

Networked Geothermal General FAQs

What is networked geothermal and how does it work?

In a networked geothermal system, a loop of pipe carries water between buildings. Boreholes a few hundred feet underground pick up the stable temperature of the earth (around 55°F) and circulate it throughout the system.

In each connected building, a ground source heat pump moves heat inside or rejects heat back into the shared loop of pipe to raise or lower indoor temperature.



The system can be installed and run by existing utilities, allowing it to be paid for by a wide customer rate base over time, in the same way the gas system is currently paid for.

Heat Pumps

What is a heat pump and how does it work?

You probably already have a heat pump in your house—in your refrigerator and freezer. Your freezer, for example, pumps heat out of it to keep its temperature low. Even when your kitchen is 90 degrees, the freezer still works effectively. Heat pumps work in the same way, except that they can pump heat into or out of a building, keeping your home warm in the winter and cool in the summer.

Why use ground source heat pumps?

Unlike the temperature of the air, which varies with the weather, the ground a few feet down is always a consistent temperature, around 55 degrees Fahrenheit. Heat pumps work most efficiently at this temperature and can easily raise the temperature of a building based on how you adjust your thermostat.

How does the efficiency of ground source heat pumps (GSHPs) compare to air source heat pumps (ASHPs)?

GSHPs have 2-3x the efficiency of air source heat pumps.

Why network the heat pumps?

By connecting buildings with different heating and cooling needs together, any excess temperature can be exchanged with other buildings. For example, the neighborhood supermarket can pull cooling off the system for its fridges, making the water hotter for nearby homes. Any extra energy not needed at the time can be stored in the ground.

Location

Where can networked geothermal be used?

The places networked geothermal can be used most readily overlaps with the location of the current natural gas system.

What can be done in places where networked geothermal isn't being used (rural/remote areas)?

Rural or remote areas where houses are further apart can use individual ground source heat pumps to heat and cool buildings. The Department of Energy is currently accepting [applications](#) for remote communities seeking technical assistance to bolster energy resilience; applications are open through May 19, 2023.

Can it work for supermarkets, labs, hospitals, and ice rinks?

Yes. The system can provide the heating and cooling needed. In fact the more different types of heating and cooling added to the system, the more efficiently it functions.

Parts of the System

What temperature is the water in the system?

The water temperature is kept between approximately 40 and 90 degrees Fahrenheit. Keeping it in this range helps keep the heat pumps in the homes happy and efficient.

What temperature is the ground surrounding the boreholes in a net geo system?

Around 55 degrees Fahrenheit.

Why is low temperature water better than steam or hot water?

Low temperature water loses less energy to the surrounding ground, making it more efficient. Also, it can deliver cooling, which we will need more of as our climate warms.

What if the water gets too cold?

There is a backup gas heater on the shared loop to heat the water up if needed. In a system installed at Colorado Mesa University, the gas backup heater has not been needed for supplemental heat for over a decade.

Are these deep boreholes?

We are not talking deep geothermal, but boreholes that are just a few hundred feet deep. There is an optimal point where the returns are diminishing for the pumping power. For a standard closed loop vertical borehole with a typical 2" pipe that transition point is often around 600' down.

Can boreholes cause earthquakes?

No. The holes themselves are only a few inches wide. Narrow and relatively shallow boreholes are not known to cause earthquakes.

Does the system use a lot of water?

No, it is a closed system which only has to be filled once. The same water is just pumped up and down the street, delivering heating or cooling to the buildings.

What happens if there's a leak?

Leaking is very rare. If the system does leak, the water supply can be isolated, leaks can be fixed and the system refilled.

Will it damage the water table?

No, this is a closed system. The system will not remove or add any water to the underground water table.

Emissions

Are the emissions lower in a networked geothermal system?

Yes. The only energy needed is electricity to pump water throughout the underground pipes and to power the ground source heat pumps. In Massachusetts, given the fuel use of our electric grid, the emissions will be 60% lower immediately in comparison to gas. As our electric grid sources more electricity from renewables, these emissions will lower even further.

How does it affect air quality?

Burning fuels such as gas, propane or oil in the home puts pollutants into our indoor air. These pollutants have been correlated with increased rates of asthma in children and other respiratory diseases. With networked geothermal, you can remove all combustion from your home, making the air you breathe cleaner.

Do you still need electricity in a networked geothermal system?

Yes. The water pump in the street that moves water throughout the pipes and the heat pump inside each building require electricity. This electricity produces less emissions now than gas

and, in Massachusetts, the electric grid will be net zero by 2050. This means that every year your home will reduce its emissions without you doing anything.

Compared to natural gas

Is networked geothermal safer than gas?

Yes. Networked geothermal systems contain just water and do not use combustion, so there's no potential of an explosion, as there is with gas.

Is it more efficient than gas?

Yes. Heat pumps *move* naturally occurring heat rather than create it through burning something, requiring much less energy to function.

How reliable is it compared to gas?

More reliable. The gas system is like a tree, with the gas moving only in one direction from the trunk to the ends of the branches. This means if any feeder branch fails, you lose gas. With interconnected networked geothermal systems, if any section fails, the others can function independently.

Cost

Will my energy bills be lower?

Yes. Because the system needs no fuel (other than electricity) and because it's so efficient, energy bills are [projected](#) to be lower than natural gas.

How would it be paid for?

The way gas and electric utilities currently work, costs are spread out over ratepayers. A networked geothermal system operated by utilities would be paid for in the same way. This would avoid the scenario of those who can afford it electrifying on their own, leaving a dwindling rate base of low-income customers to shoulder the costs of an entire gas system.

Other Questions

Are there systems like this working now?

Yes, one example is installed at the Colorado Mesa University in Grand Junction, Colorado. It has been running successfully for over a decade.

What happens if the power goes out?

If the power goes out momentarily, water will continue to pump throughout the system for some time, depending on the size of the system. Backup power generators are a good resiliency measure for longer black-outs.

Will this work with steam radiators?

Unfortunately, no, a geothermal system doesn't heat the water to a high enough temperature to become steam. You may be able to keep your radiators but switch them to hot water, however, it is more efficient to replace your current system with a hot water system.

How does energy storage work?

The bedrock below our feet stores thermal energy, effectively working as a thermal battery. Thermal energy can be added to or removed by geothermal exchange, using water loops in boreholes. Excess heat in the summer can be stored in the bedrock and used later in the winter months. It is the job of the system designer and operator to ensure that the heating and cooling demands of the buildings on the loop are balanced so that the heat extracted and put back into the ground cancel out.

The Role of Utilities

Why should we have gas utilities run them?

Installed by utilities, the cost of the system is shared across all customers over decades, allowing all to access the system. Also, unlike private companies, utilities are tightly regulated to ensure they are delivering a good product for a reasonable cost.

If we electrify everything, then we can just get rid of gas companies, right?

Well, yes, you could. In doing so you'd be eliminating hundreds of jobs and there would be financial market consequences. We think a better solution is to transition gas companies to thermal utilities, allowing them to supply a new technology that preserves good paying jobs and will provide the reliability that gas utilities have provided for many decades.

Why should we trust utilities to install these systems?

Although we tend to think of utilities only when they make mistakes or something horrific happens, they are how we get our heat, electricity and water. Almost all the time, in all sorts of weather, they quietly get us the energy we need. They are regulated to help make them lower cost and safer.