1. OVERALL PROJECT SUMMARY AND APPROACH

a. Description of GHG Reduction Measures

The City of New Haven (the "City") will undertake an historic effort to decarbonize one of its most important buildings and civic spaces, historic New Haven Union Station. Listed on the National Register of Historic Places, Union Station is an active rail station and transportation hub serving nearly 625,000 rail passengers per year and functioning as a critical transfer facility to the regional and local bus and shuttle network. Across Union Avenue from the station is a large series of parcels owned by the City and Elm City Communities ("ECC", the City's Housing Authority), which is slated for mixed-income housing development to meet a critical housing shortage in New Haven. This project will provide low-cost, clean heat to the housing development and serve as an anchor to further decarbonize the surrounding neighborhood and other nearby City facilities.

The proposed greenhouse gas (GHG) reduction measures are included within an effort to develop a Thermal Energy Network (TEN) at the project with the capability to expand beyond the project site in future phases. A TEN may also be referred to as a Fifth Generation District Heating and Cooling system. The Union Station Area Thermal Energy Network (USATEN) is a network of hydronic pipes that move heat between thermal energy resources, which may contain thermal energy storage capacity, and heat pumps in order to eliminate the use of fossil fuel at Union Station and the proposed 1,000 units of housing across the street encompassing nearly 1.1 million square feet of new construction. The primary thermal energy resources to be incorporated into the USATEN are geothermal borefields. A diversity of building load profiles will provide a TEN with robust operating characteristics and high performance.

The City will be the lead partner in the development of USATEN, will receive the grant award, and will oversee the procurement, design, construction, and commissioning of the geothermal network. Its affiliated parking authority, the New Haven Parking Authority (NHPA), is charged with the management of Union Station, and will be responsible for assisting the City and its design-build contractor in finalizing design and installation plans for the heat pump retrofits at the train station and their connections to the network. ECC will be responsible for the design and installation of the Union Square development's heat pumps and connections to the network, using funds raised for the Union Square development. Neither the NHPA nor ECC will be subrecipients, but the involvement of both are critical to the project's success. While the City plans to construct most of the geothermal network in public rights of way, ECC will work with the City to identify locations on its parcels that will not be subject to future building development and can host geothermal boreholes. All three project partners will work together in the final year of the project to establish structures for governing USATEN and recovering the cost of operations and maintenance of the system. The City will submit a Memorandum of Agreement signed by all three members of the coalition by July 1, 2024.

USATEN will not only eliminate on-site fossil fuel from the proposed properties but will provide an electric capacity resource in the form of grid interactivity, demand management, and thermal energy storage, each as a function of heat pump performance. Electric demand reductions are not only expected during the heating season, but also during cooling season as the TEN is able to modulate demand given the thermal mass profile of the associated borefields. This will alleviate any existing, potential, or future grid constraints and provide additional capacity as the surrounding neighborhood buildings and transportation shifts away from fossil fuel and electrifies. USATEN will provide a model for municipally-owned, neighborhood-scale decarbonization, public-private partnership, utilization of

engineering design best practices, and highly refined project planning techniques emphasizing local participation and equity.

The proposed site area encompasses Union Station, the vacant housing development parcel across Union Avenue, and the adjacent existing housing facility called the Robert T Wolfe Apartments, which provide 92 units of elderly and disabled housing. The Robert T Wolfe Apartments are also slated for redevelopment at the time the adjacent vacant parcel is developed for mixed-income housing. Other surface parking lots east and west of Union Station are also slated for redevelopment in the future. USATEN is adaptable and expandable to future development and existing buildings contained within the proposed project area. A project area map is below:

Image 1. Union Station Area Map. https://maps.app.goo.gl/xaHeKuKq3PodFK3g7
Parcels are outlined in red. Yellow polygons indicate existing buildings and structures.

Upon receiving an award letter from EPA, the City will begin the process of procuring and contracting with a design-build firm, with the key milestone of having a contract executed and an onboarding kick off meeting with the selected firm. The City is confident in its ability to complete these tasks within this time period. There are no risks to the implementation or effectiveness of the GHG reduction measures associated with this task.

Test borehole drilling, design, and design development will begin immediately following onboarding of the design-build firm. Given the projected number and location of the boreholes in the public rights of way that surround and transect Union Square, the City expects to drill 3-5 test boreholes, with the completion of the resulting analysis of geological conditions representing a second project milestone. The City expects that it will need to obtain surface water discharge permits from the State of Connecticut Department of Energy and Environment Protection in order to perform test drilling. While there are risks (described below) associated with drilling geothermal boreholes, the City does not anticipate that the drilling of test boreholes will present any meaningful risk to the implementation or effectiveness of the GHG reduction measures proposed.

Informed by the test borehole data, the design and design development process will result in plans and specifications completed by the City for the core components of the geothermal network (boreholes, laterals, pump station) as well as completed plans and specifications informed by the NHPA for the inlet and outlet pipes, heat exchanger, and heat pump retrofits within Union Station. During the design development process, the City and ECC will coordinate to identify any available areas on the Union

Station parcels where no new construction is planned and arrays of geothermal boreholes can be installed. Finalized plans of the geothermal borehole arrays and network, including the placement of the pump station and ancillary equipment, will represent a third project milestone.

During the design development process, a deeper investigation of space and electrical capacity constraints within Union Station may present risks to the timeline and effectiveness of the GHG reduction measures. If unanticipated structural or remediation work is required in the interior of the building, the project and associated GHG reductions may be delayed. The NHPA and the Connecticut Department of Transportation recently completed a code compliance review which found only a minimal amount of asbestos in a small section of mastic on basement pipe insulation. Aside from this, the City is not aware of any remediation hazards in Union Station. The City anticipates siting the geothermal heat pump behind the building, where the chiller is currently located, and does not anticipate structural issues with the heat pump retrofit work. Should structural or remediation difficulties arise, the project team will either need to obtain additional financial resources, or reduce the resources available for geothermal borehole drilling, which may potentially impact associated GHG reductions. The availability of space for conduits and pipe runs at Union Station requires further exploration and may pose similar risks. Finally, additional electrical capacity may be required as available panel capacity and the electrical capacity gained by removing the chiller may not be sufficient for the new geothermal heat pump. If so, additional delays stemming from the need for electrical panel or service upgrades may affect the project timeline. All of these factors will be assessed as the fourth project milestone, plans for the geothermal heat pump retrofit of Union Station, are completed in consultation with the station manager, the NHPA.

Given the City's authority over the public right of way and the limited surficial impacts of geothermal drilling related to the City's site plan review process, the City does not anticipate that drilling in City streets or on the project properties will trigger local permitting requirements related to the public right of way or soil erosion control. Given known groundwater levels and the presence of contaminants in testing on the lots east and west of Union Station, the City will again need to obtain surface water discharge and remediation water discharge permits but does not expect this to pose risks to the timing or effectiveness of the GHG reductions proposed. Building permits are needed for the in-building work at Union Station as well as site plan approval and building permits relating to the affordable housing portion of the project. The City will also need to obtain permission from the state's Public Utility Regulatory Authority to operate a geothermal utility. Obtaining all relevant permits marks the fifth project milestone.

After borehole sites in the public right of way and project parcels have been identified and permits have been obtained, drilling and sitework, including the installation of the pump station and ancillary equipment, will begin. If limited open space is available on the project development parcels, there is sufficient space in the public right of way to accommodate the number of boreholes needed for USATEN. The City will work internally and with its local legislature to arrange for parking meter bags and traffic diversion to accommodate borehole drilling in the public right of way while limiting impacts on vehicle flow and the operations of the transit center. There is a limited amount of risk relating to supply chain complications, which could increase the cost or delay the delivery of pump or ancillary equipment components. During this phase of the project, particular geotechnical risks are present that may impact the timing and effectiveness of the proposed GHG reductions.

Subsurface conditions dictate the ease of drilling geothermal boreholes, the number of rigs needed, and the timing required to drill each borehole to particular depths. Similarly, the removal, avoidance, or

interim storage of unknown and known contaminants or the encountering of undocumented underground infrastructure may slow the pace of drilling or increase costs incurred. While the City has conservatively budgeted fifteen months for this task, conditions may extend the amount of time needed, require additional drilling rigs and equipment, and raise remediation costs in order to meet the deadline. Again, this may impact the full buildout of USATEN.

Similarly, the project plans to use 850-ft deep boreholes but conditions may limit the depth to which the City can drill. Thermal transmissivity, or the ability of the ground to transmit thermal energy to the borehole and associated geothermal loop pipe, dictates how many boreholes are ultimately needed. Shallower boreholes or geologic conditions that limit thermal transmissivity (such as deeply buried bedrock) may require additional boreholes and costs. While the City has conservatively estimated the number of boreholes (285) needed to meet thermal energy loads at the station and the planned housing development, thermal transmissivity always represents a potential risk to the project budget. However, it is highly unlikely that subsurface geologic conditions are so unknown in this location that estimates are far off. Contractor and labor shortages may introduce project delays. Completion of the boreholes and the associated trenching, installation of lateral piping, and pump system will represent a major milestone for the project.

In-building retrofit equipment and contractor procurement and construction at Union Station will be managed by the NHPA with the objective of fully decommissioning the facility's electric chiller and two of three gas-fired boilers, with two remaining solely as a backup system for redundancy. While the design development process may have identified new remediation requirements, there is some risk that additional barriers and associated costs or delays may be encountered once retrofit works begins. Supply chain disruptions or delays relating to obtaining electrical equipment, heat pumps, or other ancillary components presents a heightened risk of delays and cost increases for this task. Contractor and labor shortages may again introduce project delays. The completion of the retrofit will represent another major milestone for the project.

The largest potential risk to the timely implementation of the GHG reduction measures proposed is the development timeline for the Union Square project. ECC is leading a two-year Choice Neighborhoods planning process that began in October of 2023 and, upon completion, ECC will need to complete design, financing, and construction of the development. The City currently anticipates that construction, including geothermal heat pumps and connections to the network, will be complete by mid-2028. There is significant risk that the development is not completed, or that only a portion of the development is completed, by the time USATEN is completed. This would greatly reduce the greenhouse gas emissions reductions associated with the avoided emissions from Union Square in the 2025 to 2030 timeframe.

Completion of system testing and commissioning is the final key milestone for this project. Testing and commissioning ensures the system is constructed and operating as intended and that system performance thresholds are consistently met. There is limited risk to the implementation or effectiveness of the GHG reduction measures associated with this task as system commissioning issues typically do not take long to resolve. However, should major installation errors be found during this phase of work, subsequent repairs would be needed necessary, which would result in increased costs and project delays.

Networked geothermal systems, otherwise known as TENs, are one of fourteen measures in the Connecticut Department of Energy and Environmental Protection's (CT DEEP) Priority Climate Action Plan (PCAP), beginning on page 108. The measure was chosen because networked geothermal systems

provide a shared platform for neighborhood-level decarbonization that reduces costs and increases efficiency. When displacing fossil gas space and water heating systems, networked geothermal systems reduce carbon dioxide emissions and smog-forming air pollution. In addition, this displacement eliminates the methane and nitrous oxide emissions associated with producing fossil gas. When reducing emissions related to air conditioning and water heating powered by the electric grid, networked geothermal systems reduce the above pollutants as well as particulate matter and sulfur dioxide emissions related to displaced diesel peaking capacity. As networks grow to displace gas and fuel oil-fired space and water heating systems, carbon dioxide emissions, smog-forming pollution, and particulate matter emissions are reduced.

Implementation of TENs can help communities meet the goals of the Climate Pollution Reduction (CPRG) program. These systems achieve deep and durable greenhouse gas emissions reductions while reducing criteria air pollutants and providing an affordable source of clean heating and cooling to low-income communities. Still, many communities are unfamiliar with the benefits of these thermal energy networks, despite their layered benefits and broad replicability. Utilizing CPRG funding to initiate a municipally-owned TEN will demonstrate the potential for communities across the country to "scale up" these innovative systems in order to meet climate pollution reduction goals.

b. Demonstration of Funding Need

Union Station is challenged by deferred maintenance and liable for failing equipment. Significant investment is needed to avoid continued investment in fossil fuel-fired equipment that may become stranded assets and may not reach the end of useful life due to replacement for compliance with emissions goals. In the last seven years, two of three fossil gas-fired boilers with twenty year expected operating lives have been replaced at Union Station. The third boiler was replaced in 2010. Leveraging CPRG funding to retire these systems early is necessary as the City is routinely capital-constricted due to its limited ability to raise local revenue, with tax revenues lagging behind inflation.

New development is also an opportune time to make strategic infrastructure investments. The 1,000 units of affordable and market rate housing proposed by the City's Housing Authority is a prime candidate for connection to USATEN to avoid the on-site use of fossil fuel in the first place. Even for projects that receive 9% Low-Income Housing Tax Credits and take advantage of Inflation Reduction Act (IRA) geothermal incentives, cost pressures around the development of new affordable housing make it infeasible for them to include additional capital costs for a shared thermal energy network than can serve Union Station and the surrounding neighborhood.

The City intends to make use of the elective payment provision for the geothermal investment tax credit in order to recoup its initial 40% investment in USATEN. While the City has explored funding opportunities available through the Bipartisan Infrastructure Law Guidebook, the wide array of new programs do not directly meet the needs of this project, with the closest funding opportunity being funding allotted for enhanced geothermal systems and pilot demonstrations.

Similarly, the City has reviewed the open funding opportunities available through the IRA and has found only one potentially suitable funding opportunity through the Community Change Grant Program (CCGP). CCGP's Track I, Strategy 3: Energy-Efficient, Healthy, and Resilient Housing and Buildings certainly aligns with the objectives of this project. However, at this point the City has not identified a community-based organization as a co-applicant for a CCGP application focused on Union Station and Union Square. The City also is concerned that the project timeline may not be feasible for Community

Change, given the statutory requirement that all CCGP projects must be completed within three years. This would be challenging given the timeline the City has laid out, which does not consider the additional layers of collaborative governance and community strength planning that the Community Change Grant program requires.

Finally, while the State of Connecticut is building a geothermal system in partnership with the Department of Energy and the Wallingford Housing Authority, the $13 million available through the Community Geothermal Heating and Cooling Solutions program would be insufficient for this project. The State does not provide resources or incentives for geothermal borefields or shared systems but does provide incentives of $4,000 per ton for commercial applications of ground source heat pumps through Energize CT. The City will seek to take advantage of this incentive program to reduce the cost of the 200-ton ground source heat pump to be installed at Union Station.

c. Transformative Impact

USATEN is expected to generate a transformative impact for the City and provide a model for other communities to replicate. The project will deliver expandable, low-cost, and renewable energy infrastructure to a low-income neighborhood where energy burden and the cost of maintaining aging buildings weighs financially on homeowners and renters, and prevents conversion from legacy, fossil-fueled systems to higher capital cost electric alternatives. Such infrastructure will reduce the cost of housing production at a proposed mixed-income affordable housing project needed to combat an historic housing shortage in the city and region. Shared thermal energy infrastructure can deliver clean heating and cooling at a unit cost lower than individual building heating and cooling systems and reduce operating expenses for those buildings connected to the system, freeing up funds for residents and businesses to reinvest in their properties. Affordable thermal energy is critically needed in New Haven, a city with a poverty rate of 25%, more than double the Connecticut statewide average.

The biggest hurdle to implementing any thermal energy network is delivering the first segments of the project, some of which may need to be oversized to accommodate future growth. An investment by the federal government will yield significant capacity building for the City by accelerating the management skills and knowledge of City staff needed for TEN development, management, and expansion. The City can tap the institutional knowledge of its Engineering Department's development and maintenance of its storm water system, which is readily applicable to TENs. USATEN will help deliver the lighthouse project necessary to galvanize this capacity building and apply this to neighborhood scale decarbonization. Such an effort is akin to New Haven installing its first public sewers and water mains, delivery electric power, and providing other critical municipal services throughout its history. This project would represent a watershed moment for New Haven, initiating a virtuous cycle of investment, local equity growth, and market transformation.

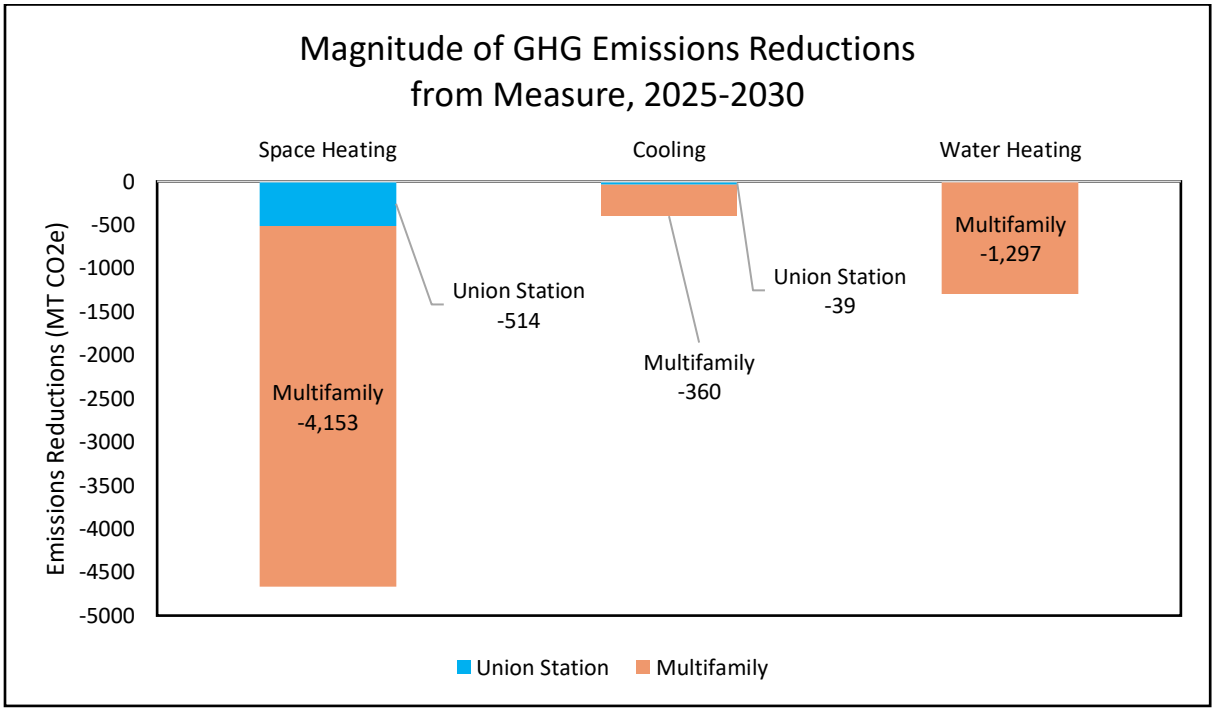
TENs are capable of alleviating the energy burden in disadvantaged communities at a scale not previously possible. Connecticut electric rates are the fourth highest in the nation, making electrification a difficult pathway for decarbonization of already energy burdened neighborhoods and affordable housing. The New England electric grid faces headwinds unlike other areas of the nation, whereby access to winter peaking gas is limited and prioritized for residential space heating, driving up electric rates during the coldest periods. Often, oil fired generation is needed on the New England grid during these constrained periods, raising carbon emissions, air pollution and electric rates. These conditions are expected to continue into the foreseeable future, making electrification more difficult. Because TENs reduce peaking electricity consumption due to the ability to store thermal energy and operate at very

high efficiency, deployment of this approach is critical to alleviating energy burden in high density neighborhoods while simultaneously supporting rapid, scaled electrification of the built environment.

The proposed USATEN location provides the City with the possibility of expanding the network further into surrounding disadvantaged communities, the historic downtown area, toward the Yale School of Medicine campus, and along major rights of way to support new development. The site is strategic as it sits at a major hub for the City and within an important economic development corridor. With the support of grant funds, the City can prove it is capable of developing and managing TENs, building momentum for expansion. The project may prove viable a municipal, public ownership development model creating an implementation framework for much of the Northeast. Nearby thermal energy resources like waste or excess heat and wastewater can be interconnected with the USATEN over time. The work will also set a major precedent for similar cities and communities, providing a critical case study for using TENs to support affordable housing production, economic development, and neighborhood-scale decarbonization. Being a high-profile project at a critical regional transportation facility and adjacent to one of the most well-known academic institutions in the world, USATEN will inspire many other municipalities to act and to invest in important decarbonization infrastructure.

2. Impact of GHG Reduction Measures

a. Magnitude of GHG Reductions from 2025 through the end of calendar year 2030



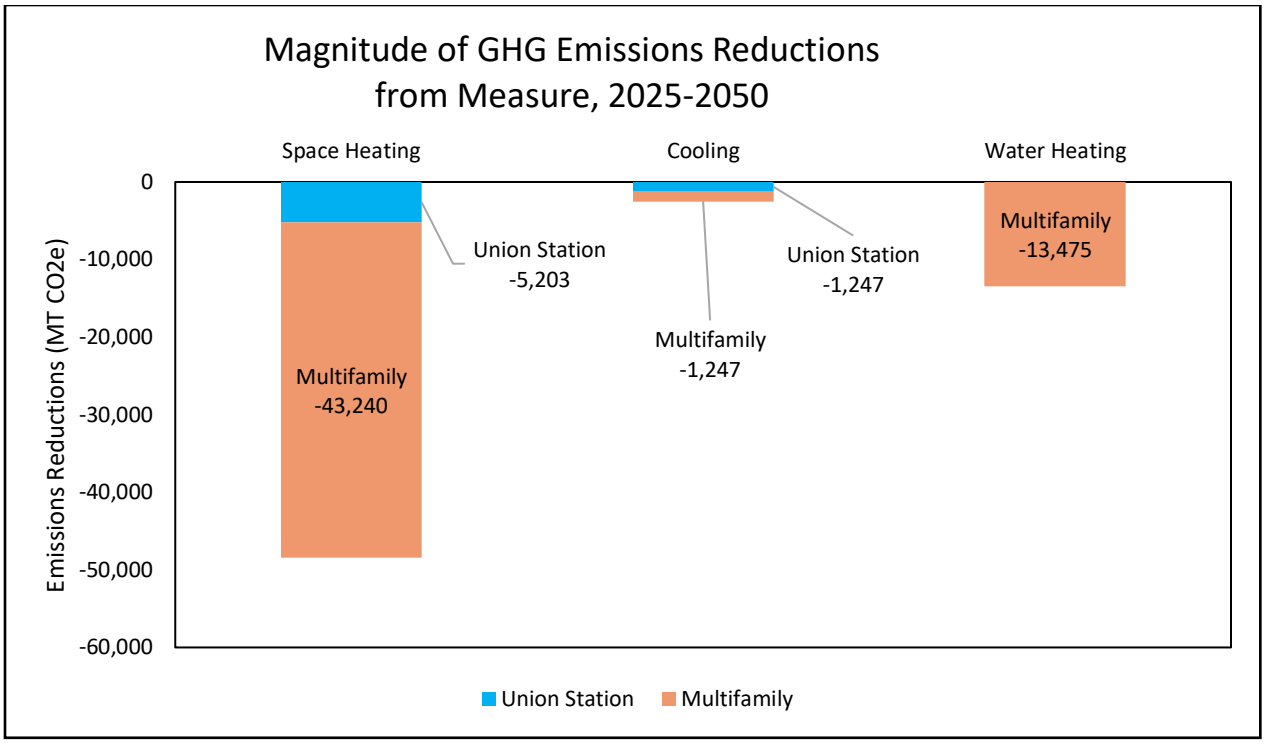
USATEN would result in a 30% reduction in cumulative greenhouse gas emisisons between 2025 and 2030, avoiding 6,363 metric tons of CO_{2e}. As the figure above demonstrates, a majority of these reductions are avoided emissions by utilizing geothermal heat pumps for heating, cooling, and domestic hot water in the Union Square development. The table below further explains these reductions by comparing cumulative greenhouse gas emissions between 2025 and 2030 from the “Business As Usual (BAU) system” to emissions from the “Ground-Source Heat Pump (GHP)” system, or USATEN. The BAU

system is defined as the current space heating (boilers) and cooling (chiller) systems at Union Station, and the gas-powered space heating and water heating systems and electric air conditioning systems that would serve the multifamily development in the absence of USATEN. These calculations assume that the systems at the multifamily building will meet minimum Energy Star Multifamily New Construction National Program Requirements and the minimum requirements of the Connecticut Housing Finance Authority and the state building code. GHP emissions 2025-2030 assume that the BAU system will operate as normal from January 1, 2025 through June 30, 2028, after which point the GHP system will operate from July 1, 2028 through the end of 2030.

Site	End-Use	BAU System	Fuel Type	BAU Emissions 2025-2030 (MT CO_{2e})	GHP Emissions 2025-2030 (MT CO_{2e})	Difference in Emissions, 2025-2030 (MT CO_{2e})
Union Station	Space Heating	3 Gas Boilers	Gas	1,453.85	939.89	-513.96
	Space Cooling	Chiller	Electric	264.65	225.22	-39.43
	ALL			1,718.50	1,165.11	-553.39
Multifamily	Space Heating	Furnaces	Gas	12,727.08	8,574.31	-4,152.76
	Water Heating	Boilers	Gas	3,952.78	2,655.97	-1,296.81
	Space Cooling	Central Air	Electric	2,876.24	2,516.31	-359.93
	ALL			19,556.10	13,746.59	-5,809.51
Total Emissions Reductions	**Total (MT CO_{2e})**	***ALL***		**21,274.60**	**14,911.70**	**-6,362.9**
	% Change				**-30%**	

As a transformative infrastructure project, USATEN would represent a highly durable greenhouse gas reduction measure if implemented. As the following section demonstrates, USATEN would lead to dramatic greenhouse gas reductions relative to a BAU baseline through 2050. With regular maintenance and upkeep, the geothermal heatpump loops operate efficiently fifty or more years. If USATEN is operational by mid-2028, the measure will effectively reduce GHG emissions on a permanent basis relative to the project period.

b. Magnitude of GHG Reductions from 2025 through the end of calendar year 2050



USATEN would result in a 76% reduction in cumulative greenhouse gas emisisons between 2025 and 2050, avoiding 63,272 metric tons of CO_{2e}. As the figure above demonstrates, a majority of these reductions are avoided emissions from utilizing geothermal heat pumps for heating, cooling, and domestic hot water in the Union Square development. The table below further explains these reductions by comparing cumulative greenhouse gas emissions between 2025 and 2050 from the "Business As Usual (BAU) System" to emissions from the "Ground-Source Heat Pump (GHP)" system, or USATEN.

Site	End-Use	BAU System	Fuel Type	BAU Emissions 2025-2050 (MT CO_{2e})	GHP Emissions 2025-2050 (MT CO_{2e})	Difference in Emissions, 2025-2050 (MT CO_{2e})
Union Station	Space Heating	3 Gas Boilers	Gas	6,212.14	1,009.44	-5,202.7
	Space Cooling	Chiller	Electric	522.61	415.70	-106.91
	ALL			6,734.75	1,425.14	-5,309.61
Multifamily	Space Heating	Furnaces	Gas	54,381.32	11,141.30	-43,240.02
	Water Heating	Boilers	Gas	16,889.76	3,414.60	-13,475.16
	Space Cooling	Central Air	Electric	5,679.77	4,432.99	-1,246.79
	ALL			76,950.86	18,988.89	-57,961.98

Total Emissions Reductions	**Total ($MT CO_{2e}$)**	***ALL***	**83,685.61**	**20,414.03**	**-63,271.58**
	% Change			**-76%**	

USATEN would provide highly durable greenhouse gas reductions in the longer term, leading to dramatic greenhouse gas reductions relative to a BAU baseline through 2050. With regular maintenance and upkeep, the geothermal heatpump loops operate efficiently fifty or more years. If USATEN is operational by mid-2028, the measure will effectively reduce GHG emissions on a permanent basis relative to the project period.

c. Cost Effectiveness of GHG Reductions

The amount of CPRG implementation grant dollars requested is $9.42 million. The total projected GHG emissions reductions for the period 2025-2030 is 6,362.9 metric tons. The resulting cost effectiveness of the GHG reduction measure is $1,480.46 per metric ton.

d. Documentation of GHG Reduction Assumptions

Please consult the Technical Appendix.

2. Environmental Results – Outputs, Outcomes, and Performance Measures

a. Expected Outputs and Outcomes

CT DEEP's PCAP on page 111 summarized the combustion-related hazardous air pollutant (HAP) and criteria air pollutant (CAP) emissions reductions associated with installing a networked geothermal system in a newly constructed neighborhood which utilizes gas furnaces for space heating, utilizing similar assumptions to those made here regarding the heating systems for the Union Square development. However, CT DEEP's modeling of HAPs and CAPs only focuses on space heating and does not include emissions related to water heating or space cooling. Therefore, in relying on CT DEEP's modeling, the estimates of HAP and CAP emissions reductions are conservatively low. CT DEEP's 375 ton modeled geothermal system is 3.8 times smaller than the estimated 1,425 tons (285 boreholes with an average of 5 tons per borehole) USATEN system. By multiplying the annual emission reductions for CT DEEP's system by the 3.8, the HAP and CAP values below were calculated on an annual basis. These reductions were then applied to over the 21.5 years the USATEN system is projected to be operational through 2050. Note that the methane emissions in the table below are only those emissions directly related to heating system combustion at the project site.

Modeling CAP Emissions Reductions				
	Pollutant	**CT PCAP: 2030 Annual Emissions Reductions in Newly Constructed Neighborhood (lbs)**	**USATEN Annual Emissions Reductions (lbs)**	**USATEN Emissions Reductions, 2025-2050 (lbs)**
Criteria Air Pollutants	CO	194	737	15,850
	CH_4	*Emissions calculated for GHG reduction estimates for multifamily – space heating.*		2,150.18
	NO_x	457	1,737	37,337

	PM (filterable)	9	34	735
	PM (primary)	37	141	3,023
	SO_2	3	11	245
Total Urban Toxics HAP		12	45.6	980.4
Total		**723**	**2,747**	**59,069**

The above emissions reductions would all be achieved in the USATEN's disadvantaged census tract and benefit adjacent disadvantaged census tracts as well. In addition to its benefits to local air quality, USATEN will reduce greenhouse gas emissions (CO_{2e}) by 6,362.9 metric tons between 2025 and 2030 and by 63,271.58 metric tons between 2025 and 2050. The progress toward these outcomes will be tracked by reviewing gas fuel use of Union Station's two remaining backup boilers and calculating GHG, HAP, and CAP emissions using emissions factors from EPA's AP-42 and WebFIRE database.

b. Performance Measures and Plan

The project team will track key performance measures across all project activities. The short-term results of the GHG reduction measures include reduced local air quality impacts as soon as the Union Station boilers are retired. Additional results include reduced electric demand levels at Union Station during the summer cooling season. As noted in 3.a., reduced heating system emissions from the geothermal retrofit in Union Station can be tracked through calculations based on utility bill data and emissions factors. With two boilers remaining solely for redundancy, emissions are expected to be at or close to zero. Avoided emissions from heating, cooling, and domestic hot water in the Union Square development can be tracked and calculated based on monitoring of the energy use of the geothermal heat pumps and their coefficients of performance. This data can be collected directly from the heat pumps, utilizing electric submeters, or estimated using resident's electric bills.

Reduced electric demand is trackable through Union Station's existing electric meter data. Project before and after peaking electric demand levels will be compared and normalized for weather changes year over year. To the extent necessary, equipment level electric use and demand can be recorded via a strategic deployment of electric submeters with at least 15-minute interval capability. A monthly and annual record or benchmarking process will be utilized to properly track system wide performance and energy usage over time.

Long-term system performance measures include ongoing measurement of peaking demand levels, and supply and return temperatures from the geothermal borefields to determine whether or not thermal runaway is present. Thermal runaway is the result of system thermal imbalance where either too much heat is withdrawn or added to a geothermal system, leaving no time for recovery. Such thermal runaway condition would be indicated by medium- and long-term shifts in supply and return temperatures trending in one particular direction, hotter or colder. Such thermal runaway condition would need to be addressed through either the addition of more geothermal boreholes or the addition of other renewable, non-emitting thermal energy resources. System supply and return temperatures will be permanently tracked by the system energy management system and associated temperature sensors.

Detailed project procurement procedures and records will be kept in order to determine whether or not best pricing is achieved for the various phases of the project's development, including the procurement

of all third-party project partners and vendors. A detailed Request for Proposals (RFP) bid list, leveling sheet, and proposal summary will be kept as a record of the outcome of the RFP process. Unitized and normalized pricing records will be kept for all aspects of the project in order to inform cost projections and budgeting for future similar projects. Examples of unitized pricing and tracking records include the final cost of drilling per borehole, the amount of time spent drilling each borehole, the drilling rig count and the deployment of personnel on a daily basis over the course of all drilling activity, the production of groundwater in gallons per minute for each borehole, and other metrics associated with the drilling of geothermal boreholes.

Project timelines will be trackable for all phases of work. Strict project timelines and timing of milestones must be adhered to in order to meet expectations relating to completion of work within specific timeframes. Timing divergence from project timelines for each phase of work will be tracked by the design-build contractor selected in real-time and against the proposed project timelines and milestones. City staff will oversee the project timeline tracking using project management software and by conducting weekly project debriefs with the design-build contractor.

After construction, the project will require at least a full year of measurement and verification. The project schedule allows for at least 15 months of measure and verification if project timelines are closely followed. The project team will extend measurement and verification for as long as the project schedule will allow in order to collect more data to inform future projects. At the very start of the project, a baseline energy consumption year will be established. The project team will implement continuous commissioning as a way to ensure USATEN operates as intended at the highest level of performance. Due to the complex nature of thermal energy networks, all associated systems and connected equipment must be monitored for system performance to be optimized. An energy management system will include power meters and electric demand meters at all major pieces of equipment which consume electricity. Such system will be installed as part of the installation of in-build work at Union Station and geothermal components of the affordable housing development. A full assessment of total system power consumption, including parasitic loads like pumps, will be regularly and continuously conducted.

Inlet and outlet temperatures as well as pipe flow must be tracked in order to ensure the system temperature and flow is consistent and set to optimize the performance of all connected heat pump equipment. Monitoring for working fluid dissolved solids, scale, and glycol mixture will be ongoing to ensure proper operation of the system, avoid fouling equipment, and to increase equipment life. A protocol for monitoring, testing, measurement and verification of the system and system component performance will set up, and all responsible parties must be engaged and educated on such protocol. A system of checks and repairs, with routing preventive maintenance, will be deployed to meet the objectives of continued and high-performance system operations with minimum downtime. Such maintenance activities and all associated costs for materials and third-party work will be permanently logged and tracked in order to inform a record of operating expenses for the system and for projections of future projects.

Other project key performance indicators to be tracked include site safety measures, the number and severity of incidents having violated site safety protocols, and incidents relating to members of the public injured on the project site. All safety incidents relating to the project are to be tracked and recorded and shared with City officials managing risk and insurance concerns. The design-build firm selected for the project is subject to all safety protocols required by the City and will also track and disclose when such violations or incidents occur.

c. Authorities, Implementation Timeline, and Milestones

The City plans to construct the USATEN primarily in the public right of way, over which the City has authority. On the parcels owned by the City and ECC that make up the Union Square development site, the City will work with ECC to identify locations suitable for geothermal arrays where new buildings will not be constructed. If the location identified is on a parcel owned by the City, then coordination with the final development plans of ECC will be sufficient. If the location identified is on a parcel owned by ECC, then a license agreement will be obtained from ECC in order for the City to drill boreholes at that location. The City will also opportunistically seek similar license agreements from the Connecticut Department of Transportation (CT DOT) to drill boreholes at locations on the Union Station parcel. With its design-build contractor, the City will identify locations, coordinate with ECC and CT DOT to determine their feasibility, and obtain licenses during the latter half of the design development and permitting processes (Q3 2025-Q2 2026, see chart below).

According to the Lease, Operating, and Funding Agreement (LOFA) for Union Station, the Mayor of New Haven and the Commissioner of CTDOT must give final approval of all capital expenditures greater than $500,000. Such capital expenditures must be recommended by the Operations Committee established pursuant to the LOFA, which consists of two CTDOT employees designated by the Commissioner and two City employees designated by the Mayor. While CTDOT has expressed support for the Union Station retrofit in its letter of support, the Operations Committee recommendation and final approval from the Commissioner will be obtained after the design process is completed in Q1-Q2 of 2026. As the NHPA manages the day-to-day operations and maintenance of Union Station, their knowledge of the existing heating and cooling systems and their involvement will be critical to finalizing the retrofit design and installation plans for the Union Station geothermal heat pump. The NHPA has committed to fulfilling this role in their Letter of Commitment and Interest.

The major tasks and timeline of activities that the City will undertake are outlined in the chart below.

	2024	*2025*				*2026*				*2027*				*2028*				*Beyond 2028*
	Q4	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	
Grant Award																		
Procurement of Design-Build Firm																		
Design and Design Development																		
Permitting																		
Test Boreholes & Other Preparatory Work																		
Drilling & Sitework																		
Equipment Procurement																		

In-Building Construction																		
Project and equipment commissioning and startup																		
Operations, Maintenance, and General System Management																		
Billing and Customer Service (As Applicable)																		

Grant Award. We expect to finalize our grant award with the EPA before the end of 2024 after learning about the project's selection for an award in October 2024. Project details confirmation and award processing may require an additional 30-60 days of time to complete.

Procurement and Contracting The first phase of the project is to conduct a procurement process to select a design-build firm to conduct full engineering design services and all work related to constructing the project. A vetted bid list will be compiled of all firms or consortiums of firms capable of provide design-build services. It is possible the project team decides to procure project development services as part of a Design-Build-Own-Operate-Maintain (DBOOM) contract or some portion thereof, which will be an approach more fully encompassing. A DBOOM arrangement may be necessary to fully take advantage of the 40% investment tax credit in the context of City budget and cash flow constraints. A full maintenance agreement will be necessary to ensure measurement, verification, and continuous commissioning and performance verification protocols are met.

An RFP will be issued by the City and proposals will be solicited through the City's standard procurement process. At bid opening, the proposals will be confirmed with solution providers and proposals leveled in order to accurately compare and select the proposer best capable of providing the services to the City at the most competitive value. Contracting and legal vetting will occur through the City's standard process. The procurement of the design-build firm is expected to be complete by end of February 2025 and contracting to be complete within 45 days of such selection, or by mid-April 2025. This process will result in the first project milestone: an executed design-build agreement.

Design and Project Development After contracting and vendor onboarding, this phase of work includes all activities related to collecting information on the existing and proposed buildings affected by USATEN, including all subsurface conditions, rights of way attributes, and other nearby infrastructure. Test boreholes will be drilled likely in 3-5 locations across the project area in order to assess geologic subsurface conditions and thermal transmissivity or conductance of the subsurface. The test boreholes will determine the ultimate number and depth of boreholes needed to meet the heating and cooling demand of the buildings served. The design firm will conduct a modeling and simulation process in order to model the heating and cooling demand of the existing and proposed buildings as well as the concurrent balancing of heating demand and potential production of waste heat during cooling, should these functions occur simultaneously. This scenario is sometimes likely given a diversity of building typologies connected to a thermal energy network, and particularly during mild weather periods. Test

boreholes will be completed before the end of May 2025. This is the first instance of site work to be completed during the project. The completion of the geologic analysis data from test boreholes and analysis of system capacity needs constitutes the another project milestone.

Once building and system capacity needs are confirmed, equipment selection and specific system design will be conducted. The design-build firm will conduct a procurement process to select equipment manufacturers and suppliers will be conducted and then driller and drilling services selection, given these have long lead times. As the system design is finalized all contractors and trades procured by the design-build firm, work will be scheduled given anticipated drilling schedules, labor availability, and equipment lead times. A working project schedule will be devised by the design-build team and the project will be managed to meet the project milestones confirmed in the final project scheduling process. Design activities and preparation for the ordering of selected equipment is expected to be complete by or before the end of December 2025, resulting in the milestone of a finalized geothermal system design and equipment specifications.

Permitting Permitting efforts will begin just before the completion of design development in November 2025. Permitting efforts including securing all building permits, required state permits, City site plan permits, and other required permits are expected by July 2026. The City will also obtain permission from the state's Public Utility Regulatory Authority to operate a geothermal utility. With the milestone of having obtain all relevant permits reached, construction can begin.

Equipment Procurement It is imperative equipment selection occurs early in the design development process given the long lead times associated with purchasing and receiving equipment like heat pumps, electric infrastructure equipment, and other critical components necessary to complete the project. There may be up to 12 months of lead time for some critical equipment items, particularly as the heat pump may originate overseas and incur additional transit time to reach New Haven. Equipment procurement is expected to be complete by the end of 2026.

Drilling and Construction Heavy coordination with City agencies, the design-build firm, and subcontractors will be required to conduct site preparation, including the restriction of movements through the project area, site safety, and the excavation of trenches for lateral piping. Accommodations are necessary to minimize transportation and pedestrian disruption in and around the project area including trench and sidewalk bridges, construction walls and fencing, and protection relating to rigging of equipment into location.

Drilling mobilization is needed and transport of drilling rigs to the site is followed by setup and the start of drilling activities. Drilling spoils disposal and groundwater discharge accommodations must be made on site. Site protection and runoff protection is necessary to contain flows of groundwater and/or the seepage of drilling mud beyond the project site and to avoid such mud from enter City catchment basins. Geothermal drilling requires drilling rigs which are fueled by diesel fuel or gasoline. It is unlikely a driller contractor will utilize fully electric drilling rigs. As such, noise and air quality concerns may be raised. Noise mitigation, such as hanging noise mitigation curtains from the construction fence, may be required. Protection to air quality is more difficult. Such impacts to air quality are temporary and will be eliminated once drilling is complete. Drilling will not occur during summer air quality alert days in order to not exacerbate poor urban air quality issues. It is anticipated that drilling will commence in the public right of way and at both project locations (Union Station and the Union Square site) in September 2026 and should extend until the end of March 2026. Such work is highly dependent on winter weather conditions; a significant amount of timeline contingency has been added to this phase of work.

Simultaneously as drilling activity commences, Union Station in-building work will commence in order to meet weather dependent timelines and to complete the cooling system transition prior to the summer season. This means the new heat pump at Union Station must be installed and ready to be connected to the newly drilled borefield before mid-May 2026. Such work would be begun at the start of the 2026 calendar year in late January or early February 2026. Otherwise, a temporary chiller or the existing chiller must remain connected to the station air handler in order to provide cooling capacity while the new heat pump is installed. The project team confirmed space is available to provide such swingover capacity between the existing chiller and the new heat pump, but this particular condition must be confirmed in the field by design professionals at the commencement of work. Completion of the boreholes and associated piping will be a critical project milestone.

Commissioning and Startup Before the end of May 2026, full heat pump cooling capacity, testing, commissioning and startup will be completed for Union Station. This is a key milestone and critical deadline due to the need for summer cooling capacity. It is expected the affordable housing development will not contain mechanical systems ready for connection to the thermal energy network until at least April 2028. Commissioning and startup of heating and cooling equipment in the affordable housing should be complete by May or June 2028, and the start of measurement and verification efforts will begin thereafter lasting for at least another 12 months. These are the milestones for project.

3. LOW-INCOME AND DISADVANTAGED COMMUNITIES

a. Community Benefits

The census tracts indicated in the "Areas_CityofNewHaven" attachment will be most proximately affected by the USATEN project as they host or are adjacent to the USATEN project site in either direction of the seasonal prevailing winds.

The project would provide financial, climate and grid resilience, and health benefits to residents of the new development at Union Square and those who relocate from Robert T. Wolfe, which is predominantly home to low-income residents of color. The census tract where the project is occurring is designated as a disadvantaged community according to the Climate and Economic Justice Screening Tool (CEJST) and scores in the 86th percentile statewide according to EPA EJSCREEN's demographic index. EJScreen data shows how the legacy of redlining, underinvestment in housing, and other social determinants of health have resulted in poor health outcomes for this community. Compared to national averages, the census tract scores in the 96th percentile for low life expectancy, in the 99th for heart disease incidence, in the 98th for prevalence of asthma, and in the 92nd for cancer prevalence.

In 2023, Union Station burned over 40,000 ccf of fossil gas. Burning fossil gas releases nitrogen oxides and other CAPs (identified in Section 3.a.), which pose serious cardiovascular, respiratory, neurological, and other health risks upon exposure. By installing the USATEN, this source of air pollution would be eliminated, reducing the likelihood that local residents, travelers, and staff at Union Station will experience airway inflammation, increased asthma attacks, heart disease, stroke, lung cancer, and other illnesses and health difficulties. The concentration of indoor air pollution can be up to two to five times greater higher than outdoor air pollution, especially if combustion equipment is not vented appropriately. Thus, indoor air pollution can be as harmful or more harmful than outdoor air pollution. Air quality in this community, which is surrounded by highways and major roadways and home to a busy train station, is a major concern for residents and the City.

CEJST shows that the census tract where this project is located is in the 98th percentile for energy cost, which is a measure of average annual energy costs divided by household income. Mapping by Connecticut's Operation Fuel shows that most of New Haven is energy burdened, with energy burdens of 7 to 10% in the disadvantaged tracts attached, with an energy burden of 9% in the host tract.

Recent Yale research of Connecticut residents shows that high energy bills cause psychological and physical health issues, as residents forego necessary expenses on food and medication, worsen chronic conditions by keeping the home too hot in summer or cold in winter, and suffer severe stress and anxiety. This builds on research from the Washington Heights neighborhood in New York City, which found that energy burden itself is a threat to both mental and physical health, leading to anxiety, depression, poor sleep, and asthma and pneumonia. Poor mental health, in turn, increases the risk of physical health problems, including diabetes, heart disease, and stroke.

Geothermal loops like the one proposed in this project can have efficiencies of 600% or more, meaning that the geothermal heat pumps release five times the energy that they consume. Compared to the 95% efficiency of modern gas furnaces, this project would provide heating, cooling, and hot water far more cost-effectively, even when accounting for the difference in price between gas and electricity. Geothermal heat pumps are also more efficient than air source heat pumps, so even if some future development in the Union Station vicinity depends on air source heat pumps, the units benefiting from this system would experience lower energy costs. Networked geothermal projects like USATEN also yield energy savings by creating economies of scale that bring energy costs down for all participants. To estimate the savings to residents, cost data from the Energize CT Heat Pump Specialists, compiled from 2020-2023 EIA energy cost data as well as NOAA weather data, is used. For a 2,045 square foot home, heating costs alone were estimated to be $1,295 using gas and $1,665 using the lowest cost air source heat pump (COP 3.1). With an assumed COP of 6, a geothermal heat pump would result in heating costs of only $659 annually, or $290 when scaled down to a 900 square foot apartment.

Historically disadvantaged communities like Union Square in New Haven are also uniquely vulnerable to the impacts of climate change. The climate crisis is causing more frequent and long-lasting power outages across the country due to erratic and extreme weather patterns. Providing geothermal energy to Union Station and the adjacent housing would insulate this regional transit hub and the neighboring community from severe power outages in the coming decades. Geothermal heating and cooling systems offer unparalleled resiliency benefits, particularly in the face of climate change and energy uncertainty. By harnessing the Earth's stable underground temperatures, these systems provide reliable heating in winter and cooling in summer, regardless of external weather conditions. Additionally, geothermal systems have long lifespans and require minimal maintenance, ensuring consistent performance over decades. This resilience not only enhances comfort and stability for homeowners and businesses but also contributes to overall energy security and sustainability. By eliminating the use of fossil fuel at Union Station and the future affordable housing development, USATEN reduces reliance on fossil fuel imports to New England, strengthening resiliency and reducing risks associated with regional and global disruptions to fossil fuel supply or unstable energy markets.

The buildings electrification trend is adding increased demand on electric infrastructure, subjecting electric grids to asymmetric loads and inability to deliver peak capacity. The addition of intermittent renewable power generation on the grid is exacerbating this problem, especially in New England. The resilience benefit of USATEN is primarily due to the centralized nature of the thermal energy network, and its relative low power demand. This means backup or emergency generation can centrally provide

service in the event of a grid outage. The system can operate longer and without interruption on backup power as it consumes less power than distributed, unitary air source heat pumps.

In order to meet the IRA apprenticeship requirements, 15% of labor hours in this project must be performed by on-the-job apprentices. Through its procurement process, the City will ensure that the design-build firm selected meets or exceeds this apprenticeship requirement. It is anticipated that the HVAC, plumbers and pipefitters, who will perform the majority of work for the project will be organized in Connecticut through the United Association (UA) Local 777. One of the primary activities of UA Local 777 is providing training and apprenticeship programs to its members. These programs ensure that workers have the skills and knowledge necessary to excel in their respective trades while also promoting safety and industry best practices. The UA is renowned for its commitment to labor training and apprenticeship programs, particularly in economic justice communities. These initiatives aim to empower individuals in underserved areas by providing them with valuable skills and opportunities for upward mobility within the plumbing, pipefitting, and HVACR industries. Through comprehensive training curricula and hands-on apprenticeship experiences, the UA equips participants with the knowledge and expertise needed to succeed in high-demand fields like geothermal energy. This is particularly important in New Haven, where access to career-building opportunities is limited and a quarter of the population lives below the poverty line.

While a labor partner has not been engaged at the time of this application, the City regularly provides job referrals to project partners and major employers through the New Haven Works jobs pipeline, which the City supports annually with a $200,000 in financial support, and the region's workforce board, the Workforce Alliance. New Haven Works is the primary funnel for job seekers in New Haven to connect to employment opportunities. Through its procurement process, the City will ensure that the design-build firm selected collaborates in good faith with New Haven Works and Workforce Alliance concerning employment opportunities associated with the project and maximize opportunities for New Haven residents to obtain jobs created as a result of the project.

In order to track air pollution and utility bill benefits for residents, the project team will review gas bill data for the two boilers remaining for redundancy Union Station and calculate estimated emission usings the emissions factors noted in 3.a. Similarly, the project team will review heat pump energy consumption data to calculate the avoided emissions due to heating, cooling, and domestic hot water use at the Union Square development.

Disbenefits to the community will arise during construction. Geothermal drilling typically requires diesel or gasoline fueled drilling rigs, which can cause noise and air quality concerns. Noise mitigation blankets may be used to address concerns, but protection against air quality impacts is more difficult. The City will require the design-build contractor to cease drilling during summer air quality alert days in order to avoid exacerbating air quality events.

b. Community Engagement

As part of its Choice Neighborhoods planning process, ECC has begun extensive community outreach to the residents of Robert T. Wolfe, the neighborhood, and New Haven at large – convening a community meeting that drew residents from the neighborhood and across the City as well as committees of residents and a steering committee to inform the future development at Union Square. Housing affordability has been a central concern of community members. The affordability crisis in Connecticut is increasingly one not only limited to rising rents but also rising costs of energy. Mapping by Operation

Fuel shows the combined affordability burden of energy and housing in the attached disadvantaged census tracts ranging from 38.6% to 55.4% of income. Alleviating these cost burdens through affordable, energy efficient development would help to meet a core and repeated community concern. Community members have described geothermal technology at Yale University that is similar what's proposed in this project as "the way of the future" and "vital to the survival of how we live". This application is directly responsive to the affordability concerns voiced by local disadvantaged community members.

ECC has also begun to the work of resident and neighborhood assessments to guide its planning process. While the results of these assessments are not yet available, key areas of focus include neighborhood investments that can support stabilization, vulnerability to heat and flooding, physical improvement priorities such as air conditioning, economic mobility, and residents' perceptions of their physical and mental health and well-being.

Upon receiving an award, an immediate campaign of public outreach and education will begin, led by the City's Office of Climate and Sustainability (OCS). The intent of the public outreach is to make the adjacent neighborhood and wider city aware of the project, its timeline, project details and the opportunity to expand the project over time to reduce carbon emissions and local air pollution further and provide for neighborhood economic development.

On a quarterly basis, OCS staff will attend meetings of the two Community Management Teams (CMTs), or neighborhood boards, for the broader Hill neighborhood that includes Union Station and Union Square. These meetings provide a regular platform for receiving feedback and design input from community members and the neighborhood's local legislators and to provide project updates and explain project benefits. The frequency of CMT attendance will increase to monthly once construction begins. To receive feedback and design input, OCS staff will also organize quarterly, publicly posted public input meetings at the Trowbridge Community Center (located three blocks from the project site) during the design development and construction phases. Outreach for these meetings will include canvassing and flyering the Trowbridge Square section of the Hill, which will provide door-to-door opportunities to receive input, address concerns, and explain the benefits of USATEN to the adjacent neighborhood.

It is necessary to create a shared vision for thermal energy networks in and around the station area. USATEN presents a major opportunity to raise awareness about climate change and improve climate literacy among New Haven residents and members of the business community. To achieve maximum outreach to surrounding neighborhoods, the City will form a community advisory board consisting of the local legislator in ward 6, residents from Robert T. Wolfe and the Trowbridge Square neighborhood, a Hill neighborhood faith leader, local Spanish-speaking community-based organizations such as JUNTA for Progressive Action, and local civic/labor groups such as New Haven Rising.

4. JOB QUALITY

As noted in Section 4.a., the City will require its selected design-build firm to meet the IRA's apprenticeship requirements. Registered Apprenticeship labor such as UA 777 would be natural partners in meeting this project objective. Union apprenticeship opportunities stemming from a Project Labor Agreement may be viable and as such would ensure the creation of high-quality jobs. Given the likelihood of involvement by unionized labor, we expect the participating unions to draw from local disadvantaged populations through New Haven Works and the Workforce Alliance, and facilitate pre-apprenticeship and apprenticeship programs which support further workforce development in New

Haven and the surrounding region and potentially engage with at-risk youth.

All Connecticut employees have the right to self-organize, to form, join or assist labor organizations, and to collectively bargain without interference from their employers. In addition, the City will require participating contractors and subcontractors to commit to remaining neutral in union organizing and operations and to agree to voluntary recognition of unions formed through the signing up of a majority of employees.

Through its own laws and policy, the City is committed to developing and nurturing a competitive local construction industry which represents New Haven's ethnic diversity. To ensure equal opportunities for construction and construction-related contractors, and to enable Black-, Latine-, and women-owned firms to overcome a history of disadvantages, the City's Small Contractor Development program provides targeted opportunities and support to these firms through bid notification, technical assistance, project-specific training, monitoring, and services.

The municipal ordinance which established the Small Contractor Development program sets utilization goals for Black-, Latine-, and women-owned businesses for City construction contracts, both as a percentage of the total value of City construction contracts and as a percentage of the total value of subcontracts. To meet the utilization goals, businesses must be small contractors that are majority owned, operated, and directed by Black, Latine, and women owner-operators registered with State of Connecticut Department of Administrative Services (DAS) or pre-certified by the Small Contractor Development program as in process to achieve state certification. The Small Contractor Development office also assists local contractors working on projects related to transportation with certification in the US EPA's MBE/WBE program.

The City requires that all bidders on construction contracts valued at over $150,000 aggressively make every effort to reach the City's utilization goals, including achieving 25% overall utilization by Black-, Latino-, and women-owned businesses. This goal exceeds the EPA's 8% objective for awarding contracts under EPA financial assistance agreements to businesses owned or controlled by socially and economically disadvantaged individuals. Contractors seeking to work with the City must submit signed letters of commitment from the registered small businesses they plan to work with, together with a list of dollar amounts associated with each agreement. Bidders who fail to meet the requirements must demonstrate their good faith efforts in a signed affidavit. This affidavit is evaluated against a set of prescribed actions including submitting subcontracting opportunities to the Small Contractor Development program for distribution and reaching out to the New Haven Regional Contractors Alliance, an area nonprofit that assists Black-, Latine-, and women-owned businesses in competing for construction contracts.

In addition to the City's Small Contractor Development program requirements, all contractors working on City construction projects are required to comply with the regulations of the City's Commission on Equal Opportunities ordinance. This ordinance requires that contractors exert maximum effort to achieve minimum hiring goals for each City project, targets of 25% of total hours worked by Black and Latine workers and 6.9% of hours worked by women workers.

Contractors must meet with Commission staff to submit plans to achieve equal opportunity in employment prior to beginning work on a City-funded project. Each day, contractors must submit to the Commission on Equal Opportunities reports of the demographics, trades worked, and work descriptions for all employees. Each week, contractors must submit weekly payroll reports to ensure compliance with

applicable local, state, or federal wage rates. This includes the prevailing wage requirements associated with this funding opportunity.

Failure to meet the minimum hiring goals or to demonstrate maximum effort to achieve the goals is cause for the director of the Commission to take remedial action, including recommending that City contracts be cancelled or that City agencies refrain from contracting with the noncomplying contractor in the future.

All of the work performed in carrying out the project will be subject to the City's Small Contractor Development and Commission on Equal Opportunities programs. In conjunction with the US EPA's MBE/WBE requirements, both municipal programs will ensure that project funds promote local economic development that is inclusive and prioritizes the utilization of Minority- and Women-Owned Businesses.

5. PROGRAMMATIC CAPABILITY AND PAST PERFORMANCE

a. Past Performance

The City has successfully completed or is currently managing the assistance agreements identified below. All agreements were implemented according to the agreement guidelines and completed agreements were appropriately closed at the end of the term.

Lead Hazard Reduction Grant Program

Federal or non-federal funding agency and assistance listing: CTLHD0495-23
Funding level: HUD Lead-Based Paint Hazard Control and Healthy Homes - $7,700,000
Project years: 2023-2027
Contact: Gail N. Ward, Phone: (202) 402-6004, Fax: (202) 755-1000, Email: gail.n.ward@hud.gov

Through this program, the New Haven Health Department (NHHD) will work with homeowners to eliminate lead hazards from 200 housing units. Additionally, the program will provide free training and certifications for 136 maintenance workers and contractors to create lead-safe homes.

Office of Minority Health, HHS Advancing Health Literacy (NH HEaL – New Haven Health Education and Literacy)

Federal or non-federal funding agency and assistance listing number: MP-CPI-21-006
Funding level: $4,000,000
Project years: 2021-2023
Contact: Robin Fuller, Email: robin.fuller@hhs.gov, **Phone:** (240) 453-8830

NHHD used this funding to lead New Haven Health Education and Literacy (HEaL), a community-driven effort to address low health literacy and poor COVID-19 outcomes among Black, Hispanic/Latinx, and multiracial individuals in 10 disproportionately impacted New Haven, Connecticut neighborhoods.

CT Department of Public Health Enhanced Detection, Response, Surveillance, and Prevention of COVID-19

Federal or non-federal funding agency and assistance listing number: 2022-0160
Funding level: $1,269,567
Project years: 2020-2024
Contact: Julie Bundy, Email: Julie.bundy@ct.gov

Through this agreement, NHHD worked to address COVID-19 rates in New Haven by enhancing laboratory detection and surveillance, strengthening laboratory testing volume and capacity, and coordinating and engaging with partners to respond to and prevent and minimize transmission of COVID-19 and other infectious diseases.

The New Haven Health Department was able to successfully manage and complete the agreements listed above by assigning at least two leading staff, the Program Manager and the NHV Health Office Manager, to the supervision of each agreement, and clearly delineating their scopes of work and responsibilities in managing the grant. The Program Manager is responsible for establishing, administering, and overseeing the programmatic and financial aspects of the program. The Program Manager directs the day-to-day operations, ensure program adherence to written protocols and data recording, and adherence to quality assurance procedures. Working with the Office of Management and Budget, the NHHD Health Office Manager manages accounting and reporting of use of funds, assists in all aspects of financial transactions, provides budget information, and tracks matching expenditures.

b. Reporting Requirements

Lead Hazard Reduction Grant Program	Timely, complete, and acceptable interim reports on a quarterly basis, which demonstrate progress to meeting expected outputs and outcomes.
Office of Minority Health, HHS Advancing Health Literacy (NH HEaL – New Haven Health Education and Literacy)	Timely, complete, and acceptable quarterly interim and final reports, which demonstrated meeting expected outputs and outcomes under the agreement.
CT Department of Public Health Enhanced Detection, Response, Surveillance, and Prevention of COVID-19	Timely, complete, and acceptable monthly reports, which demonstrate progress to meeting expected outputs and outcomes.

NHHD met all reporting requirements for the assistance agreements identified above, including the submission of programmatic reports, evaluation and technical reports, and financial reports. NHHD has extensive experience reporting quarterly to funding agencies and providing reports as requested, and consistently provides progress towards achieving the expected outputs and outcomes on a timely basis. If unforeseen issues arise, NHHD communicates with the funder immediately and provides a plan to address any issues.

c. Staff Expertise

Giovanni Zinn, P.E. is the City Engineer of the City of New Haven, serving since 2014. As City Engineer, he has worked on many projects focused on sustainable and livable infrastructure, including complete streets, encouraging alternative transportation options, adopting green infrastructure, designing resilient living shoreline installations, and reducing the City's carbon footprint through aggressive energy reduction. Prior to leading the Engineering Department, Giovanni also served as a project manager for

the City of New Haven's Engineering Department and Office of Sustainability and managed environmental programs for the City Plan Department. Giovanni graduated from Yale College in 2005.

Chris Flanagan, P.E. is the Chief Civil Engineer for the City of New Haven. Chris has worked on various infrastructure projects since joining the Engineering Department in 2016 as a project manager for the design and construction of roadway reconstruction, building renovations, and new building construction. Roadway projects have included a focus on multi-modal transportation, green infrastructure, and traffic calming measures. Building projects have incorporated sustainable architectural and mechanical systems for large commercial and recreational facilities. Chris graduated with a B.S. in Civil Engineering from Worcester Polytechnic Institute in 2016.p

Steve Winter, Executive Director of OCS, brings to this project 13 years of experience managing the operations and financials of for profit and nonprofit corporations with annual revenues ranging from $50,000 to $900,000. This includes the management, bookkeeping, and reporting for over $500,000 in funds received by Catalyst Cooperative from three grantors between 2019 and 2023. Steve served as the Alder for New Haven's 21st ward for 5 years. In this role, Steve regularly engaged with community events run by community-based and faith-based organizations as well as CMT meetings for the Newhallville, Dixwell, and East Rock neighborhoods. Steve helped engage and organize residents and community organizations around key issues affecting their neighborhoods, including development proposals, affordable housing projects, and additional park space in underserved areas. At the citywide level, Steve led the Board of Alders in passing a resolution to promote community electrification. At OCS, Steve leads the City's efforts to increase resident participation in home energy efficiency and electrification, transition the City fleet to electric vehicles, and deploy new clean energy resources at City properties.

Max Teirstein, Sustainability Analyst and Engagement Coordinator at OCS, has experience managing state and federal grant funding at an Illinoi-based nonprofit. Max brings experience conducting qualitative and quantitative research on climate change and environmental justice for the New York Attorney General's Office, the Center for Biological Diversity, University of Maryland's Center for Community Engagement, Environmental Justice, and Health, and the Yale Center for Environmental Justice. At OCS, Max is responsible for engaging environmental justice communities in the City's climate, energy, and climate adaptation and resilience programs, and working with these communities to integrate their perspectives in City climate and environmental justice decision-making.

6. BUDGET

Please see the budget below and additional details in the attached budget narrative.

Union Station Area Thermal Energy Network							
Categories	**Line Item & Itemized Cost**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total EPA Funding**
CONTRACTUAL	Design-build contractor to design and build geothermal energy network with 285 boreholes of 850 feet deep. @$50/foot of drilling, inclusive of all piping, laterals, pumping capacity, and other support equipment. Assumes a 10% increase in cost for work performed in the public right of way and an additional 15% increase in cost as a contingency to mitigate against the subsurface and thermal transmissivity risks identified in the Overall Project Summary and Approach	$1,703,320	$4,769,297	$2,271,094	$340,664	-	$9,084,375
	Portion of above design-build contract to design and install geothermal heat pump retrofit of Union Station with 200 ton heat pump. Calculated @$18/square foot for 64,240 square feet of livable area in the building. Includes 25% contingency to address potential electrical upgrades, space constraints, and remediation risks. Cost not include $800,000 in Energize CT rebates to be claimed by the City (@$4,000 per ton, 200 tons)	-	$290,430	$58,086	$38,724	-	$387,240
	TOTAL CONTRACTUAL	**$1,703,320**	**$5,059,727**	**$2,329,180**	**$379,388**	**-**	**$9,471,615**
	TOTAL FUNDING FOR UNION STATION AREA THERMAL ENERGY NETWORK	**$1,703,320**	**$5,059,727**	**$2,329,180**	**$379,388**	**-**	**$9,471,615**