



# Somerville Networked Geothermal Information Meeting

Advancing Climate Goals through Innovation  
December 9, 2024



**BURO HAPPOLD**



[somervillema.gov/ose](https://somer villema.gov/ose)



# Meeting Purpose

- Share Information about Somerville's decarbonization efforts and Climate Forward Goals
- Educate public about networked geothermal technology
- Provide next steps for the public to stay engaged
- Answer questions about study and technology



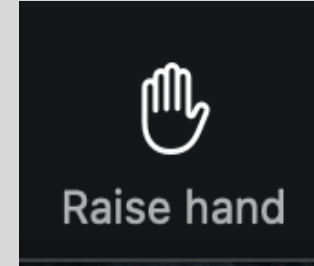
# Agenda

<b>6:00 PM</b>	<b>Welcome &amp; Agenda Review</b>
<b>6:10</b>	<b>Climate Forward Goals and Context for Networked Geothermal Study</b>
<b>6:15</b>	<b>What you can do now to decarbonize</b>
<b>6:20</b>	<b>Networked Geothermal Presentation</b>
<b>6:50</b>	<b>Q &amp; A</b>
<b>7:25</b>	<b>Next Steps &amp; Closing</b>
<b>7:30</b>	<b>Adjourn</b>



# Zoom Logistics

**After presentations:**  
Join queue to share a  
**questions** by raising hand



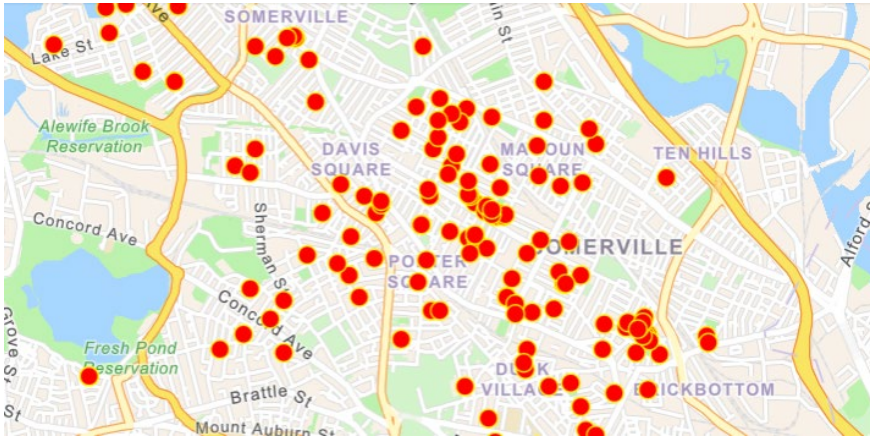
When prompted, select  
Unmute





# Poll: Who's in the Room?

## Kickstart Mass Grant to examine feasibility of Geothermal Networks in Somerville



Somerville Residents are expressing their interest in the Gas to Geo transition





# Climate Forward 2024

- Community-driven climate action plan
- Uses the latest data
- Prioritizes bold, strategic, inclusive action, investing in kids and innovation
- Addresses global issues while keeping local issues the priority
- 77 actions over 10 years
- Sets interim targets for 2030 and 2040

**Vision: Do our part and more, within and beyond our borders**



THRIVING



EQUITABLE



CARBON  
NET-NEGATIVE



RESILIENT

## 5 action areas



LEADERSHIP



COMMUNITY  
HEALTH &  
RESILIENCY



BUILDINGS  
& ENERGY



TRANSPORTATION  
& MOBILITY



NATURAL  
RESOURCES  
& WASTE

Available at [somervillema.gov/climateforward](https://somervillema.gov/climateforward)

**BURO HAPPOLD**



[somervillema.gov/ose](https://somervillema.gov/ose)



# Climate change impacts public health

Changing **climate conditions**



Shifting and more extreme  
precipitation and  
temperature patterns

Lead to **climate hazards**



Heat Waves



Flooding



Intense Storms

Which create the following **impacts to people, property, and ecosystems:**

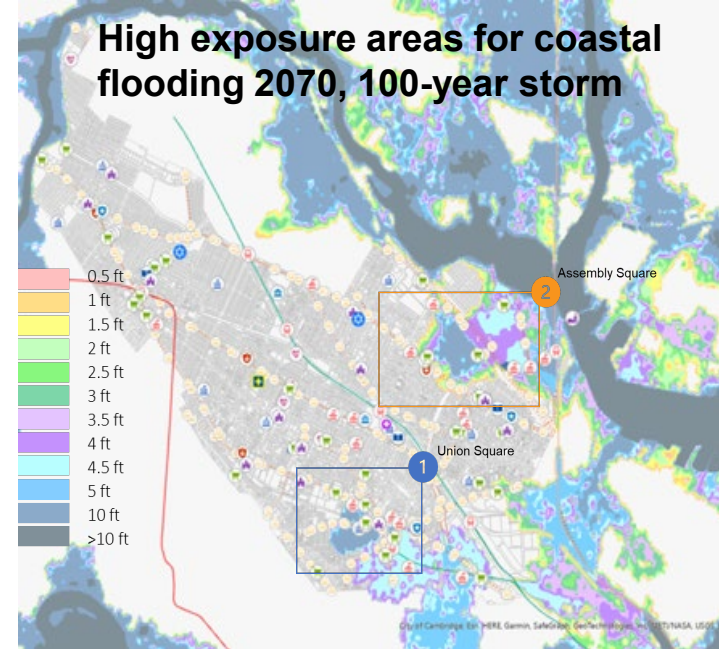
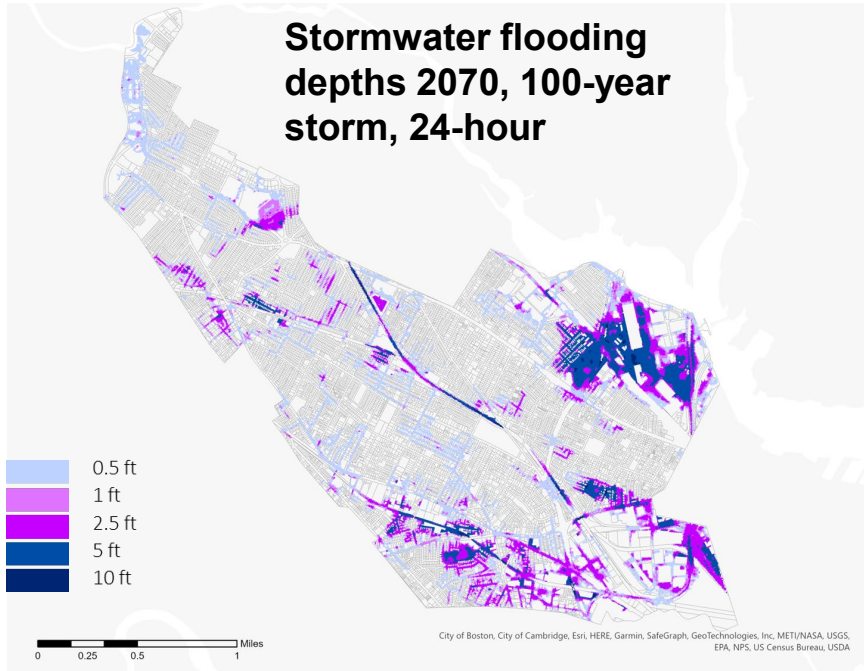
- Heat-related illnesses
- More vector-borne diseases
- Poor air quality
- Increased risk of drought
- Habitat damage
- Blocked roadways
- Infrastructure damage
- Power outages
- Business disruption

Available at [somer villema.gov/climateforward](https://somer villema.gov/climateforward)





# Climate change impacts public health



Available at [somer villema.gov/climateforward](https://somer villema.gov/climateforward)

**BURO HAPPOLD**



[somer villema.gov/ose](https://somer villema.gov/ose)

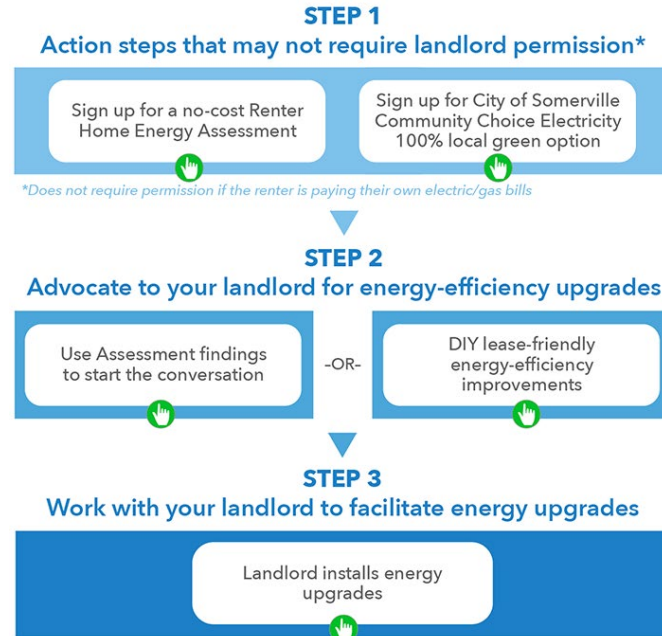


# What you can do to decarbonize now

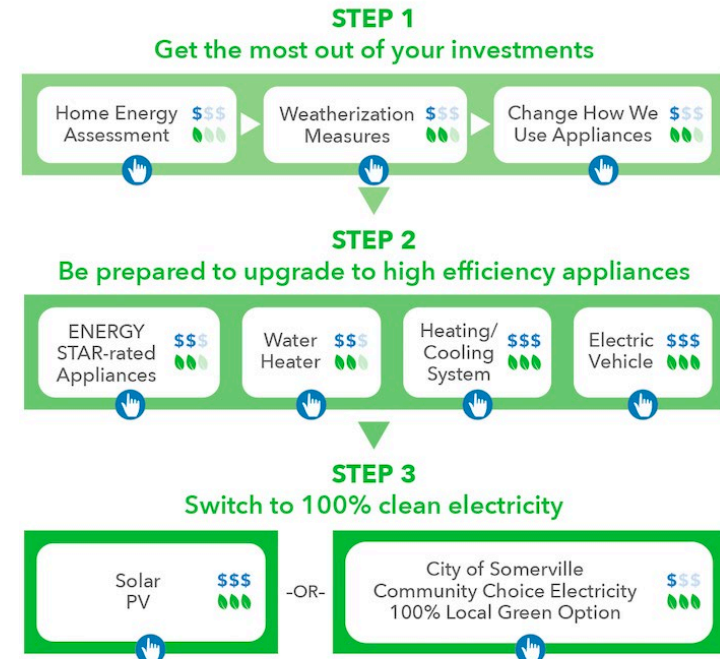
Road to **NET-ZERO**  **For Renters**

Road to **NET-ZERO**  **For Property Owners**

Visit [somer villema.gov/r2nz](https://somer villema.gov/r2nz) to learn more and get help



Visit [www.somer villema.gov/r2nz](https://www.somer villema.gov/r2nz) for tips & information.  
Start your journey to becoming a Net-Zero Hero today!



Start your journey to becoming a Net-Zero Hero today!



# City of Somerville Energy Advisor

## The Energy Advisor can help with:

- Scheduling a no-cost Mass Save home energy assessment
- Understanding the results and recommendations of your energy audit
- Understanding all the incentives, rebates, and tax credits available to you
- Evaluating different project options for your home, on your schedule, for renovations and improvements that improve the efficiency of your home
- Understanding financing options (e.g. zero-interest loans and programs for low or moderate income households)
- Reviewing quotes from contractors and evaluating the proposed projects
- Filling out forms to receive Mass Save incentives
- Sharing additional resources that could help you decarbonize your home

### Contact information:

Shannon Taylor (she/her)  
Energy Advisor  
Mayor's Office of Sustainability and Environment  
City of Somerville  
50 Evergreen Avenue, Somerville,  
MA 02145  
**[staylor@somervillema.gov](mailto:staylor@somervillema.gov)**  
Office: 617-625-6600 ext. 2424  
(leave a message)

Go to **<https://www.somervillema.gov/seen>** to learn more!



# Piloting the Gas-to-Geo Transition in Somerville

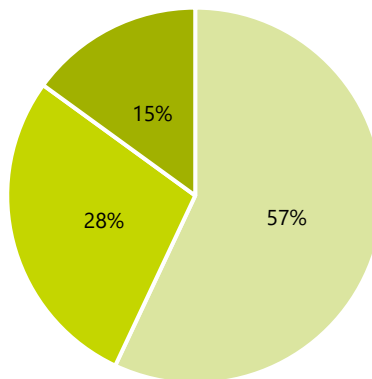
# Why Electrify Heating?

Somerville's Climate Forward aims to achieve net-zero greenhouse gas emissions by 2050

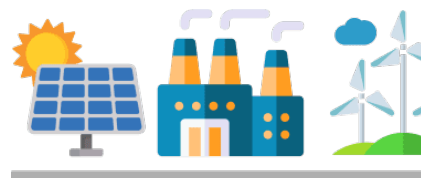
# 63%

of all greenhouse gas emissions in Somerville comes from **buildings**

Fuel Mix in Somerville



■ Natural Gas ■ Electricity ■ Fuel Oil



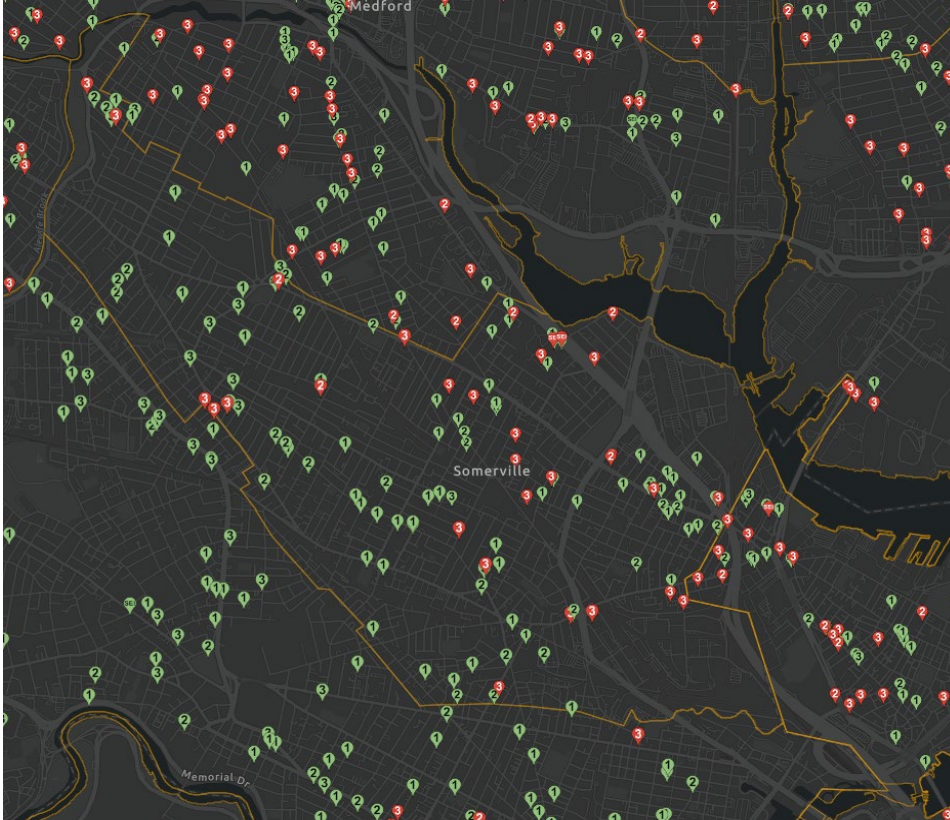
Somerville's **Community Choice Electricity (CCE)**  
[cce.somervillema.gov](http://cce.somervillema.gov)  
"Local Green" options have more renewables

**Replacing natural gas heating with electric heating systems, which can run on renewable energy, can help Somerville achieve its emissions targets**



# Natural Gas Leaks in Somerville

*10% of all building emissions come from natural gas leaks*



- Gas leaks release methane (80x global warming potential than CO<sub>2</sub>)
- Pipes across Somerville will need repairs – only to be phased out with state, utility, and local climate plans (non-pipeline alternatives)

## Gas Leaks in Somerville, MA

*Data aggregated by HEET*



Open gas leaks

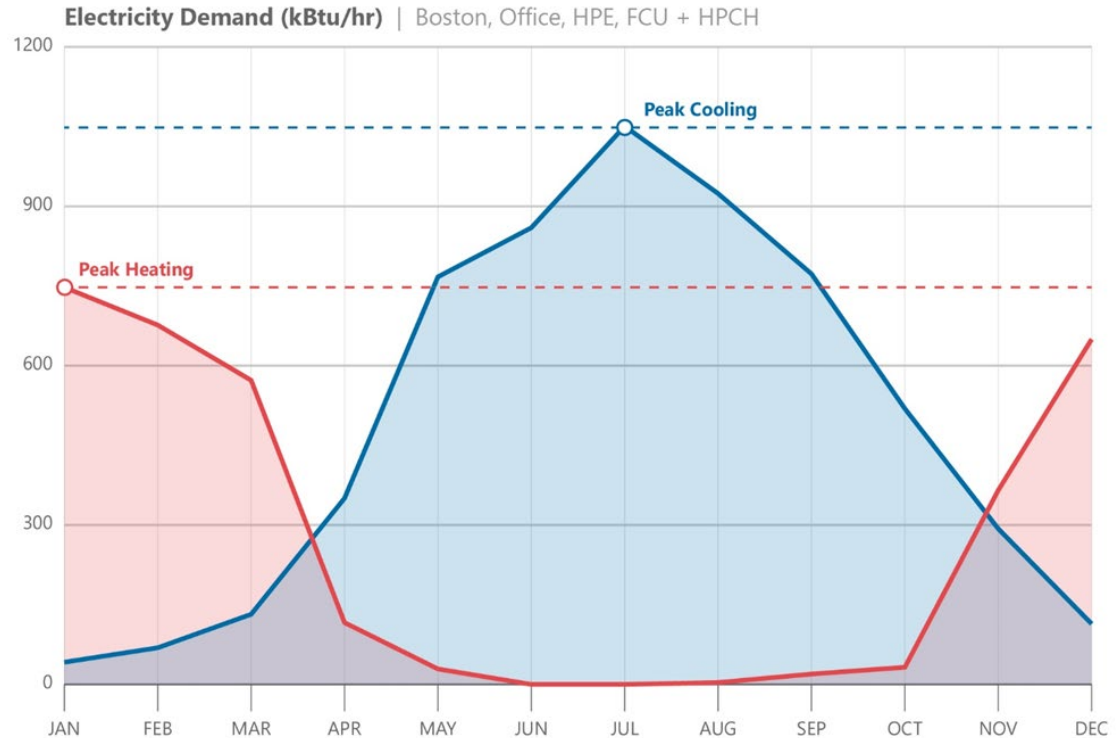


Repaired gas leaks

# Electrification Infrastructure Challenges in Somerville

*Decarbonizing buildings can increase electrical demand in the winter*

- Currently, peak cooling loads in the summer dictate the electrical service on the grid
- Risk of shifting peak electrical loads to winter season – potentially **overburdening the electrical grid**

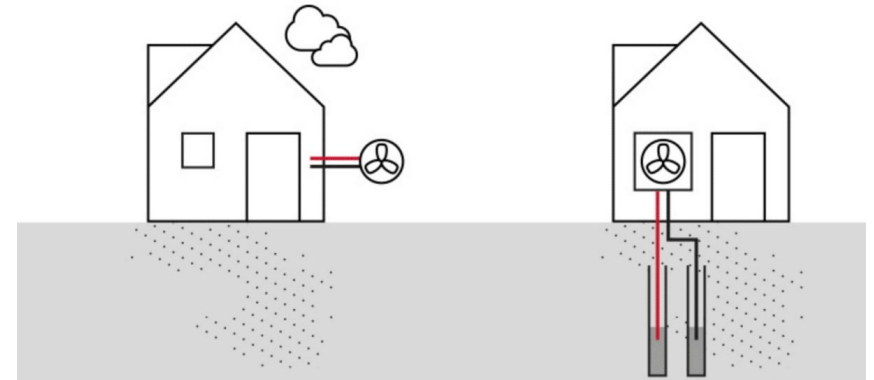
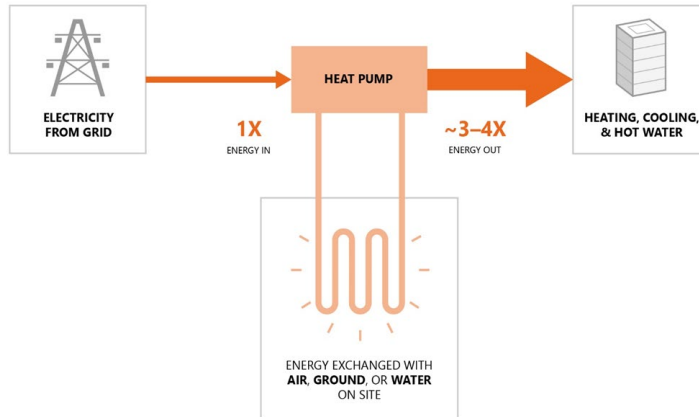




# Solution: Heat Pumps

*A well-established technology that can efficiently heat and cool our buildings*

- Heat pumps use electricity to circulate, compress, and expand air or water to move heat from one place to another (your refrigerator is a heat pump, just used for cooling)
- Can extract or release **thermal energy from air or a liquid**



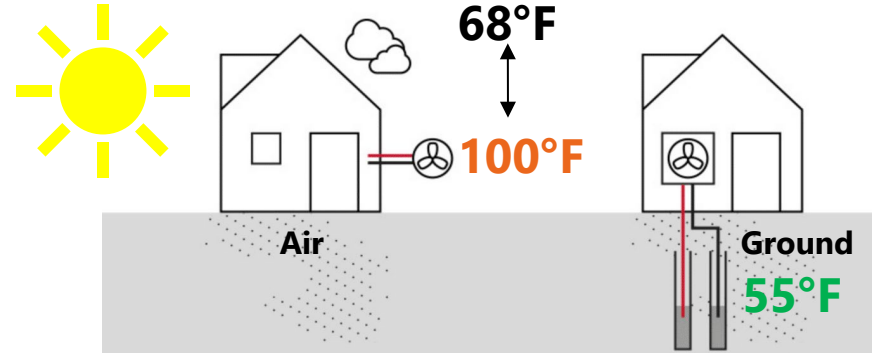
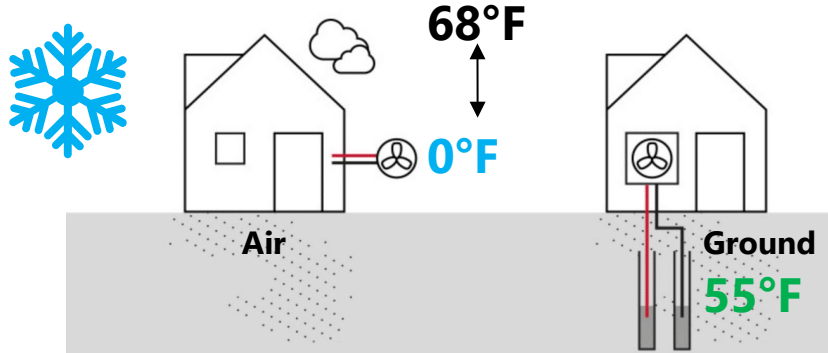
*Air-Source Heat Pump*

*Water or Ground-Source Heat Pump*



# Efficiency of Air- vs. Ground-Source Heat Pumps

*Ground-source heat pumps leverage consistent annual ground temperatures*



Efficiency is best when the temperature difference is minimized; Ground-source systems can capitalize on a constant annual ground temperature

HVAC System	Efficiency
Gas furnace	70-80%
Electric resistance heater	100%
Air-source heat pump	200-400%
Ground-source heat pump	300-500% +

How can we further capitalize on the efficiency of GSHPs?



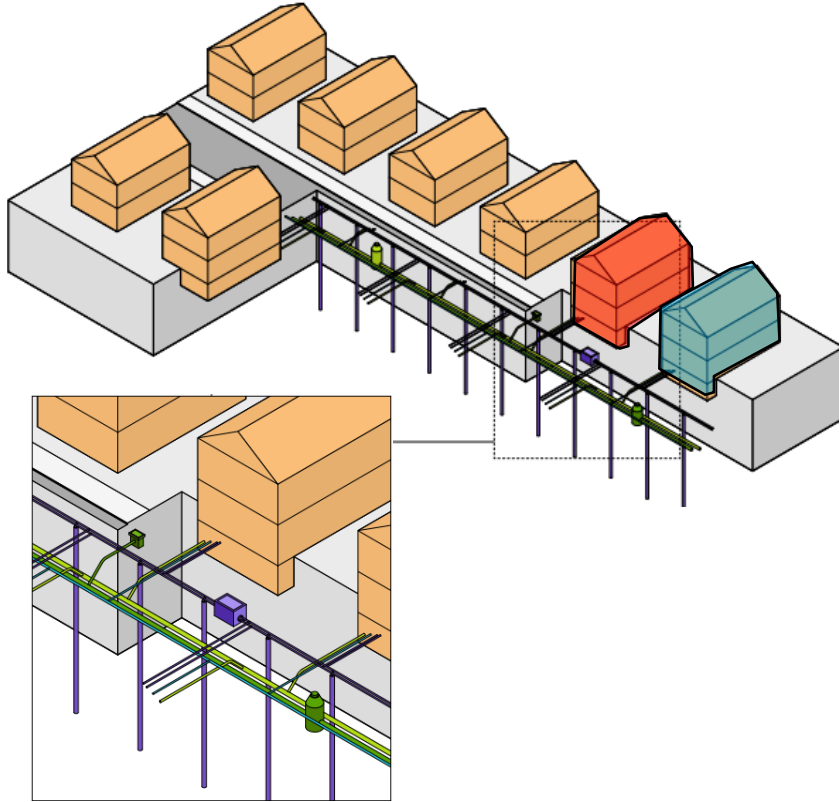
# Networked Geothermal

- Networked geothermal is an **expandable neighborhood-scale heat pump system**
- These systems interconnect individual ground-source heat pump systems to span entire neighborhoods – **replacing natural gas pipes with geothermal**
- Leverage Somerville's density to provide **local, affordable, renewable, and non-combusting** heating and cooling energy





# Components of a Networked Geothermal System



- “Shallow” **geothermal boreholes** (500-1,000 feet deep) exchange ambient ground temperature (55 °F) with pipes of water
- Distribution infrastructure in the street (same as other utilities) delivers thermal energy to buildings via **closed-loop pipe network**
- **Ground-source heat pumps** in every building take thermal energy and convert to building needs (may require retrofits)
- Connected to a meter at your home or business and **billed like other utilities**



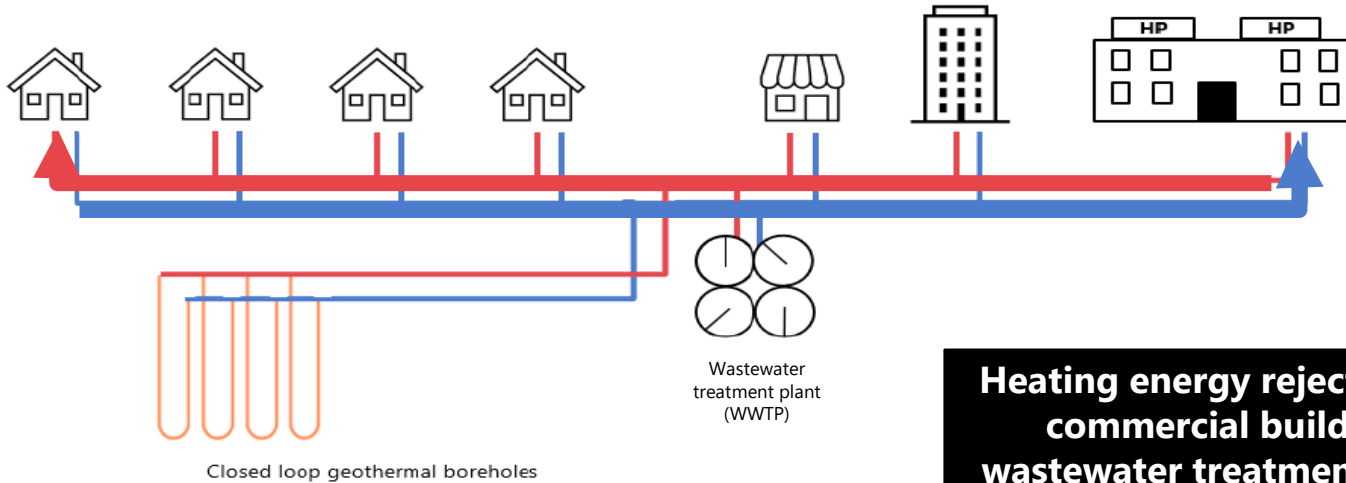
# Thermal Energy Sharing

*Buildings can utilize heating and cooling from others to improve efficiency*

## Energy Users

Houses / apartments with internal heat pump units

Commercial buildings, internal or external heat pump units



## Energy Sources / Sinks

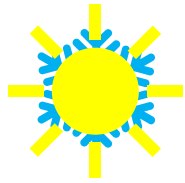
Closed loop geothermal boreholes

Wastewater treatment plant (WWTP)

**Heating energy rejected from commercial buildings, wastewater treatment plants, etc. can be used to heat other networked buildings**

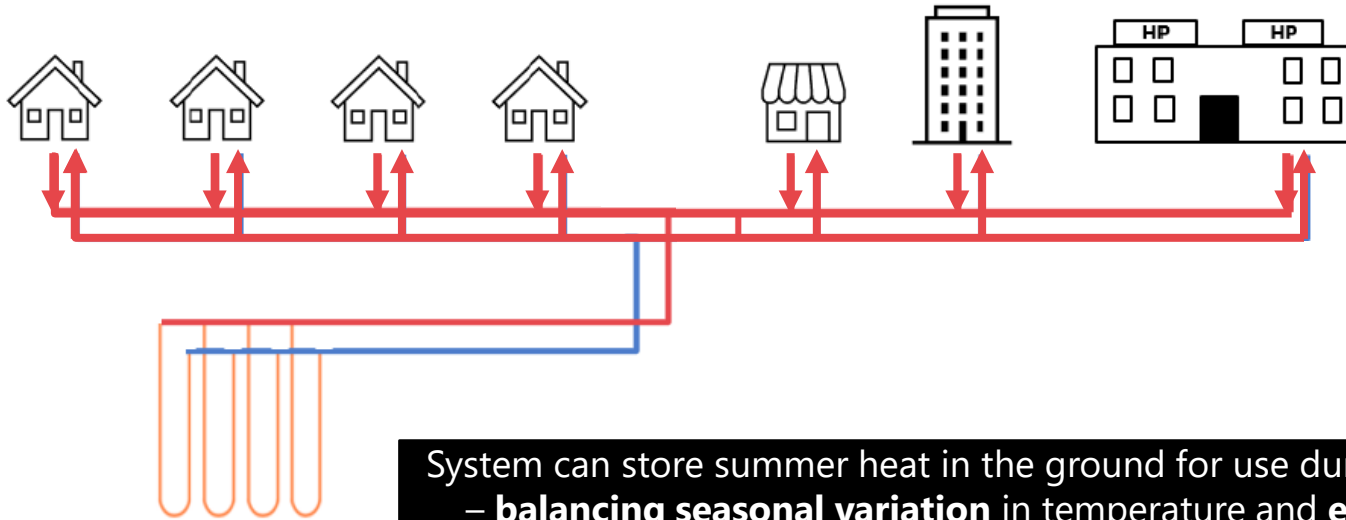
# Thermal Energy Storage

*Networked geothermal systems can store thermal energy for use in other seasons*



Houses / apartments with internal heat pump units

Commercial buildings, internal or external heat pump units



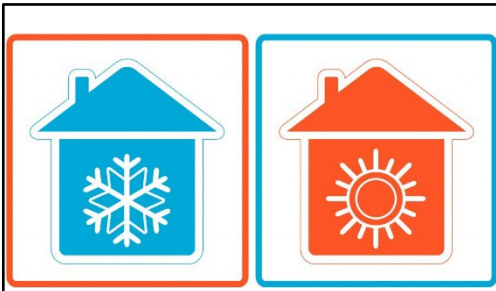
System can store summer heat in the ground for use during winter – **balancing seasonal variation** in temperature and **ensuring longevity** of performance



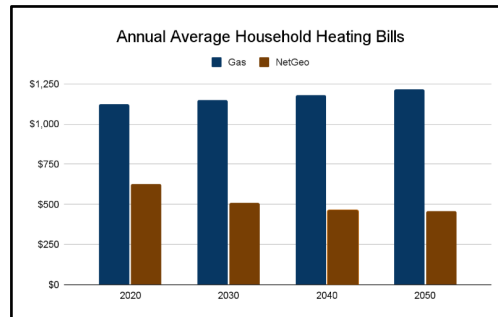
# Other Non-Energy Benefits



**Safety**



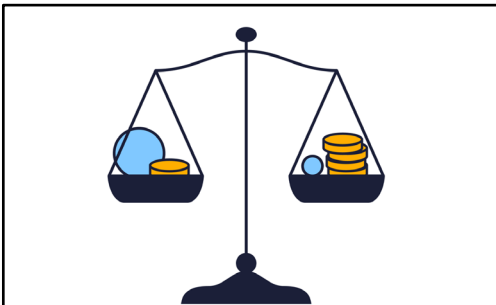
**Access to Cooling**



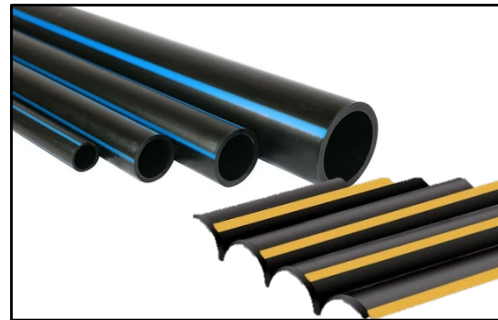
**Lower Utility Bills**



**Emissions and Air Quality**



**Equity**



**Workforce Development**



# Examples and Case Studies

## Framingham, Massachusetts

- Eversource's utility-owned networked geothermal pilot
- 140 customers (residential and commercial) with weatherization and HVAC compatibility installed
- Extension loop in design development



## Whisper Valley, Austin, Texas

- 7,500 single-family and multi-family homes, plus retail, restaurants, office parks, entertainment venues, schools, etc.
- Super Storm Uri (2021): Texas grid struggled under extreme cold temperatures while ambient loop remained in operation





# Site Selection Methodology

## Technical Considerations

- Bedrock geology and access to bedrock
- Diversity in types of buildings (blend of heating and cooling use)
- Waste heat and/or thermal resources
  - Data centers, ice rinks, or grocery stores
  - Breweries
  - Manufacturing
  - Wastewater treatment facilities
  - Mystic River
- Density of buildings (delivering thermal energy with less pipe infrastructure)







## Planning Considerations

- Open space for borefields
- Minimal infrastructure interference
- Streets with planning re-paving and/or underground utility work
- Neighborhoods with electricity or gas constraints
- Neighborhoods with leak-prone gas pipes
- Opportunities to advance energy equity (pollution, energy burden, access to cooling)


# Site Selection Methodology

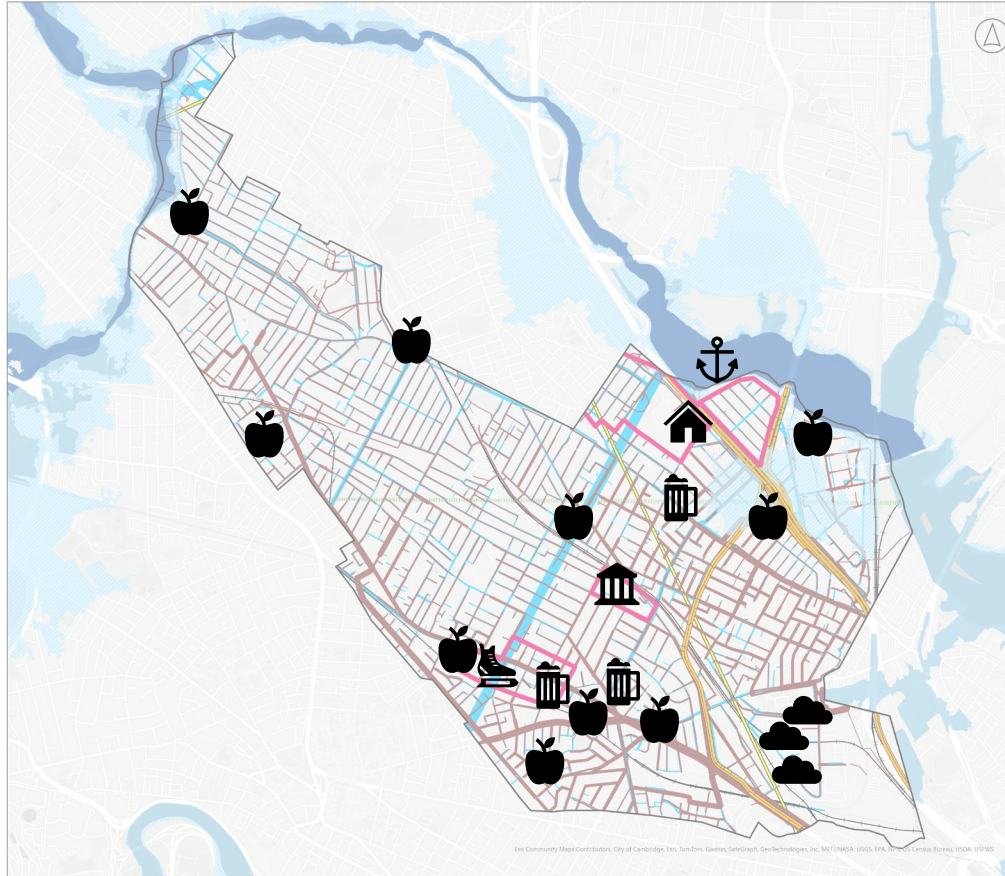
 Area of Interest

## Public Infrastructure







 Natural Gas Pipelines  
 Transmission Lines  
 Highways  
 Commuter Rail Lines  
 Water Distribution Width by Diameter  
 Sewer/Storm Width by Diameter

## FEMA National Flood Hazard

 Regulatory Floodway  
 1% Annual Chance  
 0.2% Annual Chance



## Key Landmarks and Thermal Resources

-  Grocery store
-  Data center
-  Brewery
-  Somerville Housing Authority
-  Veterans Memorial Ice Rink
-  Mystic River
-  Town Hall

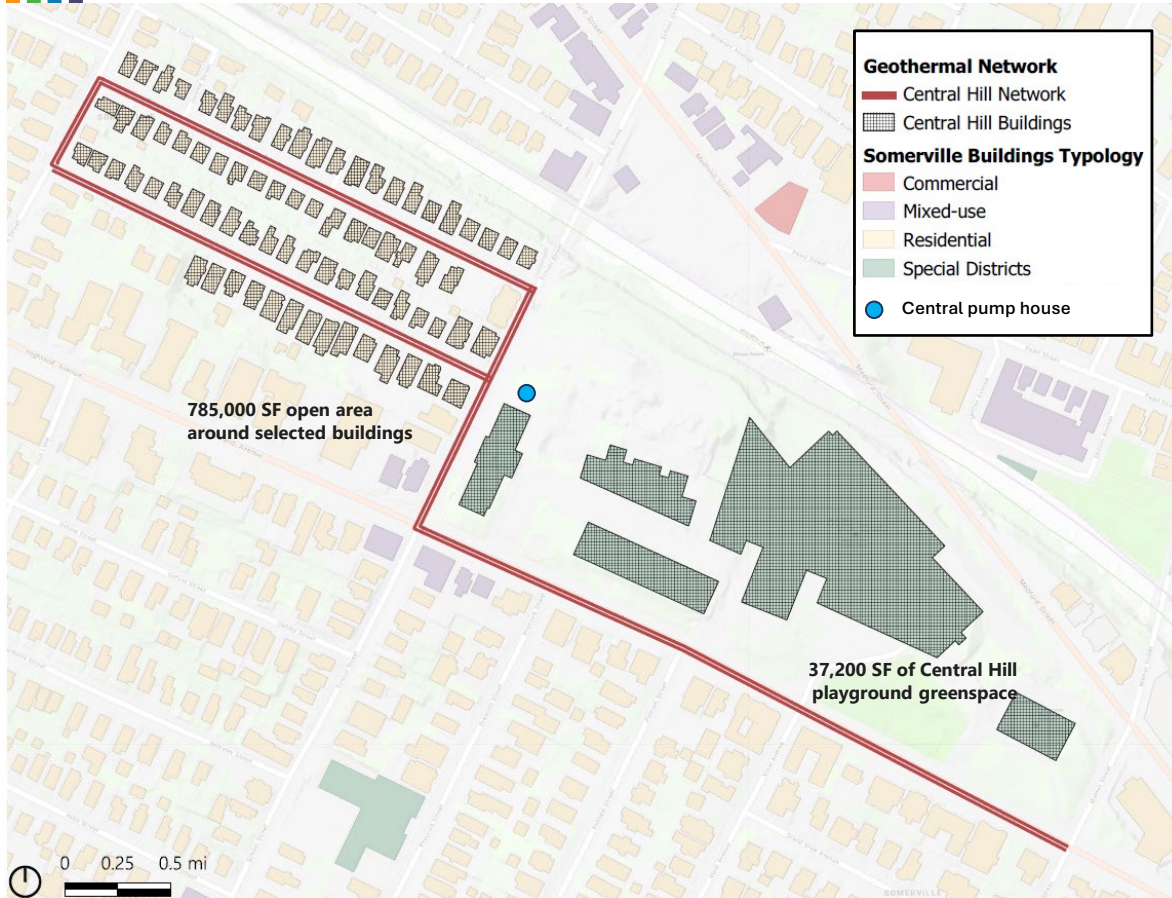
0 0.5 1 Miles





# Central Hill

*Sample network layout (for illustrative/draft purposes only)*

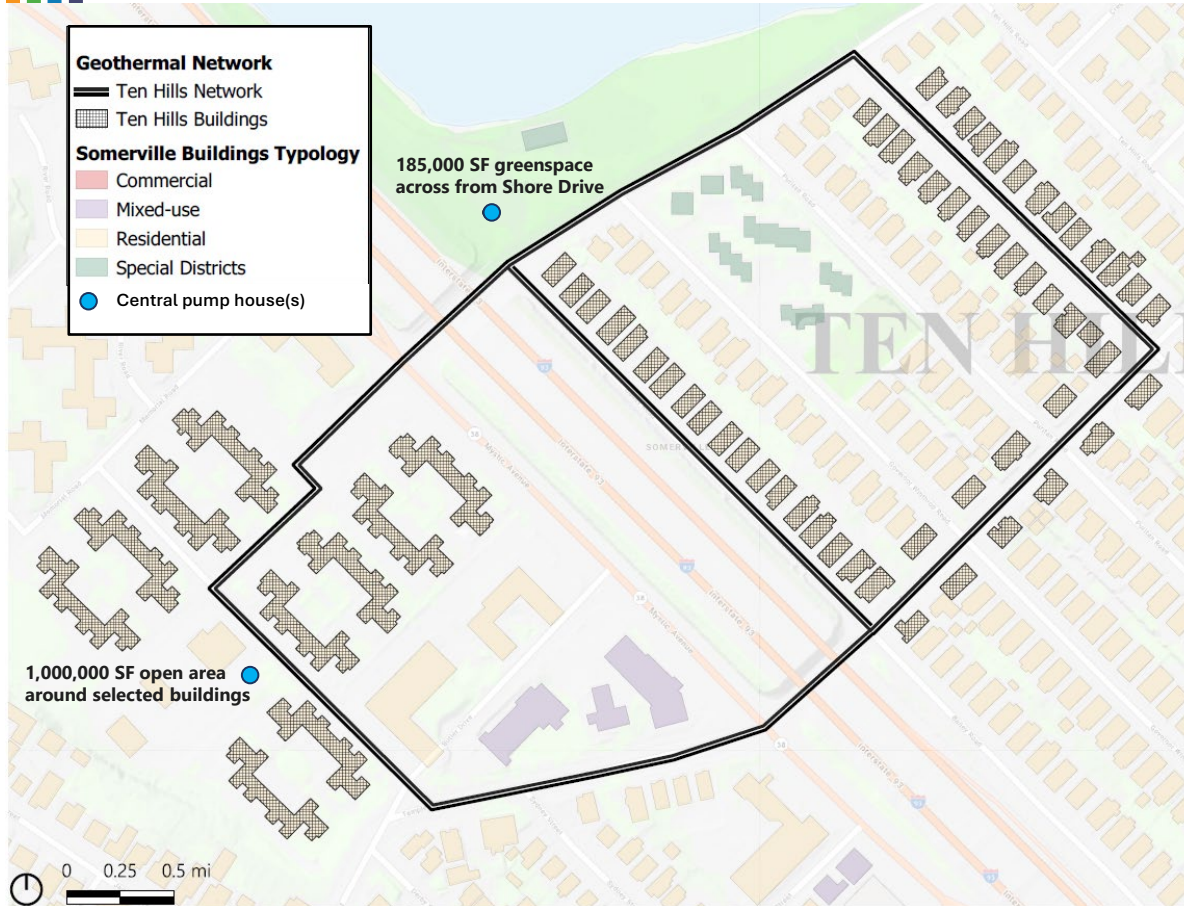


- Opportunity to showcase networked geothermal using municipal and school buildings
  - City Hall
  - Somerville High School
  - Somerville Public Library



# Ten Hills

*Sample network layout (buildings not finalized)*



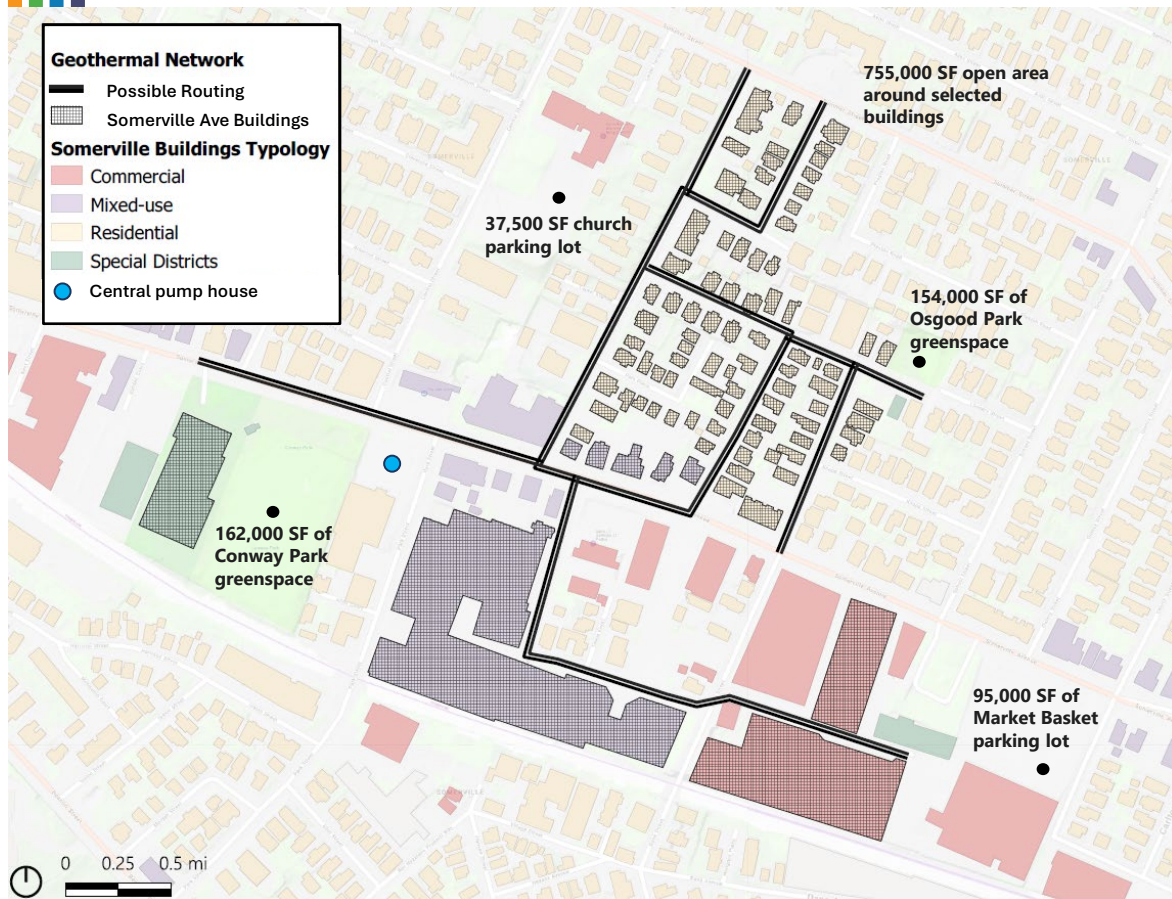
- Opportunity to provide networked geothermal to low-income housing and integrate Mystic River into a thermal energy network
  - Somerville Housing Authority
  - Mystic River
- Potential to connect under Northern Expressway to Somerville Housing Authority development (south side of expressway)





# Central Somerville Avenue

*Sample network layout (buildings not finalized)*



- Opportunity to integrate several waste heat resources into a thermal energy network
  - Ice rink
  - Breweries
  - Grocery stores
  - Other manufacturing



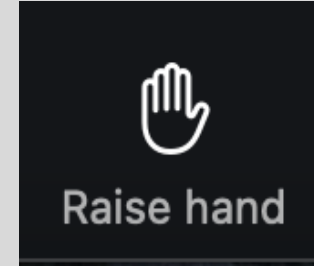
## Poll: Do you live in one of the 3 Study Areas?





# Time for Questions

**After presentations:**  
Join queue to share a  
**questions** by raising hand



When prompted, select  
Unmute





# Next Steps

- If you're in a study area (receive a mailer or doorhanger) go to [somer villema.gov/geothermal](https://somer villema.gov/geothermal) and help the study by entering your building info
- Sign up for Sustainaville Newsletter to keep informed about this study and other Climate Forward initiatives [somer villema.gov/sustainaville](https://somer villema.gov/sustainaville)
- Help us improve this community meeting and spread the word to your neighbors about the next meeting on January 8 at 6:00pm. Register at [somer villema.gov/geothermal](https://somer villema.gov/geothermal)
- Weatherize and Decarbonize your home now, learn more from the Energy Advisor visit [somer villema.gov/seen](https://somer villema.gov/seen) to learn more
- Read more at HEET Gas-to-Geo website and sign up on the Want to Geo Map visit [heet.org/what-is-gas-to-geo](https://heet.org/what-is-gas-to-geo)



# Thank You

**Garrett Anderson**

Residential Decarbonization

Program Manager

Mayor's Office of Sustainability  
and Environment

[ganderson@somervillema.gov](mailto:ganderson@somervillema.gov)  
(857)270-4403

**Naomi Gross**

Community Engagement

Specialist

Mayor's Office of Sustainability  
and Environment

[ngross@somervillema.gov](mailto:ngross@somervillema.gov)  
(857)270-2463

**Shannon Taylor**

Energy Advisor

Mayor's Office of  
Sustainability and  
Environment

[staylor@somervillema.gov](mailto:staylor@somervillema.gov)