BUILDING DECARBONIZATION COALITION

THERMAL ENERGY NETWORKS

A NEIGHBORHOOD-SCALE SOLUTION FOR HEATING AND COOLING

Thermal energy networks (TENs) provide an opportunity to reimagine how we heat and cool our homes, free from fossil fuels.

Thermal energy networks are an elegant solution to a complex problem faced by communities across the country: how to eliminate the use of fossil fuels in our buildings, at scale. With TENs, the existing gas pipe system that currently heats buildings is replaced by an underground water loop system to provide highly efficient heating and cooling to connected buildings.

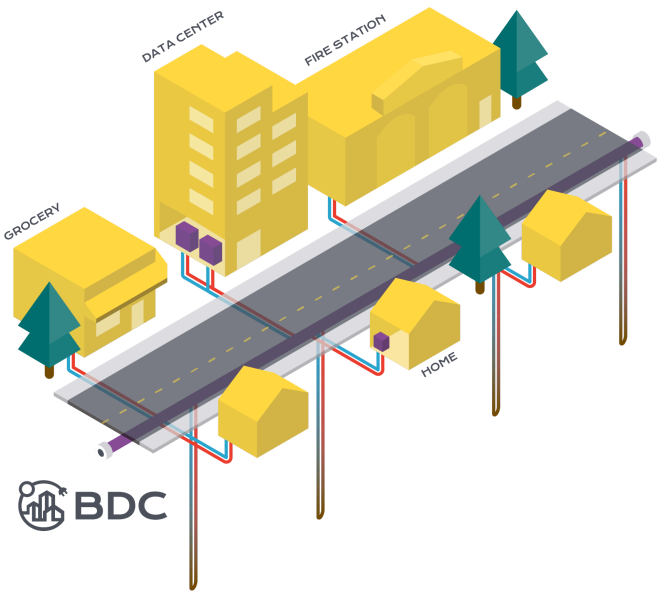

Illustration of a networked geothermal system along a street. Water circulates through boreholes and a shared loop of pipe to deliver temperature to ground source heat pumps in connected buildings.

To build to scale, thermal energy networks can be designed in many configurations and be connected to each other over time. *Networked geothermal,* for example, is a type of TEN that uses shallow boreholes (100 to 750 ft) to access the earth's ambient temperature (~55° F) to heat and cool buildings that are connected to the network. TENs do not always need boreholes; other sources of thermal energy—such as bodies of water, wastewater systems, or even energy intensive buildings (e.g. a datacenter, skating rink, grocery store)—can also be used.

Efforts underway

Several states are pursuing novel approaches to using this technology at neighborhood-scale. Massachusetts, New York, Minnesota, Colorado, and Washington have passed innovative legislation either allowing or mandating that their largest gas utilities file plans to pilot TENs.

- The New York and Colorado bills include labor provisions, and New York specifically mandates training and including workers that are displaced by the gas transition.
- In New York, utilities filed 13 TEN pilot projects with their regulatory commission.
- In spring 2023, Eversource Gas in Massachusetts broke ground on the first gas utility-installed networked geothermal system in the nation. The system will provide heating and cooling to 140 customers, which include both homes and businesses. Video description of Eversource demonstration project.

Colleges and universities have been installing TENs for years to successfully decrease emissions,

save on energy costs, and reduce water use. Examples of different systems include Colorado Mesa University, Weber State University, Stanford University, Carleton College, Princeton University, SUNY at Albany.

Communities and developers are seeing the value of installing these networks. Whisper Valley in Texas, Springwater Mattamy Homes in Ontario, and communities in New York have proposed more than 35 networks. In 2023, the Department of Energy awarded $13 million in federal grants to 11 communities across 10 states to explore thermal energy systems.

Benefits

- **Safety**: No gas in the pipes, just water.
- **Emissions**: No onsite emissions. The only emissions for a system come from the fuel used to generate the electricity used by the heat pumps in the buildings.
- **Indoor air quality**: Replacing all gas appliances with electric ones will eliminate combustion indoors. The indoor air pollution caused by combustion exacerbates many health problems, such as asthma and heart disease.
- **Cooling**: Thermal energy networks provide both efficient heating and cooling. As the climate heats up and heat waves become more common, access to reliable indoor cooling will become critical. Heat waves are already more deadly than any other severe weather event.
- **Lower energy bills**: Current predictions estimate that the customer TENs bills will be lower because they will no longer include a fuel cost (gas/propane) as a part of the bill.
- **Pathway for utility workers**: Fossil fuel workers can use the skills they already have to install the networks.
- **Efficiency and reduced demand on the electric grid**: Thermal energy networks are the most efficient system known for delivering heating and cooling and they provide energy 24/7 regardless of outdoor conditions, thereby flattening the demand for electricity on the hottest and coldest days when there is peak demand.
- **Thermal storage**: Networked geothermal boreholes can store thermal energy in the bedrock to be used months later, reducing the variability that often plagues renewable electricity generation. This energy storage increases the overall efficiency of the system further by allowing the excess heat in the summer to be stored until it's needed in the winter.
- **Local energy independence and reduced price volatility**: TENs customers will be protected from volatile energy price spikes since the energy is always available and sourced locally. Networked geothermal combined with local electric generation can achieve 100% energy independence for entire communities.
- **Reliability**: Natural gas must travel hundreds or thousands of miles from wellhead to end user, making it vulnerable to single point failures. The thermal energy for TENs is local and systems are designed with backup power.
- **Reduced water use**: Because connected commercial buildings can be cooled by the networked geothermal system, rather than by chillers (which cool through evaporation), the system can save significant amounts of water. For example, the Colorado Mesa University thermal energy network cut its water use by 60% per square foot of conditioned space.