

THE GAS UTILITY OF THE FUTURE IS HERE, AND IT LOOKS LIKE THIS

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ABSTRACT

In 2019, a natural gas utility serving 55,000 customers in northwestern New England committed to transforming its business to achieve net zero energy use by 2050. How does a fossil fuel utility transition into a resource for clean, affordable energy solutions? Inspired by states adopting versions of the Global Warming Solutions Act, and with the understanding that the utility's principal product today—fossil gas—has significant climate impacts, this company created a three-pillar climate plan: energy efficiency, helping their customers achieve affordability and climate goals through non-pipeline, in-home services, and decarbonizing what flows through the pipe (renewable natural gas, hydrogen, and geothermal).

To achieve the milestones of its climate plan, the utility made major changes. First, it reorganized itself in recognition that building an innovative business model to replace its legacy structure required an unwavering commitment from leadership and staff. Senior roles were created to specifically address decarbonization, innovation, and regulatory strategies. The company created new departments with a disciplined, customer-engaged approach to new product development and service delivery. Utility leadership encouraged employees to share their ideas for achieving the 2050 net-zero goal. Today, the former fossil fuel company is evolving into the thermal energy services utility of the future.

This paper describes the actions this company has taken in 24 months, reinventing itself as an innovation leader within the state and the gas industry. It also presents a blueprint for how gas utilities can mobilize their infrastructure to contribute to meaningful climate action.

Vermont Gas Systems (The Evolution of a Utility):

Vermont Gas Systems, Inc., known locally as VGS, is a fully regulated natural gas distribution company serving 55,000 customers in three counties comprising Vermont's northwest corner. With approximately 135 employees, a sizable portion (40 percent) of the staff regularly engages with customers as part of their daily job responsibilities. This census involves service technicians, customer care agents, and energy auditors. The long-held relationships with customers have made VGS a trusted, local resource for energy service since its beginning in 1966. In almost all the communities it serves, VGS has a remarkably high penetration rate and strong customer loyalty. Since 1966, VGS has been on a steady growth path, adding, on average, 1,000 customers per year.

That rate of growth is no longer sustainable through gas sales alone. In Vermont, the environmental, political, economic, and social impacts of climate change are incompatible with significant expansions of traditional natural gas service. At the same time, customers in this more densely populated region of Vermont rely on VGS for affordable heating and in-home energy

services. VGS has provided the least carbon-intensive fuel in Vermont until recent times, with the majority of Vermonters relying upon oil or propane for heating; now, the modern-day electric grid is largely fed by renewable sources.

In the context of the climate emergency, this dynamic has presented a unique and time-sensitive opportunity for VGS to emerge as a key stakeholder and resource for transforming the Vermont marketplace for thermal energy. VGS determined that the best way to navigate this shifting environment would be to evolve its legacy fossil fuel distribution business model. It set out to create new offerings as a thermal solutions provider, aligned with the needs of the communities it serves, and of the climate itself. VGS began its transformation by publicly acknowledging that its principal offering, fossil natural gas, has significant climate impacts.

The VGS Climate Commitment

Vermont has been a leader in successful, policy-driven energy efficiency and renewable energy programs for over two decades. The state is part of the U.S. Climate Alliance, a bipartisan coalition of 25 states that have committed to reducing greenhouse gas emissions in alignment with the goals set forth in the United Nations' 2015 Council of the Parties "Paris Agreement." In 2020, the Vermont General Assembly adopted the Global Warming Solutions Act, similar to laws passed in California, Massachusetts and other states, creating binding commitments to aggressive climate goals. Vermont's Global Warming Solutions Act established incremental targets for Vermont to decrease its greenhouse gas emissions by 80 percent by 2050, relative to a 1990 baseline for emissions. It created the Vermont Climate Council, a body empaneled to develop a statewide Vermont Climate Action Plan. The legislation required a "just transition" to ensure that the actions reduce energy burdens and minimize negative impacts on rural and historically marginalized communities. It also provided a path for Vermonters to hold the State legally accountable for achieving mandated GHG reductions targets.

In 2018, in advance of Vermont's adoption of the Global Warming Solutions Act, VGS began developing its own Climate Plan. In late 2019, the utility announced a commitment to reduce greenhouse gas emissions for its customers by 30 percent by 2030, and to be net zero by 2050.

Today VGS is at the beginning of what will be a complete redesign of its existing business model. What began as an aspirational vision has now been followed by a strategic plan.

Modeling a Climate Plan

The VGS Climate Plan has three operational pillars:

- Expand the successful energy efficiency program
- Provide new behind-the-meter or in-the-home services
- Shift what is in the pipeline to alternative, decarbonized energy sources

These three pillars (as detailed below) are built on core strengths that already existed at VGS prior to the 2019 launch of its Climate Plan. The utility adopted these priorities understanding that there was no single, “silver bullet” strategy to achieve NetZero by 2050. The strategies of decreasing energy use through efficiency measures and providing new, in-home solutions would serve as key pathways to empower customers to reduce the volume of fuel they use to heat their homes. Decarbonizing the fuel supply that reaches customers’ homes would serve as the third crucial strategy. To ensure these parts fit together, VGS developed its GHG reduction targets by following the latest climate science. The utility committed to using accurate GHG emissions accounting, including methane’s impacts and lifecycle emissions.

The process to develop these operational pillars took many months of extensive review and stakeholder engagement. The company formed a working group and took into consideration VGS’s foundational values (safety, reliability, affordability, integrity, and high-quality customer care), and the values that could influence its transformation to a new kind of utility that would have a hand in reducing greenhouse gas emissions (climate, customer, and culture). Upholding these values would remain a constant as modeling progressed on the VGS Climate Plan.

VGS staff created a baseline, “business as usual” financial model that extended 30 years. This baseline became the foundation for several program scenarios. As the Climate Plan working group explored greenhouse gas emission reducing paths to take, each proposed option contained assumptions in the baseline, “business as usual” data.

The resulting primary objective was to achieve the highest amount of carbon savings without adding volatility or unacceptable pressures on natural gas rates.

Stakeholder and Policy Engagement

VGS recognized the importance of communicating its climate goals to the communities it serves. Like many New England states, Vermont is known for its residents’ participation in local government and planning decisions. Vermonters also participate in energy planning at the statewide level. Upon adoption of its Climate Plan, VGS immediately began to advance key elements of the Plan in an effort to demonstrate its commitment to transformation. After the launch of several key initiatives that showed how the company’s operations could be recalibrated to address climate change, the utility was invited to participate in state-level climate policy discussions. VGS leaders used this newfound place at the table to engage with local and State policymakers to advocate for energy efficiency and developing a regulatory structure to facilitate a shift to alternative renewable energy for thermal needs.

Unifying Staff

The goals in VGS’s Climate Plan are ambitious. The utility quickly recognized that an all-hands-on deck approach was vital to the Plan’s success. Employees at all levels of the organization needed to feel they had a role in creating the plan and a future role in its execution. To achieve this management objective, VGS realized that motivating their entire team towards this vision was an essential first step.

To engage employees across VGS in the Plan's creation, management formed a core team representing all departments. The team comprised employees from the field and the inside office, with employees representing every level of the organizational structure. Prior to the internal announcement of the VGS Climate Plan, management conducted a survey of its employees. It showed that 83 percent of employees supported a bold vision to transform the status quo. Communications with staff about progress with the Climate Plan were and continue to be frequent, with formal quarterly presentations.

Strengthening Relationships with External Partners

VGS has always been proud of its relationships with its customers and community. For many years, it has collaborated with ratepayers, utility partners (specifically, electric distribution utilities and energy efficiency utilities), trade partners, environmental advocacy groups, organizations serving low-income customers, and regional planning commissions. Using that foundation of trust, VGS began reimagining what a natural gas utility could be with input from these partners. VGS and other Vermont-based utilities began combining resources to explore new technologies and program designs and create pilot offerings their shared customers would value.

In addition, VGS recognized that it needed to recruit new, creative partners to accelerate the implementation of ambitious, greenhouse gas emission-reducing projects. This new pool of partners helped ensure the integration of high-value propositions. The motivations of the various participants might differ, but they share the common goal of reducing greenhouse gas emissions.

New Leadership and Organizational Restructure

To get to this forward-looking perspective, in 2020 VGS brought in a new President and CEO, Neale Lunderville, to lead through this dramatic transition. Lunderville previously served as General Manager for the very forward-thinking Burlington Electric Department. After spending several months learning about the company and understanding its culture, and with frequent engagement with VGS employees, Lunderville restructured the organization to focus it on the Climate Plan's core objectives. He created roles for decarbonization and innovation projects, positioning these roles at the Vice President and Director levels:

- Vice President for Decarbonization
- Vice President for Customers and Energy Innovation
- Director of Energy Innovation
- Director of Policy and Planning

Other new roles were created to focus on strategy and public affairs, with a focus on executing the Climate Plan goals and evolving the business.

Increased Energy Efficiency Goals

Energy efficiency is the cornerstone of the VGS Climate Plan. Since 1992, VGS's own, in-house, thermal energy efficiency program has helped 42,000 customers weatherize their homes and purchase high efficiency equipment. This work has resulted in over 100,000 tons of greenhouse gas emissions avoided for the environment, and lower energy costs for customers than would have been the case without the program. These services have cut the equivalent of 20.5 billion cubic feet of natural gas use and have saved customers over \$195 million in avoided energy costs.

This history created a solid foundation for the Climate Plan. VGS now aims to substantially increase its efficiency programs by expanding its weatherization work and assisting customers as they look to electrify, targeting low- to moderate-income households. An investor-owned utility, VGS can increase that program budget by using a novel financing approach involving its own capital resources.

With the above financing flexibility, VGS can supplement its standard efficiency budget (supported with a surcharge on customer bills) with a capital investment, making program dollars available today and recouping them across the average life of an energy efficiency measure. This amortization strategy results in a lower increase in the energy efficiency charge on ratepayer bills each year than would have occurred if the budget had increased by that same amount, while allowing customers to benefit now from increased efficiency efforts. The triennial budget (2021-2026) for energy efficiency includes additional efficiency investments of approximately \$16 million, financed by VGS.

VGS has tiered its efficiency incentives to help make home weatherization and upgrading to other energy efficiency measures easier for income-qualified customers. Up until recently, the incentive for home weatherization projects was 50 percent of project costs, up to \$3,500. Beginning in 2022, VGS customers with household income less than 120 percent of Vermont's area median income (AMI) are eligible for expanded rebates, covering 75 percent of project costs up to \$5,000. Customers who have household incomes of less than 80 percent of AMI can qualify for even larger rebates, depending on eligibility. Through a partnership with a credit union, VGS also provides easy access to no- or low-interest financing. This access to capital is significant in removing remaining financial barriers for lower-income markets.

New Products and Services (What Is Offered Behind the Meter)

VGS has been serving customers in their homes for generations. This history of in-home services has generated tremendous trust from our customers and allows us to evolve our services with a decarbonization lens. The New Product Development Team is responsible for this evolution. It designs new products and services driven by customer needs, emerging technologies, and market opportunities, many of which will focus on non-fossil fuel thermal technologies. This team has been quick to recognize that one of VGS's greatest assets is its staff. VGS deploys a team of in-house, licensed and trained service technicians. These employees install and maintain home heating and cooling equipment. At a time when there is a national shortage of contractors, being able to serve customers with this level of support has proven

exceptionally valuable. As VGS expands its products and services, it looks to its service team as partners ready to move the company to its next phase of operations.

Heat Pump Water Heaters

VGS has provided its customers with an equipment leasing program since the company's inception. VGS service technicians install and maintain the leased equipment, and customers pay a reasonable monthly lease amount on their gas bills. On February 1, 2022, VGS became the first stand-alone gas utility to expand its equipment leasing program to include the leasing and sale of electric heat pump water heaters (HPWHs).

Through partnerships with Vermont's electric Energy Efficiency Utilities (Efficiency Vermont and Burlington Electric Department), VGS has directly incorporated state rebates into both the customer's monthly lease amount and the total sale cost. The state Energy Efficiency Utilities claim the energy saved and VGS is better able to maintain its relationship with current natural gas customers who are moving toward a decarbonized future with electrification.

Providing customers with a leasing option makes the technology more accessible to those for whom the upfront cost of a HPWH is prohibitive. The New Product Development Team is now exploring the replication of this model with electric cold-climate heat pumps, and with residential gas-fired heat pumps as they become more readily available.

Hybrid Heating

The New Product Development Team has also been identifying how VGS can best serve customers who are pursuing hybrid heating—that is, heating (and possibly also cooling) their homes with a centrally ducted, fossil fuel-fired furnace and a cold-climate heat pump. Through direct consumer experience and outreach to local HVAC contractors, VGS discovered that these systems were not necessarily being programmed to provide the customer with optimal dollar savings or optimal carbon savings. This is due to the cutover temperature to back-up fossil fuel heating being set too high (oftentimes in the 35-55 degree Fahrenheit range). VGS also discovered that the customer frequently is not told by their installer how the hybrid heating system has been programmed, or how to program it themselves to save the maximum amount of costs or carbon.

The New Product Development Team launched a research and development project to explore the potential of an interactive software tool, referred to as the *Cost-Carbon Calculator*. The tool allows each customer to see their hybrid heating system's specific, carbon-emitting fuel consumption. It also shows how both the system's carbon emissions and costs can change with adjustments to the outside temperature set point.

With access to this information, a customer can set unique carbon reduction goals based on how much of their space heating equipment they can afford to electrify. VGS will rely on its service technicians, supported by strategic partners, to install and maintain cold-climate heat pumps, collaborating with customers to program their hybrid systems for optimal carbon reduction. This tool will be piloted with a limited number of customers in 2022 and, if it proves useful to the customer, it will enter into the VGS product portfolio in 2023.

The Climate Action Plan has made clear that VGS has not aimed to compete with electric heat services. On the contrary, the company is committed to serving its customers with the type of thermal energy that is right for them. This commitment is based on least-cost principles, customer goals, and making objective progress on carbon reductions. The company is partnering with electric distribution utilities and others to ensure that it supports electrification when it is the least-cost thermal energy source, after considering GHG emission and environmental impacts. The integration of HPWHs and cold-climate heat pumps into VGS's portfolio of offerings is evidence of this commitment.

A Customer-Engaged Process for Innovation

The primary members of the New Product Development Team include the Energy Innovation Director and the New Product Development Manager. VGS created the team in 2021. Both members came to VGS from an electric efficiency utility, where they had years of experience in designing products and services, using best practices taken from Design Thinking, Lean Startup (Ries 2011), Business Model Generation (Osterwalder and Pigneur 2010), and Value Proposition Design.

These united processes share a practice of getting staff out of the office building and engaging with the customer, validating whether a product or service alleviates a customer's financial or logistical pain (or conversely, creates a customer gain), and repeatedly iterating upon the initial idea, based on customer feedback.

VGS designed a process for New Product Development (NPD) and promptly put appropriate practices in place, presenting them to the entire company. The NPD process provides VGS with an iterative and evidence-based method to determine whether to advance an idea from concept development through prototyping to product development. With "stage gates" between the main phases, there is appropriate rigor and accountability for demonstrating that customer value is being created, that service delivery is feasible and financially viable, and that the product aligns with the company's strategic business objectives. One of the main benefits of NPD is that the company cannot justify additional investments unless sufficient and objective evidence that customers strongly desire the product is in place. Launching products on non-actualized assumptions about the customer or market is high risk. This process mitigates the risk.

Through an internal portal, all VGS staff are encouraged to submit their ideas for new products and services, with opportunities to justify their ideas (suggestions from field experience, for example, or drawn from a discussion with a customer). The website enables staff to track the progress of their ideas through the NPD process.

Alternative Supply (What Goes in the Pipe):

Renewable Natural Gas

VGS began investigating renewable natural gas (RNG) years before its Climate Plan went into effect in 2019. The utility formed partnerships mid-decade to pursue projects to develop a digester project at a Vermont dairy farm in the hopes it could demonstrate

opportunities for methane capture in the agricultural sector. In 2018, VGS became the nation's first utility to offer its customers a retail RNG option. In 2021, VGS began to offer locally sourced RNG sourced from the largest renewable gas digester in the northeast, located at the Goodrich Family Farm in Salisbury, Vermont. The RNG generated through the anaerobic digestion of dairy manure and recycled organics at this 900-cow, generational dairy farm is fed directly into the VGS pipeline. VGS partnered with Vanguard Renewables, Middlebury College, and the Goodrich farm as the interconnecting utility and commercial off-taker for a significant portion of RNG produced by the digester.

Today, VGS customers have two options to purchase RNG. The RNG Adder Tariff allows customers to purchase RNG attributes as a percentage of their current energy use. The other option, the S-RNG Adder Tariff, allows customers to purchase RNG attributes on a per-cubic-foot basis. In addition to these voluntary RNG offerings, VGS began blending RNG into its base supply portfolio in 2020 and by the end of 2022 will have roughly 2 percent of RNG in its energy supply provided by several RNG projects. With additional RNG generation anticipated through farm projects and other renewable biogas resources, VGS plans for 20 percent of its natural gas mix to be RNG by 2030. Current and pending contracts are already making substantial progress toward these goals.

Hydrogen

Hydrogen represents a significant opportunity to serve the needs of heavy industry where process heating load is more challenging to decarbonize with other technologies. However, there are several challenges that must be addressed, including technology costs, system compatibility and fundamental business models for this new energy source, like the challenges in the early development of solar and wind industry. VGS is working with a variety of new technologies and strategies to address these obstacles.

VGS has partnered with a large semiconductor plant and a local university to develop a green hydrogen project, anticipated to break ground in 2023. In this proposed project, a 1-megawatt electrolyzer will be installed at the facility. The electrolyzer will use electricity to separate water into hydrogen and oxygen molecules. Initially, the project plan calls for use of the hydrogen as combustion fuel, co-fired with existing natural gas to supply the facility's boilers, and displace fossil consumption with renewable green hydrogen. Longer-term, VGS anticipates expanding the project through a variety of uses, including direct process consumption, transportation fuel, fuel cell backup power, as well as opportunities to compress and transport excess hydrogen to other facilities. The project is a participant in the Northeast "hydrogen hub" proposal lead by the New York State Energy Research and Development Authority (NYSERDA). The NYSERDA collaborators will be seeking a large DOE grant in 2022 as part of a federal funding program to rapidly advance hydrogen development in the U.S.

Geothermal Systems

Geothermal systems represent a compelling opportunity for VGS to reorient the company's core competencies toward a decarbonization business model. As a natural gas

distribution utility, VGS has extensive experience installing and maintaining inground pipe. It makes long-term energy infrastructure investments. It collects on its capital investments over a long-term horizon, equal to the expected life of the measures it installs from the investment. VGS also ensures the safety and performance of the system. Beyond infrastructure, and unlike most gas utilities, the company provides in-home services ranging from equipment installation to routine maintenance.

Such core competencies mirror those needed to build and maintain a utility geothermal business model, without any of the negative attributes associated with fossil fuels. The initial market targets new construction, specifically housing or small commercial developments.

What's Next

As VGS aggressively works to shift its business model, state policy must follow to ensure accountability and a level playing field for utilities across the thermal energy sector in Vermont. In December of 2021, the Vermont Climate Council shared its Vermont Climate Action Plan for achieving the goals set forth in the Global Warming Solutions Act. 26 pathways for action were included. At the top of the list of recommendations to the Vermont General Assembly was a dramatic increase in home weatherization across the state, electrifying thermal loads, and reducing fossil fuel use. To achieve these objectives an overarching framework was proposed: the Clean Heat Standard (CHS). CHS is very similar to Vermont's Renewable Portfolio Standard which sets forth targets and stratified renewables for the electric distribution utilities. CHS would serve to do the same but with thermal energy providers at the wholesale level. While both chambers of Vermont's state legislature voted to approve CHS in the spring of 2022, it did not advance into law following a gubernatorial veto. Even so, both the Governor and lawmakers have signaled their interest in implementing policy to transition the thermal sector. CHS, and similar models, are currently being studied in anticipation of Vermont's 2023 legislative session.

State policy will be important for the accountability of all thermal energy providers, but what's next for VGS lies in the utility's ability to innovate while adapting to an environment in which affordability remains paramount. Just as it remained committed to its Climate Plan vision during the COVID-19 Pandemic, VGS has not veered from its vision to decarbonize, regardless of changing conditions in the economy or in local, state, and national politics.

People: VGS is resolute in its pursuit of the talent required to decarbonize, and retention of the people at VGS who believe that vision is central to this goal. Every single person within the walls of the utility contributes to lowering carbon, from the personnel repairing the pipelines to the customer service representatives recommending new products. VGS recognizes it can only get there with its team standing shoulder to shoulder in the fight against climate change.

Learning: As one of the first leaders within the natural gas industry, VGS understands that it must look to other industries to learn adaptation, innovation, and transformation. A commitment to training within its walls is also critical to its ability to maintain safety, while operating in a research and learning environment. VGS can act as an inspiring voice and benchmark for other gas utilities, particularly given the collective need to decarbonize the global economy.

Opportunities: VGS is fortunate in its unique position that has enabled its pioneering work to decarbonize. Notably, a cold climate where thermal energy is critical, an internal service team at VGS able to install and maintain equipment, customers who expect a more renewable product, forward-thinking policymakers, and regulators who support this transformation. VGS has leveraged these opportunities that make it distinct and poised to transform.

Transformation: Bold leadership and a strong conviction in the possibility of this new future is non-negotiable. An industry that has not changed for a hundred years is being called upon to evolve or eventually shut down. VGS chooses adaptation and welcomes anyone who wants to come along for the journey.

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