Building Electrification and Clean Heating and Cooling: Business Strategies for a Carbon Constrained Economy

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Venetia Lannon – Vice President, Matrix New World Energy
New York State Clean Energy Agenda in Alignment

> Heat Pump Technologies – how they work
> Legislation, Policy, and Regulations
> Programs
> Next Steps
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)
> Transfer heat between your house and the outside air
Clean Heating & Cooling Technologies

**Air Source Heat Pumps**
- Central Ducted
- Ductless Mini-Split
- Heat Pump Water Heater
- Variable Refrigerant Flow (VRF)

**Ground/Water Source Heat Pump Systems**
- Direct Exchange
- Closed-Loop Geothermal Systems
- Open Loop System
Legislation

Climate Leadership and Community Protection Act (CLCPA)

- Established to adopt measures that put New York on a path to reduce statewide greenhouse gas emissions by 80% by 2050 and net zero emissions in all sectors of the economy.

- By exercising a global leadership role on greenhouse gas mitigation and climate change adaptation, New York will position its economy, technology centers, financial institutions, and businesses to benefit from national and international efforts to address climate change.

- Develop measures to achieve reductions in energy use in existing residential or commercial buildings, including beneficial electrification of water and space heating in buildings, establishing appliance efficiency standards, strengthening building energy codes, requiring annual building energy benchmarking, and disclosing energy efficiency in home sales.

New York City Local Law #97

- The most ambitious in the world to tackle emissions from existing buildings and impacts over 57,000 buildings over 25,000 square feet across the city (59% residential and 41% commercial) with the goal of reducing building-based emissions 40% by 2030 from a 2005 baseline.

- Sets increasingly stringent limits on carbon emissions per square foot in 2024 and 2030.
Policy

Order Authorizing Utility Energy Efficiency and Building Electrification Portfolios Through 2025 (Issued on January 16, 2020)

> The Order transfers responsibility for heat pump targets and incentives to the utilities effective April 1, 2020
> Budget of $454M and a target of 3.6 TBtu's in energy savings through 2025
> NYSERDA will focus on and support market enablement activities (budget TBD)

> Including but not limited to:
  • Workforce development
  • Consumer education and awareness
  • Low- to moderate-income consumers
  • Supply chain development
  • Clean Thermal District Systems
### Appendix C - Table C1

#### 2020-2025 Heat Pump Budgets and Targets (Gross MMBtu)

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2020-2025 Total</th>
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<td><strong>Central Hudson</strong></td>
<td></td>
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<td>48,190</td>
<td>56,479</td>
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<td><strong>Con Edison</strong></td>
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<tr>
<td>Base Budget</td>
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<td>Base Target</td>
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<td>119,716</td>
<td>151,334</td>
<td>186,941</td>
<td>219,927</td>
<td>249,162</td>
<td>1,000,000</td>
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<tr>
<td><strong>Niagara Mohawk</strong></td>
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<tr>
<td>Base Budget</td>
<td>$6,983,416</td>
<td>$11,891,672</td>
<td>$14,789,044</td>
<td>$16,424,789</td>
<td>$17,190,980</td>
<td>$17,118,933</td>
<td>$84,398,834</td>
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<tr>
<td>Base Target</td>
<td>71,239</td>
<td>132,010</td>
<td>172,203</td>
<td>210,694</td>
<td>245,889</td>
<td>280,647</td>
<td>1,112,681</td>
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<td>$10,605,014</td>
<td>$13,173,160</td>
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<td>$15,300,267</td>
<td>$15,219,288</td>
<td>$75,130,577</td>
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<td>117,911</td>
<td>153,328</td>
<td>187,944</td>
<td>219,558</td>
<td>250,383</td>
<td>992,737</td>
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<td><strong>O&amp;R</strong></td>
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<td>$15,003,888</td>
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<td>10,421</td>
<td>13,027</td>
<td>16,109</td>
<td>18,912</td>
<td>21,748</td>
<td>86,657</td>
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<tr>
<td>Base Budget</td>
<td>$747,986</td>
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<td>$1,611,466</td>
<td>$1,799,548</td>
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<td>$1,909,389</td>
<td>$9,247,775</td>
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<tr>
<td>Base Target</td>
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<td>14,206</td>
<td>18,304</td>
<td>22,468</td>
<td>26,422</td>
<td>30,282</td>
<td>119,223</td>
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<tr>
<td><strong>Total Heat Pumps</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Base Budget</td>
<td>$36,564,440</td>
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<td>Base Target</td>
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<td>424,448</td>
<td>547,045</td>
<td>672,345</td>
<td>787,186</td>
<td>896,085</td>
<td>3,566,590</td>
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</table>
Next Steps

> Joint Utilities and NYSERDA file the New Efficiency: New York Implementation Plan to DPS on 3/16/2020 for approval to roll out the new incentive programs on 4/1/2020

> NYSERDA submits Investment Plans for the Market Enablement Plans to DPS on 3/16/2020 for approval to start developing programs on 4/1/2020

> Continued engagement with stakeholders
Expanding Heat Pumps 2020 and Beyond

> New Efficiency New York
> Who is Eligible
> How Heat Pumps Contribute
> How Heat Pumps Work
> Environmental and System Benefits
> Market Eligibility
> Customer Economics
> How to Get a Rebate
New Efficiency New York

The Order has directed the Joint Utilities to adopt a minimum 3.6 TBtu savings target through 2025.

Approximate costs are $454 million.

Targets and budgets will be subject to a 2022 review and may be revised upward at that time.

**2020–2025 Heat Pump Budgets and Targets (Gross MMBtu)**

<table>
<thead>
<tr>
<th>Year</th>
<th>2020</th>
<th>20201</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2025</th>
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<td>1,112,681</td>
<td></td>
</tr>
</tbody>
</table>

Source: Order Authorizing Utility Energy Efficiency and Building Electrification Portfolios through 2025
Who is Eligible?

> Prescriptive approaches will be used for residential and small commercial Heat Pump applications

> Custom savings approaches will be used for large commercial and large multifamily applications

> All customer sectors, regardless of existing heating fuel, will be eligible

> Existing buildings and new construction will be eligible
How Heat Pumps Contribute

[Image of a house with wind turbines and a diagram showing energy consumption in the residential sector, with space heating at 44.2%, water heating at 16.9%, space cooling at 8.9%, lighting at 4.6%, refrigeration at 4.0%, electronics at 2.9%, cooking at 1.7%, and wet cleaning at 3.4%.]

Source: Researchgate.net/publication/297725347_Smart_Connected_Buildings_Design_Automation_Foundations_and_Trends
Heat Pump Options

Ground Source (geothermal)

Air Source Heat Pumps

Source: 3 nyserda.ny.gov/hy/sun-pumpe
Heat Pump Benefits

**Environmental & System**

- Heat pumps create meaningful improvements in overall efficiency and reduce carbon emissions.
- Additionally, as the State addresses customer heating needs in natural gas supply-constrained areas, electrification can be a viable alternative.
- Heat pumps are smart options that can replace both heating and cooling equipment by being warmer, cooler, comfier, easier, cleaner, healthier and safer.

Source: [Order Authorizing Utility Energy Efficiency and Building Electrification Portfolios through 2025](#)
Source: [nationalgridus.com/upstate-ny-home/energy-saving-programs/heating-your-home](#)
Market Eligibility

Customer Economics

Oil ~ $1,900 per heating season
(100 DTH heat load per year = 725 gallons oil X $2.65/gallon)

Savings ~ $925 per heating season

Typical Replacement Cost: $8,000

Geothermal ~ $975 per heating season
(100 DTH heat load per year = 6,500 kWh * $0.15/kWh)
Typical Cost: $35K

Savings ~ $600 per heating season

Air-Source ~ $1300 per heating season
(100 DTH heat load per year = 8,700 kWh * $0.15/kWh)
Typical Cost: $18K
How to Get a Rebate

> Select a participating contractor
> Heat Pumps must be installed by a participating contractor to be eligible for a rebate
> All current NYSERDA participating contractors will be grandfathered into the Program
> Obtain rebate applications at ngrid.com/uny-heatandcool
Venetia Lannon
Vice President
Matrix New World Engineering
Geothermal Energy as a Replacement for Natural Gas in Multifamily Developments

- Geothermal Energy vs. Natural Gas in Multifamily Buildings
- Cost Savings
- Success Stories: Examples from NYS and Beyond
- Our Team: Matrix New World and Buffalo Geothermal
- Appendix: GHG Comparison for Heating Buildings
Geothermal vs. Natural Gas
Geothermal vs. Natural Gas
Geothermal vs. Natural Gas
Cost Savings: NYS and Fed Incentives

**NYSERDA’s Ground Source Heat Pump Rebate Program**
> Large systems in areas impacted by a gas moratorium = $1,500 per ton of cooling capacity up to $5M per project

**Federal govt. energy tax credit provides 10% tax credit**
> All commercial geothermal system-related expenses, broadly defined (heat pumps, hot water plumbing, GC expenses, etc.)

**Federal govt. also offers 1-5 year accelerated depreciation**
> For all costs associated with geothermal installations provides tax savings of 25% (on corporate income) in the first year after construction is completed or it can be spread out over 5 years
Cost Savings: Example 400-Unit Building

<table>
<thead>
<tr>
<th>Capital Costs and Subsidies</th>
<th>Natural Gas</th>
<th>Geothermal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upfront System Equipment</td>
<td>$13M</td>
<td>$19M</td>
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<tr>
<td>Cost Avoidance</td>
<td>na</td>
<td>-$2.5M</td>
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<tr>
<td>NYSERDA Rebate</td>
<td>na</td>
<td>-$1.5M</td>
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<tr>
<td>10% Federal Tax Credit</td>
<td>na</td>
<td>-$1.6M</td>
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<tr>
<td>2020 Tax Benefit</td>
<td>-$0.4M</td>
<td>-$3.8M</td>
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<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$12.6M</strong></td>
<td><strong>$9.6M</strong></td>
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## Cost Savings: Example 400-Unit Building

<table>
<thead>
<tr>
<th>Annual Operating Costs</th>
<th>Natural Gas</th>
<th>Geothermal</th>
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</thead>
<tbody>
<tr>
<td>Power for boilers, domestic hot water, make-up air units</td>
<td>$205K</td>
<td>$30K</td>
</tr>
<tr>
<td>Water/power cooling tower</td>
<td>$67K</td>
<td>na</td>
</tr>
<tr>
<td>Electricity for heat pumps</td>
<td>$250K</td>
<td>$250K</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$100K</td>
<td>$50K</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$622K</strong></td>
<td><strong>$330K</strong></td>
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</tbody>
</table>
Success Stories: Examples from NYS

Zero Place, New Paltz

Type:
New Construction

Lot Size/Wells Drilled:
15,000 sf; 15 wells < 20% of lot; 500’ deep

Use:
42 apartments, 6 commercial spaces

Completion:
Fall 2019

NYSERDA Rebate:
$109K
Success Stories: Examples from NYS

**Siano Building, Buffalo**

**Type:**
New Construction

**Lot Size/Wells Drilled:**
4,000 sf; 9 wells ~ 20% of lot; 230' deep

**Use:**
11 apartments, 3 commercial spaces

**Completion:**
2017

**NYSERDA Rebate:**
$38K
Success Stories: Examples from NYS

Autumn Garden Complex, Lockport

Type:
New Construction

Lot Size/Wells Drilled:
10 acres; 39 wells ~15% of lot; 225’ deep

Use:
72 residential units in multiple buildings

Completion:
2017

NYSERDA Rebate:
$92K
Success Stories: Examples from NYS

Pierce Arrow Building, Buffalo

Type:
Retrofit

Lot Size/Wells Drilled:
40,000 sf; 50 wells 350' deep

Use:
127 apartments, 2 restaurants

Completion:
Winter 2019

NYSERDA Rebate:
$398K
Success Stories: Beyond NYS

**Modello, Burnaby, British Columbia**

**Type:**
New Construction

**Height:**
37 stories

**Use:**
163 residential units
4-story commercial podium
238 underground parking spaces

**Completion:**
2017
Success Stories: Beyond NYS

Compass at Seylynn Village, North Vancouver BC

**Type:**
New Construction

**Height:**
28 stories

**Use:**
247 residential units
pool and underground parking

**Completion:**
2018
Success Stories: Beyond NYS

The Exchange, Vancouver BC

Type:
New Construction/Restoration

Height:
31 stories

Use:
372K sq. ft new office tower
202-room hotel in restored historic Old Stock Exchange building

Completion:
2017
Our Team

**Matrix New World Engineering**
- Complete project management services from our Manhattan office
- Wholly owned construction subsidiary Blue World experienced in site work and all aspects of construction management
- Deep understanding of regulatory landscape

**Buffalo Geothermal**
- Designed and installed 600+ geothermal systems in NYS
- Proven track record of obtaining NYSERDA rebates and fed incentives
Greenhouse Gas Emissions for Residential Heating Options (grams per kilowatt hour)¹


³Indicates the greenhouse gas emissions from electricity used to power geothermal heat pumps; derived by the NY Geothermal Energy Association from New York State’s energy grid emissions data. See https://www.eia.gov/electricity/state/newyork/
For more information please visit:

nyserda.ny.gov/putenergytowork/chc