Cambridge Community Geothermal Pilot

Geographic Sub-Topic Area: Urban/Suburban Community

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Dave Hermantin and Garrett Gobillot, *Brightcore Energy*
Nikki Bruno and Eric Bosworth, *Eversource*

Project Overview

We are pleased to hereby submit an application to the U.S. Department of Energy's Community Geothermal Heating and Cooling Design and Deployment funding opportunity. The Cambridge Community Geothermal Pilot will deliver clean, renewable thermal energy to a diverse range of buildings in Cambridge, in line with Cambridge's Net Zero Action Plan goals for clean energy and electrification.

Background

Our proposal brings together a coalition of five organizations that each bring unique expertise to the development of the Cambridge Community Geothermal Pilot:

- The **City of Cambridge** has long been committed to addressing the causes and impacts of climate change, with a Net Zero Action Plan[1] that is designed to bring community-wide building greenhouse gas emissions to zero by 2050.

  In 2018, the City completed a Low Carbon Energy Supply Strategy[2] that identified target areas for clean, district-level energy systems. More recently, in 2021, the City actively participated in community geothermal charrettes held by an area nonprofit, in order to identify strategies for networked geothermal in Massachusetts.

  The City also brings significant experience with geothermal to this project: the City has renovated several public schools and fire stations in recent years to include ground-source systems as the primary or sole heating and cooling system. The King Open School Complex, re-opened in 2021, utilizes 190 geothermal wells and achieves Net Zero readiness. Even as far back as 2004, the City renovated City Hall Annex to include three geothermal wells that provide the entirety of the heating and cooling needed.
- The **National Renewable Energy Laboratory (NREL)** is the prime Department of Energy National Laboratory focused on renewable energy research. The geothermal group within NREL studies various aspects of geothermal energy including reservoir modeling, surface plant design, market analysis, nationwide potential, regulatory aspects, etc. As part of this project, NREL will take the lead on design and analysis of the geothermal-based district energy system, including simulation and sizing the borehole field and modeling the mass and heat transfer flows withing the district energy network.
- The **Massachusetts Clean Energy Center (MassCEC)** is a state economic development agency dedicated to accelerating the growth of the clean energy sector across the Commonwealth to spur job creation, deliver statewide environmental benefits, and secure long-term economic growth for the people of Massachusetts. MassCEC works to increase the adoption of clean energy while driving down costs and delivering financial, environmental, and economic development benefits to energy users and utility customers across the state. Through a variety of programs and initiatives, MassCEC

[1] Cambridge Net Zero Action Plan. https://www.cambridgema.gov/CDD/Projects/Climate/netzerotaskforce
[2] Cambridge Low Carbon Energy Supply Strategy. https://www.cambridgema.gov/CDD/climateandenergy/climatechangeplanning/lowcarbonenergysupplystrategy

incorporates the principles of diversity, equity, inclusion, and environmental justice to promote the equitable distribution of the health and economic benefits of clean energy and support a diverse and inclusive clean energy industry. Specifically, the workforce team at MassCEC is focused on building capacity across the statewide clean energy workforce, with an emphasis on programs that:

1. Provide residents of Environmental Justice neighborhoods and low-income communities with quality job training aligned to sustainable wage in-demand career pathways, wraparound services, and placement support.
2. Help current and former Fossil Fuel Workers transition to promising careers in the clean energy industry by deploying transferrable skills and building new skills for relevant emerging technologies.
3. Support the development, certification, and growth of clean energy Minority and Women-Owned Business Enterprises (MWBEs)
4. Connect clean energy employers to future worker pipelines through internship and on-the-job training opportunities.
5. Provide detailed information about the state and regional clean energy industry and emerging workforce needs.

- Founded in 2015, **Brightcore Energy** is a Delaware Limited Liability Company with 40^{+} employees and growing. We are headquartered in Armonk, NY with a satellite office in Brooklyn, NY. Brightcore is focused on delivering turn-key energy efficiency and renewable energy solutions to large commercial, institutional and municipal clients, primarily in the Northeast. Brightcore provides project design, development, implementation, funding, operations, maintenance, and monitoring for a wide range of technologies including geothermal heating and cooling solutions, LED lighting, building controls, solar PV, battery storage, and EV charging.

  Successful deployment of energy efficiency and renewable energy projects requires expertise across multiple disciplines: technology, design, procurement, permitting, project management, construction, finance, legal, and asset management. The staff has decades of experience across each of these disciplines, enabling us to optimize and deliver projects to the customers of the highest quality, on time, and on budget. As part of Brightcore's delivery, leverages deep financial expertise, together with Brightcore's institutional capital base, to enable customers to pursue projects with $0 investment and immediate savings. The Brightcore management team has spent over a decade financing and investing in clean energy projects (through Brightcore as well as a predecessor company, Smart Energy Capital), having deployed and financed over $500 million of on-site clean energy projects.

  Brightcore Energy has an experienced geothermal team that provides preliminary assessments, feasibility studies, planning, design, drilling, installation, monitoring, and

maintenance of commercial and community closed-loop geothermal systems. Brightcore Energy's geothermal group is led by Dave Hermantin, P.E. who has worked as a designer and construction administrator since 2003 for over 100 commercial geothermal projects throughout the New York metropolitan area and New England. Garrett Gobillot (Senior Geothermal Project Engineer) has years of experience designing, constructing, and operating geothermal systems with P.W. Grosser Consulting Inc before joining Brightcore.

The team is experienced in installing geothermal systems in a variety of geologies along the Northeast. We provide a unique drilling capability for urban/suburban environments, called UrbanGeo, that uses specialized drilling equipment that can drill inside existing buildings, at inclined boreholes, and capable of Borehole Thermal Energy Storage (BTES). Originally developed and deployed in Sweden by our partners, LKAB Wassara, UrbanGeo is an innovative HVAC solution specifically designed for applications in densely populated, urban/suburban areas. The UrbanGeo system provides the ability to install ground loops inside of existing structures as well as on new construction projects. Our proprietary drilling technology installs inclined geothermal boreholes in small areas using directional drilling techniques. This allows the boreholes to extend outward to capture more thermal mass than conventional geothermal techniques while staying within property lines.

The UrbanGeo technology can expand GSHPs applicability due to the drill rig's small size and capability of drilling inclined boreholes compared to traditional geothermal drill rigs. Leveraging the specialized drilling technique in addition to our strong relationships with local conventional drilling partners, our geothermal capabilities are well suited for navigating the complexities of a large community geothermal system in Cambridge.

- **Eversource** is a regional energy and water company with more than 9,200 employees committed to the responsible delivery of electric, gas and water services to our 4.4 million customers in Connecticut, Massachusetts, and New Hampshire. We do this with an unwavering focus on safety, reliability, integrity, customer satisfaction and corporate responsibility. We are investing in new infrastructure and innovative solutions to meet the growing needs of our customers and communities to ensure a more sustainable and equitable future and to help advance the cleaner energy future that we all desire.

  Eversource is currently building a networked geothermal system in a Framingham, MA neighborhood. Approved by the Massachusetts Department of Public Utilities in 2020, this unique pilot will be the first of its kind to offer a utility-operated networked geothermal system in a mixed use, environmental justice community. The planned route consists of 45 buildings, approximately 30 of which are residential homes. Once in service, the pilot will run through two heating and cooling seasons and will provide valuable insight regarding whether geothermal at scale can be an alternative or complementary heating option to delivered fossil fuels and natural gas. Customer

feedback and technical analysis will be collected at every stage of the project to help determine the feasibility of building geothermal loops in other communities, the expansion of the existing loop, potential municipality or private collaborations and integration with other clean technologies.

Eversource is well-positioned to deliver networked geothermal projects based on our experience as a utility. Our core business requires us to safely and reliably operate and maintain long-lived underground infrastructure, respond to emergencies, and conduct customer billing, payment, and energy efficiency services. Over the years, we have gained a comprehensive understanding of the thermal needs of our customer base. We will leverage all of these core business strengths, along with the practices and procedures from our ongoing demonstration project, to help ensure the success of a Cambridge geothermal pilot. Based on our valuable experience to-date developing this "first to market" geothermal system, we can provide the City of Cambridge and partners real time experience with system development and deployment, including both customer and technical feedback.

Project Goal

The Cambridge Community Geothermal Pilot is designed to supply ground-source thermal energy for heating, cooling and hot water to a dense urban residential neighborhood that includes multiple community facilities and a large affordable housing complex. The Pilot area also includes a state-designated Environmental Justice Community block group.

We specifically anticipate that this system will be able to supply at least 70% of the annual heating, cooling, and hot water needs of the connected buildings. We have conducted a citywide Low-Carbon Energy Supply Strategy and a Renewable Thermal Analysis that has allowed us to develop this estimate, and which we will build upon in our technical analysis. We anticipate that the deployment of this system will significantly reduce the fossil-fuel use of the participating buildings and reduce their greenhouse gas emissions by up to 2,000 tonnes CO2 from the baseline reported through the Cambridge Building Energy Use Disclosure Ordinance (see table below), in line with Cambridge's Net Zero Action Plan goals.

Furthermore, the Pilot will also be designed to identify workforce training needs during the Planning and Design period. During the Deployment Period, we then intend to develop training programs in the geothermal and renewable thermal subject areas that can be accessed by youth, minority- and women-owned businesses, and underserved communities in and around Cambridge.

Finally, we anticipate that this system can be the first community geothermal system of several in Cambridge, by proving that networked geothermal can work in dense urban environments. Through our previous work, we have identified the role that clean, district-scale thermal energy can play in decarbonizing energy use in Cambridge. Hence, the Cambridge Community Geothermal Pilot can lead the way for future systems in Cambridge, the region, and in communities across the US.

DOE Impact

A grant from this DOE Funding Opportunity would allow the technical and economic feasibility analysis to be completed, and, if selected for implementation, allow for the project to proceed to construction. To date, Cambridge has completed citywide renewable thermal analyses (using City operating funds) that identified the potential for clean district-scale energy systems to serve different building types. In addition, City staff completed a preliminary, high-level evaluation of potential networked geothermal sites for Eversource's geothermal pilot in 2021 (for which a site in another municipality was ultimately selected). A similar internal brainstorming has been conducted to analyze potential sites for this FOA.

Beyond this work, no city or state funding has been allocated for the planning, evaluation, or eventual construction of this specific community geothermal system. As a result, the award of funds by DOE would be transformative in enabling this project to move forward.

Preliminary Technical and Economic Concept Description

Project

We propose to construct a networked geothermal system that can supply a mixed group of buildings with heating, cooling, and hot water. This group of buildings, located in a dense residential neighborhood in Cambridge, encompasses multiple owners and multiple building types. It includes a Massachusetts-defined Environmental Justice Community,[3] based on a criteria of being 52% minority-identifying.

We expect that this proposed geothermal system will advance several goals:

- Demonstrating the use of community geothermal in a dense urban environment
- Bringing together a coalition of distinct partners to advance low-carbon heating solutions
- Examining how community geothermal can advance a city's clean energy and climate goals, particularly for the decarbonization of building thermal energy use
- Studying the ability of networked geothermal to reduce energy costs, especially for environmental justice
- Serving multiple building types through networked geothermal, including balancing simultaneous heating and cooling needs
- Sharing lessons that can be used by other communities across the US that are investigating opportunities for networked geothermal

We anticipate being able to advance many of these goals in the Planning and Design Budget Period, with further advancement of the goals through the implementation of the system in the Deployment Period.

Site Area

The Cambridge Community Geothermal Pilot will be located in Cambridge's Strawberry Hill neighborhood and built primarily along Cushing Street.

[3] Block Group 1, Census Tract 3543. Environmental Justice Populations in Massachusetts (arcgis.com)

Strawberry Hill is a residential neighborhood in the western part of Cambridge. It is home to a mix of single-family homes, double- and triple-deckers, and apartment buildings. In fact, 87% of households in this neighborhood live in a multi-unit building (of 2 units or more).[4] Furthermore, 57% of households in Strawberry Hill rent their home. As discussed earlier, the neighborhood includes a state-designed Environmental Justice Community.

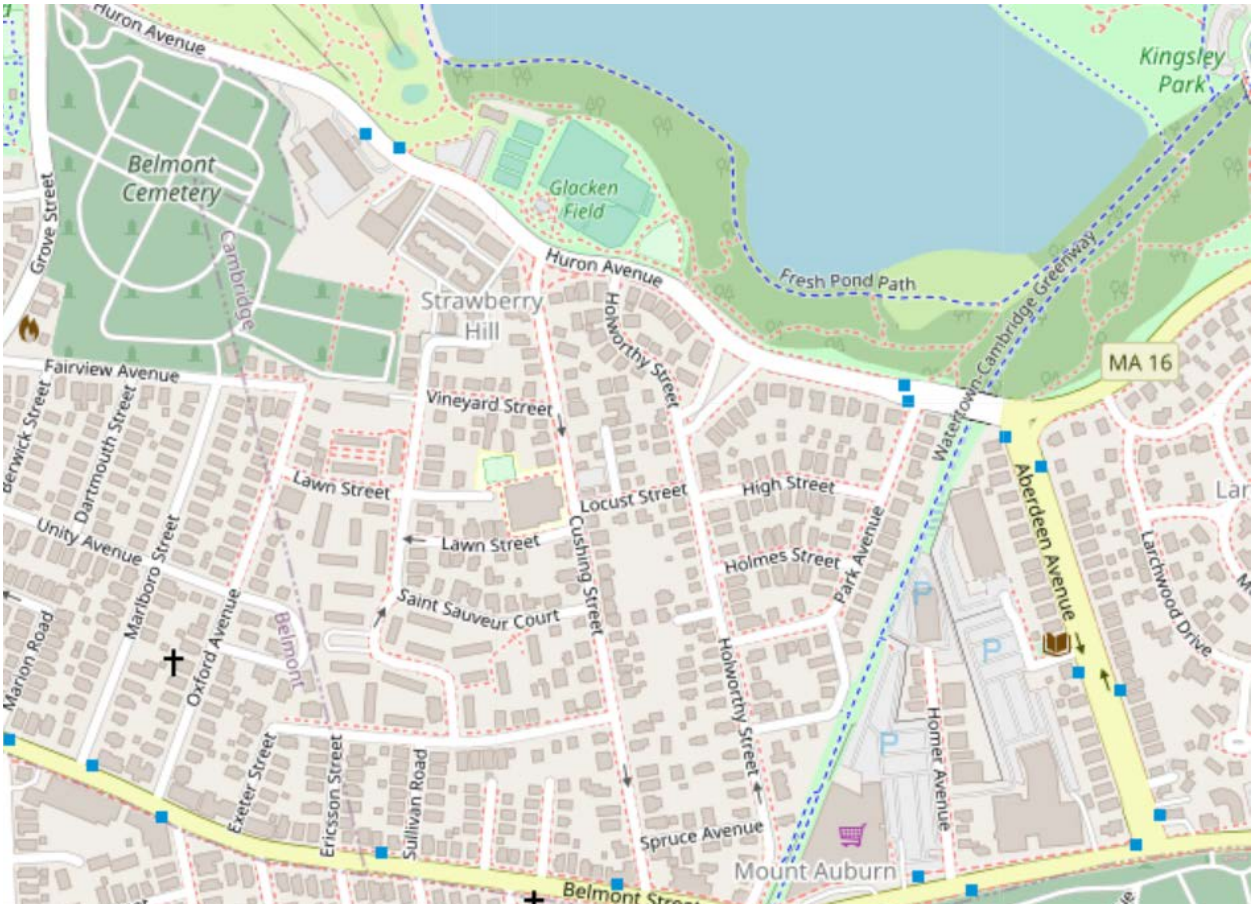

Figure 1: Strawberry Hill (from Open Street Map)

The neighborhood is home to a public school, a youth center, and a 153-unit affordable housing complex.

Cushing St. is one of the key north-south streets in Strawberry Hill, but is still a relatively narrow residential street with one travel lane. Huron Avenue, which it connects to, is an east-west connector with two travel lanes (one in each direction). Both are public rights-of-way.

All of Cambridge is served by Eversource, a gas and electric utility. The Strawberry Hill neighborhood is served by gas, and electric distribution is primarily via utility poles and overhead wires.

Proposed System Description

[4] Cambridge Neighborhood Demographic Profile. https://www.cambridgema.gov/-/media/Files/CDD/FactsandMaps/profiles/neighborhoodprofiles/neighborhood_13_profile_2019.pdf

The Cambridge Community Geothermal Pilot will utilize geothermal wells and horizontal piping to connect wells to each other and to participating buildings. We anticipate, pending technical analysis and engineering, that the majority of the wells will be located on parcels within existing open space. Geothermal wells in Cambridge, including those used by municipal buildings, range from 400 to 1200 feet in depth.

We also anticipate that the system will be a fifth generation (5G) district energy system, operating at low temperatures and capable of accepting waste heat from one building to transport it to another.

The horizontal piping will be located primarily in the public right of way. The main route of the system will extend from the corner of Cushing St. at St. Sauveur Court, up Cushing in a northerly direction, and then west along Huron Avenue for approximately 500 feet. From end to end, the horizontal piping will span approximately 1/3 of a mile.

There are several large buildings and complexes located along this corridor. We plan to further engage building owners along this corridor and then evaluate interested candidate buildings for technical and economic feasibility. Some of the key buildings include:

- Haggerty Elementary School, a 54,000-square foot public school
- A 153-unit garden-style affordable housing complex
- The Russell Youth Community Center, including its basketball court and kitchen facilities
- A 251-unit high-rise residential building
- A 58-unit townhouse-style condominium complex
- Multiple smaller private residences, including 6 single-family homes, 8 two-family homes, and 5 buildings of three units or more

Our planned outreach and our proposed technical and economic assessments, described later in this proposal, will help narrow this list of buildings to a final set of participants.

Estimated Current Heating and Cooling Needs and Cost

The City of Cambridge enacted a benchmarking ordinance in 2014, requiring large buildings to track and report their annual energy and water use using EPA Portfolio Manager. This Building Energy Use Disclosure Ordinance (BEUDO) can provide us direct insight into the energy needs of the large buildings in Strawberry Hill.

In addition, Cambridge is in the process of completing a Renewable Thermal Analysis that identified sixteen common building typologies in Cambridge and their heating and cooling demand. The analysis used BEOpt and DOE Commercial Reference building models to estimate annual energy demand and peak capacity needed. We can use this analysis to estimate heating and cooling needs.

The table below shows estimated heating and cooling needs for the buildings proposed to be served by the system:

Building	Gross Floor Area (sq. ft.)	Annual Heating and Hot Water Demand (kBTU)	Annual Cooling Need (kBTU)	Heating Capacity Needed (kBTU/h)	Cooling Capacity Needed (kBTU/h)	Estimated annual heating and cooling costs	Estimated annual GHG emissions (mtCO2e)	Estimate Source
Haggerty Elementary School	53,664	2,296,200	1,381,688	2,577	2,053	$54,000	238	BEUDO; DOE Commercial Ref building
153-unit affordable housing complex	200,633	13,294,260	2,471,835	8,730	3,541	$270,000	888	BEUDO; BEOpt Model
Russell Youth Center	24,321	184,020	518,355	1,323	872	$7,300	123	BEUDO; DOE Commercial Ref building
251-unit high rise	247,000	17,653,800	2,404,220	6,712	3,157	$350,000	1277	BEUDO; BEOpt Model
58-unit townhome complex	57,875	3,616,920	540,423	1,379	667	$72,000	268	BEUDO; BEOpt Model
40 homes in small residential buildings	40,000 (est.)	1,376,496	438,500	1,124	541	$29,000	108	BEOpt Model

Note that these estimates are based on building models and typical volumetric utility cost (not reflecting specific gas and electricity purchasing arrangements).

The total peak heating load of the system (consistently larger than cooling load) is thus 21,900 kBTU/hour, or 1,820 tons. Based on our Renewable Thermal Analysis and preliminary estimates, covering the majority of this peak heating load would require approximately 250-300 wells. (This assumes 600' depth, although ground-source wells in Cambridge have been successfully drilled to twice that depth for additional capacity.) We anticipate we would be able to locate the wells in the on-parcel open spaces available at these properties; this assumes 25' spacing between wells.

This, of course, represents just the peak heating capacity. Over the course of the year, we expect that a system of this size will be able to provide at least 70% of total thermal needs. Our technical analysis will encompass modeling that can identify this annual output in greater detail.

Proposed Technical Analysis

Led by NREL, a techno-economic analysis will be performed of the proposed geothermal district energy system. This task involves subsurface and building energy use data collection, system simulations and design, and review and sign-off by an engineering, procurement and construction (EPC) firm. Subsurface data including depth to water table and ground properties will be collected to allow simulating and sizing the borehole field. Energy demand use in the targeted buildings will be further quantified through interviews and review of utility bills. A model of the proposed district energy system will be implemented in the NREL tools dGeo and URBANopt to simulate thermal performance of the system including quantifying delivered heating and cooling to the buildings, estimating investment costs and cost savings, and assessing greenhouse gas emission reductions. Retrofits in the connected buildings will be considered to allowing tying in to the district energy network. The proposed design will be reviewed by an EPC firm to select pumps, heat exchangers, and piping material and schedule and create construction-ready plans, to be ready for development in a future phase of the project.

Current Workforce Training Programs

Since 2015, Massachusetts' Clean Energy Center (MassCEC) has managed over $53 million in publicly funded workforce development programs aimed at building a robust and diverse pipeline of professionals focused on climate-critical roles ranging from engineering and research to installation and maintenance. Massachusetts has a robust workforce development and education system with many existing programs that present opportunities to leverage state funding and best practices for building a skilled workforce. The workforce development team at MassCEC works closely with the Executive Office of Labor and Workforce Development, the Executive Office of Education, the regional MassHire workforce boards and career centers, vocational high schools, community colleges, labor unions, community-based organizations

offering workforce development, and employer partners. These ongoing collaborations position the organization to achieve increased impact through carefully aligned programming. Example programs include:

- Clean Energy Activity Day and the Learn and Earn Program gave middle and high school students their first exposure to the industry, while workforce training programs provide resources for industry-aligned curriculum, necessary equipment for training, expansion of skills training, and on-the-job learning.
- MassCEC offshore wind workforce training program grantees are building the training infrastructure from the ground up with a focus on programs that aim to reduce barriers and increase the participation of underrepresented populations and target communities in the developing offshore wind workforce.
- MassCEC's Clean Energy Internship Program helps prepare the next generation of clean energy workers by connecting college and postsecondary-certificate program students with innovative companies. The program has served over 5,000 students, and interns gain valuable experience, support Massachusetts clean energy businesses, and drive much-needed industry diversification. This last year alone, 49.6% of the participants were women, and 47.5% were BIPOC individuals.

Workplan

Project Objectives

The objective of the Cambridge Community Geothermal Pilot in the Planning and Design Period is to conduct community outreach, complete technical and economic feasibility assessments, project greenhouse gas reductions, and assess workforce training needs to enable successful implementation in the Deployment Period.

Project Scope of Work Summary and Budget Period 1 Expected Results

Four tasks are conducted in parallel during Budget Period 1 focusing on community engagement, technical design of the system, workforce training program development and obtaining permits and plans to be construction-ready for Budget Period 2. The expected results for these four tasks include

- a techno-economic analysis of the proposed geothermal district energy system including assessment of delivered heating and cooling, cost savings and geothermal borehole length requirements
- Development of a needs assessment and training program for local work force to implement, operate and maintain district energy systems in the Cambridge area.
- Engagement with local community through town halls and information sessions to understand the community's needs as well as to explain benefits of district energy system to the community
- Being construction-ready for the potential second phase of the project. This includes having the necessary permits and developed approved constructions plans by an EPC firm.

Work Breakdown Structure and Task Description

The Statement of Project Objectives contains the full description of the project tasks, subtasks, and milestones. The tasks and subtasks are summarized here. The project consists of 4 tasks, each running in parallel and requiring 12 months. The first task focuses on the technical design and analysis of the proposed geothermal district energy system. Subsurface and building energy use data is collected, the system is simulated in NREL's modeling tools UrbanOPT and dGeo and shovel-ready construction plans are developed. The second task involves creating a workforce training plan to meet the need for clean energy workers to complete the initial build of the project, its ongoing administration and maintenance, and development of similar district energy systems in the Cambridge area. Task three focuses on community engagement through town hall meetings to understand the community needs and share results with the community. The fourth task includes reviewing necessary permits and drafting the required documents, obtaining quotes from vendors and select the ownership and operation model for the proposed district energy system. Each task is associated with several milestones, listed in the table below.

Milestone Summary

Milestone Summary Table

Milestone Number	Corresponding Task or Subtask Title	Milestone Description	Anticipated Completion Date (Months from Start of the Project)
1.1.1	Data Collection	Subsurface and building energy data is collected	3
1.2.1	System Modeling	Model and simulate the subsurface (geothermal heat transfer) and surface (heat and mass flow in network)	6
1.3.1	TEA & Well Siting	Economic feasibility assessed, wellbore siting completed and EPC firm selected	9
1.4.1	EPC Review	EPC firm reviews, finetunes and approves design	12
2.1.1	Scope the workforce needs assessment research process and identify additional vendor(s) as needed	Process to identify workforce needs is scoped and additional vendor is identified	3
2.2.1	Design of all research instruments	A set of research instruments is identified including how to analyze existing data, analyze worker needs and stakeholder interview protocols	6
2.3.1	Data collection, stakeholder engagement, and initial analysis	Data is collected to assess workforce training needs	9
2.4.1	Detailed Workforce Development Plan	Training plan is developed addressing recruitment, skills training, and support services required to develop the additional workforce needed	12

3.1.1	Initial community outreach	Community engagement process is initiated	3
3.2.1	Community goals identification and buildings selection	Community engagement is continued to identified candidate buildings and community needs	9
3.3.1	Share results with community	Project results are shared with local community through town-hall meetings	12
4	Deployment preparation	Ownership and operation models are reviewed, necessary permits are identified and prepared for, and quotes are obtained	12
4	End of Budget Period 1 Goal	Performance of local district energy system has been analyzed incorporating community goals and workforce training needs. Construction-ready plans and permit application documents are developed.	12

Project Schedule and Management

Budget period 1 is planned to last 12 months, with the different tasks and milestones following a quarterly schedule. The anticipated start date and completion data for each task is listed in the table below. The City of Cambridge will serve as the primary point of contact for the project team and will coordinate activities per the milestone table by project partners. All project partners will participate in project meetings on at least a monthly basis. Quarterly check-ins will be used to ensure that the various project milestones are on track and make necessary adjustments.

Project Schedule			
Task Number	**Task or Subtask Title**	**Anticipated Start Date (Months from Start of the Project)**	**Anticipated End Date (Months from Start of the Project)**
1.1	Data Collection	1	3
1.2	System Modeling	4	6
1.3	TEA & Well Siting	7	9
1.4	EPC Review	10	12
2.1	Scope the workforce needs assessment research process and identify additional vendor(s) as needed	1	3
2.2	Design of all research instruments	4	6
2.3	Data collection, stakeholder engagement, and initial analysis	7	9
2.4	Detailed Workforce Development Plan	10	12
3.1	Initial community outreach	1	3
3.2	Community goals identification and buildings selection	4	9
3.3	Share results with community	10	12
4	Deployment preparation	1	12

Coalition Qualifications and Resources

City of Cambridge

- Role: Community Voice and Lead Applicant
- Organization: Seth Federspiel, Climate Program Manager; Nikhil Nadkarni, Energy Planner
- Qualifications: The City of Cambridge has long been committed to both addressing climate change and to fostering greater energy equity and climate justice for Cambridge's residents. In 2018, Cambridge released a Low Carbon Energy Supply Strategy that examined building energy demand across Cambridge, modeling thermal demand in particular to identify opportunity areas for district energy. In 2019, the City undertook a Renewable Thermal Analysis that identified the costs, benefits, and technical challenges of electrification for different building types; this included an examination of ground-source heat pump potential. More recently, the City examined potential sites for networked geothermal in support of a utility-led process to identify a pilot location in Massachusetts. Finally, the City brings significant experience with geothermal systems at its own municipal facilities, as the City has built or retrofitted multiple fire stations and schools with geothermal heating and cooling, going as far back as 2004. The net-zero ready King Open School complex, completed in 2021, is fossil-fuel free and features a school, community pool, and library all heated by geothermal.

  At the same time, the City is well-equipped to lead community planning and engagement processes. The City regularly conducts outreach in multiple languages, with a strong commitment to ensuring the inclusion of residents from all housing types, ages, genders, and races. The City's Community Development Department includes a Community Engagement Team with staff representing linguistic communities in Cambridge, including Spanish, Haitian Creole, Bangla, and others. An excellent example of the City's work to include community voices in climate strategy is the Neighborhood Energy microgrid project, which has conducted outreach in seven languages and with targeted outreach in an environmental justice community.

National Renewable Energy Laboratory (NREL)

- Role: technical design and analysis of geothermal district energy system
- Organization: Koenraad Beckers, PhD (NREL principal investigator); Kagan Kutun, PhD (subsurface characterization); Hyunjun Oh, PhD (surface modeling)
- Qualifications: The NREL team on this project has combined dozes of years of experience with geothermal feasibility analysis, reservoir modeling, subsurface characterization, and surface district energy modeling. NREL develops, maintains and applies in-house geothermal district energy modeling software including dGeo and URBANopt, which will be applied in this project.

Massachusetts Clean Energy Center (MassCEC)

- Role: workforce assessment and training

- Organization: Jennifer Applebaum, Managing Director, Workforce Development; Peter McPhee, Senior Program Director, Buildings
- Qualifications: MassCEC is a state economic development agency dedicated to accelerating the growth of the clean energy sector across the Commonwealth to spur job creation, deliver statewide environmental benefits, and secure long-term economic growth for the people of Massachusetts. MassCEC works to increase the adoption of clean energy while driving down costs and delivering financial, environmental, and economic development benefits to energy users and utility customers across the state. Through a variety of programs and initiatives, MassCEC incorporates the principles of diversity, equity, inclusion, and environmental justice to promote the equitable distribution of the health and economic benefits of clean energy and support a diverse and inclusive clean energy industry.

Brightcore Energy

- Role: Deployment of geothermal installation
- Organization: Dave Hermantin P.E (geothermal engineer and designer), Garrett Gobillot (geothermal engineer and designer)
- Qualifications: Brightcore is focused on delivering turn-key energy efficiency and renewable energy solutions to large commercial, institutional and municipal clients. Brightcore Energy has an experienced geothermal team that provides preliminary assessments, feasibility studies, planning, design, drilling, installation, monitoring, and maintenance of commercial and community closed-loop geothermal systems. The team has experience with over 150 geothermal projects designed and implemented in the Northeast. In addition, our exclusive partnership with our Swedish technological team, LKAB Wassara, allows us to offer a specialized drilling technique intended for dense urban environments.

Eversource

- Role: deployment and operation of geothermal installation
- Organization: Nikki Bruno, Vice President, Clean Technologies, Gas; Eric Bosworth, Senior Program Manager, Clean Technologies, Gas
- Qualifications: Eversource is an electric, gas and water utility serving 4.4 million customers in Massachusetts, Connecticut, and New Hampshire. Eversource is currently developing a networked geothermal system in Framingham, MA that will provide geothermal heating and cooling to approximately 45 buildings—a mix of residential homes, apartments, and commercial properties. We have just completed the drilling test wells and plan to begin construction later this year or early 2023, with the system estimated to be online and fully functional by mid-year 2023. Customer feedback and technical analysis is being collected at every stage of the project to help determine the feasibility of building geothermal loops in other communities, the expansion of the existing loop potential municipality or private collaborations, such as the Cambridge opportunity, and integration with other clean energy technologies.