Large Scale Geothermal Heating and Cooling Utilities

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Geothermal: The Genius Renewable

Live at Groundwater Week in partnership with NGWA

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Agenda

1. Geothermal Market Drivers
2. Individual Building Systems
3. District Style Systems
4. Design Considerations
5. Case Study
6. Q&A
Carbon-Emitting Sectors: Washington, DC

- In urban cities like Washington, DC, buildings account up to 72% of greenhouse gas emissions.

- Up to 74% of greenhouse gas emissions in buildings are due to the use of fossil fuels, primarily natural gas, to heat spaces and water.

- The U.S. Federal Sustainability Plan requires all new construction and major modernization of federal building projects larger than 25,000 ft² to be designed, constructed, and operated to be net-zero emissions by 2030.
Geothermal Exchange System Cost–Benefit Overview

- While governments are implementing strategies to move toward net-zero buildings, continuously rising construction costs make it challenging for owners to finance the upfront costs of sustainable solutions.

- There are various considerations in reviewing the financial viability of a geothermal exchange system. There may be government tax credits or other financial incentives geared toward net-zero buildings. Some financial institutions also offer green loans.

- Owners also need to consider the cost impact of not implementing a geothermal system; for example, escalating natural gas prices and increasing carbon taxes can be major factors in countries like Canada.

- Of course, the environmental cost of greenhouse gas emissions is paramount. Geothermal exchange can provide a zero-carbon-emission solution.

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Tax Credits: U.S.

• In August 2022, the U.S. government passed the Inflation Reduction Act, the largest government investment to combat climate change in U.S. history. The costs to install geothermal exchange solutions can be offset by a 30% tax credit.

• For a listing of incentives per US state, visit the Database of State Incentives for Renewables & Efficiency® [https://www.dsireusa.org/](https://www.dsireusa.org/)

- **Residential Clean Energy Credit**
  - 30%
  - 2022 to 2032

- **Investment Tax Credit (Commercial)**
  - 30%
  - 2022 to 2032
Use Case: A Stand-Alone Geothermal System

Building Developer’s Challenge
• Increased building regulations to build green.
• Managing long-term costs of building green.
• Attracting buyers or tenants that have a strong preference for green buildings.

Solution
• Drill a geothermal borefield below the building’s footprint.
• Drilling begins prior to construction/excavation, having no impact on the critical path or the building’s construction timeline.

Anticipated Outcomes
• Zero-emission heating and cooling.
• Increased rooftop space for building more residential units or to convert to amenity space.
• Ongoing operating cost less than conventional heating and cooling system.
Use Case: A District Geothermal System

Type
• Multi-purpose, campus-like developments with multiple buildings

Building Developer’s Challenge
• Increased building regulations to build green.
• Managing long-term costs of building green.

Solution
• Borefields dispersed accordingly around the site, attached together laterally to provide a heating and cooling solution across the whole site.

Anticipated Outcomes
• Zero-emission heating and cooling.
• No conventional heating and cooling system cost.
• Ongoing operating cost substantially less than conventional heating and cooling system.
Design Considerations: District Optimization

1. Load Diversity
2. Density / Scale
3. Topography / Lithology
Design Considerations: Load Diversity
Design Considerations: Density / Scale

Dense

Sparse
Design Considerations: Topography
Case Study: Oberlin College, Oberlin, Ohio

Project Type:
- District Heating & District Cooling

Project Overview
- Oberlin College has initiated a bold energy project to achieve carbon neutrality by 2025 by upgrading the century-old heating infrastructure serving its campus to a geothermal heating and cooling system.

Developer’s Need
- Oberlin wants to enable a large-scale geothermal exchange system, add cooling to buildings, and implement other building improvements that will increase student and faculty comfort year-round.
Case Study: Oberlin College, Oberlin, Ohio

Subterra’s Solution

• Subterra is drilling 850 boreholes at Oberlin College at a depth of 600ft. This brings the total vertical drilling on this project to 510,000 linear feet.
• The bore field will be located under the future outdoor sports field, and once completed, this district system will heat and cool 55+ buildings on campus.

Early Success

• Utilization of new technology that has allowed for expedited drilling timelines.
• Installation of a geothermal exchange system on this site to convert an existing steam system to a renewable heating and cooling source.
• The geothermal system will reduce campus energy consumption by 30%.
Thank You!

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