LED LIGHTING & CONTROLS

COMMERCIAL & COMMUNITY SOLAR

BATTERY ENERGY STORAGE

ELECTRIC VEHICLE CHARGING

• ARMONK, NY
• BROOKLYN, NY
• NEWBURGH, NY
• STOCKHOLM, SE
UNIQUE GEOTHERMAL BUSINESS MODEL
IN-HOUSE ENGINEERING & DESIGN, DRILLING, FINANCE AND ONGOING O&M

- Initial feasibility
- Incentive guidance
- In-house engineering and design expertise
- Brightcore drill rigs: conventional and innovative (incline, water hammer, electric, etc.)
- In-house licensed master drillers

- Energy modeling and asset optimization
- Ongoing monitoring and maintenance
- Geothermal-as-a-service
- In-house capital

✓ TURNKEY MODEL
✓ TECHNICAL EXPERTISE
✓ IN-HOUSE DRILLING
✓ INNOVATION
✓ ENERGY AS A SERVICE
✓ FINANCIAL STRENGTH
✓ LOCAL PRESENCE
GEOTHERMAL INNOVATION

Angled Drilling VS Conventional Drilling

- 138 Boreholes
- 850' Depth
- 5°, 10°, 15° Inclinations
- 7.5' & 15' Spacing

- 138 Boreholes
- 850' Depth
- Vertical Boreholes
- 21' Spacing

25,000 FT²
290,000 FT²
60,000 FT²
Limit Access Drill Rig

- Great for installations in difficult terrain and low-clearance spaces
- Rig width: 3.4 ft
- Rig Length: 10 ft
- Height (rig derrick up): 9.5 ft
- Power pack width: 5.3 ft
- Power pack length: 7.5 ft
- Power pack height: 5.1 ft

VS

Conventional Drill Rig

- Great for installations in large open areas in certain geological settings
- Height (rig derrick up): 30-33 ft
- Length of 6x4 truck: 29.5 ft
- Width of 6x4 truck: 8.4 ft
- Height of 6x4 truck: 11.2 ft
ENABLING GEOTHERMAL IN EXISTING BUILDINGS

UrbanGeo™ INNOVATIVE DRILLING TECHNOLOGY

Utilizing the Wassara Water Down-the-Hole (WDTH) drilling technology, boreholes are capable of being drilled at inclined angles from very small footprints.

Wassara Water Powered DTH Hammer

- World patented
- > 20 years in various applications
- > 25 million meters drilled in-house by LKAB

CLEAN BUILDING RETRO FITS

Low noise, low vibrations & NO DUST! System retrofits can be completed in small spaces with low overhead clearance.
THE BUSINESS CASE
FEDERAL INCENTIVES
UNDER THE INFLATION REDUCTION ACT (IRA):

• The Investment Tax Credit (ITC) for geothermal has gone from 10% to 40-50%
• This credit applies to the entire cost of the system, including interior equipment
• The credit is redeemable through direct payment for non-profit entities
**Geothermal Basics**

**Geothermal Energy**
- Production Well
- Energy Conversion Plant
- Injection Well
- Engineered Fracture System
- Hot Rock

- Geothermal uses naturally regenerating & residual heat from the earth to for power generation
- Large wellbore, deep drilling depths (>>5000')

**Geo-Exchange**
- Geo-Exchange (Ground Source Geothermal or Geo) systems use the earth to store and retrieve heat for HVAC (heat pumps)
- Relatively shallow drilling depths (up to ~850')
GEOTHERMAL BASICS
Types of Geo-exchange Geothermal

OPEN-LOOP

STANDING COLUMN WELL

CLOSED-LOOP

SOURCE:
Geothermal Systems and their Application in New York City, February 2015
GEOTHERMAL BASICS

Drilling Methods

Table 6.2 Relative Drilling Rate in Various Formations

<table>
<thead>
<tr>
<th>Formation Type</th>
<th>Cable tool</th>
<th>Direct rotary (air)</th>
<th>Direct rotary (fluid)</th>
<th>Air hammer</th>
<th>Reverse rotary</th>
<th>Drill thru-casing driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial Fans, Glacial Drift</td>
<td>Slow</td>
<td>Fast</td>
<td>Fast</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with Loose Boulders, Clay, Silt, Shale</td>
<td>Slow-difficult</td>
<td>Slow, medium to brittle shale</td>
<td></td>
<td></td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Sandstone Conglomerate</td>
<td>Slow</td>
<td>Fast</td>
<td>Fast</td>
<td></td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>Slow</td>
<td>Slow, slow</td>
<td>Fast</td>
<td></td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Basalt Layers</td>
<td>Slow</td>
<td>Medium</td>
<td>Slow to fast</td>
<td></td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Basalt-Highly Fractured-Lost Circulation Zones</td>
<td>Slow, sometimes difficult</td>
<td>Medium to fast</td>
<td>Slow to fast</td>
<td>Medium to fast</td>
<td>Medium to fast</td>
<td></td>
</tr>
<tr>
<td>Granite &amp; Other Non-Fractured Metamorphic</td>
<td>Slow</td>
<td>Medium to fast</td>
<td>Slow to medium</td>
<td>Medium to fast</td>
<td>Medium to fast</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit Type</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLYCRYSTALLINE DIAMOND COMPACT BIT</td>
<td></td>
</tr>
<tr>
<td>DTH HAMMER</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: Drilling and Well Construction, Geo-Heat Center, Oregon Institute of Technology, Klamath Falls, OR (2008); https://www.ogi.edu/services/psc/p595127. 
GEOTHERMAL BASICS
Geothermal Heat Pump Operation

Heating cycle:
- Warm supply air to conditioned space
- Cool return air from conditioned space
- Refrigerant/air heat exchange
- Expansion valve
- Domestic hot water exchanger
- Refrigerant compressor
- 95F in, 34F out

Cooling cycle:
- Cool supply air to conditioned space
- Warm return air from conditioned space
- Refrigerant/water heat exchange
- Domestic hot water exchanger
- Refrigerant compressor
- 80F in, 40F out

Temperature labels:
- 70F, 67F, 80F, 60F, 34F, 95F, 100F
GEOTHERMAL BASICS

Typical Layout Details
## GEOTHERMAL BASICS
Robust Incentive Landscape is Reducing Financial Barriers

### Federal Incentive Program Inflation Reduction Act (H.R. 5376)

<table>
<thead>
<tr>
<th>Investment Tax Credits (§ 48)</th>
<th>Base</th>
<th>Bonus Rate (5x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Credit</td>
<td>6%</td>
<td>30%</td>
</tr>
<tr>
<td>Domestic Content Adder</td>
<td>2%</td>
<td>10%</td>
</tr>
<tr>
<td>Energy Community Adder</td>
<td>2%</td>
<td>10%</td>
</tr>
</tbody>
</table>

### Best Statewide Incentive Programs
1. Massachusetts
2. New York
3. Maryland
4. Rhode Island
5. Connecticut
6. New Jersey

### Program Highlights
- MA, RI, CT – $/ton incentive
- NY, NJ – *Incentives based on energy savings*
- MD, MA – *Geothermal Renewable Energy Certificates*