aztech Geothermal
National Grid
Water Furnace

Smarter from the Ground Up™
NYS Energy Policy & Heat Pumps
That’s Todd!
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%
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.
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 Pumps Equiment

Packaged Systems [water-to-air]

Split Systems

Water-to-Water

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

ASHP [air-to-water]

Heat Pumps’ Role in the Transition Away from Fossil Fuels
John P. Ciovacco
Basic Principals & Operation of Heat Pumps
Ground Source Heat Pump - US Ground Temperatures

This is the GSHP Map.

* At well depths of 30 to 60 ft
Heat Pumps' Role in the Transition Away from Fossil Fuels

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The earth is like a solar battery absorbing nearly half of the sun’s energy. The ground stays a relatively constant temperature through the seasons, providing a warm source in winter & a cool heat sink in summer.

Geothermal Systems ~ Introduction & Overview
Heat Pump Basics

Source: idronics™ Journal by Caleffi Hydronic Solutions

Coefficient of Performance (COP)

\[
COP = \frac{\text{power output}}{\text{power input}} \quad (Q3)
\]

Q1 + Q2 = Q3
Heat Pumps’ Role in the Transition Away from Fossil Fuels

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Distribution Systems for Lower Temp Heat

- Hot Water Baseboard
- Ductless
- Radiant
- Ductwork

Radiant Panels
(aka – low temp radiators)
4 Ton Dual Speed Residential System with Horizontal Ground Loop

- Humidifier
- Zone Control Panel
- Ground Loop Water OUT
- Ground Loop Water IN
- Symphonic Internet Gateway
- Geothermal Heat Pump
- 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
Cost of Heat per Therm NYS

- Electric: 100%
- Propane: 92%
- Oil: 82%
- Air Source HP: 210%
- Natural Gas: 92%
- Geothermal: 400%

Oil @ $2.97/gal
Propane @ $2.69/gal
Natural Gas @$1.00/therm
Geothermal @ $0.14/kWh
Electric @ $0.14 kWh
Air Source HP @ $0.14/kWh

1 Therm = 100k BTU
Heat Pumps’ Role in the Transition Away from Fossil Fuels

John P. Ciovacco

Pounds of CO2 per Therm

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>CO2 Emissions (lb CO2/MBTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>188.6</td>
</tr>
<tr>
<td>Propane</td>
<td>126.7</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>110</td>
</tr>
<tr>
<td>Air Source HP</td>
<td>0.76</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.76</td>
</tr>
</tbody>
</table>

1 Therm = 100k BTU

Specific to Upstate NY. This can be 2-3x in regions dominated by coal fired utilities.

Achieve Net-Zero with purchase of renewable electricity.
## Electric Heat Pumps: Air Source and Ground Source

<table>
<thead>
<tr>
<th></th>
<th>Geothermal Heat Pump</th>
<th>Air Source Heat Pump</th>
</tr>
</thead>
</table>
| **Seasonal Heating Efficiency (Climate Zones 5 & 6)** | • 300% - 500% Efficient  
• COP 3.5 to 5  | • 200% - 250% Efficient  
• COP 2 to 2.5  |
| **Operating Cost (Heating)** | • Similar to Natural Gas  
• About ½ the cost of Propane or Oil | • Often lower than Oil and Propane – depends on price/gallon |
| **Operating Cost (AC)**    | • ~1/2 the cost of AC                   | • About the same cost as AC                              |
| **Installation Cost for 2,500 SF** | • $25K - $40K+  | • $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](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](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](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

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Commercial: (for profit)</th>
<th>Commercial: (not for profit)</th>
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</thead>
<tbody>
<tr>
<td>Federal Tax Credit</td>
<td>30% Unlimited</td>
<td>10% Unlimited</td>
<td>N/A</td>
</tr>
<tr>
<td>Depreciation</td>
<td>N/A</td>
<td>5 Year MACRS</td>
<td>N/A</td>
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<tr>
<td>NYSERDA Rebate</td>
<td>$1,500/ton, $15K cap</td>
<td>$1,200/ton, $500K cap</td>
<td>$1,200/ton, $500K cap</td>
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<tr>
<td>National Grid Rebate</td>
<td>$200 to $400/ton, $1.5K cap</td>
<td>Custom</td>
<td>Custom</td>
</tr>
<tr>
<td>NYSEG Rebate (2019)</td>
<td>TBD</td>
<td>Custom</td>
<td>Custom</td>
</tr>
<tr>
<td>Central Hudson G&amp;E</td>
<td>$264 Rate Impact Credit</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### ASHP Incentives Summary - Capital District

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<th></th>
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<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYSERDA Rebate</td>
<td>Mini-Split $500/system</td>
<td>TBD</td>
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<tr>
<td>Central Hudson G&amp;E</td>
<td>$50 to $300/unit</td>
<td>$50 to $300/ton</td>
</tr>
</tbody>
</table>

#### ASHP Water Heater Incentives Summary - Capital District

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<th>Residential</th>
<th>Commercial: (not for profit)</th>
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</thead>
<tbody>
<tr>
<td>National Grid Rebate</td>
<td>$300/unit</td>
<td>N/A</td>
</tr>
<tr>
<td>Central Hudson G&amp;E</td>
<td>$125 to $750/unit</td>
<td>N/A</td>
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</tbody>
</table>
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
Thank You, and Any Questions?

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