U.S. General Services Administration

Geothermal Energy

Adapting in the Built Environment

Presented to:
Interagency Sustainability Working Group Meeting

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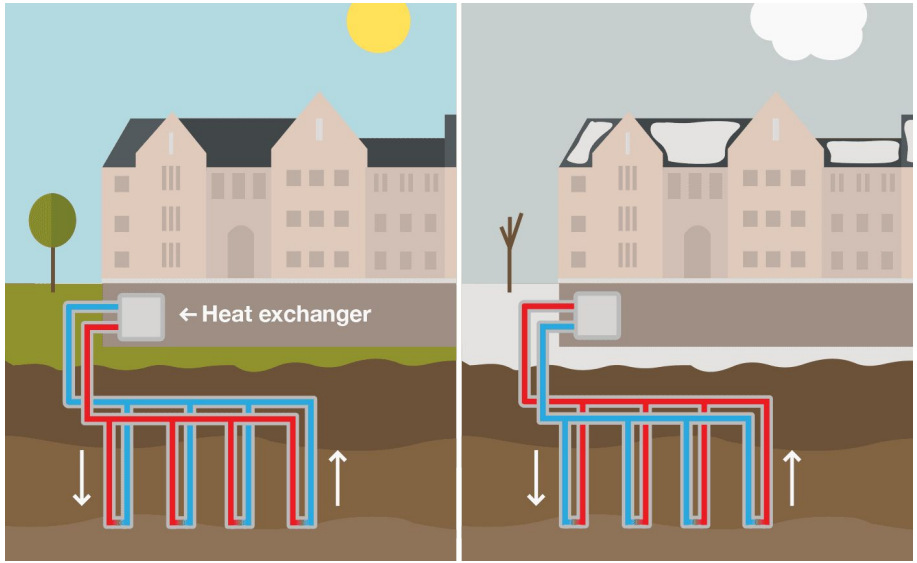
What is geothermal energy?

Geothermal energy is the subterranean thermal energy generated by the Earth's formation and its radioactive decay.

Source: https://www.canarymedia.com/articles/geothermal/magma-and-hot-rocks-iceland-seeks-the-future-of-geothermal-energy

Why consider geothermal technology?



- Helps achieve decarbonization and electrification goals such as the ones set forth by E.O. 14057
- Offers the most efficient means of satisfying heating and cooling needs of a building compared to other conventional source energy air conditioning technologies (COP up to 5.0!)
- Works in a broader range of climate zones compared to air-source counterparts

Source: https://www.nd.edu/stories/going-geothermal/

Geothermal + Heat Pumps

What are the advantages?

- Utilizing water-to-water heat pumps enables buildings to capitalize on geothermal energy
- Reduces roof mounted equipment to only air-handling equipment
- Reduces equipment footprint in mechanical rooms by consolidating heating and cooling equipment to a single entity

Source: https://automaticheating.com.au/product/revere-r134a-water-to-water-heat-pump/

Geothermal + Heat Pumps

What are the challenges?

- Requires more in-depth design analysis before confidently being considered for installation
- Thermal conductivity tests are often pursued to validate design assumptions
- Well-fields may not yield thermal capacity that is initially assumed
- Often comes with high installation costs
- Urban environments contained to smaller site footprints

Source: https://www.coloradocountrylife.coop/geothermal-energy-in-colorado/

Maximizing Benefits of Geothermal

- Energy conservation measures pair geothermal heat exchange via heat pumps with thermal storage for both heating + cooling
- Decoupled ventilation also helps reduce peak loads during summer and winter seasons
- Closed loop well-fields help conserve water consumption compared to evaporative cooling towers
- Constantly looking to learn more about what system arrangements are ideal for the different building types and use cases within the portfolio

Source: https://vertexeng.com/insights/thermal-energy-storage-for-chilled-water-systems/

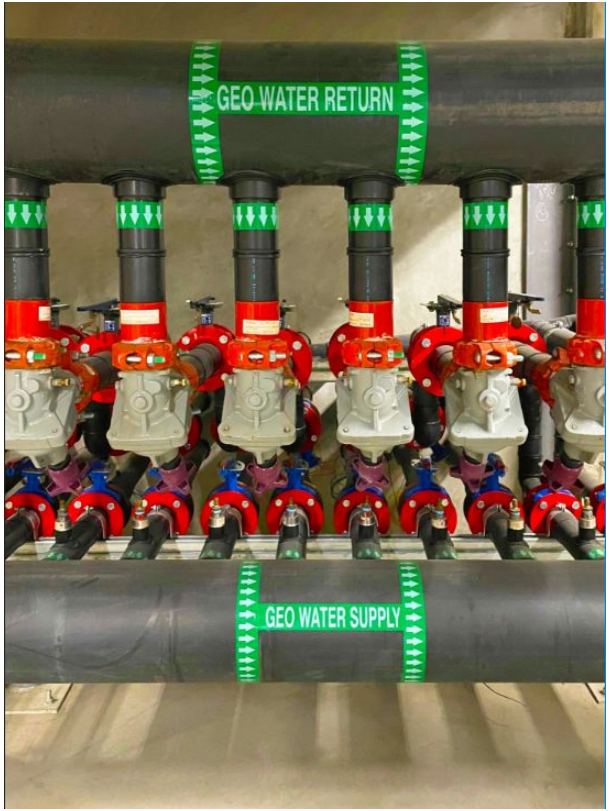
Exploring Different Shapes and Sizes

- Heat Recovery: interface with 6-pipe water-to-water heat pumps for simultaneous heating + cooling operation
- Domestic Hot Water: using geothermal technology + heat pumps for domestic hot water production in addition to building heat

Source:
https://www.waterfurnace.com/commercial/products/chillers/truclimate-500
https://www.aireserv.com/about/blog/2018/april/best-temperature-for-a-water-heater/

Looking Ahead

- Some existing GSA facilities already employ geothermal heat pump technology
- Design work happening now are assuming geothermal infrastructure
- Feasibility studies have been conducted that reaffirm the energy efficient assumptions around geothermal technology
  - OAE Net Zero Study
  - Future studies currently planned, diving into greater detail of specific system arrangements



Source: https://www.gsa.gov/real-estate/design-and-construction/engineering/facilities-standards-for-the-public-buildings-service?gsaredirect=p100

Public Buildings Service (PBS)
Office of Architecture & Engineering (OAE)
Center for Engineering

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