Integrated Resource Plan

Prepared for the Vermont Public Utility Commission

January 15, 2021

TABLE OF CONTENTS

LETTER FROM OUR CEO 2

EXECUTIVE SUMMARY 3

ANSWERING THE CALL FOR CLIMATE ACTION 3

ABOUT VGS 7

SUSTAINING OUR REGULATORY COMMITMENTS 10

1.0 FORECASTING THE ENERGY NEEDS OF OUR CUSTOMERS 12

1.1 STAKEHOLDER ENGAGEMENT 12

1.2 ENERGY EFFICIENCY 13

1.3 MEETING CONTINUED DEMAND FOR NATURAL GAS 19

2.0 ENERGY SUPPLY RESOURCES AND INFRASTRUCTURE 33

2.1 NATURAL GAS CUSTOMER SUPPLY 33

2.2 RENEWABLE NATURAL GAS 36

2.3 INNOVATION & PRO-CLIMATE PARTNERSHIPS 39

2.4 NATURAL GAS TRANSMISSION AND DISTRIBUTION SYSTEM 42

3.0 FINANCIAL & REGULATORY ASSESSMENT 51

4.0 RESILIENCY IN THE FACE OF UNCERTAINTY 57

4.1 STRATEGIC CHALLENGES AND ADVANTAGES 57

4.2 GLOBAL WARMING AND EXTREME WEATHER EVENTS 58

4.3 EMERGENCY PREPAREDNESS TRAINING AND COVID RESPONSE 59

4.4 RESILIENCY THROUGH INNOVATION: A FRAMEWORK 61

4.5 PEOPLE 64

5.0 IMPLEMENTATION PLAN 70

LETTER FROM OUR CEO

We will long remember 2020 for the shockwaves that hit our lives. Each wave brought a new round of uncertainty and anxiety. But as a state and a nation, we have persisted through a difficult year and can now look with hope on vaccines and transitions, and with an earnest belief that we can – and must – do better as we face even bigger issues in the years to come.

During the past year, our incredible VGS team rose to meet every challenge with dedication and heart. We affirmed our unwavering commitment to customers – especially during the most tenuous of times – to deliver safe, reliable, and affordable energy, as we have since 1966. We took care of each other and kept employees safe and healthy despite the complications of the pandemic. And we advanced our energy efficiency and sustainable supply strategies to add our muscle to the fight against global warming.

President and CEO, Neale Lunderville

We are pleased to file this Integrated Resource Plan ("IRP") with the Public Utility Commission ("PUC" or "Commission") as we look out to the years ahead. This plan demonstrates how we will meet the thermal energy needs of our customers safely and affordably while supporting the State's climate goals with our Climate Action Plan.

When the pandemic is over, the climate crisis will remain, and, if left unmitigated, its impact will certainly eclipse that of Covid-19. As an organization, we have committed to act now, guided by science, and in the best interest of our customers, our communities, and the state we love. As described in this IRP, VGS is meeting the challenge posed by Vermont's Comprehensive Energy Plan: to make homes and businesses as tight as possible; to help customers make the smartest energy choice for them; and to ensure our energy supply is increasingly more renewable as we approach mid-century.

VGS is committed to transforming how we meet our customers' needs with equal parts ingenuity and tenacity. At the end of 2019, we created the VGS Climate Action Plan and committed to be Net Zero by 2050 with a near-term goal of 30% greenhouse gas ("GHG") emission reductions by the end of this decade. Our three-pronged approach focuses on investing even more money in energy efficiency, advancing renewable natural gas and other sustainable supply sources, and partnering with other like-minded energy leaders on innovative strategies. VGS is confident that decarbonizing our natural gas supply will play a key role in Vermont's clean energy future.

We look forward to your feedback and partnership in the ongoing discussion of how we can best serve our customers and communities. Our work together will help Vermonters thrive for generations to come.

Neale F. Lunderville
VGS President and CEO

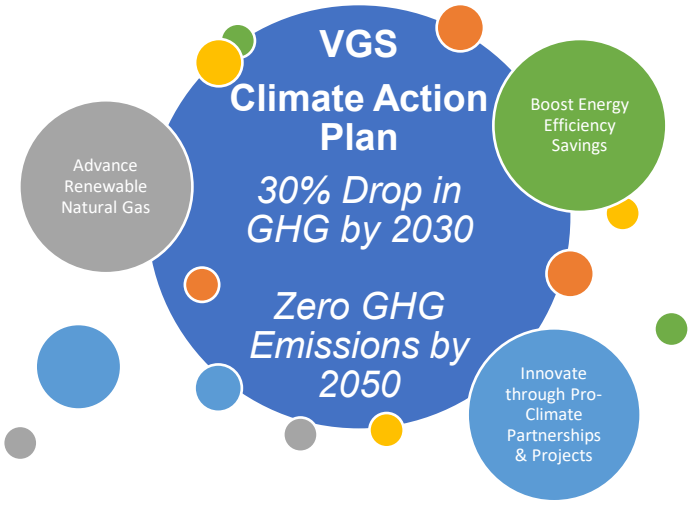
EXECUTIVE SUMMARY

ANSWERING THE CALL FOR CLIMATE ACTION

VGS's Integrated Resource Plan ("IRP" or "Plan") responds to the call to act now on climate change and offers our customers a decarbonized thermal energy future that meaningfully advances the state of Vermont's goal to achieve a 90% renewable energy profile by 2050. The IRP is a planning document that:

1) Forecasts our customers' demand for energy services in the next 20 years;
2) Evaluates the resources and strategies available to supply customers with their energy needs;
3) Considers VGS resiliency and system safety while tackling climate change; and
4) Assesses the financial implications of several planning scenarios.

The IRP outlines customers' demand for energy services and supply strategies that offer safe, reliable, and affordable low-to-no-carbon energy. The foundational priorities of safety, reliability, and affordability that have sustained VGS through decades of high customer satisfaction are fundamental to the implementation of VGS's Climate Action Plan. Our Climate Action Plan meets the objectives of both customers and our state policy over the term of this IRP by targeting a 30% reduction in GHG by 2030 and Net Zero[1] by 2050. VGS has modeled three scenarios to demonstrate avenues to address climate change, utilizing the Company's Climate Action Plan as the basis for modeling, which is unlike past IRPs that were predicated mainly on customer growth. Within each scenario the following goals are considered: (1) advancing Renewable Natural Gas ("RNG"), (2) boosting or continuing investment in energy efficiency, and (3) innovating through strategic pro-climate partnerships and energy projects.



[1] "Net Zero" or "decarbonization" as used in this Plan means that our customers' energy needs today are met in the future by reducing overall energy needs through efficiency and meeting the remainder through renewable energy sources.

VGS's IRP demonstrates our plan to meet our ambitious Climate Action Plan, advance Vermont's energy policy, and meet customers' demand for a clean energy future. Vermont law requires VGS to develop a "least-cost integrated plan" for meeting our customers' need for energy services in a manner that addresses safety, environmental, and economic costs.[2] We are required to develop a strategy, where necessary, that combines investments in energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.

VGS's IRP meets these statutory criteria while also fulfilling the terms of a memorandum of understanding ("MOU") jointly filed by VGS and the Department of Public Service ("DPS" or "Department") following the submission of VGS's 2017 IRP. The IRP also examines the opportunities and risks brought about through structural and competitive changes within the energy industry. This planning process recognizes that meeting the future energy needs of our customers means continuing our current push to reduce GHG emissions through increased deployment of RNG in our supply portfolio and increased investment in energy efficiency savings, as well as pursuing future market and technology developments such as district energy, geothermal, and hydrogen/natural gas blending.

VGS is Vermont's only regulated thermal energy provider in a state where policymakers, distribution utilities, and other partners are building a legacy of progressive leadership in energy and renewables. As such, VGS recognizes and embraces its leadership role in the decarbonization of natural gas systems and the transformation of Vermont's thermal energy market through innovative clean energy initiatives that advance a low-carbon future. Accordingly, this IRP represents a shift from prior planning models that emphasized system expansion as a principal means for new growth.

Looking ahead, VGS will continue to add customers within the existing footprint of our distribution system. The IRP considers various levels of customer growth under which the amount of natural gas customers use is declining, as well as contemplating strategies under which VGS can promote such reductions through energy efficiency and weatherization, and meet the energy needs of customers through expanded energy services. Notably, this means our modeling recognizes "negative" growth in the area of conventional natural gas sales and acknowledges that "least-cost planning" for thermal energy services means balancing ambitious climate goals and the higher cost of renewable supply and other climate solutions with long-term stability and affordability for our customers.

Our IRP includes five major components that represent discrete but interrelated planning phases:

#1 FORECASTING THE ENERGY NEEDS OF OUR CUSTOMERS

This section of the IRP asks the essential question: what energy services will our customers need during the term of the IRP? Addressing this question involves an assessment of how many customers we will serve in our territory, how much energy they will use, and how natural gas demand will be impacted by energy efficiency measures under various scenarios. Accordingly, this section includes an assessment of energy efficiency outcomes, a forecast of demand in varying increments (including hourly, daily, design

[2] *See* 30 V.S.A. § 218c.

day, and annually), and a combined 20-year demand model that we used to guide resource strategies and decisions.

#2 ENERGY SUPPLY RESOURCES AND INFRASTRUCTURE

This section of the IRP addresses how we plan to meet the energy demands of our customers. This involves our plan to supply traditional natural gas while incorporating renewable energy and sustainable supply into our portfolio, maintaining our commitment to affordability, and structuring our supply portfolio to be responsive to innovative energy solutions.

This section of the IRP also discusses how we plan to align supply planning resources with aggressive environmental goals. We see innovation as a means to supply our customers with future energy services and explain how we plan to assess emerging opportunities and innovative strategies that align with our Climate Action Plan. We also describe some of the innovations and opportunities VGS plans to evaluate and pursue as appropriate.

#3 FINANCIAL AND REGULATORY ASSESSMENT

This section of the IRP provides a financial analysis of three scenarios. Unlike prior IRPs, which modeled financial outcomes based on varying levels of customer growth, our financial assessment in the IRP contemplates our outlook for decarbonization, innovation, and climate action. The three scenarios we modeled for this IRP track the key factors and assumptions that are expected to drive the pace of our Climate Action Plan, including RNG, customer growth, and the effect of energy efficiency measures.

The “Base Case” starts with achieving a 30% GHG reduction by 2030, while the “Low Case” has a slower Climate Action Plan trajectory. The “High Case” has a more aggressive path for achieving our climate initiatives. This section helps inform our assessment of how to provide energy services at least-cost while acknowledging the variety of ways we expect robust climate action measures to increase costs over traditional natural gas service. In this section we provide an explanation of the directional financial trends these three Climate Action Plan scenarios represent, including implications for base rates, operating expenses, and capital expenditures.

High Case	Base Case	Low Case
• **RNG:** Lower price, incremental growth of 2% per year, *more* advantageous for Climate Plan • **EEU:** Aggressive Energy Efficiency Savings (results in lower customer usage) • **Customers:** *Increased* in-footprint customer growth from Base Case (increases number of meters from the Base Case) • **Strategic Electrification:** *No change* in usage due to strategic electrificaion as VGS is a top choice renewable provider (customers increased) • **Investments:** *Aggressive innovation investments*, continued general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates based upon VGS's *current depreciation study* • **Rate Base:** *Decreases approximately 12%* primarily due to accumulated depreciation outpacing capital investments, including aggressive innovation investments • **Base Rates:** Track at or below inflation over time	• **RNG:** Steady price, incremental growth of 2% per year, demonstrates VGS Climate Plan • **EEU**: Average Energy Efficiency Savings between High Case & Low Case • **Customers:** *Moderate* in-footprint customer growth. • **Strategic Electrification:** *No change* in usage due to strategic electrificaion as VGS is a renewable provider (customers remain steady) • **Investments:** *Moderate innovation investments*, continued general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates based upon VGS's *current depreciation study* • **Rate Base:** *Decreases approximately 21%* primarily due to accumulated depreciation outpacing capital investments including modest innovation investments • **Base Rates:** Track at inflation over time	• **RNG:** Higher price, incremental growth of 2% per year, *less* advantageous for Climate Plan • **EEU:** Energy Efficiency Savings approved in the Demand Resource Plan(DRP) (higher average customer usage compared to base) • **Customers:** *Decreases* in-footprint customer growth compared to Base Case (decreases customer meters from the Base Case) • **Strategic Electrification**: VGS is back-up option to alternatives, *overall decrease* in usage due to installation of cold climate heat pumps (customers decline) • **Investments:** *No innovation investments*, declining general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates increased to *accelerate depreciation*, increases pressure on base rates • **Rate Base:** *Decreases approximately 41%* primarily due to accumulated depreciation outpacing capital investments including no innovation investments • **Base Rates:** Track at or above inflation over time

Refer to Section 3.0: Financial and Regulatory Assessments for further detail.

4 RESILIENCY IN THE FACE OF UNCERTAINTY

In 2020, we continued to provide safe, reliable, and affordable service to our 54,000 customers amid a global pandemic that changed the way we work and live. In this section of the IRP, we consider the external factors that could upend our current perspective and assess our resiliency and planning strategy for extreme weather events, pandemics, and other external events. Additionally, we examine planning for the human capital aspect of our business and discuss how we propose to leverage our powerful and valuable workforce as the primary engine of our new business model, establishing the right mindsets and skillsets to serve our customers' future energy needs.

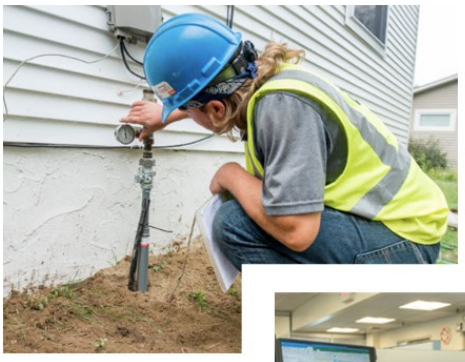
#5 IMPLEMENTATION

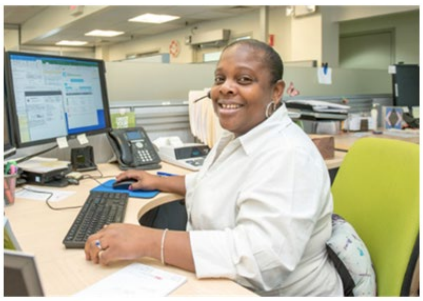
This section of the IRP builds on the prior planning phases and pulls the key factors and lessons learned into potential implementation and planning strategies. In this section we summarize the issues, challenges, and opportunities identified in the planning process and articulate key themes of our short-term and long-term planning.

ABOUT VGS

VGS AT A GLANCE

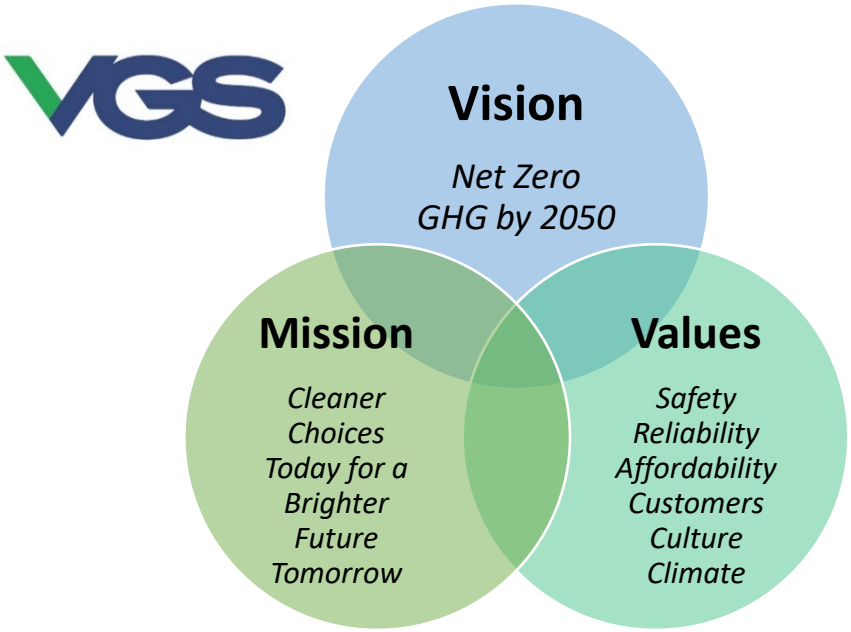
- Serving 54,000 customers
- Addison, Chittenden, and Franklin Counties
- 135 employees
- 1st in nation retail program for RNG
- $45M invested in energy efficiency since 1993
- Residential Retail Sales 29%
- Commercial Retail Sales 23%
- Interruptible Retail Sales 26%
- Wholesale 22%
- Annual revenues of $103M





CORE VALUES

VGS is a values-driven organization with a clearly articulated vision and mission that drives our strategic planning, goal setting, and regulatory approach.



PILLARS OF SUCCESS

VGS's executive team and board of directors annually complete a strategic planning process that establishes both short-term performance indicators and informs long-term planning. Our planning process is performed under the rubric of addressing strategic advantages and challenges through a set of core values. These core values are woven throughout this IRP and we consider them the pillars that are critical to our future success.

A HISTORY OF INNOVATION

Since the days when gas burning lights first illuminated homes and businesses, natural gas has played an important part in the advancement of energy innovation in this country. Just like the antique gas lights hanging in the chambers at the Vermont State House, restored and since converted to electricity, the natural gas industry has had to innovate several times to meet changing customer needs and demands. In Vermont, VGS began serving its first customers on February 3, 1966, when the initial molecules flowed through Highgate Station from the TransCanada Pipeline.[3] In the 55 years since, VGS has continued its tradition of positive disruption in the energy landscape of Vermont, evolving from a natural gas company to an Integrated Energy Services Provider that now offers renewable natural gas, objective energy expertise, energy efficiency programs, and unparalleled service to over 54,000 customers in northwestern Vermont. It is not a coincidence that VEIC's 2019 Energy Burden Report found that the areas of VGS's service territory have the lowest thermal energy burden and lowest total

[3] TransCanada Pipeline Limited is now known as TC Energy.

energy burden in all of Vermont. The almost 1,000 miles of transmission and distribution infrastructure that provide thermal energy will continue to connect VGS's customers to renewables, efficiency, and innovation to meet the State's goals of a decarbonized energy future.

Innovation today looks quite different from the modernization of thermal energy delivery that natural gas brought to northwestern Vermont over 50 years ago. Once touted as a provider of the cleanest of all of Vermont's thermal energy choices, VGS has evolved its values and mission to align with the State's energy goals and customer expectations around renewables and carbon impact. VGS is fully committed to decarbonization of its supply and delivering safe, affordable energy to its 54,000 customers in Vermont. The pursuit of innovation has been part of VGS's DNA from the start.

Highgate Station, February 3, 1966

VGS Climate Vision Announcement, November 2019

Innovation in today's energy market means renewable supply, partnering with customers and other stakeholders to advance decarbonization projects, and supporting creative financing to expand energy efficiency. It also means advancing our Climate Action Plan through RNG and boosting energy efficiency, while also pursuing innovative energy solutions. VGS was the first natural gas company in the U.S. to offer a voluntary retail option for RNG. We have initiated and supported innovative solutions for converting waste to energy while also contributing to addressing ongoing methane and water quality challenges for Vermont agriculture. In Salisbury, Vermont, VGS has partnered with Vanguard Renewables and Middlebury College to pioneer the construction of a project that will provide RNG to Middlebury College and other VGS customers beginning in 2021. We are evaluating district energy systems as a new thermal energy solution powered by waste heat from electric generators, as well as geothermal systems. Through our partners at fellow distribution utilities and Energy Efficiency Utilities ("EEUs"), we have broadened the potential for collaboration on forward-looking energy projects like waste heat, district energy, and storage of renewable energy as hydrogen blended on our system.

In late 2019, VGS became one of the first natural gas local distribution companies (without an electric business unit) in the U.S. to commit to Net Zero greenhouse gas emissions by 2050. VGS understands the unique opportunity and role it has as a distribution utility to help our customers decarbonize and fully participate in the clean energy transformation that is underway. While many organizations are stepping forward with similar pledges, VGS has modeled our commitment and created a plan for accomplishing it while keeping rates low and stable.

Through these strategies and others, we will partner with customers to deliver energy solutions that suit their needs, keep them comfortable, and meet their goals for reducing their carbon impact, while never compromising our foundational goals of safety and affordability.

SUSTAINING OUR REGULATORY COMMITMENTS

In 2017, VGS and the Department of Public Service entered a Memorandum of Understanding ("MOU") outlining components to be included in this IRP. The following provides a summary of how this IRP addresses those components:

Discussion of Clean Energy Initiatives: This IRP discusses the key energy initiatives referenced in the MOU, as well as our energy transformation planning anchored in the VGS Climate Action Plan, which is tailored to meet the policy goals of those initiatives. As such, the strategies, and implications of meeting Vermont's goal to reach 90% by 2050, including the impacts of electrification, cold climate heat pumps, and businesses' climate commitments, are not just discussed in this IRP, they are a recurring and central theme throughout.

Environmental Costs, Least-Cost Planning, and GHG Reductions: As discussed throughout the IRP, we are guided both by our Climate Action Plan and our foundational values of safety, reliability, and affordability. As our Climate Action Plan demonstrates, our planning has incorporated environmental considerations in a robust fashion, with ambitious targets to reduce GHG emissions. At the same time, we remain focused on affordability. The directional financial assessments included in this IRP provide planning insight into the various scenarios under which we may achieve our ambitious goals and provide some key insights into the potential cost impact. While we expect that increasing RNG and other ambitious climate initiatives will increase rates over traditional service, we are laser focused on finding the most cost-effective means to achieve our common climate goals. Environmental costs are also considered when efficiency measures are assessed under our approved Demand Resources Plan.

RNG Program: VGS has assessed the RNG program over the last several years. In addition to the voluntary program referenced in the 2017 MOU, VGS has worked with the Department and Commission to begin including modest levels of RNG in our general retail portfolio. As discussed in some detail in this IRP, increasing RNG is a central strategy under our Climate Action Plan. Accordingly, we have modeled several scenarios that will help us meet our customers' demand for a clean energy profile and the State's Renewable goal of 90x50, while evaluating the factors that will drive our least-cost strategy over the term of the IRP.

Short-term and long-term implementation actions: As discussed throughout the IRP, it is an uncertain time for both short- and long-term planning. Nevertheless, this IRP provides an extensive assessment of the strategies we believe will best promote a decarbonized thermal future for our customers. Under the various scenarios we assessed, implementing our Climate Action Plan at "least-cost" is the north star of our implementation plan. Specific factors driving the implementation of our plan are discussed more fully throughout the IRP, but particularly in the Implementation section.

Competitive Position of Natural Gas vs. Electric Heat: Under VGS's Climate Action Plan, we do not aim to compete with electric heat. On the contrary, we aim to serve our customers with the thermal energy that is right for them and will look to partner with electric distribution utilities and others to ensure that VGS is supporting electrification when it is the least-cost thermal energy source after considering GHG emission and environmental impacts. In this IRP, rather than assess the comparative competitive advantages of traditional natural gas and electrification, we have instead engaged in planning that focuses on what we can do to promote and encourage energy transformation through innovation, financing, and capital investments in decarbonization.

Thermal Efficiency & Negative Growth: As discussed above, this IRP is VGS's first planning exercise of this kind in recent years that does not assume some level of system expansion. This IRP assesses the impact of thermal energy efficiency measures on load and provides a broad 20-year outlook of the potential impacts on growth that could stem from a variety of climate action initiatives. Consistent with the MOU, our modeling scenarios forecast a reduction in load because of varying levels of energy efficiency savings and customer growth. Under these scenarios, we anticipate that we will be able to provide more value for customers at least-cost under scenarios where we pursue energy efficiency and environmental goals more aggressively than under a scenario where VGS takes a less active role in our customers' energy transformation.

Gas Supply: This IRP forecasts the impact of folding an increasing amount of RNG into our retail portfolio as a critical tool to advance our Climate Action Plan. Substantial investment in supply alternatives such as looping for peak load management or Compressed Natural Gas ("CNG") storage will not be necessary under the slow- to no-load growth scenarios modeled.[4]

[4] Given the declining load projected under all three planning scenarios in this IRP, VGS did not conduct a 20-year net present value analysis of competing supply options and infrastructure.

1.0 FORECASTING THE ENERGY NEEDS OF OUR CUSTOMERS

At its core, the IRP is a "plan for meeting the public's need for energy services."[5] As such, the first phase of our planning process involves an assessment of the factors that are driving our customers' energy needs over the term of the IRP. This IRP acknowledges that "least-cost" planning under Vermont's ambitious renewable energy goals requires us to do more than forecast our customers' natural gas demand. To meet the objectives of our Climate Action Plan, we must make realistic assumptions about the potential impact of clean energy initiatives and statutory goals that will decarbonize Vermont's thermal energy sector, how those initiatives may impact customer demand for natural gas, and the directional financial impact under a variety of scenarios.

As we plan for substantial GHG reductions of 30% in the next 10 years and Net Zero by 2050, we evaluated three scenarios that contemplate the potential impact on our customers' demand for natural gas considering energy efficiency measures, fuel switching, climate change, and the availability of innovative alternatives to traditional thermal resources. In this portion of the IRP, we set forth our forecast of customer demand for energy services in three areas:

- First, we acknowledge and appreciate that any attempt to forecast the energy needs of our customers over a 20-year term begins with engagement with our partners and stakeholders. In Section 1.1, we incorporate the feedback we have received from stakeholders regarding both our Climate Action Plan and the overall framework and scenarios we envision in this IRP.
- In Section 1.2, we look at how one of the key strategies of our Climate Action Plan—boosting energy efficiency—will impact customer demand. This portion of the IRP begins with a review of our energy efficiency programs and provides an overview of current and proposed energy efficiency measures under each of the previously described scenarios.
- Finally, in Section 1.3, we present our assessment of potential customer demand for natural gas under each scenario and discuss the broader thermal energy demand of our customers as we progress toward meeting our customers' future energy needs while advancing decarbonization strategies in the thermal energy sector.

1.1 STAKEHOLDER ENGAGEMENT

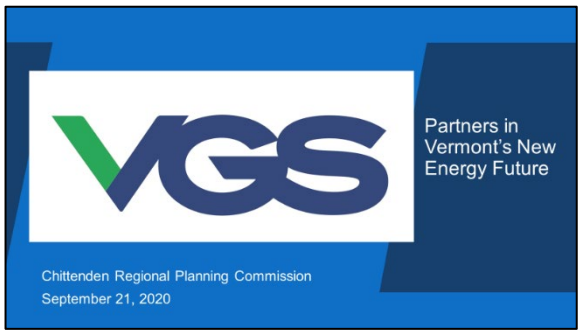
VGS completed extensive stakeholder engagement as part of the creation of this IRP including: customers; utility partners, specifically electric distribution utilities and energy efficiency utilities; trade partners; environmental groups; organizations focused on serving low-income customers; and regional planning commissions. In total, VGS met with more than 20 external stakeholders sharing both its Climate Action Plan as well as its framework for the IRP and scenarios to be tested. Additionally,

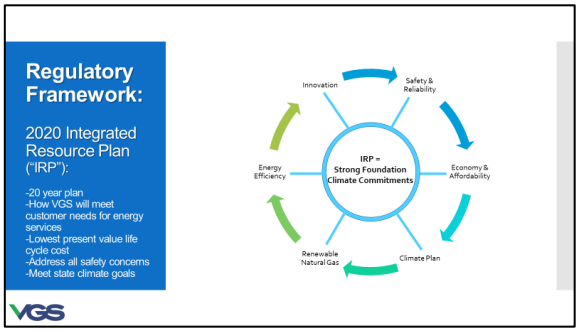
[5] *See* 30 V.S.A. § 218c.

significant employee engagement was done during the creation of both the Climate Action Plan and this IRP.

Overall, feedback was positive and receptive. “I feel like I’m talking to a completely different company” was a comment we heard from a few customers. We also heard a caution not to forget that customers love the affordability and convenience of our product and to not compromise that in pursuit of climate goals. Many applauded our efforts at innovation and recognized the opportunity that curtailed renewable electric generation presents in Vermont for hydrogen storage and blending. Still others came forward with ideas for partnering on behalf of commercial and industrial customers, which resulted in several co-presentations on shared topics around weatherization and climate. Environmental groups warned us to be mindful of greenwashing and careful not to talk out of both sides of our mouths, commenting that it is difficult to believe a fossil fuel company can serve natural gas *and* be climate-forward. The feedback shed light on our need to continue this level of engagement with all our partners as we move forward in pursuit of these goals. Explaining the “why” as well as the “how” will be critical in establishing credibility with all our stakeholders. Additionally, we were encouraged in future IRPs to think through opportunities more critically around transportation and its intersection with thermal energy.

Ultimately, we asked for additional time to complete our IRP to appropriately respond to the feedback from stakeholders. The feedback led to our decision to include a section addressing “People” in this IRP with special attention to “Change Management.” The time we took to engage stakeholders through the IRP process emphasized the importance of continuous engagement and feedback during VGS’s transformation, and we are committed to continuing this engagement.





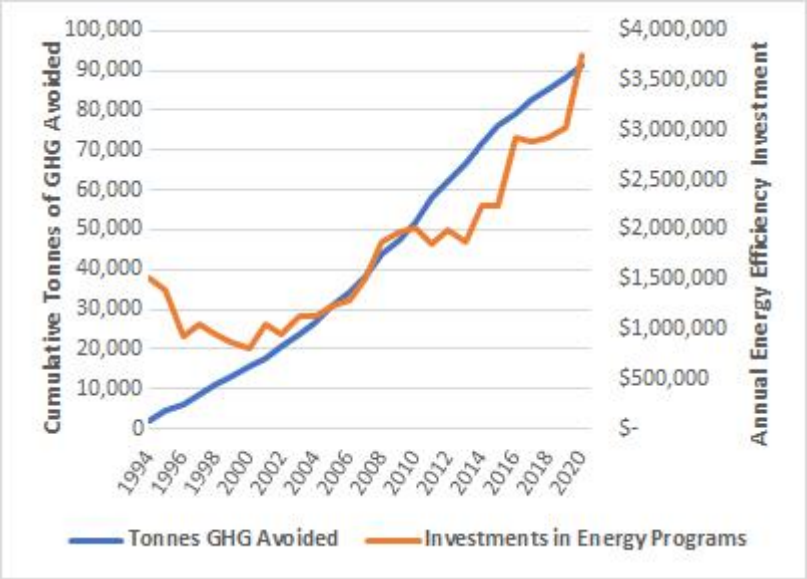
- Slide deck example from Stakeholder Outreach meetings

1.2 ENERGY EFFICIENCY

A key component of our Climate Action Plan involves boosting energy efficiency savings. Increasing the thermal performance of our customers’ homes and businesses helps reduce demand for our thermal energy supply. Accordingly, energy efficiency is a key part of the forecast of our customers’ energy needs. In this section, we discuss Vermont’s energy goals for weatherization, the success of our investments in energy efficiency, the programs we offer to meet our customers’ energy efficiency needs, and the potential energy efficiency targets under each scenario we envision as part of the overall forecast of customers’ energy needs.

A HISTORY OF INVESTMENT IN ENERGY EFFICIENCY

VGS has operated its energy efficiency programs since 1992 and has invested over $45M to help customers save energy. Since that time, VGS helped 40,000 customers save 1.7 BCF and 90,000 tonnes of carbon. In 2016, VGS became authorized to serve as a Vermont Energy Efficiency Utility. As a provider of EEU services, VGS's proposed Demand Resource Plan ("DRP") for the next three years, with an outlook for the next 20 years, was approved in late 2020.[6] Our current Triennial Plan is focused on ramping up energy efficiency programs in alignment with, and foundational to, the Company's aggressive Climate Action Plan. It outlines the potential savings for customers from 2021-2023 as well as potential savings and budgets through 2040. Expanding our efficiency program is a key input to achieving the Climate Action Plan goals. Efficiency programs drive significant greenhouse gas emission reductions by helping customers drastically reduce their energy use, as evidenced in the graph below.



Graph 1.1

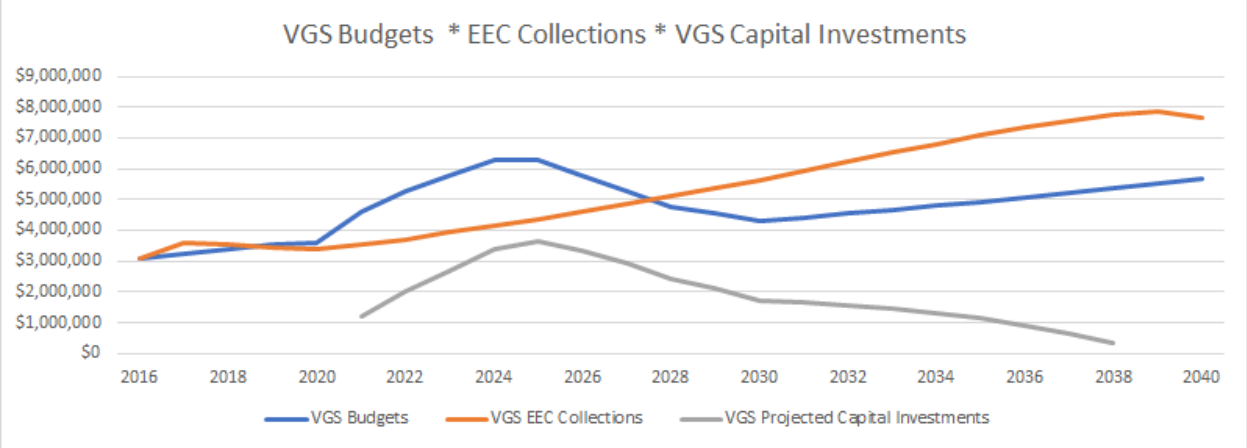
HOW IT WORKS

To achieve the State's energy goals, as modeled by Energy Action Network,[7] Vermonters need to weatherize 90,000 homes by 2050, only 27,000 of which had been completed by 2018 according to Energy Action Network's 2019 Annual Progress Report of Vermont.[8] VGS's weatherization program has been responsible for approximately 3,500 of those weatherizations. With recently approved budgets for the next three years, VGS aims to substantially increase the number of weatherization projects it does

[6] *See Petition of Vermont Department of Public Service,* Case No. 19-3272-PET (Vt. Pub. Util. Comm'n, Oct. 22, 2020).
[7] https://www.eanvt.org/wp-content/uploads/2020/02/pg4-paris.png
[8] https://www.eanvt.org/2019-progress-report/

annually with a specific focus on the income-eligible and moderate-income sectors, helping the State move closer to reaching its total weatherization goal.

As part of the Commission-approved Triennial Plan, our annual budget for energy efficiency will include additional efficiency investments financed by VGS of approximately $16M through 2026 and a projected $34M by the end of 2038. These supplemental investments will be amortized and recovered in the energy efficiency charge ("EEC") over 15 years (the approximate average energy efficiency measure life). By using its own capital resources, VGS can materially increase its efficiency spending with only a moderate increase in the EEC in each year of the Plan, as shown in the graph below. Based on the most recent Commission-approved DRP, VGS will continue to finance energy efficiency investments through 2038, resulting in a smoother rate trajectory for the EEC. This creative and innovative method of financing efficiency investments will spur an increase in energy efficiency savings while keeping costs low and affordable for Vermonters.



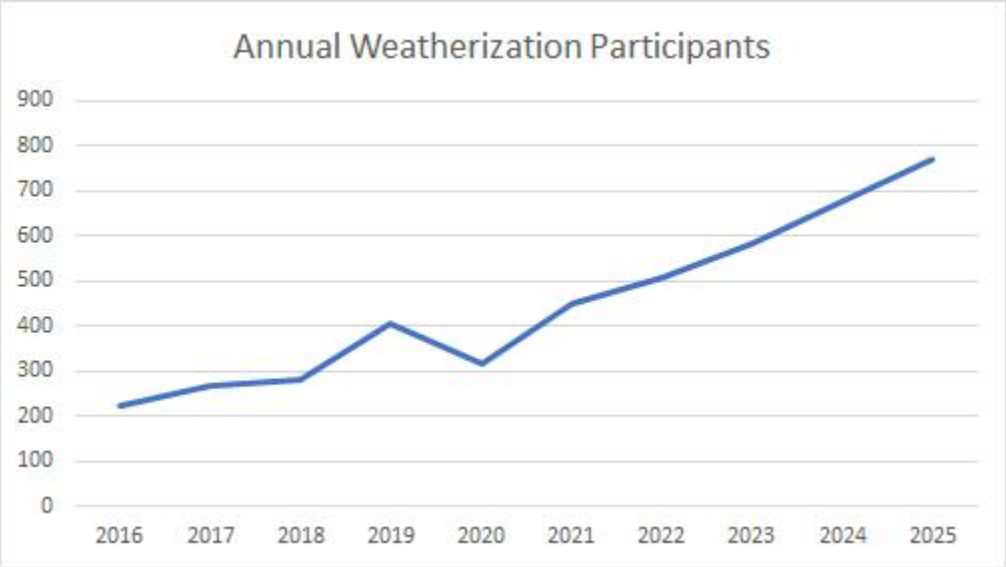
Graph 1.2

VGS has built a solid foundation of successful efficiency programs that aim to deliver new and innovative ways to achieve energy efficiency savings for its customers. These include developing new partnerships and collaborations and offering initiatives that target specific customers either by sector (residential or commercial & industrial ("C&I")) or classification (low and moderate income). In each of the scenarios used in this IRP, VGS anticipates ramping up savings levels from the last Triennial Plan to meet the increased energy savings goals set forth by the VGS Climate Action Plan and to further the State's Energy Goals set forth in 10 V.S.A. §§ 578, 580, and 581 by decreasing GHG emissions.

VGS currently offers six energy efficiency programs, tailored to the markets they serve: residential and C&I customers. The three residential programs are offered to residential properties (renter and owner-occupied), while the three C&I programs provide energy efficiency services to C&I customers of all rate

class sizes, including interruptible customers.[9] In each market, VGS's programs cover retrofit/weatherization, new construction, and equipment replacement.

The graph below shows the number of existing residential buildings that were weatherized from 2016-2019, with 2020 still being finalized, and basing projections for 2021-2025 on the most recent Commission-approved DRP.



Graph 1.3

Specifically, the efficiency programs implemented by VGS will achieve the following:

- Increasing the number of residential homes audited and weatherized – whether by VGS or our partners – with an increased focus on moderate income and income-eligible customers.
- Remaining nimble to address economic realities resulting from the Covid-19 pandemic, and modifying plans as needed to offer loans/financing/incentives structured to enable both residential and commercial customers to have the confidence to move forward on energy efficiency projects.
- Aggressively pursuing efficiency opportunities with both residential and commercial customers in Addison County.
- Assisting customers in the Burlington Electric Department ("BED") footprint to further Energy Champ and their Net Zero initiative.
- Collaborating with Efficiency Vermont ("EVT") with mutual customers to ensure seamless service delivery for customers across programs.
- Collaborating with Champlain Valley Office of Economic Opportunity ("CVOEO") for income-eligible customers.

[9] Wholesale CNG customers served under one of the VGS CNG tariffs and customers participating in self-managed energy efficiency programs are not served by the VGS efficiency programs.

- Integrating options for customers to purchase RNG to further reduce GHG emissions as part of a package with more efficient equipment.
- Continue to partner with Green Mountain Credit Union (or other partners) to provide customers with easy and low-cost financing options for energy efficiency projects.
- Sustaining the residential mobile home and condominium initiatives.[10]
- Serving neighborhoods impacted by the Burlington International Airport Sound Mitigation plan within the VGS footprint.
- Engaging small business owners to ensure comprehensive participation to reduce fuel bills to save energy dollars.

VGS has strong customer relationships with homeowners, renters, builders and developers, large and small commercial customers, and many institutional customers such as hospitals, colleges, and universities. VGS is committed to exemplary service, safety, and energy conservation, and keeping rates low and affordable. The VGS programs not only help our customers reduce their natural gas bills and reduce carbon emissions, but also offer increased comfort levels in homes and contribute to the State's energy goals.

ENERGY EFFICIENCY PLANNING SCENARIOS

Our ability to achieve energy efficiency savings for our customers will have a direct impact on our customers' energy needs over the term of this IRP. Accordingly, we included three planning scenarios that reflect potential energy efficiency impacts over the term of the IRP. To implement the EEU programming, the DRP included Resource Acquisition ("RA") costs, Development and Support Service ("DSS") costs, and other costs associated with operating the programs. In the scenarios described below the RA costs and savings vary with each of the scenarios and the DSS and other costs remain constant.

HIGH CASE SCENARIO: The High Case scenario used in this IRP reflects the aggressive energy efficiency savings VGS initially proposed as part of its DRP. Under this scenario, VGS reaches 600,000 Mcf in savings by year 2025, triples residential retrofit projects by the end of 2025, acquires one Bcf in savings by 2030, and doubles energy efficiency by 2025.

BASE CASE SCENARIO: The Base Case scenario reflects a middle ground between the EEU savings and budgets reflected in the High Case and Low Case scenarios by essentially averaging those two potential outcomes. This scenario still includes aggressive energy efficiency efforts with a ramp, reaching 600,000 Mcf by the end 2026, almost tripling residential retrofits, and approximately one Bcf in savings by 2030.

[10] Condominiums and mobile homes are prescriptive offerings that are easy to participate in with fixed incentives and savings.

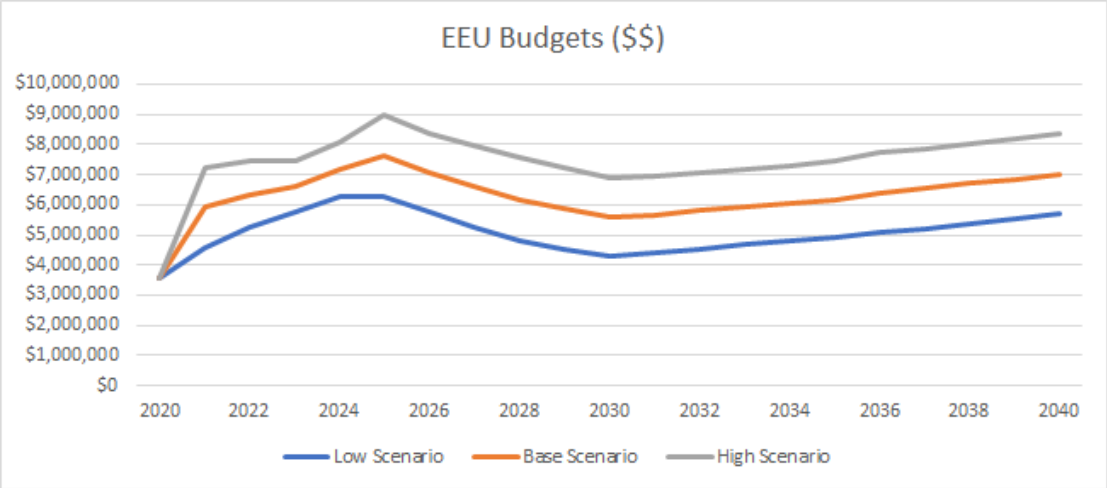
LOW CASE SCENARIO: The Low Case scenario reflects the EEU savings and spending in our current DRP[11] as approved by the Commission.

The following table reflects the Commission-approved budgeted costs and savings since becoming an EEU in 2016 out through 2023.

Commission Approved EEU Budgets	Transition Period		2018-2020 Three Year Plan			2021-2023 Three Year Plan		
	2016	2017	2018	2019	2020	2021	2022	2023
Resource Acquisition	$2,513,464	$2,720,276	$2,889,201	$3,014,426	$3,030,476	$4,047,753	$4,731,870	$5,332,596
Development & Support Services	$243,964	$251,449	$259,757	$267,135	$269,536	$260,000	$262,600	$265,226
PSD Evaluation, Fiscal Agent, TEPF, Other	$300,190	$250,030	$237,279	$234,277	$276,979	$285,580	$268,130	$167,404
	$3,057,618	$3,221,755	$3,386,237	$3,515,838	$3,576,991	$4,593,333	$5,262,600	$5,765,226
Annual Mcf Savings Budgets	69,000	77,385	65,019	66,156	64,655	70,087	80,909	88,655

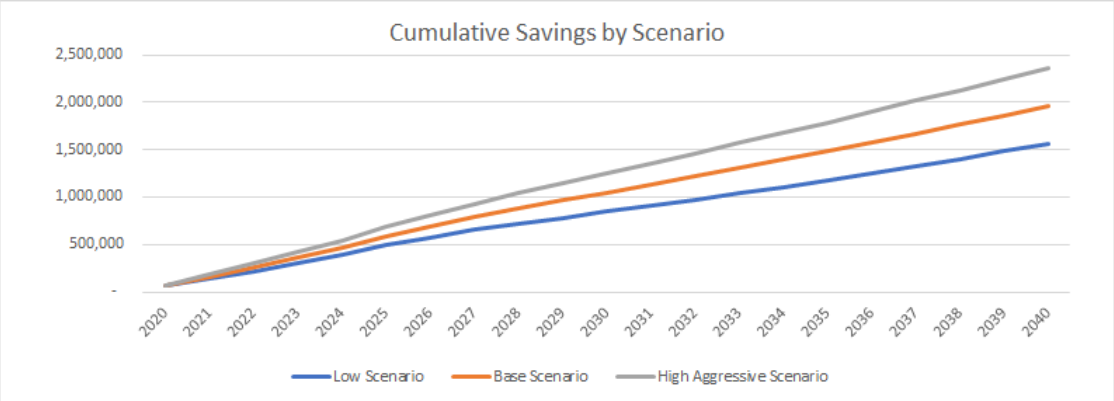
Table 1.1

The following graphs reflect both the savings and costs for each of the above scenarios through 2040.



Graph 1.4

[11] VGS will go through another DRP proceeding for the term 2024-2026, where costs and associated savings at that time may allow for more aggressive savings targets.



Graph 1.5

SUMMARY ENERGY EFFICIENCY

Clearly, these planning scenarios show greater energy efficiency savings the more aggressively we pursue those savings, while a more restrained approach results in lower savings. All three cases, however, reflect an ambitious and comprehensive strategy to ensure customer participation in both the residential and commercial sectors. Income-eligible, owner and tenant-occupied, new construction, single or multi-family buildings, as well as a wide range of businesses, are all equitably served to increase energy efficiency investments and put VGS and its customers on a path to dramatically reduce GHG emissions. The programs are comprehensive, customer-focused, and designed to be nimble, flexible, and responsive to customer demands. Eliminating roadblocks to customer participation allows customers to make informed decisions, incorporates solutions to address healthy and safety impediments, and increases collaboration and partnerships, which all contribute to advancing Vermont's energy goals.

1.3 MEETING CONTINUED DEMAND FOR NATURAL GAS

As we implement strategies to reduce our customers' carbon footprint through energy efficiency, electrification, and innovation, our long-term planning also acknowledges that our customers' energy needs will be dynamic over the 20-year planning horizon and are likely to change with emerging technologies and economics. As we galvanize behind GHG reduction strategies, we are also focused on continuing to provide safe, reliable, and affordable service to our customers over the term of the IRP. In this section, we present our forecast of natural gas demand under three planning scenarios.

First, we start with an explanation of how we typically evaluate natural gas demand and explain the trends we have seen in demand over recent years. Second, we present an assessment and forecast of potential customer growth under the High Case, Base Case, and Low Case scenarios, which show decreasing levels of new customer growth. Third, because our customer growth forecast also suggests that our customers' thermal energy needs will be transitioning over the term of the IRP, we present an assessment of the need for an integrated energy service approach to meet those demands. Finally, we present our load forecast under the High Case, Base Case, and Low Case scenarios, including detail

regarding the assumptions used in each case, use per customer, and design day requirements anticipated over the term of the IRP.

NATURAL GAS DEMAND

Natural gas demand is divided between base use and heating use. Base use is generally year-round and consists of end uses such as domestic hot water heaters, cooking equipment, clothes dryers, and commercial process loads. While base use occurs year-round, the usage profile is not flat. VGS forecasts higher base use in the colder months of the year as the water used in many processes starts at a colder temperature in the winter and needs additional energy to serve each customer's requirements. Heating use refers to space heating and is temperature driven. Additionally, there are some customers that have summer-only demands, such as asphalt paving, which impact both the base and heating use forecasts.

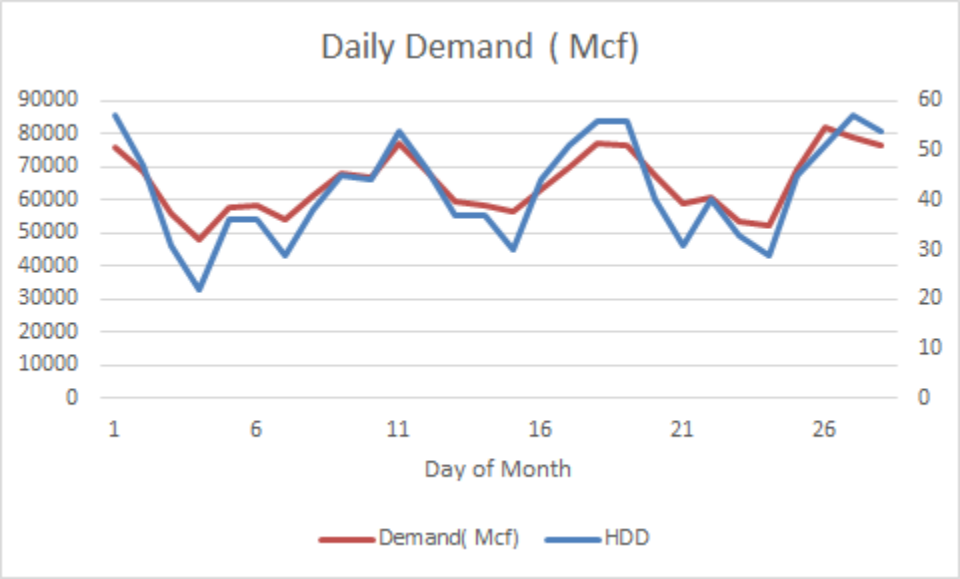
The primary driver of each of these forecasts is customer count. With robust growth over recent years, VGS's customer level has reached almost 54,000. In addition to total customers, forecasts must consider the cyclical nature of VGS's customer count. Some customers that are heat-only will shut off for the summer and turn back on for the winter months. This dynamic is shown in the graph below.

Graph 1.6

VGS also anticipates that it will lose a certain number of customers each year. VGS loses customers for a variety of reasons, including: (1) companies going out of business, (2) property redevelopment, (3) combining of several meters into one, and (4) fuel switching. Fuel switching has historically been a very small part of customer loss but may become more prevalent moving forward due to strategic electrification.

Weather also plays a significant role in demand forecasts. This is true on an hourly, daily, monthly, and annual basis. VGS forecasts and prepares to serve its firm load, made up of customers whose service cannot be interrupted to switch to an alternative fuel, on the coldest hour of the coldest day of the

year.[12] Graphs below show the typical daily demand of a winter and summer month for firm customers. The winter graph also includes heating degree days[13] to show the correlation with weather. Graph 1.8 shows The Average Monthly Demand of the last five years.



Typical Demand for Winter Months

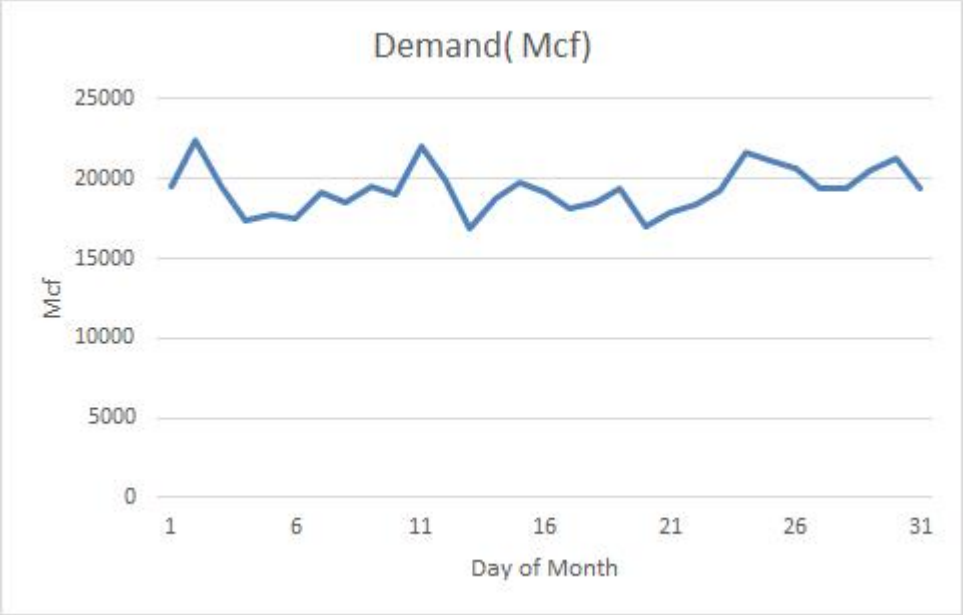
This graph illustrates that supply cannot be fulfilled by baseload supply. It demonstrates the variability of load during a typical winter month.

(HDD= Heating Degree Day)

Graph 1.7

[12] VGS has two classes of customers: firm and interruptible. Firm customers are entitled to natural gas service year-round, regardless of how cold it is. Conversely, interruptible customers can switch to an alternate fuel on 2 hours' notice from VGS and therefore may not be served in extreme weather conditions.

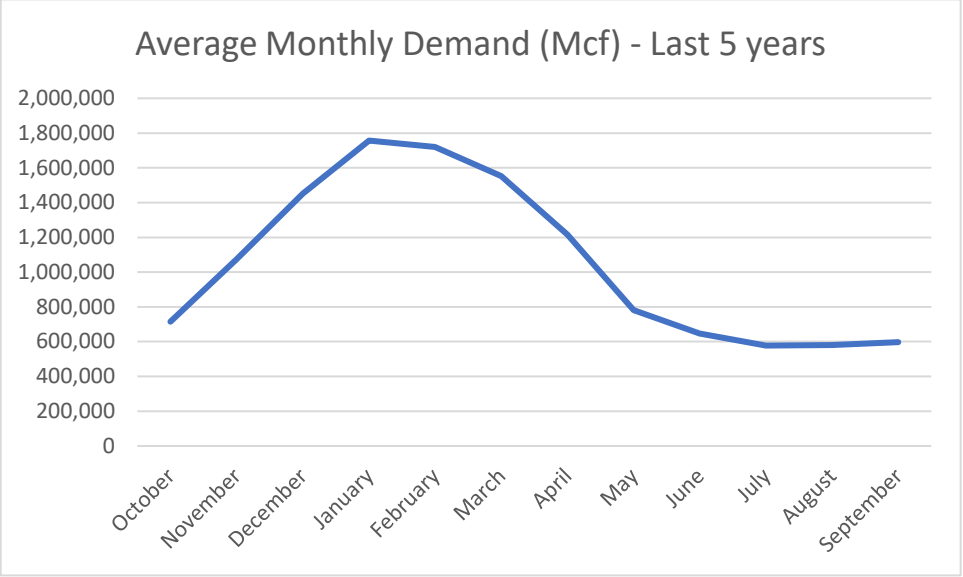
[13] A heating degree day is defined as the difference between the actual average daily temperature and 65 degrees Fahrenheit. For example, a day where the average temperature is 55 degrees, would be expressed as having 10 heating degree days.



Typical Demand for Summer Months

This graph illustrates that supply cannot be fulfilled by baseload supply. It demonstrates the variability of load during a typical winter month.

Graph 1.8



Graph 1.9

CUSTOMER GROWTH

Over the last 20 years, VGS's expansion into Addison County coupled with the high demand for low-cost fuel brought an average annual addition of approximately 1,200 new customers. Given Vermont's rural setting, VGS is limited in growth due to the low density of homes per mile and high cost of construction. This has brought a steady reduction of annual customer additions over the past 5 years down to an average of about 1,000. In areas where natural gas is available within 200 feet of an existing structure, VGS holds an overall saturation rate of 90.5%. In Chittenden and Franklin Counties, 95% of eligible homes and businesses within 200 feet of our distribution line are on natural gas, and in our newest community of Addison County, 31% of homes and businesses are on natural gas.

DEMAND FOR INTEGRATED ENERGY SERVICES

To be a VGS customer means access to service of equipment, energy efficiency services and incentives, technical expertise, exceptional customer service and emergency response. The total value proposition of VGS goes far beyond delivery of thermal energy. While customers can use any of these services, historically when customers access VGS it is for their issue at hand, which we resolve until the next opportunity to provide service. Between Customer Care, Field Services, Energy Efficiency and Marketing, VGS has 150,000 customer touches per year. Each of those contacts is an opportunity to connect customers into the total value proposition of being served by VGS. By providing an "Integrated Energy Services" approach, we equip all our employees with training to help customers beyond just their immediate issue and assist them with comfort, climate, and cost savings in their home or business. In 2020, staff built the conceptual design and began training employees in the Integrated Energy Services approach, which will be fully implemented in 2021.

Both reduced load and customer attrition forecasts highlight an opportunity to transition to an integrated energy services model that reaches beyond VGS's traditional natural gas service. We are committed to partnering with our customers to meet that demand. We anticipate that as our customers' demand for thermal energy services becomes more dynamic, it will call for a more comprehensive and integrated approach to meet customers' needs and interests regarding energy usage. The following six-pronged approach reflects the integrated energy services model we believe reflects the future of our customers' demand for energy services:

SALES

Renewing our focus on connecting new customers, particularly in Addison County,
and on reaching existing customers with new and existing products and services (e.g., weatherization).

CUSTOMER AND COMMUNITY INSIGHTS & EDUCATION

Through market research and community outreach, deepening our understanding of customer and community needs and educating consumers on the value created by energy efficiency and new products related to decarbonization.

TECHNICAL SERVICES

Training and equipping VGS Service Technicians to identify energy efficiency opportunities, sell and install energy efficient equipment, promote additional value-add products, and to capture customer insights on existing or new products.

CUSTOMER CARE CALL CENTER

Educating and training our call center representatives to engage customers with our total value proposition and to gain insights from customers that improve our product portfolio.

NEW PRODUCT DEVELOPMENT

Developing new products driven by customer needs, emerging technologies, and market opportunities.

VGS has a dynamic set of offerings for customers, including natural gas service, energy efficiency programs, rental equipment, service plans, and renewable natural gas. After completion of an extensive project to extend gas service into Addison County, for the next 5 years VGS will concentrate on sustaining manageable growth, evaluating potential to grow the service side of the organization, accomplishing efficiency targets, and growing potential for renewable natural gas, all through the lens of reducing greenhouse gas emissions.

FORECAST SCENARIOS FOR NATURAL GAS DEMAND

In the following section, we present the customer load basis for the three financial modeling scenarios—High Case, Base Case and Low Case—and provide a customer use and design day forecast for each over the term of the IRP. In forecasting customer growth, VGS has projected customers in the following categories for each scenario:

- Residential New Construction ("RNC"): Pipeline extended to serve newly constructed homes.
- Main Extension: Pipeline installed to serve existing, previously unserved, homes.
- In-Filling: Natural gas service to previously unserved customers along an existing distribution main.
- Commercial: New commercial customers ("CNC").

Finally, the three growth scenarios incorporate the energy efficiency assumptions described previously in this chapter and degrees days are held constant across the three scenarios.

HIGH CASE SCENARIO

Our High Case scenario was modeled using more aggressive Climate Action Plan projections. While we continue to see an overall decline in natural gas load under this scenario, it is more moderate than the Base Case due to higher levels of customer additions. In addition to sustaining customer interest in natural gas service, we view our innovative energy initiatives as a draw for our existing and future customers and have modeled more customer additions as a result in this scenario. Although VGS models lower customer growth overall during the term of the IRP, the High Case scenario shows more growth than is reflected in the Base Case and Low Case scenarios. Main extensions will continue to be slow, but existing and new homes as part of RNC and CNC expansions will drive some moderate growth.

BASE CASE SCENARIO

VGS's Base Case scenario models continued customer growth within our current footprint, albeit it at a slower rate, with growth coming primarily from some extensions to serve new construction projects, and main extensions within existing communities when financially viable. Our historical growth trends demonstrate that after an initial expansion into new territory, it is typical to see a decline in growth year over year in any given town. Exceptions are noted in FY21 where VGS has an ambitious Addison County goal. In FY21, two-thirds of VGS's efforts and customer goals are focused on Addison County, with the remaining one-third in Chittenden and Franklin Counties. VGS plans to market heavily in Addison County and will limit marketing in Chittenden and Franklin counties to focus on our newest community. The forecast for FY23, however, assumes Chittenden and Franklin counties will revert to the normal percentage saturation of remainder potential, while still providing Vergennes and Middlebury with a slight bump in saturation. FY24 through FY40 assumes a normal projected saturation rate for the remainder potential by town.

LOW CASE SCENARIO

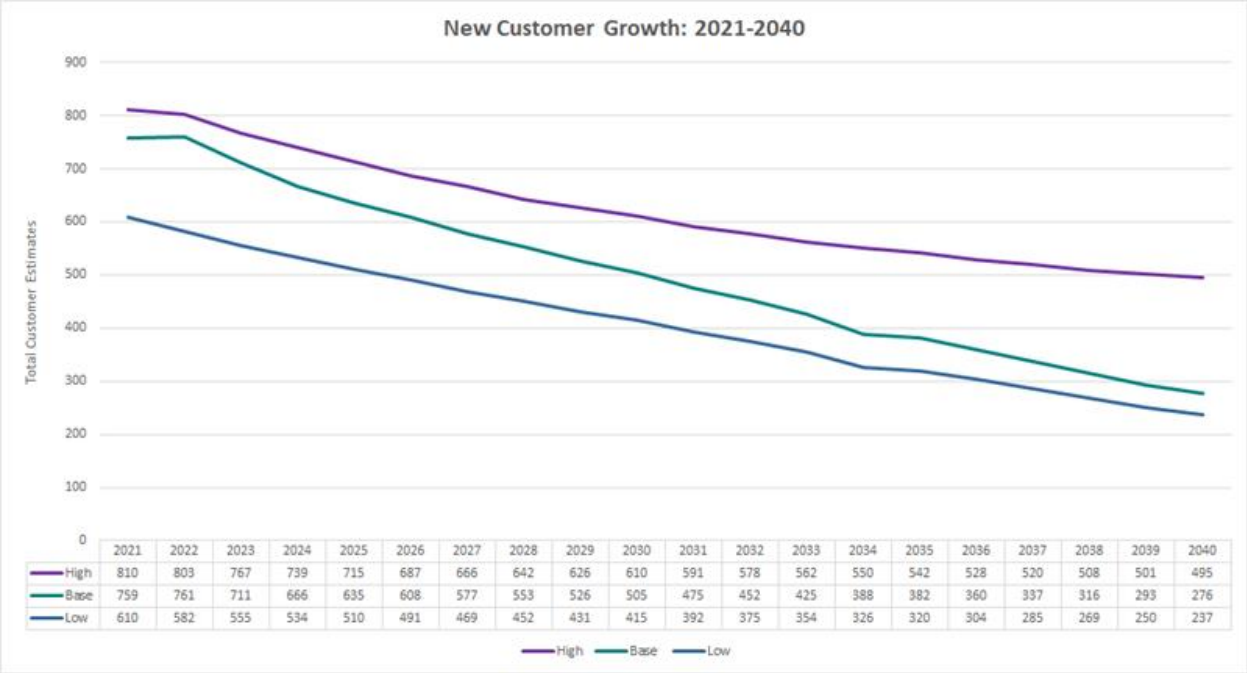
Under the Low Case scenario, we have assumed that the State's goals encouraging electrification will have a more significant impact on VGS's new customer growth forecast than under the Base Case scenario. In this scenario we have made an explicit adjustment to reduce residential customer usage to reflect a deeper penetration of cold climate heat pumps.

Historical data indicates that VGS's price advantage over propane and oil has been a significant factor in the number of new infill customers. The Low Case scenario anticipates RNG prices at a higher premium.

As additional RNG is added to our portfolio under this price forecast, we anticipate natural gas will have a reduced competitive advantage over other fuel sources, which results in lower customer growth.

Historically, VGS loses 150 customers annually. With a greater push toward renewable fuel sources and electrification, coupled with customers consolidating load from multiple meters to a single meter, we anticipate losing twice as many customers. Therefore, this case anticipates that 2021-2040 will see an additional loss above normal of 3,020 customers due to fuel switching.

VGS has projected customer growth under each of the three scenarios, which is depicted in the graph below.



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
High	810	803	767	739	715	687	666	642	626	610	591	578	562	550	542	528	520	508	501	495
Base	759	761	711	666	635	608	577	553	526	505	475	452	425	388	382	360	337	316	293	276
Low	610	582	555	534	510	491	469	452	431	415	392	375	354	326	320	304	285	269	250	237

Graph 1.10

Note: the chart above reflects the total new customer growth and does not account for customer attrition.

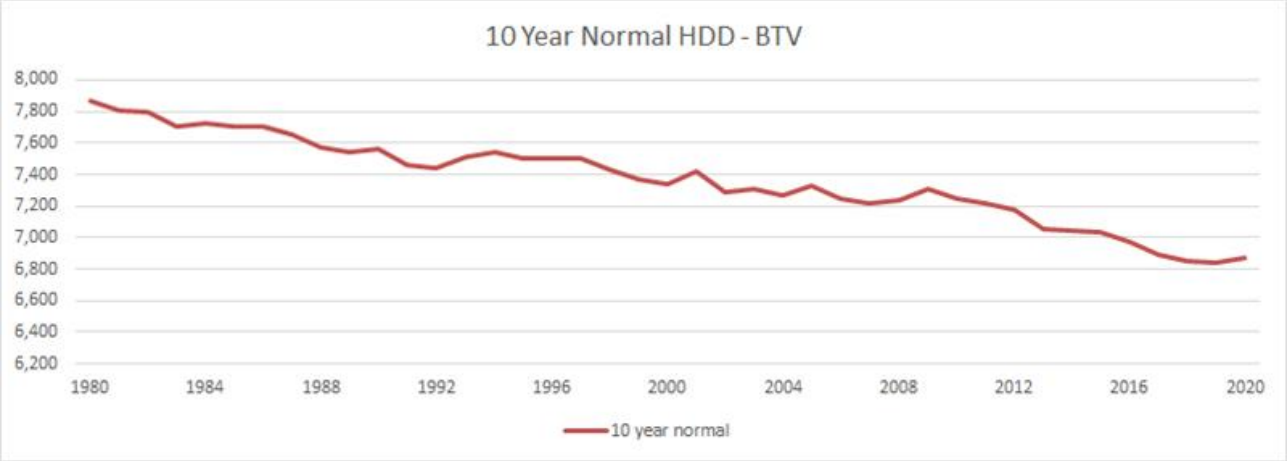
USE/CUSTOMER & WEATHER ASSUMPTIONS

In addition to forecasting the number of customers we anticipate over the term of the IRP, forecasting overall demand requires that we determine the amount of natural gas we expect customers to use. Projected natural gas demand in all three scenarios (Base, High, and Low) is based on forecasts of the following key inputs: historical customer use by rate class, projected customer counts as described in the scenarios above, forecasted normal weather, and projected efficiency upgrades among VGS's customer base.

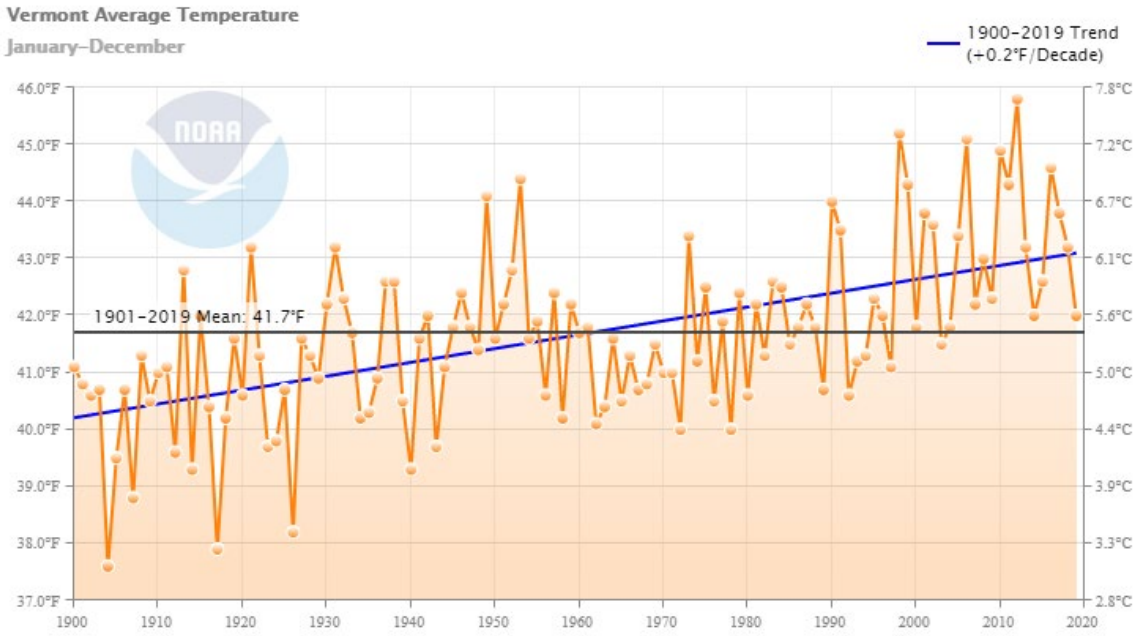
The starting point for a demand forecast is the historical customer use by rate class. For this outlook, VGS uses a 3-year average of customer use, including the effect of energy efficiency measures over the same period.

Customer demand is also forecasted using 10-year normal heating degree days ("HDD"). Industry standards vary between 10-year and 30-year normal. We utilize a multi-year average to smooth the fluctuation in weather from year to year. A 10-year normal flattens the year-to-year weather peaks. See below for the 10-year normal HDD as measured at the Burlington International Airport. The warming temperatures trend that the world is experiencing, and forecasting are discussed in further detail in Section 4.2 of this IRP.

For further analysis, graphs of the average Vermont Temperature and HDDs by year since 1990 is provided.

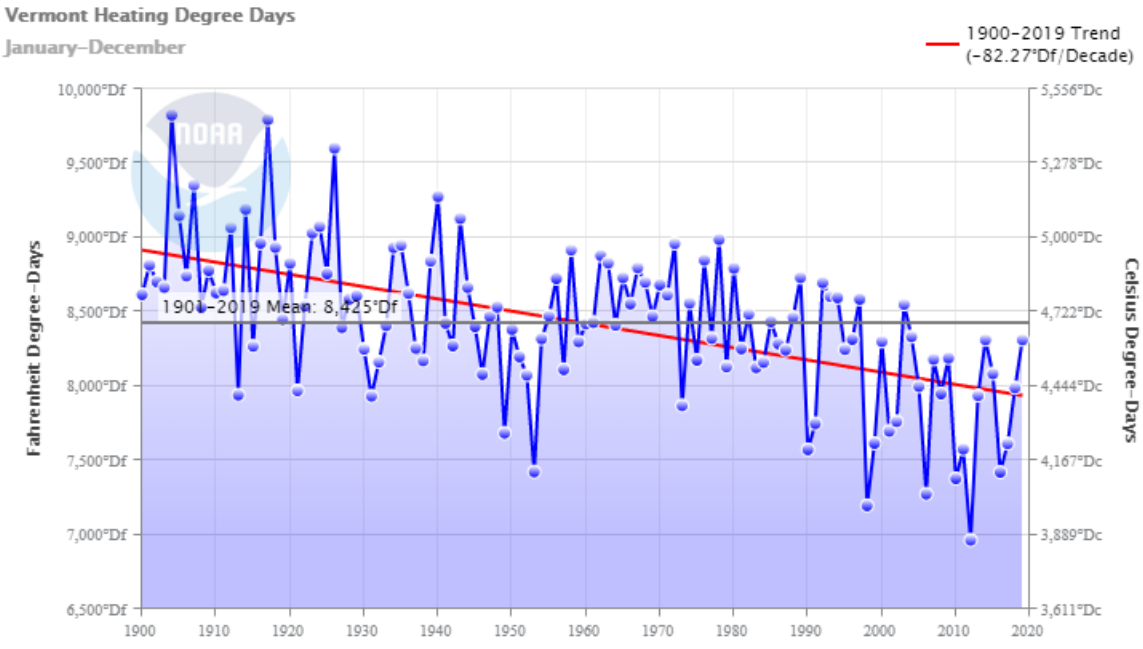


Graph 1.11



Source: NOAA

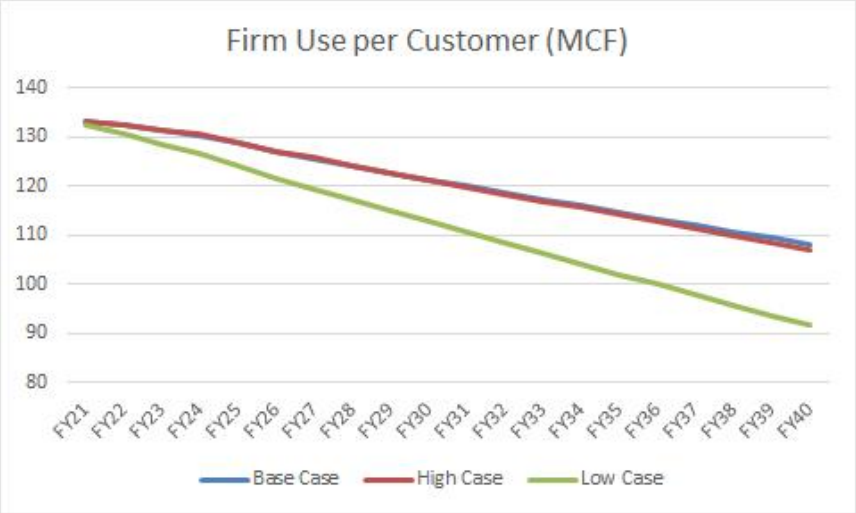
Graph 1.12



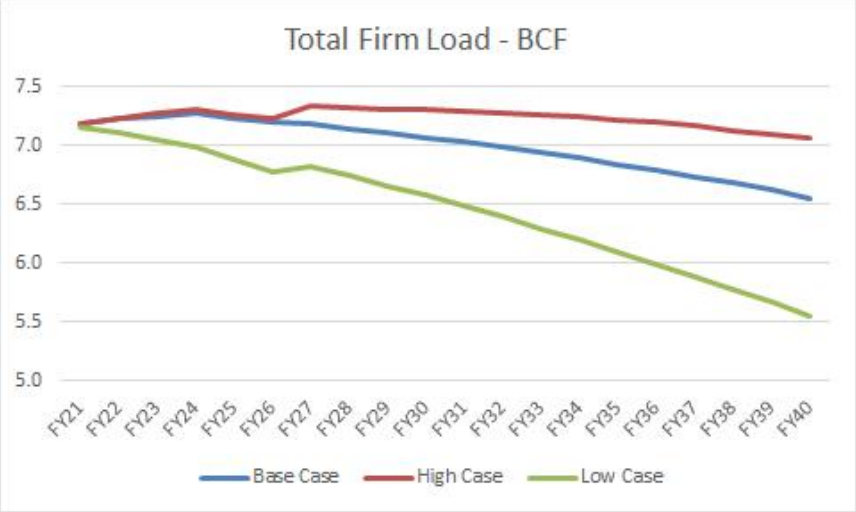
Source: NOAA

Graph 1.13

A combination of historical use/customer, weather, customer growth, and projected energy efficiency yields the following firm use in the three IRP scenarios.



Graph 1.14



Graph 1.15

DESIGN DAY

As a critical thermal energy provider, VGS must plan to meet its firm customers' load on the coldest assumed day of the year. This is referred to as the "design day." It represents a critical planning assumption to ensure that VGS can reliably meet its firm customers' demand, even in the most extreme weather. The design day forecast impacts both system infrastructure and supply resource planning. This is discussed in more detail in the Energy Supply Resources and Infrastructure section of this IRP.

In 2018, VGS completed a design day study to compare the Company's design day planning approach to the design day planning approach of other natural gas utilities in the Northeast region. The study yielded two changes to VGS's then-current design day calculation, both intended to better align VGS's planning with other regional natural gas companies.

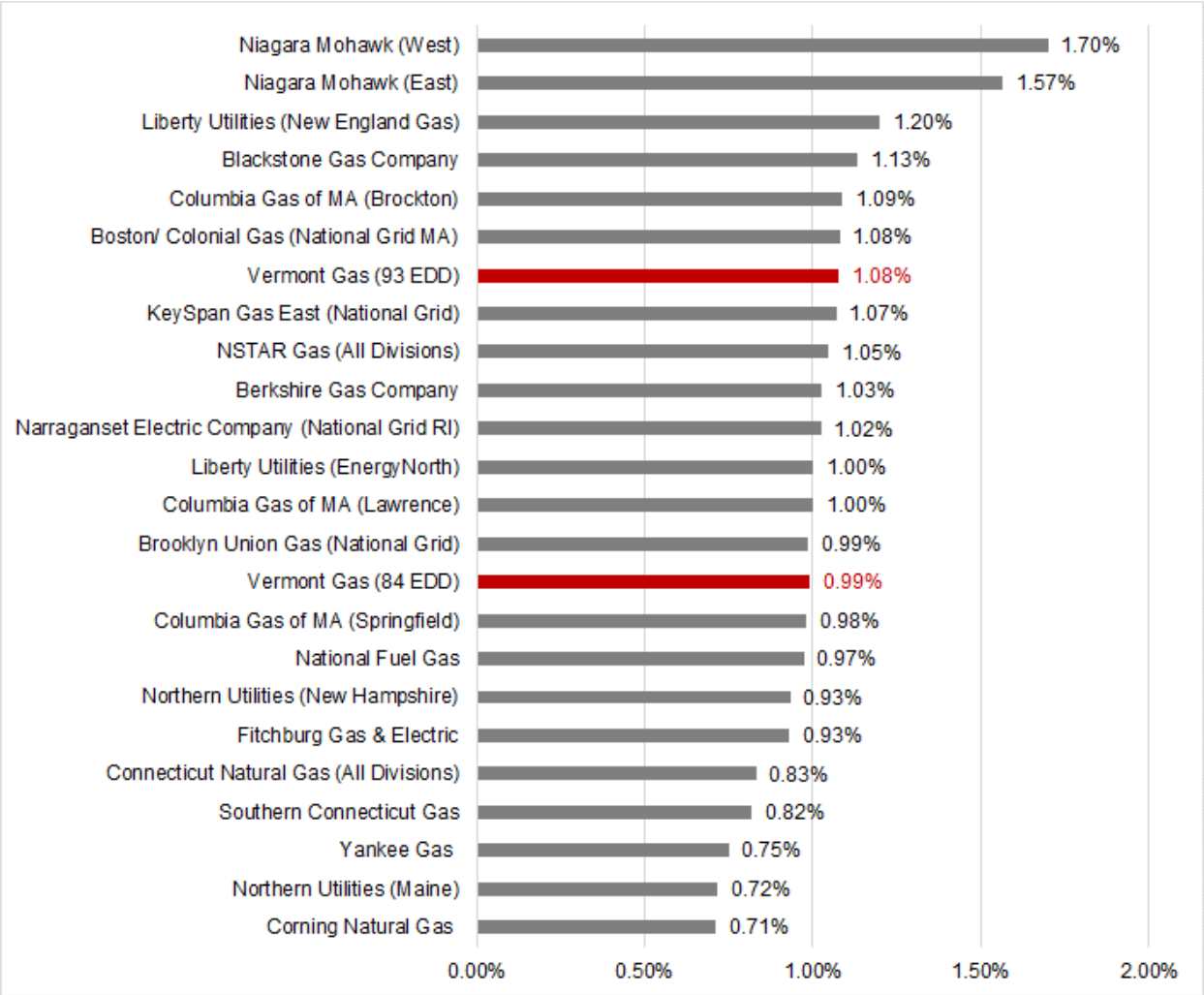
The first change was to move from the “Coldest Day in 30 years” planning standard to the “Probability of Occurrence” planning standard. The “Coldest Day” approach had the potential to result in large swings in design day calculations as the coldest day may fall off resulting in a large change in design day. In lieu of the “Coldest Day” approach, VGS is currently using a 1 in 35-year Probability of Occurrence. Probability of occurrence utilizes statistical analysis to estimate how often an event is likely to occur based on historical data. VGS uses over 30 years of historical data without adjusting for climate change to forecast the 1 in 35-year Probability of Occurrence.

The 1-in-35 probability VGS is using is approximately in the middle of its Northeast counterparts that ranged from a Probability of Occurrence of 1 in 19 to 1 in 59. The result of this change was that VGS moved from planning for an 86 HDD that was fixed until a colder day occurred, or the 86 HDD fell off in 2024 to an 83 HDD.

The second change was that VGS historically used an adjustment factor that was unique in the Northeast. The design forecast previously incorporated a factor that was based on the coldest 2-day periods in the last 3 years. The method, while statistically sound, yielded varying results from year-to-year due to colder-than-normal or warmer-than-normal winters and introduced additional volatility in the design day forecast. VGS moved to using the Standard Error of the Mean to match other Northeast utilities as well as to provide stability from year to year.

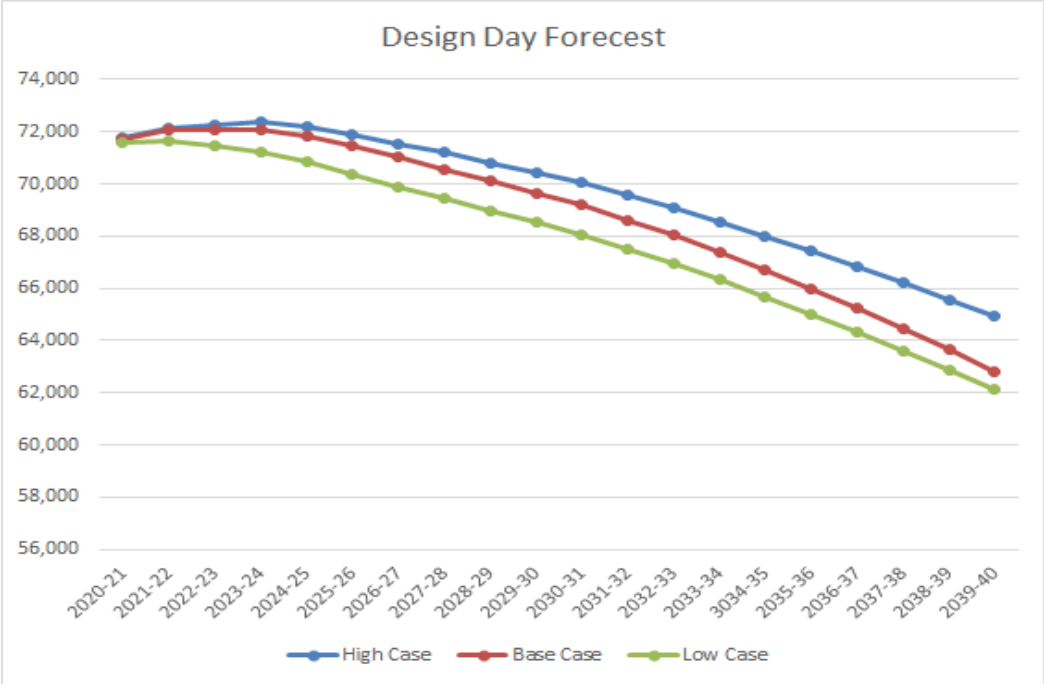
The study also benchmarked VGS’s current design day demand index, which compares the design day demand to the other utilities. The design day demand index is a comparison of design day demand as a percentage of normal year sales. The graph below shows VGS’s Design Day Index using both the coldest day in 30 years and the 2nd Coldest Day in thirty years.

DESIGN DAY INDEX



Graph 1.16

The resulting design day forecasts for each of the three cases share a common theme. In each case, the impact of energy efficiency is greater than expected design day growth, resulting in a declining design day. The design day forecast for each scenario is as follows:



Graph 1.17

SUMMARY CUSTOMER FORECAST

While today 54,000 customers count on a traditional natural gas supply, VGS is planning for loss of load and attrition while balancing the needs of current customers. Customer demand for natural gas is declining over the term of the IRP even under scenarios that contemplate continued, albeit slow, customer growth. This presents opportunities to transform our business model, focusing more on behind the meter offerings and an Integrated Energy Services approach.

As described above, lower demand influences our design day with a few caveats to keep in mind when assessing design day demand. First, while we have monitored the impact of Cold Climate Heat Pump ("CCHP") installation for a small subset of our customers and have not found a significant change to customers' natural gas usage, we do not yet have sufficient experience with CCHP to understand whether higher rates of installation will impact design-day forecasting. It is also important to note that interruptible customers are not included in design day planning as they can fuel switch during peak times. With these two caveats regarding design day methodology in mind, the resulting design day forecasts are then used to inform our overall approach to supply and infrastructure planning described in the next IRP section.

As demand for traditional natural gas is going down by design, VGS has a chance to pivot to a more decarbonized future of offerings that deliver a Net Zero pathway.

2.0 ENERGY SUPPLY RESOURCES AND INFRASTRUCTURE

The second phase of our long-term planning flows directly from the first. We know that our customers' demand for energy services will reflect dramatic reductions in GHG emission over the term of this IRP because of customers' increasingly climate-conscious choices, state energy policy, and our Climate Action Plan. This section of our IRP presents the major components of how we plan to meet our customers' energy services needs over the term of the IRP.

First, we present our overall supply objectives and describe how we plan to meet our customers' demand under the High Case, Base Case, and Low Case scenarios for overall customer load and design day as discussed above.

Second, we present another major component of our Climate Action Plan: advancing RNG. While we boost energy efficiency to lower demand, we expect to increase RNG within our retail portfolio at an average pace of 2% of retail sales per year over the term of the IRP. This section explains our approach to this procurement strategy and presents the impact of increasing RNG in the three scenarios.

Third, we acknowledge that we need to do more to close the gap. Our Climate Action Plan calls for reducing load through efficiency measures and decarbonizing load through RNG, but the third leg of the stool is critical: innovation through pro-climate partnerships and projects is expected to help us meet the future energy needs of our customers at least-cost while taking advantage of the environmental benefits of emerging technologies and strategies. In this section, we describe some of the emerging opportunities we see to build on our successful history of innovation.

Finally, we describe the transmission and distribution system that is critical to meeting our customers' demand for energy services. In this portion of our supply/infrastructure planning process, we evaluate our planning approach to transmission and distribution system investment and describe the anticipated investments in our pipeline system, both to accommodate customer demand and to ensure the continued safe reliable delivery of natural gas.

2.1 NATURAL GAS CUSTOMER SUPPLY

VGS's traditional natural gas supply plan is based on four main objectives:

1. Reliability: Ensure reliable supply to meet firm customers' annual and peak-day requirements, while minimizing curtailments to interruptible customers to maximize interruptible margins for the benefit of firm customers.

2. Flexibility: Ensure capacity and supply contracts are sufficiently flexible to optimize supply assets under various scenarios.

3. Stability: Minimize the risk of gas price volatility and its effect on rates using financial derivatives.

4. Cost-Effective: Ensure the resulting portfolio is cost effective under a variety of scenarios with consideration given to reliability, flexibility, and stability.

While these four objectives remain true, we must add a fifth objective of ensuring its supply is increasingly sustainable. VGS recognizes that it has a responsibility in the carbon impact of its supply from where we procure our supply all the way to the burner tip. This will be achieved by both increasing the amount of RNG in the portfolio and by seeking to procure sustainably produced "fossil" natural gas. VGS intends to be a leader in this area, while balancing the original four objectives.

For example, VGS is a member of the Natural Gas Supply Collaborative ("NGSC"), which is committed to encouraging natural gas suppliers and producers to support more robust voluntary reporting and increased transparency on numerous environmental and social performance indicators.

In addition to collaborations like the NGSC, the natural gas industry has many efforts underway to improve reporting, transparency, and the ability to determine a widely accepted definition of responsibly produced supply. VGS is actively participating in these efforts and is focused on working with producers that have obtained third-party certification of their production practices. Currently, two such certifications are the EO 100 Standard[14] and Trustwell[15].

VGS has traditionally purchased its supply from natural gas marketers, at supply hubs, such as Empress in Alberta, and Dawn and Parkway in Ontario. While purchases from marketers with a bid process promotes acquisition of supply at the lowest cost, information is not available to trace that supply back

[14] https://www.equitableorigin.org/

[15] https://ies.co/trustwell/

to the source. Without knowing the original source of the supply, VGS cannot ensure that its supply is produced using sustainable practices.

In recent months, VGS has directly engaged producers that have achieved either the EO 100 Standard and/or the Trustwell Standard. VGS announced a confirmed purchase with a producer who has achieved EO 100 and expects to continue to increase its overall portfolio of "Responsibly Produced" supply over time. To achieve this, VGS will need find other producers that are committed to produce in a responsible manner. In addition, VGS has started discussions with marketing companies to understand how they will fit into the responsibly produced supply marketplace.

VGS will also seek opportunities to replace traditional natural gas supply with renewables. VGS is already using RNG for a portion of its portfolio and soon will be receiving Vermont-produced RNG directly into our distribution system. VGS will continue to balance its climate initiatives and affordability as it adds more on- and off-system RNG to its portfolio.

Other renewable options to replace traditional fossil natural gas that are in various stages of development are hydrogen and synthetic natural gas ("SynGas"). Additional options to reduce the carbon footprint of VGS's customers include strategic electrification and geothermal. This is a continuously evolving list, and VGS must continue to evaluate options, while keeping an eye on affordability when creating our supply portfolio. Continually looking for the lowest cost options, while transitioning to a more sustainable supply portfolio will help VGS and its customers reach the goal of becoming Net Zero faster.

MODELING

The cost of natural gas supply is determined by the gas supply and revenue model using forecasted customer load requirements and projected demand and commodity costs, including the costs of renewable supply.[16] All three scenarios assume demand charges remain flat from 2021-2026 based on projected TC Energy tolls, followed by an annual 1.0% increase from 2026 forward. Similarly, all three scenarios assume conventional or "fossil" natural gas commodity costs increase by 1.2% annually as projected by the US Energy Information Administration ("EIA") in its 2020 Annual Energy Outlook. All three scenarios also assume that RNG is layered into the portfolio at an incremental 2% of retail sales per year, but the cost of RNG varies between each scenario as described below.[17]

[16] Demand costs refer to natural gas supply costs related to transporting and storing natural gas from market hubs to the VGS pipeline system and tend to be fixed regardless of the volume of natural gas transported. Commodity costs relate to the cost of the natural gas molecule itself and vary directly with the volume of natural gas purchased.

[17] While all scenarios assume annual increases in RNG purchases equal to 2% of retail sales, since the sales forecasts underlying the scenarios result in differing levels of retail sales, each scenario has different volumes of RNG.

HIGH CASE SCENARIO

The High Case also shows a slightly declining annual load, but at a slower pace, dropping from 13.6 Bcf in 2021 to 12.8 Bcf in 2040, while overall customer count rises 22% over the period. In this scenario VGS assumes a declining cost of RNG from the Base Case, resulting in lower overall gas costs as compared to the Base Case.

	FY21-25	FY26-FY30	FY31-FY35	FY36-FY40
Overall Gas Costs	$274,076,435	$339,480,637	$390,714,512	$425,176,438
Cost per Mcf Sold	$ 4.03	$ 5.05	$ 5.91	$ 6.58

Table 2.1

BASE CASE SCENARIO

The Base Case shows a slightly declining annual load decreasing from 13.6 Bcf in 2021 to 12.4 Bcf in 2040, while overall customer count rises 12% over the period. In the Base Case scenario, we have assumed the price of RNG is similar to today's RNG price and remains constant over the IRP term. The resulting overall gas costs are shown in the table below.

	FY21-25	FY26-FY30	FY31-FY35	FY36-FY40
Overall Gas Costs	$275,720,124	$351,347,540	$423,651,180	$489,338,802
Cost per Mcf Sold	$ 4.05	$ 5.27	$ 6.52	$ 7.77

Table 2.2

LOW CASE SCENARIO

The Low Case also shows a faster declining annual load from 13.6 Bcf in 2021 to 11.5 Bcf in 2040, while overall customer count rises 12% over the period. The cost per Mcf sold is significantly higher than the Base and High Case as the reduced customer usage results in lower utilization of VGS's facilities and a less efficient use of VGS upstream capacity. Further, in this scenario, the price of RNG increases over the term of the IRP.

	FY21-25	FY26-FY30	FY31-FY35	FY36-FY40
Overall Gas Costs	$275,145,733	$365,048,560	$453,394,660	$536,488,977
Cost per Mcf Sold	$ 4.10	$ 5.63	$ 7.29	$ 9.09

Table 2.3

The overall rate impact of RNG varies for each scenario, but generally increasing the overall RNG usage by 2% of total retail sales each year results in an average incremental annual increase to overall rates of 2.6%. It is anticipated that the lowest cost will include a mix of RNG, Hydrogen, District Energy, and other renewables.

2.2 RENEWABLE NATURAL GAS

VGS's RNG procurement strategy relies on both in-state RNG projects like the Vanguard project in Salisbury and out-of-state RNG supply secured through contracts with other suppliers. The in-state RNG

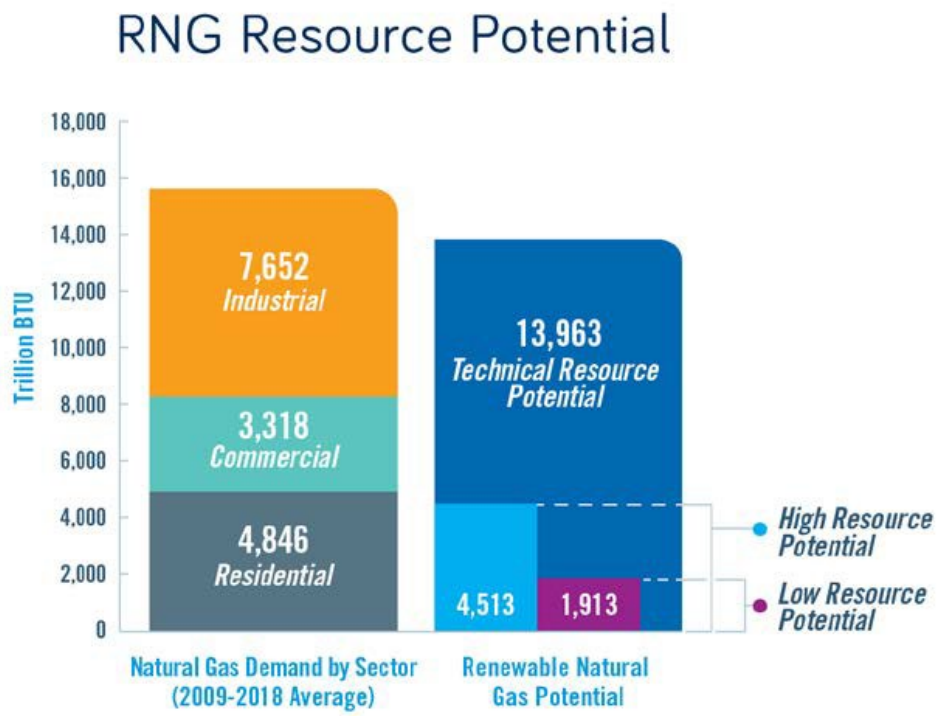
opportunities are limited by size in Vermont, but the direct and indirect benefits are enormous. The Vanguard project, for example, will produce enough RNG to provide the equivalent of heating 2,000 homes, the project will provide revenue/bedding to the farmer, provide phosphorus removal to improve water quality, and provide the additional benefits of capturing most of the methane produced by manure. In addition, this type of project could reduce VGS's costs for upstream capacity as the supply is sourced in-state, as well as supplement our system during peaks. Lastly, these projects are consistent with Vermont's preference for more local renewable energy generation.

As the combined value of in-state RNG is significant, and we have an urgency to decarbonize energy usage, we believe in-state RNG should justify a reasonable price premium over non-Vermont-based RNG projects. Such an incentive could spur the development of more in-state RNG projects like the Standard Offer Program did for the electric industry. VGS is currently looking at farm projects that could cluster multiple farms to help share the costs and believes that this concept is key to addressing the state's small farm size and waste issues. We are also looking at numerous opportunities to use compressed natural gas ("CNG") delivery to build a virtual pipeline to other RNG sources that are not near a pipeline. Using this CNG delivery method opens the RNG supply opportunity to a statewide level. VGS is excited about the potential to develop more in-state RNG projects as a key component of our strategy for achieving NetZero by 2050.

Recognizing that the development of in-state RNG is still in a nascent stage, VGS must supplement its RNG strategy by purchasing out-of-state RNG from a variety of project types, such as landfills, wastewater plants, and digesters, where the larger size of the projects (compared to Vermont's smaller scale) often means lower-priced supply.

AGA (American Gas Association) recently completed a study on RNG[18]. The table below speaks to the potential for RNG supply in the U.S.

[18] https://gasfoundation.org/wp-content/uploads/2019/12/AGA_3894-RNG-2-Pager_V-11.pdf



RENEWABLE NATURAL GAS – EFFECTS ON SYSTEM DESIGN AND SYSTEM INTEGRITY

VGS will begin to inject RNG directly into its system, starting with the Vanguard Project, and plans to steadily increase the amount it uses over time. This can influence the system in two ways.

First, depending on where the injection is located, it can influence the system design. Currently, the VGS network operates in a point-to-point fashion. It receives gas at the Canadian border, and the gas flows south to its gate stations and outward from the gate stations to end-point customers through the distribution network. If VGS receives RNG from its current take-point at the Canadian border, the system design will essentially be unchanged (provided that the properties of the gas are consistent with the gas it currently receives).

However, an on-system RNG project like Vanguard would change the way the system performs on the local distribution network. Instead of this system being fed solely from the Border and through to the Middlebury Gate Station, the Vanguard Project creates a second feed from the south providing greater resiliency for VGS.

Second, VGS will have to ensure that the properties of the RNG have no negative effects on customer equipment or VGS system integrity. This entails making sure the system that will be receiving the RNG can accommodate the additional supply and the chemical composition of the RNG has no adverse effect on any of the pipeline components. The pipeline design needs to be such that it can transport the newly injected RNG from the source through the distribution network to customers. Finally, customer equipment must be able to use the RNG the same as it would conventional natural gas.

VGS will address these issues by constructing a gate station, similar to what has been installed at the Vanguard Project RNG site for any future RNG delivered directly into the pipeline system. The purpose of such a station is to monitor the gas flowing into the VGS system, analyze and test the properties of the gas to ensure it meets gas quality standards, provide safety shut offs if quality standards are not met, measure the amount of flow through the station, regulate the pressure if necessary, and odorize the gas. A new gate station would likely need to be constructed at each new supply location.

2.3 INNOVATION & PRO-CLIMATE PARTNERSHIPS

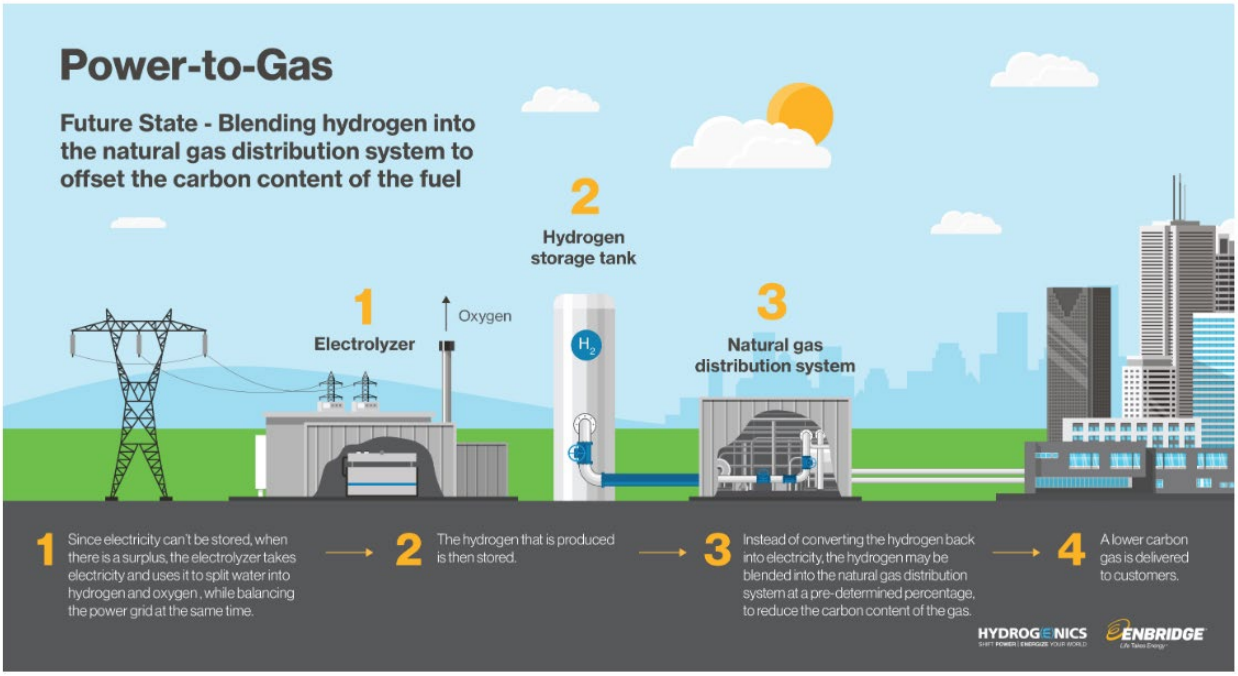
As we contemplate how we supply our customers' future energy needs, we anticipate a broad array of potential partnerships, innovations, and emerging technologies. This section describes some of the emerging opportunities we see as part of our energy future.

HYDROGEN

Hydrogen blending and storage into natural gas pipelines is a concept being contemplated in many European countries and gaining traction in the U.S. While VGS is optimistic about the more traditional RNG (biomethane) produced at landfills and digesters, hydrogen created from renewable electricity is another form of RNG that may well be an opportunity with multiple benefits. Hydrogen provides the opportunity for our system to be utilized as an enormous storage vessel for excess renewable electricity that Vermont is, and will be, generating as the State electrifies transportation and thermal. Hydrogen can be blended with natural gas (up to a certain percentage) and transported in the existing pipeline for use in natural gas equipment, it can be used unblended as a thermal fuel in specially designed equipment, or it could be used to power a hydrogen fuel cell/electric generator, providing baseload distributed electric generation. California's Public Utilities Commission has taken up hydrogen as a critical path forward to address many of their energy challenges and is currently working on a standard for pipeline injection.[19] VGS intends to continue working with the electric utilities and renewable developers to develop a hydrogen pilot in Vermont.

This diagram depicts a hydrogen facility recently completed in Ontario:

[19] https://www.cpuc.ca.gov/General.aspx?id=6442455827#Phase4_Hydrogen



For modeling purposes, VGS has not assumed any hydrogen projects, but VGS will continue to be engaged in the emerging technology and be prepared to act quickly should an opportunity[20] materialize.

CARBON CAPTURE/SYNGAS

If we examine maturity of the pathways to decarbonizing our pipeline system, first is traditional RNG from landfills and digesters, second is hydrogen blending, third is Syngas/Carbon capture, and lastly is full hydrogen. Syngas is synthesized renewable gas, ideally comprised of renewable hydrogen combined with carbon that has been captured from a variety of sources. Carbon capture is rapidly advancing to commercial scale and is expected to be a widely available technology in the next decade. VGS has anticipated that the state's largest emitters may well have a carbon capture mandate once the technology is widely available, which would consist of equipment installed on chimneys and stacks, or open-air carbon capture. Once the Carbon Capture System ("CCS") is installed the captured carbon could be blended ("synthesized") with renewable hydrogen to create Syn-Gas (methane: CH4), which is another form of RNG. This type of groundbreaking innovation is a concept that is being actively advanced around the globe and would create a "closed loop" energy cycle that would allow for using a carbon-based fuel with no environmental impact at the burner tip. Some gas utilities in Canada (including FortisBC) are even considering innovative pathways that would allow them to rate base CCS as

[20] Hydrogen-powered vehicles are also gaining traction as the potential for Green Hydrogen produced from excess renewable electricity begins to emerge. New technology is being developed that can extract the hydrogen from the natural gas system without generating carbon emissions for vehicle fueling. If successful, this type of technology could open the door to a hybridized gas system where fuel cell, hydrogen furnaces/boilers, and H2 vehicles could be fueled from green hydrogen stored and transported in our pipeline, commingled with natural gas.

a pathway to reduce carbon emissions. VGS will continue to monitor these advances and seek to develop a pilot when the technology is ready for our market.

DISTRICT ENERGY SYSTEMS/GEOTHERMAL

VGS is engaged in numerous discussions about development of District Energy Systems ("DES") using waste heat captured from renewable electric generation. These systems capture waste heat or excess steam from the generators and deliver the energy to larger customers through underground piping (hot water or steam pipes). Thermal energy delivered via underground piping is our specialty and we wish to pursue these kinds of opportunities with partners as we transition to decarbonized energy. A prospective project between VGS and BED would capture available steam from the McNeil biomass plant and deliver energy to key institutions in Burlington. VGS is considering several smaller systems near industrial digester electric generation facilities as well.

Geothermal energy systems are like DES but utilize underground watershed heat. VGS is beginning to examine this opportunity with Efficiency Vermont and DUs and will look to develop a pilot project in the next few years. The initial market focus is on new construction, specifically housing or small commercial developments off our system. Like DES, this is a strength VGS can capitalize on: long-term infrastructure and underground thermal delivery systems that require patient capital and utility expertise and resources.

RENEWABLE/DECARBONIZED THERMAL ENERGY POLICY

Most of the concepts discussed above can be accelerated but require complementary policy frameworks that will enhance the pace of this innovation. These range from a thermal renewable portfolio standard (RPS) with broad definition of what may be eligible for renewable or decarbonized thermal energy. Oregon, for example, is the first state with an RNG standard passed in 2019 which will allow 5% or greater amounts of RNG to be added to their system.[21] Colorado, California, and Maine[22] may have similar RNG "RPSs" in 2021. All these efforts are targeted to decarbonize thermal energy and effectively address climate change.

The largest driver for the RNG national marketplace has been RNG that is eligible for the lucrative incentives in the Federal Renewable Fuel Standard ("RFS") and the California Low Carbon Fuel Standard ("LCFS"), both programs targeted at RNG to power vehicles (as CNG). While there is a place for RNG vehicles in Vermont, the larger need for RNG is in the thermal arena. VGS has been a national leader in promoting the inclusion of RNG for thermal uses and as an integral part of our nation's gas utility portfolios of the future.

[21] https://oregoncub.org/news/blog/oregon-puc-drafts-final-rules-for-nations-first-renewable-natural-gas-program/2212/nr-aside-main#:~:text=Last%20year%2C%20the%20Oregon%20Legislature,Public%20Utility%20Commission%20(PUC)

[22] https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx

We are closely watching the transportation climate initiative ("TCI") and New York's effort to create a low-carbon fuel standard. Vermont should leverage the TCI platform, which in its next stage should include thermal fuels and New York's LCFS effort as a marketplace for our RNG's value. The outcome would increase the value of RNG and allow more projects to be constructed in our region. We support Vermont policymakers beginning this discussion to establish a framework that will advance these opportunities.

2.4 NATURAL GAS TRANSMISSION AND DISTRIBUTION SYSTEM

The pipeline system through which VGS's supply travels is an interconnected network of pipelines operating at both transmission and distribution pressures. For ease of reference, pipelines that operate above 100 pounds per square inch in gauge ("PSIG") are referenced as the "transmission" system, while those operating at 100 PSIG or below are referenced as the "distribution" system. Together, the transmission and distribution system, along with pressure-regulation stations, comprise VGS's pipeline network. This section of the plan describes VGS's planning approach to transmission and distribution system investment and describes the planned investments in its pipeline system, both to accommodate growth and to ensure the continued reliable delivery of natural gas. The section below discusses capital investments related to the transmission and distribution systems. It should be noted that VGS also has robust system safety and integrity management programs that will continue through the life of this plan. They include pipeline safety management systems and transmission and distribution integrity management and legacy cross-bore programs.

TRANSMISSION SYSTEM

VGS operates approximately 118 miles of transmission lines. The transmission system interconnects with the TC Energy System at VGS's border station located in Highgate, Vermont. This point is currently the sole supply of natural gas for the entirety of the pipeline system. The southern terminus of the transmission system is in Middlebury, Vermont.

The key planning criteria for the transmission system is that it must be designed to ensure reliable delivery of natural gas supply on a year-round basis and, most importantly, on a design-day. The determination of design-day requirements is described more fully in Section 1.3 above. For transmission planning purposes, interruptible customers are assumed to be fully curtailed on a design day.

Historically, as customer base grew and natural gas usage increased, design-day requirements increased causing VGS to periodically expand the total throughput capability of the transmission system. To date the preferred method has been to install segments of 16-inch transmission-pressure pipeline parallel to the existing 10-inch transmission-pressure pipeline. VGS refers to this as its transmission system "looping." Not only has looping allowed VGS to increase its throughput, but having dual lines increases the reliability of the single-feed system. Should one line go down, the second can continue to supply customers. Phase I of the looping project was constructed in 1995, reinforcing the critical Missisquoi River crossing. With the completion of Phase VII in 2016, the 10-inch system is "looped" with 16-inch pipe from the border station to Sandy Birch Road in Georgia, Vermont.

This IRP is unique in that in all scenarios that are being examined, the design day impact of energy efficiency outweighs the impact of customer growth, resulting in a *decreasing* design day. With that, there is little reason to expand the capacity of the transmission network unless something changes that causes either the system capacity to decrease or customer design day demand to increase.

MEETING DESIGN DAY DEMAND

In assuring the transmission network can meet customer demand, VGS evaluates the design day customer load as compared to existing system capacity. The capacity of the transmission system is impacted by several factors, including the assumed pressure from TC Energy, the minimum operating pressures required at the south end of the system, and the load patterns on the system.

VGS uses the following key parameters:

- Maximum inlet pressure at Border Station 580 PSIG
- Minimum Delivery Pressure at Southern Terminus 250 PSIG
- Minimum Delivery Pressure at Winooski Gate Station 225 PSIG
- Minimum Delivery Pressure at North Burlington 100 PSIG
- Maximum Velocity of Gas in Pipeline 60 ft/sec.
- Peak Hour Ratio 5%
- Maximum Propane/Air to NG ratio 30%

Each of these factors is discussed briefly below.

DELIVERY PRESSURE Transmission system capacity is impacted by the pressure entering the system. The higher the delivery pressure the more capacity is available. The delivery pressure assumption VGS uses for transmission planning purposes is equal to the current contractual minimum pressure from TC Energy. While often higher pressures are available, VGS only relies on *contractual* pressures for design-day capacity calculations. This is unchanged from prior IRP planning assumptions.

MINIMUM DELIVERY PRESSURE AT SOUTHERN TERMINUS The minimum pressure at the southern terminus of VGS's system also impacts transmission capacity. The lower the acceptable southern terminus pressure, the greater the available capacity. The assumed southern terminus pressure of 250 PSIG is set at a level to ensure firm customer service can continue uninterrupted. The southern terminus of the transmission system is Middlebury Gate Station. This assumption is consistent with the prior IRP.

MINIMUM DELIVERY PRESSURE AT WINOOSKI GATE STATION Although Middlebury Gate Station is the southern terminus of the full transmission system, Winooski Gate Station is the southern terminus of the 10-inch transmission line, which is the main trunk of the network, making it a critical node of the system. For design purposes, VGS assumes the minimum delivery pressure required at Winooski Gate Station to be 225 PSIG. This allows for more total throughput, as Winooski Gate Station provides the

largest amount of gas into the system, while still maintaining flexibility. This criterion is unchanged from the last IRP.

MINIMUM DELIVERY PRESSURE AT NORTH BURLINGTON VGS relies on a propane air injection facility to meet a portion of its capacity requirements. Therefore, the 8" North Burlington lateral between the Propane/Air Plant ("PAP") and Convent Square must have adequate pressure to enable deliveries of propane/air to the North Burlington/Colchester area. Monitoring these pressures will ensure the PAP can be utilized to its potential. This planning parameter is unchanged from the prior IRP and is stated as 100 PSIG in "Meeting Design Day."

MAXIMUM VELOCITY The velocity of the natural gas is set at a maximum of 60 feet per second. Higher velocities result in unnecessary wear and tear on measurement and control equipment, which in turn results in increased maintenance and repair costs. This planning parameter is unchanged from the prior IRP.

PEAK-HOUR RATIO Peak-hour ratio (i.e., the peak hour load as a percent of the daily load) affects the capacity of the transmission system: the higher the peak-hour ratio, the lower the capacity on the transmission system. For purposes of this plan, a 5% peak-hour ratio was used. This is consistent with industry standards and is unchanged from the prior IRP.

PROPANE-AIR TO NATURAL GAS RATIO During peak-periods, VGS injects a mixture of propane and air into its transmission system to both supplement the natural gas supply and increase the available capacity on the transmission system. The higher the ratio of propane-air to natural gas, the greater the available capacity on the transmission system. However, if the ratio of propane-air is too high, there can be an adverse impact on the functioning of natural gas appliances. Consistent with past planning assumptions, for purposes of this plan, VGS has used a 30% maximum ratio. Experience indicates that at higher levels, operational difficulties downstream of the propane-air plant may occur.

In addition to the factors listed above, the send-out pattern (i.e., where on the VGS system the load occurs) impacts the transmission capacity. Load located at the northern end of the system has less of an impact on system capacity than load located at the southern end due to the additional capacity of the 16-inch looping. The send-out percentages used in the calculations are shown in Table 5.1 and are based on actual, historical, take-off patterns.

Gate Station	Flow as a Percent of Total System Flow (%)
Carter Hill Road, Highgate	0.02%
Route 78, Swanton	2.18%
Sheldon Town	0.80%
Lower Newton Road, St. Albans	0.22%
Lake Street, St. Albans	5.59%
Nason Road, St. Albans	4.27%
Georgia Plains Road, Georgia	0.18%
Sandy Birch Road, Georgia	0.83%
Murray Road, Milton	0.02%
Christine Court, Milton	0.21%
Quail Hollow, Milton	0.23%
Milton (Route 7)	2.40%
Catamount Industrial Park, Milton	0.68%
Middle Road, Colchester	4.98%
Sunderland Station, Colchester	8.15%
Mallett's Bay Avenue, Colchester	1.48%
Convent Square, Burlington	18.20%
Winooski (Gorge Road)	35.24%
Williston (Route 2)	10.78%
Plank Road, New Haven	1.73%
Middlebury (Route 7)	1.81%

Table 2.4

The above assumptions are all entered in VGS's network-analysis software, GL Nobel Denton, Inc. Synergi Gas Version 4.9, to determine the current pipeline capacity. The resulting current capacity of the transmission pipeline is calculated at 69,808 Mcf/d. This capacity is supplemented with output of the propane-air plant.

Given the critical nature of design-day reliability, in 2018 VGS completed a full analysis of its PAP to assess the capacity of the plant. As a result of that analysis, VGS reduced the capacity of the PAP used in design day planning from 7,729 Mcf/d to 6,566 Mcf/d. Although VGS's previous assumption of 7,729 Mcf/d is valid, it was decided during the analysis to use an additional factor of safety in the calculation which reduced the capacity of the PAP to 6,566 Mcf/d. When added to the pipeline capacity, the total system capacity becomes 76,374 Mcf/d.

When compared to the estimated peak send out of the highest forecasted design day from the three scenarios described in the Customer Demand Section, the current total system capacity is enough to cover the demand needs for the length of this IRP. This can be seen in Table 2.4 below.

Winter Season	Estimated Peak-Day Send Out	Estimate Pipeline Capacity	Estimated Propane/Air Capacity	Total System Capacity	Estimated System Capacity Excess/(Shortfall)
2020-21	71,746	69,808	6,566	76,374	4,628
2021-22	72,147	69,808	6,566	76,374	4,227
2022-23	72,272	69,808	6,566	76,374	4,102
2023-24	72,398	69,808	6,566	76,374	3,976
2024-25	72,206	69,808	6,566	76,374	4,168
2025-26	71,864	69,808	6,566	76,374	4,510
2026-27	71,531	69,808	6,566	76,374	4,843
2027-28	71,216	69,808	6,566	76,374	5,158
2028-29	70,824	69,808	6,566	76,374	5,550
2029-30	70,430	69,808	6,566	76,374	5,944

Table 2.5

With that, there should be no need for transmission system expansion. However, there are some scenarios that may require VGS to investigate methods of adding capacity to the system. For example, the Propane-Air Plant is more than 30 years old. It may require a significant overhaul to continue its reliable operation into the future, otherwise an alternative to replace its capacity would be necessary. Or there is the risk that TC Energy can no longer provide the pressure VGS requires, or that we get a large firm customer not planned for in the prior, or an interruptible customer opts for firm service. In

such a situation VGS will evaluate different methods for cost effectively adding capacity on the system. Options that could be considered include:

- Construction of a temporary or permanent liquefied natural gas facility.
- Utilization of trucked or stored compressed natural gas.
- Increased contractual pressure from TC Energy.
- Overhaul/expansion of the propane-air plant.
- Additional transmission system looping.

Each of these options would be assessed for least-cost alternatives after due consideration of safety and reliability.

DISTRIBUTION SYSTEM

As of December 31, 2020, VGS had 875 miles of distribution mains and 41,466 service lines.[23] This section addresses the additional investment in distribution mains, services, and meters necessary to serve the projected customer growth and continue to modernize the existing distribution system.

Distribution system planning is driven by the projected number of customers. The investment in incremental distribution main, services, and meters is determined based on the projected number of customers and historical averages for footage per customer and the percent of customers requiring mains and services. The cost for mains and services is then estimated using these footages and the current cost per foot, escalated with an inflator each year. While this is a reasonable planning assumption to estimate the cost of infrastructure, the actual cost for any given main extension will vary depending on the construction conditions encountered and the actual footage required. In practice, main extensions more than 100 feet are subject to a feasibility assessment. Under the current feasibility model, the 10-year revenues from a projected distribution expansion must cover the 10-year carrying costs of that investment on a net present value basis. If the individual project passes the assessment, it is determined to be an appropriate investment and VGS pursues the project. If the project does not pass this feasibility threshold, VGS seeks a customer contribution to construction costs before proceeding. Applying this feasibility assessment ensures that new investments will not result in upward rate pressure over the 10-year horizon. Annually, VGS expects to invest approximately $3,000,000 on these growth projects in the Base Case.

OTHER SYSTEM INVESTMENTS

In addition to the growth-related investments described above, VGS does planning and assessments related to ensuring the ongoing safe operation of its pipeline network. This includes, but is not limited to, the following:

[23] A service line connects the distribution pipeline to a customer premise.

- Periodic review of system flow analysis to identify areas of the distribution network that may require reinforcement.
- Risk-based assessments of the transmission and distribution system pursuant to federally mandated transmission and distribution system integrity management programs.
- On-going leak detection initiatives.
- Review of gate station conditions.
- Review of meter-testing results.

A brief description of some of the results of these planning initiatives is described below:

DISTRIBUTION REINFORCEMENT As with the transmission system, the distribution system network is analyzed using VGS's network-analysis software. The system is modeled annually with the addition of new loads on the distribution system. Over the past few years VGS has completed some distribution reinforcement projects to bolster the system capabilities. These projects all aided in raising the overall end pressures in the Burlington distribution system, which allowed for increased capacity. This work, which was completed over the last several years, has yielded a fairly robust system that will carry VGS into the future. Presently the greater Burlington area is not in need of any distribution pipeline reinforcements. Should an area within the system experience exceptional growth, then VGS would install distribution reinforcements. One of the most beneficial additions to the system for future reliability has been from the facilities installed associated with the Addison Natural Gas Project. The Williston Gate Station, located on Route 2 in Williston, provides a back feed into the Burlington area boosting the pressures throughout the system. This has increased VGS's ability to deliver to the entire Burlington distribution system, as well as adding flexibility in how the system is operated.

More recently VGS has been focused on distribution networks other than the Burlington network. Specifically, the Milton distribution network is currently comprised of five individual gate stations. Each one is the sole source of gas to its respective network. VGS has been performing modeling and analysis to determine if these networks can be connected by distribution pipe to reduce the overall number of stations needed, and to give redundancy to the otherwise single-feed systems. As it currently stands, the plan is to connect all five of the Milton networks with the Sandy Birch system in Georgia, Vermont, for a total connection of six individual gate station networks. Once the connections are made, VGS would retire three gate stations: Milton Gate, Quail Hollow Gate, and Murray Avenue Gate, and run the system off the remaining three stations: Catamount Gate, Christine Court Gate, and Sandy Birch Gate. This would cut the amount of gate station maintenance in half, while increasing the reliability of the overall network due to having multiple feeds. The capital investment needed to make these connections is projected to be $2,000,000 and is offset by deferred replacement costs of the Murray Avenue and Quail Hollow stations that would be required within the next 10 years.

GATE & INDUSTRIAL STATION IMPROVEMENTS Some of the existing gate and industrial stations in the system are more than 30 years old and it is therefore appropriate to proactively plan for replacement that may be needed. The new technology available will provide better information, enhanced flexibility, and improved safety/security. VGS plans to upgrade several gate and industrial measurement stations during the first five years of this plan. Although these gate station improvement projects do not increase

system capacity, they do ensure VGS is able to reliably serve its customers. VGS anticipates that its gate stations and industrial meter stations will continue to need upgrading as the facilities age. Some of the criteria that are reviewed in deciding whether a station needs attention are: obsolete equipment, physical condition of the piping, equipment capacity, maintenance history, and overall safety of the system and personnel working on the equipment. Currently the following stations are expected to be upgraded:

- MILTON GATE STATION In the prior IRP it was discussed that this station would need replacement soon. Now, as mentioned in the above Distribution Reinforcement section, it is being evaluated whether this station can be retired altogether. Currently this is the direction VGS is leaning due to the benefits discussed above.
- CATAMOUNT GATE STATION This station was built in 1984 and the orifices in the regulators have been increased in size several times to keep up with the growth in the area. As mentioned above, VGS plans to connect the Catamount Station to the Milton station area to help as a backup and redundancy for the Milton systems. If this connection is to be made between the Milton networks, a larger station at Catamount Station would be necessary to be able to handle the entire load of the larger combined network. The replacement of other components that supply the Catamount Station would also need to be replaced to handle the higher flow rates. The cost estimate for the replacement of the Catamount Gate Station is approximately $2,000,000 and would be offset by deferred replacement costs of the Milton station that needs attention in the coming years.
- MALLETS BAY AVE GATE STATION This station was built in 1990 and incorporated a standard design and components common for that era. The design and components can be difficult to remove, replace, and maintain and do not reflect modern station design and components that incorporate safer and easier access for technicians performing maintenance operations.
- ROUTE 78 GATE STATION AND SHELDON/ROCK TENN GATE STATIONS These stations would benefit from buildings over the station to reduce noise and protect the station from the elements.

METER REPLACEMENT Through the meter testing process, VGS has identified several classes of meters to be replaced. As a result of several years' implementation of the testing program, VGS has determined that it is appropriate to proactively begin replacing meters when they have been in the field for 25 years. This IRP assumes the continuation of this practice.

DISTRBUTION REPLACEMENT PROGRAM The Distribution Replacement Program enables VGS to modernize our distribution system through replacements of typically older mains and services. It is a program that evaluates risks and helps to ensure the safety and integrity of our pipelines. VGS continuously assesses risk for items including but not limited to leaks, pipe material, pipe coating, cathodic protection, code compliance, types of pipe fittings, and environmental factors. From this process, VGS generates and maintains a list of potential replacement projects based on a ranking of risks and their impact. Each year, VGS uses this list to replace one to two miles of main and approximately one hundred services. Another benefit of this program is reducing the potential for methane emissions by reducing the risk for future leaks.

TRANSMISSION MAIN LINE VALVE REPLACEMENT PROGRAM VGS has begun the process of replacing aging main line valves (MLVs) on the 10-inch transmission line. The 50+ year-old MLVs are nearing the end of their useful lives. Replacing them improves the reliability of the transmission system and increases the chances for a successful inline inspection of the 10-inch line. The IRP assumes the replacement of one valve per year for the next five years. Each replacement costs approximately between $500,000-$900,000 in 2020 dollars.

3.0 FINANCIAL & REGULATORY ASSESSMENT

The financial analysis developed in this IRP presents the comparison of the financial implications of the three scenarios from a cost-of-service perspective while including other key financial metrics. While the financial analysis does not support a current or future rate filing, the intent is to understand the directionality of each scenario and identify potential stresses that VGS should explore further in near- or long-term planning.

To help frame the financial analysis, the table below summarizes the key inputs to the financial modeling.

High Case	Base Case	Low Case
• **RNG:** Lower price, incremental growth of 2% per year, *more* advantageous for Climate Plan • **EEU:** Aggressive Energy Efficiency Savings (results in lower customer usage) • **Customers:** *Increased* in-footprint customer growth from Base Case (increases number of meters from the Base Case) • **Strategic Electrification:** *No change* in usage due to strategic electrificaion as VGS is a top choice renewable provider (customers increased) • **Investments:** *Aggressive innovation investments*, continued general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates based upon VGS's *current depreciation study* • **Rate Base:** *Decreases approximately 12%* primarily due to accumulated depreciation outpacing capital investments, including aggressive innovation investments • **Base Rates:** Track at or below inflation over time	• **RNG:** Steady price, incremental growth of 2% per year, demonstrates VGS Climate Plan • **EEU**: Average Energy Efficiency Savings between High Case & Low Case • **Customers:** *Moderate* in-footprint customer growth. • **Strategic Electrification:** *No change* in usage due to strategic electrificaion as VGS is a renewable provider (customers remain steady) • **Investments:** *Moderate innovation investments*, continued general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates based upon VGS's *current depreciation study* • **Rate Base:** *Decreases approximately 21%* primarily due to accumulated depreciation outpacing capital investments including modest innovation investments • **Base Rates:** Track at inflation over time	• **RNG:** Higher price, incremental growth of 2% per year, *less* advantageous for Climate Plan • **EEU:** Energy Efficiency Savings approved in the Demand Resource Plan(DRP) (higher average customer usage compared to base) • **Customers:** *Decreases* in-footprint customer growth compared to Base Case (decreases customer meters from the Base Case) • **Strategic Electrification**: VGS is back-up option to alternatives, *overall decrease* in usage due to installation of cold climate heat pumps (customers decline) • **Investments:** *No innovation investments*, declining general plant and repair/replace capex • **Operating Expenses:** Approximately held at *inflation* • **Depreciation:** Rates increased to *accelerate depreciation*, increases pressure on base rates • **Rate Base:** *Decreases approximately 41%* primarily due to accumulated depreciation outpacing capital investments including no innovation investments • **Base Rates:** Track at or above inflation over time

For each scenario, key assumptions have been made to derive average rate base, gas costs, operating expenses, capital expenditures, and total other expenses, as well as return and other important aspects of customer rates. Some of these key assumptions are discussed in more detail below:

ASSUMPTIONS:

Purchased Gas Costs/Renewable Natural Gas: The purchased gas adjustment for each scenario is determined from the gas costs and revenue models described in Section 2.0 – Energy Supply Resources and Infrastructure section, including RNG.

Energy Efficiency Utility: For each scenario, EEU savings and spending assumptions were developed, as described in Section 1.2, and were incorporated into the estimates of customer usage used for supply planning. In the High Case, aggressive energy efficiency leads to a greater reduction in customer usage as compared to Base and Low scenarios. EEU in the Low Case is in line with the approved DRP and while customer usage still declines over time, the usage reduction is moderated from the other two scenarios.

Base Case EEU assumptions are modeled as a middle ground between the other two cases. In all scenarios the EEU-driven changes in usage impact both Purchased Gas Adjustment ("PGA") & Base Rates due to varying degrees of loss in load.

Customers: As described in more detail within Section 1.3, each scenario provides for customer growth at varying levels depending on the advancement of the Climate Action Plan. The differences in customer growth in turn result in differences in customer usage across the three scenarios.

Strategic Electrification: This IRP incorporates consideration of how strategic electrification may impact VGS's customer base and load forecasts. We anticipate that increased adoption of Cold Climate Heat Pumps by VGS customers as a result of our Climate Action Plan efforts and collaboration with other energy service providers will reduce the number of VGS natural gas customers as well as customer usage. Specifically, in the Low Case, VGS modeled an additional reduction in per residential customer usage due to more aggressive adoption of CCHP by VGS customers. This loss of customer usage ultimately leads to a loss of load, which puts increased pressure on customer PGA & Base Rates over the 20-year time horizon. In the High Case, we have modeled a scenario under which RNG is a more competitive alternative for customers to reduce their GHG emissions, resulting in almost no overall impact on VGS's usage per customer, as additional customer growth offsets electrification efforts. In the Base Case, we modeled a scenario where there is no change in customer usage as a result of strategic electrification, but also no significant customer growth because we anticipate that customers will be looking for more aggressive climate action alternatives than those modeled under this scenario.

Capital Investments: Capital investments in our modeling reflect the estimated investments in transmission, distribution, mains, and other infrastructure needed to maintain safe and reliable service. These investments are referred to in this plan as repair/replace capex. As previously described in this IRP, we do not anticipate significant system expansion and therefore have not included the transmission or distribution infrastructure investment that would be needed for such expansions. Instead, we modeled our scenarios based on the need to continue making repair/replace investments to maintain the existing system and meet the customer growth reflected in each scenario. These include, but are not limited to, investments in meters, encoder receiver transmitters ("ERTs"), general gate stations maintenance/replacement, mains replacement, and investments to complete non-transmission customer growth.

Climate Action Plan initiatives are expected to require significant future investment in innovation to propel our decarbonization efforts and meet the State's energy goals. In the High Case and Base Case, we forecast achieving Climate Action Plan metrics at a greater pace, and therefore we have modeled those scenarios based on the anticipated capital investments that are likely needed to achieve a higher pace of GHG reductions. To forecast the directional financial impact of such investments, we modeled scenarios under which the Company invests in innovation at levels that reflect our historical investment levels related to additional infrastructure investments (e.g., transmission looping and investments beyond repair/replace and general growth capex). Rather than invest those funds in traditional system expansion and infrastructure, we modeled these scenarios based on deploying those investments in Climate Action Plan and state renewable energy efforts. Under the Low Case, we modeled less

aggressive achievement of Climate Action Plan goals and no investment in the innovation initiatives that would drive greater GHG reductions along with a slowdown in overall capital investments.

Operating (Responsibility) Expenses: All three scenarios are modeled based on operating expenses, which include salaries and benefits, that are escalated at a 2% inflation rate per year. While the Company is committed to controlling expenses, for the purpose of this high-level modelling, no explicit cost-containment initiatives were modeled.

Amortization Expense: We do not model any significant difference in VGS's amortization expense among the three scenarios, which is based on the following and is consistent with current practice:

- The legacy DSM buckets assume a 10-year amortization period;
- The Barge Canal balance currently being amortized assumes a 20-year amortization period;
- The amortization of the Addison Natural Gas Project regulatory assets assumes a 10-year amortization period; and
- The pension settlement accounting experienced since 2017 is amortized over the assumed remaining life of the pension plan.

Other Notable Expenses

Depreciation Expense: The depreciation expense is based upon projected plant-in-service for each year of the IRP. In the High and Base Case scenarios, we modeled the depreciation rates by plant type from the Company's current Depreciation Study, which took effect for rates in effect November 1, 2020. Under the Low Case, we modeled a scenario under which the useful life of depreciating assets increased, resulting in an accelerated depreciation schedule.

Accumulated Depreciation: Accumulated Depreciation is increased annually by the depreciation expense associated with plant-in-service and therefore tracks the depreciation expenses and rates described above.

Taxes Other Than Income: Taxes other than income assume a property tax rate of approximately 2.0% per year plus gross receipts and weatherization taxes at 0.525% and 0.75% respectively, consistent with current rates.

Interest Expense: Interest expense is broken into long-term and short-term. Long-term interest expense is based on VGS's current long-term debt ("LTD") structure, adjusted for any maturities. The scenarios assume sufficient debt to maintain a 50% debt-to-equity capital structure, consistent with the Company's current capital structure.

For purposes of this analysis, short-term interest is assumed to be approximately 2.0% based upon current markets and an expected increase in interest rates due to the current state of capital markets during the Covid-19 pandemic.

The Company further notes that in each scenario there may be a potential opportunity to reduce short-term debt with additional long-term debt financing; however, for purposes of this analysis, long-term

debt financing was not assumed in any scenario as this would not materially impact interest expense or interpretation of the scenarios. Furthermore, as traditional capital investments in infrastructure flatten or trail off, VGS may not need to replace such LTD maturity, depending on other investments the Company may make, such as within energy innovation.

Rate Base: Consistent with ratemaking practice, rate base is calculated using a 13-month average. Within each scenario, over the 20-year period, rate base varies primarily based upon the key assumptions noted above.

Return on Equity: The Company modeled all three scenarios (High, Base, & Low) based upon the Public Utility Commission's approved 2021 ROE of 8.65%, increased by 20 basis points each year through 2025 and then held constant at 9.45%.

Capital Structure: The financial scenarios were projected assuming the Company's current authorized equity ratio of 50%.

System Expansion & Reliability Fund ("SERF"): The three scenarios reflect SERF fully returned to customers by 2024 to allow for continued rate smoothing and to avoid rate cliffs.

RESULTS

The financial analysis was modeled for the three scenarios discussed in this IRP to inform potential near- and long-term planning strategies. The modeling strikes a balance among the key assumptions detailed above and reflects the potential directional impact regarding our strategic priorities to advance the VGS Climate Action Plan while remaining focused on maintaining a stable financial position that will continue to support affordable, reliable, and safe energy services to meet our customers' energy needs over the term of the IRP. Notably, the financial planning is intended to demonstrate the potential directional impacts of various outcomes rather than a precise forecast of specific financial outcomes.

Under all three cases, we modeled rates consistent with our current rate structure, under which "base rates" recover the non-gas components of the Company's operations and gas costs are passed through to customers through the purchased gas adjustment. Our modeling demonstrates that under the Base and High Case scenarios, there are modest to moderate annual base rate increases. Under the Low Case scenario, the modeling shows base rate increases are slightly higher, especially in the earlier years, which is primarily due to loss of customer load and accelerated depreciation. The following summarizes the directional outcome of each scenario and provides additional detail relating to innovation investments:

> **High Case:** This case models achievement of the VGS Climate Action Plan through lower RNG costs, higher customer growth, and more aggressive energy efficiency efforts, as well as capital investments in innovation. The High Case models innovation investments in line with the current proposed Alternative Regulation Plan for years 2022-2024 in Case No. 19-3529-PET, as well as assumptions for later years of the IRP. The assumed innovation capital investments, with a 25-year depreciable life, are as follows:

Year	Capital Investment ($ millions)
2022-2024	$2
2025-2027	$6 each year

Table 3.1

The modeling acknowledges that we are in the early stages of identifying those innovations investments that are most likely to result in value for customers, and therefore, we did not conduct a specific Net Present Value associated with such investments in both the high and low case. Overall, the High Case shows that base rates track at or below inflation over time, the use of SERF is ramped down in combination with decreasing RNG prices, aggressive EEU initiatives drive energy efficiency savings, and reduced GHG emissions and forward-looking innovations investments drive increased customer interest in VGS services.

Base Case: This case models a middle ground approach to climate action between the Low and High Cases, wherein we forecasted the directional financial impact of a scenario where RNG prices are moderately higher than traditional natural gas, VGS is maintaining customers with a slight increase, and VGS is deploying more modest investment innovations that promote state energy policy:

Year	Capital Investment ($ millions)
2022	$2
2023	$2
2024	$2
2025/2026	$3 each year
2028/2029	$3 each year
2036/2037	$3 each year

Table 3.2

Under the Base Case scenario, base rate increases are approximately in line with inflation over time, the use of SERF is ramped down in combination with steady RNG pricing, and continued EEU initiatives and innovation investments drive gains in our GHG reduction targets as we experience modest customer growth.

Low Case: This case models increasing RNG prices, less aggressive energy efficiency efforts than modeled in the Base Case, and no investment in climate action innovation, resulting in an overall decrease in usage driven more by minimal customer growth than customer energy efficiency savings. Capital expenditures as discussed above are decreased in the Low Case by approximately 0.5%-2% each year to account for the slower pace of growth. Lastly, Low Case

depreciation expenses are accelerated as discussed above to accommodate for the shorter useful life of assets that is forecasted under a contracting growth model. The depreciation of transmission mains assets was accelerated by approximately 10 years, distribution mains by approximately 5 years, and the remaining general plant by less than half a year, resulting in an increase in depreciation expense of approximately 8%. In combination with the loss of customer load, which spreads expenses across fewer customers, this results in upward base rate pressure. Although this is not the Company's vision, we found it useful to take a hard look at the directional forecast of a less vigorous approach to our Climate Action Plan, which shows that a less committed approach to meeting our climate goals not only falls short of Vermont's energy policy goals, but also puts added rate pressure on customers.

Overall, the Low Case modeling shows base rates track approximately at or above inflation over time, the use of SERF is ramped down in combination with rising RNG prices, and lower energy efficiency and innovative climate investments paired with lower customer growth.

Additional information regarding the output of the scenarios described above is provided in the following attachments:

High Scenario:	Attachment 3.1 (High Case Scenario)
Base Scenario:	Attachment 3.2 (Base Case Scenario)
Low Scenario:	Attachment 3.3 (Low Case Scenario)

4.0 RESILIENCY IN THE FACE OF UNCERTAINTY

In 2020, we continued to provide service to our 54,000 customers amidst a global pandemic that changed the way we work and live. In this section of the IRP, we consider the external factors that could upend our current perspective and assess our resiliency and planning strategy for extreme weather events, pandemics, and other external events.

We start with a summary of the strategic challenges and advantages facing the Company as we consider how to serve the energy needs of our customers over the term of the IRP.

Next, we consider the implications of extreme weather events and global climate change and articulate some of the planning tools we may utilize to accommodate the resulting impacts on customers' needs for energy services.

Third, we discuss VGS's emergency preparedness and describe the Company's Covid-19 response strategies as a basis for considering these and other tools that will support VGS's resiliency in the face of change, which sometimes involves rapid disruption of the status quo, as was the case with Covid-19 last year. We also consider the potential impact on VGS resulting from broader economic challenges.

Fourth, we consider strategies that will promote resiliency and successful outcomes as we pivot toward an ambitious Climate Action Plan that will involve changes to both our energy services and how we provide them. This section discusses our framework for pursuing innovative products and the process of new product development and summarizes some of the innovative products we anticipate pursuing under this framework during the term of this IRP.

Finally, our planning process acknowledges that one of VGS's greatest assets is our people. As we pursue an aggressive Climate Action Plan, we plan to leverage the value our powerful workforce to fuel our transformation. At the same time, we anticipate the need for change management as our company shifts its focus toward a more integrated energy service model. In this section, we discuss the change management, engagement, mindsets, and skillsets that will fuel our work over the term of the IRP.

4.1 STRATEGIC CHALLENGES AND ADVANTAGES

As part of our strategic planning process, VGS identified advantages and challenges that we face in the current environment, which informed the creation of the VGS Climate Action Plan and will be important considerations to leverage or mitigate in the implementation of this IRP.

Challenges

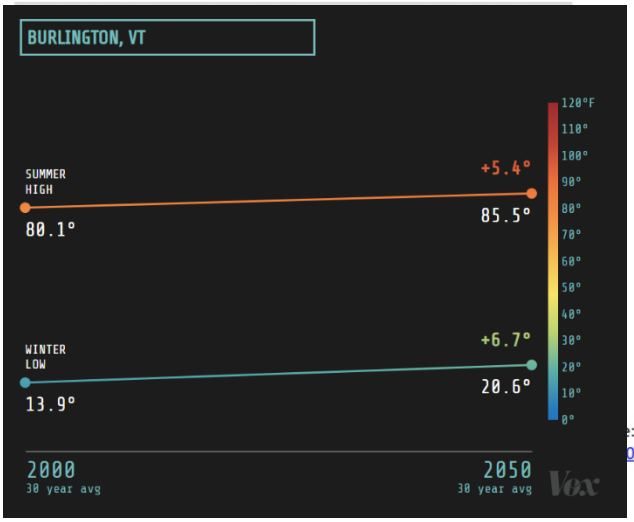
- Future looking state energy policy sees a limited role for fossil fuels
- Vermont policymakers considering anti-fossil fuel policies
- Loss of competitive advantage if utilities alone shoulder climate initiatives
- Misalignment between customers' ability to pay and the cost of accomplishing the state's goals
- Shrinking growth opportunities in footprint for traditional service offerings
- Customer preferences shift to renewable non-gas heating sources, e.g., electric heat pumps
- Lack of awareness on benefits of RNG
- Safety events in other states
- Uncertainty around the lasting impact of Covid-19
- Slight risk in the financing for the DRP

Advantages

- Highly satisfied customers which enables engagement
- High customer trust favors continued support of the company and expansion of services
- For energy decisions, most customers prefer straightforward transactions offered by a trusted utility partner
- Demand increasing for thermal energy efficiency
- RNG, hydrogen, and thermal/electric innovation ascending within industry
- Strategic partnerships with electric utilities can quickly advance energy transformation
- State policymakers' openness to VGS involvement
- Vermont's innovative regulators
- For talented jobseekers looking for both innovation and security, VGS is an attractive option
- Climate change and Covid-19 create environment for necessary change

4.2 GLOBAL WARMING AND EXTREME WEATHER EVENTS

EXTREME WEATHER EVENTS IMPACT ON CUSTOMER DEMAND



Changes to the surface temperature of the Earth have caused unprecedented weather events that are more intense and more frequent. Hurricane Irene was devastating for Vermont in 2011, causing roadways to flood and resulting in large costly impacts to infrastructure. Extreme rainfall is also a risk from climate change. Hurricane Irene had very minimal impact on VGS due to the underground nature of our infrastructure. The vast majority of VGS' river crossings utilized horizontal directional drilling (HDD) to install the pipe below the rivers and river buffers. We train our team to look for flood potential during their various patrols and surveys. We have specific patrols that pertain to erosion and flooding that are triggered by certain rain events. The annual mean temperature in Vermont has increased by 2.4 degrees Celsius since 1895.[24]

[24] https://www.geo.umass.edu/climate/stateClimateReports/VT_ClimateReport_CSRC.pdf

The predicted increase in temperature for Vermont, as shown in the above graphic, shows warmer summers and much warmer winters. [25] As a thermal energy provider, warmer temperatures mean lower natural gas usage. While lower usage is good for reducing carbon emissions, extremes in temperature can have the opposite effect as well, impacting VGS's ability to serve its firm customers should the weather be colder than the design day capacity of the system.

To account for unpredictable weather, VGS anticipates the need for the following over the term of the IRP:

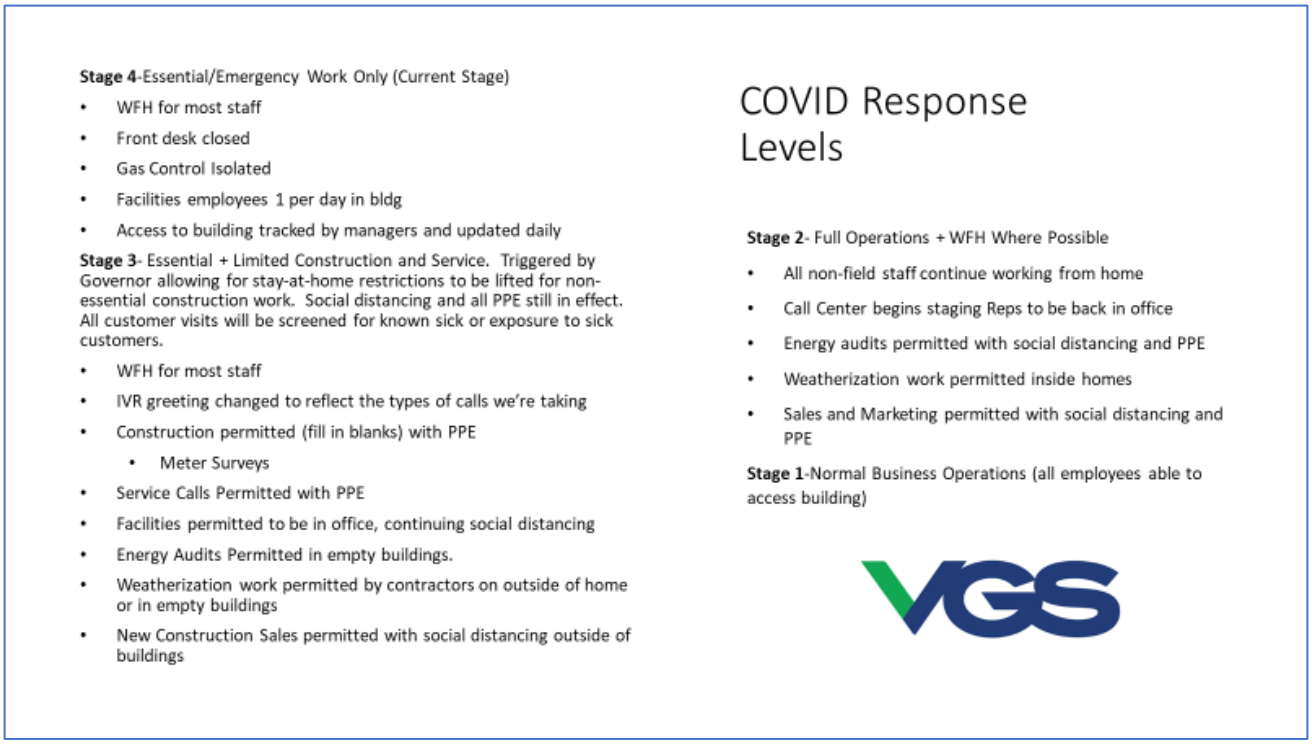
- Consideration of whether a broader range of historical weather data should be used when determining design day.
- Consideration of usage profiles and cost contributions of interruptible customers
- Consideration of the information and basis for potential forecasts regarding a decrease in usage due to warmer weather.
- Consideration of whether a potential climate change factor to adjust annual and design day load forecasts is necessary.
- Continued consideration of electrification such as cold climate heat pumps and related impacts on design day.

4.3 EMERGENCY PREPAREDNESS TRAINING AND COVID RESPONSE

This section reviews some of the lessons learned regarding our emergency preparedness in 2020. VGS has extensive plans in place for response to emergency events like Hurricane Irene and annually operates large scale drills in preparation for such events. These plans apply to any large-scale emergency event that may occur where VGS customers are without service. The plans include a flood risk program where we list locations we have identified as potential flood risk areas. After heavy rain or reported flooding we complete surveys on the flood risk areas.

The Covid-19 pandemic is a real-world situation that has tested our ability to respond to unforeseen circumstances. In response to the pandemic, VGS promptly formed a Covid-19 response team in February 2020 in anticipation of the impact of the pandemic to Vermont, with special attention given to the need to keep our essential workers and customers healthy and protected during this time. VGS identified several levels of response based on the spread of the pandemic and the Governor's mandates and scaled back to emergency-only operations from March through June. The following illustrates the staged approach we have taken to address Covid-19 impacts.

[25] https://www.vox.com/a/weather-climate-change-us-cities-global-warming



In addition to having a substantial impact on our operations, the pandemic has created economic uncertainty and upended many sectors of the economy. As the world enters the second year of the global pandemic with vaccination rollouts sluggish and a new strain to contend with,[26] the economic outlook for Vermont and the country is unpredictable and difficult to forecast. Two federal economic stimuli have breathed some life back into the economy but the longer we remain in partial or complete stay-at-home mandates, Vermont's various economic sectors remain in a holding pattern. Local efforts to keep the economy from backsliding in Vermont after the pandemic are emerging with VGS's close partners like VT Council on Rural Development.[27]

Recognizing the potential adverse financial circumstance of our customers, VGS promptly terminated any disconnection proceedings in the beginning of the pandemic and the Commission and Department have worked to ensure that utility customers of all kinds throughout Vermont do not face utility disconnections during this challenging time. VGS's experience during the pandemic has demonstrated that with more people at home, residential usage has increased while commercial usage has gone down, and industrial usage has remained fairly constant. Along with Vermont's other regulated utilities, VGS quickly agreed to put struggling customers on payment plans to provide grace during this period. While

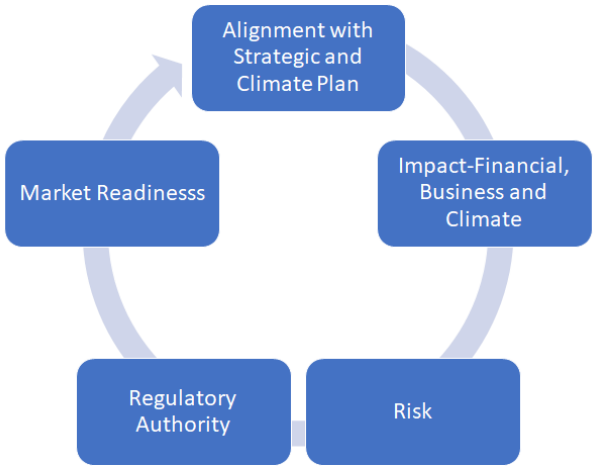
[26] https://www.pbs.org/newshour/show/u-s-vaccine-rollout-remains-sluggish-as-new-coronavirus-strain-spreads

[27] https://vermontbiz.com/news/2020/december/31/costello-future-vermont-post-Covid

customers did utilize this program, our accounts receivables have remained constant throughout the pandemic and for purposes of this IRP are forecast to remain the same.

4.4 RESILIENCY THROUGH INNOVATION: A FRAMEWORK

Through this IRP, we have described the changing energy needs of our customers and the changing energy industry and contemplated how VGS will serve those customers at least-cost while ensuring that we continue to transform and innovate to meet customers' growing need for a decarbonized thermal energy future. A key part of our transformation planning process is designed to ensure resiliency and success throughout this transition. Because we see the exploration of innovative opportunities to use our pipeline for non-geomorphic fuels, investing in other decarbonized underground infrastructure, expanding our energy efficiency programs, and evaluating new ideas for products and services to achieve our goals as hallmarks of our transition, we have developed a framework to consider whether opportunities—such as renewable natural gas (in-state and out-of-state), hydrogen blending/storage, Syngas, carbon capture, geothermal, and district energy systems—align with our short- and long-term planning horizons. The following reflects the framework under which we plan to evaluate opportunities for innovation through an objective, criteria-based process:

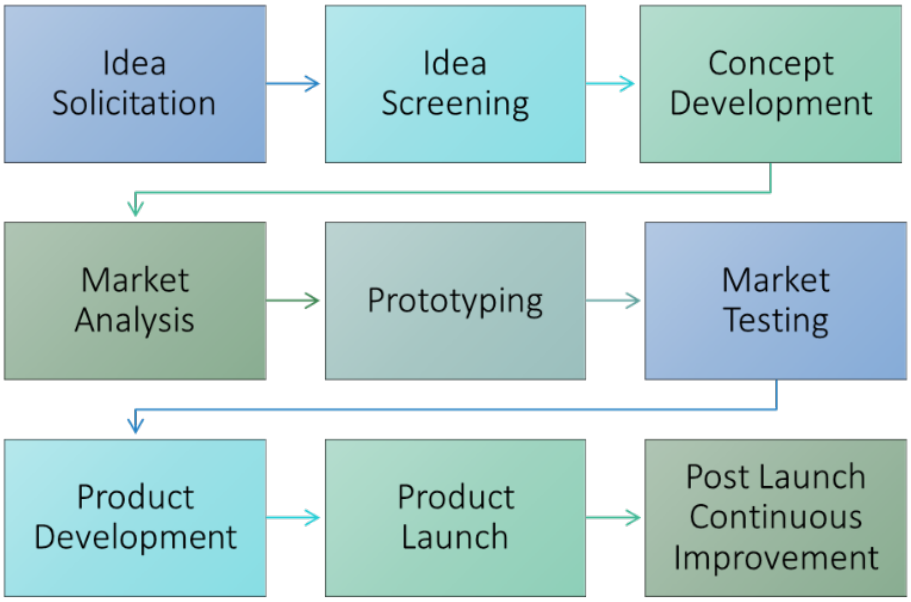


As VGS expands our innovation portfolio we will work with stakeholders, partners, regulators, and customers to advance these concepts in the manner that best serves us and our stakeholders.

PURSUING CLIMATE-FORWARD PRODUCTS

As VGS embraces the transformation of our energy delivery systems, we will examine new products and services that help our customers and advance our climate goals. VGS has a long history of providing behind-the-meter services, and when coupled with our efficiency program, we believe we have a unique opportunity to advance our vision. Examples of the products we are considering are natural gas-fired heat pumps for hot water and heating, micro-CHP/generators, hydrogen fuel cells, Electric Cold Climate Heat Pumps with natural gas backup, natural gas vehicles, and many other

developing products. VGS is working to implement a rigorous new product development ("NPD") process and innovation framework to gauge which offerings meet customer needs and align with our business objectives. While none of the products mentioned above are at a stage where they are modeled in this IRP, we expect to have several strategies and products to model in subsequent IRPs. The flow chart below depicts our product development lifecycle at a high level.



A new product development stage-gate process ensures that investments in products & services are based on sufficient and objective evidence of customer need and aligned with key business objectives.

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 is in alignment with the company's strategic business objectives. One of the main benefits of NPD is that without sufficient and objective evidence that customers strongly desire the product, additional investments cannot be justified. Launching products based on assumptions about the customer or market is high risk. This process safeguards against these risks. One significant asset that VGS has well beyond its physical infrastructure is extensive customer engagement activity through our customer care center, our sales team, our energy efficiency team, and our service techs. Each year VGS has tens of thousands of customer interactions. Collectively these interactions are a different sort of pipeline for understanding customer needs, discovering gaps in market solutions, and generating the ideas we will need to explore as part of our business transformation.

Additional potential future product offerings include:

NATURAL GAS-FIRED COLD-CLIMATE HEAT PUMPS

Natural gas-fired cold-climate heat pumps can produce domestic hot water and/or provide heating. They operate in a similar manner to Electric Heat Pumps and can provide a Coefficient of Performance ("COP") of 1.5 (i.e., 150% efficient). While this technology has been available in the commercial equipment space for several years, it is only now emerging for residential equipment. We expect natural gas-fired heat pump water heaters ("NGHPWH") to be available in 2021, and that VGS will install a few test units as proof of concept. With over 15,000 customers who currently lease a water heater or have VGS servicing their water heater, this provides a ripe market. Most of these legacy-installed water heaters have COP of less than .8 (80%). If VGS can offer these customers a gas-fired heat pump water heater with COP of 1.5 (150%), the savings would be close to 50%. With the piloting of NGHPWH, VGS may also consider offering electric heat pump water heaters ("HPWH"), working with our customers' specific needs to install the unit that best meets their needs.

MICRO-COMBINED HEAT AND POWER (CHP)/GENERATORS

These units could be installed to provide backup generation during electrical outages, peaking services, and in some cases a combined heat and power unit ("CHP") for a home or business. American Council for and Energy Efficient Economy ("ACEEE") published a study[28] in 2016 that estimates these units could reduce peak electric demand by 38%. Companies like Nextgrid[29] in Ontario are developing gas-fired CHP that will provide a home's electric and hot water; these units also include a battery to store electricity for the home. When you factor in the on-site efficiency of these units at over 85%, versus the New England ISO power mix, these units may well be cost-effective and low carbon. Hydrogen fuel cell generators are technology that can also fit in this category, using VGS's system to transport clean hydrogen to these distributed generators. These fuel cells could provide baseload electric generation with zero carbon emissions to complement Vermont's intermittent renewable electric resources. VGS will monitor these developments and investigate the product offerings in this area in the coming years.

SMART THERMOSTAT/METER

For several years, VGS has worked to develop a vision in the smart thermostat area. It is a different business model than that of the electric utilities smart meter, but one that will have significant benefits if deployed widescale. The concept involves the installation of smart thermostats, (e.g., NEST, Ecobee or other), to control the heating and cooling systems of a home. These units could be controlled by the homeowner, or customers could enroll in a demand response program run by VGS or in collaboration with our electric utility partners. In this model, customers' heating and cooling systems would be adjusted slightly to provide excess capacity during peak events. These units could also be connected to real-time wireless meter readings (like electric distribution utilities have today) and provide customers with a clear understanding of their energy costs as well as safety and efficiency data on their systems. For example, a customer or VGS's service team could tell if the heating system was "short-cycling"

[28] https://www.aceee.org/files/proceedings/2016/data/papers/1_8.pdf

[29] http://www.gonextgrid.com/technology/

(operating inefficiently), or even detect a leak or that a gas range was left on. The potential in this area seems significant, but it will take a considerable amount of planning and customer engagement before VGS would be able to advance a widescale program.

NATURAL GAS-POWERED VEHICLES

In many areas of the country natural gas is powering a clean energy transition in the heavy-duty vehicle sector by converting diesel buses, refuse truck, and other commercial vehicles. Natural gas engines are a proven technology as they have low to zero NOx emissions and with federal/state incentives can be influential as Renewable Natural Gas. At the federal level, the Renewable Fuel Standard ("RFS") and at the state level, programs like the California Low Carbon Fuel Standard ("LCFS") have created a robust market for RNG, with incentives valued from $5/mcf to over $60/mcf to the producer. In California it is estimated that nearly 90% of the Natural Gas Vehicles ("NGV") are powered by renewable natural gas with negative carbon impact[30] VGS currently uses RNG to power our NGVs and we are working with our other NGV customers to convert their NGV fleets. While the focus in Vermont has been on electric passenger vehicles, policy makers should not overlook the opportunity of NGV powered by RNG in the heavy-duty vehicle sector. While there may be challenges with converting fleets to NGVs (for example, the vehicles have more upfront cost, they require a natural gas filling station, and they have different maintenance procedures) all these challenges can be overcome with smart public policy such as what California has exhibited. Vermont should consider an LCFS-like structure or joining in with New York on their LCFS framework discussions, which would allow more in-state RNG projects to come online and solve a significant problem of emissions from transportation by greening our heavy-duty fleets in northwestern Vermont.

4.5 PEOPLE

RESOURCING THE FUTURE OF THERMAL ENERGY

VGS's two most important assets are its infrastructure and its people. Without the dedicated people who put public safety and customers first, achieving the Climate Action Plan while also ensuring we continue to deliver thermal energy safely and affordably to our customers would be impossible. People are the engine of VGS, spanning operations, gas control, customer service, energy efficiency, engineering, maintenance, and service, along with support functions like IT, Human Resources, and Finance. These employees serve the needs of 54,000 customers and have earned high marks in customer satisfaction. The vision for the future of VGS needs these employees *plus* growth in the innovation arm of our organization. While our customer numbers may not grow substantially, boosting energy efficiency, pursuing partnerships and projects that drive decarbonization, and delivering comprehensive energy services to our customers will take additional staffing, and provide an

[30] https://www.act-news.com/news/california-natural-gas-vehicle-fuel-achieves-first-ever-carbon-negative-milestone/

opportunity for much needed jobs in Vermont. VGS takes immense pride in being a top employer and important contributor to the economic vitality of Vermont and wants to grow this capacity in the future, while keeping an eye on the affordability of natural gas for our customers.

CHANGE MANAGEMENT

In our industry, doing something well over time has ensured safety, reliability, and consistency for customers. With the kind of transformation VGS is pursuing, change is not only inevitable, but also imperative. Managing that change both for employees as well as our customers will fortify our success at accomplishing the vision, but the change must occur without losing the above-mentioned values that customers have come to rely on.

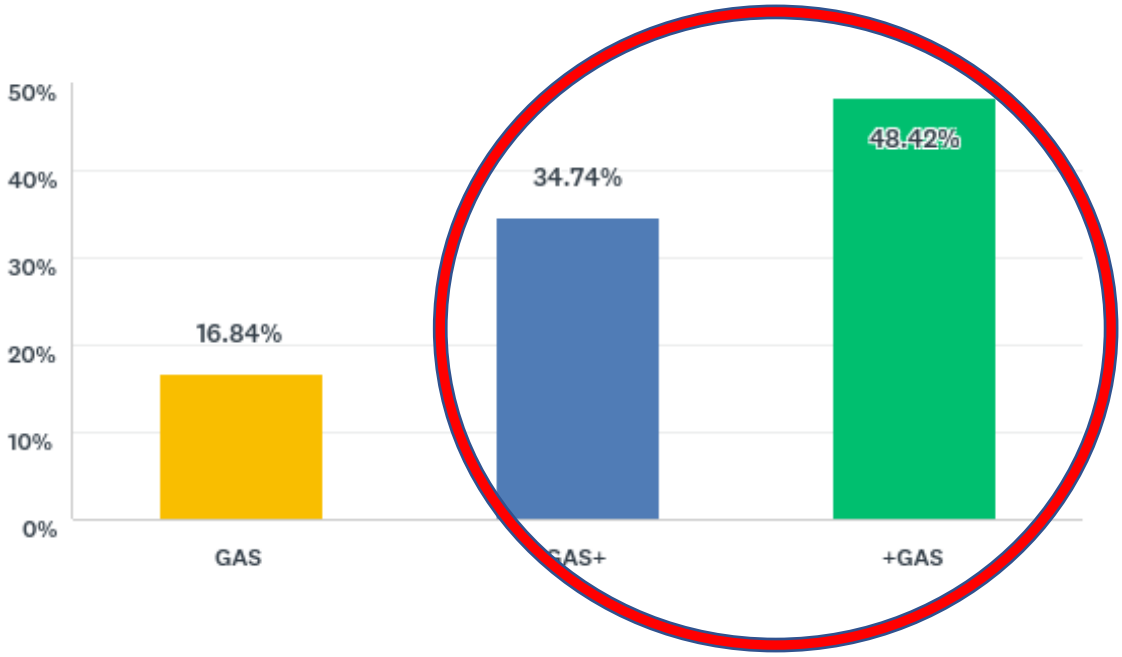
VGS's approach to change management is outlined in the model below and consists of four tenets:

1. Lead with culture.
2. Frontline focus.
3. Engage customers every day.
4. Assess and adapt.

LEAD WITH CULTURE

Organizational culture can be hard to describe but easy to feel: the healthiest cultures are the ones that walk the talk with people that emulate the values the organization wishes to espouse. At VGS, the culture is steeped in safety, pride, integrity, and a deeply engrained commitment to keeping Vermonters warm. Our culture is steadfast and evolving as employees embrace and understand that our pride lies in the outcome of what our energy brings to customers rather than the product itself. An increasingly renewable thermal supply enhances our culture and deepens the commitment of employees to being stewards of the lowest-carbon-impact way to bring warmth. The deep pride that employees have at VGS means they are completely bought in to the change that is necessary to ensure VGS stays an important player in the energy future of Vermont.

When creating the Climate Action Plan, a core team representing all our departments was formed including employees from the field and the inside office and employees representing every level of the organization. An internal survey of employees ahead of our Climate Action Plan announcement showed that 83% of employees supported the bold vision to transform. The table below shows employees chose a greener future focused on more sustainable gas supply with increased energy efficiency and behind-the-meter offerings. An important thing to note is that our employees are also our customers, part of our communities, and proud Vermonters. They believe in a more sustainable future for themselves and their families, too.



Graph 4.1[31]

[31] Gas+ ("Gas Plus") is a term used by VGS staff to describe a business model of providing traditional natural gas, plus new RNG supply, enhanced in-home services, and continued system improvement in general support of Vermont's sustainability goals. +Gas ("Plus Gas") refers to a vision for the future providing low-to-no carbon

"We take care of one another" is a mantra at VGS. It informs our policies and decision-making because when we take care of each other, we take better care of our customers, our community, and our one planet. This means understanding the needs, motivations, and feedback up and down the organization, and working to create an open and welcoming workplace for all employees.

In July 2020, VGS made a commitment to Diversity, Equity, and Inclusion measures. With this public statement VGS commits to fostering an environment that is welcoming, inclusive, and just for all. The steps in this statement range from trainings to modernizing hiring practices to encouraging civic responsibility.

VGS measures and keeps track of our culture through several surveys and employee focus groups and uses Vermont Biz Magazine's "Best Places to Work" survey as both a baseline and to measure trends in engagement over time.

FRONTLINE FOCUS

By definition, VGS's frontline – customer care reps, field service techs, street crews, energy auditors, and others – is the closest to real action. From daily customer interactions to safety checks and pipe replacements, the frontline is the beating heart of our organization and we strive to keep their pulse strong and healthy. We have worked to empower our frontline to make decisions and provide them the tools and training to get the job done right. On the flip side, they take responsibility for the work and are held accountable for their decisions.

Company leadership prioritizes person-to-person check-ins and open time to listen rather than talk. Out of these ongoing conversations have come improvements around enhanced engagement, highlighting the operations and frontline employees, and moving decision-making closer to where the work is occurring.

Constant communication is essential to reinforce the vision and the path ahead. VGS implemented weekly all-employee Town Hall meetings to highlight various aspects of our business and the link to climate, as well as consistent weekly "Friday Reads" messages that summarize the most essential information occurring both internally and externally for employees. Quarterly "All Hands" meetings focus attention on the broader health of the organization from financials to diversity, equity, and inclusion. These are not one-way meetings; employees are invited to engage, ask questions, participate, and present to the broader group. From the strategic planning process to the performance indicators for company performance, employees have a line of sight for what is needed to accomplish the Climate Action Plan.

Finally, VGS is proud to be affiliated with the International Brotherhood of Electrical Workers ("IBEW") Local 300. 53 of our employees are IBEW members. Management and labor work together to improve the safety and ensure the professional development of our employees.

thermal energy through an array of innovation, efficiency, and RNG supply options, plus continuing to serve traditional natural gas as part of its gas supply, all in direct support of Vermont's 90% renewable by 2050 sustainability goal.

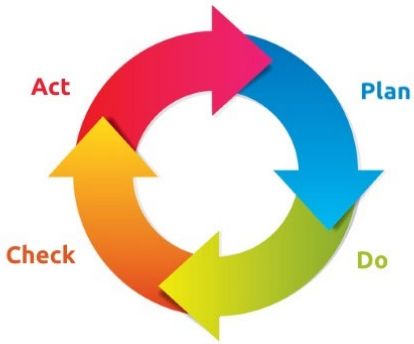
ENGAGE CUSTOMERS EVERYDAY

Although VGS has a history of innovation and carbon savings for its customers, that story and reputation is not widely known. We have seen in our quarterly customer satisfaction surveys that when customers think about us, they appreciate good service and affordable rates, feel we keep them safe, and would refer us to a friend. These are excellent aspects of our business that customers have come to count on, and we want to be very attentive to not erode the trust we have built over many decades.

At the start of designing our climate commitment, VGS engaged a list of stakeholders spanning customers, electric utilities, energy efficiency utilities, low-income organizations, and other trade allies as illustrated in the Stakeholder Engagement section above. Most were in favor of our pursuit of decarbonization but many of the customers, specifically large businesses, warned of concerns around affordability. Continuing to tell the "why" behind our story and to prove that we are serious and accountable to the goals we have set will be crucial. We conducted several customer focus groups in 2020 and the resounding message from customers was that they wished we did more around sustainability. The challenge is that they are unaware of any of our efforts to-date around sustainability, let alone our new vision for the future. Although customers have been happy with our services, they desire a more renewable supply and VGS is ready to deliver on that expectation, continually telling our story and bringing customers along in our transformation.

In addition, VGS has better aligned resources to deliver on our Climate Plan. Three centers of excellence were designed, focused on customers: Center for Safety and Reliability, Center for Customer and Climate Innovation, and Center for Corporate Performance and Strategy. The new orientation of our organization is completely centered around the customer experience, as illustrated below. By bringing together all customer-facing departments and approaching each customer touch through an integrated energy services lens, we are removing inefficiencies and placing the full value proposition of being a VGS customer at the customer's fingertips.

ASSESS AND ADAPT



For this change to be successful—and lasting—checking back in with both our stakeholders and VGS staff on the success of the changes will be an important part of the VGS process. VGS seeks to be a learning organization and is committed to continuous improvement, which includes employee satisfaction and culture. This will be an iterative process cycling back through the principles laid out in this section. Frankly, we have set goals but may need to adjust the mechanism to accomplish them as new technologies, projects, and partnerships evolve. VGS is engaging support from outside agencies to help test the current model and recommend ways to pivot in case there are obstacles to accomplishing the RNG and energy efficiency aspects of the Plan.

MINDSETS AND SKILLSETS

MINDSETS

Since 1965, VGS customers have appreciated our commitment to safety, reliability, and affordability. Over the last decade, the Company has seen a dramatic shift in how prospective customers view natural gas: they appreciate the ease that comes with signing up for our services, but they also have a deep desire to reduce their carbon impact. We believe there are opportunities for us to continue to evolve our message to educate Vermonters about the VGS Climate Plan and our commitment to combatting climate change. Shifting our messaging will help motivate customers to make the most informed decisions when it comes to their energy choices.

SKILLSETS

To keep up with an ever-changing industry, employee training and succession planning will be instrumental in ensuring that we create a diverse, educated, and enthusiastic workforce. Building the next generation of thoughtful energy innovators will require strategic partnerships with our technical schools and universities. Additional efforts and training programs for our contractors will help us deliver on our commitment to significantly increase the number of homes and businesses we weatherize.

VGS partnered with CEDO, Efficiency Vermont and ReSource in the fall of 2020 to train 8 contractors who will enter the world of weatherization contractors.

5.0 IMPLEMENTATION PLAN

As demonstrated throughout this IRP, VGS's short- and long-term planning is galvanized around continuing to meet our customers' demand for thermal heating services as we answer the call for a cleaner decarbonized thermal energy future. With a rapidly evolving future, VGS must be nimble and continuously reassess planning as policy, customer expectations, and the world change around us.

Our short-term implementation strategies involve preparing the Company for the years ahead by understanding our customers' thermal energy needs in a decarbonized energy market, creating opportunities to pursue innovation that will help meet those needs, structuring our company for the energy transformation ahead, and taking action now on the strategies that can help our customers lower their thermal GHG emissions, such as increasing the sustainability of our supply and doubling down on energy efficiency investments. In the near term we plan to implement a 2% increase in RNG throughout our retail supply portfolio on an annual basis and begin enhancing our investment in energy innovation projects. We will implement our approved DRP spending, and in doing so secure greater energy efficiency savings and reduce customers' demand for thermal energy. In the next few years, we plan to engage with partners and stakeholders to pursue district energy projects and other innovative solutions that will support the City of Burlington's carbon neutral mission and the commitment of local businesses to decarbonize their own footprints. At the same time, we plan to operationalize the first in-state RNG supply in Salisbury, Vermont, and commence the planning stages for additional in-state projects with similar potential.

Our long-term planning horizon places VGS at the forefront of a thermal energy transformation in Vermont. We look forward to developing into a more integrated energy services company that meets our customers' demand for thermal energy with a multi-pronged approach that accounts for affordability and sustainability while diversifying the services and products that will be needed to meet customers' demand for a decarbonized thermal energy future. We plan to work with legislators, other policymakers, and thermal heat providers to establish pro-climate thermal legislation that provides a roadmap for decarbonized thermal heating services throughout Vermont. We will amplify our behind-the-meter capacity to assist customers with the financing and implementation of alternative thermal heating strategies, and engage with customers, regulators, and policymakers about the most affordable and ambitious steps we can support to advance our Climate Action Plan and the state's renewable energy goals.

Section	Implementation
Customer Demand Planning Strategy	• Evaluate potential reduced customer usage due to warmer climate and work on sustainable supply planning and forecasting. • Evaluate, monitor, and plan for customer losses resulting from electrification and other fuel switching options and integrate services to cooperate, support, and sustain smart electrification. • Evaluate and assess the need for additional system pressure needs from Canadian transmission system to serve all customers effectively under higher-than-expected growth. • Promote and develop energy services that reflect more diverse thermal alternatives and address customers' demand for an Integrated Energy Services Provider. • Develop and pursue more robust behind-the-meter strategy to support customers through financing, installation, and services that promote customers' energy transformation.
Infrastructure and Supply Strategy	• Pursue increased RNG supply both in-state and out-of-state to increase overall supply portfolio in an aggressive but affordable manner, accounting for market fluctuations and opportunities. • Enhance demand for sustainable supply more broadly to provide leadership and accountability in the industry.
Climate and Innovation Strategy	• Pursue District Energy in Burlington in partnership with other stakeholders to increase carbon neutral thermal supply for customers. • Pursue innovative projects and pilots such as a Hydrogen Research Pilot with Vermont Electric Coop to assess viability of energy storage and supply alternatives. • Collaborate with partners, legislators, and thermal heating stakeholders on pro-climate legislation that will advance more decarbonization of the thermal energy sector throughout Vermont. • Pursue Alternative Regulation plans that will promote innovation and encourage investment in a clean energy future. • Continue pursuing aggressive options to increase energy efficiency savings through our current and future Demand Resource Plans. • Continue to monitor and address financial and rate impacts resulting from climate & innovation strategy, remaining focused on stable and affordable rates.
People Strategy	• Inspire and sustain stronger partnerships with other distribution and efficiency utilities to enhance the experience and energy services available to shared customers. • Develop and implement training plan to align resources with Climate Action Plan and state policy. • Develop and implement enhanced recruiting plan to draw talent to power energy transformation. • Implement comprehensive external communications plan that educates and inspires customers to take action on climate priorities.

	2020	2025	2030	2035	2040
Average Number of Customers	53,400	56,500	60,300	63,300	65,900
Firm Gas Sales MCF	7,100,000	7,300,000	7,200,000	7,200,000	7,000,000
Interruptible Gas Sales MCF	6,400,000	6,300,000	6,100,000	5,900,000	5,800,000
Total MCF Sales	13,500,000	13,600,000	13,300,000	13,100,000	12,800,000
Firm Gas Revenue	22,300,000	36,500,000	48,600,000	57,100,000	62,300,000
Firm Base Revenue	55,000,000	64,700,000	69,300,000	73,900,000	78,100,000
SERF Withdrawls	5,000,000	0	0	0	0
Total Firm Revenue	82,300,000	101,200,000	117,900,000	131,000,000	140,400,000
Interruptible Revenue	22,600,000	23,800,000	23,900,000	24,300,000	24,700,000
Rental & Other Revenue	2,400,000	2,100,000	2,200,000	2,400,000	2,600,000
Total Revenue	107,300,000	127,100,000	144,000,000	157,700,000	167,700,000
Cost of Gas	45,500,000	60,900,000	72,500,000	81,400,000	87,000,000
Responsibility Expenses	20,200,000	21,500,000	23,700,000	26,200,000	28,900,000
Depreciation	11,300,000	14,000,000	16,200,000	18,500,000	20,900,000
DSM & Regulatory Amortization	600,000	600,000	-	-	-
Taxes Other Than Income	8,200,000	9,600,000	10,900,000	12,000,000	13,300,000
Interest Expense	7,200,000	6,200,000	5,400,000	5,100,000	4,500,000
Income Taxes	4,600,000	3,600,000	3,900,000	3,600,000	3,200,000
Return*	10,500,000	11,400,000	11,400,000	10,800,000	9,800,000
Total Non-Gas Cost of Service	54,900,000	64,700,000	69,300,000	73,900,000	78,100,000
Total Cost of Service	107,300,000	127,100,000	144,000,000	157,700,000	167,700,000
Capital Expenditures	16,400,000	17,500,000	11,900,000	12,400,000	12,900,000
Average Rate Base	267,300,000	256,500,000	258,200,000	245,500,000	224,000,000
Short & Long Term Debt	153,400,000	135,100,000	130,300,000	122,500,000	111,300,000
Stockholders Equity	134,700,000	129,300,000	129,900,000	123,900,000	112,700,000

* Authorized Return matches 2020 (9.2%) & 2021 (8.65%) Orders then increased 20 thought 2025 where it is held at 9.45% through 2040.

	2020	2025	2030	2035	2040
Average Number of Customers	53,400	56,300	58,300	59,700	60,600
Firm Gas Sales MCF	7,100,000	7,300,000	7,000,000	6,800,000	6,500,000
Interruptible Gas Sales MCF	6,400,000	6,400,000	6,200,000	6,100,000	5,900,000
Total MCF Sales	13,500,000	13,700,000	13,200,000	12,900,000	12,400,000
Firm Gas Revenue	22,300,000	37,400,000	52,000,000	65,500,000	77,400,000
Firm Base Revenue	55,000,000	64,500,000	68,300,000	71,700,000	75,100,000
SERF Withdrawls	5,000,000	0	0	0	0
Total Firm Revenue	82,300,000	101,900,000	120,300,000	137,200,000	152,500,000
Interruptible Revenue	22,600,000	23,900,000	24,200,000	24,800,000	25,300,000
Rental & Other Revenue	2,400,000	2,100,000	2,200,000	2,400,000	2,600,000
Total Revenue	107,300,000	127,900,000	146,700,000	164,400,000	180,400,000
Cost of Gas	45,500,000	61,800,000	76,200,000	90,200,000	102,700,000
Responsibility Expenses	20,200,000	21,500,000	23,700,000	26,200,000	28,900,000
Depreciation	11,300,000	14,000,000	15,800,000	17,900,000	20,100,000
DSM & Regulatory Amortization	600,000	600,000	-	-	-
Taxes Other Than Income	8,200,000	9,600,000	10,800,000	12,000,000	13,200,000
Interest Expense	7,200,000	6,200,000	5,300,000	5,100,000	4,400,000
Income Taxes	4,600,000	3,600,000	3,700,000	3,200,000	2,700,000
Return*	10,500,000	11,200,000	11,100,000	9,700,000	8,500,000
Total Non-Gas Cost of Service	54,900,000	64,500,000	68,300,000	71,700,000	75,100,000
Total Cost of Service	107,300,000	127,900,000	146,700,000	164,400,000	180,400,000
Capital Expenditures	16,400,000	14,500,000	11,900,000	12,400,000	12,900,000
Average Rate Base	267,300,000	256,500,000	250,200,000	234,000,000	210,400,000
Short & Long Term Debt	153,400,000	134,400,000	125,300,000	118,100,000	104,900,000
Stockholders Equity	134,700,000	129,300,000	126,300,000	116,100,000	101,300,000

* Authorized Return matches 2020 (9.2%) & 2021 (8.65%) Orders then increased 20 thought 2025 where it is held at 9.45% through 2040.

Attachment 3.3 (Low Case Scenario)

	2020	2025	2030	2035	2040
Average Number of Customers	53,400	55,500	58,300	59,700	60,600
Firm Gas Sales MCF	7,100,000	6,900,000	6,500,000	6,000,000	5,500,000
Interruptible Gas Sales MCF	6,400,000	6,400,000	6,300,000	6,100,000	6,000,000
Total MCF Sales	13,500,000	13,300,000	12,800,000	12,100,000	11,500,000
Firm Gas Revenue	22,300,000	37,500,000	55,900,000	72,300,000	87,800,000
Firm Base Revenue	55,000,000	66,000,000	67,700,000	71,100,000	72,800,000
SERF Withdrawls	5,000,000	0	0	0	0
Total Firm Revenue	82,300,000	103,500,000	123,600,000	143,400,000	160,600,000
Interruptible Revenue	22,600,000	24,000,000	24,400,000	25,100,000	25,800,000
Rental & Other Revenue	2,400,000	2,100,000	2,200,000	2,400,000	2,600,000
Total Revenue	107,300,000	129,600,000	150,200,000	170,900,000	189,000,000
Cost of Gas	45,500,000	61,900,000	80,400,000	97,500,000	113,700,000
Responsibility Expenses	20,200,000	21,500,000	23,700,000	26,200,000	28,900,000
Depreciation	11,300,000	14,900,000	16,400,000	18,100,000	19,600,000
DSM & Regulatory Amortization	600,000	600,000	-	-	-
Taxes Other Than Income	8,200,000	9,600,000	10,800,000	11,900,000	13,200,000
Interest Expense	7,200,000	6,200,000	5,200,000	4,800,000	3,900,000
Income Taxes	4,600,000	3,300,000	3,400,000	3,100,000	2,300,000
Return*	10,500,000	12,000,000	10,300,000	9,500,000	7,400,000
Total Non-Gas Cost of Service	54,900,000	66,000,000	67,700,000	71,100,000	72,800,000
Total Cost of Service	107,300,000	129,600,000	150,200,000	170,900,000	189,000,000
Capital Expenditures	16,400,000	11,500,000	10,800,000	10,200,000	9,500,000
Average Rate Base	267,300,000	254,300,000	232,700,000	200,900,000	158,300,000
Short & Long Term Debt	153,400,000	134,400,000	117,200,000	100,900,000	78,800,000
Stockholders Equity	134,700,000	126,700,000	116,700,000	99,900,000	78,700,000

* Authorized Return matches 2020 (9.2%) & 2021 (8.65%) Orders then increased 20 thought 2025 where it is held at 9.45% through 2040.