GOING BIG: Using Networked Geothermal to Accelerate Building Decarbonization

Geothermal: The Genius Renewable

Live at Groundwater Week in partnership with NGWA

Las Vegas, NV
December 5-7, 2023
CEUs for this workshop

Be sure to scan the QR for Tuesday, Wednesday, and Thursday workshops to get points towards your IGSHPA certification CEUs.
Today’s Presenters

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Brian Urlaub
Associate VP, Director of Geothermal Operations
*Salas O’Brien*
Key Players and Drivers pushing TEN’s

• Department of Energy (DOE) and the Geothermal Technologies Office (GTO) are driving this technology from the federal government level.

• DOE sent out a FOA Grant for “Community Network Geothermal” projects with funding of up to $13mil
  • Selected 11 projects for the first phase.

• National Renewable Energy Laboratories (NREL) just had the first ever “Thermal Energy Network” symposium at their HQ in Colorado.
  • NREL is looking to develop software/online tools to assist in high level assessment of TEN’s to make feasibility assessment faster and easier.
Where are TEN’s having the most interest?

• New York – Due to the states mandate called “Utility Thermal Energy Network and Jobs Act” which required regulated utilities do pilot projects.

• Massachusetts – Started with HEET and Columbia Gas looking at a pilot project due to Merrimack Valley Incident.
  • MA has since started to promote TEN’s and with Eversource implementing the very first in the U.S. it is getting a lot of attention.

• Colorado – State regulation and interest is pushing this concept, which has turned Xcel Energy into doing a pilot project.

• Minnesota – State mandates for clean energy is driving regulated utilities to look at TEN’s. Centerpoint Energy is looking at a pilot project in 2024.
Salas O’Brien’s involvement in TEN’s

• Berczy-Glen – Residential New Construction Development in Markham, Ontario. 312 single family and Row houses on a TEN system. 100% geothermal with all infrastructure in ROW. Been in operation for 1 year.

• The Children’s Village – Retrofit of 65 buildings in Dobbs Ferry, NY from fuel oil to TEN Geothermal. Mix of buildings from residential to apartments and schools. 100% geo including DHW. Design is currently at 80%. Going for Bid.

• Arverne East – Residential/Multi-Family & Commercial new construction development in Rockaways, NY. 10 Commercial/MF, 80+/- townhomes, & 90-100 Bungalows. Project is currently in Design.

• Epic Systems – Private office campus, new construction in Verona, WI. Over 45 buildings and more coming. 25k+ tons of capacity. Multiple energy sources with TEN connecting 5 central plants and energy sources.

• Eversource – Residential/Commercial retrofit with utility owned TEN. Phase 1 is almost completely installed. Building retrofits are next. Phase 2 design is just starting. Phase 2 will connect to phase 1.

• Many many more in either feasibility phase, bid phase, or design phase.
Realities of TEN’s

- For strictly single family residential the cost benefits may not be there to interconnect the systems due to higher installation costs unless the capex can be amortized for 50 years+.

- Finding the available space that can be used for the “thermal assets” is also difficult in many locations, and working out the below grade property access contracts can be a hinderance.

- The cost for restoration of city streets and lateral connections can also be a very high first cost that makes the financial proforma less attractive.

- Site selection is critical to having the lowest cost:
  - Open space or available land for thermal assets
  - Streets and utilities could maybe be done in conjunction with other work
  - Density/Proximity of buildings to one another
  - Diversity of thermal loads to reduce thermal asset needs
Zachary Fink
President
ZBF Geothermal, LLC
TENs in NYC and NYS

• Projects are driven by a state grant program - NYSERDA PON 4614 and a state law Utility Thermal Energy and Jobs Act (UTEN)

• NYS Utilities are in the process of proposing their final project designs
  • 7 largest utilities have proposed their projects
  • National Grid building on the success of their project in Lowell, Massachusetts has proposed 4 district geothermal systems
  • Con Edison has proposed 3 TEN’s, including 1 with a geothermal borefield field. Their pilot proposal is testing using two separate TENs to thermally balance the loads of the other TEN
Con Edison’s Mount Vernon UTEN

Source: Con Edison’s UTEN Filing on 11/30/23
TENs in NYS/ NYC

- NYSERDA PON 4614: Community Heat Pump Systems
  - Funded Feasibility Studies (up to 100%), Designs (up to 50%), and Installations (up to $4M & 50%)
  - Competitive Application Process
  - ZBF Geothermal’s Projects in NYC under PON 4614
    - Arverne East (Design) – Design 95% Completed
    - LCOR Coney Island (Implementation) – System is operational. Move into the building in March
    - 1 Java (Design and Implementation) – System is under construction

Annual Conference, December 5 - 7, 2023 – Las Vegas, NV
Arverne East: Multi-faceted Development
Queens, New York
Joseph Hitt
Utility Analyst
New York State Department of Public Service
Utility Thermal Energy Network & Jobs Act

Joseph Hitt
Utility Analyst
Overview

- **Definition – Thermal Energy Network**: All real estate, fixtures and personal property operated, owned, used or to be used for or in connection with or to facilitate a utility-scale distribution infrastructure project that supplies thermal energy.

- **The Act (passed May 25th, 2022) amends various laws**, including the Public Service Law (PSL) to direct the PSC to:
  - **PSL §66-t(1):** Initiate a proceeding within 3 months to support development of thermal energy networks and consider the various ownership, market, and rate structures to support the provision of thermal energy services by the utilities.
  - **Promulgate rules and regulations within two years to:**
    - a) Create fair market access rules for utility-owned thermal energy networks to align with the climate justice and greenhouse gas emissions reductions requirements of the CLCPA and that does not increase greenhouse gas emissions or co-pollutants;
    - b) Exempt small-scale thermal energy networks not owned by utilities;
    - c) Promote the training and transition of utility workers impacted by the Act; and
    - d) Encourage 3rd party participation & competition where it will maximize benefits to customers.
Overview (Cont.)

- **PSL §66-t(2):** Requires the seven largest gas, electric, or combination gas and electric corporations (investor-owned utilities) to propose within three months of effective date between one and five thermal network pilot projects (Pilot Projects) –at least one of which must be sited in a Disadvantaged Community – for PSC review.

- **Amends LIPA’s Enabling Statute:** LIPA & PSEG-LI are required to meet the same Pilot Project requirements, although subject to DPS review.

- **Also amends the Labor Law:**
  - Any thermal energy network created shall demonstrate that the gas or electric corporation has entered into a labor peace agreement with a bona fide labor organization or jurisdiction that is actively engaged in representing gas and electric corporation employees
  - This law applies prevailing wage and direct entry pre-apprenticeship requirements to thermal energy projects
Timeline To-Date

- **July 2022** - Utility Thermal Energy Network and Jobs Act Signed into law
- **September 2022** - Initiating Order
- **October 2022** - Utility Initial Filings
- **December 2022** - Technical Conference Held
- **January 2023** - Utility Pilot Project Proposal Filings
- **April 2023** - Initial Comments Submitted
- **May, June, August 2023** - Supplemental Filings, Pilot Project Withdrawals and Additional Comments
- **September 2023** - Staff UTEN Report and Guidance Order
- **November 2023** - Technical Conference for UTEN Terms and Definitions
- **December 15, 2023** - Utility Pilot Project Supplemental Filings expected
- **March 31, 2024** - Staff to convene one or more technical conferences regarding performance metrics before March 31, 2024
Pilot Projects and Guidance Orders

- **September 2022** - Commission instituted a proceeding (Case 22-M-0429) and issued an Order on Developing Thermal Energy Networks Pursuant to the Utility Thermal Energy Network and Jobs Act
  - Recognizes the pilot projects as the primary mechanism in which to gain sufficient experience to consider necessary rules and establishes a stepped implementation approach
  - Directed Staff and utilities a process and timeline to file pilot projects for each of the seven largest utilities
  - In January 2023, the seven utilities proposed 14 pilot projects with estimated total costs of $360-$435 million and 1-2-year timeframes from approval to construction.

- **September 2023** - Draft Order Providing Guidance on Development of Utility Thermal Energy Network Pilot Projects
  - Setup a **Phased Implementation** approach of 5 stages, outlined as follows:
    1. Pilot Project Scope, Feasibility, and Stakeholder Engagement
    2. Pilot Project Engineering Design and Customer Protection Plan – this filing will be subject to a public comment period after which the Commission will consider whether to authorize the project to advance to Stage 3.
    3. Customer Enrollment and Pilot Project Construction
    4. Pilot Project Operation and Management
    5. Pilot Project Review, Recommendations, and Conclusion
  - Directed Staff to convene a **Technical Conference** to develop mutually agreed upon key terms and definitions
  - Established four categories of **Performance Metrics**: 1) Technical 2) Financial 3) Customer or Societal 4) Safety and Reliability
  - Utilities are directed to file monthly **Progress & Expenditure Reports** starting Nov. 15, 2023
Pilot Project Stages and Timeline

Stage 1
Initial Pilot Project Proposals Filed

Stage 1
Pilot Project Scope, Feasibility, and Stakeholder Engagement

Stage 2
Pilot Project Engineering Design and Customer Protection Plan

Stage 3
Customer Enrollment and Pilot Project Construction

Stage 4
Pilot Project Operation and Management

Stage 5
Pilot Project Review, Recommendations, and Conclusion

September 2023 Guidance Order

Staff Letter Confirming Compliance

Order Authorizing Customer Enrollment and Pilot Project Construction

All pilot project proposals are currently in Stage 1.
• Initial Pilot Project Proposals filed on January 9, 2023.
• Guidance Order provides clarifications, establishes stage-gate approach, and identifies additional information needed to advance projects to next stage.

Individual pilot project decisions will be provided beginning at Stage 2.
• Staff issues letter confirming compliance with Guidance Order and advances project(s) to Stage 2 or notes deficiencies to be addressed.
• Utilities file Final Engineering Design and Customer Protection Plans for each pilot project within 9 months of Staff letter.

Advancement of Pilot Project to Stage 3 through project-specific Commission Order(s).
• Utilities file Final UTEN Pilot Project Engineering Design and Customer Protection Plans. Filings will be issued for public comment.
• Order will finalize pilot project operational requirements, cost recovery, CPPs, performance monitoring and reporting structure.
• Pilot project will be operational for a minimum of 5 years.
Pilot Projects and Guidance Orders

Further Guidance Provided in the following areas via the September 2023 Guidance Order:

- **Clarification on UTEN Design Options** - Each Utility’s proposed Pilot Projects should consider the most efficient, reliable, and affordable solutions in the design and operation of their proposed UTENs.
- **Diversity of Pilot Projects** - Diversity of Pilot Project design will provide important information that can be evaluated to support further thermal energy development.
- **Disadvantaged Communities** - The Act requires each utility to propose at least one Pilot Project located in a Disadvantaged Community within that utility’s service territory.
- **Technical, Economic and Operational Aspects**
  - UTEN Optimization and Balancing
  - Thermal Energy Resources
  - Safety, Reliability, and Resiliency
  - On-site Energy Efficiency Upgrades
  - Comparative Analysis of UTEN Systems vs Individual Electrification
- **Customer Protection Plans** - At the core of a successful UTEN Pilot Project is customer adoption and satisfaction. The Final UTEN Pilot Project Proposal shall include a Preliminary Customer Protection Plan, that includes the following components: (1) the basic conceptional structure of the Final Customer Protection Plan, (2) customer engagement activities, and (3) a customer agreement template that documents the customers’ rights and responsibilities that are associated with the Pilot Project.
- **Labor Requirements** - The Act clearly calls for the Utilities to not just develop and operate UTENs but to do so in ways that support good jobs and training opportunities in the localities where UTENs are to be located.
Document and Matter links

Utility Thermal Energy Networks and Jobs Act
https://www.nysenate.gov/legislation/bills/2021/A10493
https://assembly.state.ny.us/leg/?default_fld=&leg_video=&bn=A10493&term=2021&Summary=Y&Actions=Y&Memo=Y&Text=Y

Proceeding on Motion of the Commission to Implement the Requirements of the Utility Thermal Energy Network and Jobs Act, Case 22-M-0429

In the Matter of Utility Thermal Energy Network Terms and Definitions, Matter 23-02117
Bryce Carter
Emerging Markets Program Manager for Geothermal Strategic Initiatives & Finance
Colorado Energy Office

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The Heat Beneath Our Feet
Colorado’s Geothermal Energy Policy
Statewide Greenhouse Gas (GHG) pollution reduction goals
(HB19-1261 and SB23-016)

“Colorado shall strive to increase renewable energy generation and eliminate statewide greenhouse gas pollution by the middle of the twenty-first century and have goals of achieving, at a minimum, a...”

- 26% reduction by 2025
- 50% reduction by 2030
- 75% reduction by 2040

Net Zero emissions by 2050

*relative to 2005 GHG pollution levels
2023 study: electricity sector is on track for 98.5% GHG cuts by 2040!
What is geothermal energy’s role for Colorado to achieve net zero?

- Geothermal electricity provides **clean, firm electricity**, which is pivotal to achieve a fully renewable electric grid.
- Geothermal heating and cooling is an **economical and dependable electrification** solution for consumers and utilities alike.
- Geothermal energy is a key tool for **community resilience** in the face of extreme weather events with grid balancing and district heating benefits.
- Requires **similar workforce skills and experience** as oil and gas sector.
Thermal Energy Networks: Heat as a Resource

Heat Producers
- Data Centers
- Factories
- Hot spring runoff
- Sewage
- Oil & Gas
- Building cooling
- Grocery Stores
- Ice rinks

Geothermal Exchange System
System is sized, monitored and actively managed to balance heating and cooling needs throughout the year, ensuring efficient ground temperatures

Heat Consumers
- Building heating
- Agriculture
- Snowmelt

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Colorado Thermal Energy Network Case Studies

- **Colorado Mesa University**: Includes 1.2 million sq ft and achieves upward of 8.9 COP in the winter, saving $1.5 million/year (2% tuition)

- **National Western Center**: Largest sewer-heat recovery system in North America; provides 90% of campus heating and cooling

- **Brown Ranch**: New 1,100 home development in an energy transition community; projected $100+ million in energy savings over 30 years
Colorado leads nation with projected $158 million of incentives for geothermal energy through 2032

- **SB21-264**: Clean Heat Framework
- **HB22-1381**: CEO Geothermal Energy Grant Program ($12 million)
- **HB23-1252**: Thermal Energy Networks
- **HB23-1272**: Tax Policy That Advances Decarbonization
  - Heat Pump Tax Credit (estimated $53 million)
  - Geothermal Electricity Tax Credit Offering ($35 million ITC + $1m/yr PTC)
HB22-1381: CEO Geothermal Energy Grant Program

$12 million in grants to support the use of zero-emission, geothermal energy for electricity generation and space/water heating and cooling in homes, businesses, and communities.

First round of Request for Applications is NOW OPEN until January 19th, 2024
For more info visit: energyoffice.colorado.gov/geothermal-energy-grant

For more information, visit: https://doi.org/10.5194/adgeo-49-129-2019
# HB23-1272: State Geothermal Tax Credits

<table>
<thead>
<tr>
<th>Geothermal Electricity</th>
<th>2024 - 2033</th>
</tr>
</thead>
</table>
| Investment Tax Credit  | 30% - 50% ITC, merit-based  
                          | $5 million cap per project  
                          | Program cap of $35 million  |
| Production Tax Credit  | $0.003/kWh or $3/MWh |

<table>
<thead>
<tr>
<th>Heat Pump Technology (per residential unit)</th>
<th>2024 - 2025</th>
<th>2026 - 2029</th>
<th>2029 - 2033</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-Source</td>
<td>$1,500</td>
<td>$1,000</td>
<td>$500</td>
</tr>
<tr>
<td>Ground-Source, Water-Source, or combination system including either</td>
<td>$3,000</td>
<td>$2,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>Heat Pump Water Heater</td>
<td>$500</td>
<td>$250</td>
<td>$250</td>
</tr>
</tbody>
</table>

The nonresidential building rate is the tax credit multiplied by the number of increments of 4 tons up to 100 tons per building. Thermal energy networks may combine the credit per connected residential unit and nonresidential building.
HB23-1272: Heat Pump Contractor Certification

- Contractors administering state tax credits must be certified by the CEO
  - Streamlines credit for consumers
  - Provides needed market data to better inform future policy to support the sector; workforce development

- Contractors may retain a percentage of the tax credit (e.g. 10% or $300 per GSHP)
Thank you!

Stay grounded as Colorado geothermal heats up: 
Join the CEO GEO newsletter!

Program information is available at: 
energyoffice.colorado.gov/geothermal-energy-grant

Bryce Carter
Emerging Markets Program Manager for Geothermal
Colorado Energy Office
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Questions / Discussion
EXTRA SLIDES
(COLORADO ENERGY OFFICE)
Applicants constructing a new building and are installing a geothermal system as primary heating and cooling system for the building. Must meet 2021 IECC or newer, and use licensed plumbing or mechanical contractors with apprenticeship program.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>For-Profit $/ton</th>
<th>Non-Profit $/ton</th>
<th>Tonnage Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Residential</td>
<td>$2,000</td>
<td>$3,000</td>
<td>100</td>
</tr>
<tr>
<td>Multifamily</td>
<td>$2,000</td>
<td>$3,000</td>
<td>100</td>
</tr>
<tr>
<td>Single-Family</td>
<td>$2,000</td>
<td>$2,000</td>
<td>5 tons</td>
</tr>
</tbody>
</table>

Limited to 100 buildings per contractor. The use of funds for building retrofits is being assessed. 80% of total fund may be awarded to SSG Grants, with at least 25% of SSGG must be awarded to low-income, disproportionately impacted, or just transition communities.
Applicants constructing ground-source, water-source, or multi source thermal systems that serve more than one building.

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Eligible Funding</th>
<th>Stipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoping Study</td>
<td>Up to $100,000 per project</td>
<td>Determine GHG reduction potential and reasonable-costs</td>
</tr>
<tr>
<td>Detailed Design Study</td>
<td>Up to $500,000 per project</td>
<td>Evaluate issues, legal and financial responsibilities</td>
</tr>
<tr>
<td>Installation</td>
<td>Up to $500,000 per project</td>
<td>Up to 50% of the first $1 million in project costs</td>
</tr>
</tbody>
</table>

Parties involved with the application may not apply for more than 2 grants per year. Up to 25% of fund may be awarded to CDHG and prioritize projects in low-income, disproportionately impacted, or just transition communities and maximize projects that would not otherwise occur.
### Geothermal Electricity Generation Grant

Applicants developing geothermal electricity generation and/or projects which pair with electrolyzers to produce hydrogen from geothermal energy generation.

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Eligible Funding</th>
</tr>
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<tbody>
<tr>
<td>Identify and explore suitable resources (&lt;$1 million)</td>
<td>Up to 50% of study cost ($500k max) Up to 60% of study cost if includes hydrogen production or direct air capture ($600k max)</td>
</tr>
<tr>
<td>Identify and explore suitable resources (&gt;1 million)</td>
<td>Up to $500,000 per project; and,</td>
</tr>
<tr>
<td>Resources needing confirmation through drilling &amp; testing</td>
<td>Up to an additional $500,000 may be awarded by CEO</td>
</tr>
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Eligible for local governments, corporations, and gas or electric service public utilities. A person may apply for more than one cost-matching grant in a year for <$1m project; no more than 2 grants >$1m. Up to 40% of total money in fund may be awarded through grants to support geothermal electricity generation and resource development, which may include hydrogen generation produced from geothermal energy.
SB21-264: Clean Heat Framework

- Requires investor-owned utilities to file plans with the PUC to provide rebates and incentives to help consumers shift from gas to electric appliances.
- Gas distribution utilities required to submit clean heat plans with the PUC on how they will reduce GHG emission levels by 4% in 2025 and 22% in 2030 below 2015 levels.
- These plans will help gas utilities transition the businesses and the services they provide to their customers to better align with the state’s greenhouse gas emissions reduction targets.
Gas utilities may propose thermal energy networks to PUC not otherwise included in a clean heat plan (SB21-264) or DSM filing.

Pilot geothermal project required for utilities over 500k customers (Xcel Energy) to be filed by September 1, 2024 with an assessment of its potential and models/mechanisms for widespread adoption.

Before Jan. 1, 2025, PUC shall initiate proceeding to determine commission rulemaking or legislative changes are needed to facilitate development of thermal energy.