



**FILED VIA ePUC**

March 3, 2025

Holly R. Anderson  
Clerk of the Commission  
112 State Street  
Montpelier, VT 05620-2701

Re: Case No. 24-3460-INV, Public Utility Commission investigation into thermal energy exchange networks pursuant to Act 142 of 2024

Dear Ms. Anderson:

Public Act No. 142 (2024) directs the Vermont Public Utility Commission (“Commission”) to file a report by December 1, 2025, with House and Senate committees “on how to support the development of thermal energy exchange networks and the permitting of thermal energy exchange network providers.”<sup>1</sup> By Order dated November 19, 2024, the Commission opened an investigation to gather information for the report and requested that interested parties file information or suggestions related to permitting, construction, operations, and rates of thermal energy exchange networks. Accordingly, Vermont Gas Systems, Inc. (“VGS”) is pleased to offer the following comments.

*i. VGS’s Relevant Experience*

VGS has been engaged in exploratory work around the feasibility of providing geothermal services to customers for the past few years. In July 2022, VGS provided notice to the Commission that we were conducting exploratory work for various geothermal projects.<sup>2</sup> In that filing, we discussed the many benefits of geothermal systems and how utilities could play a critical role in overcoming market barriers and improving accessibility in Vermont. Shortly thereafter, we provided notice to the Commission of our intent to participate in a geothermal project at the Rutland Regional Medical Center campus that presented valuable opportunities for the customer’s carbon reduction and VGS’s research and development. Although we did not ultimately participate in that project,<sup>3</sup> VGS has continued to explore geothermal initiatives and partnerships.

Working with a diverse stakeholder group including town planners, developers, and geothermal system designers and installers, we have conducted feasibility studies for several multi-customer projects in our current service area. The feasibility studies considered site geology, capital costs for the outside equipment, installation costs for the inside equipment, and expected energy and maintenance costs for the end customer. The projects we have explored range from large multi-

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<sup>1</sup> Public Act No. 142, 2024 Vt., Adj. Sess., at 21.

<sup>2</sup> See Case No. 22A-3045, correspondence of Jill Pfenning, dated July 29, 2022.

<sup>3</sup> See Case No. 22A-4238, correspondence of Jill Pfenning, dated September 27, 2022, and Commission Order dated November 15, 2022.

family market rate apartment buildings to mixed residential developments with permanently affordable apartments and townhomes. VGS is currently partnering with Champlain Housing Trust on plans for a community-scale geothermal project for low-income homes in Hinesburg, known as Windy Ridge.<sup>4</sup>

Utility-style geothermal systems could closely resemble VGS's existing gas distribution business. Construction of geothermal systems, like gas distribution, involves installing underground piping, designed to last up to fifty years, and serving multiple customers or entire neighborhoods. Service and maintenance involve servicing energy infrastructure and maintaining integrity and reliability over its useful life. And service charges involve recovering costs over time through periodic charges like those found on customer bills today.

We note that our financial analysis has included customer cost comparisons for existing gas customers, new customers that would connect to our gas system, and other non-gas customers outside our current service area. It is no surprise that because of the low monthly cost of natural gas, geothermal services for existing gas customers or new construction that would otherwise connect with the gas system are not competitive with the use of natural gas when the up-front costs of installation for geothermal are recovered directly from those customers. That said, geothermal services may be more viable from a customer cost perspective in jurisdictions that have a primary renewable energy mandate for new construction, such as Burlington and South Burlington, where natural gas is no longer an option as a primary heating source for newly built homes. Additionally, if VGS were to provide geothermal service to customers beyond its gas infrastructure and current service area, those customers would likely experience savings as compared with other thermal energy options (oil and propane, for example) and a greater benefit in reducing the state's greenhouse gas emissions.

We believe geothermal networks are a promising decarbonization path and that VGS has great potential to facilitate their expansion in Vermont. We are eager to support the Commission in its review of geothermal networks.

## *ii. Construction and Operation*

Geothermal systems are considered the most efficient heating and cooling systems available. According to the U.S. Environmental Protection Agency, "For every unit of electricity used in operating the system, the heat pump can deliver as much as five times the energy from the ground."<sup>5</sup> Ground Source Heat Pumps used in geothermal systems ("GSHPs") typically have an efficiency rating between 3.0 and 5.0. This means for every unit of energy input into the GSHP,

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<sup>4</sup> The Windy Ridge project was awarded a U.S. Department of Energy grant to support design and installation. VGS expects to file a detailed innovation notice with the Commission once project funding is confirmed. Note that Act 142 expressly allows companies already regulated by the Commission to pursue thermal energy exchange network projects prior to completion of the Commission's study. Public Act No. 142 (2024 Vt., Adj. Sess.) at 21.

<sup>5</sup> U.S. Department of Energy, *Guide to Geothermal Heat Pumps* (February 2011), available at [https://www.energy.gov/sites/prod/files/guide\\_to\\_geothermal\\_heat\\_pumps.pdf](https://www.energy.gov/sites/prod/files/guide_to_geothermal_heat_pumps.pdf).

it can generate 3-5 times *more* output. High efficiency natural gas furnaces are rated around 0.97, and the best boilers are around 0.95. There is no other thermal technology currently that outperforms GSHPs.

Because geothermal uses the steady temperatures of the earth, it is considered a renewable resource, requiring very little energy to extract. Any greenhouse gas emission associated with geothermal system operation comes only from the electricity source powering the GSHP. In areas of Vermont where the electric utility has 100% carbon-free electricity, a geothermal system carrying the complete thermal load of insulated buildings could virtually eliminate heating emissions. By displacing traditional oil, propane, or natural gas, geothermal systems can deliver a meaningful carbon benefit for generations.

Geothermal systems heat and cool a building by transferring energy to and from the earth. In Vermont, the temperature underground is close to 50 degrees Fahrenheit year-round, presenting a renewable and consistent energy source. A geothermal system takes advantage of this constant temperature by transferring it through a GSHP to provide space heating and cooling.<sup>6</sup>

A typical installation consists of an underground closed loop system outside and a GSHP and ductwork or hydronic piping inside the building. As shown in Figure 1, the ground loop system is filled with water or a non-toxic water-glycol medium that acts as the heat exchanger between the internal systems and the ground loop.<sup>7</sup> During winter, the temperature-steady heat from the ground is absorbed by the water solution as it circulates through the subterranean piping.

The warmed medium is then carried into the building where a heat pump concentrates the thermal energy and transfers it through an air or hydronic distribution system. In warm weather, this process is reversed to cool the building. As shown in Figure 2 below, the same process can be used for multi-customer loops, where a single wellfield serves several customers.<sup>8</sup>

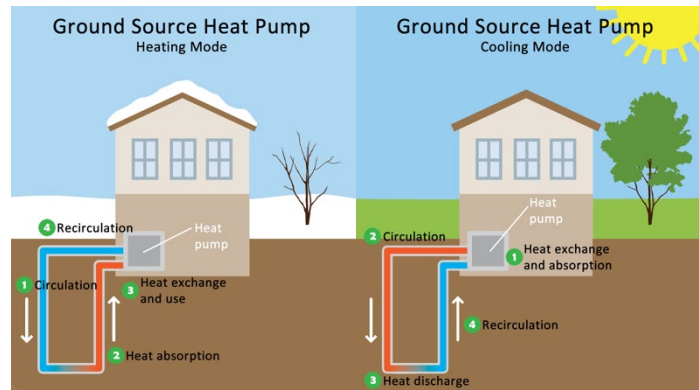


Figure 1

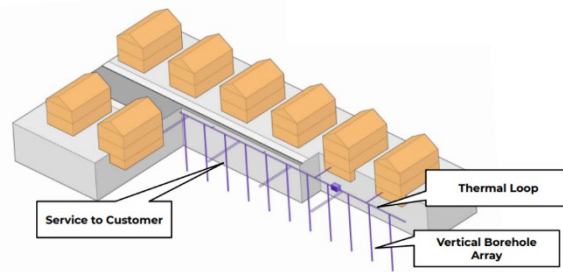
<sup>6</sup> For more information on how geothermal systems function, see NYSERDA's short video, *How it works Ground Source Heat Pumps*, available at <https://www.youtube.com/watch?v=qV48cX4d-WY>.

<sup>7</sup> Images courtesy of U.S. Environmental Protection Agency, *Geothermal Heating and Cooling Technologies*, available at [https://19january2017snapshot.epa.gov/rhc/geothermal-heating-and-cooling-technologies\\_.html](https://19january2017snapshot.epa.gov/rhc/geothermal-heating-and-cooling-technologies_.html).

<sup>8</sup> Image courtesy of HEET, *Stakeholder Charrette Report* (Nov. 10, 2021), available at [https://cdn.prod.website-files.com/649aeb5aaa8188e00cea66bb/650475de22458be74e7d4931\\_Charrette-9-Report.pdf](https://cdn.prod.website-files.com/649aeb5aaa8188e00cea66bb/650475de22458be74e7d4931_Charrette-9-Report.pdf).

There are some notable differences between installing a geothermal system for a single building and installing a networked geothermal system that connects multiple buildings. While a single building system is limited to meeting the heating and cooling needs of a single building, a networked system has the potential to improve the overall efficiency of the system by balancing heating and cooling loads among buildings. For example, buildings with large cooling loads

(e.g., supermarkets, ice rinks) can supply rejected heat for other buildings' space and water heating needs (e.g., residential or office buildings). These types of efficiencies from a networked system can reduce the operational costs of energy as well as the number of boreholes needed for the system, potentially lowering the capital costs of the project. A networked system can often be expanded easily by adding additional boreholes and interconnections for the new building. Because of the increased complexity of a networked system, the design process requires extensive energy modelling, customized design and construction considerations such as siting the borefield, and engineering the underground horizontal piping that connects buildings.



**Figure 2**

Because GSHPs are utilizing the steady-state ground temperature, there are no performance issues during times when extreme outside air temperatures present challenges to air source heat pumps (“ASHPs”), such as cold climate heat pumps. Comfort and efficiency are not sacrificed, and, often, no backup heating systems are required to keep the space comfortable. Moreover, GSHPs do not exacerbate winter peaking events on Vermont’s coldest days because they do not lose efficiency in cold weather. In contrast, ASHPs work harder and utilize more electricity as temperatures drop. As the U.S. Department of Energy states, “Relative to air-source heat pumps, [GSHPs] are quieter, last longer, need little maintenance, and do not depend on the temperature of the outside air.”<sup>9</sup>

Though geothermal systems carry higher up-front costs than ASHPs, when a lifecycle cost analysis is used to compare geothermal against other renewable sources, geothermal outperforms due to lower maintenance and longer replacement cycles. The installed costs for the inside equipment of ASHPs and GSHPs are comparable, but installing the below-ground geothermal piping system adds an additional capital cost of approximately 30% to overall system costs. GSHPs are not only more efficient than any other heating and cooling equipment, however, they also last longer. Whereas ASHPs can last up to 15 years if properly maintained, GSHPs can last 25 years. This is primarily because GSHPs are located entirely inside the building and require minimum maintenance, while ASHP condensers sit outside the building, subject to the elements and requiring significant preventive maintenance both inside and outside. Additionally, GSHPs do not require external refrigerant lines, while ASHPs have refrigerant line sets running between the outside and inside of the building and can be susceptible to leaks.

<sup>9</sup> U.S. Department of Energy, *Geothermal Heat Pumps*, available at <https://www.energy.gov/energysaver/geothermal-heat-pumps>.

*iii. Rates*

Our experience exploring projects and collaborating with utilities interested in geothermal development in other jurisdictions has shown that up-front cost is consistently an obstacle to success for multi-customer projects. Some form of subsidization, through incentives or other ratepayer contribution, is likely necessary to make material progress toward community geothermal as a viable option. Among the several states actively pursuing thermal energy networks under legislative directives, many are utilizing ratepayer funds in various forms. For example, in Massachusetts, gas utilities' pipe replacement programs can now include replacement of aging pipe with geothermal systems;<sup>10</sup> in Minnesota, innovation plans filed by gas utilities with more than 800,000 customers must include spending of at least 15% on thermal energy network projects;<sup>11</sup> and in Washington, gas utilities under multiyear rate plans can propose merging their traditional gas regulated operations rate base with thermal energy network investments, which could allow cost recovery of thermal energy network investment in a manner similar to traditional gas investments.<sup>12</sup>

At VGS, we have done a financial analysis of several new construction geothermal systems under different scenarios. One of the most viable methods to make these kinds of systems financially feasible is a utility-owned model, where the cost of installation is included in rate base and, like other similar long-term system investments, recovered across a broad group of

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<sup>10</sup> See Mass. Senate No. 2995, An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy, § 99 (2021) (providing that the Department of Public Utilities may, upon application of a gas company, authorize one or more pilot projects for the development of utility-scale renewable thermal energy, and that the Department may further “approve recovery of costs” for such projects and may also permit a gas company to bill for thermal energy under such pilots), available at <https://malegislature.gov/Bills/191/S2995>; see also Mass. House No. 5060, An Act Driving Clean Energy and Offshore Wind, § 58 (2022) (amending the definition of “eligible infrastructure replacement” for purposes of gas system replacement eligible for cost recovery through rates to include replacements that “may include replacing gas infrastructure with utility-scale non-emitting renewable thermal energy infrastructure”), available at <https://malegislature.gov/Bills/192/H5060>, or see Mass. Gen. Laws ch. 164, § 145(a) (2025), available at: <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section145>.

The State of New York is also urging gas utilities to pursue thermal energy networks by requiring utilities to submit pilot proposals. See N.Y. Senate Bill No. 9422, An Act to Amend the Public Service Law, the Transportation Corporations Law, the Labor Law and the Public Authorities Law, In Relation to Thermal Energy Networks (2022) (providing that the purpose “is to remove the legal barriers to utility development of thermal energy networks and require the public service commission to direct utilities to commence thermal energy network pilots in each major utility territory), available at <https://www.nysenate.gov/legislation/bills/2021/S9422>.

<sup>11</sup> See Minn. Stat. § 216B.2427, subdiv. 9a (2024) (“Innovation plans filed after July 1, 2024, under this section by a utility with more than 800,000 customers must include spending of at least 15 percent of the utility's proposed total incremental costs over the five-year term of the proposed innovation plan for thermal energy networks projects.”), available at <https://www.revisor.mn.gov/statutes/cite/216B.2427>.

<sup>12</sup> See Wash. H.B. 2131, § 1 (2024) (amending definition of “gas company” to include owning, controlling, operating, or managing a thermal energy network in the state); *id.* § 2 (setting forth the process for commission review of a gas company or electric company’s proposed thermal energy network work); *id.* § 7 (authorizing gas utilities or gas-electric combination utilities under multiyear rate plans to propose merging regulated gas operations rate base with operation of thermal energy networks), available at <https://lawfilesexternal.wa.gov/biennium/2023-24/Pdf/Bills/House%20Passed%20Legislature/2131-S.PL.pdf?q=20250302100826>.

customers over a long period of time. Many businesses operate with a much shorter investment recovery timeframe that does not accommodate long-term infrastructure investments. For example, most developers in Vermont capable of implementing networked geothermal systems prefer to install heating equipment that allows homes to be sold outright, without taking on the long-term burden of owning and operating a networked geothermal system. This is why the utility-owned model is critical to advancing geothermal systems at scale, where capital costs can be recovered over time and shared among a broad group of customers, and where responsibility for operation and maintenance rests with an entity capable of providing stable long-term service. This structure promotes long-term investment that smooths the up-front cost for customers and provides a stable monthly rate, characteristics that could unlock access to geothermal across the state.

Under utility ownership, geothermal customers would pay a tariffed monthly rate. If a customer received direct service through a utility-owned geothermal system, they would pay a monthly charge with two components: one that covers the long-term capital investment and a second that covers ongoing maintenance costs, electric costs to operate the external components, administrative costs, and insurance. The rate structure initially could be specific to each geothermal system, however, spreading the overall cost of construction for a large group of geothermal networks among a broader customer group could provide geothermal customers more stable and affordable rates and help scale investment in a way that will promote greater geothermal implementation. Eventually, geothermal customers could participate in this thermal energy model through a standard geothermal service tariff that would encompass capital and operating costs into a geothermal rate that applied across multiple systems.

It will be critical to both the success of geothermal systems in Vermont and VGS's energy transition to treat these investments as part of VGS's larger suite of thermal energy investments in Vermont. Incorporating long-term investments like this in VGS rate base provides multiple benefits. For current customers, this would enable VGS to expand service offerings, provide customers with another low- to no-carbon thermal solution, and share in broader carbon reduction benefits even if they do not use geothermal themselves. Customers that transition to geothermal would benefit from the high level of service and reliability provided by our long-term commitment to Vermont's thermal future. Adding geothermal services could help to diversify our rate base and revenue sources, allowing VGS to grow our customer base at the same time we are helping traditional customers reduce natural gas usage. And this model has the potential to promote affordability for both existing natural gas customers and future geothermal customers. By utilizing a broad group of thermal investments in our rate base, we can continue to promote affordability for customers that have not yet transitioned to a lower-carbon thermal alternative. Growing customer base and increasing the portfolio of services VGS offers to include geothermal services are part of VGS's long-term strategy to keep service affordable for all customers as load on the natural gas system decreases over time.<sup>13</sup>

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<sup>13</sup> See Case No. 24-0125-PET, VGS 2024 Integrated Resource Plan (filed January 16, 2024) at 50 ("For networked geothermal systems that serve multiple customers, VGS is exploring what utility ownership of the outside loop system would look like, in a model where VGS would provide operation and maintenance of that

*iv. Permitting*

The Commission’s first objective regarding proposed permitting solutions for geothermal projects should be to ensure that permitting does not create yet another barrier to geothermal installation in Vermont. Geothermal faces many practical and financial barriers. This is why the Commission’s two primary discovery questions are inseparable: Geothermal networks can be supported by making them affordable and supporting financial models that promote long-term investment and recovery. They can also be supported by creating a permitting framework that promotes entry into this space, reduces costs, and helps simplify the process of designing and constructing a networked geothermal system.

For many reasons, 30 V.S.A. § 248 (“Section 248”), which governs the construction of energy generation, transmission infrastructure, and energy storage projects, is not the right fit for networked geothermal projects. For one, many of the criteria under Section 248 are largely irrelevant to these networked projects because they are not connected to a larger transmission infrastructure. Because of that, traditional Section 248 considerations largely do not apply. Additionally, there are three overarching characteristics that differentiate geothermal projects from those currently subject to Section 248. First, no geothermal provider will be operating as a monopoly in the market; there are a variety of competitive thermal services available throughout the state. Second, geothermal projects are self-contained; they do not travel linear distances or carry impacts beyond the immediate community they serve, and they are almost entirely underground, with little to no impact to aesthetics or habitat. Finally, there is no supply component because the water or water-glycol medium travels in a contained continuous loop. We also note here that the significant Section 248 process—and its associated costs—would make almost all geothermal networks, which are already teetering on the edge of viability, financially infeasible.

We value the critical role that Section 248 plays protecting many important state interests, but those interests relevant to geothermal system construction are already protected by existing Act 250 permitting processes. That is, developers with construction plans triggering Act 250 jurisdiction are required to analyze impacts regardless of whether they plan to utilize a thermal energy network. Plainly, we believe state interests are adequately protected and the best way to support the development of thermal energy exchange networks includes avoiding additional permitting time and costs.

*v. Other Considerations*

We suggest a few additional issues for the Commission’s consideration in advance of its report to the General Assembly. First, in efforts to remove obstacles from geothermal development, we suggest it may be appropriate to exempt geothermal facilities from property tax. Similarly, we

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system to customers. In that model, VGS may direct capital expenditure to invest in these networked geothermal systems.”); *see also id.* at 76–77 (discussing expected load decline over the term of the IRP and how VGS is exploring alternative sources of revenue and areas of investment to keep rates affordable for customers).

suggest addressing utility rights-of-way issues in the context of geothermal facilities. Lastly, we recommend the Commission analyze the definitions prescribed by the General Assembly and make recommendations for when regulation would be appropriate and when it would not. For example, we agree that it is not necessary to regulate geothermal development for single services. But the current Act 142 definition of “thermal energy exchange network” may be overly inclusive because not every community-scale project will warrant a networked design. We suggest the final definitions eliminate gaps in policy and provide utilities with the ability to design systems most cost effectively. We would be pleased to expand on these and other topics at the Commission’s direction.

*vi. Conclusion*

Geothermal is a unique proposition that lessens or potentially eliminates fossil fuel consumption, reduces total energy consumption, and provides summer cooling with zero incremental capital expense. Because of all its potential benefits, we are eager to see geothermal expand. Please do not hesitate to reach out to our team with any questions or requests.

Respectfully submitted,

/s/ Mary G. Bouchard

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