Heat Pumps: Not Pipelines

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AGREE New York
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We work together to:

*reduce* fossil fuels used for heating and cooling;

*educate* people about heat pumps;

*accelerate* heat pump adoption;

*advocate* for policies that will enable all New Yorkers to afford to make the switch!

renewableheatnow.org
We can't solve problems by using the same kind of thinking we used when we created them.

-Albert Einstein
What do we use energy for?
How much does all this energy cost us?

$50 billion per year

Per person per year: $2,524
Hidden Costs

• Extreme weather, made worse by climate change, along with the health impacts of burning fossil fuels, has cost the U.S. economy at least $240 billion a year over the past ten years. (2017, National Geographic)
Main Sources Of Greenhouse Gases in NYS

- Transportation: 34%
- Buildings: 32%
- Electricity: 20%
- Waste & Other: 8%
- Industry: 6%

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

Heat Pumps: Not Pipelines
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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
2015 NYS Energy Plan: Goals by 2030

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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. 100% by 2050

70%
100% by 2050

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Heat Pumps Can Play a Big Role in These Areas
How do we get there?

- Energy efficiency and conservation
- 100% Renewable Electricity
- System balancing
- Electrify Everything

Heat Pumps, Not Pipelines!
Large Scale Beneficial Electrification Required

40% GHG Emissions Reduction by 2030
Requires Significant Conversions / Additions:
- 3.3 Million Battery Electric Vehicles 220,000 per Year
- 3.5 Million Housing Unit Heat Pumps 233,000 per Year
- 40% Commercial, Industrial Buildings with Heat Pumps 27,000 per Year
- 82.1 Terra-Watt Hours of Carbon Free Electric Power 5.5 TWh per Year

80% GHG Emissions Reduction by 2050
Requires Additional Conversions / Additions of:
- 5.2 Million Battery Electric Vehicles 260,000 per Year
- 3 Million Housing Unit Heat Pumps 150,000 per Year
- 80% Commercial, Industrial Buildings with Heat Pumps 20,250 per Year
- 86.3 Terra-Watt Hours of Carbon Free Electric Power 4.3 TWh per Year

Source: Jerry Acton - April 11, 2019

Heat Pumps: Not Pipelines
Heat Pump Basics

Coefficient of Performance (COP)

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

3 Units of renewable thermal energy from the air, ground, lake or pond.

1 Unit of electricity we buy.

4 Units of thermal energy to the space - that’s a COP = 4

Source: idronics™ Journal by Caleffi Hydronic Solutions

Heat Pumps: Not Pipelines
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)

Direct Exchange | Open Loop System

Source: NYSEDA

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ASHP - Ductless Mini-Splits

- 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 compressors
- Multiple indoor distribution units from single compressor unit.
- Simultaneous heating & cooling
- Small diameter refrigerant distribution in building
- Available in ASHP, WSHP or used as GSHP

Heat Pumps: Not Pipelines
GSHP Closed Loop Options

- Horizontal Loops
- Vertical Loops
- Pond Loops
- Direct Exchange

Heat Pumps: Not Pipelines
Cost of Heat per Therm NYS

1 Therm = 100k BTU

- 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
Pounds of CO2 per Therm

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<th>Fuel Type</th>
<th>CO2 Emissions (lb CO2/MBTU)</th>
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<tr>
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<tr>
<td>Geothermal</td>
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</tr>
</tbody>
</table>

1 Therm = 100k BTU

Achieve Net-Zero with purchase of renewable electricity

Specific to Upstate NY. This can be 2-3 x in regions dominated by coal fired utilities.
London Heat Map - 2009

WHAT IS IT?

- A user-friendly, map-based, web application which provides a variety of heating data for the greater London area.
- The map’s primary use is for identifying opportunities for decentralized energy projects in London.
- Provides energy and financial analysis for various combinations of buildings.
- Primarily focused on high temperature heating but it’s moving in the right direction.
London Waste Heat Map - 2014

WHAT’S DIFFERENT?

• Also an interactive map-based, web application showing “waste heat” sources.
• The published study cites 11 sources of waste heat into 3 categories.

Environmental Sources
  • Ground, Air, River

Process Sources
  • Power Plants, Industrial, Commercial

Infrastructure Sources
  • Sewer Heat, Substation Transformers, London Underground

These Waste Heat Sources are in the temperature range of commercially available Heat Pumps.

"I am convinced that with the increasing use of renewable power sources, large-scale heat pumps connected to district heating systems will play a major role in the future heating of cities in the UK."

-Lucy Padfield, Dir of District Heating, Ramboll
Are the utilities on board with this?

- Heat Pump Incentives
- Oil to Gas Conversions
- Pipeline Expansions
- Ongoing Gas Investment
- Manufactured Moratoria
Natural Gas – forces changing the market

- NYS GHG Reduction goals indicate no fossil fuels after 2050
  - Pipeline extensions and repairs are being viewed from this perspective.
  - Presently 60 to 85 years are common depreciation schedules
  - Potential of “Stranded Assets” based on NYS policy direction

- 20 Year GWP methane goes from a 34 to 86 multiplier based on CO2

- Leakage rates for natural gas will likely be set at 4% of delivered fuel
  - Will make buildings the #1 GHG emissions source in NYS – larger than transportation

- “100 Foot Rule” is being challenged by environmental groups
  - Presently utilities book these connections at $12K - $25K+ for single family homes

Utilities not permitted to rate-base ground loop assets
Who makes decisions over the utilities?

John B. Rhodes, Chair

Gregg C. Sayre  Diane X. Burman  James S. Alesi  Tracy Edwards
PSC Process

• Legalistic vs Democratic
• Utilities have an advantage
Join us on October 17 to hold the PSC accountable