

Stakeholder Charrette Report

Charrette #7: Community Site Review | August 2, 2021

Char-rette: a meeting in which all stakeholders in a project attempt to resolve conflicts and map solutions

Background

Decarbonizing the way we heat and cool our buildings is essential to a stable climate and a zero-emissions future.

[HEET](#)¹, a non-profit climate solutions incubator, has designed a method for gas utilities to deliver renewable, non-emitting and non-combusting heating and cooling. This technology, known as [networked geothermal](#)², consists of pipes filled with water that are installed in the street and connected to ground source heat pumps in buildings. The system can be installed and operated by existing gas utilities, providing a way forward for a transition off natural gas and for states and municipalities to meet emission reduction mandates.

Increasingly, utilities and energy advocates across the U.S. and internationally are considering networked geothermal as a viable electrification pathway, business model and alternative to fossil fuels. In Massachusetts, six networked geothermal demonstration projects have been approved for installation and are moving forward.

Each of HEET's [charrettes](#) is an ongoing effort to work together across diverse perspectives and backgrounds, generate ideas and anticipate barriers. In this way, we can move towards a just energy transition—one with clean, safe and accessible energy, low customer bills and good jobs—as rapidly, wisely and justly as possible.

Executive Summary

HEET hosted its Community Site Review Charrette at District Hall Innovation Center in Boston, MA with both in person and virtual attendees. This charrette examined four promising sites identified by Eversource Gas for potential inclusion in their [Geothermal Pilot Program](#)³ and provided an opportunity for Eversource to gather community input on its site

¹ HEET, Home Energy Efficiency Team, is a Massachusetts-based non-profit dedicated to cutting carbon emissions now by driving systems change.

² Networked geothermal is also commonly referred to as thermal energy networks. In the past, it has been called the GeoMicroDistrict or GeoGrid.

³ Eversource has now selected Framingham as the first site for a networked geothermal installation and construction has begun. For details, see:

heet.org/2022/11/23/eversource-gas-breaks-ground-on-first-networked-geothermal-installation/



selection process. Early and continual engagement with the community and key stakeholders will be key to the program's success.

The 63 participants present included utility executives, regulators, labor and workforce representatives, community organizations, advocates, geothermal designers and installers, and heat pump installers and manufacturers.



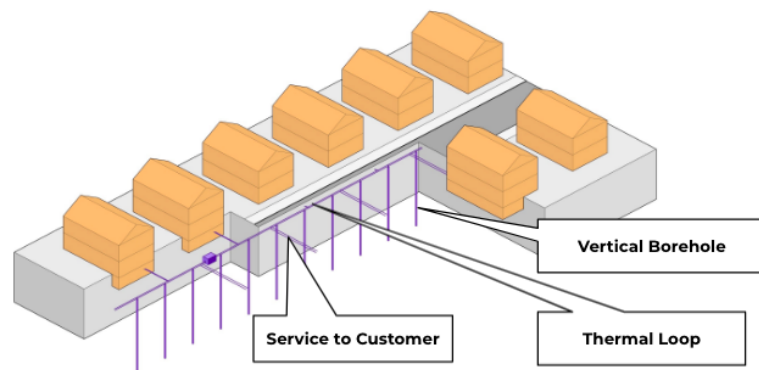
HEET deeply thanks all participants for their input. This report will be shared with participants and other stakeholders, including utilities and state regulators.⁴ HEET also thanks E4theFuture and other funders for their support of HEET's charrettes.

Introduction

To reach the climate goals of Massachusetts and other states, we will have to transition away from natural gas for building heating. At the same time, our existing gas infrastructure is aging, leaking and in need of significant repair.

Massachusetts' current plan to reach state climate emissions reduction goals is to electrify buildings using air source heat pumps. According to a model called the [Falcon Curve](#), this will put a significant burden on the electric grid.

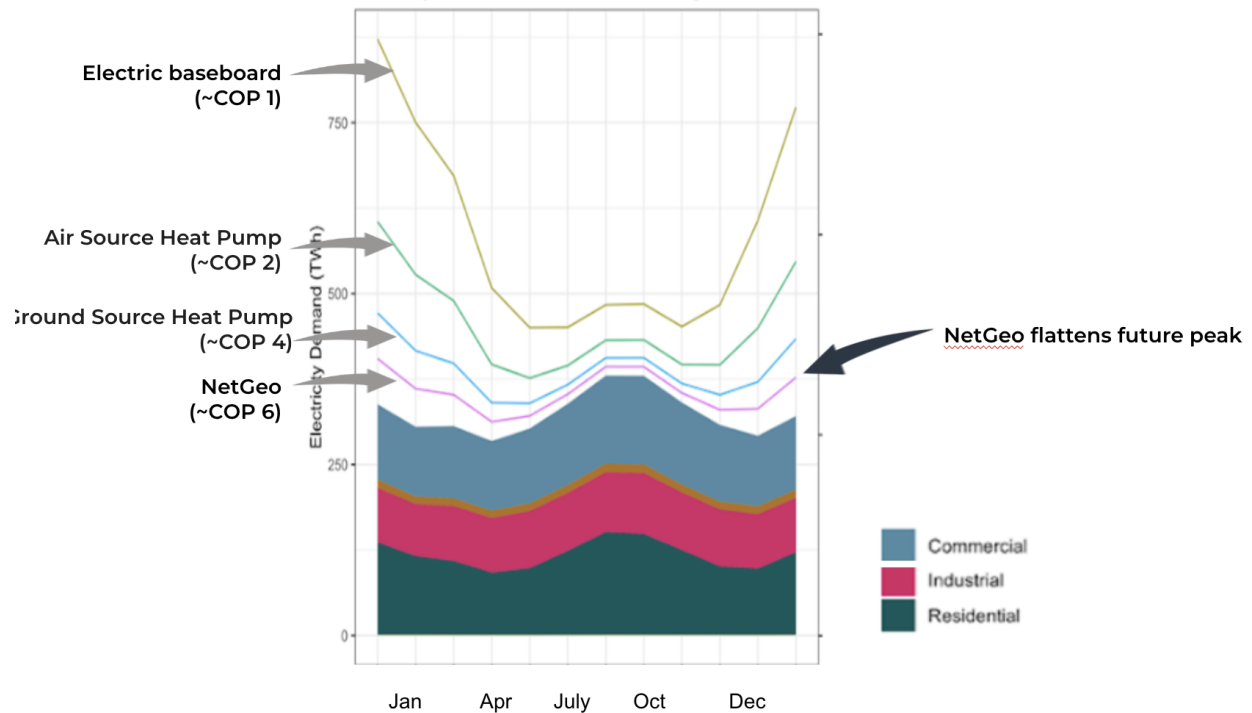
Currently, natural gas supplies a large portion of our winter heating needs. Some of the gas can be stored in liquified natural gas containers and used when needed, primarily in extreme winter events. Moving this large winter energy need to the electric system would radically increase the electric peak load during the winter.



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The Falcon Curve model—named because the silhouette of the winter peaks look like a falcon with its wings raised high—demonstrates that the efficiency of different electrification methods matters. Since networked geothermal is the most efficient method known for heating and cooling buildings, it would radically lower the future winter electric peaks, also lowering projected energy bills. Additionally, with networked geothermal, excess heat from buildings can be stored underground during the summer and pulled out as needed during the winter.

Future US Seasonal Electric Peaks (as we electrify)



Buonocore, J., Salimifard, P., Magavi, Z., Allen, J., "The Falcon Curve: Implications of Seasonal Building Energy Use and Seasonal Energy Storage for Healthy Decarbonization" DOI: [10.21203/rs.3.rs-1054606/v1](https://doi.org/10.21203/rs.3.rs-1054606/v1)

HEET's [networked geothermal](#) model is a solution that replaces aging gas infrastructure with networks of water pipes and ground source heat pumps, installed along street segments. The infrastructure can be owned and maintained by gas utilities, who already have the rights of way, customers, workforce and financing. Sections can interconnect over time to allow for an incremental evolution from gas to geo. The bigger and more diverse the system is, the more balanced it becomes, meaning lower costs and higher energy savings.

While we know that a transition away from gas is necessary, it poses financial risk to the millions who rely on gas for affordable heat. Customers who are better positioned financially will be able to transition their buildings to clean electricity on their own, leaving disadvantaged populations—including the elderly, low-income and environmental justice households—shouldering the costs of the entire gas system.



HEET and its network of allies propose transitioning gas utilities to thermal distribution companies, a move that would allow a broad customer base to adopt renewable technology at an affordable rate.

Presenters

- **Nikki Bruno**, Director of Clean Energy Technologies at Eversource Energy
- **Consultants from [CDM Smith](#)**, an engineering and construction company specializing in water, environment, transportation and energy and facilities projects:
 - **Jon Welch**, Vice President
 - **John Rhyner**, Senior Geologist
 - **Melissa Harclerode**, Sustainability Discipline Leader
- **Dr. Philosoek Kim**, Program Director at [ARPA-E](#)

Nikki Bruno

Nikki Bruno, Director of Clean Energy Technologies at Eversource Energy, reported on the status of Eversource's upcoming networked geothermal demonstration projects⁵.

Eversource would like to pick a typical site to evaluate feasibility, cost and performance.

The utility is looking to answer to some key questions:

- Is this a service line Eversource wants to own?
- How much would the networked geothermal system reduce emissions?
- Do customers get what they want and what they need?

Jon Welch, John Rhyner and Melissa Harclerode of CDM Smith

[CDM Smith](#) is the engineering company supporting Eversource in its site selection process.

Jon Welch, Vice President at CDM Smith, is the project manager for the demonstration program. John Rhyner is the Geothermal Geological lead and Melissa Harclerode is the Sustainability Discipline Lead.

Jon Welch explained that site selection is being carried out in a tiered approach. Initially, there was a high-level screening, then a more detailed review, along with a review of geologic factors. A detailed feasibility analysis is currently underway.

John Rhyner described key criteria used during the site selection process. After an initial screening, customer willingness to participate was assessed along with an evaluation of environmental concerns. Next, a detailed study of the geology and technical feasibility will be performed for the proposed sites.

For the initial screening, CDM Smith assessed the following prerequisites:

⁵ For current updates on Eversource's networked geothermal installation and site selection, see: <https://www.framinghamma.gov/3416/Geothermal-Pilot-Program>

- Sufficient width of the natural gas right of way for the boreholes required
- Minimum of one low-income, multi-family building
- Mix of commercial and residential buildings
- Must not interfere with public infrastructure (aqueduct, train/subway)

Other important criteria assessed:

- Is the site located in Eversource Electric Service territory, as well as Eversource Gas territory?
- What are the operational concerns with the existing natural gas distribution system?
- Does the neighborhood include delivered-fuel customers?
- Is there initial customer willingness?
- Is the building load the right size? (Must have adequate overall building load, with a total target of 300 tons⁶.)
- Is there an environmentally hazardous site within the territory?

CDM Smith is now performing a secondary evaluation of geologic conditions. Rhyner stated that most technical challenges can be overcome, but customer willingness is very important to the success of the project.

Rhyner presented an overview of each site that passed initial screening. The following four sites are under consideration for the networked geothermal installation and are undergoing additional review by Eversource:

- Framingham: Normandy Road/Thelma Road
- Boston: Margin Street/Hyde Park Ave
- Cambridge: Windsor Street/Washington Street
- Worcester: Lagrange Street/Main Street

Melissa Harclerode described the set of demographic indicators that will influence site selection. These include evaluation of low income, environmental justice and minority community participation, population density and property values. Air quality will also be evaluated, with the hope that the demonstration project will improve indoor air quality, given the removal of combustion for heating within the building. Demographic indicators will identify who is being served by the project and who may be impacted by the installation.

Dr. Philseok Kim

Dr. Philseok Kim is a program director at the Advanced Research Projects Agency ([ARPA-E](#)) within the U.S. Department of Energy.

Dr. Kim explained that ARPA-E is an agency that provides research and development funding for higher risk innovation projects that could fundamentally change how we get, use and store energy to enhance the economic and energy security of the United States.

⁶ A ton is a unit of heat, equivalent to the amount of energy needed to melt a ton of ice. Tons are used in terms of the amount of heat a building needs annually.

Dr. Kim stated that solutions are needed to solve key technology barriers to widespread adoption of networked geothermal across all major cities in the U.S. There is a need for open source tools to run feasibility studies. In addition, it will be important to implement coordination and control of complex networked geothermal systems.

Discussion and Attendee Comments

In four breakout sessions, participants reviewed Eversource's proposed networked geothermal demonstration sites. Groups were asked to provide pros and cons for each, based on the following major categories:

Demonstration Site Participants

- Willing customers?
- Low-income customers?
- Gas customers?
- Some delivered fuel customers? (i.e. fuel oil)

Politics

- Local municipal support?
- Local community support?
- Opposition?
- Good news story?

Site Conditions

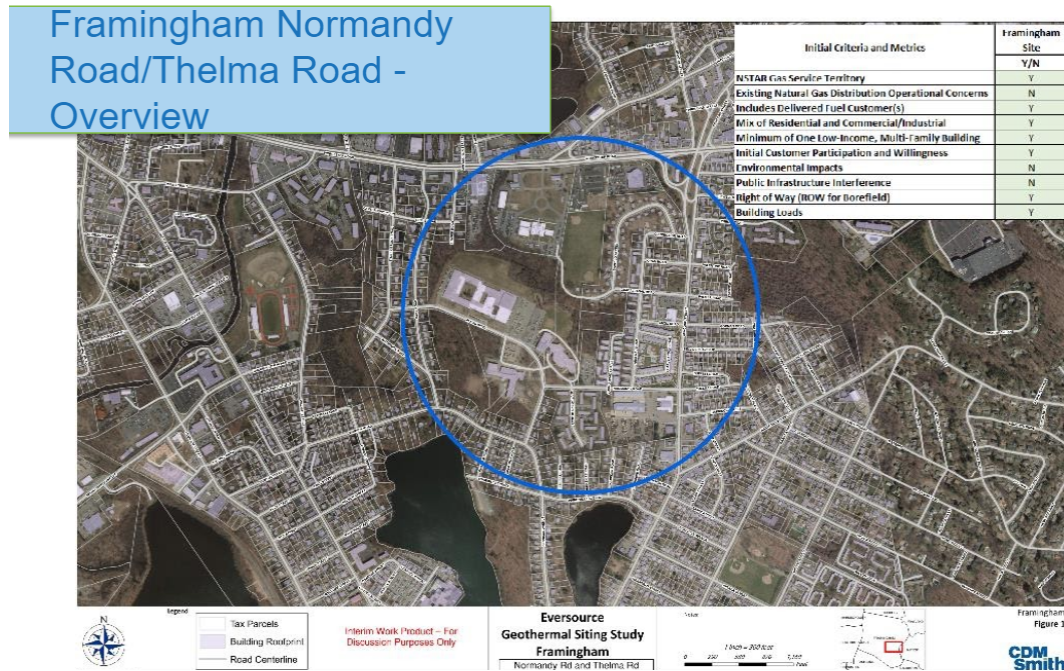
- Adequate space in the street?
- Subsurface contamination issues?
- Repaving or underground work needed?
- Issues with permitting?

Buildings

- Number of building units ~100?
- Cooling use estimated?
- Heating use estimated?
- Any buildings with steam-heat (expensive to retrofit)?

After the breakout sessions, each group presented a summary of their discussion.

Pros and Cons: Framingham



Pros:

- Politics: Engaged city and local support
- Participants: Includes environmental justice neighborhood and a mix of gas and delivered fuel
- Buildings: Diverse loads, variety of buildings
- Site conditions: Strong bedrock

Cons:

- Site conditions: Possible contamination

The breakout session concluded that Framingham is well suited to participate in the Eversource demonstration project. The group determined that the overall customer willingness is high and some community outreach has already begun. Energy efficiency programs offered by MassCEC in Framingham have been popular and speak to residents' readiness to engage. The city has been supportive of the project and is also working on an energy resilience study.

The group also noted that there is trust between residents and building owners. Another advantage is a high mix of customers using gas, electric and delivered fuel. Site conditions are favorable: minimal casing is needed, which will make drilling costs lower. There are no known issues with permitting. Framingham has a number of options that would reflect the required mix of buildings.

Pros and Cons: Boston - Hyde Park



Pros:

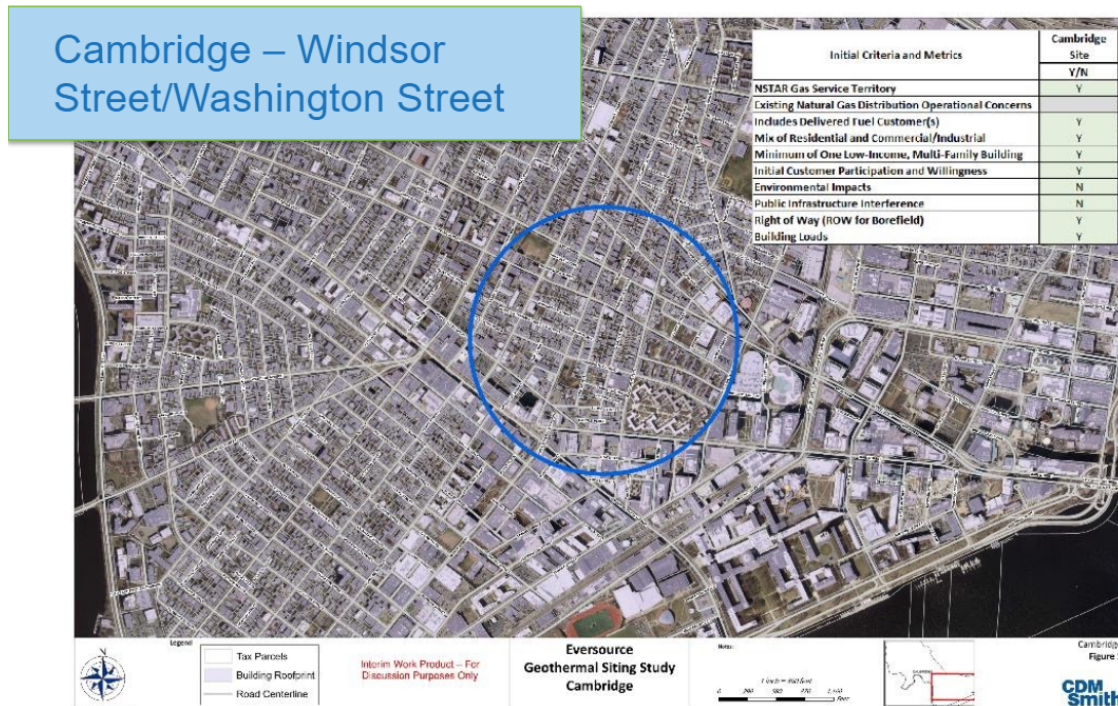
- Politics: Engaged and committed city
- Participants: Environmental justice neighborhood and a mix of gas and delivered fuel
- Buildings: Diverse loads
- Site conditions: Bedrock(a good material for drilling); adequate space in the street ; potential to take advantage of streams for thermal management in the long term

Cons:

- Participants: Not sure about the status of community outreach/engagement; may be a challenge for multi-units (owner vs renter decision making)
- Buildings: Not sure about HVAC mix
- Site conditions: More challenging issues with permitting

The breakout session participants reported that Boston/Hyde Park offers a number of advantages for Eversource’s demonstration project. Households include low-income and environmental justice customers and there is local/municipal support for the project. The buildings offer a diverse mix for load balancing. Choosing a site in Boston would be a good choice due to the density, presence of environmental justice communities and diversity of buildings and resources. The amount of outreach already completed and the community’s willingness to participate was unknown. Overall drilling and repaving cost impacts have not been determined.

Pros and Cons: Cambridge



Pros:

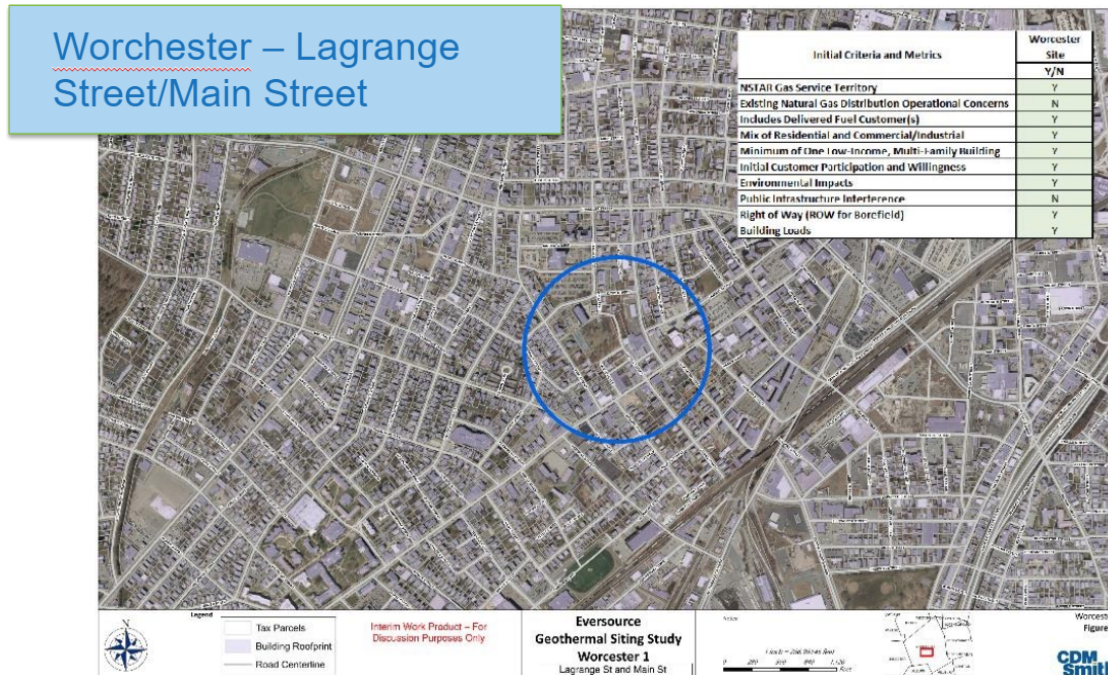
- Politics: Community is engaged
- Participants: Aware of climate change and receptive to networked geothermal
- Site conditions: Road construction is planned and could fit into building a networked geothermal system

Cons:

- Site conditions: 50-100 ft bedrock means possible drilling challenges; may be more prone to shifting than harder bedrock, like granite

The breakout session concluded that the Cambridge site would be a good fit for the Eversource demonstration project due to the level of community awareness, concern for environmental issues and popular consensus that there is a need for such a project. A networked geothermal demonstration project would likely face little or no opposition within the city. Another advantage of the Cambridge site is that the neighborhood’s roads are already set for a major construction project in 2022 to address sewer overflow. The potential to combine these two projects while the streets are open could reduce cost, increase efficiency and mitigate disruption caused by construction. In addition, there could be potential for replacement of older drinking water pipes, or opportunities to shift electrical utilities and broadband below ground while construction is underway.

Pros and Cons: Worcester



Pros:

- Politics: Very engaged and committed city; municipal support
- Participants: Environmental justice neighborhood; high percentage of renters
- Buildings: Mix of gas and delivered fuel; mix of residential and commercial buildings

Cons:

- Buildings: Property conditions are varied and include older buildings; concern about how all customers would be included with equal access

The breakout session strongly recommended Worcester as a site. Worcester has significant community interest in being selected. The neighborhood identified is a lower income and environmental justice community with many two to three family buildings. Buildings include a mix of small commercial spaces in addition to residential housing. There are also a few key players in the area that are a good fit for load balancing: a YMCA, a grocery store, an ice rink, a hospital and Clark University.

The group also noted that Worcester has challenges that, if solved in a demonstration project, could prove useful in the scaling of networked geothermal to city-size installations.

After each breakout group presented their findings, the audience was asked to vote on which town or municipality was best suited for the first Eversource Demonstration Program.

Worcester received the most votes. It is worth noting that results may have been influenced by the substantial number of Worcester residents present at the charrette.



Additional Information:

[HEET slide deck](#)

For more information about HEET and its work on networked geothermal:

<https://heet.org>

<https://heet.org/who-we-are/our-people/>

<https://heet.org/geo/>

<https://heet.org/community-charrette-reports/>

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