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May 6, 2022

By E-Mail

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, 5th Floor
Boston, MA 02110

Re: D.P.U. 20-80 – Investigation by the Department of Public Utilities on its own Motion into the Role of Gas Local Distribution Companies as the Commonwealth Achieves its Target 2050 Climate Goals

Dear Secretary Marini:

On behalf of Home Energy Efficiency Team, Inc. (HEET), please find enclosed public comments for the above-referenced docket.

Please feel free to contact me with any questions.

Sincerely,

Courtney Feeley Karp

Enclosures

Cc: Sarah Smegal, Hearing Officer
Service List, D.P.U. 20-80

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Proceedings into the Role of Gas Local Distribution Companies as the Commonwealth Achieves its Target 2050 Climate Goals	**)**

D.P.U. 20-80

ALTERNATIVE REGULATORY PROPOSAL by HOME ENERGY EFFICIENCY TEAM, INC.

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DATED: May 6, 2022

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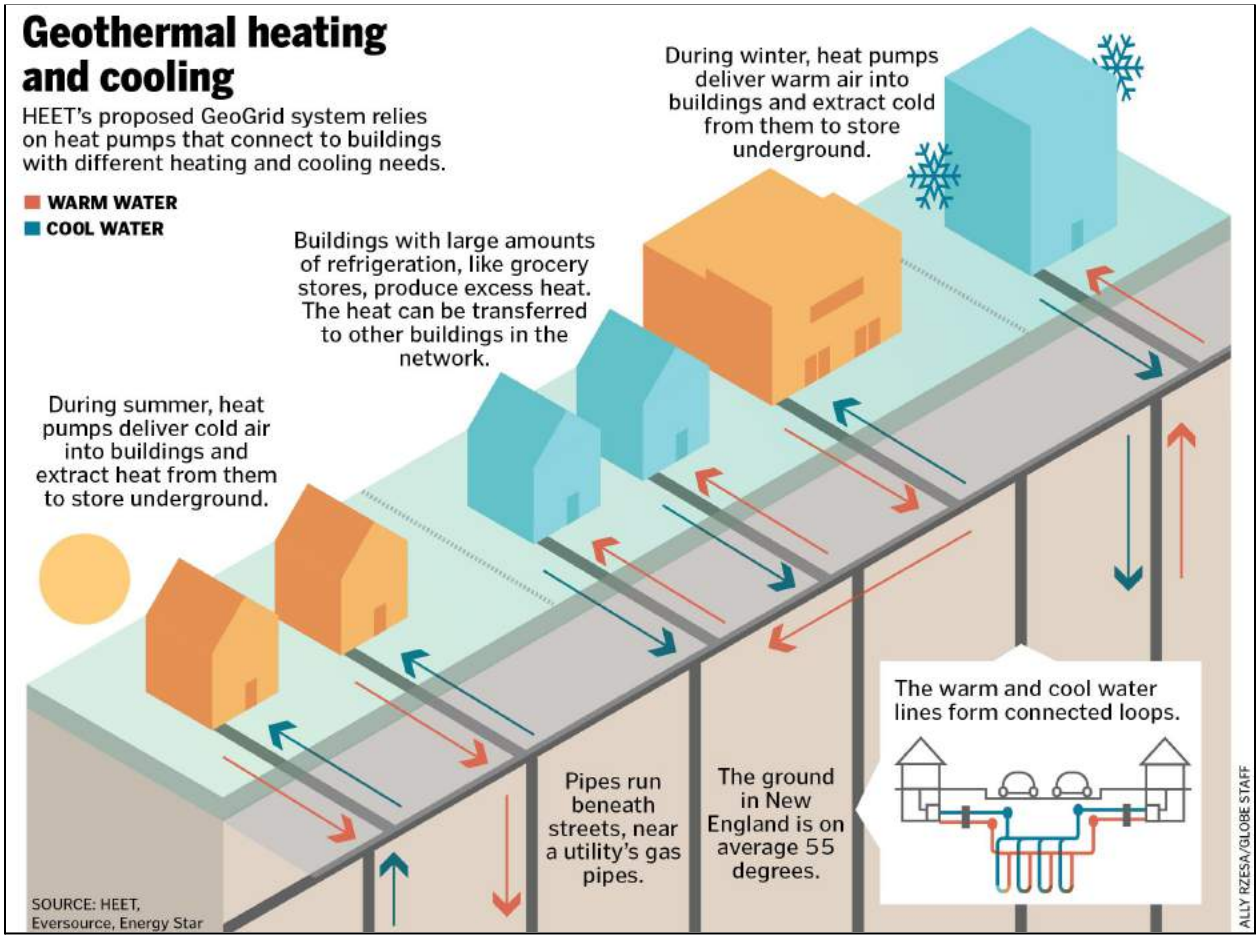


Image from the Boston Globe

Introduction

We greatly appreciate the Department of Public Utilities ("Department") opening this D.P.U 20-80 investigation into the role of gas local distribution companies as the Commonwealth achieves its target 2050 climate goals.

HEET (Home Energy Efficiency Team, inc) is a Massachusetts 501(c)3 nonprofit climate solutions incubator. HEET is the inventor of the gas-to-Geo-Grid pathway, the idea that gas utilities can transition to ambient networked ground source heat pumps installed in the right of way of the street. HEET's Geo Grid is referred to in the E3 "Independent Consultant Report - Decarbonization Pathways" (referred to from here on as the E3 Report) as Networked Geothermal, therefore we will refer to it as such from here on.

HEET works with all stakeholders to innovate and iterate, creating solutions that all can say yes to. HEET is funded by foundations, donors and government funding. We do not take funding from industry, including gas utilities or heat pump manufacturers.

This letter proposes regulatory changes that could allow an equitable and safe transition to meet the state's net zero emissions mandate by 2050. The changes should also meet the Department's other mandates of reliability, affordability and security, and preferably allow the gas utilities to maintain their business.

We are grateful for the opportunity to provide these comments and to provide an Alternative Regulatory Proposal to those provided in the E3 Report and LDC filings. This is a moment of inflection, where we must change our energy infrastructure and systems to meet the Commonwealth's net zero emission mandate. How well we manage this change will impact our Commonwealth's future in terms of economics, safety, equity and climate. We believe the answers are in front of us that will lead us to a better future for all.

Executive Summary

On June 4, 2020, the Attorney General ("AG") petitioned the Department of Public Utilities (the "Department") to open an investigation "to assess the future of local gas distribution company ("LDC") operations and planning in light of the Commonwealth's legally binding statewide limit of net-zero greenhouse gas ("GHG") emissions by 2050"[1] or what has become known as the future of gas. The AG notes compliance will require "the LDCs to make significant changes to their planning processes and business model. It will also require the

[1] D.P.U. 20-80, Petition of the Attorney General at 1 (2020).

Department to develop new policies and structures to protect ratepayers and ensure a safe, reliable, and fair transition away from reliance on natural gas and other fossil fuels."[2]

After receipt of a slew of public comments in support of such an investigation, on October 29, 2020 the Department opened its investigation "to develop a regulatory and policy roadmap to guide the evolution of the gas distribution industry, while providing ratepayer protection and helping the Commonwealth achieve its goal of net-zero GHG emissions energy."[3] The Department then ordered the issuance of a joint RFP by the LDCs to conduct an independent consultant[4] to prepare a report to analyze the Commonwealth's 2050 Roadmaps, additional pathways, and otherwise review each LDC's impact. The LDCs were also instructed to file the consultant's report and with their individual plans to help achieve the Commonwealth's 2050 emissions mandate by March 1, 2022.[5]

On March 18, 2022,[6] the LDCs filed these items with the Department and a notice and order for public comments was subsequently issued. In addition the hearing officer on this docket issued a memorandum on April 15, 2022 specifically requesting the submission of alternative proposals, particularly regulatory frameworks, as part of the public comment process.

When the Department opened this investigation to explore the "future of gas" under the mandates of the Global Warming Solutions Act ("GWSA") to achieve net zero by 2050, HEET and many other stakeholders looked forward to helping the Department and the LDCs meet this moment to draft a plan to meet these vital emission reduction mandates. As the Intergovernmental Panel on Climate Change (IPCC Fifth Assessment Report) clearly states, the science is indicating that the data is trending closer to the worst case scenario. The moment is now. We must have a transformative change in our energy usage. Period.

The E3 report as filed utilizes a limited approach that results in LDC plans insufficiently expansive to achieve the GWSA mandates: the boundaries or parameters of E3's study (detailed below) fail to fully grasp the scope in both time and space of the emissions problems as well as its solutions. Therefore, E3's resulting recommendations are unacceptably narrow and limited and may in all likelihood exacerbate many of the existing inequities in the energy system.

In addition to the flawed recommendations resulting from E3's limited approach, the report fails to account for current scientifically accepted accounting, and there is a need for further sensitivity analysis to appropriately account for the system's current emissions and how reductions are measured. Detailed below, we explain why the numbers currently used by Massachusetts and utilized in E3's report on impact of methane are not accurate. Massachusetts currently uses a Global Warming Potential (GWP) for methane of 25 times that of carbon dioxide (CO_2) over a time horizon of 100 years in order to match the actual atmospheric time horizon of

[2] *Id.* at 2.
[3] D.P.U. 20-80, Vote and Order at 4 (2020).
[4] The LDCs ultimately selected E3 as the independent consultant.
[5] D.P.U. 20-80 Vote and Order at 4-6.
[6] The Department granted an extension of time to the original March 1, 2022 deadline to the LDCs.

CO_2. The recent Intergovernmental Panel on Climate Change (IPCC) report on current scientific knowledge has shown methane's impact over 100 years is actually 28 to 36 times that of C and more significantly, the vast majority of methane's (CH_4) impact is within the first 20 years. New York State has already updated its methane accounting to the scientifically correct IPCC GWP for the 20-year timespan. There is legislative language in consideration in Massachusetts to do the same here. To develop the right long term plan we need broad consensus on the scope of the problem and the value of the proposed solutions, and this requires correct GHG accounting immediately and consistently as we proceed. Consideration of the impact of a change to the scientifically correct methane accounting is essential to ensuring E3's excellent work is not at risk of loss of relevancy.

Change is hard, but change is what is needed - it is not a burden but an opportunity. As Shalanda Baker said, "I think we have to be creative. We're so locked into these old models where, you know, there's always going to be someone on the short end of this. But I think energy, the energy transition, lends itself to the possibility of justice — because you can put solar on rooftops, because people can come together to own a project that will power their community. It's not inevitable that this will be unjust. We can change it. I think this is a remarkable opportunity to really take back the energy system in service of those who've been on the bottom."[7]

In critiquing E3's approach, we do so not just to simply point out the confines of the analysis, but to lay the foundation for an alternative proposal that will better serve the goals of both the report and the GWSA mandate. At the core of HEET's critique is that the E3 recommendations reflect a thinking of how the gas companies have traditionally operated and now need to pivot to meet the GWSA mandate. That is simply not enough. Innovation is not desirable, it is essential. As a long time stakeholder in gas leak issues, we are well aware of the safety concerns in the older lines of the infrastructure, and the LDC concerns that radical change will mean safety risk. But, the companies can innovate and design more boldly, safely, reliably, and cost effectively.

In these comments, we suggest the Hybrid Electrification approach fails to adequately or effectively transform the gas system. This is for a number of reasons, but in large part because the approach remains individual user or customer centric. By thinking of the gas system at a larger community level, it can be appropriately pruned back in the short term as part of the transition and in a safe, cost effective way to right size it for longer-term thermal delivery to customers. In approaching this change it is imperative that the LDCs and the Department not see this as a race to 2050, but that we are building an energy system for generations to come, for which net zero by 2050 is the first major milestone. There are going to be costs, no matter the technology or approach. We need to allow for broad experimentation in the short term on how to deliver thermal energy from non-emitting resources or in some hybrid capacity, to avoid opportunity costs of picking a path that has higher costs for less results (or possibly no results).

[7] Shalanda Baker, WBUR interview, Jan 20, 2021. https://www.wbur.org/news/2021/01/20/its-not-inevitable-that-this-will-be-unjust-a-qa-with-shalanda-baker-on-energy-justice

And a short term plan can help ensure that the transition is done in a deliberate way and centering both effectiveness and equity.

To this end, HEET proposes a near term period of innovation from 2022-2030 to pilot and report on various technologies and approaches to help transform gas distribution companies into thermal delivery companies. In so doing, we recognize the enormity of the task at hand with respect to the regulatory framework. There are a multitude of statutory and regulatory provisions by which the LDCs currently operate that conflict with the necessary steps to enable effective transition. Given the enormous potential for unintended consequences when great changes are made, as well as the short timeframe allotted to submit comments, we understand fully that a more thorough regulatory vetting will be necessary. We therefore propose authorizing a working group to robustly consider these foundational issues. HEET offers its services to the Department to facilitate such a working group[8] where sessions would include experts and stakeholders from all viewpoints to address technical questions and impacts such as cost, safety, equity, etc. Several of the proposed E3 pathways use thermal delivery methods –such as hydrogen, renewable natural gas, syngas and networked geothermal– that are not widely known or understood. It is critical for regulators and stakeholders to understand all methods well so all can think through the potential impacts.

We believe there are some core pieces of any discussion of an alternative regulatory framework: (1) the LDCs must become thermal management companies not gas companies; (2) we must in the short term trial many technologies to inform long term planning; (3) we must assess the existing infrastructure for where GSEP investment can be safely avoided or deferred; (4) we must ensure the costs of the system and the transition are done so in a just and equitable way.

As part of this innovation period, it is essential for the Department to begin to conceive of a transition from local gas distribution companies to local thermal delivery companies. The LDCs should install, own, and maintain non-emitting thermal infrastructure. One of the biggest concerns raised looking at this transition through an equity lens is that those less able to afford a switch individually to a non-emitting thermal source will bear greater burdens of the cost of the system as the transition progresses. This concern comes up against the desire for a speedy transition. Customers are currently incentivized through the Commonwealth's Three Year Plans[9] to transition to non-emitting heat pumps, but it is not enough, and the process must be carefully managed to ensure that, as Prof. Baker points out, we do not continue to burden those that have traditionally been on the bottom. Similarly, we must center workforce development and the needs of workers as any pathway is further developed.

[8] HEET is well positioned to help launch such a working group. As a thought leader recognized by all stakeholders for facilitation of discussions of these hard questions, HEET can develop, with the Department, a highly participatory working group allowing full consideration and collaborative iteration of the possible pathways before us. We have seen positive outcomes from a series of "charrettes" (participatory, problem-solving workshops) on networked geothermal, where diverse stakeholders were able to probe the hard questions and spin out ideas into solutions or take them off the table.

[9] D.P.U. 21-120-D.P.U. 21-129, Order at 113 (2022).

In order to meet this challenge of a just transition, the Department needs to see across all the policy levers that are enabling non-emitting thermal delivery and ensure that the costs are transparent and appropriately accounted for and shared equitably. One possible option is to have all customers, both those on the existing gas infrastructure and those that transition to non-emitting resources all contribute to the costs of both systems. This will require some radical re-thinking of cost allocation but to do anything else would ensure that those at the bottom in Prof. Baker's words continue to hold the rest of us up. This too requires probing study and investigation before implementation should be attempted.

In addition to changing the mindset of the LDCs from buying, selling and delivering gas to that of a thermal delivery and management, it is necessary to create immediate opportunities for the deployment of various technologies in service of such a mission. Data can be shared and reviewed to avoid the opportunity costs of spending too much time on strategies that are less effective. Instead we need to focus on the ones with more potential. In order to effectively undertake this review, it is also imperative to right size the gas system for the future demand and rate base, and to avoid the risk of stranded assets by reducing GSEP as much as safety permits. This can be accomplished in part through the transition of targeted areas to non-emitting thermal infrastructure, or a thermal network, which is a community-scale hybrid approach that avoids long term commitment to any one thermal source. Part of the conversations we have with LDCs and environmental stakeholders alike is that our conception of the GeoGrid is more than creating networked geothermal. This thermal network proposal separates the delivery infrastructure from the thermal source, allowing a flexibility that is needed now. As detailed below, the transition for a given street segment could be to connect GSHPs in customer buildings to an ambient loop of water without no boreholes attached, instead alternate renewable thermal sources will keep the water with temperature desired. This approach captures the benefits of the Hybrid Electrification Path without locking in gas infrastructure or any one choice of source energy for the future.

In the bulk of our comments, we have tried to provide the Department with a detailed walk through of our view of the E3 report, showing why its approach does not meet this moment in terms not just of the 2050 mandate, but the necessary wholesale reimagining of our energy delivery system. We appreciate the opportunity to provide our perspectives on the E3 proposal as as well present alternative pathways both in our thinking and visioning as well as the actions of LDCs and their customers to achieve the ultimate purpose of the GWSA mandate, to create any energy system that improves air quality, health, energy independence, and security, as well as good jobs for generations to come.

Threaded through the many details is an overarching theme that we need to stop and recognize the monumental scope of the task at hand. Radical reformation of our statutes and regulations relative to the current purpose of the LDCs needs is absolutely required for any successful transition path. We need to conceive a solution that centers the community, not just the customer. While the Department should continue to support customer driven options to transition off fossil based fuels within the existing frameworks, this docket is a unique

opportunity to go beyond such a piecemeal approach to overlay a more equitable and efficient transition.

As perhaps is evident, HEET raises many ideas and questions we would love to discuss further, iterate and improve, and we are happy to further and more deeply partner with the Department in its continued review and engagement with stakeholders.

Framing Thoughts and Comments

We acknowledge the Department's instructions to utilize the pathways, assumptions, and results developed and will do so in our alternative regulatory proposal. To, in part, explain the reasoning behind some of the regulatory suggestions we present, we include this preamble outlining the specific limitations of the report we sought to address.

Boundary Limitations

Any modeling study of this kind must define the boundaries of the study, including time, space, and components analyzed. Such boundary choices naturally impact the outcomes and can, if not well-matched to the question, handicap the ability to provide an answer. Boundary choices can interfere with our ability to select the wisest paths for the long term and for all.

- **Time Boundaries:** The E3 report, as instructed, only considered the decarbonization of gas to meet emissions mandates up until 2050. Yet this is an industry that has multi-decade planning cycles and infrastructure investments that span generations. Cutting the analysis off at 2050 reduces our ability to understand long-term financial impacts, generational equity, and understand what will be the lowest cost lowest emissions energy system to meet the needs of the next century. This creates risks of lock-in and short term gain for long term pain as we aim for a 2050 emissions target rather than for the best energy system for the coming centuries.

- **Geographic Boundaries:** Our Commonwealth's impact does not stop at the border even if the E3 report did (and in our opinion should) constrain itself to Massachusetts. Every therm of our natural gas is mined outside of the Commonwealth, impacting the people, land and water there. Our emissions and their impacts also affect regions outside of our Commonwealth. E3s report does not consistently account for or acknowledge this interdependency and the inherent risks it presents.

- **Pathway Boundaries:** Creating inconsistencies, or unnecessary boundaries, between pathway scenarios interferes with the apples to apples comparison and our ability to normalize the outcomes and choose wisely. For example, the exclusion of energy

efficiency costs from the Hybrid Electrification Pathway creates an inconsistency of cost accounting and logic between the choices considered. Networked heat pumps can, for example, meet thermal demand in the absence of energy efficiency as well, but the Networked Geothermal pathway included these energy efficiency costs. The networked geothermal pathway could also include oil customer conversions and their emissions savings in a comparable way to the Hybrid Electrification scenario, yet this choice too was not normalized, creating boundaries between which pathways can legitimately be compared.

- **Measurement Boundaries:** Which measurements and components are included and excluded from consideration naturally influence the outcomes. For example, the annual total natural gas system's fugitive methane emissions as directly measured by Sargent et al[10] are six times higher than the state's reported natural gas system emissions. This key discrepancy occurs because we chose to estimate our gas system emissions based on miles of leak prone mains and services. This excludes emissions from other components of the gas system in MA and it excludes any behind the meter leakage. While behind the meter leakage is not legally the responsibility of our LDCs, this leakage is still natural gas associated emissions which can be increased or decreased by policy choices. Yet they are not included in our state's accounting and therefore not in the report. Whether measured and accounted for or not, those molecules of methane are real and warming our atmosphere. A further example is commented on by the consultants on page 52 of the technical report where they observe the questionable measurement boundary for renewable fuels.

- **Energy Boundaries:** Perhaps most relevant to this report, there is a curious convention in our distinctions between physical forms of energy. You may have learned them in physics class as 'kinetic, chemical, nuclear, electric, thermal, radiant, etc..' Wind energy is kinetic energy which we transform through a piece of technology (a wind turbine) into electric energy and we then transport that electric energy. Solar energy is radiant energy which we transform through a piece of technology into either electric (solar PV panels) or thermal energy (solar thermal tubes). Methane gas is chemical energy which we transform through a piece of technology (a boiler that combusts the gas) into thermal energy and then transport that throughout or between our buildings.

  As we reimagine our energy system we must clearly define and name what energy we are talking about and what we are doing with it. When we widely refer to 'electrification' as the deployment of heat pumps, we are erasing the thermal energy component of this renewable non-emitting technology. A heat pump is a piece of technology which captures and moves thermal energy, which we then distribute without or between buildings. It uses electric energy in the same way that a condensing boiler heating a home uses electricity for ignition, controls and pumping. Yet we call the heat pump electrification, and not the

[10]Majority of US urban natural gas emissions unaccounted for in inventories; Sargent et al, Proceedings of the National Academy of Sciences; October 25, 2021 | 118 (44) e2105804118 | https://doi.org/10.1073/pnas.2105804118

boiler. This strange convention in our energy policy world has great risks. What we do not see and name can disrupt our outcomes and our understanding. Nowhere in the E3 report is the contribution of non-emitting renewable thermal energy named, nor shown in the graphics. An excellent example is on page 85 of the E3 Report, which could have in it 'air thermal', 'ground thermal', and 'waste thermal' or even just 'thermal' in order to illustrate the energy provision of any form of heat pump or thermal capture.

The consultants raise a boundary limitation example in the technical analysis on pages 33 and 34 under the title 'weather year'. What they do not observe is the warming trend over those 40 years caused by our changing climate.

As an additional example of the intersections between energy systems that the 'Energy Boundaries' Limitation raises, we appreciate the consultants raising the challenge of the electric grid peak shifting from summer to winter, as well as the ability of the Hybrid Electrification model to mitigate this challenge. Yet networked heat pumps, such as those in the Networked Geothermal pathway, are a non-emitting solution that can meet the same challenge. This is clearly stated in the E3 Report, "Networked geothermal systems have the potential to provide renewable decarbonized heat without causing large electric peak demands in winter."[11] The reduction in winter peaks is also well illustrated by the Falcon Curve[12] in Figures 1 and 2 below. The impact of customer thermal energy technologies on the electric grid depends on their efficiency. This Falcon Curve, far scarier than the duck curve, is the direct result of shifting from chemical energy such as methane gas and heating oil (which we store annually to meet winter peaks) to thermal energy production or storage technologies. Some technologies do not provide annual energy storage, such as electric baseboard or air source heat pumps (ASHPs), and some can, such as GSHP and networked GSHPs. A high electric grid winter peak increases the difficulty and cost of the electric grid sourcing enough energy from renewables to meet its emission targets. These costs could reduce affordability.

[11] Independent Consultant's report - Decarbonization Pathways, E3, pg 18

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

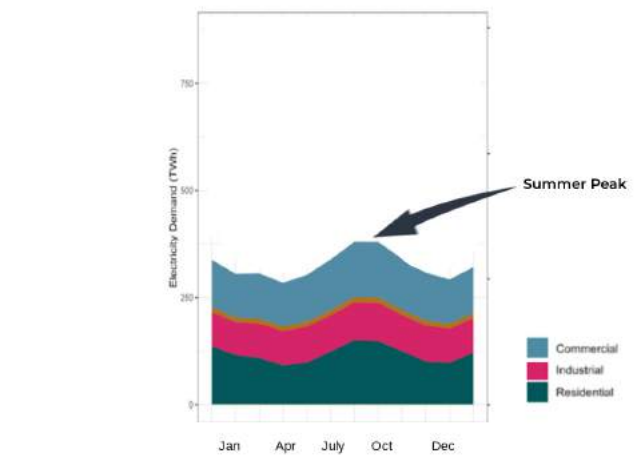


Figure 1 - Current annual US electric grid peaks

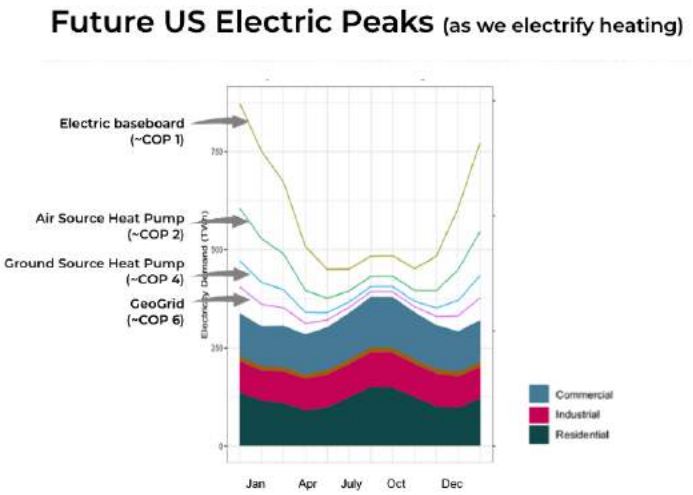


Figure 2 - Future estimated US electric grid peaks shown depending on method of building electrification. Please note these peaks do not account for ASHP efficiency changes at different air temperatures. The peaks for air source heat pumps are likely to be higher. Both figures adjusted from Buonocore, J., Salimifard, P., Magavi, Z., Allen, J., "The Falcon Curve: Implications of Seasonal Building Energy Use and Seasonal Energy Storage for Healthy Decarbonization" DOI: 10.21203/rs.3.rs-1054606/v1

Risk Assessment Limitations

While the E3 report acknowledged several risks and the inherent uncertainty within which we must make decisions, the scope of the report did not include an analysis of such risks or the clear

identification of asymmetric risks. This is a serious limitation, particularly when, given the potential worst effects of climate change, an error in one direction carries consequences that far outweigh an error in the other direction. In other words, failing to address emissions sufficiently is catastrophic, while exceeding emissions goals and therefore spending more money is not catastrophic. Therefore we comment below on the most relevant risk assessment limitations.

- **Inherent Emissions Target Risks:** Our climate mandates issued in the Global Warming Solutions Act (GWSA) and An Act Creating a Next Generation Roadmap legislation are intended to avoid the worst risks of climate catastrophe for our Commonwealth and to do our best to participate in the global effort, through the Paris Accord, to avoid a tragedy of the commons for our climate. It bears stating that these targets were decisions made in uncertainty and within the context of political feasibility. As the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report clearly states, the science indicates that the data is trending closer to the worst-case scenario. The loss of life, property, and civil society, in addition to ecosystem destruction, is an outsized risk in comparison to the risk of economic costs and disruption through cutting slightly more greenhouse gas than expected. A rational choice is to bias decisions toward caution in the face of such an extreme asymmetric risk.

- **GHG Accounting Update Risks:** Consideration of the impact of a change to the scientifically correct methane accounting is essential to ensuring E3's excellent work is not at risk of loss of relevancy as well as ensuring emissions reductions achieved are real. Natural gas is over 90% methane, which is a potent and fast acting greenhouse gas when leaked unburned. Massachusetts currently uses a Global Warming Potential (GWP) for methane of 25 times that of carbon dioxide (CO_2) over a time horizon of 100 years in order to match the actual atmospheric time horizon of CO_2. The recent Intergovernmental Panel on Climate Change (IPCC) report on current scientific knowledge has shown methane's impact over 100 years is actually 28 to 36 times that of CO_2.

  Secondly, the vast majority of methane's (CH_4) impact is within the first 20 years.[13] Therefore, using the 100-year time frame makes methane appear to have dramatically less impact than is actually the case. The 100-year time frame obscures the impact of our natural gas system, as well as the potential of methane reductions to rapidly enable us to meet our emissions mandates.

  Additionally, this measurement error is likely to change soon. Our federal and our state governments are, according to their signing of the Paris Accord, expected to update accounting to the IPCC Fifth Assessment Report's GWPs by 2024. New York State has already updated its methane accounting to the scientifically correct IPCC GWP for the 20-year timespan. There is legislative language in consideration in Massachusetts to do the same here. This high risk of a greenhouse gas (GHG) accounting update in this decade will change the results of the E3 report.

[13] "For CH4, which has a short lifetime, the 100-year GWP of 28–36 is much less than the 20-year GWP of 84–87." https://www.epa.gov/ghgemissions/understanding-global-warming-potentials

- **Incomplete Information Risk -** This is an always present risk which is somewhat reduced through broad engagement with diverse voices and expertise. It is particularly present in situations of innovation or novelty and is best addressed by, when possible, stating the unknown. A clear example of this risk is present in E3's 'Networked Geothermal Pathway' which was reasonably based on the performance and cost data provided by the Buro Happold Study of the technical and economic feasibility of this technology for Massachusetts. This study, however, was of individual street-segment-scale installations, not of the 'Geo Grid' or larger thermal network which would result from interconnecting these initial installations. This means that the efficiency gains that come from high load diversity could only occur within each street segment, rather than throughout a larger interconnected system. The full benefit of thermal opportunities, or larger sources and sinks such as data centers or supermarkets, was thus not captured in E3's report. This not yet quantified benefit is an example of incomplete information that adds risk to decision making. HEET is seeking to help address this by working together with Excel Energy, Grey Edge Group and Colorado Mesa University to quantify the impact of their incremental expansion over 15 years of a system very much like the Geo Grid or Networked Geothermal technology. Initial findings show an increase in efficiency through interconnection such that the linear feet of boreholes per ton is decreased by more than half in comparison to single building installations of ground source heat pumps (GSHPs). This far exceeds the cautious and street-segment-constrained calculations in the Buro Happold study and demonstrates the risks inherent in incomplete information, particularly in the case of novel or innovative solutions.

Various intersections of boundary and risk assessment limitations can also have important consequences. For example, should our Commonwealth respond to the 'Inherent Emissions Target Risks' by requiring further emissions reductions, in case one of the other sectors such as transportation does not reach its emissions targets? In case an emissions target was missed,our 'Time Boundary Limitation' would suddenly matter more since some of the pathways modeled (Networked Geothermal and 100% Decommissioning) would continue, without additional gas infrastructure investment, to reduce emissions as the electric grid sources more of its energy from renewables. Other pathways (for instance, the Efficient Gas Equipment, Low Electrification and Hybrid Electrification pathways) would require major investment to reduce emissions beyond a certain point, since they might necessitate moving to green hydrogen which requires replacement of all appliances.

In order to ensure as many degrees of freedom as possible and the greatest chance of success in the face of uncertainty, the HEET regulatory framework proposal specifically requires consideration of impacts to 2100 and prioritizes pathways which have the potential to achieve physically real zero emissions.

Alternative Regulatory Proposals

Aiming High

These proposals are based on 'The Role of Gas Distribution Companies in Achieving the Commonwealth's Climate Goals' technical and regulatory reports and we choose to address the limitations and risks and consequences discussed in the above section 'framing thoughts and comments' by aiming higher. Specifically, we are aiming for the evolution of our current natural gas system into an energy system that meets the existing 2050 goals, while also having the potential to deliver zero emissions, and to provide safe, affordable, reliable energy to 2100 and beyond, equitably. We are aware of the once in many generations opportunity in front of us - to reimagine and rebuild the energy system we need for a better future. We wish to live in a world where humanity continues to advance - each generation better off than the last - a society where anticipation outweighs nostalgia.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Energy system modeling considers the impacts of decision to 2100*
- *Energy system modeling includes sensitivity analyses for emissions accounting changes*

Decision making in Uncertainty

We do not have all the information we need to know exactly how to achieve these goals. Yet, given the short time period between now and 2050 and the scale of the current GSEP expenditures each year, we must act quickly without certainty. We propose the following principles to guide this:

1. Close no door to zero emissions
2. Never decrease safety
3. Never decrease equity

Forced to make decisions with imperfect information, we must play a game of statistics, weighing the probability of outcomes and the scale of risks. We can increase our likelihood of betting well by increasing and improving our information. The first way to achieve this is rapid piloting and experimentation with consistent evaluation and transparency, just as proposed by the consultants. We firmly support this tactic and want to specifically add fully transparent sharing of all data and key learnings (naturally minus customer personal data) to ensure maximum benefit and learning. Additionally, we can increase the integrity of our information by creating collaborative frameworks for engagement across stakeholders with a diversity of views and expertise. Hence we propose the Department convene working groups as needed.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Transparent sharing of data and key learnings*

- *Department participates in and hosts diverse working groups*

Finally, we want to acknowledge that the existing legislative and regulatory framework is a catch-22. Currently gas utilities are not allowed to sell anything but gas, a business with an uncertain future given the state's emissions mandate and this 20-80 docket. Meanwhile gas utilities are mandated to replace leakprone gas infrastructure with new gas infrastructure (i.e. GSEP). These investments normally take more than 50 years to pay off through customer bills. This catch-22 of only being allowed to sell and invest in an energy system that might not be allowed long term, forces a very risky infrastructure investment that is not in the interest of either gas utilities or their customers who ultimately pay for the investment.

Regulatory Innovation Phase

We can also increase our odds of success by staying in an innovation framework, with boundaries relaxed, pilots and pivots welcomed, and pathway doors held open. Such a framework is radically different from the regulatory framework that is needed in the maintenance of safety, reliability, and affordability in an existing utility model. In this Regulatory Innovation Phase, the model itself is in question and 'failure' is expected, tolerated, and constrained in scale with each 'failure' a key learning allowing us to prune possible pathways through a process of elimination. Always with consistent metrics for safety, reliability, affordability, security, emissions, and equity impacts.

To first create the environment within which we can innovate, iterate, and learn how best to move forward with lower risk, we suggest a regulatory innovation phase from 2022 to 2030 with annual reassessment. During this time period, the gas utilities are permitted to pilot an array of technologies and pathways as suggested by the gas utility consultant reports. Which means they are essentially piloting their own evolution into a thermal distribution company. Hence the need to have an umbrella over this entire innovation process with a defined timespan and processes and goals and metrics. This work is hard and mistakes will be made, thus naming it an innovation phase provides some psychological safety for all involved.

Finally, our gas companies are investor-owned corporations with fiduciary responsibility to their shareholders. This obligation is not aligned with the outsized reliance or dependence our society and individuals have on the continued provision of service, hence the presence of regulatory bodies such as the Department. In the standard business world, Schumpeter described innovation in the face of change as driving waves of creative destruction. We are facing that scale of change in the provision of thermal service, yet the social, safety, and economic cost of classic creative destruction cannot be borne. It is in the hands of the administration and legislation to steer us clear of such collapse and to manage what we propose is instead 'Creative Evolution.' A regulatory innovation phase makes clear space for this market to evolve and solve the challenges it faces without massive disruption to the public service provided.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Define a Special 'Regulatory Innovation Phase' from 2023 to 2030*

This innovation must not take place independent of the energy transition unfolding in other sectors. Utility and state planning and incentives are at cross purposes currently. For instance the local gas utility is replacing gas infrastructure to reduce leaks and allow for green hydrogen, while the Commonwealth is planning over the next eight years to move a million households to electricity for heating. If you assume half of those households are current gas customers, then it would be equivalent to roughly a third of the current gas rate base in the state that would be removed from that rate base. The remaining two thirds would be left carrying a higher proportion of the supply costs, causing problems with affordability and equity. Meanwhile, transitioning that many customers from gas to electricity will impact the electric grid (the attached ISO-NE forecast shows current and predicted rates of heat pump installations, as well as potential impacts on the New England electric grid). Trade offs must be assessed in terms of cost and emissions and equity in order to allow us to move forward with speed, reducing costs for all. To ensure integrated infrastructure planning we suggest an advisory council for the duration of the regulatory innovation phase, that connects representatives of each key decision making body in the Commonwealth's energy transition to ensure coordination.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Create an advisory council for the thermal transition*

Piloting the Evolution from Gas to Thermal Utility

It is HEET's experience that customers want their homes safely and affordably warm despite the majority never understanding the fuel or technology that makes that possible. Ask a gas customer if they are burning methane, propane or butane gas and you will often receive a blank stare in return. Ask them if their heating bill was high this winter or if their house was warm enough and they will have much more to say. What we repeatedly hear from the public is that they need safe, affordable, reliably warm homes and would like to get that without emissions, without equity or job loss or security risks - and without having to think about it. They don't need gas, they need heat.

As the clearest purpose of our existing gas companies is the provision of heat, or thermal energy, we strongly suggest a clear acknowledgement of this core purpose as we seek to fundamentally change the technology, business model, and regulatory model of these utilities to meet our emissions mandates while balancing safety, reliability, affordability, security, and equity. Although they are referred to as 'gas companies' and permitted by statute to sell gas, it would not be logically permissible for them to deliver or sell air, even though air is also a gas. An electric utility delivers electric energy. A utility with a purpose to deliver thermal energy, should be called a thermal utility. By correcting this historic inconsistency in language, we not only improve technical accuracy, we also define these utilities by their core purpose, rather than by the current technology used.

We will still need thermal energy past 2050 and gas companies have the expertise, financing and right of way in the street to meet those needs in an equitable way if allowed to. A thermal company can by name and definition include all the provision of thermal service contained within the consultants pathways. This definitional expansion and permissioning improves alignment between company goals and public need. The resulting inclusion of all customers whose needs are met by the thermal company into one rate base, regardless of technology used, allows stabilization of the rate base through this innovation phase while we determine the best path forward.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Define gas companies as thermal companies*
- *Allow gas utilities to move, distribute and sell thermal energy*
- *All ratepayers provided thermal service are one thermal rate base*
- *Obligation to serve can be met through provision of thermal energy*

Funding & Cost Containment in the Innovation Phase

Innovation and its requisite tolerance of error requires additional funding and staffing beyond approved used and useful capital investments on the rate base. Solving this climate challenge would be beneficial, not just to Massachusetts, but to our whole country. The DOE's loan program office (LPO) has $44 Billion to invest in higher risk technologies at a 2 to 4% interest rate to multisolve climate and energy. HEET has discussed with the LPO the potential to direct funds to scale networked geothermal. Perhaps, defining Massachusetts as a Thermal Transition Innovation Hub could bring in funding to direct to technical and regulatory innovation.

Even with additional external funding, an effort to maximize impact and minimize sunk costs in the innovation phase means that some investment in the current gas infrastructure should be paused or redirected. Wherever existing gas infrastructure investments can safely be delayed, they should be allowed to be delayed while our thermal utilities pilot different infrastructures.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Delay of gas system investments, where safe, to avoid infrastructure lock-in before pathway selection*

The GSEP program, in the context of thermal utility innovation and avoidance of 'lock-in', is challenging in that it requires a balancing of safety considerations with considerations of economic risk and infrastructure lock-in. Yet, investments delayed can protect against stranded assets and allow for more investment for the pathway chosen.

Over the next 20 years, an analysis based on E3's report calculated the total GSEP expenditures will be $40 billion.[14] Do we really want to bet all of that money that alternate gasses will work in the long-term in a widespread way? That is $23,000 per gas customer, assuming the customer base stays the same size over the entire time period of the amortization (highly unlikely). If the gas customer base shrinks considerably, each remaining gas customer will be responsible for much more than $23,000 of the GSEP expenditures. This $40 billion is not counting any additional gas infrastructure investments because of gas constraints, new services, etc.

E3's report shows that gas customers and revenue will decline precipitously in all pathways. The best way to safeguard the economic stability of the gas utilities and reduce the impact on their customers and workers is to rightsize the gas system to allow its revenues and fixed costs to meet demand in the future.

Therefore, we propose that the Distribution Integrity Management Program (DIMP) rating be used to categorize leak-prone pipe that can safely wait 5 or 10 years until replacement. Given that there are at least 17 years of pipe replacement ahead of us, it's likely that at least two thirds or more of the pipe can wait a few years. As an example, surveying the Pipeline Hazardous Materials and Safety Administration (PHMSA) data for the last 20 years in New England, we could find no case of catastrophic failure from natural forces for any material except cast iron, and of no diameter bigger than 12 inches. Potentially larger diameter cast iron and pipes of other material can be safely delayed during the innovation period, especially if there is an increase in gas leak repairs and winter safety patrols.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *GSEP sorted by DIMP safety rating so the maximum possible pipe replacements can be safely delayed*
- *Delayed pipe replacement triggers increased gas leak repairs and winter patrols*

Given the 50 year or longer depreciation schedule of any gas assets installed now, and the fast changing situation and need for investor confidence, targeted transition to non-emitting thermal technologies might be wise. The technologies can help rightsize the gas system to meet future demand and rate base, while diversifying the thermal utilities business model and reducing risk to it and its customers. The non-emitting thermal technologies include networked geothermal and individual-building installations of air source heat pumps (ASHPs) and GSHPs. Where appropriate to fund the piloting, demonstration, and experimentation of this innovation phase, GSEP and other gas infrastructure investments (including investments because of gas constraints, new services, etc.) can be directed to the replacement of leakprone pipe with these non-emitting thermal technologies. These technologies could be amortized, as gas infrastructure is, over their used and useful life. Allowing this redirection of gas infrastructure expenditures allows the thermal utilities to cherry pick the best opportunities to experiment and learn from, while reducing the risk of stranded assets.

[14] Dorie Seavey, London School of Economics, Commonwealth Magazine op-ed, April 26, 2022, https://commonwealthmagazine.org/opinion/spending-billions-fixing-gas-system-makes-no-sense/

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *GSEP expenditures can be redirected to non-emitting technologies*
- *Non-emitting technologies can be amortized for their used and useful lifetime*

The Commonwealth is currently behind on its electrification goal of 1 million homes electrified by 2030. The tactical transition of street segments from gas to heat pumps of different types can help the state meet its goal. The E3 analysis found that 210,000 customers can be switched to networked geothermal by 2030 and over 858,000 by 2050.[15] Another persuasive point is that the E3 report shows that the Targeted Electrification pathway had the lowest embedded systems costs by 2050 of all eight pathways and resulted in one of the lowest annual revenue requirements per customer.[16]

It is also of note that some streets cost a lot more than others. For instance, the range of costs of gas infrastructure in Boston Gas's 2021 GSEP plans is greater than an order of magnitude, ranging from $199 to $2,483 per linear foot.[17] It is possible that the range for cost per customer is just as wide. The streets with the highest cost per customer are those that are perhaps the most risky for the gas utilities and ratepayers. Selectively transitioning higher-cost GSEP streets to non-emitting thermal can help meet emissions mandates long term. One potential way to do this would be to select streets where the total cost of the gas infrastructure investment, as well as the total cost of the needed electric grid investment and the likely cost of fuel, over the next 50 years will be higher than the cost to transition that street to the current average MassCEC cost of individual building installs of ground source or air source heat pumps.

Targeting high-costs streets & neighborhoods on non-critical gas infrastructure (such as distal ends and parallel streets) for transition during this innovation phase can help rightsize the gas infrastructure to meet the declining rate base, reducing gas utility risk while helping it develop an alternate business model. Additionally if these street segments are transitioned to air source or ground source heat pumps or to the networked ground source heat pumps, they will help meet the state's emission mandates.

Even as GSEP funds can assist in funding pilots of several non-emitting pathways, there are other funds on the table that need regulatory permission to access. The avoidance or reduction of electric peaks can be compensated by the electric grid, reducing electric rates for customers demonstrating pathways that can provide this service and reflecting a true benefit of several of the proposed pathways. For example, NYSERDA calculates the value and cost shift opportunities by gas utility including the societal value of reducing emissions, electric peak load and the inverse cost shift of heat pump customers paying for more than their "fair share of fixed

[15] See DPU 20-80, Information Request 2-9, lines 16 and 17.
[16] Independent Consultant Report - Decarbonization Pathways, E3, March 2022, Figure 23, page 64.
[17] See DPU 21-GSEP-03, NG-AS-4.xls. https://eeaonline.eea.state.ma.us/DPU/Fileroom/dockets/bynumber. The most expensive per linear foot is 273-340 Walnut Ave, Roxbury.

electric grids costs."[18] The cost savings have started to be applied to the heat pump customers' bills according to the type and efficiency of the heat pump. The electric rate savings ranges from $1,200 to $300 per year for a single family home.[19] The E3 Report calculated that the gas system supplied on average $1,200 of peak electric capacity for Hybrid and Targeted Electrification customers each year.[20] This annual reduction of peak electricity should be paid to gas customers who transition to non-emitting thermal technologies (such as ASHP, GSHP and networked geothermal). Doing so would strongly incentivize them to transition to methods that meet the state's mandates.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Independent study quantifying the value and cost shift savings by utility, resulting in lower electric rates for customers who transition to non-emitting thermal*

Another source of funding relevant for the weatherization and building upgrades included in the majority of pathways is Mass Save. However, there are often barriers to weatherization not paid for by Mass Save, which can be paid for through regulatory assets or other innovation or flexible funds available. Covering upfront costs for the customer's needed retrofits, including insulation, appliances and other changes is a requirement of an equitable transition. Some strategies for cost recovery include A) heat pump and appliance amortization over the lifespan of that appliance, B) easing the appliances as Green Mountain Power does in Vermont, or C) considering them as regulatory assets.

In the case of networked geothermal, we propose that the thermal infrastructure, or thermal 'plant' paid for by the utility and amortized, include the heat pumps during this innovation period. This will reduce customer costs while increasing participation and equity of access. If needed, a meter may be placed between the heat pump and the customer HVAC distribution system to maintain the conventional boundary between customer and utility responsibilities and ownership.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Thermal infrastructure includes heat pumps*

Finally, as the consultants propose, an accelerated straight-line or unit-of-production depreciation can avoid gas infrastructure stranded assets. Reducing or avoiding stranded assets is highly relevant to the funding of the transition and avoidance of rising cost burdens for customers. However, consideration of political feasibility and energy burden impacts makes the initial customer cost increase a barrier to adoption. Thus we recommend a novel approach - that the utility bond portion of the accelerated unit of production depreciation be permitted to use 'proactive securitization' for the near-term years, eliminating the increase on customer bills at

[18] See the Appendix. New Efficiency: New York, Analysis of Residential Heat Pump Potential and Economics. NYSERDA. Pg 58
[19] Ibid. pg 59
[20] The Role of Gas Companies in Achieving the Commonwealth's Climate Goals, E3. pg 22

the start of the straight line depreciation. Proactive securitization is not normally considered because of the risk to the customer. However, in this case, the risk to the customer of long-term stranded assets is larger than the much smaller risk that the thermal utility will go bankrupt in the next few years. Furthermore, this financial mechanism could allow us to depreciate the existing gas infrastructure in alignment with the state emissions mandates while reducing overall expenditures, and without raising customer burden today or in the future.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Use proactive securitization to eliminate cost differential of straight line depreciation*

As stated earlier, currently the gas utilities can only sell gas, are required to invest in gas infrastructure at a large scale and are simultaneously required to reduce emissions beyond what gas can achieve - and before the used and useful lifespan of their infrastructure. These mandates are contradictory and while we know that shifting thermal energy provision away from combustion and towards a form of heat pump is urgently needed, we also know that maintaining safety and affordability on the existing gas system through the transition is necessary. This, and other balancing acts, mean there are many pathway details that are uncertain. Directly acknowledging the need for innovation and iteration and regulatory elbow-room allows us to reduce risk for all. The above list of regulatory suggestions within the umbrella of a 'Regulatory Innovation Phase' are intended to reset the boundaries for thermal service and permit the process of innovation and iteration as we find our way forward.

We are at an inflection point and faced with both a great challenge and great opportunity. Let's place Massachusetts firmly into the leading role we already occupy, defining us globally as a Thermal Transition Innovation Hub.

Thermal Network Framework: A Risk Reduction Pathway of Pathways

The Hybrid that Could

Within the umbrella of the 'Regulatory Innovation Phase' we propose a 'Thermal Network Framework' that balances between the urgent need for emissions reductions and the need for risk reduction in our decarbonization decision-making. This framework interconnects multiple proposed pathways from the reports and allows mix and match experimentation without hazard to consistency of customer service. The framework would allow us to more safely pilot and learn even as we keep moving forward to our goals in a timely way.

It is clear from the E3 report that the Hybrid Electrification Pathway was a favorite for a number of good reasons, not the least of which was that it just felt like less change, and change is hard. It also addressed the great challenge of ASHP magnification of winter peaking on the electric grid and the challenge of utility bill spiking with a shrinking customer base. It even allowed success without widespread weatherization (which is also hard). Yet the hybrid pathway does not meet

our commitment to aim high. It tethers us to a massive fixed-cost infrastructure which will require billions of dollars of investment long into the future with little use. It does not eliminate safety challenges, nor will it eliminate emissions. It requires customer investment in an ASHP and a gas boiler, which over the course of 50 years could be four to five ASHPs and two gas boilers, which doesn't sound that affordable or practical at all. Especially when this high number of appliances could be just one to two GSHPs instead.[21] How can we have the benefits of the hybrid model and aim higher too?

We can shift scales for the Hybrid Electrification Pathway, from hybridizing at the customer building scale to hybridizing at the street or community scale. Imagine networked geothermal without boreholes. What remains is an ambient-temperature shared loop of water running up and down the street, with service loops running to each building. For each customer in this community-scale Hybrid Electrification model, switch out the ASHP for a GSHP. Well, technically, a ground source heat pump is really a water source heat pump since the temperature in the ground is pumped to the heat pump through water. However, we will stick with the convention of describing it as a GSHP. A GSHP is a well established technology that has a longer useful life than the ASHP, a higher efficiency that remains flat throughout the seasonal temperature fluctuations, and is far less prone to refrigerant leaks since all refrigerant is within a factory-sealed product. Needless to say, most refrigerants have a global warming potential that dwarfs methane's GWP. Thus, in that same 50-year-time period, one GSHP could cover the same thermal loads at a higher efficiency with less impact on the electric grid and fewer HVAC replacements than in the single-building scale Hybrid Electrification pathway. Instead of having a backup supplemental heating system in each unit, you can have a single supplemental heating system connected to the shared loop of water. In this community-scale Hybrid Electrification the maintenance of the ambient temperature in the shared loop of water is technology agnostic, allowing piloting of multiple approaches, technologies, or energy sources, without a large risky investment into gas specific delivery infrastructure.

GSHPs do not need energy efficiency retrofits to meet thermal loads since they are not straining to pull temperature from the air when it is 0 or 100 degrees. This constant efficiency, no matter what the outside air temperature, reduces the electric grid winter and summer peaks and gives GSHPs a wider efficacy range in a cold climate. The shared loop of water running up and down the street moves waste thermal energy from one building to the next. An efficiency gain that some European installations[22] claim results in a 30-40% reduction in energy needed. Despite these efficiencies and the resulting flexibility to choose not to weatherize, weatherization can further improve efficiency and customer comfort.

Our thermal utilities can invest in this type of community-scale Hybrid Electrification infrastructure with the certainty that it can be used and useful far into the future - and they can now experiment with how to source the thermal energy they are delivering with this universal thermal delivery system. This delivery system provides the flexibility of testing, changing, or

[21] GSHPs have a longer lifespan than ASHPs partly because they are not stressed by pulling temperature from the extreme temperature variability of air (between 0 and 100 degrees fahrenheit), but instead work with the ground's consistent temperature, which in Massachusetts stays in the 50s and partly because they are factory sealed and therefore less prone to leaks.
[22] Such as E.on's EctoGrid, https://www.eon.se/en_US/foeretag/ectogrid

adding a thermal source, such as an ASHP, a high-efficiency RNG boiler, a sewer waste heat recovery system, geothermal boreholes, etc., without disrupting many customers. This allows a lower risk innovation phase and time for alignment. While HEET has proposed that geothermal boreholes are the ideal thermal source for such a thermal network (see appendices), we are always open to alternatives and to gathering more data from which to de-risk decision-making. Rather than invest in new gas infrastructure through GSEP, which moves us towards either the Efficient Gas Equipment or the Single-building Hybrid Electrification pathways, we can redirect the GSEP investment to this thermal network piping and remain flexible as we move forward, buying time to experiment and refine the distributed provision of thermal energy to this network without greenhouse gas emissions. The pipes are the same HDPE plastic, therefore the workforce and their certifications and skills are nearly the same.

In Europe, this community-scale Hybrid Electrification approach is referred to as a '5G' or a fifth generation of district energy. A 5G system uses distributed heat pumps combined with distributed thermal sources and sinks to create the sort of enormous flexibility that we need as we face a changing and increasingly unpredictable climate. A 30-mile radius region of London has just committed to this approach as their decarbonization of buildings strategy. Glasgow, Scotland released statements at COP26 sharing how this approach would allow them to achieve their climate targets. China has moved an entire city to a version of this type of system. Ithaca, NY has committed to zero emissions by 2030 and is currently performing a feasibility study for the south side of their city to move to a thermal network supplied by geothermal. Their sustainability manager has been invited to the World Economic Forum in Davos, Switzerland to present on their plans. There is an emerging consensus (and excitement!) that a thermal network approach can balance the need for rapid transition with the need for risk reduction and flexibility - even in the face of a changing climate.

This proposed Thermal Network Utility Regulatory Framework is an umbrella that allows the piloting of a community-scale Hybrid Electrification Pathway, Networked Geothermal Pathway, or Targeted Electrification Pathway, can be used to achieve 100% Gas Decommissioning, High Electrification, Low Electrification or 2030 CECP goals, and can allow piloting of the use of Efficient Gas Equipment, SNG, Hydrogen, or Biomethane with less safety and economic risk. Within this framework, each thermal utility can begin to define the decision-making thresholds for where and when to deploy various thermal technologies. This is a model with fewer boilers, less risk, and more flexibility. Why install gas pipe when you can install water pipe and then have the freedom to choose whether you are going to use gas, RNG, hydrogen, ground thermal, air thermal, or waste thermal as your supply?! The last three are non-emitting, local, less expensive and with lower price volatility, and therefore strongly preferred.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Allow Pathways to pilot within a thermal network framework to reduce risk.*

Given the application of a community-scale Hybrid Electrification pathway to targeted streets to reduce gas infrastructure investment and to allow for a non-emitting thermal transition, there are a number of adjustments needed to maximize the benefit of this approach. Naturally, not all gas

network regulations would carry over, but being explicit about workforce carryover would ensure the utilities can maintain a stable work force throughout the transition period, ensuring good jobs remain as well as ensuring safety standards are met.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Adjust existing regulations to reflect the shift from gas to water in pipes (no PHMSA!)*
- *Create regulatory equivalence for gas / thermal workers ensuring workforce continuity*

Additionally, in any territory applying this thermal network model the mandate to serve must be able to be met by a non-emitting thermal service to protect against duplication of delivery infrastructure.

For those streets targeted for transition, but where there is not yet thermal service, the LDC can be allowed to subcontract installation of an individual GSHP (or ASHP if appropriate) to a reputable provider and provide aggregated low-cost financing for all such installs. This idea has been discussed in part with both Dandelion Energy and the DOE's LPO to confirm installation and funding feasibility.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *The mandate to serve can be met by thermal service*
- *Permission to subcontract and finance individual ASHP or GSHP installs for customers*

Single building installations of GSHPs could be designed for future interconnection by stubbing a connection to the street or by siting the boreholes in the public right of way. If or when the street is shifted onto the thermal network, whether supplied by geothermal or other sources, the customer can be easily interconnected. This allows the utilities to 1) rightsize their gas infrastructure now, 2) grow the thermal network at a reasonable pace, 3) reconnect customers to utility infrastructure as it arrives. Increasing the number of connected customers will increase the efficiency of the thermal network.

The inherent flexibility of thermal networks, such as community-scale Hybrid Electrification and Networked Geothermal, allows the LDCs, their customers, workers and investors to move forward with reduced risk. If the approved networked geothermal demonstration projects prove financially viable across a lot of the gas system, then we can add boreholes to any community-scale Hybrid Electrification streets to maintain the temperature of the shared loop of water without combustion or with less electricity. For example, a street on the thermal network that was using RNG to maintain the loop's water temperature and found it not cost-effective, could then update to another technology that was more financially attractive and had lower emissions. If we find that wastewater thermal capture is an efficient and reliable source of energy, we can switch to that. If arrays of titanium sea-water heat pumps in Boston Harbor could both reliably and cost-effectively supply temperature to downtown Boston, then we install those. Could the heat pulled from the harbor help lower the bay's temperature and bring lobsters back? We have no idea. Sea-water heat pumps are currently being used in China and Norway. There are

so many possibilities and so much to learn and we have to act so quickly. Building a thermal network on which we can pilot and test all suggested technologies and multiple pathways allows us to reduce emissions at speed, avoid gas infrastructure investment, and remain flexible in terms of the sourcing of our thermal energy. We will be able to pivot to any of the pathways proposed by the consultants, just on the street- or neighborhood-scale rather than building by building.

Summary of advantages of hybridizing on a street or neighborhood scale rather than a house by house hybridization

- **Avoiding permanent and costly gas infrastructure lock-in**. High risk for all since cost is paid back over decades at a point when A) all the pathways in E3 report show a radical reduction in gas use and gas customers, and B) heat pumps are quickly increasing in technological capabilities and popularity with customers. 21,000 heat pumps were installed in MA last year according to ISO-NE.[23] Business model evolution is business survival and protects the public from the adverse consequences of business collapse.

- **Slowing or avoiding the decline in customers and the decrease in therms/btus delivered of all E3 pathways**. Adding to the impact of electrification and efficiency and migration of customers, our warming climate will further reduce the overall number of therms sold. Especially as climate warms, heating degree days will on average decrease as cooling needs increase, making each therm used in a gas system more expensive. A Community-scale Hybrid Electrification system with a shared loop of ambient-temperature water (AKA, a thermal network) connecting heat pumps in each building can provide both heating and cooling and can expand territory and add customers, further stabilizing the thermal utility model.

- **Flexibility of thermal source connected to the thermal network can avoid the risk of blended fuels failing to meet emission or affordability mandates** - The blended fuels cannot be injected into the distribution system, since the pipes will continue to leak (which will make it impossible for these fuels to meet the 90% reduction we need to meet the Paris Accord). The fuels will cost more, and hasten the demise of the gas utilities. Additionally, blended fuels come from outside of our borders and outside of our control. Already Massachusetts has the most volatile gas price at the citygate in the country. Moving to blended fuels is likely to increase that volatility since more states will be competing for the limited fuels. The less gas we use, the less we will be hostage to future potential price hikes of these blended fuels.

- **De-linking reduction of combustion from cost per BTU delivered -** In the hybrid model cost increase per BTU delivered will be the largest for gas customers who use very little, such as the single-building Hybrid Electrification gas customers. These customers

[23] See the attached document: ISO-NE Final 2022 Heating Electrification Forecast, April 28, 2022, Slide 8.

will be paying a delivery charge all year round, but using gas only on winter peaks. While the proposal to offset this challenge by monetizing the electric grid benefits is smart, it is paying money for combustion, something we want to get away from, and we would have to maintain an intact gas system to do so. Instead, moving to the community Hybrid Electrification pathway will allow the thermal utility to reduce its investment in risky gas infrastructure, and to switch from a street-level gas backup heater for peak use to a heat pump once the cost of gas delivered becomes too expensive.

- **Minimizing the risk of a successful single-building Hybrid Electrification model -** As the annual cost of gas service spikes, while the gas service is only used two to three weeks a year, customers with financial means will switch to less expensive alternatives for supplemental heat, increasing the slide toward gas stranded assets on the backs of the customers without financial means.

Tactical Thermal Transition

Whether approaching the pathway piloting and regulatory innovation phase through a thermal network framework or not, the tactical and targeted deployment of the available technologies to their appropriate use is a must. Working at a building scale will require different solutions than a street or neighborhood scale. And, even at the thermal network scale, not all streets or regions of the thermal network will have thermal loads best met by the same technologies. So a major challenge ahead of us is the allocation of the right technology, at the right scale, to the right locations, at the right time. This is our definition of a tactical thermal transition.

To do this well, we must assemble the data and information needed to inform such decisions, which is in part begun by the consultants in these reports. The next phase ahead, where we open up to piloting and demonstrations and evaluation and data collection - both technical and social - will result in an enormous amount of information. What knowledge do we need for a tactical thermal transition? Our first need is to build a visualization and decision-making tool with data layers allowing us to see and understand the patterns. Couple these data layers with decision making algorithms and we will be more able to determine the best path forward for each street or neighborhood.

The layers of information could include current infrastructure (for example mains & services age, material, MAOP, DIMP rating, dependency & cost of replacement), capacity constraints on the gas system and the electric grid, building stock (sq.ft, HVAC, weatherization, EUI), thermal opportunities (a heat map showing different sources and sinks), hydrogeology, as well as environmental justice neighborhoods, low-income customer density and other key social data mapping. A recent RFP in California requested the development of a similar tool to ensure economic and equitable electrification.

Associated Regulatory Suggestions
(see Summary of Regulatory Proposal below for more information)

- *Issue RFP for Thermal Tactical Transition Tool*

Criteria for Tactical Thermal Transition Decision-making:

Department Core Considerations:

Safety - prioritizes non-combustion alternatives over combustion-dependent alternatives as well as raises serious concerns about any pathway that considers delivering hydrogen to homes. A significant reduction in safety, in the face of alternatives, is a no-go.

Reliability - includes the reliability of energy supply, which prioritizes local thermal sources from air, ground, water, or waste over any supplies that rely on external markets and interstate transport. It also includes the reliability or resilience of the system design in the face of disruptions, disasters, or other challenges. The abilities to 'island', to store energy, and to swap energy sources are all prioritized. The design of our existing gas system, for example, is inherently vulnerable to single-point failure anywhere from production to end-use, disrupting service to all the downstream customers (see Rhode Island gas outage 2019).[24] This would be considered less reliable than a thermal network of distributed heat pumps that could island, swap sources, and include distributed thermal storage.

Equity - has multiple components as well, including equity of access to decision-making and information and services, generational equity, and equity in the distribution of benefit and burden. Several of these were raised and addressed in the consultant's reports. One potential indicator or metric that could be used to assess the impact of a decision on equity is the direction of the decision's influence on the Gini Coefficient. Regardless of metric, this consideration prioritizes those pathways that eliminate up front costs and result in the lowest and least volatile energy bill.

Security - prioritizes pathways that do not include explosive gas and can provide islanding and decentralized functionality.

Affordability - prioritizes pathways with low or no upfront costs and with annual energy bills equal to or lower than current bills. Of the eight pathways that E3 analyzed, Networked Geothermal has some of the lower customer energy bills over time, as well as the lowest energy burden on low income non-migrating gas customers over time.[25] We believe this low cost could be maintained when combined with other pathways using a single merged thermal rate base that allows new thermal customers to replace migrating gas customers, while adding the year-round revenue of efficient cooling as a thermal service.

[24] https://www.bostonglobe.com/metro/2019/01/25/rhode-island-community-suffers-through-days-long-natural-gas-outage/LsRGhqefBH4vNlwQOUrWmJ/story.html

[25] The Role of Gas Distribution Companies in Achieving the Commonwealth's Climate Goals, Independent Consultant Report - DRAFT, Part II: Considerations and Alternatives for Regulatory Design to Support Transition Plans. Figure 23. https://thefutureofgas.com/content/downloads/2.15.22%20-%20DRAFT%20Independent%20Consultant%20Technical%20Report%20-%20Part%20II%20(Regulatory%20Designs).pdf

Emissions - Each of the 8 E3 pathways meets, according to the letter of the law, our emissions mandates. Yet the error bar on each pathway's emissions is not the same and the vulnerability to failure in the face of regulatory or legislative change at the federal, state, or local level (i.e. BERDO or BEUDO) is far higher for those that rely on such assumptions as zero emissions for RNG or the continued underestimation of leaked unburned methane and methane's GWP. Therefore, this consideration prioritizes outcomes that are resilient and robust. Heat pumps, for example, use only locally available emissions-free thermal energy and electricity, which has associated emissions that can decline to zero as the electric grid moves to renewable energy.[26]

Other Key Metrics & Considerations:

Customer Willingness: The consultants wisely raised the challenge of customer choice, willingness, and rate of adoption. This is perhaps the largest challenge of all. The following additional proposals address this:

> Undergrounding Electric: Visible improvement is always more motivating than invisible improvement. It is widely understood that customers prefer undergrounded electric utilities - it is safer, increases reliability, and is more attractive. The cost of undergrounding is high, however, though many utilities are considering its worth given the costs associated with the increasing rate of disruptive climate events. A significant portion of the cost is the excavation and street repair which creates an incredible opportunity for thermal utilities to incentivize customer participation and willingness in the modernization and upgrade of our energy system. When the thermal utility installs the thermal pipes, they could synergistically provide access to the electric utility. Perhaps there could even be a 'utilidor' with all utilities placed in a single easily accessed trench for repair going forward. Either way, the customer sees dramatic visible benefits motivating their enthusiastic participation. Under these circumstances, whole neighborhoods could become more resilient, safe, and reliable.
>
> Evolving investor-owned utilities to B-corporations - this may facilitate alignment between public need and corporate decision-making, and send a strong signal that alignment of public good and corporate decisions is a priority. This could significantly increase trust across the stakeholder system.
>
> Convening Conversations: It is promising that Eversource and National Grid have received much interest from residents, developers and municipalities in being part of their networked geothermal demonstration projects. For example, please see the attached letters of support for the Eversource installation to be in Worcester. These are, in part, the result of community engagement and trust building, including HEET's Charrette #8

[26]GeoMicroDistrict Feasibility Study, Buro Happold Engineering, 2019. https://heet.org/wp-content/uploads/2019/11/HEET-BH-GeoMicroDistrict-Final-Report-v2.pdf

which brought Worcester and other communities, together with Eversource Gas and many other stakeholders in an open conversation.

Customer Choice: If the gas company is mandated to upgrade their thermal service to one that meets modern climate and safety standards, customers can choose to A) accept the upgrade to the less expensive thermal service which also supplies cooling, B) switch to ASHPs and get cooling, C) remain on fossil fuels by adding a propane tank or other fossil fuel tank to their property as allowed by local code. It should be noted, that the gas utilities cannot pay for, install or depreciate the propane tanks since that would not meet emission mandates or the intention of this thermal transition.

Electric Grid and Energy System Impact: Two key points are the quantification, and monetization of thermal technology to mitigate peaks on the electric grid, provide thermal storage, or otherwise support emissions reduction. These peak costs are incorporated in the electricity rates customers pay throughout the year and can be responsible for up to 30% of customer's total electricity costs currently. These peaking costs are likely to increase as we shift large sectors of our energy system, like transportation, onto our electric grid, while moving the fuel source to renewable energy.

Annual efficiency curves matter: GSHPs are more efficient than ASHPs,[27] because the ground below the frost level stays at a consistent 55 degree fahrenheit temperature, a temperature that allows heat pumps to work at their maximum efficiency. Networked geothermal, through thermal storage in the bedrock and through the reuse of wasted thermal energy, is even more efficient, requiring minimal amounts of electricity to work. Thus, as the E3 report says, "Networked geothermal systems have the potential to provide renewable decarbonized heat without causing large electric peak demands in winter" in comparison to other methods of building electrification.[28] This reduction in winter peak demands will necessitate less of a build-out of our electric grid and of the renewable energy needed to supply it. The result will allow us to accelerate our transition to a lower-emitting future, for a lower cost.

Business Model Stabilization - Even as we consider every other aspect of this transition, we must not forget to acknowledge the necessity of investor confidence. Utility and/or regulatory resistance to change will inevitably destroy investor confidence. Clear signaling from legislative and regulatory bodies can help to stabilize investor confidence during risky regulatory times. Why does this matter? Well, if investors lose confidence, the interest rate and the resulting weighted average cost of capital for the infrastructure investments will increase, in turn, increasing customer rates, damaging affordability and equity.

Research & Learning - This is a consideration of knowledge gained, transparency, and trust. A pilot or exploration that is not measured, documented, and shared publicly will not increase trust,

[27] Independent Consultant's report - Decarbonization Pathways, E3, pg 53
[28] Independent Consultant's report - Decarbonization Pathways, E3, pg 18

but damage it. Shared outcomes that cannot be compared between sites or utilities cannot move us forward. Regulatory permission to innovate and demonstrate novel approaches must include rigorous requirements for trusted third-party data collection, normalization, and outcome One example of how this could be provided going forward is the MA legislature allocation of $5 million of the American Rescue Plan Act (ARPA) funds, to be administered by the Massachusetts Clean Energy Center, to "pay for a research team to oversee collect and analyze data related to the design and operation of the networked geothermal demonstration projects" approved by the Department. The research team will conduct a third-party evaluation of the projects and technology, monitor the thermal energy storage, create a public data bank of normalized data, document best practices and project scaled up impacts. This research team will allow all to know under what circumstances networked geothermal performs well, allowing us to plan forward and continue to learn, meeting this research consideration.

Summary of Regulatory Proposals

Regulatory Catch-22
Currently, the LDCs are only allowed to sell gas and they must replace leakprone gas infrastructure at a large scale, while reducing emissions to a level that makes that gas infrastructure investment questionable. They must also provide new gas services even as they know they need to reduce their customer base. These regulatory mandates are contradictory within themselves and contradictory with other infrastructure planning and with state incentives. They need to be adjusted to allow for more efficient application of resources.

Need for a regulatory innovation period
In order to find the right regulatory structure to meet the Commonwealth's net zero emissions mandate, change is required. Under normal circumstances, regulations are used to maintain safety, reliability and affordability. In this moment of inflection, we instead need an innovation framework, with conventional restrictions relaxed, pilots and pivots welcomed, and the door to alternate pathways open.

In this Innovation Phase, 'failure' is expected, but constrained in scale, to allow each to be a key learning. Each potential pathway is evaluated with the consistent metrics of safety, reliability, affordability, security, emissions, and equity, with pathways that fail being eliminated.

To allow for innovation, iteration, and to learn how best to move forward with lower risk, we suggest a regulatory innovation phase until 2030 with annual reporting and reassessment. During this time period, the gas utilities are permitted to pilot not just an array of technologies and pathways as suggested by the consultants, but also to pilot their own evolution into non-emitting thermal utilities, tactically deploying multiple pathways and technologies across their territories.

Green Mountain Power in Vermont can have pilots approved within two weeks so long as they are small enough in scale.

- **Pilots encouraged and fast-tracked**
  So long as the pilot does not decrease safety and the results from the pilot have a reasonable chance of resulting in lower energy bills and emissions for all, a pilot involving 100 customers or fewer can be approved within a month.

Thermal utilities

- **Allow gas utilities to make, distribute, and sell thermal energy** - this change to the statutory definition of our gas companies in Chapter 164 of the general law is necessary to allow these utilities to attempt to meet the GWSA. They are currently mandated to sell what cannot meet the Commonwealth's emission mandates.

- **Obligation to serve can be met through provision of thermal energy** - while commented on in Section 91 of Chapter 164, this obligation appears to be codified within the Department's existing LDC customer contract language. It can be updated by the Department to define a continuation of service as inclusive of thermal service upgrades that meet the states' emissions mandates and that continue an equal or better level of safety, reliability, affordability, security, and equity.

- **Merged gas/thermal rate base** - All customers served during this regulatory innovation phase remain a single rate base regardless of thermal technology or service received (i.e.whether supplied through gas or non-emitting thermal method). This merged rate base allows stabilization of the rate base and revenues through allowing gas customers to be transitioned to other technologies while still remaining in the same rate base. The stabilization of rate base and revenues will reduce impacts on affordability and equity as our state determines future categorization and regulations around technologies and service. All thermal infrastructure installed can be amortized over its expected lifetime, the same as gas infrastructure is now.

- **Issue an RFP for Thermal Tactical Transition Tool** - In order to most efficiently and safety rightsize the gas infrastructure for the future demand and rate base, a data-based decision-making tool is needed to find thresholds for gas mains wher possible to be transitioned to non-emitting thermal infrastructure. Some of the potential data to be used might include potential avoided costs, energy use, local geology, environmental justice neighborhoods, etc. A recent request for proposals (RFP) in California requested the development of a similar tool to ensure economic and equitable electrification.

- **Adjust existing regulations to reflect the shift from gas to water in pipes (no PHMSA!) -** In order to allow the shift from gas in the pipes to water in the pipes, remove PHMSA requirements and safety requirements for the installed water pipes since they are only relevant to a combustible gas.

Slowing Risky Investment During Innovation Phase, while Allowing for Innovation
Investing in new gas infrastructure at this point is high risk at this point for gas utilities, workers, investors and customers. All the pathways in E3 Report show a radical reduction in gas use and gas customers, decreasing the number of customers to pay off that gas infrastructure investment. Slowing down the investment in combustion infrastructure wherever safe will reduce the potential for assets that might not be used and useful post 2050. Allowing the gas infrastructure investment where possible to be spent instead on non-emitting thermal infrastructure will allow for innovation, protecting the public from the adverse consequences of a business collapse.

- **Pipeline safety rating temporarily used to more narrowly prioritize pipe replacement**
  Until 2030, in order to slow the investment in what might be potentially stranded assets, the Distribution Integrity Management Program (DIMP) safety rating is used until 2030 to more narrowly define which pipes should be replaced. LDCs meanwhile increase gas winter patrols and leak repair repair.

- **GSEP and other gas system infrastructure investments are allowed to be delayed**
  Until 2030, in this context of thermal utility innovation and the need to avoid 'locking in investment in combustion infrastructure', the existing GSEP, gas constraints and other gas infrastructure investments are permitted where safe to be delayed, for up to a decade.

- **GSEP and other gas infrastructure investments can be spent on street-level targeted transition** - Gas infrastructure expenditures (including GSEP, gas constraints and any new developments) that cannot be delayed may be directed to non-emitting renewable thermal energy systems, such as networked geothermal or individual-building installations of ground source heat pumps (GSHPs) or air source heat pumps (ASHPs). This will allow the gas utilities to cherry pick the best opportunities to experiment and learn from, while rightsizing the gas infrastructure to meet future demand.

- **Non-emitting infrastructure can be amortized over its used and useful lifetime -** As part of the rate base, non-emitting thermal infrastructure can be amortized as gas infrastructure is over its used and useful lifetime.

- **No new gas services past a date selected by the Department** - After a date selected by the Department, the mandate to serve can be met only by non-emitting thermal service. Investment in dual systems at the customer level would be contradictory to the intent.

Reducing Upfront Customer Costs
To reduce upfront customer cost and risk while increasing participation and equity of access, it is critical that building retrofits, as much as possible, be paid for by LDCs.

- **Weatherization and other building upgrades can be part of LDC regulatory asset -** any portion of weatherization, or barrier removal needed for weatherization, or other needed building upgrades (such as changes in the building's distribution system) needed

to utilize the non-emitting thermal infrastructure, that is not paid for by Mass Save, may be financed by the LDC as part of a regulatory asset.

- **Utility Thermal Infrastructure includes Heat Pumps** - As each of the technology pathways is tested within this innovation period, any appliances required to become non-emitting may be provided to customers without upfront cost and be included in the assets of the utility. A meter may be placed between the heat pump and the customer HVAC distribution system to maintain the conventional boundary between customer and utility responsibilities and ownership. Massachusetts utilities in the past have installed gas water heaters and other appliances as part of their depreciated rate base.

Incentivizing emission and electric grid peak reductions

Customers participating in non-emitting thermal pilots that reduce winter and summers, such as GSHP and networked geothermal, will be reducing electric grid peaks in comparison to other methods of building electrification, while increasing electricity use overall. The E3 Report found this winter peak reduction is worth $1,200 per customer.[29] New York state calculates the value and cost shift opportunities by gas utility including the societal value of reducing emissions, electric peak load and the inverse cost shift of heat pump customers paying for more than their "fair share of fixed electric grids costs."[30] The cost savings have started to be applied to the heat pump customers' bills according to the type and efficiency of the heat pump. The electric rate savings ranges from $1,200 to $300 per year for a single family home.[31]

- **An independent study quantifies the avoided or reduced electric and gas peaks and usage, resulting in lower rates for customers who transition -** To further ensure stable rates during this innovation period, thermal utilities are permitted to receive aggregate compensation of non-emitting thermal peak-cutting service to the electric grid which is directly applied to reduce costs that customers carry. Lower electricity rate for non-emitting thermal infrastructure based on electric and gas peaks and increased electric revenue and avoided gas consumption.

Increasing Equitable Outcomes

- **Accelerated straight line depreciation with proactive securitization**- As the ERM consultants propose in their regulatory proposal, an accelerated straight line or unit of production depreciation can avoid gas infrastructure stranded assets. However, consideration of political feasibility and energy burden impacts make the initial customer cost increase a barrier to adoption. Thus we recommend that the utility-bond portion of the accelerated unit of production depreciation be permitted to use 'proactive securitization' for the next few years, eliminating the increase on customer bills. Proactive securitization is not normally considered because of the risk to the customer. In this case, the risk to the customer of stranded assets is large, justifying the short-term small risk to the rate payer in order to reduce the larger long-term risk.

[29] Independent Consultant Report - Regulatory Design, E3, pg 22
[30] See the Appendix. New Efficiency: New York, Analysis of Residential Heat Pump Potential and Economics. NYSERDA. Pg 58
[31] Ibid. pg 59

- **Workforce stabilization** - In order to ensure equity, there should be a regulatory equivalence for contractual obligations to the workforce, including compensation and benefits, for the existing gas workforce as it moves from gas pipe to water pipe.

- **Encouraging Investor Owned Utilities to evolve to B-corporations** - we greatly encourage this as a way to facilitate alignment between public need and corporate decision-making. This could significantly increase trust across the system which is much needed for the success of the thermal transition.

Increased information sharing, reporting, and iteration

- **Annual Thermal Transition Plans until 2030** - As requested in the ERM Regulatory Proposal, annual requests and reports from the LDCS would further require transparent sharing of data and key learnings to ensure maximum benefit and course-correction.

- **Department participates in and hosts diverse working groups** - In order to learn from all and reduce unintended consequences, it is important to share ideas and information and potential ways forward with a diverse group of stakeholders, incorporating feedback, ideas and information in the actions taken.

- **An advisory council created for thermal transition** - in order to ensure a wide range of experts consider potential pathways and methods, an advisory council should be created incorporporating expertise from LDCs, environmental and low income advocates, gas workforce, and others.

Summary

Current regulation ensures disaster for gas utilities, low income residents, gas workers and the climate.

The regulatory changes listed above are intended to allow the gas utilities to evolve their business rather than collapse, potentially to prosper, while aligning and aiding the goals of our Commonwealth to meet our net zero mandate faster, lowering electric winter peak, all in an equitable and safe way. It enlists our gas utilities in the enormous task of transforming our energy system to zero emissions while protecting the ratepayers, the low-income, and the gas workers. A just transition.

We see a better future for all. There is a lot of work ahead of us. There is a lot of rigorous careful thinking and research, a lot of bravery and informed risk-taking, and likely a lot of missteps ahead of us. This alternative regulatory proposal, in all its nested layers, is intended to make safe room for that process of innovation and iteration even as we rapidly decarbonize. The last time a

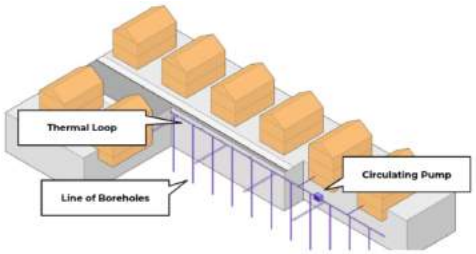
group of humans took on such a project was in the 1800s, when we imagined and built the gas infrastructure we still use today.

Our hope is that what we imagine and build today can be used and useful for the next 200 years.

Appendices

- Decarbonizing Building Heat in Massachusetts; Applied Economics Clinic, March 2022 https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/624b0a84c9794d56d374dcac/1649085062630/HEET+Decarbonizing+Gas_Report_AEC_23Mar2022+%281%29.pdf
- New Efficiency: New York, Analysis of Residential Heat Pump Potential and Economics. NYSERDA, Final Report, Jan 2019 https://cdn.shopify.com/s/files/1/0326/2837/files/NYSERDA_EE_report.pdf?167528292 4961837979
- 5th generation district heating and cooling systems: A review of existing cases in Europe; Buffa et al, Science Direct. https://doi.org/10.1016/j.rser.2018.12.059
- NYSERDA Community Heat Pumps Projects, $15 million allocated. https://www.nyserda.ny.gov/All-Programs/Community-Heat-Pump-Systems/Winners
- Local Warming, Audrey Schulman , Works in Progress. April 2022. https://www.worksinprogress.co/issue/local-warming/

Geo Block & Geo Grid Technical Definition



A Geo Block is a street-segment networked ground-source heat-pump system with a loop of pipe filled with pure water (no glycol added) running up and down the street in the gas utility's right of way. There are service loops running to each building. Each has a heat pump inside their building that pulls heating or cooling thermal energy from the water in the service line, to deliver the needed temperature through that building's distribution system.

There are boreholes in the right of way of the street. The boreholes are used as needed to return the water in the delivery loop to temperature. The water is maintained in an "ambient" temperature window of approximately 40 to 90 degrees fahrenheit. This is the temperature in which heat pumps are most efficient and their life span is the longest. There is a supplemental heater and cooler on the shared loop of water as backup in case the system needs a temperature boost in unusual heating or cooling events.

Geo Blocks are designed to interconnect so they can grow over time into a Geo Grid. A Geo Grid is the energy system that results from the interconnection of multiple Geo Blocks at a community, municipal or regional scale. As the system grows larger, the temperature of the water is easier to balance, both synchronously and asynchronously, by using the different thermal energy sources and sinks (such as data centers, hockey rinks, supermarkets, office buildings, rivers, etc. within the Geo Grid). Thermal energy sinks and sources should be sought out actively as the system grows. There should be centralized management and optimization of the system for greatest efficiency and least cost of installation. As the Geo Grid grows, fewer supplemental backup heaters and coolers are needed on the shared loops.

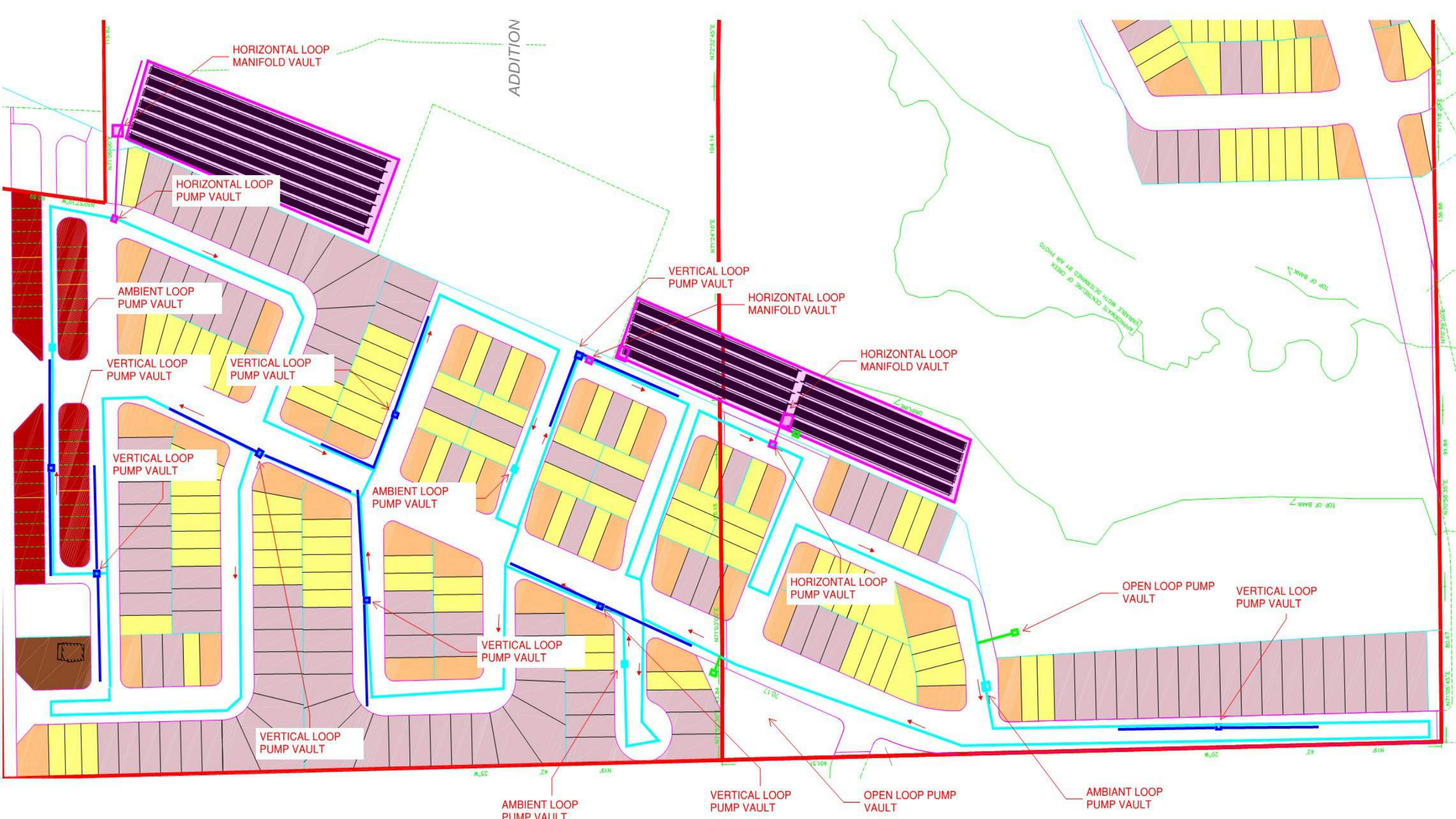
Each Geo Block is sized for stochastic load, meaning the system is sized for the probable heating and cooling extremes of the aggregated customers, not for the simple sum of each customer's maximal heating or cooling peaks. The more customers there are, the less the likelihood of all the heating or cooling peak demands occurring simultaneously for any reason, thus making it maximally efficient to shift such unlikely events to rely on supplemental boiler or chiller use. This likelihood is further reduced if diverse thermal energy sources and sinks are actively incorporated into design. As the stochastically calculated system peak demands decrease, the installed infrastructure cost and therefore the customer costs decrease as well. This decrease means the system efficiency increases, which reduces the electric grid loads and, again, customer costs. In summary, as the GeoBlocks are interconnected to create a utility-scale Geo Grid, the energy efficiency increases and the customer costs decrease, positively impacting both thermal and electric energy systems.

(continued below)

Geothermal Community System – Berczy Glen

System Goals / Challenges

- 312 Homes – interconnected with common geothermal loop
- Use hybrid Open, horizontal & vertical geothermal heat exchangers
- Infrastructure placed within streets to utilize same contractors for installation of utilities (no green space for infrastructure)
- Deliver same temperature geothermal fluid to all homes within +/-2C for equal efficiencies
- Locate circulating pumps within below grade vaults in ROW
- Design for resiliency and redundancy


HORIZONTAL LOOP MANIFOLD VAULT
HORIZONTAL LOOP PUMP VAULT
ADDITION
AMBIENT LOOP PUMP VAULT
VERTICAL LOOP PUMP VAULT
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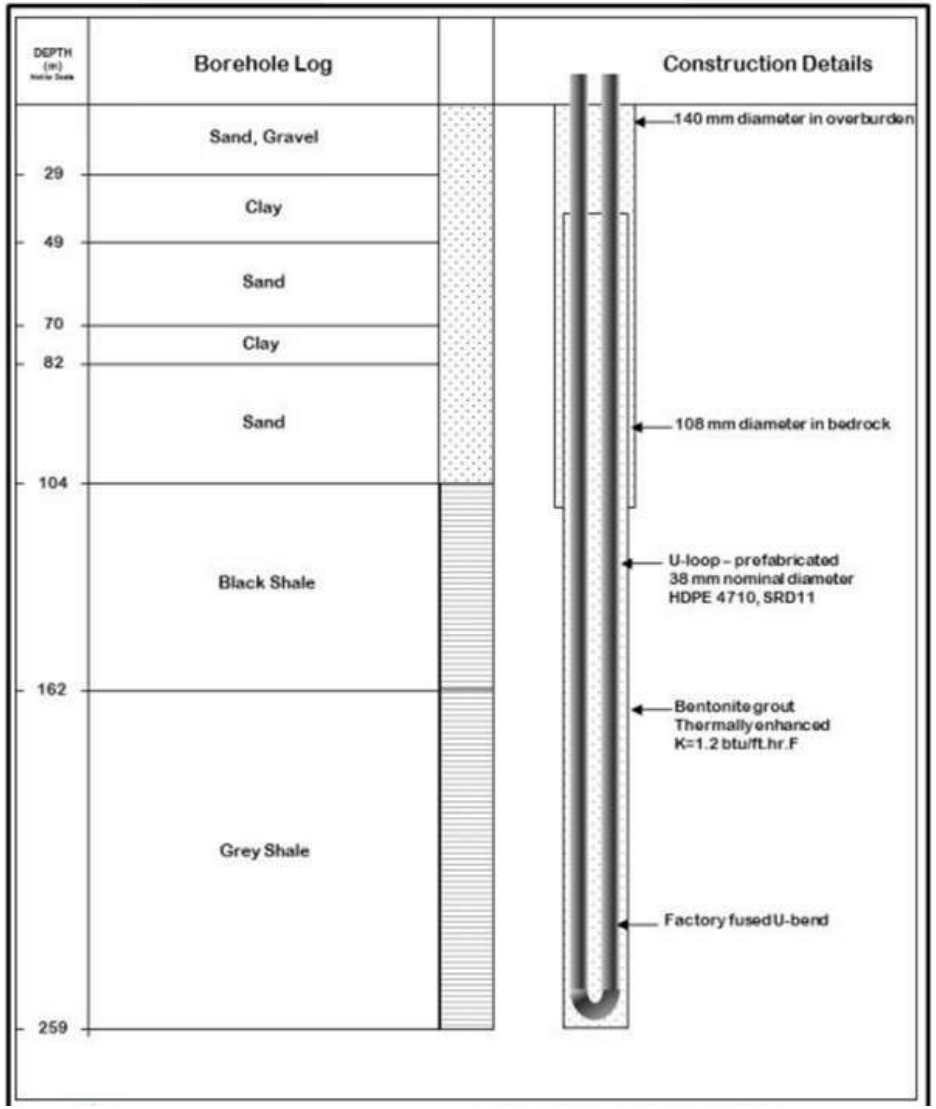
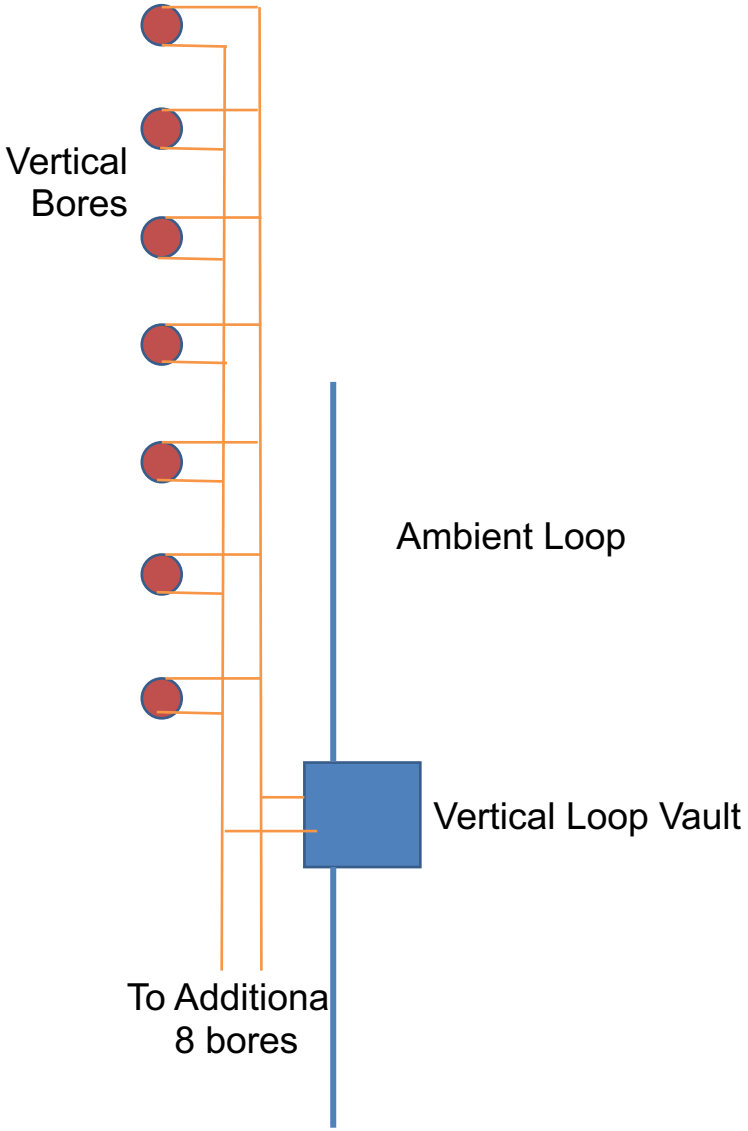
Vertical Test Bore – Thermal Response

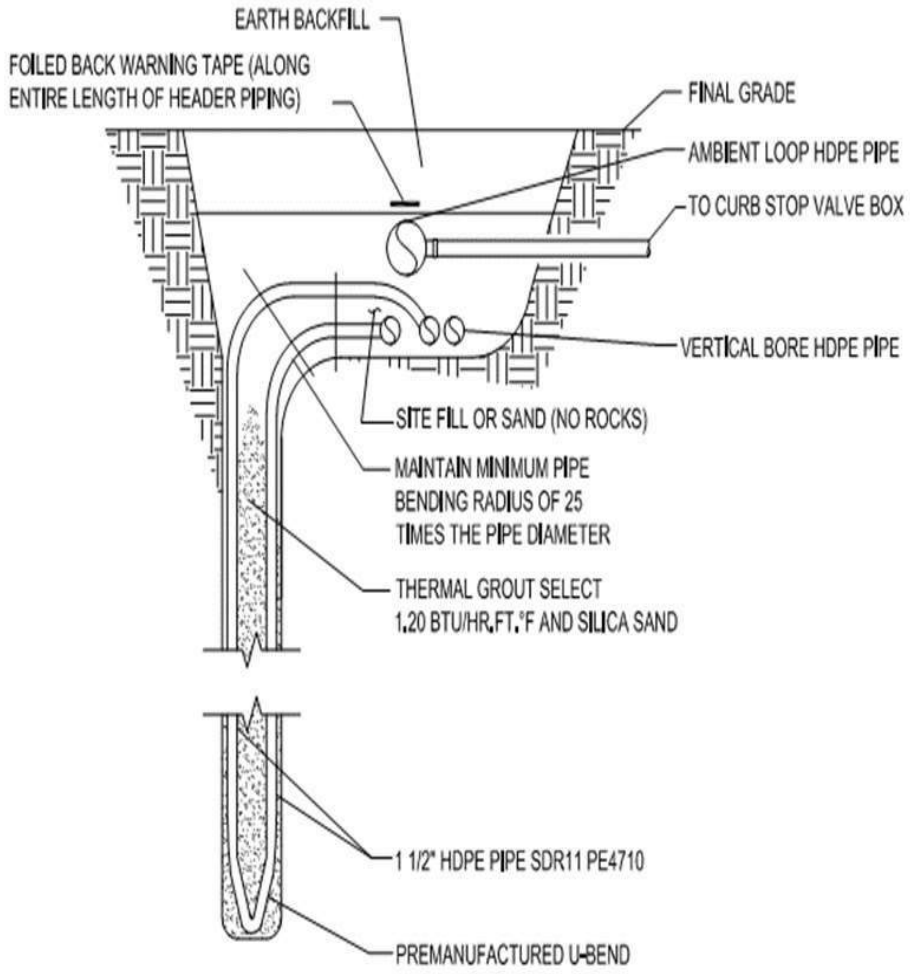


Vertical Loop Test Bore:

- 850’ Deep Bore
- 5.5”dia. Hole to 350’ (temp cased)
- 4.5”dia. Hole to 850 (uncased)
- 1.5” HDPE U-Bend installed
- Grouted w/ Bentonite top to bottom
- Conductivity of 1.58
- Average Mean Earth Temp is 11.1C

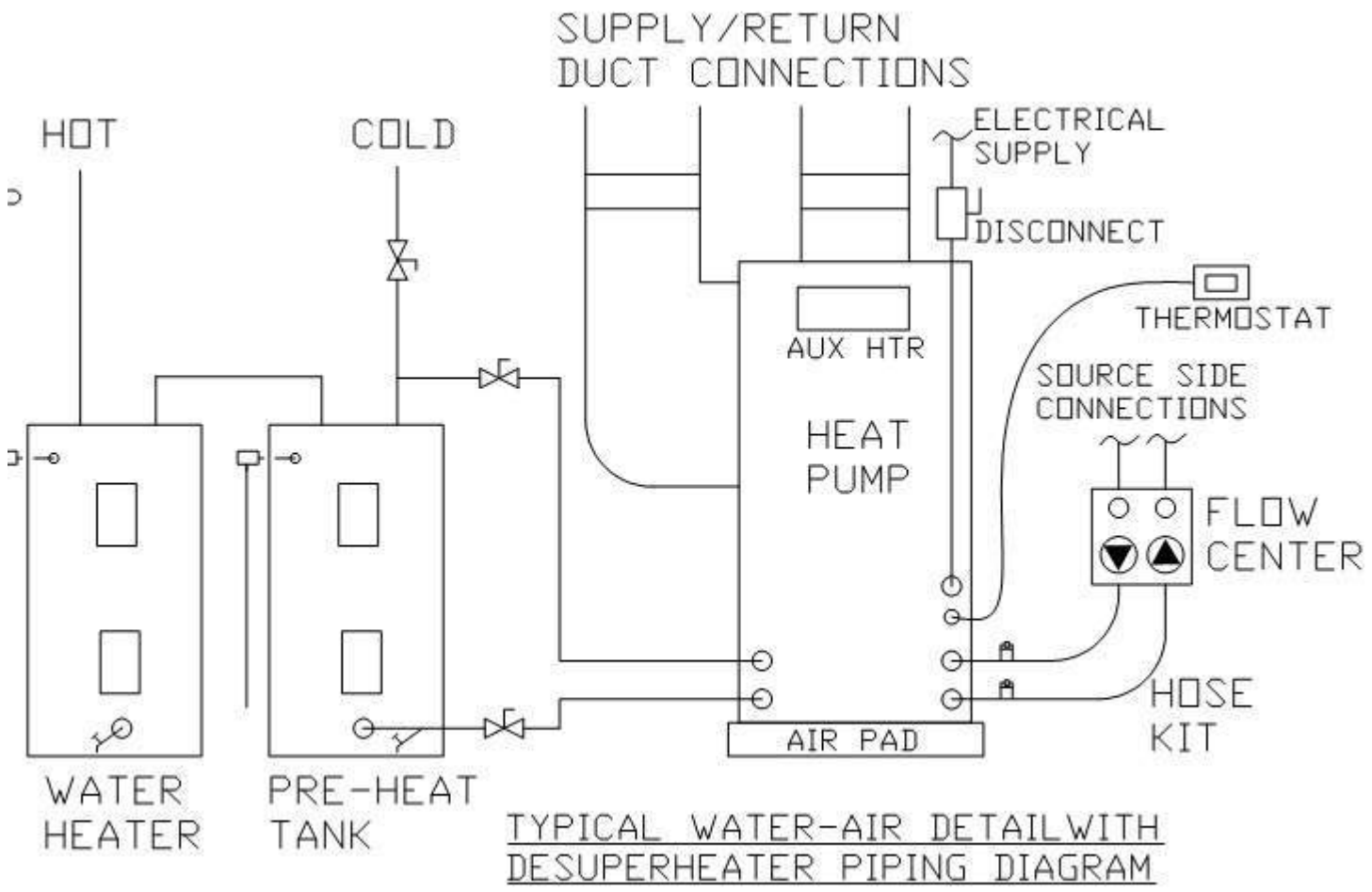
Vertical Loop Details:





- All bores are grouted from bottom to top with bentonite seal
- 14 bore holes per sub-group
- 1 pump vault per sub-group
- All manifold lateral piping below ambient loop pipe

Geothermal In-Home HVAC System



- Water to Air Geothermal Heat Pump system in the home
- Multiple Manufacturers to choose from in the market-place
- Provides up to 60% domestic hot water heating (desup)
- No substantial changes to home infrastructure, i.e. ductwork, mechanical room space

Final Design

- 312 Homes (mixed of single family and townhomes)
- All vertical geothermal heat exchangers only
  - 144 Bores @ 850’ (11 pods)(122,400LF of Bore all in ROW)
- Infrastructure placed within streets to utilize same contractors for installation
- Deliver same temperature geothermal fluid to all homes within +/-2C
- All pumps are located in underground vaults within ROW
- 5000+ of 6” HDPE Ambient Loop piping (single pipe)
- Each home/lot has a curb stop with direct buried iso valves

D. ANY LATERAL GEOTHERMAL PIPING RUNNING ALONG WATER SUPPLY WITHIN 0.5 METERS AND FOR A DISTANCE OF MORE THAN 2 METERS, SHALL BE INSULATED TO PREVENT FREEZING WATER SUPPLY.

E. WHERE THE VERTICAL LOOP PIPING IS SHOWN ON PLAN NEXT TO THE AMBIENT LOOP, ACTUAL PIPING SHALL BE BENEATH AMBIENT PIPING. THIS IS SHOWN FOR DIAGRAMMATIC PURPOSES ONLY. SEE CIVIL DRAWINGS FOR ACTUAL PIPE LOCATIONS AND ELEVATIONS.

F. WHERE AMBIENT LOOP PIPING IS SHOWN ON PLAN NEXT TO ANOTHER AMBIENT PIPE, THE ACTUAL PIPING SHALL BE VERTICALLY STACKED 1FT ABOVE ONE ANOTHER. THIS IS SHOWN FOR DIAGRAMMATIC PURPOSES ONLY. SEE CIVIL DRAWINGS FOR ACTUAL PIPE LOCATIONS AND ELEVATIONS.

59	4	42.5	28	16	109.3	114.1	S-122.5	S-119.3	170.2
60		42.6	29	15	109.4	S-118.1	S-122.6	S-119.4	170.3
44		43.1	30	14	28	S-118.2	S-121.1	N-120.1	170.4
43		43.2	31	13	27	S-118.3	S-121.2	N-120.2	171.1
42		43.3	32		26	S-118.4	S-121.3	N-120.3	171.2
		43.4	33		25	S-118.5	S-121.4	N-120.4	171.3
			34		24	S-118.6	S-121.5	N-120.5	171.4
			BLK 127			S-117.1	S-121.6	N-119.1	171.5
			1			S-117.2	N-115.1	N-119.2	83
						S-117.3	N-115.2	N-119.3	84
						S-117.4	N-115.3	N-119.4	85
						S-117.5	N-115.4	N-122.1	86
						S-117.6	N-116.1	N-122.2	
						S-116.1	N-116.2	N-122.3	
						S-116.2	N-116.3	N-122.4	
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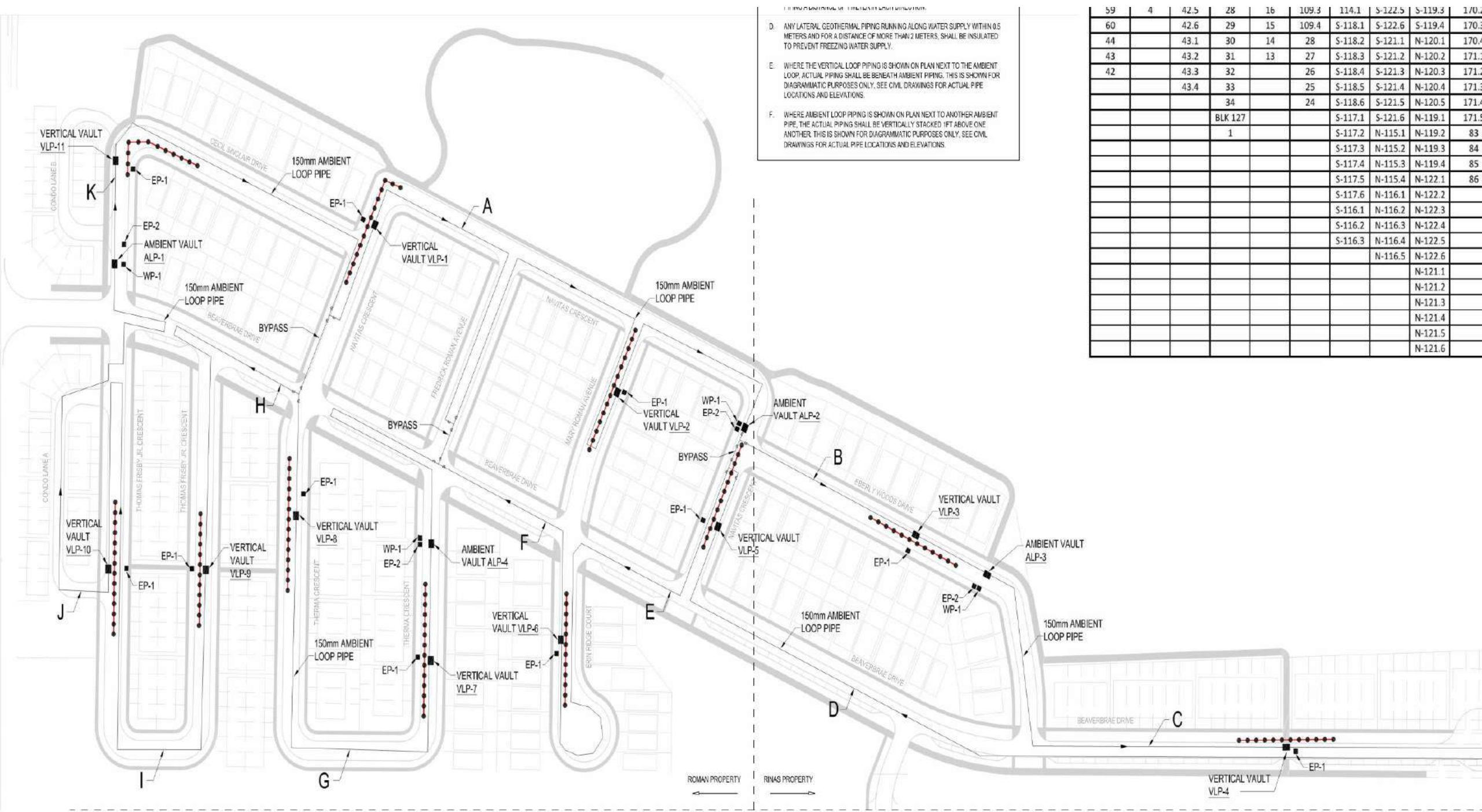
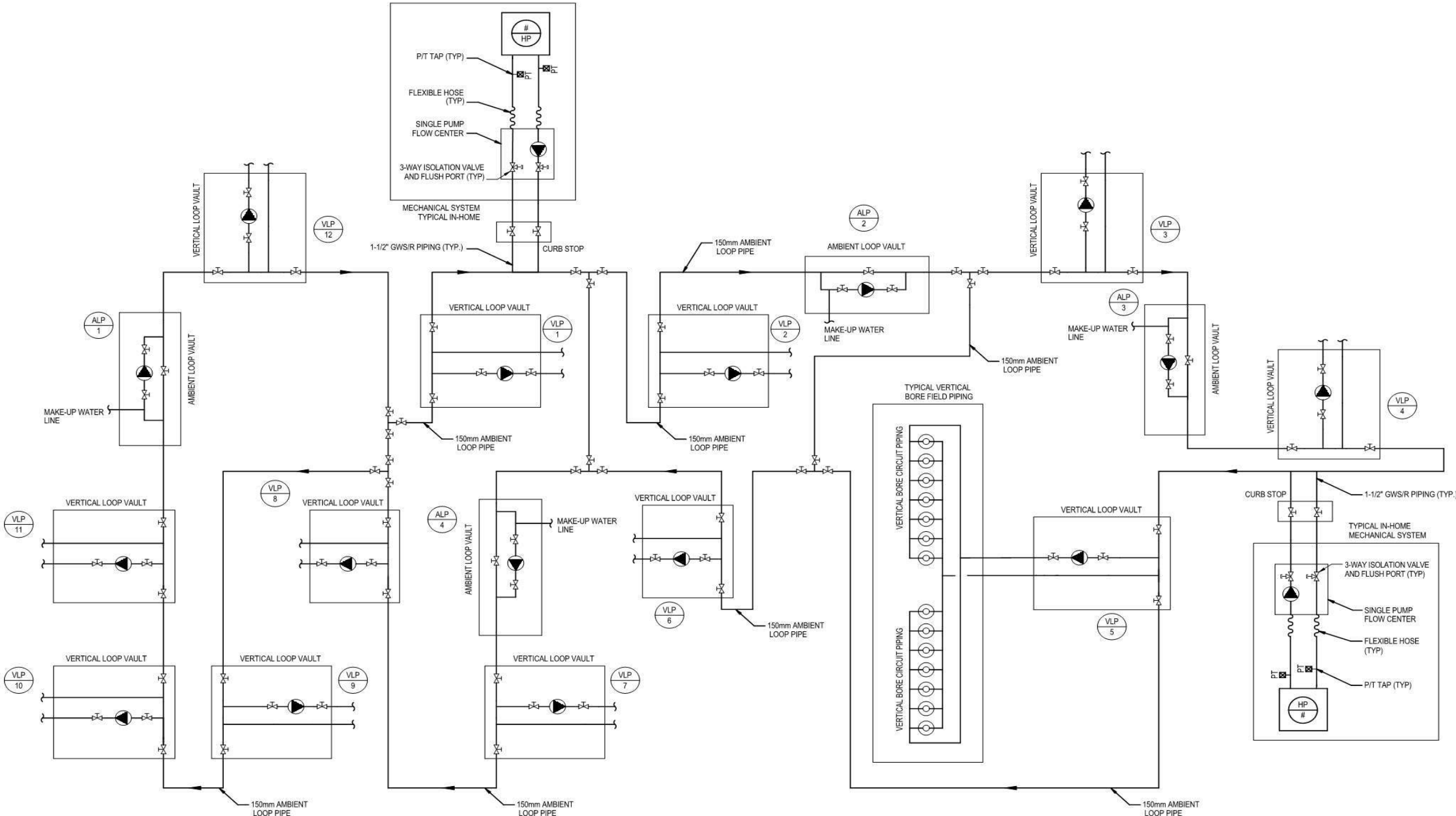
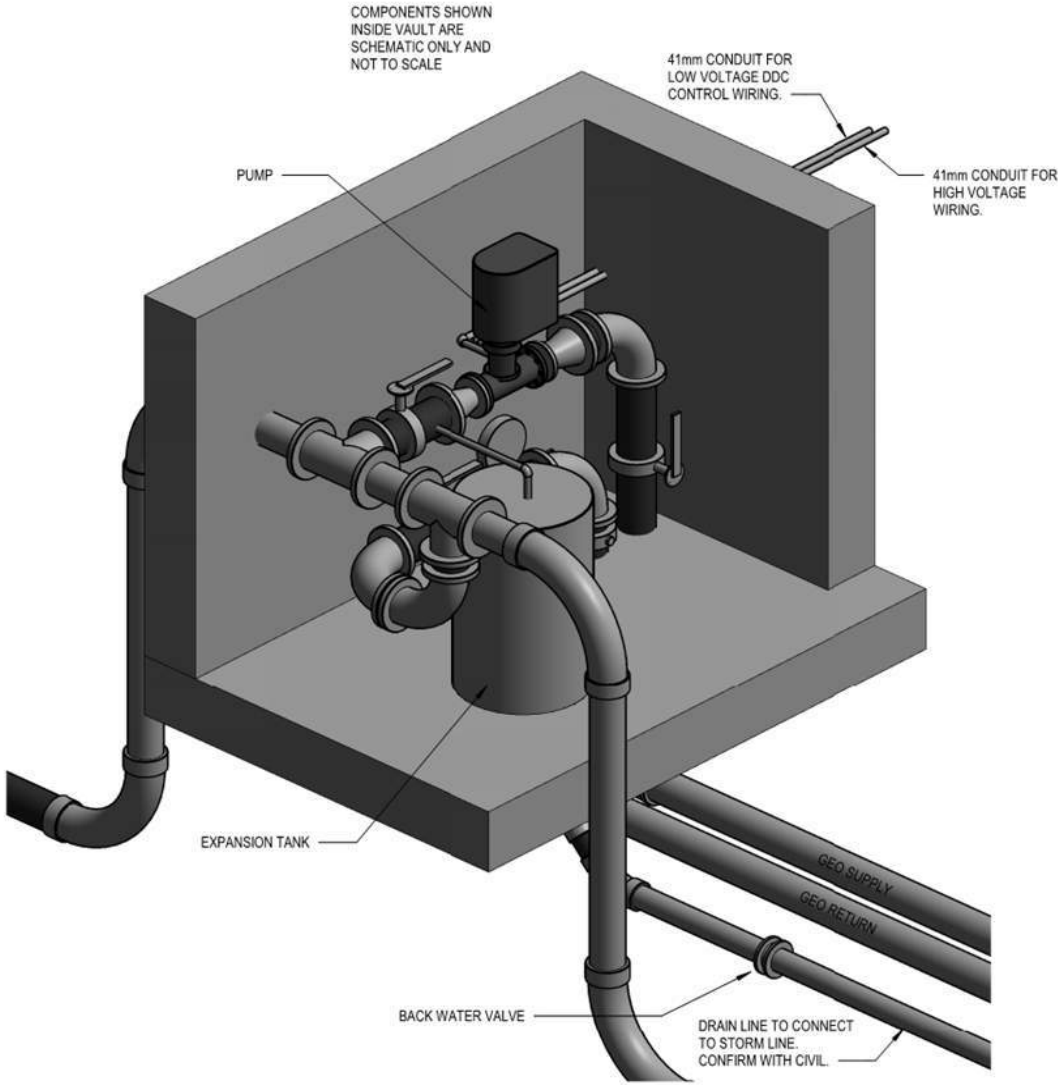
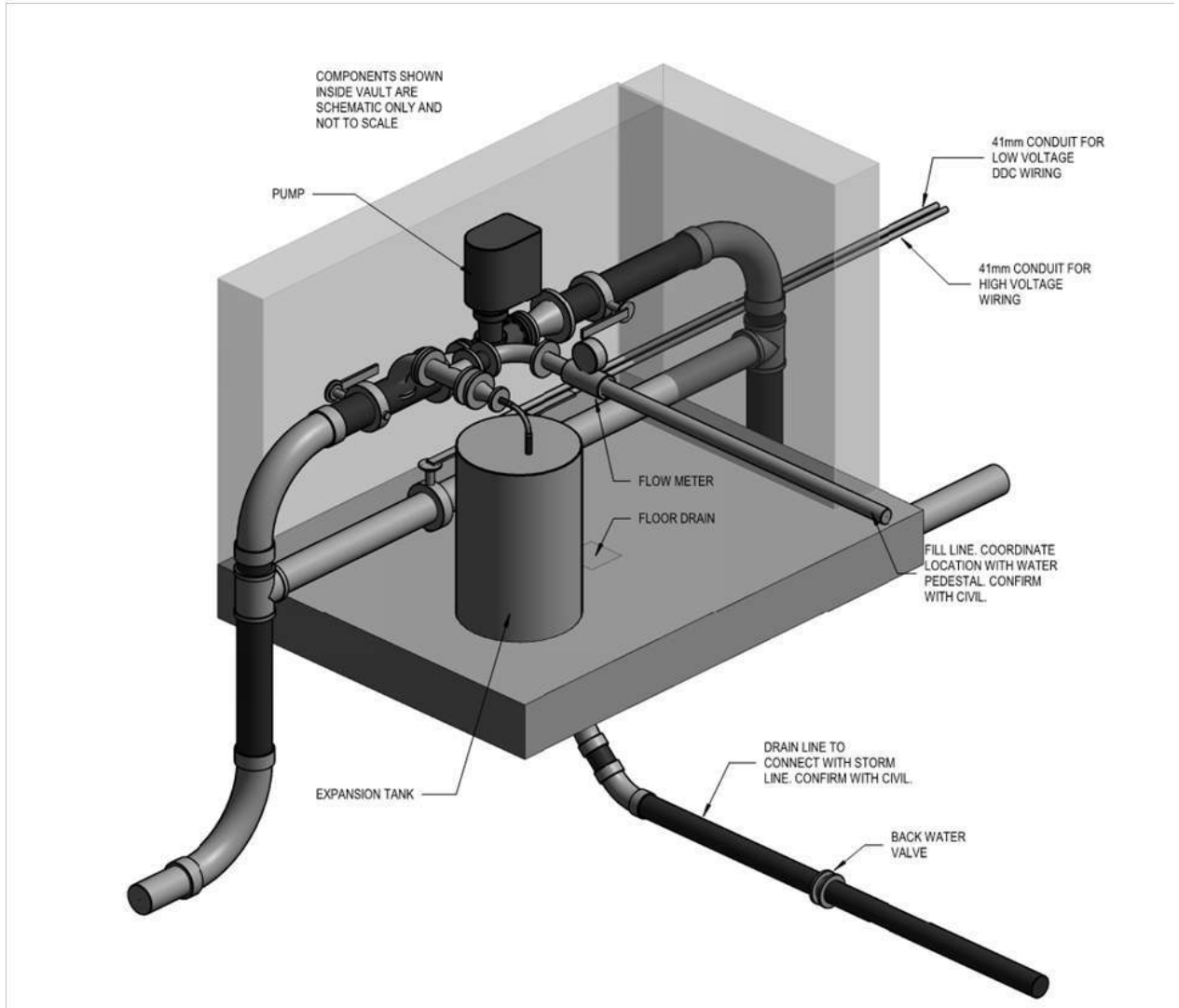


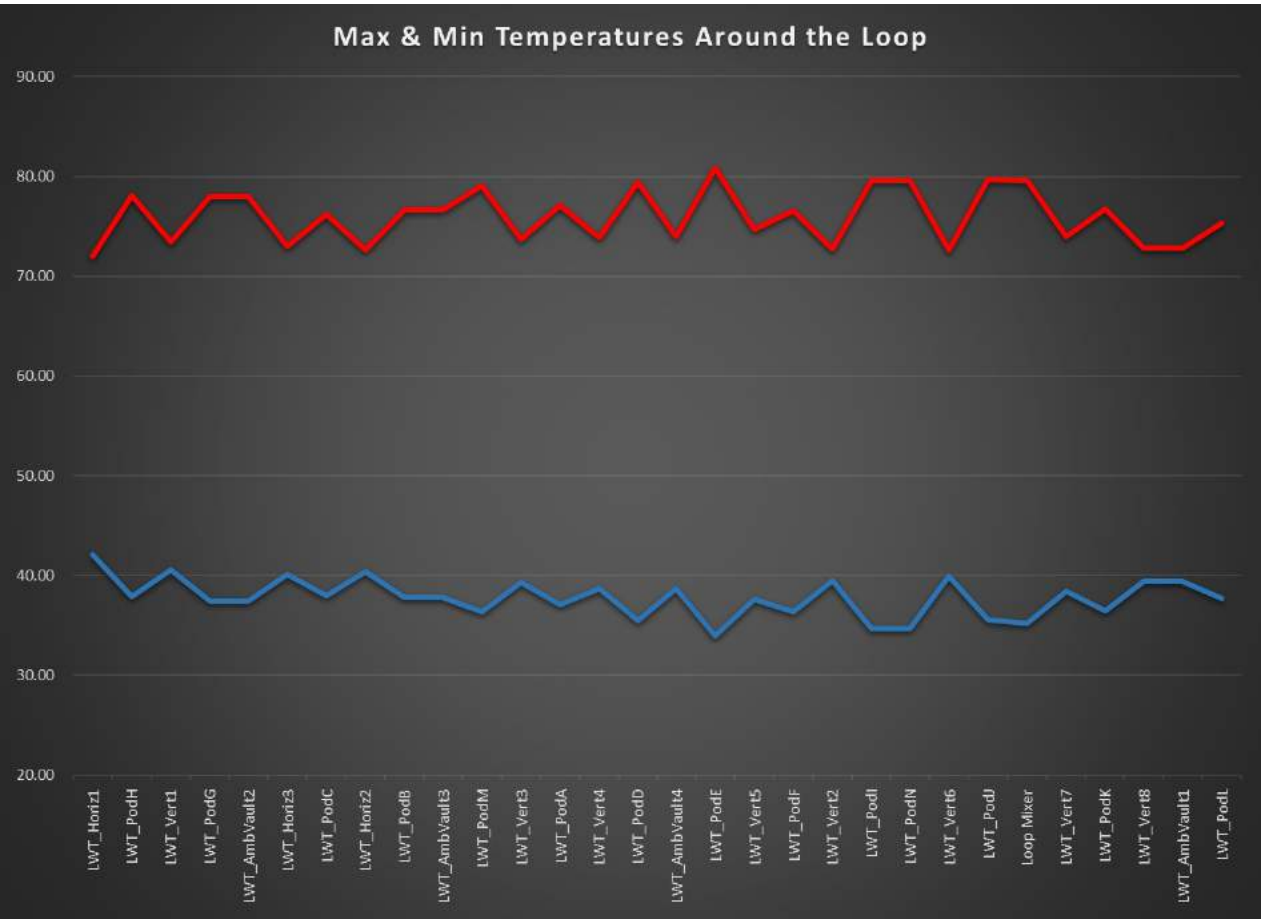

#
HP
P/T TAP (TYP)
PT
PT
FLEXIBLE HOSE (TYP)
SINGLE PUMP FLOW CENTER
3-WAY ISOLATION VALVE AND FLUSH PORT (TYP)
MECHANICAL SYSTEM TYPICAL IN-HOME
CURB STOP
1-1/2" GWS/R PIPING (TYP.)
VERTICAL LOOP VAULT
VLP 12
VLP 1
VLP 2
VLP 3
VLP 4
VLP 5
VLP 6
VLP 7
VLP 8
VLP 9
VLP 10
VLP 11
ALP 1
ALP 2
ALP 3
ALP 4
AMBIENT LOOP VAULT
MAKE-UP WATER LINE
150mm AMBIENT LOOP PIPE
TYPICAL VERTICAL BORE FIELD PIPING
VERTICAL BORE CIRCUIT PIPING
TYPICAL IN-HOME MECHANICAL SYSTEM

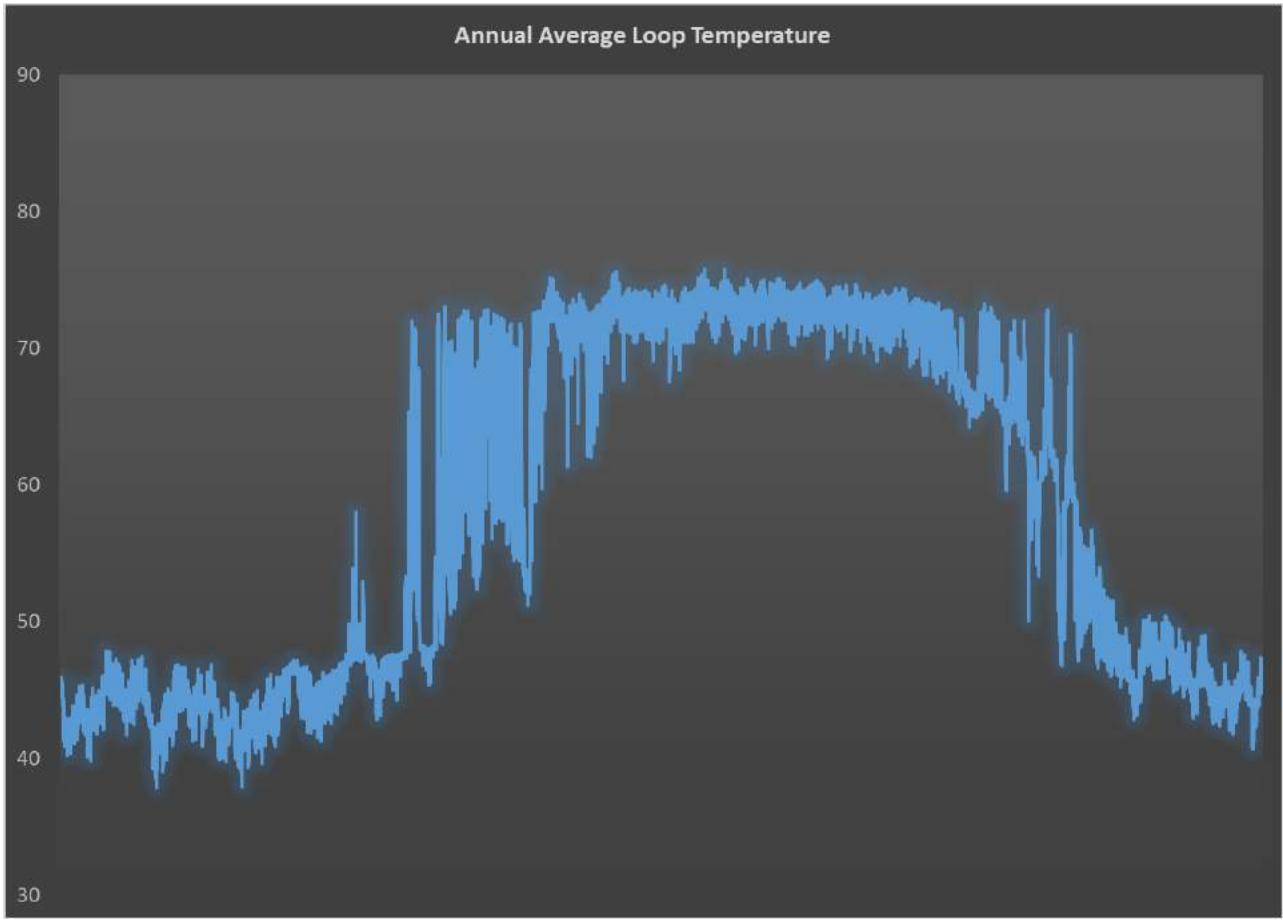
Geothermal Buried Pump Vaults



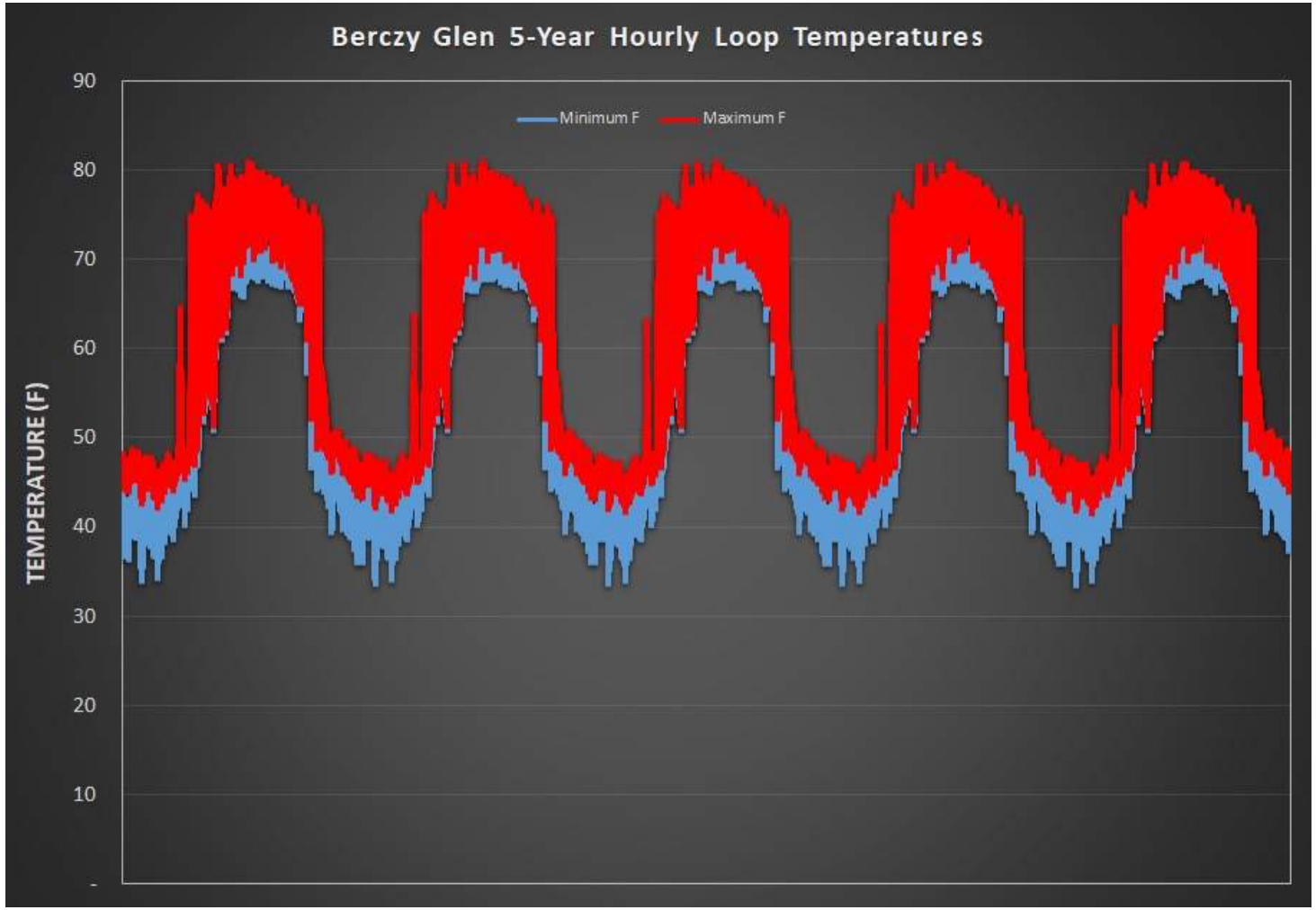


TRANSYS Thermal Energy Model Profiles





5 Year Loop/Earth Temperatures



Question???

Comments?

APRIL 28, 2022

Final 2022 Heating Electrification Forecast

Outline

- Introduction & Forecast Framework
- Air-Source Heat Pump (ASHP) Adoption
- ASHP Energy Forecast
- ASHP Demand Forecast

Acronyms

- **AMI** – Advanced Metering Infrastructure
- **ASHP** – Air-Source Heat Pump
- **CELT** – Capacity, Energy, Loads and Transmission
- **GHG** – Greenhouse Gas
- **GSHP** – Ground-Source Heat Pumps
- **GWH** – Gigawatt-Hour
- **HDD** – Heating Degree Days
- **HE** – Hour Ending
- **LFC** – Load Forecast Committee
- **MW** – Megawatt
- **RSP** – Regional System Plan

Introduction

- Heating electrification is expected to play a pivotal role in the achievement of New England state greenhouse gas (GHG) reduction mandates and goals
- Forecasted impacts of heating electrification on state and regional electric energy and demand are included as part of the 2022 Capacity, Energy, Loads, and Transmission (CELT) forecast
- The 2022 heating electrification forecast focuses on adoption of air-source heat pumps (ASHPs)
  - Consideration of other heating electrification technologies, such as ground source heat pumps (GSHPs) and heat pump hot water heaters (HPHWs), may also be warranted in future forecasts
  - **Forecast is relevant for winter months only (January-April, and October-December)**
- ISO discussed methodology, assumptions, and related energy and demand impacts associated with the heating electrification forecast at the NEPOOL Load Forecast Committee (LFC), including the following presentations:
  - Background and assumptions the November 12, 2021 LFC meetings;
  - The draft 2022 electrification forecast at the December 10, 2021 LFC meeting;

Forecast Framework

- There are two general components to the forecast:
  1. Forecast the adoption of ASHPs for each state and the region over the next ten years
  2. Use data-driven assumptions to convert the ASHP adoption forecast into estimated impacts on monthly energy and demand by state

ASHP ADOPTION FORECAST

ASHP Adoption Assumptions

State	State Guidance on ASHP Adoption Assumptions	Shares (Partial/Full) of Heating Provided by ASHP Growth
CT	Based on values provided by CT officials for the 2021 adoption forecast	Approximately 16% are full heating, 2022-2031
MA	Based on 2021 planned installations provided by MA EE Program Administrators; growth thereafter provided by MA officials	13% of annual growth is full heating in 2022, with annual shares increasing each year until reaching 43% full heating by 2031
ME	2022 values from Efficiency Maine Trust; 3% annual growth assumed thereafter; adoption values align with Maine's Climate Action Plan	29% of annual growth is full heating in 2022, with annual shares increasing each year until reaching 83% full heating by 2031
NH	Based on 2021 Planned installations provided by NH EE Program Administrators; 20% annual growth thereafter	2% of annual growth is full heating over period 2022-2023, with annual shares increasing 2% each year, reaching 18% in 2031
RI	Based on 2021 planned installations provided by RI EE Program Administrators; 20% annual growth thereafter	13% of annual growth is full heating in 2022, with annual shares increasing each year until reaching 43% full heating by 2031
VT	2022-2031 values provided by Vermont officials	13% of annual growth is full heating in 2022, with annual shares increasing each year until reaching 43% full heating by 2031

ASHP Adoption Forecast

Includes Assumed Legacy Electric Heat Replacement

Year	Annual ASHP Installs (Thousands)						
	CT	MA	ME	NH	RI	VT	ISO-NE
2022	3.5	21.1	22.2	3.9	2.3	10.7	63.7
2023	4.0	24.3	22.9	5.1	2.7	11.0	70.0
2024	4.6	42.0	23.5	5.6	3.3	11.4	90.4
2025	5.2	59.6	24.3	6.2	3.9	11.7	111.0
2026	6.1	75.5	25.0	6.8	4.7	12.0	130.1
2027	7.0	89.4	25.7	7.5	5.7	12.3	147.5
2028	8.0	103.6	26.5	8.2	6.8	12.7	165.8
2029	9.2	114.3	27.3	9.1	8.2	13.1	181.1
2030	10.6	121.9	28.1	10.0	9.8	12.2	192.5
2031	12.1	128.0	29.0	11.0	11.8	11.5	203.4
Cumulative Total	**70.1**	**779.5**	**254.5**	**73.4**	**59.3**	**118.6**	**1,355.4**
Approx. Share of Households with ASHP in 2031 (%) *	6.2%	28.9%	54.3%	13.9%	15.3%	51.4%	24.3%
Approx. Share of Legacy Electric Heat Replacement **	17%	16%	7%	9%	11%	6%	14%

* Based on Moody's Analytics February 2021 forecast of number of household by state

** Source: U.S. Census Bureau, Selected Housing Characteristics, 2015-2019 American Community Survey 5-year Estimates

Final 2022 ASHP Adoption Forecast

Excludes *Assumed Legacy Electric Heat Replacement*

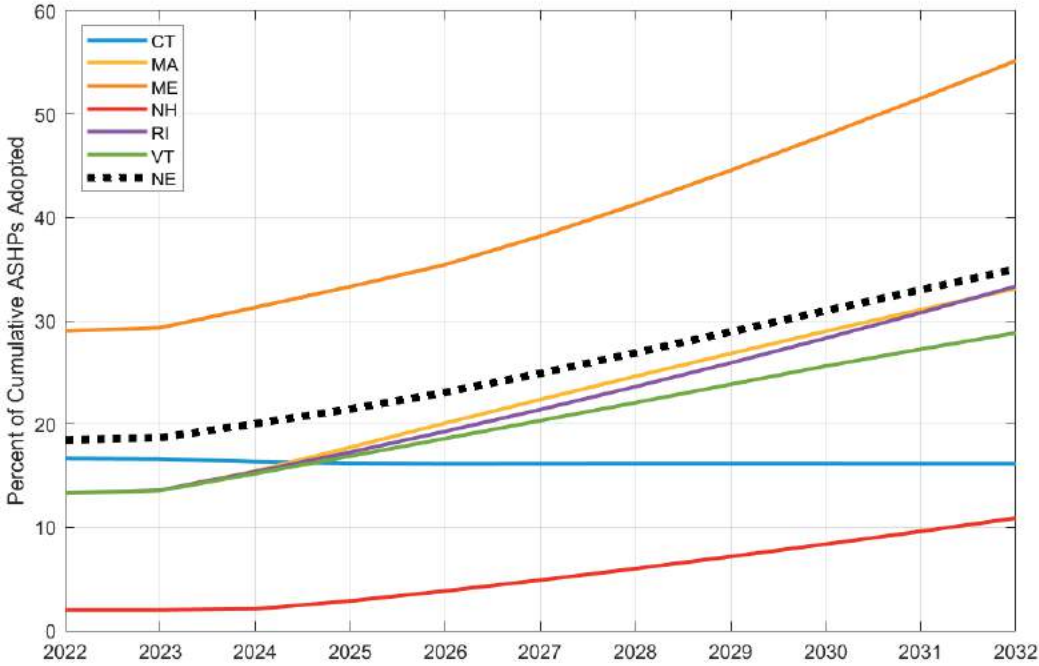
- ASPH adoption values tabulated are net of installations assumed to replace legacy electric resistance heat
  - Assumed state shares of ASHP installations that replace resistance heat are based on state residential shares with electric heat listed as primary heat source in 2019 American Community Survey data (see prior slide)
- Without data to verify otherwise, no net impact on winter energy and demand is assumed for applications with legacy electric heat, recognizing:
  - Some installations will replace active resistance heating systems (resulting in decreased electricity use), but others may replace unused resistance heating systems (resulting in increased electricity use) or result in continued use of resistance or other pre-existing backup systems during cold weather conditions

Year	Annual ASHP Installs (Thousands)						
	CT	MA	ME	NH	RI	VT	ISO-NE
2022	2.9	17.7	20.6	3.6	2.0	10.1	57.0
2023	3.3	20.4	21.3	4.7	2.4	10.4	62.5
2024	3.8	35.3	21.6	5.1	2.9	10.7	79.7
2025	4.3	50.0	22.6	5.6	3.5	11.0	97.1
2026	5.0	63.4	23.3	6.2	4.2	11.3	113.4
2027	5.8	75.0	23.9	6.8	5.1	11.6	128.2
2028	6.6	87.0	24.6	7.5	6.1	11.9	143.7
2029	7.6	96.0	25.4	8.2	7.3	12.3	156.8
2030	8.8	102.4	26.1	9.1	8.7	11..4	166.5
2031	10.1	107.5	27.0	10.0	10.5	10.8	175.6
Cumulative Total	**58.2**	**654.7**	**236.4**	**66.8**	**52.7**	**100.1**	**1,180.5**

Full Heating ASHPs

Shares of Cumulative ASHP Adoption

- Regional shares of forecast ASHP adoption that are assumed to be installed in full heat applications increase over time
  - Partial heating applications are assumed to make up the remainder of ASHP installations
- The growing share of ASHPs in full heating applications drives a significant share of the energy and demand forecast growth in the later years of the heating electrification forecast

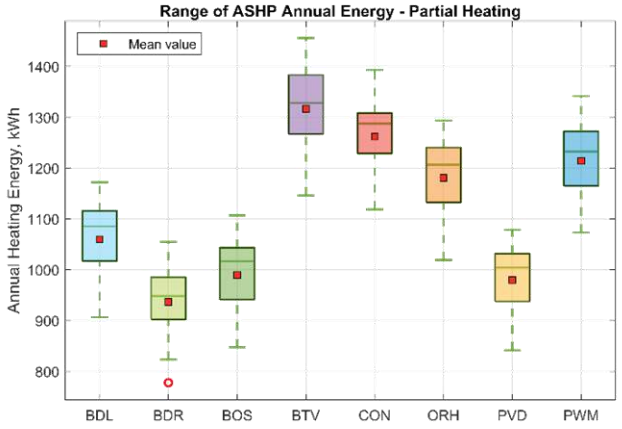


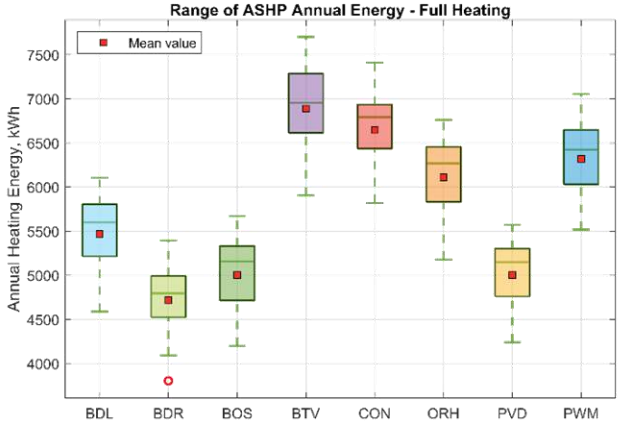
FINAL 2022 HEATING ELECTRIFICATION ENERGY FORECAST

Historical Simulations Using ASHP Models

- Hourly partial and full ASHP profiles were simulated based on regression models and weather over the period 1991-2020 (30 years)
  - Corresponds to the "weather normal" period used for gross energy modeling
- Based on historical weather associated with ISO's 8 weather stations, the boxplots to the right reflect the varying amounts of annual ASHP heating energy (in kWh)
  - Modeled hourly demand is summed to annual heating energy
  - Mean values plotted represent "weather normal" energy per ASHP at each station

City, State	Weather Station
Boston, MA	BOS
Bridgeport, CT	BDR
Burlington, VT	BTV
Concord, NH	CON
Portland, ME	PWM
Providence, RI	PVD
Windsor Locks, CT	BDL
Worcester, MA	ORH





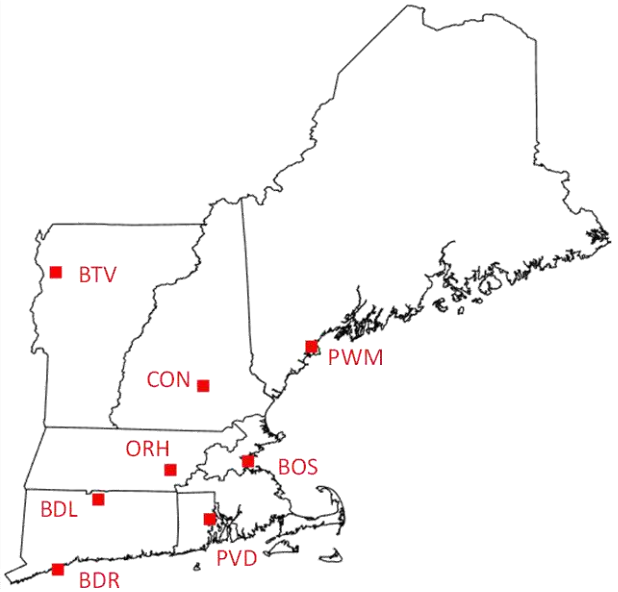
Weather Station Based ASHP Profiles

Station Weights for Each State

State ASHP energy are derived using station weights tabulated below

Weather Station (City, State)	Weather Station	CT	MA	ME	NH	RI	VT
Boston, MA	BOS	-	0.44	-	-	-	-
Bridgeport, CT	BDR	0.17	-	-	-	-	-
Burlington, VT	BTV	-	-	-	-	-	1.00
Concord, NH	CON	-	-	-	1.00	-	-
Portland, ME	PWM	-	-	1.00	-	-	-
Providence, RI	PVD	-	0.27	-	-	1.00	-
Windsor Locks, CT	BDL	0.83	0.16	-	-	-	-
Worcester, MA	ORH	-	0.13	-	-	-	-

Locations of weather stations

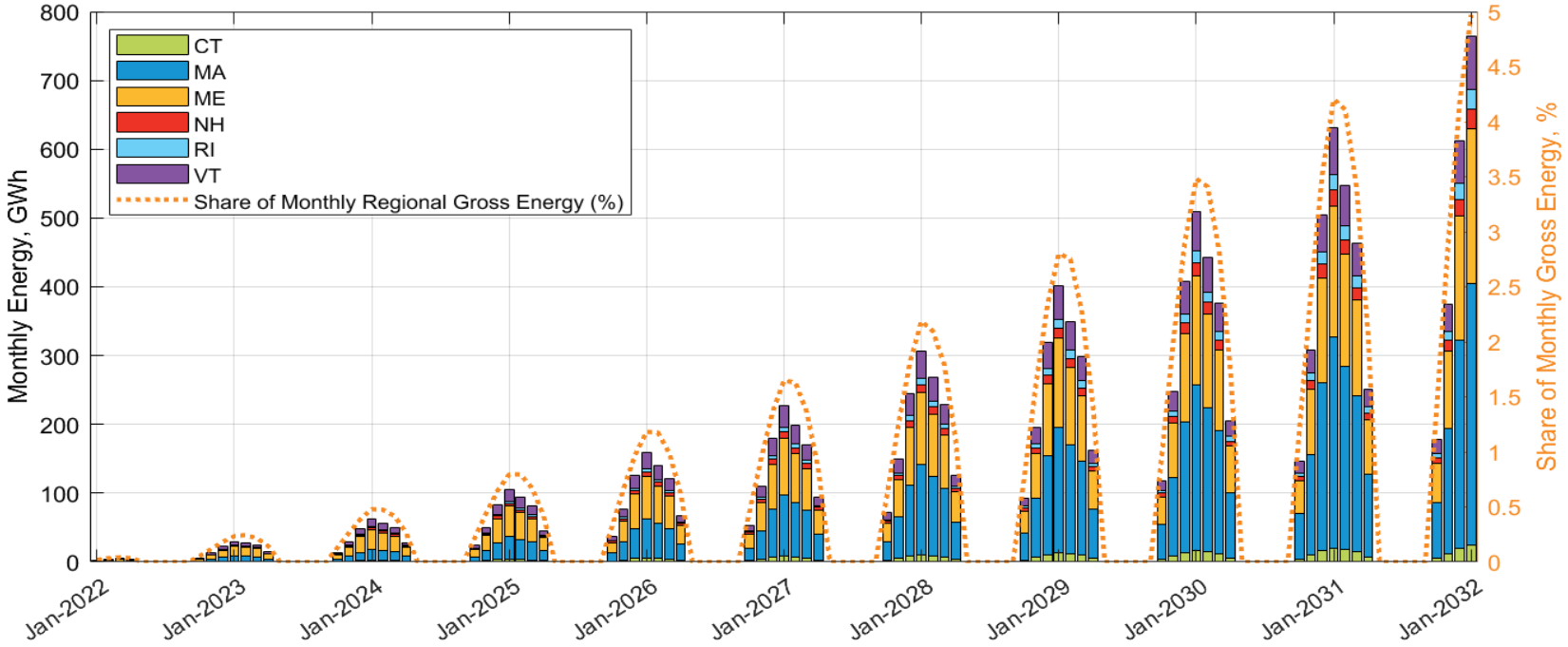


Estimating Energy Impacts of ASHP Adoption

- The process for estimating monthly energy impacts for each state is as follows:
  1. Calculate the mean monthly energy value for the hourly demand simulations generated for each type of ASHP (i.e., full/partial) based on station-level weather described on previous slides
  2. Use station weights tabulated on slide 13 to convert to a state weather basis
  3. Multiply by the appropriate monthly ASHP adoption values for each ASHP type
  4. Sum resulting energy values for both ASHP type (i.e., full + partial ASHPs)
  5. Gross up by 6% to account for assumed transmission and distribution losses, consistent with other forecast processes
- Regional ASHP energy is the sum of the resulting state ASHP energy values
- Refer to slides 37-40 of the ISO's Long-Term Load Forecast Methodology Overview for background information on the methodology used for the gross energy forecast

Final 2022 Heating Electrification Forecast

Monthly Energy, GWh



Final 2022 Heating Electrification Forecast

Annual Energy, GWh

	Annual Energy (GWh)									
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Connecticut	2	8	15	22	30	40	52	65	80	97
Massachusetts	13	46	98	184	306	467	666	906	1,180	1,487
Maine	27	89	157	233	317	413	521	641	775	923
New Hampshire	2	8	16	24	35	47	61	77	96	118
Rhode Island	1	5	10	16	24	35	48	64	85	112
Vermont	10	33	59	88	120	154	193	234	277	320
Total	**56**	**189**	**354**	**566**	**832**	**1,155**	**1,539**	**1,987**	**2,493**	**3,056**

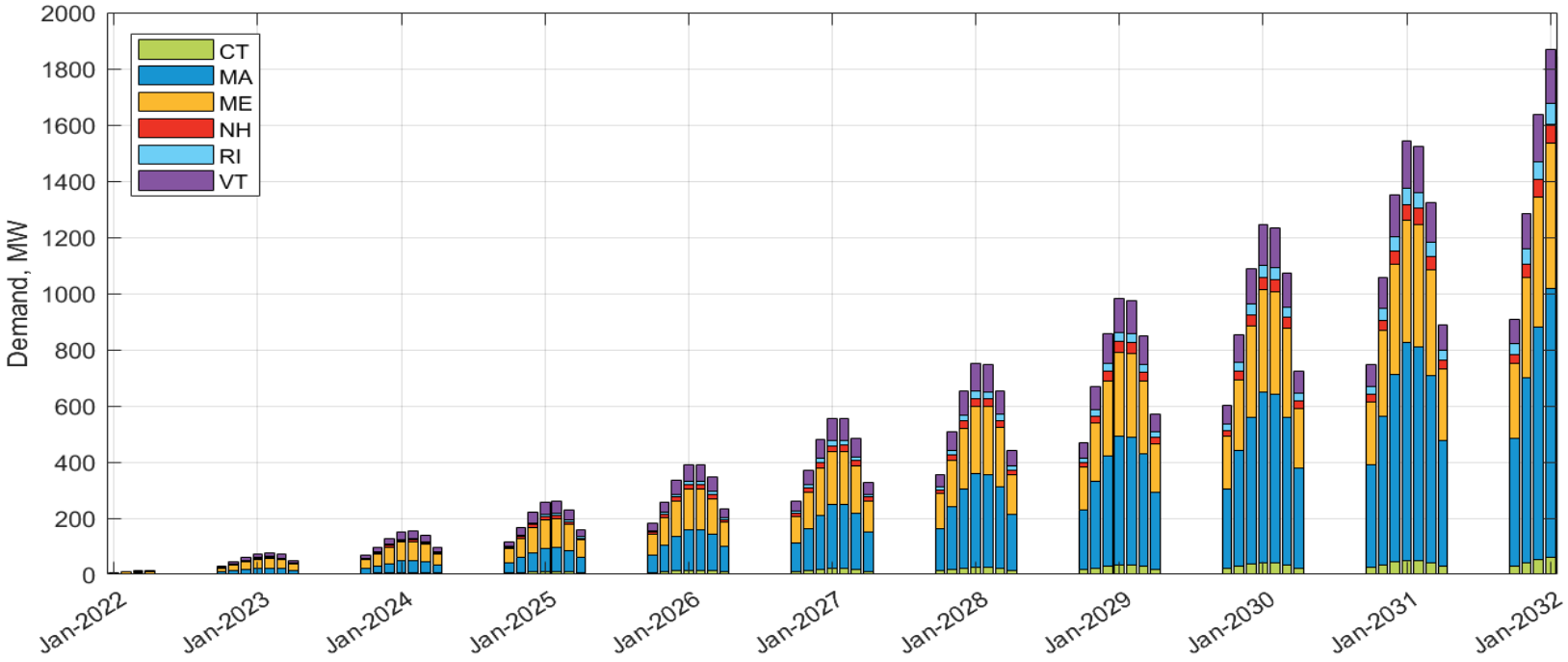
FINAL 2022 HEATING ELECTRIFICATION DEMAND FORECAST

Estimating Demand Impacts of ASHP Adoption

- The weekly weather distributions used to generate weekly gross load forecast distributions are used to estimate monthly ASHP demand impacts for each state as follows:
  1. Input weekly state weather distributions (for each week in a given month) to the hour ending 18 demand regression model for each type of ASHP (i.e., full/partial)
  2. Multiply resulting per ASHP demand value by the appropriate monthly ASHP adoption values for each ASHP type
  3. Sum resulting demand values for both ASHP type (i.e., full + partial ASHPs)
  4. Calculate the "50/50" (i.e., "P95") and "90/10" (i.e., "P99") values for each week of the forecast; maximum 50/50 and 90/10 values in each month are monthly demand forecasts
     - Aligns with the percentiles used in the gross load forecast
  5. Gross up by 8% to account for assumed transmission and distribution losses, consistent with other forecast processes
- Regional ASHP demand is the sum of the resulting coincident state ASHP demand values
- Refer to slides 41-47 of the ISO's Long-Term Load Forecast Methodology Overview for background information on the methodology used for the gross demand forecast

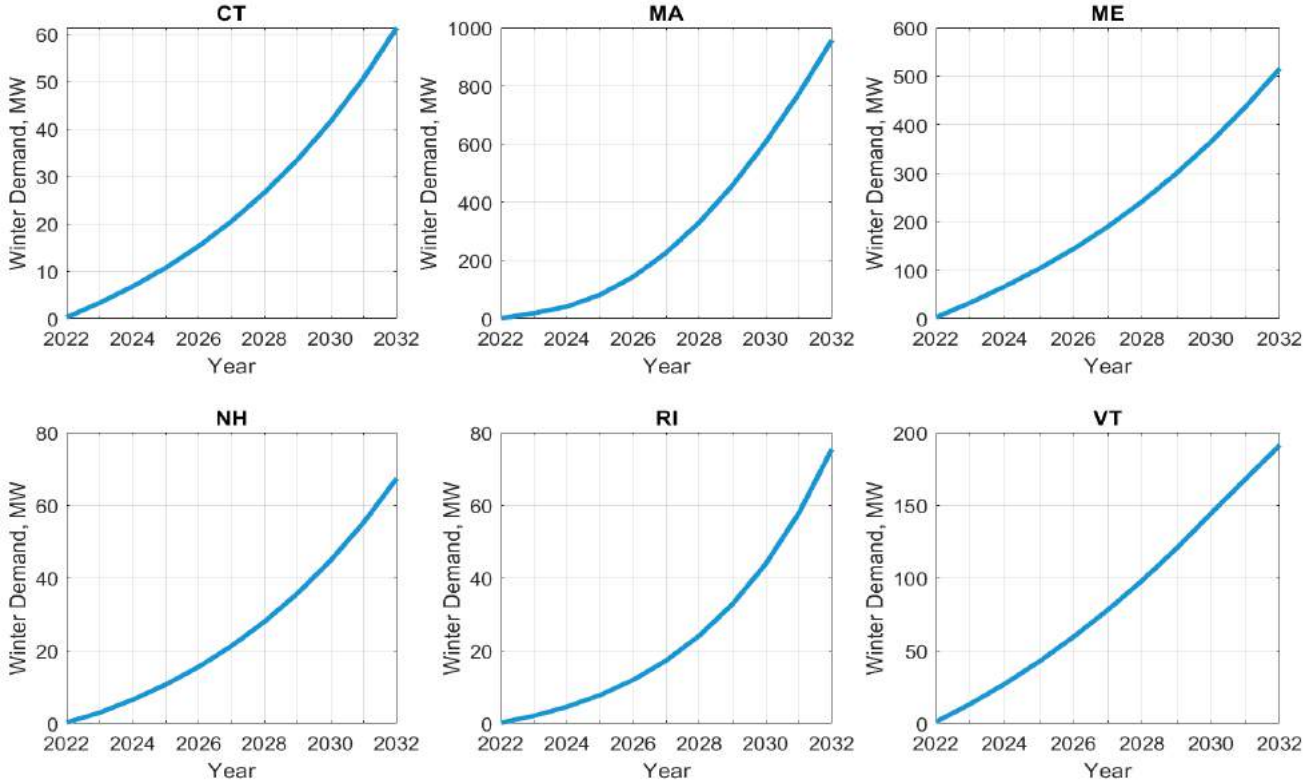
Final 2022 Heating Electrification Forecast

Monthly Demand, MW (50/50)



Final 2022 Heating Electrification Forecast

State-by-State Winter (January) Peak Demand, MW (50/50)



Final 2022 Heating Electrification Forecast

Winter (January) Demand, MW (50/50)

	Winter Peak (MW)									
Year	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Connecticut	3	7	10	15	20	26	34	42	52	63
Massachusetts	17	37	77	137	218	326	449	594	766	962
Maine	31	63	101	144	188	236	294	359	445	533
New Hampshire	3	6	10	15	21	27	35	44	55	67
Rhode Island	2	4	7	12	18	24	33	44	58	78
Vermont	13	26	41	57	76	96	118	145	169	196
Total	**68**	**143**	**247**	**379**	**542**	**736**	**963**	**1,227**	**1,544**	**1,899**

Heating Electrification Forecast

Reporting and Publications

- The final 2022 heating electrification forecast described herein is included in CELT 2022
  - All gross and net energy and demand forecasts reported in both 2022 CELT and in the 2022 Forecast Data workbook are inclusive of heating electrification
  - Breakout of annual energy and seasonal demand are reported in 2022 CELT Section 1.7, and 2022 Forecast Data worksheet 16
- For the 2022 forecast, the state energy and demand heating electrification forecasts are allocated to ISO Load Zones and Regional System Plan (RSP) Subareas based on information obtained during the ISO's annual Multiregional Modeling Working Group (MMWG) network model creation process
  - Load shares by substation are submitted by Transmission Owners, as described in Section 2.3 of the Transmission Planning Technical Guide Appendix J: Load Modeling Guide

Emma B. Gates Apartments
20-24 Castle Street, Worcester, MA
508-635-7109

August 2, 2021

Re: Eversource—Letter of Support for Geothermal Pilot Program in Worcester's Main South

To Whom it May Concern:

On behalf of the Emma B. Gates Apartments, 20-24 Castle Street, I am writing to express our enthusiastic support for the proposed Main South site as a location for Eversource's Geothermal Pilot Program project.

Emma B. Gates Apartments, built in 1887, is a six-unit, historic apartment building located in Main South at the foot of Castle Park and in line with the Castle Street row houses owned by local developer and landlord Frank Zitomersky. Castle Park and Street are named such because it was the site of the Oread Institute, a Castle-like structure, which towered over Main South on Goat Hill. Ely Thayer commissioned the Castle's construction in 1847 to host the Oread Institute, which, at that time was the only all-female collegiate institution in the United States and the second collegiate institution to admit women (the first was Oberlin College). Among many other accomplishments, Thayer, dedicated significant resources to the Kansas Free Soil movement, which opposed slavery's expansion into any new territories or states during the Civil War era.

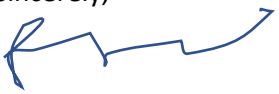
As owners and stewards of the Emma B. Gates Apartments for nearly 30 years now, we are proud of its legacy of innovation, inventiveness, and work for social justice. We believe that this Geothermal Pilot Program is very much in keeping with this legacy and that our Main South community is poised for the type of cooperation, education and commitment required to make a sustainable Geo Block or Grid. We are long time members of Castle Streets community gardens and have worked closely with Main South's numerous non-profits on community and economic development, environmental justice, and affordable housing work. Examples of our readiness and capacity to tackle this endeavor include the investments our community has already made over the last three years with Mass Development through a close knit and active partnership of neighborhood institutions, residents, and small businesses.

The Main South area is densely populated and contains an excellent mix of residential, commercial, and civic uses. This mix lends itself to maximizing the benefits of a Geo Block or grid. Increasingly, the impacts of climate change and prolonged spells of intense heat, underscore the need for clean energy solutions to cool our buildings.

We strongly support efforts and innovations to reduce Main South's overall carbon footprint, while also improving the economic, social and physical well being of our community members.

Please do not hesitate to contact me at your earliest convenience should you have questions, comments or need further information on this matter or any other.

Sincerely,



Scott Hayman, Emma B. Gates Apartments

WORCESTER REGIONAL
CHAMBER OF COMMERCE
RECRUIT | RETAIN | INCUBATE

August 5, 2021

Re: Eversource-Letter of Support for Geothermal Pilot Program for Worcester, MA

To Whom It May Concern:

Please let this letter serve as a letter of support for the proposed Main South site for the above referenced program. The Worcester Regional Chamber of Commerce represents approximately 2,100 member businesses from all industries and of all sizes. Our service area encompasses 35 cities and towns and other communities in Central Massachusetts.

The Chamber is the lead organization for recruiting new businesses to the area, retaining existing industry and attracting a skilled workforce so the region can thrive economically. The proposed Main South neighborhood is well-positioned to flourish if given the opportunity and needed resources. As the second largest city in New England, we continue to see more and more developers and residents move to Worcester and this part of the city is poised to surge in both residential and commercial development.

This innovative pilot project will help achieve the benchmarks set by the Chamber and the City's administration by providing participants with new cost-effective HVAC equipment that not only provides cooling for many who currently do not have air conditioning, but also significantly reduces their carbon footprint.

It is with full confidence that the Worcester Regional Chamber of Commerce supports this project as we believe this site would be an excellent candidate for the proposed Geothermal Program Pilot and welcome the opportunity to continue to work with Eversource.

Thank you.

Yours truly,

Timothy P. Murray
President & CEO

311 Main Street, Suite 200 • Worcester, Massachusetts 01608
T 508.753.2924 | E info@worcesterchamber.org | W www.worcesterchamber.org

Edward M. Augustus, Jr.
CITY MANAGER

CITY OF WORCESTER

July 23, 2021

Re: Eversource – Letter of Support for Geothermal Pilot Program in Worcester

To Whom It May Concern:

I'm writing to express the city's support for the proposed Main South site (see attached) for the Eversource Geothermal Pilot Program. This neighborhood in Worcester checks off many of the boxes for an excellent pilot site. It's in an environmental justice area with a diverse groups of renters and small business owners. Much of the area is controlled by a few, supportive property owners, including Frank Zitomersky, the Main South CDC and Civico. It builds on the significant and ongoing work by MassDevelopment. And it dovetails well with the city's recently completed Green Worcester Plan and the State's recently approved Carbon Roadmap.

The Green Worcester Plan, the Carbon Roadmap and MassDevelopment all include a vision of not just a more sustainable future, but a more equitable and resilient one too. The proposed Main South neighborhood is well-poised to flourish if given the opportunity and resources. This innovative pilot project can help achieve this goal by providing participants with new cost-effective HVAC equipment that not only provides cooling for many who currently do not have air conditioning, but also significantly reduces their carbon footprint.

Based on these expected benefits, we believe that not only can this area meet the Pilot's goals, but also provide additional avenues of benefit for Eversource and the community. Specifically, wouldn't it be nice to be able to tell a story that shows not only the practical benefits, but also the harder to measure societal benefits too? The city has reached out to representatives from both WPI and Clark University to assist us in measuring and documenting these co-benefits, which could be instrumental in helping the technology gain acceptance in traditionally underserved areas. We are looking to measure both the overall effectiveness of the program from a user perspective and how the program can be used to create community resilience through the sharing of information (including non-financial benefits, such as improved comfort, participant's reduced carbon footprints, and general pride of place for helping implement leading edge technology) regarding the Pilot.

We believe this site would be an excellent candidate for the proposed Geothermal Program Pilot and would welcome the opportunity to work with Eversource on this important project.

Edward M. Augustus, Jr.
City Manager

OFFICE OF THE CITY MANAGER, CITY HALL, WORCESTER, MASSACHUSETTS 01608
TELEPHONE (508) 799-1175 FAX (508) 799-1208
EMAIL: citymanager@worcesterma.gov

Taylor Bearden, Partner
Civico Development, LLC
2 Tammie Road
Hopedale, MA 01747

August 6, 2021

Nikki Bruno, Director
Clean Technologies
Eversource Energy
300 Cadwell Drive
Springfield, MA 01104

RE: Eversource Geothermal Pilot Project | Letter of Support for Worcester's Main South Community

To Whom It May Concern:

I am writing on behalf of Civico Development, LLC to express my support for the Eversource GeoBlock pilot and my endorsement of Worcester's Main South as the host community for the project. Civico is a community-focused real estate investment and development group committed to quality design, historic preservation, and neighborhood-oriented infill development. Our work in Worcester has leveraged over $15MM of private investment into energy retrofits of neighborhood housing stock. Additionally, we are developing a historic mill complex into 64-units of mixed-income housing in the heart of the Main South.

I was educated at Clark University, am a current Main South resident, and an investor in this neighborhood. I feel strongly that our community is well-positioned to support Eversource in this pilot. Importantly, Eversource would be enthusiastically welcomed *through the entire process*. The Main South's combination of grassroots and institutional support, progressive City governance, and legacy of collaborative problem solving are an invaluable combination that make enduring public-private partnerships possible.

I recently had the privilege of attending HEET's GeoMicroDistrict Listening Session in Boston and was impressed by the diverse group of stakeholders convened in service of a successful pilot. Although it is in our best interest as a Commonwealth to advance these technologies for everyone, the Main South has the diversity, commitment, and institutional support to host a successful pilot project which could provide a viable template for the rest of the Commonwealth.

Thank you for your commitment to advancing these important technologies.

Sincerely,

Taylor W. Bearden

JAMES P. McGOVERN
SECOND DISTRICT, MASSACHUSETTS

CHAIRMAN
COMMITTEE ON RULES

SENIOR DEMOCRATIC WHIP

Congress of the United States
House of Representatives

408 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-2102
(202) 225-6101

12 EAST WORCESTER STREET, SUITE 1
WORCESTER, MA 01604
(508) 831-7356

94 PLEASANT STREET
NORTHAMPTON, MA 01060
(413) 341-8700

24 CHURCH STREET, ROOM 27
LEOMINSTER, MA 01453
(978) 466-3552

August 12, 2021

To Whom It May Concern:

I am writing to add my support for Eversources's pilot networked geothermal project in Main South Worcester.

Now more than ever, our global community is reminded daily of the stark reality of the effects of climate change. The time to act – in ways big and small – is now. By focusing on what our communities can do together to address climate change we can ensure that we pass along a better world to our children.

I am proud to have played an active role of Main South's ongoing efforts for revitalization that protects its residents and small businesses. I know all the players at the table that are advocating for this project and can attest to their collaborative talent, commitment, and mutual trust. I can assure you that, should Main South be selected for this pilot, these community partners will stay at the table and work through the inevitable challenges this project will face.

As we tackle climate change effectively, we must do it together – across all spectrums of our neighborhoods. I stand with Main South leadership in this fight and ask for your full and fair consideration of their application. If I can be of further assistance, please don't hesitate to contact me.

Sincerely,

James P. McGovern
Member of Congress

Main South Community Development Corporation
875 Main Street
Worcester, Massachusetts 01610
(508) 752-6181 / FAX (508) 797-4514

J. Stephen Teasdale, Executive Director
Hilda Ramirez, President

July 27, 2021

Re: Eversource – Letter of Support for Geothermal Pilot Program in Worcester

To Whom it May Concern:

On behalf of the Main South CDC, I am writing to express our support for the proposed Main South site as a location for Eversource's Geothermal Pilot Program project.

The Main South CDC is a neighborhood-based community development corporation serving a lower income, largely minority population in one of Worcester's inner-city neighborhoods. The agency was incorporated in 1986 and was established as the result of a partnership between neighborhood residents and Clark University officials who both shared common concerns about the ongoing cycle of disinvestment and blight that was perpetuating the economic decline of the area. Since its establishment, the Main South CDC has proven to be a successful agent for transformative change. It has developed over 350 units of affordable housing, undertaken various economic development projects, worked on youth violence prevention and small business initiatives.

Eversource's Geothermal Pilot program would be ideally suited supporting the CDC's neighborhood revitalization efforts and specifically to the proposed Main South site for several reasons.

Firstly, the project and the proposed site complements the investment and work being done in this section of the neighborhood as part of Mass Development's Transformative Development Initiative. For the last three years, Mass Development and a partnership of neighborhood institutions and stakeholders have been working to improve the aesthetic appeal of this section of the neighborhood with a focus on small business development and the creation of economic opportunity and growth. The work here is driven by principles of racial equity, social justice and economic inclusion. The Geothermal project offers the opportunity to provide clean energy at lower cost to lower income renters and homeowners in this lower income community.

Secondly, the proposed site offers a spatially concentrated assortment of residential and commercial businesses that have been identified as interested participants in the Eversource

project. Due to the high population density in this area a proportionately large number of residents and businesses could benefit from this opportunity whilst keeping infrastructure costs within manageable proportions.

Thirdly, many of the buildings that would incorporate the geo-thermal technology have outdated heating systems that are not energy efficient and leave a high carbon footprint. The geo-thermal technology corrects this. Additionally, urban neighborhoods are increasingly becoming "heat sinks" as climate change results in progressively hotter temperatures. With little shade and high residential densities residents in urban neighborhoods need access to air conditioning for both comfort and health reasons. The Eversource proposal will provide for air conditioning in residential and business units and as such will further environmental justice objectives.

We hope that Eversource will select the proposed Main South site for one of its geothermal pilot projects. It would continue the revitalization efforts underway in this diverse community, provide healthier living environments for low-moderate income renters and homeowners and reduce the area's carbon footprint.

Thank you for your consideration.

Sincerely,

J. Stephen Teasdale, Executive Director
Main South CDC
(508) 752-6181

The City of WORCESTER

SARAI RIVERA
District 4 City Councilor

City Hall, Room 310
445 Main St.
Worcester, MA

August 10, 2021

To Whom It May Concern:

As the elected local district councilor for Main South, including the area of interest for the Eversource Network Geothermal pilot, I am writing to express my great support for this effort. I stand ready to assist in any manner to make this pilot a success for our small neighborhood and our City.

The Worcester City Council, under the leadership of Mayor Joe Petty and City Manager Ed Augustus, has adopted the Worcester Green Energy Plan (attached). The Plan was adopted unanimously in April of 2021. Its overarching goal is "making Worcester one of the most sustainable and climate-resilient mid-sized cities in America by 2050."

Main South is an area of great diversity in all arenas. I believe that a project such as this will greatly expand our understanding of the opportunities and challenges of replacing gas energy with renewable ground source heat pumps. I will be proud that such knowledge occurs as a result of Main South's participation.

Sincerely,

Sarai Rivera
Worcester City Councilor – District 4

Room 310, City Hall ■ 455 Main Street ■ Worcester, Massachusetts 01608-1889
Telephone (508) 799-1049 ■ Fax (508) 799-1194
E-Mail: RiveraSA@worcesterma.gov

FOR YOUTH DEVELOPMENT®
FOR HEALTHY LIVING
FOR SOCIAL RESPONSIBILITY

YMCA of Central Massachusetts

David Connell
President and CEO

Polly A. Tatum, Esq.
Chair, Board of Directors

Association Service Center
766 Main Street
Worcester, MA 01610
P 508.755.6101
ymcaofcm.org

Boroughs Family Branch
4 Valente Drive
Westborough, MA 01581

Central Community Branch
766 Main Street
Worcester, MA 01610

Greendale Family Branch
75 Shore Drive
Worcester, MA 01605

Leominster Community Branch
108 Adams Street
Leominster, MA 01453

Montachusett Community Branch
55 Wallace Avenue
Fitchburg, MA 01420

Tri-Community Family Branch
43 Everett Street
Southbridge, MA 01550

Mission Statement
The YMCA of Central Massachusetts is an association united in a common goal to strengthen our communities and to develop the spirit, mind and body of all persons, regardless of means, through activities guided by and based upon our core values of caring, honesty, respect and responsibility.

August 2, 2021

To Whom It May Concern,

On behalf of the YMCA of Central Massachusetts, I am writing to express support for the Eversource Geothermal Pilot Project to be located in the Main South District. The YMCA of Central Massachusetts is committed to its vision and has renewed its commitment to youth development, healthy living and social responsibility. Our Y is uniquely positioned to be that organization – a place where young people, families, seniors have the space and support they need to act on what is important to them. Situated in the heart of the Commonwealth, we can be a platform for empowering communities to create positive change. This is only possible when the Y is there for all, where we work tirelessly to achieve our mission: *to be an Association united in a common goal to strengthen our communities and to develop the spirit, mind and body of all persons, regardless of means, through activities guided by and based upon our core values of caring, honesty, respect and responsibility.* This mission has guided our institution for 157 years, delivering impactful programs and services that address community needs.

The Y's urban centers and in particular the Central Community Branch, located as a major anchor of the TDI District provides a great opportunity in supporting the next generation of leaders and transformational thinking to some of the issues associated within our City. Poverty, food insecurity, substance abuse and substandard education, for example, pose a real threat to parents desperately trying to raise young families. Factors relative to social determinants of health are also barriers to advancement. Within this space we believe that current and future investment like the "Geothermal Pilot Program" will support our agenda for a more equable community. Our Central Branch serves over 1,000 people on a daily basis that includes childcare, before and after school programs, teens, seniors and families. During the last 17 months, the Y has served 1.4 million meals, housed over 1,500 children in child care and camps and supported over 500 teens. This was done while supporting over 3,500 struggling members as they rebuild from COVID-19. In addition, the location serves as the hub for local and state meetings and we are reminded that the YMCA Fuller Family Park provides safe, green space for hundreds of community families and friends.

The YMCA welcomes this project in our neighborhood. As a non-profit organization with property, programs and people, we encourage anything positive that will improve the overall environment of our community and will work with state, local, business and leaders to fulfill this goal.

Sincerely,

David Connell
President and CEO

MassDevelopment

89 Shrewsbury Street
Suite 300
Worcester, MA 01604

Main: 508-363-2799
Fax: 508-363-2976

massdevelopment.com

August 5, 2021

Re: Eversource-Letter of Support for Geothermal Pilot Program for Worcester, MA

To Whom It May Concern:

Please let this letter serve as a letter of support for the proposed Main South site for the above referenced program.

Since 2018, MassDevelopment has been heavily invested in neighborhood scale economic-development in the Main South neighborhood through our Transformative Development Initiative (TDI) program. TDI is a neighborhood accelerator for Gateway Cities that brings a toolbox of resources to a commercial within a district within a city to focus on a variety of work that leads to increased neighborhood vibrancy and equitable economic development. Our vision is a connected network of Gateway Cities in which sustainable, restored market conditions more accurately reflect the promise of the community.

In Main South, TDI has been working with a cross-sector local partnership, including the City, the Main South Business Association, local property owners and residents, the Main South Community Development Corporation, the Worcester Regional Environmental Council, the YMCA of Central Massachusetts, and Clark University. The work has been heavily focused on amplifying the neighborhood as a unique, diverse commercial district. While public perception is often that Worcester is economically booming, the city's recent success is uneven across the city. Main South struggles with long held perceptions of safety and disinvestment, and many of MassDevelopment's efforts have been focused on changing those perceptions on a local and regional level, as well as helping shore up local businesses, many of which are culturally unique and are long-time community institutions. A recent success has been the establishment of the Main South Business Association, an effort to coordinate the neighborhood business owners and entrepreneurs to bring positive change to the neighborhood. In addition, the TDI Partnership, aided by MassDevelopment technical assistance, is in the process of finalizing cohesive branding, identity banners, mapping and brochures. The TDI Partnership continues to complete focused work, together with the City management, on quality of life and public safety for residents.

A core aspect of the TDI program is the placement of a full time MassDevelopment staff member in the neighborhood to work with the partnership on local initiatives. Fellow Ivette Olmeda is entering her fourth year of this fellowship working with local partners, stakeholders, and neighbors. As an economic development organizer, who already has years of credibility built with the neighborhood, Ivette is a critical resource for helping consolidate participation in a geothermal microgrid in the neighborhood. We are also

currently meeting with City officials to discuss launching our Property Assessed Clean Energy (PACE) program, which can perfectly complement the geothermal micro-grid project by reducing energy usage loads from buildings and therefore the micro-grid's sizing costs.

In addition to hiring Ivette, MassDevelopment has invested over $500,000 in other neighborhood-level projects since 2018 through TDI, including neighborhood planning and marketing technical assistance, small business grant supports, and funding for key arts and cultural economy projects. As part of the real estate portion of our work, we are working with many of the major property owners in the neighborhood, including Zu Architecture, the Main South CDC, and Civico development. These three entities alone control many properties in the neighborhood with a variety of uses, ranging from housing to industrial. Our local relationships will also allow us to approach individual property owners credibly, so that the appropriate use and location mix for the pilot can be obtained.

The TDI staff at MassDevelopment believe that innovative pilot projects, such as this one through Eversource, should be made available in an equitable way—often overlooked urban neighborhoods like Main South should have a shot at accessing the latest technology, and communities that are vulnerable from an environmental justice standpoint deserve to see major investments in renewable energy. We hope that our investments in the neighborhood in the past several years will help give Eversource the confidence to invest along with us—we have the necessary partnerships and organizational capacity already in place: let's leverage that difficult work to make the geothermal micro-grid pilot a reality.

Sincerely,

Ivette Olmeda

MassDevelopment Transformative Development Initiative Fellow

Shyla Ruffer Matthews

Shyla Ruffer Matthews, CCIM

MassDevelopment Vice President of Community Investment

CITY OF

Worcester
MASSACHUSETTS

JOSEPH M. PETTY
MAYOR

City Hall • Room 305
455 Main Street
Worcester, MA 01608-1892

Office: 508-799-1153
Fax: 508-799-1156
mayor@worcesterma.gov

August 5th, 2021

Re: Eversource – Geothermal Pilot Program in Worcester

To Whom It May Concern:

I am writing to express my support for the proposed Main South Geothermal Pilot Program in the City of Worcester. As part of the Green Worcester Plan we are partnering with various organizations to diversify our power sources and ebb the tide of our reliance on fossil fuels; geothermal energy is a terrific complement to our solar arrays in which we have invested heavily.

For too long advances in energy efficiency have been reserved for the economically advantaged and out of reach for those most in need of relief in their utility bills; people like the population of the Main South neighborhood who are often living in older, multifamily homes with outdated physical plants.

This project also represents a tremendous opportunity to create a collaboration between a private property owner, a neighborhood in dire need of updating and investment in its infrastructure, and community organizations. I offer this letter of support without hesitation nor reservation. Should you have any questions do feel free to reach out to my office at 508-799-1153.

Sincerely,

Joseph M. Petty

Main South
Beacon Brightly
Neighborhood Association

July 28th, 2021

To Whom it May Concern:

I am writing on behalf of the Main South Beacon Brightly Neighborhood Association (MSBBNA) to express support for the Eversource Geothermal Pilot Project to be located in the Main South neighborhood. The MSBBNA is a neighborhood association formed in 1990 comprised of residents, property owners, and agencies that have been working continuously to build community capacity and improve the quality of life in our neighborhood.

We are excited and hopeful about the opportunity for the geothermal project to be piloted in our MSBB neighborhood. We would be happy to assist in educating the MSB community about this initiative, and help to identify properties that are willing to participate. The MSBB neighborhood is one of the most densely populated, with the most racially, culturally, and economically diverse community in our city. The MSBB uses an equity justice lens to improve our neighborhood- looking at racial equity, social justice, economic justice, and environmental justice. Thus, this initiative fits in with our principles of equitable community development and sustainability, allowing for cost-effective HVAC equipment, which will both decrease our carbon footprint and provide cooling to many low-moderate income residents.

The MSBB neighborhood association and all its partners has a strong history of collaboration, and this project would build-upon many current and past initiatives. We are most hopeful for the consideration and would look forward to collaborating with you on this important initiative- for not just the Main South neighborhood but for our city.

Sincerely,

Brenda Jenkins

Maritza Cruz

Brenda Jenkins, Co-Chair

Maritza Cruz, Co-Chair

REGIONAL ENVIRONMENTAL COUNCIL

August 9, 2021

To Whom It May Concern,

On behalf of the Regional Environmental Council, I am writing to express our support for the proposed Main South site as a location for Eversource's Geothermal Pilot Program.

The Regional Environmental Council (REC) is a grassroots food justice organization with deep roots in environmental justice organizing in Worcester for the past 50 years. Our mission is to bring people together to create a just food system and to build healthy, sustainable, and equitable communities in Worcester, MA and beyond. While our current programs focus primarily on increasing access to healthy local food and building resilient local food systems, we see environmental sustainability as integral to realizing that vision.

Our offices are located in the heart of Main South, on Castle Street, adjacent to the city's oldest community garden and blocks from our urban farm site, where our YouthGROW program operates. Our neighbors here in Main South include the families of YouthGROW participants, community gardeners who participate in our garden network, and customers at our farmers market. They also include a close-knit network of small businesses and community organizations with a deep history of collaboration. These relationships have only been strengthened by the support and investment of Mass Development over the past three years.

In parallel to this, our neighborhood is already feeling the disproportionate impacts of the climate crisis. Our youth have spent the summer working with Northeastern University to support community-based research around extreme temperature events and understand what is needed to improve community resilience. We know that clean energy solutions are fundamental to this work and strongly support efforts to reduce Main South's overall carbon footprint. Our neighborhood is ready and well positioned to support Eversource in this pilot.

Please feel free to reach out to me with further questions,

Grace Sliwoski

Grace Sliwoski

grace@recworcester.org

Director of Programs

The Commonwealth of Massachusetts
House of Representatives
24 Beacon Street, Boston, MA 02133

Mary S. Keefe
State Representative • 15th Worcester District
Mary.Keefe@mahouse.gov • (617) 722-2017

August 6, 2021

Bill Akley, President
Eversource Gas
247 Station Drive
Westwood, MA 02090

Re: Eversource – Letter of Support for Geothermal Pilot Program in Worcester

Dear Mr. Akley:

I am writing to express my support for the proposed Main South site (see attached map) for the Eversource Geothermal Pilot Program. This neighborhood in Worcester satisfies many of the criteria for an excellent pilot site. It's in an environmental justice area with a diverse group of renters and small business owners. Much of the area is controlled by a few, supportive property owners, including Frank Zitomersky, from the Main South CDC and Civico. It builds on the significant and ongoing work by MassDevelopment and it dovetails well with the city's recently completed Green Worcester Plan and the state's recently approved Carbon Roadmap.

The Green Worcester Plan, the Carbon Roadmap and MassDevelopment all include a vision of not just a more sustainable future, but a more equitable and resilient one too. The proposed Main South neighborhood is well-poised to flourish if given the opportunity and resources. This innovative pilot project can help achieve this goal by providing participants with new cost-effective HVAC equipment that not only provides cooling for many who currently do not have air conditioning, but also significantly reduces their carbon footprint.

Based on these expected benefits, we believe that not only can this area meet the pilot's goals, but also provide additional avenues of benefit for Eversource and the community. The city has reached out to representatives from both WPI and Clark University to assist with measuring and documenting the projected benefits, which could be instrumental in helping underserved constituents accept the technology. We are looking to measure both the overall effectiveness of the program from a user perspective and how the program can be used to create community resilience through the sharing of information (including non-financial benefits such as improved comfort, participant's reduced carbon footprints, and general pride of place for helping implement leading edge technology) regarding the pilot.

We believe this site would be an excellent candidate for the proposed Geothermal Pilot Program and would welcome the opportunity to work with Eversource on this important project. Please do not hesitate to contact my office if you have any questions.

The Commonwealth of Massachusetts
MASSACHUSETTS SENATE
OFFICE OF THE PRESIDENT EMERITA

SENATOR HARRIETTE L. CHANDLER
PRESIDENT EMERITA
First Worcester District

State House, Room 333
Boston, MA 02133-1053
Tel: (617) 722-1544

Harriette.Chandler@MAsenate.Gov
www.MAsenate.Gov

To Whom It May Concern:

I write in support of locating Eversource's Geothermal Pilot Program in Worcester's Main South site. As one of two state Senators who represents the City of Worcester, and as a passionate advocate for clean energy and environmental justice, I enthusiastically welcome Eversource's Geothermal Pilot proposal and believe that Main South, an environmental justice community, is uniquely positioned to benefit from and collaborate on the development of this innovative clean energy system.

I have worked with my colleagues in the Legislature to draft and pass legislation to achieve net-zero carbon emissions by 2050. This Pilot Program offered by Eversource implements many key components outlined and enshrined by Beacon Hill's clean energy agenda. Most specifically, the use of efficient clean heating pumps reduces our reliance on harmful fossil fuels, and can accelerate Worcester and the Commonwealth's progress towards reducing their overall carbon footprint.

Worcester has experienced tremendous economic development over the past decade. And much of that progress is thanks to an open and collaborative City Government and civic community. As you are already aware, multiple community organizations, constituents, municipal leaders, and businesses people alike have testified in support of locating this Pilot at the Main South site. This overwhelming demonstration of unified support is a testament to the community's willingness and ability to partner with Eversource in developing this ground-breaking clean energy grid.

It would be a tremendous privilege for my City to accept such a pilot program, not only for the opportunity to build a state-of-the-art clean energy grid, but to ensure that future generations of diverse Worcester residents are protected from the harmful effects of fossil fuels. I once again reiterate my support, and am available to you if you have any questions or concerns.

Sincerely,

Harriette L. Chandler

HARRIETTE L. CHANDLER
State Senator
First Worcester District

August 5, 2021

RE: Geothermal Pilot Program

To Whom it May Concern:

On behalf of the Main South Transformative Development Initiative (TDI) Partnership, we are writing to express support for the Eversource Geothermal Pilot Project to be located in the Main South District. The Main South TDI Partnership is a cross-sector partnership focused on economic development in the Main South neighborhood. As a representative group of Main South stakeholders, we would welcome this project in our neighborhood.

Piloting this project in the Main South neighborhood is appropriate for many reasons. Firstly, as an environmental justice area, our neighborhood struggles with inadequate access to healthy food, inadequate transportation, unsafe homes, few green spaces and few trees, and an abundance of impervious surfaces. Any opportunity to reduce our carbon footprint, promote sustainability, and cut heating costs is welcome. Secondly, this project builds-upon the community development work in the neighborhood our partnership is working on. Lastly, as a united neighborhood with a strong sense of community and relationships amongst residents, business owners, and agencies, our ability to communicate and collaborate is strong.

Again, the Main South TDI partnership is supportive of locating this pilot project in the Main South district, and would do what we can to promote the initiative.

Sincerely,

Ivette Olmeda

Ivette Olmeda
TDI Fellow - Worcester
Transformative Development Initiative (TDI)

WCG

WORCESTER COMMON GROUND, INC.

wcgcdc.org

a Community Development Corporation

Re: Eversource – Letter of Support for Geothermal Pilot Program in Worcester

To Whom It May Concern:

I am writing on behalf of Worcester Common Ground CDC which abuts the Main South CDC as one of the two neighborhood-based community development corporations that encompass the identified area of interest for this project.

Worcester Common Ground wholeheartedly supports the Main South site for Eversource's Networked Geothermal Pilot Program. As such we commit to working with Eversource on community outreach, education, and consumer buy-in for this effort.

Worcester Common Ground owns property within the targeted area (5 Piedmont Street) and commits to having evaluation discussions including this property as to its appropriateness to be included in the pilot. This building, in addition to housing our corporate offices, consists of 12 units of affordable housing and ground floor leased office space.

Like the Main South CDC, we are a well-established organization with a rich history of transformative change, including not only affordable housing but also community gardens, a bioshelter and rooftop hydroponic greenhouse. Our commitment to environmental justice is further demonstrated in our latest project on Chandler Street where we are installing air source heat pumps.

Worcester Common Ground believes that this project is an important and necessary step in addressing our hazardous dependence on fossil fuel. We welcome the opportunity to advocate for the pilot program to be located in Main South for both our planet and our residents.

Sincerely,

Yvette Dyson

Yvette Dyson, Executive Director