SPP 609 WORKSHOP · CASE STUDY REPORT

Networked Geothermal

in Massachusetts

Nine case studies on the feasibility-to-construction environment

Arlington · Framingham · Smith College · Lowell
Amherst College · Somerville · Deerfield
Greentech Park / Worcester · New Bedford

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Editor’s Note

This report is a graduate workshop study of nine networked geothermal projects in Massachusetts, prepared in the UMass Amherst School of Public Policy in spring 2026. It draws on public records, feasibility studies, regulatory filings, news coverage, and municipal minutes, together with a small number of confidential interviews. Coverage and detail vary by project and by what the public record contains. The cost and scale figures are feasibility-stage estimates, reported as ranges where a project modeled more than one scenario, and the cross-case comparisons are indicative rather than precise. Interviewees are described by professional role rather than by name, in keeping with the study’s confidentiality commitment, and Appendix C describes the team’s use of AI tools. We welcome corrections and updated information. Please write to juniperkatz@umass.edu.

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Executive Summary

This report examines nine networked geothermal projects across Massachusetts. As interest in networked geothermal increases, we wanted to gather information by examining different cases in Massachusetts. We selected our cases to reflect the range of pathways currently being attempted in the Commonwealth: utility-owned pilots in Framingham and Lowell; two self-financed institutional deployments at Amherst College and Smith College; a quasi-public industrial redevelopment at Worcester's Greentech Park (also funded by a HEET Kickstart study); and several municipal Home Energy Efficiency Team (HEET) Kickstart feasibility studies (Arlington, Somerville, Deerfield, and New Bedford). Taken together, the cases show that Massachusetts has built strong enabling policies. These include the 2050 net-zero mandate, the Department of Public Utilities' (DPU) Docket 20-80 order, the HEET Kickstart grants, and Massachusetts Clean Energy Center (MassCEC) incentives. Inflation Reduction Act (IRA) tax credits are also supportive of geothermal.

To conduct our research, we used qualitative methods, including reviewing publicly available press releases, project websites, and government documents to gather data and context. We conducted five interviews with stakeholders. In addition, we performed quantitative analysis around factors like the network of actors at play in projects and the extent of the permitting process, among others. While we identified multiple trends that seem significant, we also examine the following two primary questions: How do we extend these lessons to other projects in Massachusetts and other places? In addition, what groups or organizations have the capacity to gather, analyze, and share this institutional information to support future projects?

HEADLINE FINDINGS

- Only Framingham is fully complete. Smith College has partial operation as it works to in phases, with parts of the system running while others are still under construction.
- The *primary* constraints tended to be cost-related with issues relating to network ownership, financing, and distance between buildings – or building density, coming up repeatedly in our research. Whether the building uses and proximity will support the cost of networked geothermal installation and who will pay for conversion of existing infrastructure both emerged as critical questions.
- Framingham demonstrates the technical feasibility of utility-owned networked geothermal. However, per-building costs of ~$595K raise questions about replicability without major support from government programs.
- Amherst College's self-financed pathway depends on institutional capital that may be unavailable to municipalities.
- Deerfield's study found that networked geothermal was technically feasible but not cost-competitive with Air Source Heat Pumps (ASHPs). Insufficient building density also contributed to the cancellation of the utility-led project in Lowell. Networked geothermal needs adequate building density which public policies cannot change in the short run.

THE CENTRAL TENSION

Massachusetts has created demand for networked geothermal, but it hasn’t finished building the institutional pathway – ownership, financing, and permitting – to convert that demand into built infrastructure.

1. Introduction

1.1 Why networked geothermal

Ground source heat pumps are an efficient way to heat and cool buildings. This is primarily because they use the mass of the ground to store heat and cold that can be transferred to circulating liquid via bore holes. Networked geothermal, also called a thermal energy network, connects multiple buildings to a shared ambient-temperature loop that exchanges heat and cold with the ground through closed-loop boreholes and pipes. Ground temperatures in Massachusetts are thermally stable near 10-11 °C at modest depths, which allows heat pumps to achieve coefficients of performance (ratio of delivered thermal energy to electrical input) typically between 3.5 and 5.0, several times better than resistance heating and materially better than air-source heat pumps on the coldest New England days. Implementing geothermal networks is complex for a variety of reasons. A thermal loop is subject to network economics: its costs and benefits accrue at the scale of a neighborhood or campus. That scale is what makes it powerful, and what makes it institutionally challenging.

Though networked geothermal systems offer efficient heating and cooling, there are long-term considerations. The chief one is subsurface thermal interference, which can reduce system efficiency over time if there is an imbalance between heating and cooling needs. Because the loops are sealed, closed-loop systems carry a much lower groundwater-contamination risk than open-loop wells, though sound borehole grouting during construction remains important.

1.2 The Massachusetts policy environment

Several policies were adopted in the last five years that relate to the adoption of alternative technologies like networked geothermal: the 2021 Massachusetts climate law's net-zero-by-2050 mandate; the Department of Public Utilities' 2020 order in Docket 19-120 approving the first utility-owned geothermal pilot under an existing gas franchise; HEET's Kickstart Massachusetts program (which distributed $450,000 across thirteen communities to fund feasibility studies); MassCEC incentives; and federal IRA credits for ground-source heat pumps. Together, they have generated a pipeline of feasibility-stage projects.

Federal Inflation Reduction Act incentives supported several cases. The IRA’s 30% investment tax credit is available to tax-exempt institutions through elective (direct) pay, and the IRA also created the Energy Infrastructure Reinvestment program, a Department of Energy loan-guarantee program for energy-infrastructure owners [1]. What does not yet exist is a cost-effective path to construction. As of April 2026, only Framingham (utility-led), Amherst College (self-financed), and Smith College have moved beyond feasibility to start construction. The rest of the cases reveal the specific places the pipeline from feasibility to completion can stall.

1.3 Report Scope

This report provides a preliminary overview of nine of the fifteen networked geothermal (GT) projects currently at some stage of development in Massachusetts. The factors discovered here apply to much of the built environment in Massachusetts and New England, as well as other locations with a mix of historic and newer building stock, so it is likely that some of the lessons we describe here can be meaningfully applied to other settings.

2. Methodology

2.1 Case Selection criteria

- Located in Massachusetts, with a networked geothermal system as the project concept.
- At least one publicly available feasibility study, Department of Public Utilities (DPU) filing, or equivalent technical documentation.
- Diversity across project types: utility-led, institutional, community/municipal, and private/quasi-public.

2.2 Evaluation framework

Each case was assessed across five dimensions. These five dimensions provided a consistent framework for understanding the technical, economic, regulatory, and community factors that influence a geothermal deployment's success. Together, these five dimensions will help researchers and policymakers identify the conditions, opportunities, and potential challenges that shape geothermal deployment and longevity.

Technical	System type, borefield design, borehole count and depth, tons capacity, buildings served.
Governance	Lead organization, ownership model, regulatory authority, and key institutional actors.
Economics	Gross and net cost, per-building cost, funding sources, projected savings, and payback.
Permitting	The range of permits required to commence construction, including National Pollutant Discharge Elimination System (NPDES), state well registration, wetlands, trench and right-of-way, utility coordination.
Equity & engagement	Environmental Justice (EJ)-area siting, affordable housing inclusion, resident outreach, and survey response.

2.3 Sources

Each case profile was prepared by students and faculty participating in an applied research course within the School of Public Policy at UMass Amherst in February-May 2026. Student composition includes undergraduate and graduate students. Primary data sources include Buro Happold and Brightcore feasibility reports, HEET Kickstart summaries, Eversource pilot webinars and construction updates, municipal meeting minutes, DPU filings, and local and national press and in some cases, interviews with knowledgeable people engaged in the project. Each profile lists its sources and flags gaps where the public record was incomplete.

3. Case Studies

The nine sections that follow each profile one project using a shared structure: snapshot table, overview, governance and actors, funding and costs, community engagement, and a “Why this case matters” takeaway.

01	CASE STUDY

Town of Arlington Networked Geothermal

Feasibility · HEET Kickstart · equity-anchored

PROJECT SNAPSHOT

Location	Arlington, Middlesex County, MA
Project type	Community (HEET Kickstart)
Status	Feasibility completed (Feb 24, 2025)
Lead organization	Town of Arlington
System scale	2 sites / 44 buildings · 153 boreholes × 500 ft · 460 tons
Estimated cost	$17.1M gross · ~$9.9M net after ITC + Mass Save
Key obstacle	No identified construction funding
Policy anchor	Arlington 2021 Net Zero Action Plan

PJ1 · Prepared by Juniper Katz, March 2026

Arlington Overview

The Town of Arlington is exploring a networked geothermal system to serve two public buildings in East Arlington: Thompson Elementary School (69,786 GSF, built 2013, ~600 occupants) [2] and the Arlington Housing Authority's Menotomy Manor affordable housing complex (43 townhouse buildings, 179 units, ~500 residents, built 1948) [2,5]. The proposed design calls for 153 boreholes drilled to 500 feet in North Union Park, adjacent to the school, connected via lateral piping to both sites [2]. The system would replace natural gas heating in both buildings and provide cooling capacity that neither building currently has in full [1]. The project was funded through a $50,000 HEET Kickstart grant (top-tier award from the $450,000 MassCEC-funded program) [3,4,8] and studied by Brightcore Energy LLC [2]. The Town is implementing its Net Zero Action Plan, which charts a path toward net zero emissions by 2050, and has deployed numerous clean energy, waste reduction, green infrastructure, building efficiency, and sustainable transportation projects [6].

Arlington Governance & Actors

The Arlington Geothermal project is headed by a collaborative multi-level partnership of municipal leadership, housing authorities, community organizations, consultants, technical experts, and state support. The town project team consists of a Sustainability Manager, a student Fellow, and the Environmental Planner/Conservation Agent [2]. The town project team coordinates day-to-day planning and leads the town's climate and energy initiatives. Town leadership members oversee the project and ensure the geothermal project is aligned with municipal priorities and is efficiently coordinated across departments [2,3,4]. The nonprofit organization HEET plays a central role in facilitating and funding the project [6,8]. Brightcore Energy LLC and Energy Modeling Lab provided engineering and performance consulting services to establish the technical feasibility and thermal load for the town's networked geothermal program [2]. At the state level, the Massachusetts Executive Office of Housing and Livable Communities assists with integrating housing with geothermal and housing modernization efforts to support ground source heat pump infrastructure [2]. Community advocates including Electrify Arlington, help educate the community about energy-related technologies [2]. Another community advocate group is Sustainable Arlington [2], an organization that promotes climate stabilization and sustainability initiatives within the Arlington community.

Arlington Funding & Costs

The total gross cost of the Arlington networked geothermal system is $17,100,000, which includes $5.9 million for borehole drilling, $2.2 million for piping, $6.5 million for the Thompson building retrofit, and $2.5 million for the Menotomy building retrofit [2]. Utilizing a 30% Federal Tax Credit (ITC) the project reduced its cost by $5,130,000, as long as the project is using the required wage and apprenticeship standards [1]. In addition, the project is using a Mass Save rebate of $2,070,000 at $4,500 per ton for a 460-ton system, with the pre-approval required for its systems larger than 150 tons [2]. After applying both the ITC and Mass Save incentives, the Arlington geothermal system would cost approximately $9,900,000 [2]. The project is expected to generate an annual savings of about $302,000 compared to an air-source heat pump alternative, while reducing emissions by an estimated 307 tons of CO_2 per year [1]. At this savings rate, the break even point at the net cost is approximately 33 years ($9.9M ÷ $302K/yr), or 27 years if the domestic content bonus (a provision under the Inflation Reduction Act (IRA) that offers an additional 10% tax credit bonus to clean energy projects that use American-made materials and components in their construction.) applies [2]. Without the ITC and Mass Save, the gross-cost payback would be $17.1M ÷ $302K = 57 years.

Construction funding has not been identified; the Kickstart grant covers only feasibility [2]. Notably, a search of both the 2024 and 2025 Arlington Town Meeting warrants found no mention of "geothermal" which could mean that no public appropriation for construction has been formally proposed [author's review of Arlington Town Meeting warrants, 2024 and 2025]. The gap between feasibility funding and construction funding could be a recurring challenge across HEET Kickstart communities and is worth tracking across cases.

Arlington Community Engagement & Equity

The engagement approach is notable for its breadth. The project team used at least six distinct outreach methods like fairs, educational events, door hangers and more [2,6]. In its outreach efforts, the town emphasized making geothermal technology tangible through things like Lego models, candy-themed activities for children, and in-person Q&A [2]. The research documents do not show evidence of organized opposition, though institutional stakeholders raised concerns about who would fund the project and whether operational costs would increase (HEET summary) [6]. Notably, as of July 2024, the Sustainability Manager acknowledged engagement had "not yet begun in earnest," [5] and AHA Executive Director Jack Nagle stated: "We don't want to talk about hypotheticals until it's something we can commit to [5]." The engagement was led partly by the Town's DEI Division and explicitly targeted a socioeconomically diverse, environmental justice neighborhood [2,6]. Arlington Housing Authority has a track record in engaging with residents over energy changes. Whether the feasibility-phase engagement translates into durable community support for construction is an open question due to the disruptions that geothermal projects can cause.

WHY THIS CASE MATTERS

Arlington shows how a municipality can move networked geothermal from policy goal to defined feasibility-stage project, anchored by a Net Zero Plan, a public school, and an affordable-housing site in an EJ neighborhood. This project demonstrated strong community engagement but proponents worry about continuing the process without certainty in its construction.

CASE STUDY

02

Eversource Networked Geothermal Pilot, Framingham

The first utility-owned networked geothermal system in the U.S.

PROJECT SNAPSHOT

Location	Framingham, Middlesex County, MA
Project type	Utility (Eversource · NSTAR Gas)
Status	Operating — formal O&M phase began Aug 2025
Lead organization	Eversource Energy
System scale	37 buildings · 88 boreholes (600–700 ft) · 375 tons · ~135 customers
Estimated cost	~$22M gross (Phase 1); net cost pending IRA confirmation
Key obstacle	Scalability at sustainable cost without long-term subsidies
Policy anchor	MA DPU Order, Docket 19-120 (2020 rate case)

PJ2 · Prepared by William Sullivan, April 2026

Framingham Overview

This Eversource Networked Geothermal pilot in Framingham is notable for being the first utility-owned and utility-operated networked geothermal system in the country [10]. The project consists of about one mile of ambient loop that travels through a variety of homes and buildings including single-family, multifamily buildings, small businesses, a fire station, and five Framingham Housing Authority (FHA) affordable apartment buildings [9]. The entire system is owned and operated by Eversource, and works by drawing thermal energy from the eighty-eight boreholes drilled in three borefields. The main field is located under the Farley Lot at MassBay Community College, a second satellite field is behind the fire station on Concord St., and a third is at Rose Kennedy Lane [9, 10]. Across thirty-seven buildings, the loop serves approximately 375 tons of heating and cooling load. This system is replacing the prior mix of gas, oil, electrical resistance, and delivered fuel with Ground Source Heat Pumps (GSHP) [9, 11].

Framingham Governance & Actors

According to reporting, the project idea originated with Zeyneb Magavi and Audrey Schulman, Co-Executive Directors of HEET, pitching the concept of a utility-owned and utility-operated networked geothermal pilot to Bill Akley, then President of Gas Distribution at Eversource [9]. Nikki Bruno, Vice President of Clean Technologies at Eversource was another internal champion who played an integral role in driving the project through the DPU rate case process. Eric Bosworth, the Manager of Clean Technologies, led day-to-day construction and operations management through 2025 [9, 11]. Liam

Needham, the Director of Thermal Solutions, and Cindy Galvin, a Community Partner, also played key roles in technical oversight and neighborhood outreach, respectively [9, 11]. An important actor in Government was Sustainability Coordinator for the City of Framingham, Shawn Luz, who helped bring in institutions like the fire station, FHA, and MassBay Community College into the project [9]. The Massachusetts DPU (Docket D.P.U. 19-120) serves as the primary regulatory authority, and the Learning From the Ground Up (LeGUp) research team has been conducting independent data collection since July 2024 [10].

Framingham Funding & Costs

Phase 1 was funded entirely through Eversource ratepayer funds, approved through the DPU rate case, which makes it the only confirmed funding source for core pilot construction [9]. The total gross cost is approximately $22 million, with customers paying no direct capital cost. This yielded a rough per-building cost of about $595,000 across thirty-seven buildings [9]. Eversource covered all equipment purchases, HVAC conversions, electrical panel upgrades, and building retrofits as part of the pilot scope [11]. A nominal monthly service fee was established, about eight dollars a month for income-eligible customers, ten dollars a month for residential, and twenty dollars a month for commercial. This was primarily to establish a billing relationship rather than to recover costs [11]. The project was ineligible for Department of Energy (DOE) geothermal grants because it predated the DOE's geothermal grant program in which existing projects were excluded [11]. Preliminary performance data as of December 2025 suggests gas customers are saving approximately $16/month ($192/year), rising to about $50/month with the new heat pump utility rate effective November 2025. Oil customers are saving approximately $68/month ($816/year), rising to about $104/month with the new rate [10].

Framingham Community Engagement & Equity

Community engagement began before construction, with HEET leading an initial neighborhood charrette to introduce the concept [9]. Eversource then conducted door-to-door canvassing, community meetings, and four public webinars (April 2023, October 2023, October 2024, December 2025), direct mail, municipal briefings, a dedicated project hotline, weekly construction updates, school STEM events, science fairs, and an open-house tent on Concord Street [10, 11]. Approximately 80% of eligible residential homeowners along the route opted to participate, with 40 signed letters of interest generated in the first weekend of canvassing alone [11]. No opposition was documented in any source reviewed. Support was strong and extensive, with FHA residents being described as "thrilled" [9]. Equity was explicitly built into the project's design: the FHA affordable housing buildings received the largest proportional energy and emissions benefits, converting from electric resistance heating to achieve approximately 75% reductions in both cost and emissions [11].

WHY THIS CASE MATTERS

Framingham is the only MA case to fully navigate the utility-led pathway from concept to formal operations, under existing regulatory authority, without new legislation, with the utility bearing upfront capital risk. It is proof of technical feasibility, but not yet proof of economic replicability. This project is important because it acts as a proof-of-concept that a regulated gas utility can own and operate networked geothermal infrastructure, possibly acting as a model for future gas utility decarbonization both state-wide and nationally [9].

CASE STUDY

03

Smith College Campus Geothermal

Multi-phase capital project eventually supporting the entire campus

PROJECT SNAPSHOT

Location	Northampton, Hampshire County, Massachusetts
Project type	Institution
Status	Operating/Phased Construction
Lead organization	Smith College
System scale	93 buildings, 2.7 million GSF, 72 800’ boreholes (Phase 1)
Estimated cost	$210 million
Key obstacle	Multi-year construction project, Mill River crossing permit
Policy anchor	2030 Carbon Neutrality Goal, Northampton Fossil-Fuel Free Building Code (2025)

PJ3 · Prepared by Anncy Berthe Najac, May 2026

Smith College Overview

Smith College is replacing their aging fossil-fuel-fired steam heating system with a geothermal district energy network, the largest capital undertaking in the college's history. [14, 20] The project broke ground in May 2022 and will serve 93 buildings (~2.7M GSF) across three designated districts within college grounds. [14, 22] The system uses closed-loop boreholes drilled to ~800 ft, powered by renewable electricity purchased from a power purchase agreement with a solar farm. [20] The North District (72 boreholes beneath Davis Meadow) began heating buildings in Fall 2024. [20] The Central District requires a directional bore under Mill River near the Paradise Pond dam. [20] When complete (~2028), the system is expected to cut carbon emissions 80–90%, reduce water use by 10%+, and help achieve carbon neutrality by 2030. [14] Smith is recognized as the first college in New England to pursue this and has been highlighted by the UN Framework on Climate Change in the Race to Zero Emissions. [20]

Smith College Governance & Actors

The Board of Trustees formally approved the project in May 2022, and Board Chair Alison Overseth '80 and President Kathleen McCartney spoke publicly on the decision. [20] Internal leadership included administrators Weisbord, DeSwert, Conant, Hartwell, Hooker, and Dougherty. [13, 14, 20] Salas O'Brien led the design engineering, with Ian Davies as lead engineer, and Bond Construction, under Justin Nash, carried out the work. [13, 14] The project traces its origin to a 2019 pilot test well drilled by Professor

Denise McKahn. [20] At the city level, Northampton updated its building code to a fossil-fuel-free standard in January 2025 and, in October 2024, was designated in the Commonwealth's Municipal Fossil Fuel Free Building Demonstration Program. [17, 24]

Smith College Funding & Costs

The project carries a $210M gross budget, and a 30-year lifecycle comparison puts the geothermal system at $279M against $340M for business as usual. [14, 22] IRA eligibility turns on prevailing-wage, domestic-content, and energy-community bonus credits and on begin-construction determinations. [22] In FY2024 Smith reported $3.8B in total assets, with Phase 1 placed in service. [23] Northampton City Council minutes record building-permit revenue from the project. [24] The Massachusetts Alternative Energy Portfolio Standard (APS) Renewable Thermal program and National Grid's custom incentive plans, set out in the 2020 District Energy Master Plan, round out the financing picture. [13]

Smith College Community Engagement & Equity

From the start, this project grew out of the college community itself. Students, staff, faculty, and trustees spent years laying the groundwork through the Study Group on Climate Change and the District Energy Working Group before the project ever broke ground. [14] Smith also formalized its commitment through the Second Nature Carbon Commitment, which required developing a climate action plan, setting a target date for neutrality, and reporting greenhouse gas emissions annually. [16] When the board finally voted “yes” in May 2022, David DeSwert noted that the project had generated a rare level of consensus across the institution, including among faculty, which is unusual for an infrastructure project of this scale. [19]

Once construction began, the college made a point of giving the work meaning beyond the machinery. CEEDS and the Botanic Garden restored Davis Meadow above the North District borefield with native plantings meant to increase biodiversity and sequester carbon, tying the restoration into Smith's broader Landscape Master Plan. [20] The college also opened its doors to neighbors: in October 2024, representatives from the Hadley School District visited to tour the project, and Smith has been in ongoing conversations with MIT, Vassar, and local K-12 schools considering similar transitions. [20] The project was also recognized by the UN Framework on Climate Change as part of the Race to Zero Emissions. [20]

Not everything has been seamless: the soccer pitch was relocated, outdoor tournaments were put on hold, trails and roads were closed, and roughly 70,000 cubic yards of soil have been moved so far. But the college has kept the community informed through regular online updates throughout construction. [20] At the city level, Northampton's January 2025 unanimous vote to ban fossil fuels in new construction was explicitly framed as an equity issue, with Ward 7 Councilor Rachel Maiore saying the policy was about looking after residents and noting that climate change disproportionately affects vulnerable and poor communities. The council also carved out an exception for buildings connected to a geothermal network like Smith's, a direct acknowledgment of the project's role in making the policy workable. [17]

WHY THIS CASE MATTERS

Smith is one of the few campus geothermal projects that has made it to construction and into operation. The relative speed with which Smith College was able to move from a 2020 Master Plan, to breaking ground in May 2022, to an operating Phase 1 district by Fall 2024 shows that the transition from idea to reality is possible at this scale when the institution is aligned and the capital is in place.

CASE STUDY

04

Lowell Geothermal Pilot Project

Utility-owned pilot project in an Environmental Justice community

PROJECT SNAPSHOT

Location	Lowell, Middlesex County, MA
Project type	Utility
Status	Cancelled
Lead organization	National Grid
System scale	"31 customers", mixed-use
Estimated cost	$15.6 million
Key obstacle	Labor/drilling costs
Policy anchor	DPU Order 20-80

PJ4 · Prepared by Catherine Bult, May 2026

Lowell Overview

The proposed project was meant to serve "31 customers" in the Acre neighborhood of north Lowell. [25] The site contained a mixture of older residential units, a Lowell Housing Authority property, and two buildings on the UMass Lowell campus. [30] This site in Lowell was selected for a utility-funded ground source geothermal network pilot project because it met a series of criteria. Of 14 possible sites in Massachusetts, this site was the only one that met all four:

1. Located in an Environmental Justice area
2. Diverse load profiles (commercial, low-density residential, high-density residential)
3. Gas-constrained area
4. Potential alternative to replacing leak-prone, aging gas pipes [26, p.4]

Lowell Governance & Actors

This project was initiated by National Grid as a utility-led pilot, predating the DPU's December 2023 Order 20-80. With this order, the DPU stated that it would "no longer allow cost recovery for gas infrastructure without proof that non-gas alternatives were considered or for the promotion of natural gas expansion". [28] National Grid worked with the RIST Institute at UMass Lowell, as well as the UMass Lowell administration. [29, 30] They also worked with the City of Lowell. [29] National Grid consulted with the Home Energy Efficiency Team (HEET) on "site selection, funding strategies, and data collection." [*Ibid*.] National Grid cancelled the project after construction costs came back too high. [25]

Lowell Funding & Costs

Because the project was cancelled a couple of years ago, publicly available information around funding is limited. National Grid was funding the project as a pilot to demonstrate the feasibility of utility-scale networked geothermal. [26] The allotted budget for the build was $15.6 million over five years, with $6.4 million in capital costs and $9.2 million for operations and maintenance. [25] When contractor bids for drilling and construction came back over the budgeted amount, National Grid cancelled the project. [31]

Lowell Community Engagement & Equity

The project's Environmental Justice plan describes multiple methods of outreach to the owners and occupants of the buildings within the prospective project area. National Grid determined that they would focus on getting Customer Agreements with owners rather than renters, to ensure owners only paid participation fees that they had consented to. [29, p.13-14] National Grid initially sent potential participants postcards with the City Manager's signature. A second wave of postcards included a hotline and a link to the project's website. After that, a door-to-door campaign to speak with occupants or leave door-hangers if they were unavailable sought to build interest in the project. After that, representatives called owner-occupied buildings to offer more information about the program. Lastly, the utility distributed flyers in English, Spanish, Portuguese, and Khmer. [29, p. 14]

The plan also describes many important considerations for further outreach, including strengthening relationships with trusted community organizations and learning about and respecting the different decision-making modalities of the diverse communities that make up Lowell. [29, p. 26]

> **WHY THIS CASE MATTERS**
> This case demonstrates the importance of economies of scale and the availability of trained labor to project viability. Broad, thoughtful community outreach involved multi-lingual communication and working with trusted partner organizations.

CASE STUDY

05

Amherst College Networked Geothermal System

The largest capital project in the college's history

PROJECT SNAPSHOT

Location	Amherst College, Amherst, Hampshire County, MA
Project type	Institutional (College)
Status	Under construction (as of April 2026)
Lead organization	Amherst College
System scale	80 buildings · 143 boreholes · 3,130 tons cooling
Estimated cost	~$80M total, self-financed
Key obstacle	Connecting a legacy steam campus to low-temperature GT while maintaining operations. This transition requires extensive building retrofits, including converting steam-based systems to low-temperature hot water distribution and upgrading internal heating infrastructure.
Policy anchor	Amherst College Climate Action Plan (net-zero by 2030)

PJ5 · Prepared by Collier Davis, May 2026

Amherst College Overview

Amherst College is currently constructing a networked geothermal system that will serve the campus [33]. Amherst College plans to install a 143-borehole geothermal system, including approximately 10,000 feet of underground piping, connected to the campus's central energy plant to provide heating and cooling campus-wide [34]. Amherst College is transitioning to ground source heat pumps to help achieve its decarbonization plan by 2030 [35]. The system will replace the existing steam-based infrastructure with a more efficient low-temperature hot water network, framing the project as both a decarbonization initiative and a long-term campus infrastructure transformation.

Amherst College Governance & Actors

The project team for Amherst College's geothermal initiative includes internal leadership from capital project managers, including Chris Tait and Daren Gray, working alongside Amherst College's Climate Action Task Force. External consultants include engineering, design, and permitting partners such as Salas O'Brien, Haley & Aldrich, Berkshire Design, and C&H Architects [34]. Amherst College is partnered with Integral Group as a sustainability and engineering consultant to support the integration of Amherst College's campus-wide geothermal and low-temperature heating network. Amherst College and its

Climate Action Task Force consulted with Integral Group to evaluate the technical and financial feasibility of transitioning the campus energy system.[36] Integral Group then created a Zero Carbon Energy Study to guide Amherst College's transition to a campus-wide geothermal and electrified energy system in support of its carbon-neutrality goals.[36]

Amherst College Funding & Costs

The Amherst College Board of Trustees announced that it is investing about $80 million into the geothermal project.[40] In addition to reducing emissions, the new geothermal system is expected to lower long-term infrastructure maintenance costs. Amherst College estimates that updating the current cogeneration infrastructure would cost approximately $12.5 million every 15 years, whereas maintaining and updating the new geothermal system infrastructure and heat pump systems will cost about $4.39 million every 17 years.[38] This project will replace the current steam system, which has a cooling capacity of 3,130 tons, replacing the current steam-based infrastructure.[36] The project is expected to reduce Amherst College's carbon emissions by approximately 13,300 metric tons of CO_2 annually.[38]

Amherst College Community Engagement & Equity

Engagement for Amherst College's geothermal project has occurred through both formal and informal settings. Events such as public hearings, planning board presentations, conservation commission hearings, and board of health hearings, along with town committee updates and opportunities for public comment on the project. Outreach has also taken the form of local news coverage and college communications to inform the broader Amherst community. Most of these community engagement efforts have been led by the college to ensure regulation and community approval. One concern about the project has emerged regarding the potential impact on wetlands and specifically Fearing Brook, highlighted during Conservation Commission discussions. [42]

WHY THIS CASE MATTERS

Amherst College demonstrates how networked geothermal can be deployed efficiently when a well-capitalized institution is able to self-finance and coordinate implementation with construction partners such as Harry Grodsky & Co. and Skillings & Sons. However, this pathway may not be replicable for many Massachusetts communities. The college moved directly from feasibility to construction, whereas most municipalities face greater financial and administrative constraints. It also underscored the significant building retrofits required to transition from legacy steam systems to low-temperature geothermal, a costly and technical barrier for less-resourced communities.

06

CASE STUDY

City of Somerville Networked Geothermal

A community-led feasibility study in New England's densest city

PROJECT SNAPSHOT

Location	Somerville, Middlesex County, MA
Project type	Community (HEET Kickstart)
Status	Feasibility completed (March 2025)
Lead organization	City of Somerville (Office of Sustainability and Environment)
System scale	up to 635 buildings in the service area (58–285 connected across the four modeled networks) · up to 312 boreholes × 500 ft
Estimated cost	\$12.45M–\$29.5M gross · \$6.62M–\$16.46M net (4 models)
Key obstacle	No construction funding, no designated operator, no permits filed
Policy anchor	Climate Forward 2024 (carbon net-negative by 2050)

PJ6 · Prepared by Edinam Glymin, April 2026

Somerville Overview

The City of Somerville, Massachusetts is pursuing a networked geothermal system across three target neighborhoods: Central Hill, which contains City Hall, the public high school, and the public library within a dense residential area; Ten Hills, a residential area bordering the Mystic River with several large Somerville Housing Authority complexes; and a corridor along Central Somerville Avenue, a mixed-use strip where waste heat recovery opportunities could supply thermal energy to adjacent buildings.[43] The system would deliver heating and cooling to users, replacing natural gas systems that currently meet most space and water heating demand in the city. The system would consist of up to 312 closed-loop boreholes drilled to 500 feet, connected via a thermal energy network to deliver heating and cooling to between 58 and 285 buildings depending on the model selected.[43] The feasibility study was funded through a \$50,000 HEET Kickstart grant and conducted by Buro Happold in collaboration with drilling contractor Brightcore.[43, 44]

Somerville Governance & Actors

The Office of Sustainability and Environment (OSE) led the project, managed procurement, and serves as the primary client, with Garrett Anderson, OSE Energy Manager, as the main public point of contact.[43,46] Buro Happold conducted the feasibility study and techno-economic analysis, while Brightcore Energy handled borefield design and cost estimation.[43] Mayor Katjana Ballantyne publicly endorsed the project and framed it as central to the city's decarbonization goals. [43,46] Multiple regulatory bodies hold decision authority over any future construction. The Massachusetts Department of Public Utilities (DPU) regulates networked geothermal operators and would require an Emergency Response Plan and Operator Qualification Plan. Massachusetts Department of Environmental Protection (MassDEP) and the Environmental Protection Agency (EPA) co-issue National Pollutant Discharge Elimination System (NPDES) drilling discharge permits, and the city's engineering and water departments control local soil disturbance, trench, and hydrant permits. [43] Coordination with the Massachusetts Bay Transportation Authority (MBTA) is required for any network routing crossing the Green Line or Lowell commuter rail.[43]

Somerville Funding & Costs

Across the four modeled network configurations, the feasibility study estimated a gross installation cost ranging from approximately $12.45 million to $29.5 million, with a net cost after the federal Investment Tax Credit and Mass Save rebates ranging from about $6.62 million to $16.46 million. The system is projected to deliver between $0.62 million and $2.17 million in annual energy and maintenance savings and to reduce carbon emissions by roughly 463 to 1,995 tons of CO_2 per year, depending on the configuration. The only confirmed funding is the $50,000 Kickstart feasibility grant. No construction funding has been identified, no operator of record has been designated, and no permit applications have been filed as of early 2026.[45]

Somerville Community Engagement & Equity

The City of Somerville's OSE led all public engagement, distributing materials to approximately 890 households and holding two virtual town halls in December 2024 and January 2025 with roughly 100 attendees each, followed by a public results meeting on March 25, 2025 [43, 46]. About 220 responses were collected from a resident survey, though results were never published [43]. The report describes resident reaction as showing "interest and excitement," with the HEET program directing nearly 50% of its total grant funding to environmental justice communities [44], and the May 2025 electrification report framing geothermal as a solution to transformer upgrade costs that fall disproportionately on renters and affordable housing residents, who make up more than two-thirds of Somerville's population [45]. The key gap is that engagement to date has only been informational; survey results remain unpublished and no City Council vote or formal public comment process has occurred.

> **WHY THIS CASE MATTERS**
>
> Somerville shows that Massachusetts has strong policies and incentives for networked geothermal, but the institutional plumbing is not ready. The city has a sound study, a preferred site, four modeled configurations, and plausible economics, but no funding, no operator, and no permits. The gap is institutional, not technical.

CASE STUDY

07

Town of Deerfield Networked Geothermal

A rural feasibility study that reached a clear negative conclusion

PROJECT SNAPSHOT

Location	South Deerfield, Franklin County, MA
Project type	Community (HEET Kickstart)
Status	Feasibility completed (August 2025)
Lead organization	Town of Deerfield
System scale	3 iterations modeled · 25–100+ buildings · 35–130 boreholes
Estimated cost	$11.0M–$27.5M gross (varies by iteration and drilling cost)
Key obstacle	Not cost-competitive vs. ASHPs in any scenario modeled
Policy anchor	MA Global Warming Solutions Act; Berkshire Gas hookup moratorium

PJ7 · Prepared by Hyunju Kang, April 2026

Deerfield Overview

The Town of Deerfield, a rural community of just over 5,000 residents in Franklin County, Western Massachusetts, pursued a networked geothermal feasibility study through the HEET Kickstart Massachusetts program, funded by a $50,000 grant from HEET and the Massachusetts Clean Energy Center (MassCEC) [48]. The study, conducted by engineering firm Buro Happold, evaluated network configurations centered on the South Deerfield village core, encompassing key municipal buildings and commercial anchors such as Berkshire Brewing Company [49]. Deerfield was selected for its strong institutional commitment to climate resilience. It was the first town in the Commonwealth to enter the Municipal Vulnerability Preparedness (MVP) program and because an active Berkshire Gas hookup moratorium makes fossil fuel alternatives structurally necessary rather than aspirational [50].

Deerfield Governance & Actors

The project was initiated and led by town government officials, with no utility involvement [48, 50]. Selectboard Chair Tim Hilchey served as the primary political champion, pursuing the HEET grant after a visit by State Climate Chief Melissa Hoffer in October 2023, while Planning Board Chair Denise Mason coordinated community outreach and grant administration, and Town Administrator Christopher Dunne bridged the technical study team and town committees [50]. Engineering firm Buro Happold conducted the feasibility study, producing a draft (February 2025) and final report (August 2025) [48, 49]. On the funding and program side, HEET administered the $50,000 Kickstart Massachusetts grant in partnership with MassCEC, and also connected Deerfield with peer pilot communities [50]. Community engagement was sustained by the MVP Core Group and Energy Conservation Committee, with academic support from the UMass Amherst Landscape Architecture and Regional Planning (LARP) department on outreach materials [50]. Frontier Regional School was the only external institution to proactively engage during the study, and the Franklin Regional Council Of Governments (FRCOG) planned to disseminate findings through its regional energy committee [50].

Deerfield Funding & Costs

The only confirmed funding is the $50,000 HEET Kickstart feasibility grant from HEET and MassCEC; no construction funding has been identified or committed.[50] The study modeled three network iterations at drilling costs of $40, $60, and $80 per linear foot, with total capital costs ranging from approximately $11M (Iteration 1, smallest) to $27.5M (Iteration 3, full network) [48]. No net costs after incentives are available, as none have been formally pursued, though the study identifies several potential sources including the Federal ITC (30%), Mass Save rebates ($4,500/ton), and DOE block grants, all available through at least 2032 [48]. Economically, the network does not outperform the alternative: across all iterations and drilling cost scenarios, individual ASHP installations are less expensive over a 60-year modeled period, with the geothermal payback horizon exceeding 50 years even in the most favorable configuration [48, 49].

Deerfield Community Engagement & Equity

Community engagement was led by the MVP Core Group, Energy Conservation Committee, and UMass LARP through a series of public meetings and presentations between July 2024 and July 2025, culminating in an online survey (July 7–25, 2025) and a final public information session with Buro Happold [48, 50]. The survey yielded 29 responses showing substantial interest. Most respondents said they were interested in participating in a geothermal network, several gave qualified answers citing practical constraints such as renting or HOA restrictions, and only a few were not interested.[48] Broader stakeholder readiness was more limited, as Frontier Regional School was the only institution to proactively engage, and the study recommends additional outreach particularly for residents along the proposed network corridors [48, 50]. On equity, Deerfield does not fall within a formally designated EJ zone and no EJ-specific engagement strategies were employed; the study does not address income-based affordability or displacement risk.[48, 50]

WHY THIS CASE MATTERS

Deerfield feasibility study concluded that the project would be technically feasible but economically noncompetitive. The finding is not a failure of the technology but a function of density thresholds, suggesting the Kickstart program may need density-contingent grants or integration with planned municipal development to convert rural feasibility spend into deployable projects.

08

CASE STUDY

Greentech Park Networked Geothermal, Worcester

The only industrial-scale Kickstart feasibility in the portfolio

PROJECT SNAPSHOT

Location	Worcester, Worcester County, MA
Project type	Private / quasi-public developer
Status	Geothermal at feasibility; broader site in pre-construction
Lead organization	New Garden Park (Worcester Business Development Corporation)
System scale	4 buildings · 700–1,100 boreholes · 1M GSF · ~350 tons capacity
Estimated cost	$40M–$85M gross; net not calculated
Key obstacle	Capitalization for geothermal at industrial scale
Policy anchor	None identified — developer-driven rather than policy-mandated

PJ8 · Prepared by Depre Carr, April 2026

Worcester Overview

The Greentech Park is an industrial park under redevelopment in Northern Worcester. It was acquired by the Worcester Business Development Corporation (WBDC) in 2022 to serve new industrial businesses [53, p. 1]. The campus will have four new buildings with 1,000,000 square feet of combined floor space [54, 53, p. 3]. The project developers are considering whether or not to keep gas heating or switch to a geothermal energy network. This project is the only HEET/Kickstart-funded feasibility study for an industrial customer base [55].

Worcester Governance & Actors

New Garden Park (NGP) initiated the project and also manages and funds the development [53]. NGP is a subsidiary of the WBDC, a non-profit quasi-public institution. HEET administered the Kickstart Project grant for the geothermal feasibility study [53].

Worcester Funding & Costs

The feasibility study projected a gross cost estimate of $40-$85 million for installing the network. The study identified two incentives: the Inflation Reduction Act incentives for GSHPs, and the Mass Save energy efficiency program. The study did not attempt to incorporate the incentives into a cost estimate. The only confirmed funding is the $50,000 Kickstart feasibility grant. No construction funding has been identified, no operator of record has been designated, and no permit applications have been filed as of early 2026.

Gross Cost Estimate	Incentives Identified	Funding
$40mill - $85mill (cost of GSHP installation) [53, p. 17]	IRA GSHP incentives, Mass Save energy efficiency program [53, p. 13-14]	Kickstart grant: $50,000 [53] Remaining funding unclear

Worcester Community Engagement & Equity

NGP had two stages of stakeholder engagement. First, they conducted site visits with Eversource on April 26, 2024, and had a virtual meeting with Eversource and National Grid on May 21, 2024 [53 p. 2]. Second, they held community meetings through the Greendale Revitalization Taskforce, where GSHPs were discussed with community members [55 p. 2]. The feasibility study notes that the reaction from stakeholders was “generally supportive of its implementation” [53 p. 2].

WHY THIS CASE MATTERS

Greentech Park is a contrasting governance model: a quasi-public developer using networked geothermal for manufacturing / industrial uses and brownfield redevelopment, with a notably lighter permitting burden (no city well permit; closed-loop systems are exempt from MassDEP Underground Injection Control (UIC)). Whether capitalization can be secured at this scale without utility or grant frameworks is the central open question.

CASE STUDY

09

City of New Bedford Networked Geothermal

Strong community interest, stalled momentum

PROJECT SNAPSHOT

Location	New Bedford, Bristol County, MA
Project type	Community (HEET Kickstart)
Status	Feasibility: no identifiable movement since the study
Lead organization	City of New Bedford
System scale	Not yet determined (2 candidate sites under consideration)
Estimated cost	Not publicly available
Key obstacle	Pre-1950 housing stock and brownfield contamination at proposed sites
Policy anchor	None identified (municipal resilience dashboard, no formal climate plan)

PJ9 · Prepared by Alice Potapov, April 2026

New Bedford Overview

This project is in the exploratory phase, considering two different sites for a potential networked geothermal project. The first site is a city-owned decontaminated vacant lot, formerly Morse Cutting Tool. The second is the historic Arnold Mansions, which hosts the Wamsutta Club, a local private club that expressed interest in geothermal options [56, p. 3-5]. Both sites are in the central, historic part of New Bedford in mixed-use neighborhoods. The Morse Cutting Tool Lot is a Brownfield site located in an environmental justice area, where indoor air quality was impacted due to the site [57, p. 2].

New Bedford Governance & Actors

The project is led by the City of New Bedford. HEET administered the Kickstart Project grant for the feasibility study. Neighborhoods United, a collective of local neighborhood groups, engaged members of the community by spreading awareness of the project and facilitating information sharing that developed public support [56].

New Bedford Funding & Costs

The identified source of funding for this project is from the Kickstart Massachusetts program, which awarded $450,000 in tiered grants across thirteen communities (including New Bedford) [58]; New Bedford's individual award amount could not be confirmed.

New Bedford Community Engagement & Equity

Community engagement for the potential of networked geothermal in the affected neighborhoods is well documented. Methods include surveys and feedback forms, online/social media outreach, and public information sessions [56, p. 1]. Collaboration with Neighborhoods United, a collective of neighborhood organizations, allowed for an easier and wider spread of information [57, p. 4]. Survey results showed majority positive reactions to networked geothermal. Almost 70% of respondents indicated interest in being considered for pilot programs [56, p. 2]. Importantly, 85% of respondents were single-family homeowners who currently heat their homes with natural gas.

WHY THIS CASE MATTERS

New Bedford is yet another example of successful community outreach and engagement by the Kickstart program. Even so, this is a case where strong community interest and municipal sustainability capacity have not translated into project momentum, possibly deprioritized in favor of the Congdon-DeValles Elementary School GT project. It raises a portfolio-wide question: can feasibility-stage engagement sustain itself when institutional follow-through is slow?

4. Qualitative Analysis

4.1 Methods

In the course of performing the case studies, our workshop group identified twenty potential interview candidates. After outreach from mid-March to mid-April, we were able to complete five interviews. The interviewees included municipal staff, an elected official, a state energy-agency project manager, and a participant at a stakeholder institution involved in one of the projects. The interview protocol was reviewed by the University of Massachusetts Human Research Protection Office and determined not to be human subjects research by the office (HRPO determination 7662). Identifying information for interviews is withheld from reporting to protect anonymity.

The interviews were conducted remotely over Zoom and lasted 35-60 minutes. Four of the five interviews were successfully recorded. One interview was not recorded due to technical issues but researchers were able to refer to the AI-generated summary of the interview and the interviewer's memory of the conversation to extract information. After completing the interviews, team members wrote a memo summarizing the salient points from the interviews as well as making transcripts available for review by the qualitative team.

A subset of the full team read through the transcripts and summaries and generated concept maps for each interview to capture themes and emergent points of interest.

4.2 Findings

In addition to reaffirming the centrality of accurate budgeting and unexpected economic or environmental hurdles, several nuances emerged. The primary findings are listed below and then described in more detail, these include:

1. Lack of centralized coordination and information sharing between projects in MA
2. Complexities Around Utility Profits/Shareholders
    a. Possible leverage points
        i. Maintaining profitability in energy transition
        ii. Retaining and redirecting specialized labor
3. Local factors affecting geothermal political viability
    a. Merrimack Valley gas explosion in 2018
4. Potential Thermal Imbalance in geothermal systems over time
5. Suggestions for scoping networks to address issues
6. Further stakeholders to follow up with

1. Lack of Centralized Coordination and Information Sharing

With the exception of HEET, which facilitates and holds the results of feasibility studies and other resources, we couldn't identify a single organization or agency who collects all records or insights generated from geothermal pilot projects in Massachusetts. One interviewee clearly described the spread of administrative requirements held by different Massachusetts Departments. These include work orders, coordination, and potential rate adjustments with the Department of Public Utilities (DPU), well drilling and water withdrawal permits at the Department of Environmental Protections (DEP), and feasibility study funding through MassCEC and HEET. While the interviewee acknowledged that lessons learned by early implementers like Framingham, Smith College, and Amherst College should be collected and shared, they also clarified that "How we do that is still being learned, and maybe more importantly, what we're promoting, is still being learned".

2. Complexities Around Utility Profits/Shareholders

The implementation of networked geothermal projects can depend on coordination with multiple existing utility companies, which may have divergent profit incentives. This can affect which sites get considered. These insights did not appear in the publicly-available information we reviewed, but multiple interviewees touched on them. One source explained that in areas where one utility supplies gas and the other supplies electricity, there's no incentive for the gas supplier to facilitate the transition to geothermal because they would lose customers. This means at least one structural barrier to geothermal conversion can be avoided by projects in locations where the same utility supplies both gas and electricity, as the utility won't actually "lose" customers when the heating method changes. Another interviewee expanded on this by explaining that, "You know, that's at the bottom of it [...] it's fortunate that there's some neat technology that has some other side benefits but that was never the object of that. It was always the objective to make sure that the gas company or gas company side did not lose all of their money and you know, their stockholders didn't lose all of their money" as demand for gas declined. This pragmatic assessment seems like an important structural consideration to carry forward in evaluating the economic and political feasibility of future projects.

Utilities are also motivated to minimize the costs of building geothermal networks. One way to do this is by focusing on new construction, designed for networked geothermal from the beginning. One interviewee described how "Eversource has made it clear that they want to focus their geothermal efforts on new construction", as this means buildings can be purpose-built for connection to networked geothermal, rather than needing expensive retrofitting. Conversely, another interviewee framed the replacement of gas infrastructure with geothermal as "infrastructure", rather than retrofitting. "If you're gonna have to do it anyway, then it's not a retrofit, it's infrastructure [...] We're providing this infrastructure for users now and in the future, and it costs what it costs. [...] What's the payback on a power line? Like, who cares? You have to have the power." In another case, one interviewee emphasized how important the historic maintenance and "best practices" updates to the network's buildings had been in facilitating the transition to geothermal.

However, there are also enabling factors for utility companies to pivot to networked geothermal. One interviewee mentioned that their consultants had explained that ground source geothermal "could create an alternative business model for gas companies that they own the rights of way already. And using their rights of way for pipes that they already have. Geothermal networking could help them transition from selling gas to burn to straight up selling the heat. And that kind of blew my mind, but [...] it's a wonderful thought." Another member raised the point that plumbers and gas pipe workers already have the skills for laying and connecting pipes for ground source geothermal. This helped enhance their optimism for ground geothermal overall, even as their proposed site was too dispersed to be economically viable at this time.

3. Local Factor Affecting Geothermal Political Viability

External events influenced the development of networked geothermal in Massachusetts. One interviewee described the importance of the tragic gas line explosions in the Merrimack Valley in 2018. The explosions affected the communities of Lawrence, Andover, and North Andover. Beyond focusing public attention on the dangers of aging gas infrastructure, a portion of the settlement paid out by the utilities was directed towards exploring geothermal in that area, according to one source.

4. Potential Thermal Imbalance in Geothermal Systems Over Time

A question that had dawned on our team over time was confirmed by one interviewee, who said that the thermal loads on ground-source geothermal networks in cold-dominant areas like Massachusetts will gradually become imbalanced over time. The interviewee stated that, "It's tough to have a fully geothermal system in New England without some good places to sink your cooling [...] the 20-year trend lines of the temperature around the boreholes [...] would get colder and colder every year", reducing the system's capacity to provide heat in the winter. The interviewee continued, "You need a place to put all that cooling to make these systems work". This issue may change over time as increasing temperatures due to climate change cause Massachusetts to be warmer in the summer.

5. Suggestions for Scoping Networks to Address Issues

Building on these previous themes, some interviews suggested that some types of buildings are more suited to geothermal networks. One interviewee mentioned that including sites like labs or data centers that have a substantial, consistent need for cooling in the network would improve long-term thermal stability. One proposed site was considered primarily because of a planned development with cooling-dominant building loads. Interviewees also suggested that sites owned by a single, private owner present some potential efficiencies, or that utilities would specifically have the capacity to make a large enough network to mitigate the eventual thermal load imbalance.

6. Further Stakeholders to Follow Up With

Across the various interviews, our respondents shared a set of further contacts to reach out to for more information. The team did not interview these people for this research. These included:

- A research lab at UMass Lowell
- National Renewable Energy Laboratory (NREL)
- Federal Realty (Boston/Somerville property owner)
- Boston Green Ribbon Commission

Analysis

A subset of the full team reviewed the interview transcripts and summary memos prepared by interviewers. We identified a set of topic areas we anticipated encountering in the responses as a priori categories which included costs, unexpected obstacles, and complex permitting processes. In addition to the deductively identified categories, we also identified insights that emerged inductively from the review of the interview materials.

Themes that emerged from the network diagrams for the interviews included:

- Barriers/Issues:
  - Cost, building age/distribution, system conversions/retrofitting, length of repayment time
  - Geology: Waterways, additional water underground, soil conditions
- Beneficial factors:
  - Local political and public support, pre-existing commitment to building upkeep, favorable geology at some eastern Massachusetts sites, HEET and federal funds
- Stakeholders:
  - City and town governments, residents, community organizations, the utility companies, institutions as both consultants and participants in pilot projects
- Outreach:
  - Public meetings, postcards, hotlines, websites, an extensive Environmental Justice plan, multi-lingual materials, and partnerships with trusted community organizations to reach marginalized communities
- Scope:
  - Downtown or private campuses, residential and mixed-use areas, questions around thermal load balancing and utility investment

These subjects inform our Key Findings, in conjunction with data from the quantitative team.

Acknowledgement of Limitations:

While each individual interview contained many useful insights, their arrival fairly late in our research timeline hindered the depth of analysis we were able to perform. We appreciate the time our respondents took to speak with us, and hope this represents a reasonable synthesis of their responses.

5. Quantitative Analysis

Data Completeness

We performed a data completeness analysis because we found that data availability depended on a variety of factors across the nine cases. These included how far along in the process a given project was, as well as whether and what information was publicly available. This also assisted our ability to systematically categorize the information we found. It is important to note that our data collection was done in a short time frame with publicly available data that varies widely in accessibility and quality. As such, it is imperative to establish the quality/extent of data that we are basing our findings off of. Table 1, a heatmap of data completeness was produced directly from our data schema with completeness percentages based on the number of values that we know exist because of the stage of the project, but were not found during our data collection process. Details on the variables that make up each data category can be found in Table 2.

	Project Info	Site & Location	System Scale	Timeline	Financials	Benefits	Permitting & Policy	Community	Key Actors	Overall
Arlington	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
New Bedford	100%	100%	100%	83%	100%	100%	100%	100%	100%	98%
Amherst College	100%	100%	100%	100%	100%	86%	100%	100%	100%	98%
Deerfield	100%	100%	100%	100%	100%	57%	100%	100%	100%	95%
Somerville	100%	100%	83%	100%	89%	86%	56%	100%	100%	88%
Smith College	100%	100%	100%	83%	100%	86%	67%	83%	40%	85%
Framingham	100%	100%	100%	83%	89%	29%	78%	83%	100%	83%
Lowell	100%	100%	67%	83%	89%	29%	89%	100%	80%	81%
Worcester	100%	100%	100%	100%	78%	14%	56%	100%	40%	75%
Category Avg	100%	100%	94%	93%	94%	65%	83%	96%	84%	89%

0% 100%

Table 1. Data Completeness Heatmap by Variable Category

Please see Table 2 below for a more detailed breakdown of the variables captured in each data category:

Data Category	**Variables**
Project Info	Project name, town, county, project type, lead organization, utility involvement, state/status date
Site & Location	Site selection status, location details, service area description
System Scale	# building planned, # buildings connected, # boreholes planned, # boreholes installed, loop length (ft), system capacity (tons)
Timeline	Date first proposed, date feasibility completed, date construction started, date operational, date cancelled, timeline notes
Financials	Total gross cost, total net cost, cost per building, funding sources, incentives used, funding notes, feasibility funder
Benefits	Carbon savings w/ unit, cost savings w/ unit, payback period (years), benefits notes, break even point
Permitting & Policy	Policy consideration, permit consideration, key permits required, permits obtained w/ date, pending permits, permitting challenges, regulatory classification
Community	Community engagement/types, opposition, support
Key Actors	Consultants, drilling contractor, municipal champion, community champion, key actor notes

Table 2. Data Categories and Data Definitions for Data Collected on Each Case

Geographic Overview of Selected Cases

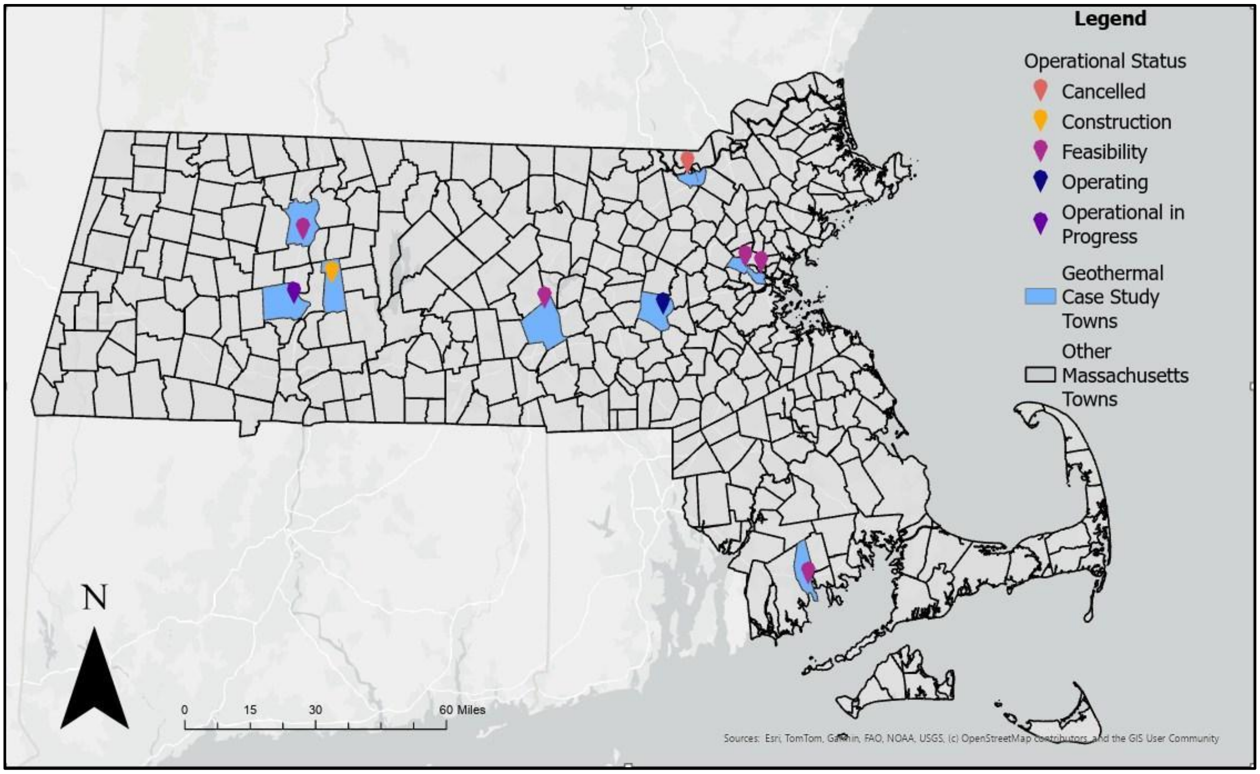

Figure 1. Map of Massachusetts Networked Geothermal Project Cases

This map illustrates the spatial distribution and the operational status of the nine cases selected for this research. The projects are dispersed statewide, with concentrations in eastern Massachusetts and the Pioneer Valley regions. The map reflects projects in urban and semi-rural locations throughout the state.

Actor Network

As organizations collaborate on implementing networked geothermal projects they establish professional relationships and develop sharable expertise. This forms a network of actors that are responsible for implementation and become resources for further networked geothermal projects. Analyzing the actor network reveals what kinds of organizations collaborate on a networked geothermal project, how the network develops through collaboration, and which organizations are most influential or broadly important. Figure 2 depicts the network of actors identified in the research. The actor network begins to form with HEET's policy advocacy and its gas-to-geo campaign. HEET pitched the Framingham geothermal pilot to Eversource and funded the feasibility study. Eversource then hired Salas O'Brien, an engineering consulting firm, to conduct the study. Salas O'Brien is the only node that bridges the Amherst College and Smith College cases and bridges the two colleges to the rest of the network. Salas O'Brien conducted the feasibility study for Smith College and contributed to Integral Group's feasibility study for Amherst College. Smith College hired Bond Construction for its drilling, and Amherst College hired Skillings & Sons and Harry Grodsky & Co. for its drilling.

HEET further anchors the network by implementing the Kickstart Project, which provided feasibility funding to the remaining seven cases. As a result, HEET has the most degrees in the network. Eversource and National Grid are uniquely positioned in the network. Both are project leads for their respective pilot projects in Framingham and Lowell, but are also involved with multiple other projects from their positions as public utilities. For this reason, they are listed twice in the network graph below, once as a lead organization and once as an involved utility.

Smaller organization-clusters occur around project leaders, as many consultants and drilling contractors are hired by only one project. The network includes six consultants and five drilling contractors. The consultants include Salas O'Brien, Brightcore Energy, Buro Happold, Haley & Aldrich, UMass Lowell's RIST Institute, and Integral Group. Salas O'Brien is involved in three projects. Brightcore Energy and Buro Happold are each involved in two projects and are both involved in the Somerville feasibility study. The remaining consultants are each involved in only one project. Amherst College is the only project with two drilling contractors; all drilling contractors in the network are involved in only one project.

The Figure 2 below includes both directed and undirected edges. Every edge connecting to a lead organization is directed. Most other edges are undirected and link organizations that are both connected to a lead organization. Governmental organizations such as MassCEC or the Environmental Protection Agency are not included.

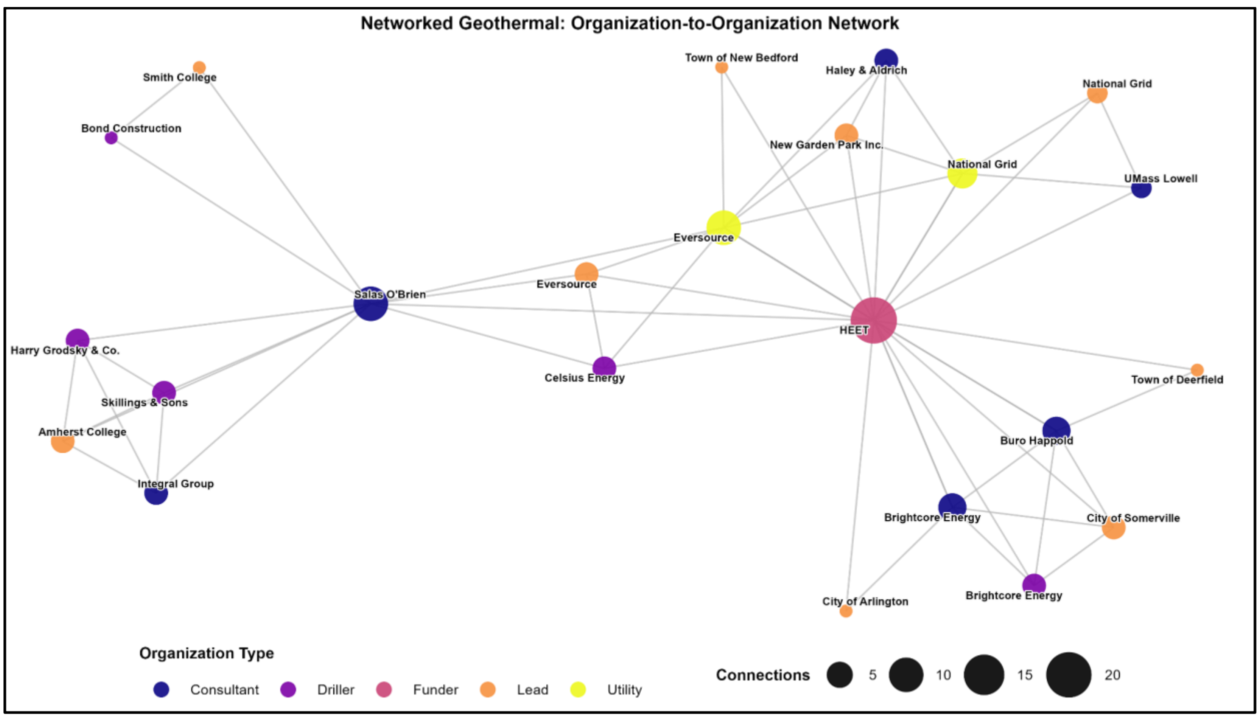

Figure 2. Networked Geothermal: Organization-to-Organization Network

Note: Eversource and National Grid appear twice in the visualization. This is due to the fact that both companies operated as lead organizations for their respective pilot projects, but also operated as engaged stakeholders and utility service providers for multiple other projects outside of their roles as lead organizations.

Timeline

The nine cases have various starting dates spanning seven years, and have progressed to various implementation stages: feasibility, construction, operation, and cancellation. The timelines for these nine cases reveal how long each stage of implementation takes as well as the time differences between early and late adopters. The primary trend identified from the project timelines was the difference in feasibility durations. As the earliest adopters, Eversource and Smith College had far longer feasibility phases than the later adopters who received Kickstart feasibility grants. The timeline for the Amherst College case is less clear, as a precise start and end date for their feasibility study could not be determined from publicly available information. With that exception, all of the cases that started in 2020 or earlier had feasibility studies lasting three years or more, while all cases starting after 2020 had feasibility phases lasting less than three years. Figure 3 below is a Gantt chart depicting the timelines for each project. Amherst College's timeline does not show a proposed phase, because its feasibility start date is not publicly available. Smith College has a nuanced construction and operation phase. As their project is constructed in segments, parts of the system are operational while other parts are still under construction today.

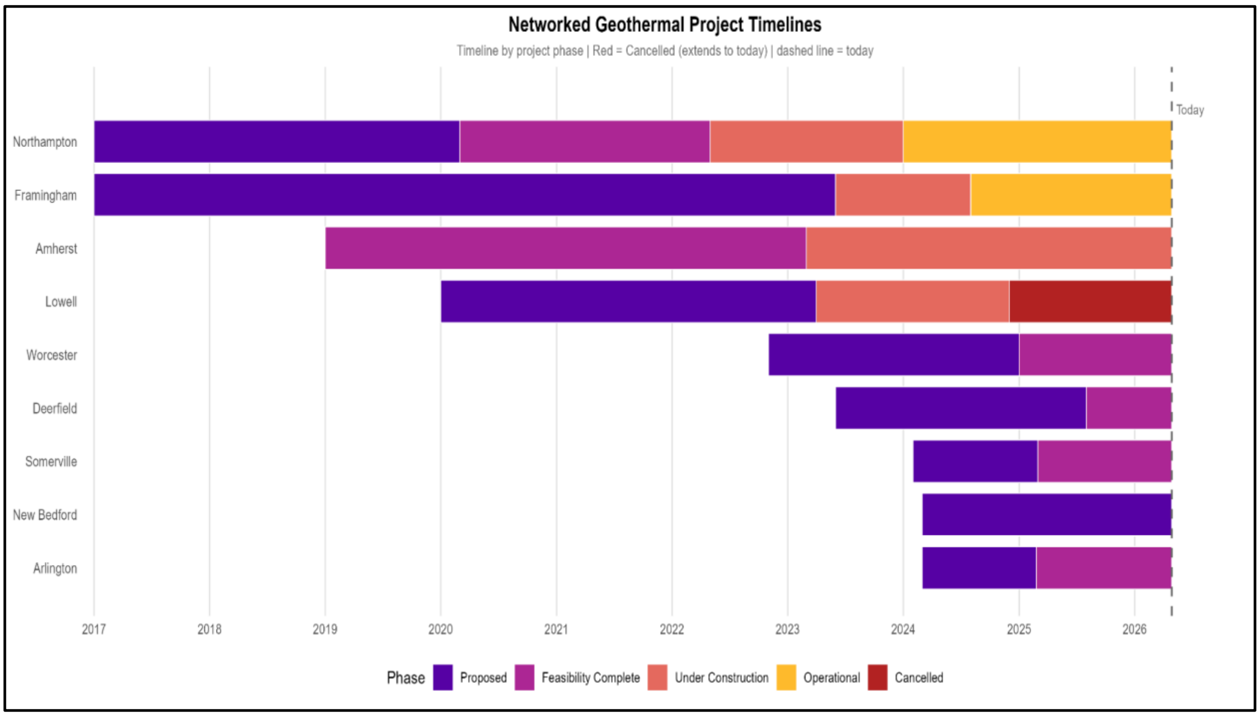

Figure 3. Networked Geothermal Project Timelines

Financial Feasibility and Challenges

For these nine cases, financial feasibility refers to a geothermal project's ability to secure funding, demonstrate long-term economic viability, and provide affordable benefits to the communities it serves. Financial feasibility is a critical factor in geothermal deployment, as securing adequate funding is often the deciding factor in whether the project can progress from feasibility study to construction. High upfront and unexpected cost increases can create significant barriers to implementation. The nine case studies demonstrate the diverse economic conditions under which geothermal projects are developed and implemented in Massachusetts.

The nine Massachusetts networked geothermal projects span a wide range of development stages, from Operating (Framingham), Operating/Phased Construction (Smith), and Construction (Amherst), to Feasibility (Worcester, Arlington, Deerfield, Somerville, New Bedford), and Cancelled (Lowell), reflecting the broader and still-evolving landscape of networked geothermal adoption across the state. Total gross costs reported in public documents range from about \$11M (Deerfield) to \$210M (Smith College), but the more revealing metric is cost per building. Somerville (~635 buildings, \$23–47K/building) demonstrates the strongest economy of scale, while Worcester (4 buildings, \$10–21.2M/building) demonstrates how low density renders per-connection costs very high, underscoring that building density and load diversity are the primary drivers of economic viability across all project types. Lowell's cancellation despite a relatively modest total cost further suggests that affordability is not determined by gross cost alone, as financing structure, regulatory support, and institutional commitment are equally decisive. Of the nine projects, only three have reached construction, and the five projects remaining at feasibility stage face an unresolved funding gap with no committed construction financing, indicating that the transition from study to shovel can be the most significant barrier in the current landscape.

Several limitations apply to the cost figures presented. Total Gross Cost represents upfront capital costs only, excluding incentives such as the Federal ITC (30%) and Mass Save rebates, long-term O&M costs, and permitting fees across all projects. The figures are also not directly comparable across projects, for a variety of reasons. College-affiliated projects (Smith, Amherst) are institutionally self-financed and include campus-wide infrastructure. Meanwhile, utility-led projects such as Framingham absorb customer-side retrofit costs within their gross cost. And finally, community and developer feasibility studies such as Deerfield, Arlington, and Worcester reflect infrastructure construction estimates only, with building-level upgrades counted separately. These figures are feasibility-stage estimates. Where a study modeled several scenarios, we report the full range rather than a midpoint. Single-scenario figures we treat as approximate. Table 1 shows where the public record is complete and where it is not. Cost per building is the least comparable measure, because the projects count buildings differently. Arlington’s two sites hold 44 structures, Somerville reports roughly 635 buildings in its service area against 58 to 285 connected in its models, and the college campuses count buildings campus-wide. Cost per building therefore indicates orders of magnitude, not a precise ranking.

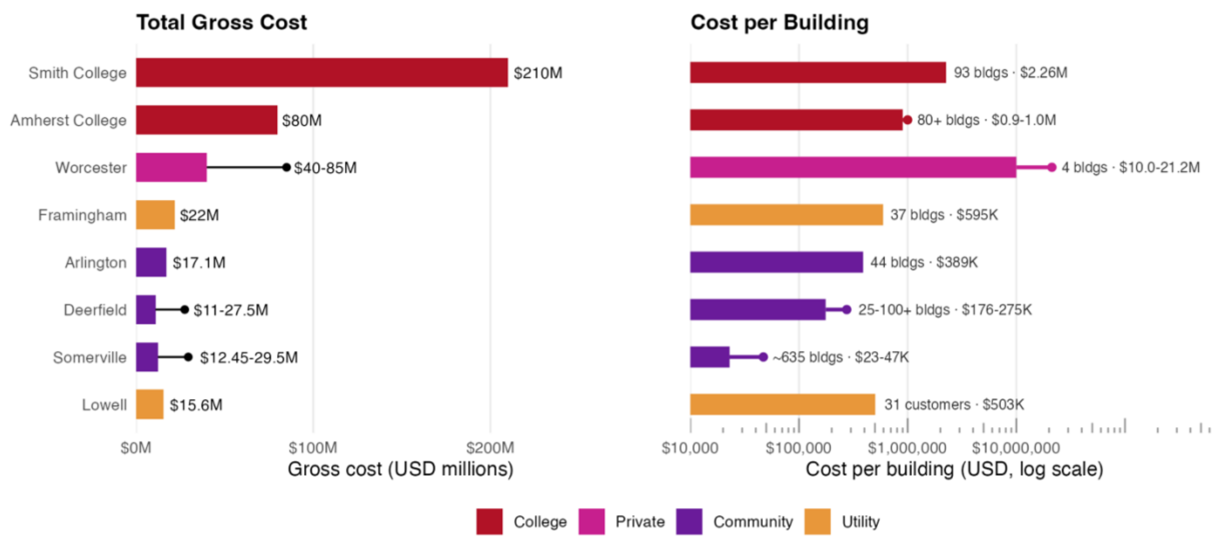

Figure 4. Gross Project Cost and Project Cost per Building

Permitting Process and Challenges

Permitting is the process where a project developer obtains official authorization from government agencies before beginning construction or operation. Each permit represents a formal review by a regulatory body such as a city building department, state environmental agency, or public utility commission, confirming that a proposed project meets legal, safety, and environmental standards. Permits are required at the federal, state, and local levels, and the specific permits needed depend on the nature of the project, its location, and its potential impacts on the surrounding environment and community.

For networked geothermal systems, permitting is a critical step as these projects involve drilling, underground infrastructure and connections to existing buildings and they must navigate multiple overlapping regulatory frameworks. The permitting process can determine whether a project moves forward, how long it takes, and how much it costs, making it one of the most significant practical barriers to scaling geothermal energy in Massachusetts.

We reviewed permitting across the nine case communities, recognizing that the Framingham and Amherst College projects have broken ground and navigated a broad and demanding permit portfolio spanning all four categories: water and discharge approvals, environmental review, site and construction permits, and regulatory filings. The categories in this section reflect the permits identified across each case study, grouped according to their regulatory function and the particular challenges encountered in each project context. Framingham in particular required the most extensive permitting of any project in the study, including a grant of location, a MassDOT access permit, a zoning special permit, and a Massachusetts Historical Commission (MHC) notification form alongside the standard construction permits. This reflects the added complexity of installing infrastructure in public areas which intersect with state road infrastructure, historic commission oversight, and municipal zoning in ways that campus projects do not. It is worth noting that Framingham stands out as a project to have completed the full development pipeline, from feasibility assessment through to operational deployment.

For the five HEET Kickstart communities: Arlington, Somerville, Deerfield, Worcester and New Bedford, the permit matrix is largely forward looking. These projects have identified what they will need but have not yet secured anything, because none have moved to construction. Somerville's feasibility study is the most permit-ready, having mapped requirements across all four categories including DPU filing implications and MBTA coordination. Arlington and Deerfield follow closely. Worcester and New Bedford have the thinnest documentation, reflecting their earlier-stage scoping status.

Smith College is reported as operating and in phased construction (partly running though incomplete), but we did not find any records of required or obtained permits, or permitting challenges.

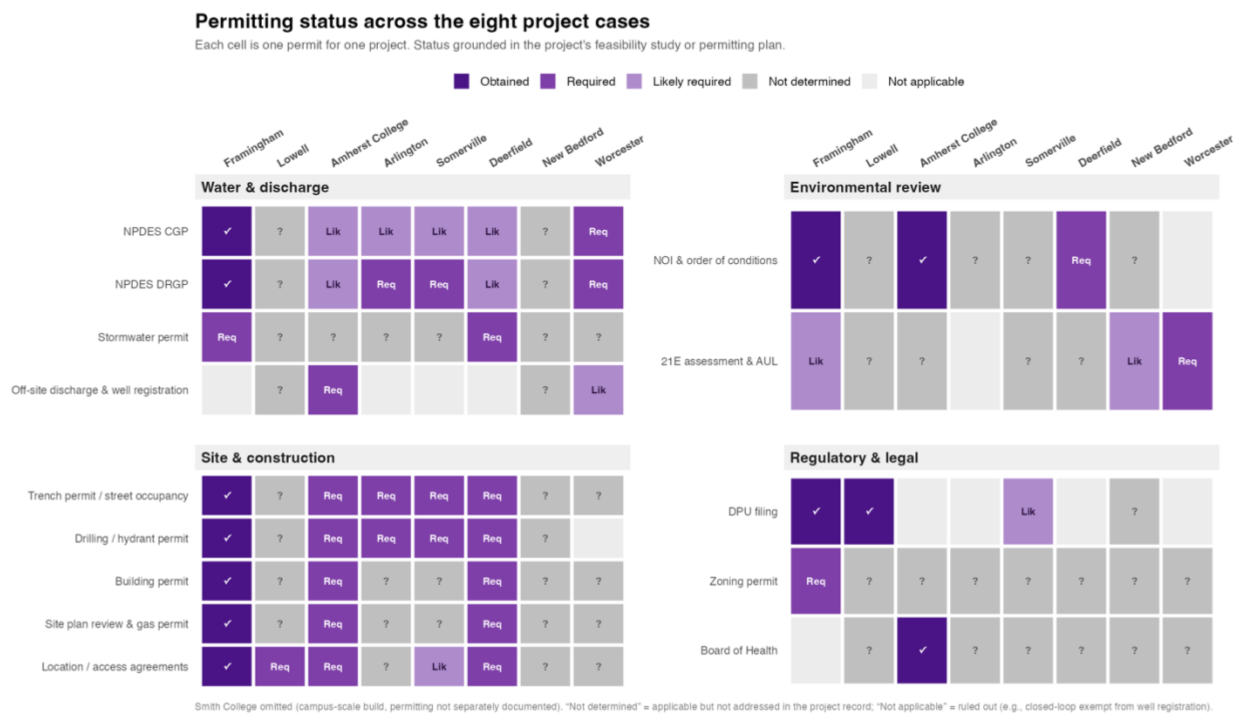

Figure 5. Permitting Matrix

Permitting also emerged as one of the most significant practical barriers to deployment because the cumulative burden of navigating multiple agencies, inconsistent local requirements and long approval timelines adds cost and uncertainty that can stall projects entirely.

Administrative challenges, which refer to the practical burden of paperwork, fees, and process overhead on the developer side, are the most widespread, affecting five of nine projects. The National Pollutant Discharge Elimination System (NPDES) permitting process, which can take more than three months, and costs $25,000 to $30,000 and above, is the single most-cited obstacle across project types. Boring fee structures designed for individual buildings, and not multi-borehole neighborhood systems, systematically undercharge for the administrative work involved while creating unpredictable cost exposure for project developers.

Environmental constraints also impacted projects, particularly wetlands proximity and high water table conditions. For example, Deerfield sits in the Connecticut River valley, which has groundwater close to the surface. The Amherst College campus sits within areas where groundwater protection is regulated under the Massachusetts Wetlands Protection Act, and these raise environmental concerns about drilling and overall systems performance. The state of Massachusetts restricts drilling within 50 feet of a water tunnel, so placing boreholes in the greenspace south of the library in Somerville poses a challenge. The Conservation commission also required fencing modification for turtle tunnels near Gleason pond in Framingham as a measure to preserve their habitats from extensive invasion.

The absence of a formal regulatory classification for networked geothermal systems means that communities must navigate a permitting process without clear guidance on which agency oversees these projects, what approvals are needed, or what compliance looks like. Without an established regulatory pathway, community-led projects cannot easily determine which agency has jurisdiction, what approvals are required, or how to demonstrate compliance, a gap that no individual community can resolve on its own.

The permitting data suggest that the barrier to scale is not primarily technical. Projects that reach construction can navigate the permit system. The more pressing challenge is that existing systems were not designed for this type of project, and the communities best positioned to develop networked geothermal face the most complex permitting environments.

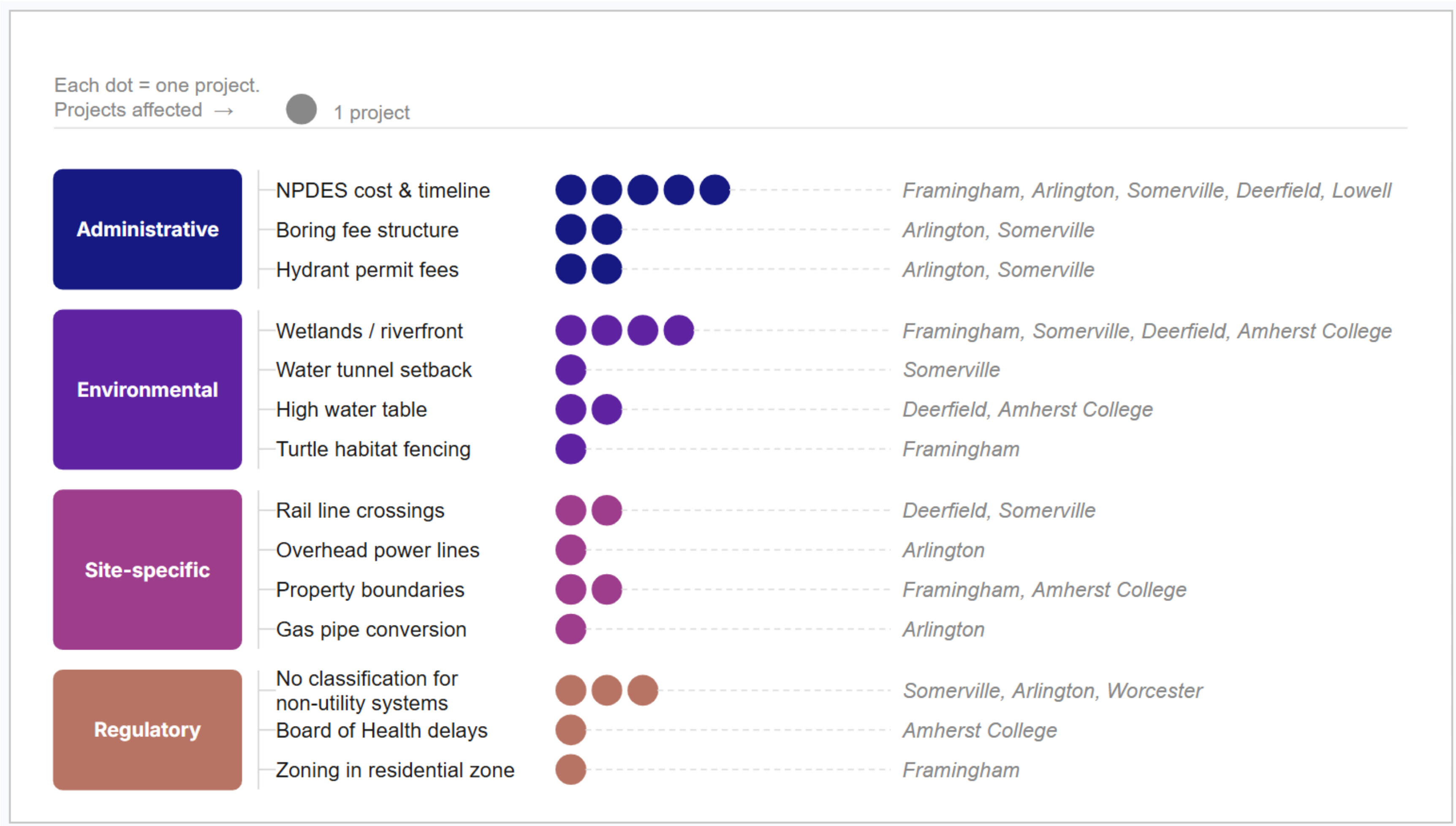

Figure 6. Project Permitting Challenges

6. Key Findings

Broadly, we encountered two categories of factors that enabled or hindered the projects included in the case studies.

Enabling Factors:

6.1 Widespread policy and political support

Networked geothermal in Massachusetts has emerged in a favorable policy and political environment shaped by advocacy, a shifting regulatory landscape, and events that fundamentally changed public appetite for gas alternatives. At the state level, Eversource's Framingham pilot was approved through its 2020 gas rate case (DPU Docket 19-120), and the DPU's later Order 20-80 (the Future of Gas investigation, December 2023) established a broader framework requiring gas companies to weigh non-gas alternatives such as networked geothermal. These developments were the product of sustained engagement by HEET, MassCEC, and allied organizations that had been building the case for networked geothermal long before the first borehole was drilled. The 2018 Merrimack Valley gas explosions, which killed one person, injured dozens, and displaced thousands across Lawrence, Andover, and North Andover, materially shifted the range of public discussion, making the risks of aging gas infrastructure very real for residents and policymakers. This created political space for gas alternatives that would have been harder to access before that point. At the local level, mayoral endorsements, sustainability office leadership, housing authority partnerships, and school district commitments are documented across nearly every project in the study. In Arlington, Somerville, Lowell, and Framingham, this support was actively cultivated through public meetings, educational events, and direct outreach to building owners and residents, producing a political environment in which the community knows about the technology and understands at least some of the potential benefits.

6.2 Community outreach

The outreach methods varied significantly across the projects, reflecting differences in project type, scale, and stage. Framingham and Lowell, as operational utility pilots, conducted the most extensive resident engagement, including door-to-door canvassing, public meetings, door hangers, and direct outreach to building owners within the proposed service area. This also included making sure to offer materials in multiple relevant languages and working with trusted community organizations. Somerville also engaged in extensive outreach, including door knocking and public meetings. The college projects relied on internal governance processes; faculty senate, board of trustees, and student sustainability committees rather than public-facing engagement. Among the HEET Kickstart communities, public meetings and online materials were universal, with some also adopting door-to-door outreach, surveys, and direct enrollment conversations.

6.3 Multistakeholder process

No single actor has the full combination of technical expertise, regulatory standing, capital access, and community relationships needed to develop a project on its own. Across the nine cases, the stakeholder landscape consistently included municipal governments, housing authorities, community organizations, utilities, and residents, each bringing different interests, constraints, and capacities to the table. HEET touches nearly every community project as program coordinator and technical resource, with MassCEC grant funding disbursed through HEET to individual communities. Municipal sustainability offices provide local coordination and political legitimacy. Utilities, while not leading community-pathway projects, hold the regulatory standing and institutional capacity that community-led projects currently lack, making them important potential partners. The projects that moved furthest, Framingham and the college campuses, had a single institution with clear decision-making authority. Community-pathway projects face a more complex coordination challenge spanning municipal government, housing authorities, community organizations, and private building owners simultaneously, and building the governance infrastructure to manage that complexity is as important as any technical or financial task.

Challenging Factors:

6.4 Retrofitting and scalability costs

Retrofitting existing building stock is one of the most persistent cost pressures across the case communities. Unlike new construction, where geothermal infrastructure can be designed in from the start, existing buildings originally designed for fossil fuel heating systems need to be retrofitted. Converting these buildings to hydronic systems compatible with ground-source heat pumps requires interior work that must be designed and financed building-by-building. The economics of networked geothermal improve significantly at larger scale, as more buildings sharing the same borefield infrastructure reduces the per-building cost of drilling, piping, and system management. Somerville's feasibility study highlighted this directly: cost per building drops substantially as the number of connected buildings increases across its four modeled scenarios. However, achieving that scale requires simultaneous enrollment of enough buildings to justify the upfront infrastructure investment, a financing problem that community projects have not yet solved. In addition, unexpected costs from the retrofitting process can derail projects, as happened at the Acre neighborhood project in Lowell.

6.5 Limited labor availability

The Lowell project was cancelled after the only two bids for contract labor came back in excess of what National Grid allocated for capital costs. One interviewee indicated that the newness of the geothermal market meant that fewer workers/companies were capable of and had the capacity to provide the needed services. If more projects happen and more firms enter the market, costs could go down. One interviewee anticipated that this issue could potentially be resolved, as long as Massachusetts enables the training and re-skilling of workers to expand the labor pool.

6.6 Geological suitability

Massachusetts presents a varied geological landscape that directly affects how many boreholes a project needs, how difficult they are to drill, and whether cost estimates hold at construction. Framingham, Somerville, and Arlington are located on hard metamorphic bedrock that is well suited for closed-loop geothermal. Western Massachusetts presents a different picture. Amherst and Deerfield sit in the Connecticut River valley, characterized by loose glacial sediments and groundwater that lies near the surface and which complicates drilling, triggers additional permitting for water discharge, and requires more boreholes to meet the same heating and cooling load. This affects how efficiently the ground transfers heat to and from a borehole, a geological variable that informs system sizing and cost.

6.7 Underlying Complexities

The economic interests of key actors must be considered when attempting to implement networked geothermal at scale. The expansion of networked geothermal hinges on an assessment of what utility companies stand to gain and lose, and what happens when those interests are not aligned with accelerating geothermal adoption. Gas-only suppliers face a fundamental tension: supporting geothermal means actively displacing their core revenue stream of gas customers. Without strong policy requirements or financial incentives, there is little economic incentive to pursue the removal of gas infrastructure for ground sourced heat pump systems. The high cost of retrofitting existing buildings naturally pushes utilities to focus on new construction with known demand loads, where geothermal can be classified and financed as infrastructure from the onset rather than bolted onto systems designed for gas.

The most compelling counterargument, raised by interviewees across conversations throughout this study, is that ground-source geothermal could offer gas companies an alternative business model that plays to their existing strengths. They already own the rights of way, have experienced pipe-laying and drilling workforces, and have the regulatory relationships needed to operate energy networks at neighborhood scale. Redirecting that labor and infrastructure capacity toward thermal energy networks, rather than shedding it, reframes geothermal not as a threat to the gas utility model but as its successor. Whether that reframing translates into action depends on whether policy, through tariff structures, cost recovery mechanisms, or logistical adaptations makes the transition concrete enough to act on.

7. Reflections and Generalizability

Due to our project's structure as a comparative case study, our results can only be generalized analytically and not statistically. A comparative case study seemed appropriate because we wanted to examine individual projects closely, in their real-world contexts. Additionally, the complexity of factors surrounding each project means that the boundaries between the project and its context require exploration. Each of us produced a profile of a single Massachusetts networked geothermal project using a shared structure (snapshot, governance, funding, permitting, engagement, takeaway), and the comparison across those profiles suggests the cross-case patterns we've described here. However, this methodological choice also defines the limits of what we can claim. We can describe what is happening in the cases, and we can identify what appear to be shared barriers and divergent pathways. But this still leaves questions as to how these lessons can be meaningfully retained and applied beyond the life of this project.

We identified certain factors that were specific to Massachusetts – a favorable policy environment and financial support for feasibility studies, and the public priority to replace aging natural gas infrastructure after a very prominent tragedy. These ideas don't need to be limited to Massachusetts in the future, however. In addition, several factors do apply in other contexts – historic housing/building stock exists across the country and retrofitting will present an additional challenge in those places as well. Likewise, the complex permitting process in Massachusetts can serve as both a positive example of what to consider when developing or refining a networked geothermal approval process, but also areas where streamlining could occur.

8. Recommendations

The cases align on multiple observations: the technology is feasible, and the policy intent to facilitate an alternative to gas heating is clearly demonstrated through programs like the HEET loans and DPU Order 20-80. Building momentum from here requires creating a pathway from feasibility to implementation through a combination of policy, finance, and sharing lessons learned. Each recommendation below addresses a specific point at which our cases showed the existing system breaking down.

From Feasibility to Construction:

The Kickstart program ends with the completion of the feasibility study, which is where most projects stall even when the conclusions indicate networked geothermal is feasible. Future networked geothermal grantors, including state energy development agencies like MassCEC and federal agencies like the Department of Energy, should pair feasibility grants with competitive follow-on construction grants based on project readiness. This can address instances where networked geothermal is technically feasible but cannot capitalize.

Costly Retrofits:

The cases of Framingham and Smith College showed that most of the project costs involved retrofitting each building, including installing networked geothermal uplinks and reworking heating systems. The loop itself was only part of the bill. Existing energy efficiency services programs, such as Mass Save[1], should include retrofits like installing uplinks and conversion from steam-based heating to low-temperature hot water that facilitate future networked geothermal installations.

Density at Intake:

Deerfield's feasibility study shows that networked geothermal may fail to be economically competitive compared to other climate control alternatives in low building density environments. For future projects, we recommend screening for density at intake using HEET's LeGUp framework.

A Unified Permitting Framework:

Arlington's boring permit is written for three wells, not 153; Worcester imposes none at all. Our recommendation is that there should be a published state permitting playbook, which would standardize NPDES timelines and align municipal fee structures with the scale of network drilling.

Equity by Design, Not by Discretion:

Arlington, Framingham, and Lowell centered equity in their projects; some others did not. State governments should require environmental-justice siting preference, affordable-housing inclusion, and income-indexed rates into networked geothermal incentives programs rather than leaving them to project-level choice. Generally, state governments regulate utilities through public utility commissions. Also, state governments set policies around environmental justice protections and affordable housing

[1] Mass Save is a collaboration of gas and electric utilities offering energy efficiency services like home energy assessments, financing, and income-based assistance that is mandated by the Commonwealth of Massachusetts.

development. Thus, state governments are better situated than local governments for setting these priorities.

Combining Capital Expenses for Efficiency:

The cases that moved most efficiently integrated networked geothermal into another planned investment or climate and sustainability priority, whether this was a campus capital plan at Amherst College, a brownfield redevelopment at Greentech Park, or a utility rate case at Framingham. The cases that stalled tended to be standalone municipal explorations without another significant project happening as well. We recommend that municipalities consider geothermal scoping when they undertake other large capital projects, such as school construction, housing development, or major roadwork, so that trenching, financing, and political momentum can be shared across projects rather than developed from scratch for each one. Amherst College and Smith College's self-financed pathway is closed to most municipalities, but hospitals, universities, school districts, and housing authorities can play a similar role.

Designating a Leading Agency:

A theme that runs through the report and through our methodology is that no single body currently holds the memory and progress of these projects. HEET tracks the Kickstart cohort. The DPU sees the legislation and policy. MassCEC holds incentive program data. Municipalities hold individual feasibility reports, and project managers hold lessons learned. None of these actors is currently positioned to maintain a public longitudinal registry of every networked geothermal project. We recommend that one body, MassCEC with HEET and academic support, be formally asked to maintain a public registry of project status, key metrics, and post performance outcomes, so that upcoming projects can build on what's been done. To that end, HEET's LeGUp program is developing a model which "will share key learnings, best practices, and determine a normalized dataset for the cross-comparison of projects" [61]. Likewise, the bill recently advanced by the state legislature's Joint Committee on Telecommunications, Utilities, and Energy, H.3543, proposes to create a "thermal commons" as well as a commission. The proposed commission would help define the "thermal commons" and answer key questions like accessing thermal energy under public lands, whether drilling should be prohibited in some locations, and the extent of landowners' thermal rights, among others. [62] These seem like excellent first steps towards building and refining institutional knowledge as networked geothermal continues to expand.

LOOKING AHEAD

We hope that this case study provides useful insights into the fundamental tensions that can derail ground source geothermal networks in Massachusetts, despite broad political and public support. Further consolidation and organization of knowledge in this space can hopefully be used to expand and streamline access to this energy solution.

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Note:

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Appendix A — Quantitative Methodology notes

Use this appendix to document: (i) how the case profiles were sourced and vetted; (ii) key assumptions in cost or savings figures (e.g., ASHP baseline vs. continued gas); (iii) identified gaps in the public record; and (iv) any calculations the report relies on (e.g., emissions factors, payback methodology).

Network Analysis

The network visualization was constructed in R using the igraph, ggraph, tidygraph, visNetwork, tidyverse and viridis packages. We started by using dplyr::select to remove irrelevant columns, then wrote the resulting data frame to a CSV for manual cleaning, which involved resolving multiple spellings and cells containing multiple actors. The data frame was sufficiently small to permit manual cleaning. Team members clarified the roles of each actor when necessary. We then constructed the network visualization to include all non-governmental organizations, undirected edges, and discrete nodes for actors with various roles, such as Eversource and National Grid. Governmental organizations such as DPU, DOER, or Federal Agencies were not included because our schema lacked governmental variables. Lastly, we cycled through multiple seeds until the layout produced a network with minimal edge ambiguity and sufficiently spread nodes.

Timeline Gantt Chart

The timeline Gantt Chart was constructed in R using the tidyverse, scales, lubridate, and viridis packages. Lubridate was used to clean and standardize dates. There were significant gaps in the timeline data. There were cases, like the Framingham case, where the start date for the feasibility phase and the construction phase were known, but not the end date for the feasibility phase. In such cases, the start of the construction phase would be treated as the end of the feasibility phase. Some instances of missing data were less clear. The end date for Amherst College's feasibility phase is known, but not when it started. Such gaps were left in place to be transparent about data completeness.

Cost Comparison and Normalization

Cost figures for this analysis were extracted from the "*networked_geothermal_schema_2026*" dataset, specifically from the *Total_Cost_Gross* and *Cost_Per_Building* fields across all nine projects. Of the nine projects included in the dataset, Project 9 was excluded from the cost comparison due to NA values in both cost fields, resulting in an analytical sample of eight projects. For projects where *Cost_Per_Building* was not explicitly provided in the dataset, the figure was derived by dividing *Total_Cost_Gross* by the corresponding building count. Where cost ranges were reported rather than single values (Worcester: $40–85M; Deerfield: $11–28M; Somerville: $12–30M), the midpoint was not used for normalization. Instead, the full range was preserved to reflect the uncertainty inherent in feasibility-stage estimates. All *Total_Cost_Gross* figures represent upfront capital expenditure only, prior to any incentives, rebates, or tax credits, and building counts reflect the proposed or planned scope at the time of each project's feasibility or construction documentation. No adjustments were made to account for differences in project type, financing structure, or scope of included costs across projects, as these vary materially between college-affiliated, utility-led, and community feasibility projects and are addressed separately in the limitations section.

Permit Tree

Permits documented across the nine case communities were organized into four categories: water and discharge, environmental review, site and construction, and regulatory and legal. Each project was mapped to the specific permits it had either obtained or identified as required, based on data collected. Projects for which no permit data was available, most notably Smith College, were excluded from the permit tree. Permitting challenges were similarly grouped into four categories: administrative, environmental, site-specific, and regulatory, based on the nature of the obstacle involved.

Appendix B — Glossary

Borehole	Vertical closed-loop well (typically 500-700 ft in MA) hosting the heat exchanger.
COP	Coefficient of performance- ratio of delivered thermal energy to electrical input.
DOE	The United States Department of Energy
DPU Docket 19-120	2020 MA DPU order approving Eversource's Framingham networked geothermal pilot.
EJ area	State-designated environmental justice block group.
EPA	Environmental Protection Agency
GSHP	Ground-source heat pump- the building-side equipment that exchanges heat with the loop.
HEET Kickstart	MassCEC-funded program administered by Home Energy Efficiency Team (HEET), providing feasibility-study grants to MA communities.
LeGUp	Learning from the Ground Up- Research team formed by HEET, with the goal of learning from the first utility geothermal networks in the country.
MBTA	Massachusetts Bay Transportation Authority
MVP	Municipal Vulnerability Preparedness is a Massachusetts state program that helps municipalities assess their vulnerability to climate change impacts and access grant funding for resilience projects.
Networked geothermal	Shared ambient-temperature thermal loop serving multiple buildings, usually with a single operator.
NPDES	National Pollutant Discharge Elimination System- required for drilling-related discharges.
OSE	Office of Sustainability and Environment
WBDC	Worcester Business Development Corporation
NGP	New Garden Park

Appendix C — Statement on AI Use

AI tools were used in the development of this document. The team used the UMass Gen AI platform, which has access to OpenAI, Anthropic, DeepSeek, Meta, Mistral, and xAI LLMs. The UMass Gen AI platform facilitated the uses of LLMs detailed below.

AI was used to locate relevant documents and retrieve data, which was reviewed and authenticated by the researchers. The Arlington case profile was drafted with substantial AI assistance, working from documents gathered by a research assistant and from AI-assisted web searches, and was reviewed by the instructor.

ChatGPT was used as a coding assistant for ArcGIS for Figure 1, specifically for implementing geocode addresses and Massachusetts municipal borders.

Claude was also used as a coding assistant for R for Figures 2 and 3, specifically for mastering previously unfamiliar packages: igraph, ggraph, and visNetwork.

Developing Table 1 and Figures 4 through 6 also involved Claude as a coding assistant for planning the visual design and organization of the visualizations.

An AI summary was used in place of a full transcript for one interview as noted in the report.

Claude was used to verify the qualitative themes from another interview.

Claude was used while planning the visual design and layout of the final report.

Lastly, Claude was also used in some cases to verify citations adhered to the APA citation style.