



# **VERMONT GAS SYSTEMS, INC. INTEGRATED RESOURCE PLAN**

January 16, 2024



# TABLE OF CONTENTS

MESSAGE FROM OUR CEO .....	4
EXECUTIVE SUMMARY .....	5
<b>1. CUSTOMER DEMAND AND FORECAST .....</b>	<b>9</b>
1.1. LOAD FORECAST .....	10
1.2. ENERGY EFFICIENCY UTILITY .....	15
<b>2. SCENARIO ANALYSIS: CARBON REDUCTION PATHWAYS .....</b>	<b>21</b>
2.1. STATE AND LOCAL THERMAL POLICY .....	22
2.2. STAKEHOLDER ENGAGEMENT .....	27
2.3. INTEGRATED ENERGY SERVICES .....	28
2.4. SCENARIOS .....	33
<b>3. SUPPLY .....</b>	<b>39</b>
3.1. TRADITIONAL NATURAL GAS .....	40
3.2. RNG AND OTHER ALTERNATIVE SUPPLY .....	43
3.3. GREENHOUSE GAS EMISSIONS REDUCTION VALUATION .....	51
<b>4. INFRASTRUCTURE .....</b>	<b>54</b>
4.1. NATURAL GAS TRANSMISSION & DISTRIBUTION .....	55
4.2. PEOPLE .....	69
4.3. EMERGENCY PREPAREDNESS .....	72
4.4. CYBERSECURITY .....	74
<b>5. INTEGRATED ANALYSIS AND ACTION PLAN .....</b>	<b>75</b>
5.1. REDUCING OUR RELIANCE ON TRADITIONAL NATURAL GAS .....	76
5.2. PATHWAYS TO CARBON REDUCTION .....	77
5.3. CONCLUSION .....	79
<b>6. FINANCIAL ASSESSMENT .....</b>	<b>80</b>
6.1. FINANCIAL STATEMENTS .....	81
6.2. COST OF SERVICE .....	85



**7. APPENDICES** ..... [86](#)

    APPENDIX A: VGS EEU 2024-2026 TRIENNIAL PLAN ..... 87

    APPENDIX B: VGS 2023 ANNUAL SUPPLY PLAN ..... 127

    APPENDIX C: VGS RNG IN-STATE POTENTIAL STUDY ..... 141

# LETTER FROM OUR CEO

VGS is pleased to file this Integrated Resource Plan with the Public Utility Commission. Our plan provides a long-term strategy to serve customers' energy needs affordably as we also transform Vermont's thermal energy sector to reduce greenhouse gas emissions and meet the demands of climate change. We know first-hand that our customers are managing many challenges, whether it is the continuing impact of the Covid-19 emergency and its effect on our children and families, persistent economic uncertainty, or the devastating effect of this past summer's flooding. As one of Vermont's foundational institutions that provides an essential service to tens of thousands of Vermonters, we understand our job is to provide stability and reliability to our customers in times of need while we also lead the effort to accelerate solutions to the climate emergency.



The long-term plan we present today is guided by rapidly changing energy policy, the General Assembly's 2023 mandate to develop a comprehensive framework that will guide how obligated thermal fuel providers can cost-effectively address carbon emissions, and VGS's core duty to provide customers with safe and reliable service. The plan also reflects months of collaboration among VGS's dedicated team, VGS customers, the Department of Public Service, and many interested stakeholders who offered thoughtful and productive feedback about VGS and how we will continue to serve customers' energy needs well into the future.

I want to thank everyone who contributed to this planning process. Together, we tested assumptions, honed scenarios, and developed a roadmap that will help guide our continued efforts to adapt to the urgent challenge of climate change, support the vitality of the families and businesses that rely on us as an essential partner, and provide safe and reliable heating services to Vermonters at least cost. We are grateful for the continued partnership this work will require and look forward to continued dialogue on how we can best serve our customers and communities.

A handwritten signature in blue ink, which appears to read "Neale".

Neale F. Lunderville  
President & CEO



# EXECUTIVE SUMMARY

## EXECUTIVE SUMMARY

This Integrated Resource Plan (“IRP” or “Plan”) represents Vermont Gas Systems, Inc.’s (“VGS” or the “Company”) plan for meeting its customers’ need for energy services at the lowest present value life cycle cost over a twenty-year planning horizon. This means that the Plan identifies a long-term approach for offering affordable thermal energy service to customers, but also addresses the urgent challenges and potential economic costs of climate change, as well as the ongoing need to maintain safe and reliable service for thousands of Vermonters.<sup>1</sup>

As northwest Vermont’s integrated energy services provider, VGS has provided warmth to Vermont homes and businesses for almost sixty years and has facilitated comprehensive energy efficiency services to customers for more than three decades. The VGS thermal heating workforce is the largest of its kind in Vermont, with more than 140 dedicated employees, including HVAC technicians who are engaged with our customers at all hours of the day in every season. Our IRP evaluates how VGS will continue to provide safe, affordable, and reliable thermal energy service in a rapidly evolving energy landscape that requires us to further amplify our award-winning energy efficiency programs and expand our growing portfolio of decarbonized heating and cooling options for Vermonters to meet the climate goals set forth in Vermont’s Global Warming Solutions Act (“GWSA”).<sup>2</sup>

Previously, our long-term planning process under 30 V.S.A. § 218c was focused on how VGS would respond to then-growing demand for natural gas service, including the safety protocols and infrastructure investments needed to serve increasing energy demands of Vermont customers. As regulations and policy priorities have shifted toward reducing greenhouse gas emissions at an accelerating pace, our long-term planning process has also evolved from one rooted in customer-growth forecasts to one that is focused on carbon reduction pathways.<sup>3</sup>

As a result, our Plan begins with an assessment of future customer demand and evaluates alternative pathways to provide our more than 55,000 customers in Addison, Chittenden, and Franklin counties with a decarbonized thermal energy future. This is an essential component of the “least-cost integrated plan” required by 30 V.S.A. § 218c, which requires costs to be assessed with due regard to State energy goals. The scenarios we are planning for are firmly rooted in both the state and local thermal

---

1 See 30 V.S.A. § 218c.

2 See 10 V.S.A. § 578 et seq.

3 This IRP is responsive to 30 V.S.A. § 218c regarding least-cost integrated planning as well as a Memorandum of Understanding (“MOU”) between VGS and the Department of Public Service that was approved by the Commission alongside our 2021 IRP, in Case No. 21-0167-PET. The MOU required VGS to engage with the Department at least six months in advance of filing this IRP. Accordingly, VGS and the Department met routinely to discuss elements of this IRP between July 2023 and January 2024. The MOU also contemplated that VGS would complete a study demonstrating the procurement potential of renewable natural gas (“RNG”) within Vermont and nearby, which is discussed in Section 3.2. Finally, the MOU required this IRP to include: (a) an analysis around procuring alternative fuels; (b) a description of VGS’s work developing a framework around greenhouse gas emissions to inform resource procurement; and (c) a discussion of system resilience and reliability, including both physical and cyber systems. These topics are addressed in Sections 3.2, 3.3, and 4.4, respectively.

energy policies that are driving key reductions in carbon emissions and, in particular, are consistent with the Global Warming Solutions Act mandates and the Department of Public Service's (the "Department") 2022 Vermont Comprehensive Energy Plan ("CEP").<sup>4</sup>

- In Section 1 of the Plan, we assess potential changes in customers' use of natural gas and discuss factors that impact natural gas load forecasts, including the impact of our energy efficiency investments. Since 1993, VGS has invested \$55 million in energy efficiency, and expansion of that commitment is one of the key strategies of our Plan to provide decarbonized thermal energy to our existing natural gas customers. This includes residential customers (29% of sales), commercial customers (23% of sales), and interruptible customers (48% of sales).
- In Section 2 of the Plan, we take stock of the state and local thermal energy policies that shape our energy future in Vermont, discuss how our stakeholder engagement has informed our outlook, and assess the potential for providing expanded thermal energy services as an integrated energy services provider. This is where we also discuss the following three alternative scenarios or pathways to provide energy services that are consistent with the Global Warming Solutions Act:
  - (1) a High Electrification scenario where the majority of our customers achieve carbon reduction through electrification,
  - (2) a High Fuels scenario that contemplates the impacts of achieving significant carbon reductions through renewable fuel alternatives, and
  - (3) a Hybrid approach that includes a balance of both electrification and renewable fuel options.
- In Sections 3 and 4 of the Plan, we assess available supply resources and the infrastructure needed to provide the energy services required for our customers to continue the transition from traditional natural gas to a decarbonized thermal energy future. This involves an assessment of options to ensure cost-effective traditional natural gas supply. But as the first natural gas utility in the country to offer a renewable natural gas program with the strong support of the Department of Public Service and Public Utility Commission (the "Commission"), we also discuss alternative supply procurement options and the potential for expanding our RNG sources from both within Vermont and elsewhere.
- In Section 5 of the Plan, we analyze the potential impact of both a High Electrification scenario and a High Fuels scenario and assess why we believe the Hybrid scenario provides the right target for action on our current planning horizon. We discuss some of the associated risks and benefits of these

---

<sup>4</sup> See 2022 Vermont Comprehensive Energy Plan, available at: [https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan\\_0.pdf](https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf).

alternatives as well as how we plan to manage a dramatic energy transformation while continuing to offer affordable thermal heating services.

- Finally, in Section 6, we provide a financial assessment of pursuing the Hybrid scenario over a five-year planning horizon. This is intended to provide reasonable assumptions about the impact of pursuing a long-term plan within the framework discussed in this Plan and provides a directional indication of the financial impact to VGS and its customers over the term of this IRP.

Throughout, this Plan is also guided by the core values of our organization. We consider these foundational priorities to be the pillars that are critical to our success.

<b>SAFETY</b>  The safest company in Vermont for our people, pipeline, and the public	<b>CUSTOMERS</b>  Exceptional customer care every day	<b>CLIMATE</b>  Lowest possible carbon impact	<b>CULTURE</b>  Best place to work in Vermont	<b>FINANCIAL PERFORMANCE</b>  Healthy, successful business
---	---	---	---	--

Finally, concurrent with developing this IRP, the 2023 Affordable Heat Act (“Act 18”) was passed by the Vermont General Assembly and the early stages of the Commission’s proceedings establishing the framework for a potential Clean Heat Standard were unfolding.<sup>5</sup> Although critical details of the Clean Heat Standard are still in the rulemaking process, and thus premature for practical integration into this IRP, the imminent obligations of Act 18 are ever-present in our planning processes. The planning targets we have modeled throughout this planning process are consistent with the GWSA requirements that will guide the Clean Heat Standard. Additionally, pending the establishment of more fully developed Clean Heat Standard requirements, we have incorporated in our planning the increased financial demands of reducing greenhouse gas (“GHG”) emissions through increased investment in energy efficiency, expanding in-home electrification opportunities, pursuing alternative supply deployment and procurement, and exploration of future market and technology developments. Our attention to developing thermal policy and the critical element of providing an equitable transition to Vermont’s most vulnerable populations is also discussed in Section 2.1 below. Fast-developing state and local policy informs every aspect of our business planning.

---

<sup>5</sup> See Case No. 23-2220-RULE and Case No. 23-2221-INV.



## **CUSTOMER DEMAND AND FORECAST**

## 1. CUSTOMER DEMAND AND FORECAST

Our customers' present and future demand for energy services is a core element of our long-term planning process. The 2024 IRP is based on the view that our customers' demand for decarbonized energy solutions will continue to grow during the twenty-year planning horizon. Thus, like our last IRP, the 2024 IRP provides a roadmap for VGS to advance the significant carbon reductions that our customers are seeking. This shift in customer demand is not only promoted by the Global Warming Solutions Act and other state and local policies, it is also a recurring theme in our discussions with stakeholders and the primary driver of VGS's push to expand our customer offerings through an integrated energy services model.

Accordingly, our long-term planning horizon pivots away from a sole focus on traditional natural gas planning and toward our customers' priorities to reduce greenhouse gas emissions at a price they can afford. Advancing GWSA reductions in the residential and commercial heating sector means thermal service providers in Vermont need to make significant carbon reduction investments and adapt our long-term planning process to suit our goals. Thus, consistent with the GWSA, the compliance targets that we expect to emerge from the potential Clean Heat Standard, and the Department's Comprehensive Energy Plan, our 2024 IRP is focused on alternative supply and demand scenarios that offer pathways toward Vermont's GWSA carbon reduction mandates. These scenarios—and the state and local thermal energy policies that are driving them—are discussed below in Section 2.

As a foundation for these ambitious planning scenarios, we begin with a basic understanding of our customers' current and future demand for natural gas service. This traditional assessment of our customers' energy needs not only serves as a springboard from which we can evaluate carbon reduction pathways, it also provides the baseline for our scenario modeling. In this section of the IRP, we assess our customers' foundational need for safe, affordable, and reliable natural gas service over the term of the IRP and how that demand is expected to look based on our current energy efficiency planning.

### 1.1. LOAD FORECAST

The present and future demand for natural gas is represented by a load forecast that is based on the number of customers we anticipate, patterns about how our customers use natural gas, expectations about how energy efficiency efforts will reduce natural gas use, assumptions about how the weather will impact usage patterns, and conservative assumptions that ensure that we are prepared to meet firm customer demand on the coldest day of the year. In this section, we discuss how VGS developed the natural gas load forecast that serves as the baseline for our long-term carbon reduction scenario modeling.

#### CUSTOMER GROWTH

Our customers continually report excellent overall customer satisfaction, and natural

gas remains the most affordable thermal fuel available in our service area. Still, the robust customer growth we experienced in past years has decreased with a shift in focus toward electrification in the thermal sector driven by state and local policy. At the high point of pipeline system expansion, VGS added approximately 1,200 new gas customers annually. In 2023, that number landed around 650. Customer growth has also been impacted by VGS's slowing system expansion in recent years, which can be illustrated by an overall decrease in VGS's new construction. For example, in 2019, VGS constructed 50,000 feet of main pipeline. That was reduced to 33,000 feet in 2021 and 19,000 feet in 2022. Our customer forecast is also driven by our historical success rate in the communities that we serve. In Addison County, we already serve about 50% of potential customers, and in Chittenden and Franklin counties, we estimate that VGS already serves about 93% of all potential customers. When combined with slowing system expansion to new communities, this historical success translates into lower customer growth potential within our existing infrastructure.

These customer growth trends are also consistent with VGS's drive to meet customer demand for greenhouse gas reduction options. As we transition to low- and no-carbon thermal options like hybrid thermal systems and electrification, we expect the number of customers that only take natural gas service will decline.<sup>6</sup> Accordingly, our load forecast starts with a baseline that assumes customer growth and attrition based on historical patterns. As discussed in Section 2.4 below, we also model scenarios under which customer growth declines more rapidly based on accelerated uptake of electrification.

## CUSTOMER USE & 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 is based on forecasts of the following key inputs: historical customer use by rate class, projected customer counts, forecasted normal weather, projected efficiency upgrades among VGS's customer base, and historical customer attrition.

The starting point for a demand forecast is the historical customer use by rate class. For this outlook, VGS uses a three-year average of customer use, including the effect of energy efficiency measures over the same period. Customer demand is also forecasted using ten-year normal heating degree days. Industry standards vary between ten-year and thirty-year normal. We utilize a multi-year average to smooth the fluctuation in weather from year to year. A ten-year normal flattens the year-to-year weather peaks.

## NATURAL GAS DEMAND

As we implement strategies to reduce our customers' carbon footprint through energy efficiency and electrification, our long-term planning also acknowledges that our customers' energy needs will be dynamic over the twenty-year planning horizon and

---

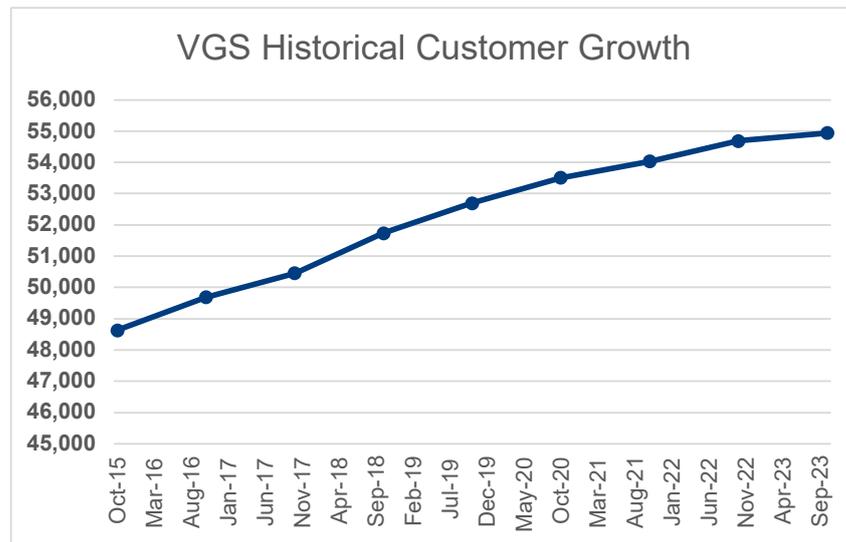
<sup>6</sup> References to hybrid thermal systems in this IRP are describing systems that use natural gas and electric appliances cooperatively to heat customers' homes and businesses. Our growing portfolio of products and services is detailed in Section 2.3, below.

are likely to change with emerging technologies and economics. As we initiate 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.

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 impacts both the base and heating use forecasts.

The primary driver of each of these forecasts is customer count. With steady growth over recent years, VGS’s customer level has reached over 55,000.

**FIGURE A: Historical Customer Growth**

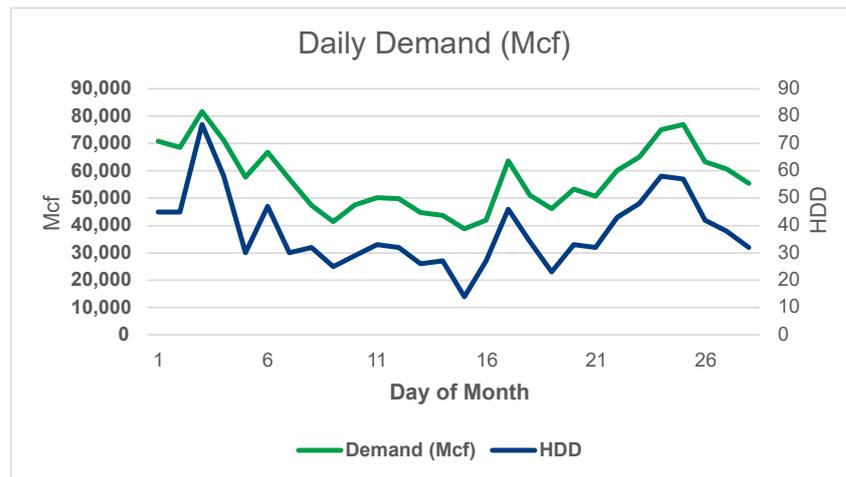


VGS also anticipates losing a certain number of customers each year. VGS loses customers for a variety of reasons, including: (1) companies going out of business, (2) property redevelopment, (3) combining of several meters into one, and (4) fuel switching. Fuel switching from natural gas to other heating sources has historically been a very small part of customer loss, but we are seeing a greater degree of switching due to electrification, and we expect that trend to continue in response to state and local policy as well as customers trending away from fossil gas use. We also anticipate customer load loss from weatherization and other efficiency improvements and due to switches to hybrid heating systems.

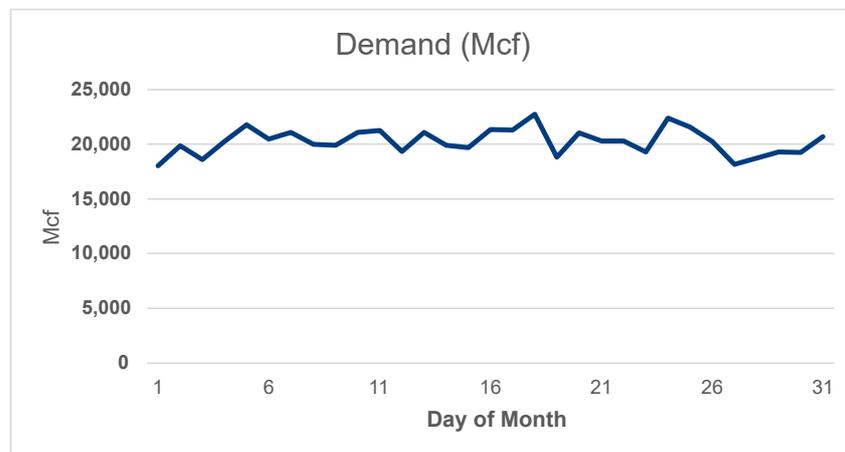
Weather also plays a significant role in demand forecasts. This is true on an hourly, daily, monthly, and annual basis. VGS forecasts and prepares to serve its firm load, made up of customers whose service cannot be interrupted to switch to an alternative fuel, on the coldest hour of the coldest day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

respectively. They show that demand cannot be met solely by baseload supply, which is the supply we know we can deliver ratably over the month regardless of weather changes. A majority of our baseload supply is procured during our annual Supply Request-For-Proposals (“RFP”) each summer but is also purchased on a month-to-month basis. Figure B demonstrates the variability of load during a typical winter month. It also includes heating degree days to show the correlation with weather. Figure D shows the average monthly demand of the last five years.

**FIGURE B: Typical Demand for Winter Months<sup>7</sup>**

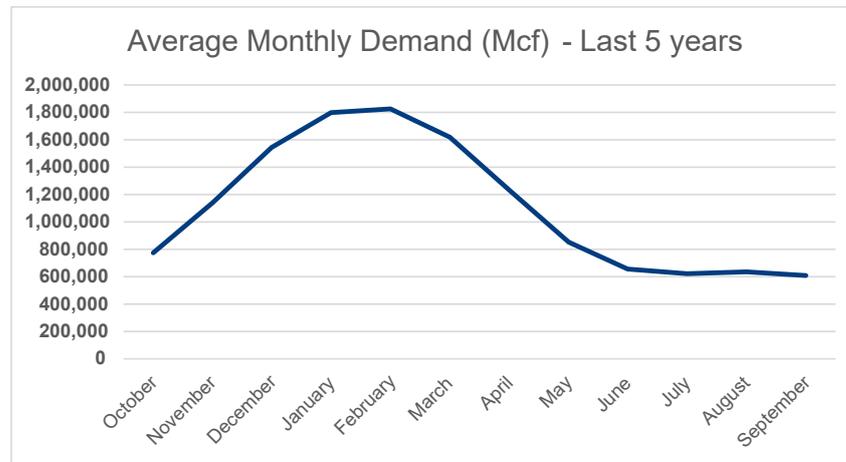


**FIGURE C: Typical Demand for Summer Months**



<sup>7</sup> “HDD” in this context refers to Heating Degree Day, which is a measure of how cold the temperature was on a given day or during a period of days produced by comparing the mean outdoor temperatures recorded for a location to a standard temperature, usually 65° Fahrenheit.

**FIGURE D: Average Monthly Demand for the Last Five Years**



## 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. As we continue to experience extreme cold weather events from the effects of climate change, VGS expects that this could affect design requirements and in turn affect the capacity needed to serve our customers on the coldest day of the year.<sup>8</sup> We also anticipate that hybrid customers will be using natural gas on the coldest day of the year as heat pumps have decreased effectiveness in extreme cold weather conditions. The design day forecast impacts both supply resource planning and system infrastructure, which are discussed in Sections 3 and 4, respectively.

VGS currently uses a “probability of occurrence” planning standard. Probability of occurrence utilizes statistical analysis to estimate how often an event is likely to occur based on historical data. VGS uses more than thirty years of historical data, without adjusting for climate change, to forecast the design day requirements. This 1-in-35-year probability of occurrence standard helps predict how likely we are to have a design day event.<sup>9</sup> This method produces consistent design day demands by reducing fluctuations in demand as extreme weather is added or removed from the historical period.

<sup>8</sup> VGS may need to maintain its upstream capacity commitments from TC Energy to continue to manage these extreme cold weather events despite a decrease in overall load from a warming climate. This would mean that we would need to maintain upstream capacity that we could otherwise turn back, and would likely only be needed during these extreme cold weather events. To manage the cost impacts of maintaining this capacity, VGS would continue to utilize asset management to minimize the impact to customers.

<sup>9</sup> In 2018, VGS conducted a peak day study, which showed that the 1-in-35 probability standard that VGS uses was approximately in the middle of what our Northeast counterparts use, which ranged from a probability of occurrence of 1-in-19 to 1-in-59.

## CUSTOMER FORECAST SUMMARY

While today more than 55,000 customers count on a traditional natural gas supply, VGS is planning for expected loss of load and historical attrition while balancing the needs of current customers. Customer demand for traditional natural gas is expected to decline 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 in-home offerings and an integrated energy services approach, as discussed in Section 2.3 below.

As described above, lower demand influences our design day, but it is also important to note that interruptible customers are not included in design day planning because they can fuel switch during peak times. With this in mind, the resulting design day forecasts are then used to inform our overall approach to supply and infrastructure planning.

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

## 1.2. ENERGY EFFICIENCY UTILITY

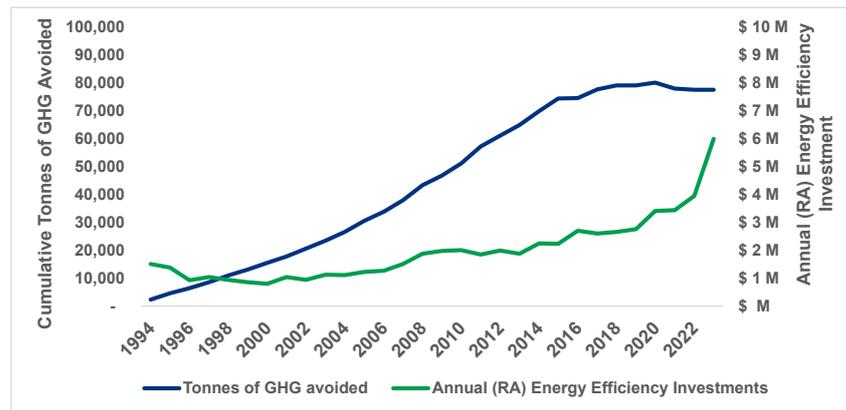
VGS has been committed to energy efficiency for more than thirty years. Our ability to achieve energy efficiency savings for our customers will have a direct impact on our customers' energy needs over the term of this IRP and support our efforts to reduce greenhouse gas emissions in line with State goals. Boosting thermal performance in residential homes and businesses, increasing access to the latest and most efficient in-home heating and water heating solutions, and displacing fossil fuels with cleaner and more efficient energy alternatives all contribute to lower energy usage, thereby decreasing demand on the Company's energy supply portfolio.

VGS has operated its energy efficiency programs since 1993 and was appointed an Energy Efficiency Utility ("EEU") by the Commission in 2016. Since the inception of VGS's efficiency programs in the 1990s, VGS has applied approximately \$55 million to help customers save energy and has incentivized more than 44,000 customers to save 1.8 Bcf and 98,000 tonnes of carbon. Figure E on page 16 shows the historical spending and avoided emissions since beginning our efficiency programs.<sup>10</sup>

---

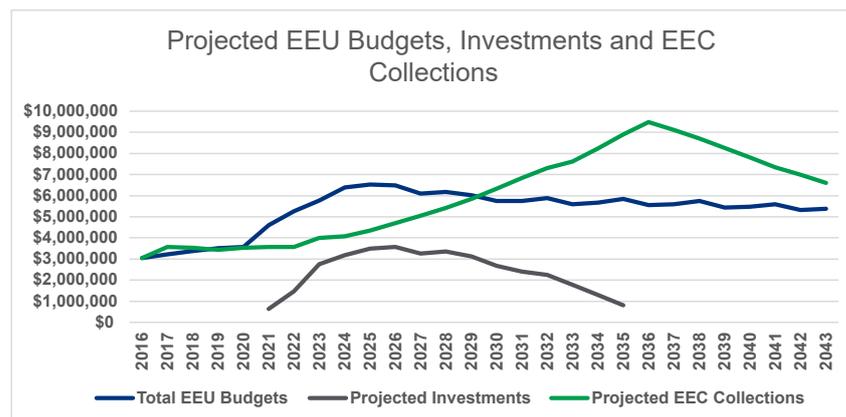
<sup>10</sup> Weatherization and equipment efficiency improvements typically include average lifetimes of just under twenty years. Cumulative emissions reductions ramp up for the first fifteen to twenty years and then level off as measure lifetimes for cumulative savings expire. Even if VGS were to stop our efficiency programs, reductions in emissions would continue to accumulate for a number of years depending upon the measure lifetime.

**FIGURE E: EEU Historical Spending and Avoided Emissions**



VGS’s Energy Efficiency Utility is funded by a charge on customers’ bills known as the Energy Efficiency Charge (“EEC”), which is calculated by VGS and approved by the Commission on an annual basis, consistent with Commission Rule 5.300 and the Company’s most recently approved Demand Resource Plan (“DRP”).<sup>11</sup> As discussed in the prior IRP, through our 2021-2023 DRP, we significantly increased energy efficiency spending as part of VGS’s Climate Action Plan. To mitigate the immediate rate impact of that increased spending, we established an investment mechanism for the EEU that is financed by VGS’s distribution utility to allow for more constant and stable rate impacts.<sup>12</sup> By using our own capital resources, VGS can materially increase efficiency spending with only a moderate increase in the EEC each year, as shown in Figure F below.<sup>13</sup>

**FIGURE F: Projected EEU Budgets, Investments, and EEC Collections**



11 See Case No. 23-1985-INV for VGS’s most recent EEC and Case No. 22-2954-PET for VGS’s most recent DRP

12 See Case No. 19-3272-PET.

13 Figure F is for illustrative purposes only. Actual EEC collections and investments depend on updates to load forecasts. We update EEU budgets, investments, and collections through periodic Commission proceedings.

In fall 2023, an update to the DRP was approved for 2024-2026 with a continuation of this financing mechanism.<sup>14</sup> The 2024-2026 EEU budget includes investments just under \$10.5M, with approximately \$35M by the end of 2043 to be amortized and recovered through the EEC over fifteen years, which is the approximate average energy efficiency measure life.

## 2024-2026 TRIENNIAL PLAN

Following approval of our DRP update, VGS's Triennial Plan for the period 2024-2026 was filed in December 2023, and is attached here as Appendix A.<sup>15</sup> It presents an ambitious and comprehensive strategy to ensure customer participation in energy efficiency in both the residential and commercial sectors.

We offer six energy efficiency programs, including three residential programs and three commercial and industrial programs: (1) Residential Retrofit/Weatherization, (2) Residential New Construction, (3) Residential Equipment Replacement, (4) Commercial Retrofit, (5) Commercial New Construction, and (6) Commercial Equipment Replacement. These programs are comprehensive, customer-focused, and designed to be adaptably responsive to customer demands and State energy goals. The Triennial Plan provides opportunities for participation by customers with a wide variety of building types, including owner- and tenant-occupied buildings, single- and multi-family buildings, large and small commercial buildings, and new construction.

As discussed in Section 2.1, State policy is clear that the most energy-burdened Vermonters should be prioritized for energy improvements in order to ensure an equitable energy transition. Consistent with such policy, our Triennial Plan includes an increased focus on serving low- and moderate-income ("LMI") customers through generous financial incentives, on-bill financing, and other services designed to eliminate roadblocks and help customers make informed decisions. In particular, our approved budgets aim to substantially increase the number of weatherization projects we do annually, with a specific focus on the income-eligible and moderate-income sectors.

In 2022, VGS launched and began servicing projects through the Weatherization Repayment Assistance program ("WRAP"), which is a two-year pilot program funded by the state and overseen by the Vermont Housing Finance Agency. Under the program, a participant can pay for qualifying weatherization projects like insulation and air sealing, as well as heat pumps and advanced wood heating systems, through a monthly charge on their gas bill that allows them to pay for the improvements over time. VGS supports the use of on-bill financing for efficiency improvements and is collecting data on WRAP participants and lessons learned for future program design.

Additionally, our rebate structure is progressive, providing greater incentives for income-qualified customers. Effective 2022, VGS increased the size and availability of

---

14 See Case No. 22-2954-PET.

15 See Case No. 23-4102-INV.

rebates for customers with incomes less than 120% of area median income. Effective 2024, VGS increased weatherization rebate levels and is launching an equipment “early replacement” program for low-income customers to maximize savings opportunities. In these ways, the EEU is leading VGS’s efforts for an equitable transition, and as discussed throughout this IRP, all of VGS is committed to prioritizing LMI customers and households with high energy burdens.

Also paramount to our Triennial Plan is proactive development of partnerships and collaborations throughout our communities. Several entities are critical to our success targeting specific customers by sector and eligibility. For example, we assist Burlington Electric Department customers with multi-family weatherization to further that city’s NetZero initiative. We collaborate with Efficiency Vermont to ensure seamless service delivery for mutual customers across programs. We partner with Green Mountain Credit Union to provide customers with easy and low-cost financing options. And we join with the Champlain Valley Office of Economic Opportunity to engage and support income-eligible customers.

As discussed below, we have strong relationships with customers in all sectors. From homeowners and small businesses to builders and large institutions, our customers trust us to help them reduce their natural gas bills and GHG emissions and increase comfort in their homes and businesses, as we have done for many decades.

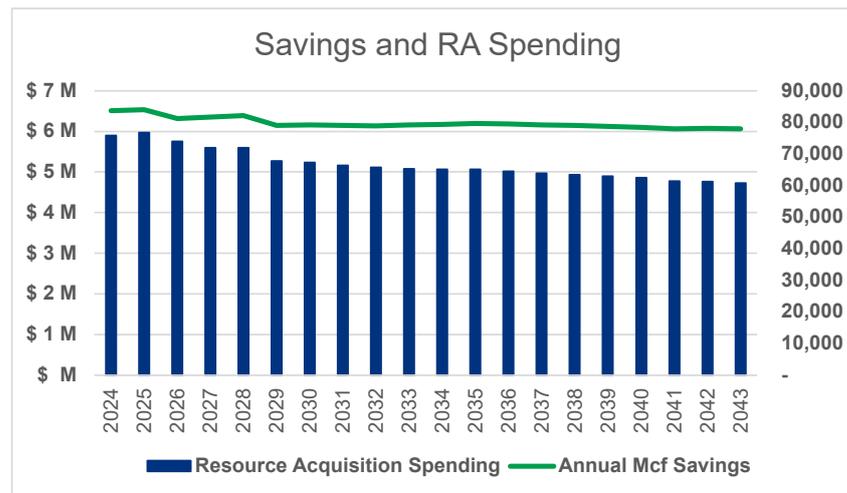
## INFLUENCING NATURAL GAS DEMAND

As noted above, the state’s appointed EEUs participate in a Demand Resource Plan proceeding or update proceeding every three years. At a minimum, it includes a potential study of program achievable savings and costs, stakeholder engagement, and a rate and bill impact analysis. Ultimately, the proceeding results in Commission-approved costs and spending with a twenty-year outlook. As detailed in Section 2.4 below, this IRP examines three emissions forecasting scenarios (high fuels, high electrification, and hybrid). For this purpose, the EEU has adopted identical scenario outputs for all three cases based on the most recent DRP. This is because VGS envisions roughly the same level of energy efficiency savings will be pursued regardless of which GHG reduction pathway is chosen.<sup>16</sup> This further establishes the prominence and importance of energy efficiency to VGS’s overall GHG reduction goals. To implement EEU programming, the DRP included Resource Acquisition (“RA”) costs, Development and Support Service costs, and other operating costs. The scenario used in all three cases is illustrated in Figure G on page 19, which reflects projected RA spending and annual Mcf savings.

---

16 Alternative GWSA compliance pathways are detailed below in Section 2.4.

**FIGURE G: Savings and Resource Acquisition Spending**

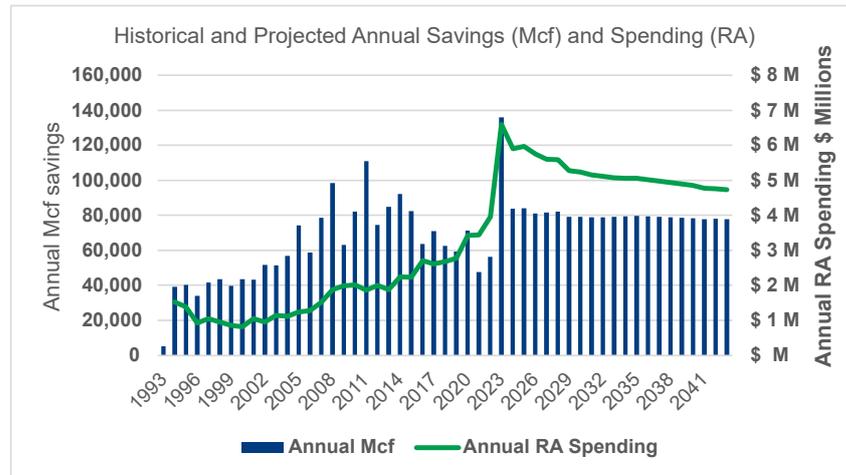


The projected savings are directly linked to the program achievable savings projections over the next twenty years. They remain mostly constant, starting at a high of approximately 84,000 annual Mcf savings down to a low just under 78,000 annual Mcf savings. The tapering of energy efficiency potential is attributed to electrification, increased energy codes, and increased baseline efficiencies. Additionally, with a heightened focus on increasing weatherization projects for low- and moderate-income Vermonters in the earlier years, the spending starts higher and slightly tapers off as more homes are weatherized and federal and state efficiency codes are improved.

Notably, the projects prioritized by the Triennial Plan tend to have higher program acquisition costs than those historically pursued by VGS’s Energy Efficiency Utility. Commercial projects typically result in higher savings for the least cost. Residential projects that do not require health and safety improvements prior to weatherization are similarly cost effective. Conversely, this Triennial Plan’s shift to increased engagement with low- and moderate-income customers who require higher incentive levels on projects that often include complex older buildings, together with rising material and labor costs, means spending will be higher than prior years. Figure H on page 20 shows this shift in the relationship between RA spending and annual Mcf savings.<sup>17</sup> Nevertheless, we believe that prioritizing efficiency improvements for these customers carries an intrinsic value that justifies this upward shift in dollars per Mcf saved. In addition to reducing energy costs, efficiency improvements improve occupant health and safety, increase building durability, and ensure individuals are more comfortable in their homes. Weatherizing buildings is an important step to reduce thermal energy consumption and affords customers more primary heating system options to decarbonize further. Prioritizing our support for income-eligible customers helps

<sup>17</sup> Note that large commercial projects generally take longer to complete, often resulting in sporadic spikes in annual savings. In particular, the Covid-19 pandemic caused a disruption to projects moving forward during the 2021-2022 time period due to economic uncertainty, workforce disruptions, and material shortages resulting in a dip and then 2023 spike when those projects were finally completed.

further our mission of providing affordable energy options for all of our customers and is consistent with Vermont’s critical Just Transitions policy.<sup>18</sup>



**FIGURE H: Historical and Projected Annual Savings and Spending**

Our longstanding efficiency program is the foundation for our growing integrated energy services. The program’s maturity, established partnerships, and outstanding customer service has paved the way for innovation throughout the organization. VGS is extremely proud of the work its Energy Efficiency Utility does to decrease natural gas demand and improve comfort for customers in all sectors. We look forward to its continued success and leadership as the Company, as a whole, furthers its contributions toward reducing carbon emissions in support of Vermont’s ambitious energy objectives.

18 See 2022 Vermont Comprehensive Energy Plan, Section 3.2, available at: [https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan\\_0.pdf](https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf).



## **SCENARIO ANALYSIS: CARBON REDUCTION PATHWAYS**

## 2. SCENARIO ANALYSIS: CARBON REDUCTION PATHWAYS

The 2024 IRP is about how VGS will continue to serve its customers with essential thermal energy while also charting paths that are consistent with a dramatic increase in demand for low- and no-carbon thermal energy in the next twenty years. Accordingly, the IRP builds upon the traditional customer load forecast as a baseline and evaluates the potential impact of three different scenarios that model pathways for VGS and its customers to contribute to carbon emissions reductions consistent with the 2050 emissions targets in the Global Warming Solutions Act.

This modeling exercise examines the implications of achieving carbon reductions at a pace in line with the GWSA while also assessing potential changes in customer behavior, evolution of state and local energy policy, the emergence of new technologies, and other factors that influence change in the thermal energy sector. While the pathways we have modeled provide insight into the directional impacts of different carbon reduction paths, they are all influenced by three important factors: (1) evolving state and local policy that will transition the thermal sector; (2) VGS's in-depth stakeholder engagement and ongoing customer interaction that demonstrate changing community and customer needs; and (3) VGS's push to transform the Company with a growing portfolio of integrated energy services, including services to help customers reduce greenhouse gas emissions in line with State goals.

In this section of the IRP, we begin with a discussion of these three factors because they each have a significant impact on our future and have informed the way we have structured our scenario planning in this IRP. This is followed by a detailed discussion of the three different pathways we modeled, including "High Electrification," "High Fuels," and "Hybrid" scenarios that cut emissions on target with the GWSA. These scenarios build on the baseline load forecast from Section 1 to stress test the implications of drastic changes to the status quo. We explain each of the scenarios in detail, discuss the modeling assumptions, and evaluate the directional impacts of each scenario.

### 2.1. STATE AND LOCAL THERMAL POLICY

As demonstrated in our 2021 IRP, VGS is leading the charge toward a decarbonized thermal energy future that meaningfully advances Vermont's commitment to a renewable energy profile. We are focused on transforming how we meet our customers' needs and to guiding equitable progress with optionality for all Vermonters in this energy transition. In this section, we discuss evolving state and local thermal policy that is informing the future of our business and how we are working proactively to help enable an equitable transition for our customers.

#### GLOBAL WARMING SOLUTIONS ACT & COMPREHENSIVE ENERGY PLAN

While the statutory basis for Vermont energy policy is set out in multiple sections of State law, the Global Warming Solutions Act established the schedule for statewide

greenhouse gas emissions reductions. These requirements constitute a “north star” to guide State climate policy. Taken together, 10 V.S.A. § 578(a)(1), (2), and (3) require a 26% reduction from 2005 levels by January 1, 2025; a 40% reduction from 1990 levels by January 1, 2030; and an 80% reduction from 1990 levels by January 1, 2050. These targets are binding, and failure to achieve the mandates on schedule would prompt the Secretary of the Agency of Natural Resources to adopt or amend rules necessary to affect the requirements.

The GWSA also established the Vermont Climate Council (“Council”) to develop policy to achieve the Act’s requirements. The Council issued Vermont’s first-ever Climate Action Plan (“CAP”) in 2022 and has begun the process of revising it, which will be issued in 2025.<sup>19</sup> The CAP represents one of the central pieces of policy to describe how the thermal sector share of GHG emissions reductions should take place. The adjacent Comprehensive Energy Plan is a complementary planning document. The CEP looks at the statewide energy mix and considers various scenarios necessary to meet current and future energy needs in Vermont. The latest edition of the CEP was published in 2022. The CEP sets goals for the total energy Vermont should acquire from renewable sources, including 25% by 2025; 45% by 2035; and 90% by 2050. The Department of Public Service updates the CEP every six years.

## EVOLVING LOCAL POLICY

Since passage of the GWSA in 2020, the two largest municipalities in VGS’s service territory have adopted thermal energy ordinances that impact VGS’s traditional natural gas business. Both Burlington and South Burlington set local performance standards that require primary heating systems to be installed in new buildings that will meet 85% of the building’s design heating load and be fueled by renewable energy. Burlington’s primary renewable heating ordinance took effect on September 8, 2021, while South Burlington’s went live February 15, 2023. South Burlington’s ordinance further expanded the requirement to apply to all water heating systems effective February 15, 2025. Most recently, Burlington implemented a carbon fee on new construction, and existing buildings of greater than 50,000 square feet, that choose equipment fueled by a fossil energy source. Though the carbon fee ordinance includes exemptions for alternative supply options VGS can provide, the regulation represents the first carbon pricing policy in Vermont.

The aforementioned cities represent approximately 40% of VGS’s total customer base. Although these communities have already achieved in-fill levels that suggest limited near-term potential for new gas connections, such requirements add a layer of local regulation that increases complexity and could impact longer-term development and usage trends. This growing patchwork of regulations could complicate a smooth statewide energy transition. VGS is closely monitoring these types of decisions and has factored them into analysis and scenarios within this IRP.

---

<sup>19</sup> See Initial Vermont Climate Action Plan, available at: <https://climatechange.vermont.gov/readtheplan>.

## THE AFFORDABLE HEAT ACT & POTENTIAL CLEAN HEAT STANDARD

As noted above, the 2023 enactment of Act 18, the Affordable Heat Act, began a process to set policy that will guide statewide GHG emission reductions in the thermal sector. The centerpiece of Act 18 is a potential new performance standard, the Clean Heat Standard. The framework is similar to the Renewable Energy Standard that has successfully guided Vermont's electric sector to cleaner energy sources since it was adopted in 2015. Once fully implemented, Act 18 will require energy companies that import liquid and gaseous heating fuels into Vermont to reduce emissions in line with the GWSA 2030 and 2050 requirements. Obligated parties can meet the performance standard by selling lower-emitting heating fuels such as renewable natural gas or biofuels, and by supporting activities, such as electrification through use of heat pumps, that help Vermonters adopt cleaner heating options.

While Act 18's establishment of a Clean Heat Standard provides some clarity to entities that import thermal energy into Vermont, key programmatic decisions are subject to design by the Commission and its advisory groups and subsequent approval of final rules by the General Assembly. In the event the General Assembly does not approve the program during its 2025-2026 biennium, we assume alternative proposals would be enacted. As such, VGS has embraced strategies around GHG emissions reduction that will guide Company activities and position VGS to adapt its approach regardless of the specifics of how State policy develops.

Turning to the early phases of Act 18's development, an absence of immediate policy decisions has challenged obligated parties to rigorously vet thermal energy solutions and weigh their respective costs and benefits in the early action period that commenced January 1, 2023. VGS has made steady progress to scale thermal solutions that are defined as eligible clean heat measures separate and apart from the Act 18 requirements. Examples of measures VGS has funded or provided to thermal users include: thermal energy efficiency improvements and weatherization; electric cold-climate heat pumps; electric heat pump water heaters; electric appliances providing thermal end uses; and renewable natural gas.

VGS has spent considerable time planning for another aspect of Act 18 implementation that involves the types and categories of credits obligated parties must retire each year. Act 18's requirement for equitable distribution of credits sets out the minimum for credits delivered to low- and moderate-income Vermonters. Of these, at least half must be installed measures that entail capital investment. The percentage attributable to these categories could change based upon subsequent Commission analysis showing good cause for adjustment. As we explore strategies to help LMI customers decarbonize, and simultaneously achieve cost-effective compliance, understanding the types of permissible measures available to satisfy requirements will be important. Regardless of the final design, our longstanding experience installing and servicing thermal products puts us in a strong position to support Act 18's equity goals for LMI residential customers.

Elsewhere in the Act 18 development process, we are engaging in the stakeholder process to establish the emissions schedule methodology that will determine credit values and the carbon intensity (“CI”) scores for fuels.<sup>20</sup> Central to both decisions is a balanced lifecycle analysis framework based on the Argonne National Laboratory GREET Model.<sup>21</sup> The final design advanced by the Commission will set parameters that will inform credit values. However, it is expected these credit values will change over time as the policy is periodically reviewed and revised, as per statute. This is also true of the declining carbon intensity score provision, which applies to gas and will decrease over time, potentially requiring adjustment in VGS’s alternative supply portfolio to earn credits.

Taking a wider view of Act 18, VGS is eager to learn the results of the thermal resources potential study due September 1, 2024. Modeling from the Department’s consultant will provide valuable information on what is feasible based upon available resources. To date, there is no definitive data on how much of the thermal sector reduction in greenhouse gas emissions Act 18 can reasonably achieve. Researching and filling this data gap should provide clarity to VGS, other obligated parties, and policymakers.

At a broader level, our teams have also followed deliberations in an increasing number of state venues in which consequential energy policies are developed, recommended, or set. Several of these venues were defined or expanded by the GWSA. The most notable is the Vermont Climate Council.

As discussed in this section, the range of local and state climate policies represent significant uncertainty that Vermont thermal energy providers must navigate. VGS continues to monitor developments in and across these governmental bodies. From a planning standpoint, tracking these efforts and adjusting our strategies to successfully comply with emerging guidance requires continued analysis and engagement. Our teams are committing significant resources to manage these processes and ensure value for our customers, and we anticipate continuing to do so for the foreseeable future.

## EQUITABLE TRANSITION

As we examine the implications of an energy transition in the thermal energy sector that upends traditional service models, we are also focused on the impact this transition will have in our communities. Consistent with State policy guidance on ways energy providers can incorporate equity criteria into their planning approach, VGS has worked to center our operations and new programs around equity so that we can reduce emissions in line with State energy policy. In this section, we summarize the policy that is guiding VGS’s decisions. Several examples of the ways our teams are factoring equity into our current practices and long-term planning are included throughout this IRP.

---

20 Carbon Intensity is detailed in Section 3, below

21 See Argonne National Laboratory, R&D GREET Model, available at: <https://greet.anl.gov/>.

The GWSA set out a strategic focus to prioritize the “most cost-effective, technologically feasible, and equitable greenhouse gas emissions reduction pathways.”<sup>22</sup> Both the Initial Climate Action Plan and Comprehensive Energy Plan developed how equity and the GWSA’s targets should be weighed during policy planning. Act 18 of 2023 provided a more complete framework on how equity should be incorporated into managing the transition to less emitting thermal energy sources. VGS has reviewed these laws and plans, and we have adapted relevant guidance as we align with Vermont’s objectives.

As a general note, VGS’s customer-facing operations include regular interactions with Vermonters, many of whom are lower-income and likely to be disproportionately impacted by climate change. The CAP describes the importance of engaging such groups to make informed policy decisions. Likewise, the CEP notes the necessity of including feedback from Vermonters who have suffered from historic inequities, including BIPOC, low-income communities, and people with disabilities. As an organization, VGS has sought to address barriers that perpetuate harms.

During and after the Covid-19 emergency, such efforts were central to supporting the needs of VGS customers as they encountered unprecedented disruption. VGS’s Customer Care team served as liaisons to those in need, routing Vermonters to available federal and state resources to ease financial hardship. In the post-emergency timeframe, VGS worked collaboratively with impacted customers to reduce outstanding balances and the number of accounts in arrears. Throughout, engagement was done in a manner geared toward reducing stigma and centering customer needs in the process. Likewise, in the aftermath of the historic flooding in the summer of 2023, VGS has led the way in garnering a coalition of partners to serve income qualified Vermonters in need of assistance, as discussed in greater detail in Section 2.3.

VGS partners with community and state-led financial assistance programs to ensure our customers can access reliable service throughout the year, including times of peak usage. Examples include VGS’s Low Income Assistance Program and working with community action partners to direct customers to other resources available to address financial hardship. In the event a customer falls behind on their monthly utility bill, our Customer Care team helps facilitate a manageable schedule to support repayment over time.

A final note on Act 18 and State thermal policy relates to the cost of the natural gas VGS serves. Natural gas has historically been the most stable and affordable thermal option available in the state. While Act 18, the CAP, and the CEP state that the most energy-burdened Vermonters should be prioritized for energy improvements, they do not comprehensively address the fact that low-income VGS customers generally have a lower energy burden than Vermonters of similar income levels who utilize more expensive thermal fuels. We are monitoring state energy conversations to make sure we achieve alignment with the policy intent for these customers.

---

22 10 V.S.A. § 592(d)(1).

## 2.2. STAKEHOLDER ENGAGEMENT

VGS conducted outreach for this IRP over several months beginning in the summer of 2023 and concluding in the fall. VGS contacted groups of varied backgrounds and expertise. Outreach was conducted in conversations with VGS representatives. Participants included: customers; municipal government policymakers; regional economic development organizations; chambers of commerce; electric utilities with service territory overlap; energy efficiency utilities; environmental stakeholders; and organizations whose missions include serving low-income and historically marginalized communities. All told, 36 sessions were held to gather input as we framed our IRP.

Stakeholder engagement sessions were facilitated by VGS staff with relevant knowledge (e.g., the public affairs team engaged municipal entities, whereas members of the customer team engaged with key accounts). To frame the discussion, VGS staff made a presentation to recap our history and efforts to decarbonize in line with State requirements, discuss recent trends in energy policy, including an overview of Act 18, and introduce the IRP process and how it relates to planning for future customer needs and services. The discussion was flexible to allow participants to ask questions throughout. Finally, VGS posed a series of questions to obtain feedback on the IRP process as it related to the stakeholders' areas of focus. Notes were captured to record topics for reference and reflection during the IRP creation process. Examples of questions include: (1) what are we doing well as your thermal energy provider that we should continue?; (2) where are there gaps in our current service to your organization?; (3) what are your suggestions for how we should change?; and (4) what are the most important service delivery elements for us to focus on?

There was some thematic consistency based upon the perspectives of commenting stakeholders. For instance, municipal, regional, and statewide economic development advocates expressed general wariness about the pace of decarbonization proposed by state climate policy. These stakeholders noted the importance of affordable residential and commercial development. While all acknowledged that reducing emissions was positive for the region and state, and most voiced interest in electric and renewable thermal technology, they stressed the importance of stable energy rates, especially against a backdrop of inflation.

Key account customers reflected the anxiety of recent economic hardship during and following the Covid-19 pandemic. For large commercial and industrial customers, all noted their business strategies had to change to accommodate nationwide and regional economic swings, and that inflation was a persistent hardship. Most notably, they pointed to a scarcity of workers as the region's greatest challenge. Whereas utility cost stability had dominated their advocacy in the first decades of the 2000s, these stakeholders reported that workforce and housing shortages have become the greatest barrier to growth.

Environmental organizations questioned whether the state, VGS, and other thermal

energy providers were moving quickly enough to decarbonize in line with Vermont's GWSA requirements. They asked for information about the make-up of VGS's supply portfolio and whether there were plans to ensure gas infrastructure did not become a liability as users gradually transition to other non-gas thermal solutions. These topics came amid expressions of gratitude that VGS has taken steps to offer Vermonters heat pump technology and weatherization services that reduce fossil gas usage.

Across discussions, stakeholders urged that any transition to cleaner thermal sources preserve affordability for low- and moderate-income Vermonters. Organizations that serve historically marginalized communities (such as the Champlain Valley Office of Economic Opportunity and Chittenden Housing Trust) noted the importance of equitable policy design. They voiced unease around the price differential between operating heat pumps and operating natural gas-fired systems, and they highlighted concerns about how inflation and other pressures, including the scarcity of housing, had impacted the cost of many essential needs.

As we met with stakeholders and accumulated input, we reflected their themes in the topics addressed throughout this IRP. For instance, this cycle's outreach to municipal policymakers led to the addition of the sections reviewing local thermal policy. Comments about the feasibility of the gas utility model have informed the scenarios analysis. Consideration about the needs of historically marginalized communities who experience a greater energy burden was given preeminence throughout. VGS thanks participants and welcomes continued input as Vermont's energy policy advances. We appreciate that our partnerships with community members are ongoing, particularly during this challenging transition.

## 2.3. INTEGRATED ENERGY SERVICES

As we look to a future of decreased demand for traditional natural gas and increased demand for carbon reduction solutions in the thermal sector, VGS is poised to lead this energy transition based on our many years of being a trusted energy services provider to our customers. Instead of viewing this transition as a threat to VGS, we see it as an opportunity to continue to do what we have done best for many decades—provide warmth to customers—only now that warmth will be provided through a portfolio of traditional and innovative solutions. Because customer demand for thermal energy services has become more dynamic, and requires a more comprehensive and integrated approach, we have built our cross-functional Customer & Energy Services department to rapidly and effectively respond to changing market needs with the goal of enabling aggressive carbon reduction over the term of this IRP.

In this section, we discuss how we will leverage our customer-facing teams, who have the most direct awareness of our customers' needs and interests, together with our new product development team, to work tirelessly to reduce customer demand and bring lower carbon alternatives into customer homes and businesses. We also discuss the approach and progress of our new product development efforts, summarizing recent products and pilots launched.

## CUSTOMER-FACING EXPERTISE

VGS has long prided itself on the fact that when customers think about VGS, they recognize excellent service, affordable rates, and safety and reliability. Customers have come to count on these as the foundations of our business. As we continue to evolve and innovate in pursuit of carbon reduction in furtherance of State climate goals, we are passionately attentive to preserving the trust we have built with customers over many decades.

For close to sixty years, VGS customers have appreciated our commitment to safety, reliability, and affordability. And today, VGS customers are also asking for decarbonized thermal products. Though natural gas remains the most affordable thermal fuel option in Vermont, VGS customers' sentiments mirror the growing public belief that reducing environmental impacts is also a priority. VGS's in-home services are continuing to evolve to meet this demand, broadening our offerings to include additional electrification and hybrid heating solutions.

Customer & Energy Services constitutes the largest department in the VGS organization. The department includes Field Services, Customer Care, Billing, the EEU, and Sales. From this department, VGS has nearly 200,000 points of contact with customers each year. Each of those contacts is an opportunity to connect customers with our evolving suite of products and services, and our efforts to move the Company forward with carbon reduction while preserving customer trust have so far been met with success. We are pleased with, and honored by, our customers' continued trust in us, and remain eagerly committed to meeting their changing needs.

VGS is deeply committed to workforce development. As a thermal utility that regularly works with building developers, HVAC, plumbing, and electrical contractors to serve customer needs, we are very familiar with workforce shortages impacting Vermont and how they affect delivery of thermal services. VGS's service team supports the needs of thousands of customers each year.

In recent years, we have seen increasing customer interest in new technologies that can reduce an individual's carbon footprint and improve comfort. According to the Energy Action Network, to achieve Vermont's greenhouse gas emission reduction mandates, thousands of Vermonters need to be trained "with the skills to electrify the transportation sector, install clean energy solutions, weatherize homes, build net zero commercial buildings, and sustainably manage our working lands, forests, and waterways."<sup>23</sup> VGS agrees with this assessment and is taking steps as an organization to equip our workforce with the skills to contribute to climate solutions. As we expand the portfolio of electric appliances and energy efficiency services we offer, we add to the amount of statewide capacity available to support adoption of clean thermal solutions, consistent with the priorities of the CAP and CEP.

---

23 Energy Action Network, Climate Workforce Coalition, available at [www.eanvt.org/net-work-action-teams/climate-workforce](http://www.eanvt.org/net-work-action-teams/climate-workforce).

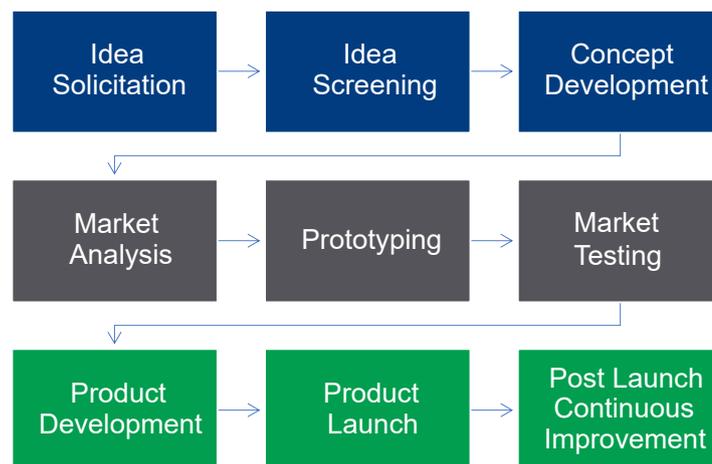
Additionally, Senator Peter Welch has called for strengthening of public-private partnerships to support job training in the green energy sector.<sup>24</sup> VGS is positioned to accept and effectively steer existing funds available from the American Rescue Plan Act, the Inflation Reduction Act, and other state and federal programs toward workforce development to broaden the trade skills of our current workforce and help develop a new climate workforce.

## A GROWING PORTFOLIO: NEW PRODUCT DEVELOPMENT

Because our customers and the broader community are relying on us to help lead a thermal energy carbon reduction revolution, it is critical that we make sound decisions about what options ultimately become available through VGS. Accordingly, we have implemented a rigorous new product development (“NPD”) process to gauge which offerings meet customer needs and align with our objective to provide affordable alternatives to help Vermonters reduce carbon emissions and keep warm.

The NPD process provides VGS with an iterative and evidence-based method to determine whether to advance a carbon reducing alternative from concept through prototyping to product development. With “stage-gate” decisions 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 VGS’s strategic business objectives and regulatory mandates. For example, without sufficient and objective evidence that customers strongly desire the product or that the product will measurably reduce greenhouse gas emissions, additional investments cannot be justified. For reference, Figure I below depicts our product development lifecycle at a high level.

**FIGURE I: New Product Development Stage-Gate Process**



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

24 Peter Welch, U.S. Senator for Vermont, Press Release dated Sept. 21, 2023, available at: <https://www.welch.senate.gov/welch-calls-for-strengthened-public-private-partnerships-to-support-job-training-and-workforce-development-in-the-green-energy-sector/>.

One significant asset for VGS's NPD process is our extensive customer engagement activity. As noted above, we have many thousands of customer interactions each year. These interactions create a channel for understanding customer needs and discovering gaps in existing market solutions. Further, as VGS reviews new low-emitting, non-gas thermal solutions to bring to market, prioritizing equity is critically important. Leveraging available federal and state resources to deploy these solutions to Vermonters with greatest need has been a focus and will be important to spurring thermal sector transformation.

Since the 2021 IRP, we have applied this NPD process to many concepts, leading to several product launches. Below is a list of new products and pilot projects that are now in our portfolio:

#### **NEW PRODUCTS:**

**Heat Pump Water Heaters:** In 2022, as part of our in-home services, VGS began offering electric heat pump water heaters ("HPWH") to residential customers as a zero-carbon alternative to our existing natural gas-fired water heater offerings.<sup>25</sup> As it relates to annual energy and maintenance costs, HPWHs are cost-comparable to most natural gas water heating solutions. From a GHG perspective, this small step helps open the conversation with our customers around decarbonization, efficiency, and alternatives to natural gas for a range of thermal needs. The HPWHs we are installing are communications-ready and could be retrofit for future flexible load management purposes. Importantly, VGS has been granted dollars to deploy these appliances to income-qualifying Vermonters.

**Residential Hybrid Heating - Cold Climate Heat Pumps with Integrated Controls:** In 2023, we added centrally ducted heat pumps ("CDHP") into our in-home services portfolio.<sup>26</sup> As part of a hybrid heating system (CDHP and natural gas furnace), the adoption of a CDHP provides our customers a clear path to decarbonizing their space heating, which is often the largest portion of their home carbon footprint. A hybrid system also increases the resilience of their homes and provides highly efficient central cooling when desired. Lastly, we are installing wi-fi-capable integrated controls that automatically switch between the two systems based on outside temperatures. In 2024 we plan to launch the second part of our heat pump offering: mini-splits (also known as ductless heat pumps). Integration of mini-split systems with existing boilers through smart-thermostats will be critical to allow customers to easily leverage the carbon cutting benefit provided by the addition of heat pumps. Wi-fi-enabled integrated controls have the added advantage of enabling flexible load management opportunities, which will be especially valuable as Vermont moves toward being a winter peaking state. With growing demand for heat pump technology, VGS has been assessing ways to deploy centrally ducted and ductless heat pumps, with a particular focus on low-income Vermonters.

---

25 See Case No. 21A-4694.

26 See Case No. 23A-4231.

## PILOT PROJECTS:

**Residential Hybrid Heating - Cost vs. Carbon Estimator:** In 2022-2023, we developed an online tool, with an energy consultant and in consultation with the electric EEs, to help our customers understand the cost and carbon implications of adopting a CDHP as part of a hybrid heating system. The user-friendly estimator graphically illustrates the relationship between carbon reduction and energy costs based on various outside temperature set points chosen by the user. This tool addresses the ambiguity and biases consumers face when choosing whether to install a heat pump and provides guidance on how to optimize it based on their cost and carbon goals. In the next phase of development, VGS will provide customers with access to the estimator through our website, allowing them to explore, learn about, and estimate carbon reduction and cost implications.

**New Commercial Water Heating Technology Pilots:** Through our Innovation and EEU teams, VGS is piloting and exploring several more efficient commercial water heating technologies that are reducing energy consumption by up to 50% in some cases. These include commercial natural gas on-demand water heaters and natural gas heat pumps. These are particularly useful as retrofits in the multi-family housing sector which has traditionally been hard to decarbonize through electrification. We are also watching a promising all electric on-demand water heating appliance for commercial applications.

**Large-Scale Electric Boiler Pilot:** In July 2022, VGS invested in technology to support large-scale hybrid heating.<sup>27</sup> We contributed to an electric boiler optimization project at the Jay Peak Resort Pump House Water Park that will inform how deploying traditional fossil fuel boilers and electric boilers with smart technology can support large industrial VGS customers interested in displacing a portion of their natural gas load. During the summer of 2023, the project commenced operation. We will observe the electric boiler and control module and review project data to inform similar technological advances for commercial VGS customers, which comprise a challenging sector to decarbonize.

**Vermont Energy Recovery Teams Pilot:** In August 2023, the Department asked distribution utilities to consider individual or collective responses to help residents impacted by the historic July 2023 floods. In response, VGS, Green Mountain Power Corporation, Vermont Public Power Supply Authority, Vermont Electric Cooperative, Washington Electric Cooperative, Hardwick Electric, and Efficiency Vermont joined forces to provide direct assistance to low-to-moderate income property owners who needed critical energy systems replaced in order to re-occupy their homes. Working with the State's Disaster Recovery Office and Capstone<sup>28</sup>, with funding support from Vermont Community Foundation and Vermont Low Income Trust for Electricity, this

---

<sup>27</sup> See Case No. 22A-2094.

<sup>28</sup> Capstone Community Action is one of five Community Action Agencies in Vermont. Since 1965, Capstone has served low-income residents of Lamoille, Orange, and Washington counties and nine communities in Windsor, Addison, and Rutland counties.

utility coalition provided affected residents with project coordination assistance including finding a contractor, providing technical assistance, and identifying funding sources to supplement insurance and Federal Emergency Management Agency dollars. This effort has aided well over 100 impacted LMI residents and continues into 2024. We are hopeful that this project coordination model will inform continued LMI assistance through an equitable energy transition, with or without emergency circumstances.

In addition to the projects and pilots described above, we are also pursuing RNG sources, hydrogen, steam, and geothermal, which are discussed in Section 3.2 regarding RNG and other alternative fuels.

## 2.4. SCENARIOS

Now, with the background above around evolving thermal policy, the interests of our customers and community, and the growing portfolio of services we are prepared to provide, we turn to this IRP's scenario analysis.

Traditional VGS scenario planning for purposes of integrated resource planning has focused on varying levels of customer demand based principally on differing projections for additions of new customers, portrayed in base, high, and low cases. In this IRP, VGS predicts customer load decrease over the twenty-year timeframe, considering changes in state and local climate policy as well as tracking toward achievement of emissions reductions set forth in the GWSA. The scenarios presented, therefore, consider emissions reduction to meet GWSA goals, analyze different pathways to achieve that result, and in turn determine what effect that has on VGS's overall fossil gas load. This analysis, while different from a traditional IRP approach, is necessary to the requirements of 30 V.S.A. § 218c and anticipates customer needs for thermal energy resources during a time of great transition for VGS and other thermal energy providers. It also encapsulates some of our thinking around how we are planning for a future decline in the primary product that we sell today, and it identifies some of the factors VGS will take into consideration as these future decisions are made.

The carbon analysis thus developed in this IRP presents the comparison of the implications of three scenarios on sales volume of gas and associated emissions. While the carbon analysis does not support a current or future rate filing, the intent is to aid in understanding the directionality of each scenario and to identify potential stresses that VGS should explore further in short- and long-term planning. Specifically, VGS considered a baseline where VGS takes no further action to reduce emissions beyond currently planned EEU and current RNG plans and applied three emissions reduction scenarios to that baseline. Each of the three emissions reduction scenarios contemplates achievement of GWSA 2050 targets through different pathways: high electrification, which assumes VGS customers electrify at a faster pace, leading to a more dramatic decline in load during the term of this IRP; high fuels, which assumes VGS achieves emissions reduction primarily through the use of renewable fuels, such as RNG; and hybrid, which assumes a mix of electrification and renewable fuels. In

these three emissions reduction scenarios, overall VGS gas load declines by 38%, 12%, and 22%, for high electrification, high fuels, and hybrid respectively.

## MODELING ASSUMPTIONS

The preliminary customer load projection is a baseline against which the scenarios are evaluated. The baseline case establishes a carbon-emissions forecast that assumes that no carbon reduction efforts beyond VGS's current RNG plans take place, neither internally at VGS nor in State policy. If VGS were to follow this baseline case, we would not meet emissions reduction levels set in the GWSA. As it relates to alternative supply in the baseline, VGS continues to ramp up its existing RNG program consistent with current plans (20% of supply) but goes no further. The baseline case also assumes that VGS pursues energy efficiency savings in line with its recently approved DRP. Additional assumptions are detailed below.

From the baseline, three additional scenarios are presented that explore pathways to emissions reduction that will meet the GWSA as applied to the thermal sector and correspondingly to VGS's share of emissions in the thermal sector. The first two, high electrification and high fuels, evaluate the outer bounds of possible outcomes that alternatively rely on deep electrification and wide use of renewable fuels. The third considers a hybrid scenario that suggests a middle path incorporating a combination of electrification and use of renewable fuels. It is notable, however, that all three scenarios apply a "hybrid" approach, as the High Electrification scenario employs use of some renewable fuels, and the High Fuels scenario includes some limited customer electrification.

### BASELINE ASSUMPTIONS:

**Purchased Gas Costs:** The Purchased Gas Adjustment ("PGA") for each scenario is determined from the gas costs and revenue models described in Section 3.1.

**Energy Efficiency Utility:** For each scenario, including the baseline, 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. All scenarios are in line with the approved DRP.

**Customers:** As described in more detail within Section 1.1, the baseline case assumes customer growth and attrition levels that we have historically seen for each rate class.

**Other Emissions Reductions:** The baseline case assumes no additional emissions reductions beyond the assumed EEU savings and current RNG program. Specifically, it does not contemplate any incremental emissions reductions from either heat pump installation or carbon reduction efforts funded by VGS's Climate Action and Innovation Budget in its Alternative Regulation Plan ("ARP").<sup>29</sup>

---

29

See Alternative Regulation Plan filed August 25, 2023 in Case No. 22-5085-PET.

## RESULTS

**Baseline:** As discussed above, the baseline case establishes the baseline emissions forecast against which each scenario is evaluated. The baseline case shows gently declining load over time due to assumptions around customer attrition and the increasing impact of efficiency measures, which are assumed to reduce average usage across the residential and commercial customer base throughout the forecast period. Figure K depicts forecast retail sales volume in blue (note that for modeling purposes, retail sales for the baseline case and High-Fuels scenario, described below, are identical).

Emissions in the baseline case decline more steeply than would be suggested by changes in load due to the fulfillment of VGS’s existing RNG program, which is currently designed to fulfill 20% of retail supply with RNG. Incremental emissions reductions are particularly apparent through the early 2030s while the program is increasing supply toward that goal. While emissions continue to decline thereafter, the baseline case does not include deeper reductions that will be necessary to meet the emissions levels stipulated by the Global Warming Solutions Act. Figure J depicts emissions under the baseline assumptions in green bars, which may be compared to the forecast interpolated GWSA emissions reduction pathway (the “glideslope”) in grey.

**High Electrification:** The High Electrification scenario depicts a future that relies heavily on deployment of electrified devices to satisfy space heating, water heating, and cooking demand. To model this scenario, VGS used load forecasts separated by rate class, and segregated load from rate classes R, G1, and G2 for deployment of deep electrification measures.<sup>30</sup> VGS approached the electrification analysis this way with the assumption that larger and industrial customers would be harder to fuel switch to electricity for their needs during the term of this IRP.

The Energy Action Network’s 2023 Annual Progress Report suggests that 10,000 Vermont households replace heating systems annually.<sup>31</sup> According to the Vermont Housing Finance Agency, there are approximately 330,000 housing units in the state<sup>32</sup>, so by simple division, the fastest natural replacement time for all of the residential heating systems in Vermont is 33 years. For purposes of the High Electrification scenario, it is assumed that when a home converts its primary heating system (which is

---

30 Our firm rates are currently classified as follows:

Domestic Service	Rate R
Commercial, General Service Low Usage, Low Load Factor	Rate G1
Commercial, General Service Low Usage, High Load Factor	Rate G2
Commercial, General Service High Usage, Low Load Factor	Rate G3
Commercial, General Service High Usage, High Load Factor	Rate G4

31 See Energy Action Network Annual Progress Report for Vermont 2023 at 19, available at: <https://eanvt.org/wp-content/uploads/2023/09/EAN-APR-2023-web.pdf>.

32 See VHFA Vermont Housing Needs Assessment, available at: [https://outside.vermont.gov/agency/ACCD/ACCD\\_Web\\_Docs/Housing/Housing-Needs-Assessment/HNA-Fact-Sheet-3-Housing-Stock.pdf](https://outside.vermont.gov/agency/ACCD/ACCD_Web_Docs/Housing/Housing-Needs-Assessment/HNA-Fact-Sheet-3-Housing-Stock.pdf); VHFA quotes 331,106 homes in Vermont as of 2020. For the purposes of a simplified analysis, 330,000 is used.

generally the highest consumption natural gas appliance in a home), all other natural gas appliances are also converted and this customer disconnects from the VGS system. Rate categories G1 and G2 represent small commercial and multi-family properties, which are assumed to be addressable through electrification at the same rate as residential buildings, and are assigned the same rate of attrition as rate class R. Finally, it is assumed that no new customers from these rate classes will join the system. Using this simplified method, a direct rate of decline can be calculated extending to zero after the full 33-year replacement cycle.

Load for large user categories (rate classes G3, G4, and interruptible customers) remains unchanged from the baseline case in the High Electrification scenario. This represents the difficulty in converting load from large users, however, it is worth noting that load from this category of consumers is already assumed to fall by approximately 16% over the forecast period due to the impact of improved efficiency. All things considered, it is likely the assumptions used in the R, G1, and G2 categories are aggressive. So while it is likely that some electrification technologies will emerge to serve large-heat needs (such as electric boilers like that deployed at Jay Peak), the net impact of the assumptions in this scenario represents the fastest rate at which electrification would be achieved under an aggressive electrification policy.

Figure K depicts total retail sales volume (all rate classes) compared to sales under other scenarios. High Electrification is shown in grey and represents a total drop of approximately 38%. In order to meet VGS's share of the GWSA's thermal sector reduction requirements, renewable fuels are added to the supply portfolio to supplement emissions reductions that occur through electrification. Figure L depicts the volume of renewable fuels included in the PGA portfolio over the forecast period. High Electrification is shown in grey and represents the lowest deployment of RNG across the three scenarios. The volume of renewable fuels increases during the early years before steadying around 2.5 Bcf per year.<sup>33</sup> Finally, Figure J depicts a comparison between retail emissions under the scenarios and the baseline case. Blue bars represent emissions for the scenario<sup>34</sup>, which match the GWSA glideslope shown in grey.

**High Fuels:** The High Fuels scenario illustrates a future in which Vermont permits wide use of renewable fuels to achieve desired emissions reductions. The High Fuels scenario maintains the sales assumptions from the baseline case, including standard levels of customer attrition and progressive efficiency investments, but adds increasing amounts of renewable fuel over time to meet emissions targets. Figure K depicts retail sales over the forecast period, which decline approximately 12% in line with the baseline case.

Figure L depicts the volume of renewable fuels included in the PGA portfolio over the forecast period. As with the other scenarios, there is faster adoption in the early period

---

33 For modeling purposes, renewable fuels are assumed to have a carbon intensity score of 0 g CO<sub>2</sub>e/MJ. Inclusion of fuels with lower scores would require lower volumes of renewable fuel for the same emissions reduction, and vice versa.

34 Figure J shows only one set of bars (in blue) for all scenarios. Each scenario solves for an emissions profile that matches the GWSA glideslope resulting in identical emissions for each.

while VGS completes procurement of initial volumes associated with its existing RNG program, followed by a longer period of progressively increasing renewable supply. At the conclusion of the forecast period, RNG represents 57% of the gas procurement portfolio, or approximately 5.4 Bcf.

As with the other scenarios, Figure J depicts that the High Fuels scenario meets the GWSA glideslope.

**Hybrid:** The Hybrid scenario envisions a future that incorporates both strategic electrification and renewable fuels to achieve GWSA targets. Similar to the High Electrification scenario, VGS segregated rate classes that serve residential and small commercial users (rate classes R, G1, and G2), and used the same paradigm described in that scenario to establish a rate of adoption.

For this case, however, it is assumed heating systems are hybridized upon replacement, rather than converted to exclusively electric equipment. The most prominent example of this type of system is the use of centrally ducted heat pumps in conjunction with a liquid- or gas-fired furnace, but equipment might also be a combination of other electrification heating devices (such as mini-splits) in conjunction with a traditional furnace or boiler system. Such deployments are assumed to use electrified heating during moderate weather and switch to the traditional system during the coldest periods, and when demand on the electric grid is high.

The Hybrid scenario assumes that existing home heating systems in Vermont are hybridized over the same 33-year period used in the High Electrification scenario. In addition, all new customers from the R, G1, and G2 rate classes joining the VGS system are assumed to be hybrid starting in 2025. Hybrid customers are assumed to use 40% less gas than a non-hybrid customer, and the volume of new customers is assumed to be consistent with historical levels. In 2024, a non-hybrid customer in the residential rate class is assumed to consume approximately 83 Mcf per year, which means that a hybrid customer is expected to use approximately 50 Mcf per year. Due to the impacts of increasing efficiency, by the end of the forecast period in 2043, the same customers would be expected to use 72 Mcf and 43 Mcf, respectively.

While some heat pumps may be technically capable of displacing greater heating load, for modeling purposes displacement was limited to 40% to represent likely achievement based on the proportion of home natural gas use addressable by heat pumps, price sensitivity among some customers that limits maximum deployment based on economics, and behavioral factors that reduce usage from optimum.

Similar to the High Electrification scenario, although consumption among large users (rate classes G3, G4, and interruptible customers) is unchanged from the baseline, it includes the baseline assumptions of increasing efficiency improvements.

Retail sales decline at an intermediate rate, faster than the High Fuels scenario, but slower than the High Electrification scenario. Total reduction in sales volume is estimated to be approximately 2.4 Bcf, or 22%. Retail sales volumes are depicted in

Figure K.

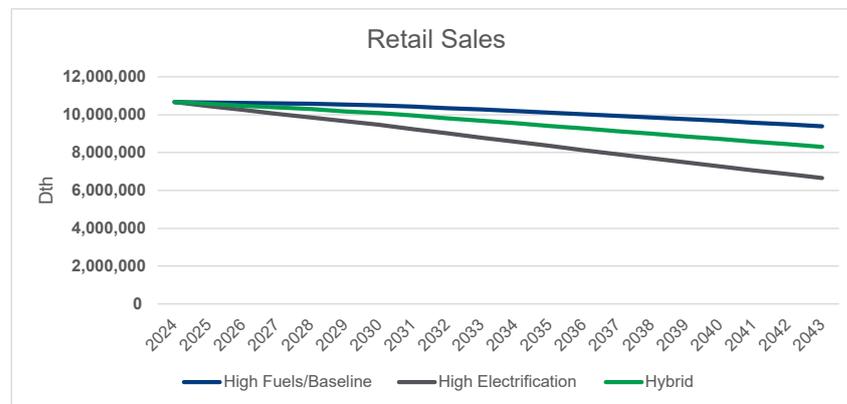
Renewable fuels are deployed at the rate necessary to achieve the GWSA glidepath, which results in total volumes that fall between the High Electrification and the High Fuels scenarios, as depicted in Figure L. Total renewable fuel volume in 2043 is approximately 52% of retail sales, which represents about 4.3 Bcf.

Finally, Figure J depicts the achievement of an emissions profile consistent with the GWSA.

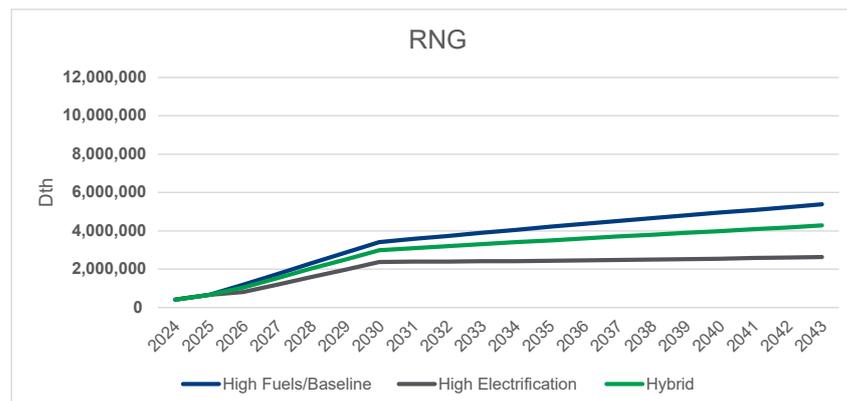
**FIGURE J: Achievement of Emissions Profile Consistent with the GWSA**



**FIGURE K: Retail Sales Volumes**



**FIGURE L: RNG Deployment Volumes**





**SUPPLY**

### 3. SUPPLY

A central component of the 2023 IRP planning process involves assessing what resources are available to meet the energy needs of our customers at least cost. As our customers’ demand for low- and no- carbon thermal resources increase over the term of the IRP, both the resources we rely upon to meet that demand and the associated cost of supplying thermal energy services will change to meet that demand. Accordingly, the 2023 IRP assesses the supply options under a rubric of both traditional natural gas supply modeling and an increasing mix of low- and no-carbon supply options.

This section of the IRP starts with traditional natural gas supply planning. As an essential services provider, we understand that customers rely upon VGS for safe, reliable, and affordable thermal energy. Accordingly, our planning process begins with a review of the basic framework needed to provide that service, as we have for decades. Additionally, the 2024 IRP looks to the future of our supply portfolio to assess the potential alternative supply sources that we expect to emerge over the term of the IRP. We discuss renewable natural gas and other innovations in biofuels and thermal energy services, such as district heating systems and networked geothermal. Finally, we discuss the development of a greenhouse gas emissions valuation framework that informs resource procurement decisions and helps measure our success toward carbon emissions reductions.

#### 3.1. TRADITIONAL NATURAL GAS

VGS’s traditional natural gas supply plan has been based on four main objectives: Reliability, Flexibility, Stability, and Cost-Effectiveness. We have recently added Sustainably Produced, as discussed below.

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-Effectiveness: Ensure the resulting portfolio is cost effective under a variety of scenarios with consideration given to reliability, flexibility, and stability.
5. Sustainably Produced: Continue to procure additional sustainably produced “fossil” natural gas with the intent to reach 100%.



## GAS SUPPLY PLAN

VGS's current supply portfolio includes baseload, storage, and spot market supply and is comprised of a combination of renewable natural gas, responsibly sourced gas, and traditional natural gas. The supply is transported using a combination of our contracts on the Enbridge system to bring gas procured from Dawn, Ontario, to the interconnection of the TC Energy pipeline in Parkway, Ontario. VGS has multiple contracts on the TC Energy system that transport gas procured from Parkway, Ontario, to Philipsburg, Quebec, where the VGS interconnection in Highgate, Vermont, connects at the Canadian/U.S. border.

VGS's annual baseload supply is market-based and generally priced at NYMEX plus or minus basis differential. NYMEX-based pricing refers to the monthly closing cost of a natural gas contract on the New York Mercantile Exchange, plus or minus an adder to account for purchasing at Union-Parkway or Union-Dawn on the Enbridge Gas system. Since NYMEX-based pricing will fluctuate with wholesale natural gas markets, that portion of the supply costs is fixed or "locked" with VGS's hedging program, as described below. VGS also utilizes storage contracts to serve firm customers. These contracts allow VGS to inject natural gas during the summer and shoulder season months when demand is lower and withdraw it during winter. This also allows VGS to maintain flexibility to respond to varying customer demand during the critical winter heating season.

To reduce rate volatility, the Company utilizes a systematic hedging strategy. Though hedging practices can come in various forms, VGS generally utilizes swaps to lock in a fixed price over a set period despite the changing market prices. Hedging with a fixed price natural gas swap allows us to fix natural gas costs, regardless of whether wholesale natural gas prices rise or fall between the dates that VGS enters the transaction and the expiration date of the transaction. If the price of natural gas increases, the gain on the swap offsets the increase in actual cost. On the other hand, if the price of natural gas decreases, the loss on the swap is offset by a decrease in the actual cost. During the term of this IRP, VGS may explore other methods of utilizing hedging that are consistent with the goal of affordability as costs associated with carbon reduction increase.

We currently have nineteen active gas supply agreements with suppliers. These agreements have no purchase obligation until a transaction is executed. The term, quantity, and price of each transaction are negotiated at the time of purchase. In addition, we have several financial derivative agreements to execute financial hedge transactions. Like the supply contracts, these financial agreements also have no obligation until a financial transaction is executed.

Please see Appendix B for VGS's most recently filed Gas Supply and Renewable Natural Gas Report, which contains further information on our supply practices, transportation contracts, and VGS's hedging strategy.

## SUSTAINABLY PRODUCED NATURAL GAS

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, most notably on fugitive GHG and methane emissions.

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, three such certifications are the MiQ Standard, Equitable Origin 100 Standard, and Trustwell Standard.<sup>35</sup>

VGS has traditionally purchased its supply from natural gas marketers at supply hubs such as Dawn and Parkway in Ontario. While purchases from marketers with a bid process promote acquisition of supply at the lowest cost, information is not always available to trace that supply back to the source. Without knowing the original source of the supply, VGS cannot ensure that its supply is produced using sustainable practices.

VGS has directly engaged producers that have achieved either the Equitable Origin 100, MiQ, or Trustwell standard. We recently completed our annual Supply RFP, which procured 100% of our expected firm load, and 70% of our storage for the next year (approximately 6.8 Bcf), and purchased 100% of that RFP as responsibly produced gas. VGS expects to continue to increase its overall portfolio of “Responsibly Produced” supply over time. To achieve this, VGS will need to find other producers that are committed to producing in a responsible manner. In addition, VGS has had discussions with gas 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 cost-effective renewable supply. VGS is using RNG for a portion of its portfolio and receives Vermont-produced RNG directly into our distribution system. We will continue to balance our climate initiatives and affordability as we add more on- and off-system RNG to our portfolio. All three scenarios described above rely heavily upon RNG to achieve emissions reduction under the GWSA.

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.<sup>36</sup> The gas model assumes demand

---

35 More information about the MiQ standard, Equitable Origin standard, and Trustwell standard are available at the following locations, respectively: <https://miq.org/document/miq-standard-carbon-intensity-standard/>; <https://www.equitableorigin.org/>; <https://www.projectcanary.com/wp-content/uploads/2021/01/IES-TrustWell-Ratings-Definition-Doc.pdf>.

36 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.

charges remain flat from 2024-2026 based on projected TC Energy tolls, followed by an annual 1.0% increase from 2026 forward. Similarly, the model assumes traditional or “fossil” natural gas commodity costs increase by 2.32% annually as projected by the U.S. Energy Information Administration in its 2023 Annual Energy Outlook.

## 3.2. RNG AND OTHER ALTERNATIVE SUPPLY

As VGS looks toward a decarbonized future, RNG is one of many products and services we expect to continue to deploy. VGS evaluates its portfolio of decarbonization products, including RNG, in the context of current and expected policies at the state and federal levels, the available capacity of such products to deliver carbon reduction in the market, and the cost to bring those carbon reductions to bear. Considering State climate requirements embodied in the GWSA and Act 18, VGS expects RNG to be a significant component of the strategy to continue to deliver least-cost carbon reducing supply to its customers during the term of this IRP.

With State climate goals in mind, VGS’s RNG procurement strategy relies on both in-state RNG projects like the Goodrich Family Farm Project in Salisbury and the proposed Bellevue RNG project in Berkshire, and out-of-state RNG supply secured through contracts with other suppliers. Although in-state RNG opportunities are limited by size and proximity to VGS’s infrastructure, the direct and indirect benefits are substantial. The Goodrich project, for example, produces enough energy to heat 2,000 homes, returns revenue to the farm, produces high-quality livestock bedding, removes phosphorus that would otherwise pollute Lake Champlain, avoids substantial methane emissions from manure, and processes significant volumes of organic food waste from local manufacturers. If approved by the Commission, the Bellevue project is expected to provide similar benefits.<sup>37</sup> These in-state resources deliver RNG directly onto the VGS system and, in aggregate, work to reduce VGS’s costs for upstream capacity and transportation. In-state RNG resources that are connected to VGS’s system also implicate infrastructure capital expenditure to ensure safe interconnection and delivery to VGS customers; these costs are folded into VGS’s cost of service, much like the expansion of infrastructure to provide traditional natural gas service has been. VGS recognizes that in this way, we have an important role to play in the development of in-state RNG resources.

Delivery of out-of-state RNG to the VGS system helps to balance volumes procured locally and ensures adequate supply of cost-effective renewable fuels within VGS’s portfolio. Out-of-state RNG purchase contracts such as VGS’s agreement with Archaea Energy Marketing LLC (“Archaea”) also provide VGS with flexibility to manage the cost of RNG for customers by enabling, in some cases, resale options to generate revenue to offset the higher cost of RNG as compared to fossil gas.<sup>38</sup> In addition, VGS is exploring more nascent technologies, such as green hydrogen and synthesis gas, which are not yet ready for broad deployment but represent potential technological advancements that justify exploratory investments today.

<sup>37</sup> See Case No. 23-0880-PET.

<sup>38</sup> The Archaea contract was approved by the Commission in Case No. 22-2230-PET.

As a condition of the 2021 MOU, VGS agreed to include in this 2024 IRP an analysis illustrating how we determined the appropriate amount of RNG, hydrogen, and synthesis gas to procure. Our analysis around RNG is detailed below and was informed by the Archaea contract and Alternative Regulation Plan proceedings. Regarding hydrogen and synthesis gas, we are early in the exploration of these alternatives, and it is thus premature to assess a specific amount that we would include in our procurement forecasts at this time.

Currently, the use of RNG is incentivized by federal policy for transportation fuel, as well as for stationary uses as many states encourage utilities to offer their customers a path to decarbonization. As discussed above, the Vermont General Assembly passed Act 18 in 2023, which includes a potential Clean Heat Standard, as a path to decarbonize the thermal sector, which accounts for approximately one third of the State's carbon emissions. While rulemaking for Act 18 is ongoing, the text and intent of the law provide guidance into the type of activities that will earn credits under Act 18, including RNG, to contribute to the decarbonization transition.

Renewable fuels generally come at a higher cost than the fossil gas supply but offer climate benefits that can be achieved immediately and at an abatement cost below the social cost of carbon suggested by the Vermont Climate Council. The social cost of carbon is a metric that considers the present value of the future costs of allowing one ton of carbon to be emitted. Depending on the project, the cost per metric ton of avoided carbon dioxide-equivalent emissions can range from under \$100 to several hundred dollars.

VGS remains cognizant of the impact renewable fuels have on customer rates and expects to target projects on the basis of least-cost abatement. Such determinations also consider the value of local renewable development. Often in-state projects are considerably more expensive to develop and operate but contribute to local economies by returning value to local farms, businesses, and workers, as well as making positive impacts on local environmental concerns by, for example, reducing runoff and managing odors. Still, the economies of scale achieved by larger projects outside Vermont can, in many cases, provide lower abatement costs, which is why VGS intends to pursue a portfolio of RNG projects diversified across locations and feedstocks. This methodology helps to improve reliability and add versatility and resiliency across the portfolio.

On the open market, RNG prices are influenced by the availability of alternative markets and the incentives offered in those jurisdictions, and by the carbon intensity score achieved by a specific production facility. CI expresses the life cycle carbon dioxide-equivalent ("CO<sub>2e</sub>") emissions associated with a production facility in a common unit that can be compared across various resources (commonly, grams of CO<sub>2e</sub> per Megajoule of energy). VGS relies on CI scores for each of the RNG production sources in its portfolio to evaluate the amount of carbon reduced compared to traditional natural gas. In conjunction with the incremental cost of a renewable fuel over traditional natural gas, we determine the cost of carbon abatement per metric

ton of carbon dioxide equivalent as discussed in Section 3.3. Some RNG production facilities, such as those using farm manure, achieve negative CI scores because the counterfactual – the scenario that would have occurred without the project – results in the release of potent greenhouse gases like methane.

As VGS adjusts its RNG procurement methodologies to account for carbon intensity, we must consider how State policy has evolved to recognize the individual attributes of each renewable energy source through life cycle accounting. The state’s general approach to carbon intensity and life-cycle accounting are detailed in Act 18.<sup>39</sup> Further, Act 18 requires that for biofuels, including RNG, to be eligible to earn Clean Heat Credits, they must have increasingly lower (better from a carbon reduction perspective) CI.<sup>40</sup> Accordingly, we expect to propose adjustments to our RNG program broadly that more accurately respect the carbon intensity of each resource in the portfolio by aligning cost and carbon benefit in a more meaningful way.

As such, VGS must consider new valuation structures that offer cost-effective carbon abatement, even when the outright price on a volumetric basis is higher than resources that are currently in our portfolio. For example, RNG that achieves a deeply negative carbon intensity will be highly valued by the open market. Such RNG supplies may be valued at \$50/Mcf or higher, but because they achieve significant carbon abatement, they will still offer a cost per metric ton of avoided carbon dioxide that is within the range of existing resources.

Adding these types of resources will require not only a new way of evaluating value in procurement, but also changes to the way RNG is incorporated into VGS’s portfolio. Historically, our program treated all RNG as qualitatively identically and considered only the outright price per unit of energy delivered. As an early mover, we hold many contracts that are priced much lower than today’s market.

The scenarios evaluated in the scope of this Plan indicate considerable residual demand for natural gas even in the High Electrification scenario, and VGS expects to procure increasing volumes of renewable fuels to help meet the requirements of Act 18 and the Global Warming Solutions Act. The ability to secure RNG supply is constrained by market factors, in particular limited production volumes and competition among buyers, that is likely to lead to increasing prices. VGS expects to manage these concerns by leveraging its natural strengths.

VGS is able to offer stable commercial terms for RNG purchase over long duration, which helps developers attain the certainty needed to secure financing. Second, by valuing RNG for its carbon abatement, we are able to accurately compensate project developers for the higher cost to construct better projects, rather than focusing exclusively on the cost of supply on the basis of energy volume. Third, as a small utility, we do not need record-setting deal sizes to achieve our procurement requirements; rather, we will use our size strategically to work with small-scale projects as they come to market.

---

39 30 V.S.A § 8127(g) and (f).

40 30 V.S.A. § 8127(f).

Further, VGS expects to begin developing balancing tools that will allow more dynamic volumetric management of RNG to help manage any supply disruptions that may happen. Many of these tools are likely to mirror those available in traditional natural gas markets, and may include the use of options, storage, and transportation instruments.

## IN-STATE RNG POTENTIAL STUDY

One of the risks attendant to the procurement of RNG is understanding what supply is available, whether in-state or out-of-state. VGS wanted to understand the potential for in-state RNG, in particular, to be able to support in-state RNG development for the many benefits discussed above. Accordingly, we retained Stone Environmental to evaluate the potential production of RNG in Vermont. Responsive to the condition of our 2021 MOU, the study, titled *Quantifying the Potential for Production of Renewable Natural Gas in Vermont*, evaluated three primary feedstock types: landfill gas, wastewater, and agricultural manure. It is attached hereto as Appendix C. In aggregate for all feedstocks, the study found nearly 1.9 Bcf of potential RNG production in Vermont.

The study identified the sole operating landfill in Vermont, located in Coventry, as the most likely source of RNG from this feedstock, and estimated approximately 390,000 MMBtu of theoretic RNG production potential. The report also noted that much of the biogas produced at the Coventry landfill is already utilized for electricity production by Washington Electric Cooperative, Inc.

The study further identified more than 100 permitted wastewater treatment facilities in Vermont that produce wastewater sludge, the primary feedstock available for RNG production from the treatment process. Despite the high number of facilities, the estimated potential production from wastewater is low because biogas-producing solids constitute a small percentage of the available wastewater sludge.

Finally, the study evaluated the volume of dairy manure produced in Vermont and its potential to produce RNG. As of 2020, the study identified approximately 208,000 head of cattle, which in aggregate are theoretically capable of producing approximately 1.464 Bcf of RNG. Further evaluation determined that approximately 850,000 MMBtu of that total are within the counties of Addison, Chittenden, and Franklin, to which VGS provides natural gas service, and would therefore be the most economic to develop, as the facilities would be able to inject directly into VGS's system, just as the Goodrich Family Farm Project does today. Many farms in Vermont are, however, too small to economically develop individual RNG projects, so the study further evaluated the use of a clustering strategy that would group several neighboring farms together for the purpose of developing an aggregated RNG production site. Using this approach, the potential production within Addison, Chittenden, and Franklin counties was determined to be 716,371 MMBtu per year.

The study included a brief analysis of likely development of RNG by applying a reduction to the total potential production amount, some of which may be unachievable for economic or logistical reasons. This portion of the study considered low- and high-development scenarios by blindly applying blanket reductions to

the total potential production. The low case considered development of 30% of the potential, resulting in 562,177 MMBtu produced per year, while the high case considered 70% of the potential, resulting in 1,311,749 MMBtu produced per year. Breaking this further into the low and high amounts within VGS's likely development reach (Addison, Chittenden, and Franklin counties), resulted in 256,389 MMBtu and 600,576 MMBtu, respectively. Finally, the low- and high-case potentials were applied to potential development exclusively within five miles of existing VGS distribution and transmission infrastructure, which resulted in 159,483 MMBtu and 372,127 MMBtu, respectively.

The study suggested likely CI ratings for the feedstocks evaluated, noting that dairy manure-based RNG has an outsized benefit compared to other feedstocks considered because of its CI score of negative 271. The study does not address the cost to bring potentially available volumes to market, but it is generally agreed that RNG will be more costly than traditional sources of geologic natural gas on a volumetric basis. Costs to develop RNG facilities vary widely based on the size, location, and feedstocks deployed.

The study identified its data limitations, noting the conservative way the modeling responded to ambiguities or inclusion questions, resulting in estimates that are likely lower than actual values. That said, the report concludes that, with significant investment, potential exists for substantial progress towards meeting GWSA greenhouse gas reduction targets with locally produced RNG.

## REGIONAL RNG SOURCES

In addition to RNG generated within Vermont's borders, VGS has sourced, and will continue to source, RNG from neighboring states and regions where cost-effective supply can be obtained. In general, VGS pursues RNG supply from projects located where physical transportation to the VGS system is available. Physical transportation is secured on the primary market from pipeline owners directly, and on the secondary market from owners that hold existing transportation contracts. In this way, VGS can show that it owns the right to transport physical gas from the location of production to the VGS system, where the RNG can be delivered to customers.

The North American natural gas grid is highly interconnected and has been designed to efficiently move large volumes of energy between disparate regions. This existing infrastructure similarly allows RNG to move between regions without the need for incremental investment. Each operator within the grid has a scheduling system, detailing shipments into, out of, and among the points under its jurisdiction. By scheduling RNG from point to point along the grid, the physical movement of such volumes can be documented.

The ownership of a gas transportation contract conveys the right to deliver natural gas at one location and receive it back at another location. Like all commodity markets, the nature of transportation relies on the fundamental condition that natural gas is fungible—that is, the physical use of a natural gas molecule is not impacted by its source. The idea that some subset of the natural gas within the transportation system is qualitatively distinct requires the use of a different market mechanism that recognizes

the renewable attributes of RNG. The movement of such attributes conveys the right to recognize renewable characteristics associated with the production of RNG, characteristics that are not present during the production of geologic natural gas. The production and conveyance of the attributes by an RNG producer is the justification for the higher price normally paid for RNG, because the producer has made additional investments to develop a renewable resource. This system is analogous to that used to support development of renewable power, where Renewable Energy Credits (“RECs”) are created by wind, solar, and hydroelectric generators (among others) that recognize the uniquely improved qualities of certain electrons over others, even though electrons cannot be directly tracked through the transmission grid.

Physical transportation comes at a cost, however, and is not strictly necessary to recognize the economic value of RNG or renewable attributes. It does allow for the physical linkage of a production facility to the VGS system, providing a strong chain of custody. Likewise, Act 18 currently requires that for RNG to earn Clean Heat Credits, there must be a contractual pathway for the physical delivery of the gas from injection to VGS’s system.<sup>41</sup> Several software systems are currently under development that may enhance the transparency and reporting for environmental attributes, which lends credibility to the marketplace and provides another method to verify the provenance of a particular RNG supply. VGS is a strong supporter of such systems and expects to make wider use as the software becomes more mature and is adopted by more counterparties.

## OTHER ALTERNATIVE SUPPLY

VGS understands that to meet State emission reduction goals, including those set forth in the GWSA and Act 18, it will need to procure increasing amounts of cost-effective alternative supply over the term of this IRP. While today the primary alternative supply in VGS’s portfolio is RNG, we expect that the alternative supply portfolio will continue to grow, expand, and diversify in the coming years to ensure that VGS customers are provided the most cost-effective carbon-reducing supply available. We expect that this will include hydrogen, synthesis gas, and district and networked energy systems such as geothermal. To the extent that such alternative supply is in-state and, in some cases, connected directly to VGS’s system, VGS anticipates potential capital expenditures during the term of this IRP to support that development

**Hydrogen:** VGS is continuing to consider hydrogen as a low- or zero-carbon potential replacement for natural gas. While hydrogen may be produced using a variety of techniques, those that use electrolysis powered by renewable electricity are favored for producing green hydrogen<sup>42</sup> with zero or near-zero carbon emissions. VGS envisions a future where green hydrogen is a component of its overall retail portfolio, much like RNG today, and is in the early stages of exploration as to how that would work in the VGS system. VGS expects that the development of hydrogen resources to inject into the VGS system may require significant capital expenditure, including for demonstration projects such as the GlobalFoundries project described below.

---

41 30 V.S.A. § 8127(e).

42 “Green hydrogen” is hydrogen produced from renewable electricity.

VGS is currently developing its first green hydrogen pilot project at the GlobalFoundries campus in Essex Junction. This initial installation will use hydrogen on-campus only, providing a limited and controlled environment to evaluate performance of the electrolysis system, gas handling equipment, and controls systems. Green hydrogen from electrolysis is an important method of shifting the phase of energy between power and gas, allowing renewable electricity to power hard-to-decarbonize processes currently reliant on gaseous fuel. For this project, VGS has begun initial spending and anticipates additional capital expenditure to bring the project online.<sup>43</sup>

Use of hydrogen in legacy natural gas distribution systems presents some known challenges, chiefly the risk of hydrogen embrittlement. When exposed directly to hydrogen, carbon steel may become weakened by the absorption and migration of hydrogen to the metal-grain boundaries, where microscopic bubbles form, compromising the tensile strength of the metal. VGS's system is, on average, younger than many gas-distribution systems in the United States, and therefore includes very little uncoated carbon steel piping, instead favoring more modern alternatives such as high-density polyethylene that are not susceptible to hydrogen embrittlement.

Other operational challenges for widespread adoption of hydrogen exist. Hydrogen gas has a lower energy density per unit of volume than natural gas, which may require recalibration or modification for natural gas equipment. Hydrogen also may require different safety protocols, considering that combustion of pure hydrogen emits no visible light or flame and that hydrogen may not interact with existing early warning devices, such as commercially available detectors for flammable gasses and carbon dioxide.

Much research is currently being performed with hydrogen and many pilot projects have been announced. While VGS is learning from its own direct experience with the GlobalFoundries pilot, other projects will produce results that will also inform our decisions on the use of hydrogen at a wider scale in a safe and responsible manner. The GlobalFoundries project avoids many of the uncertainties by blending the gas in low volumes with natural gas, ensuring combustion characteristics remain within the acceptable parameters set by equipment manufacturers.

The cost of green hydrogen is currently high relative to other decarbonization alternatives such as RNG. However, hydrogen technology is in its infancy, and the federal government's Hydrogen Earthshot effort, coordinated through the Department of Energy, will inject billions in investments into the space.<sup>44</sup> The Earthshot effort targets the production hydrogen at or under \$2/kg, which represents about \$16/MMBtu, lower than many RNG sources. The GlobalFoundries project allows VGS to conduct critical early trials that will prepare the utility for the hydrogen economy for the future.

---

43 See Case No. 22A-1621 and Case No. 23A-3399.

44 See Office of Energy Efficiency & Renewable Energy, Hydrogen Shot, available at: <https://www.energy.gov/eere/fuelcells/hydrogen-shot>.

**Synthesis Natural Gas:** Synthesis natural gas is one solution to uncertainties presented by the use of hydrogen in natural gas distribution systems. Synthesis natural gas is produced through the process of bio-methanation that combines hydrogen and carbon dioxide to produce methane, the primary constituent of natural gas. Synthesis natural gas can be distributed by the current pipeline system without modification and used by customers in the same manner as fossil and renewable natural gases, providing a method to introduce hydrogen-based energy to the natural gas system without the embrittlement concerns discussed above. When paired with renewable electrolysis production of hydrogen, and carbon capture technology, the same carbon molecule could be combusted, captured, synthesized with green hydrogen, and re-combusted in a continuous cycle that produces net-zero emissions over a very short time-cycle.

**District Energy Systems and Networked Geothermal:** In addition to hydrogen deployment, we are also exploring District Energy Systems (“DES”), including one planned for the City of Burlington. VGS is engaged in numerous discussions about development of DES using waste heat captured from renewable electric generation. These systems capture heat from the central generators and efficiently deliver the energy to larger customers through underground piping (hot water or steam pipes). A prospective project between VGS and Burlington Electric Department would capture available steam from the McNeil biomass plant and deliver energy to key institutions in Burlington.

We are also working to develop a way for VGS to provide networked geothermal systems for customers, including exploring opportunities that address market barriers and promote solution scaling to deliver unique value. Geothermal systems are considered the most efficient heating and cooling systems available, and developing a community loop approach, where many customers could be served from the same underground loop, could enable decarbonized thermal services for many sectors.

At community scale, geothermal energy systems are essentially another form of DES. By utilizing the near constant temperature of the earth below the frost line, this thermal resource can be distributed much like our traditional natural gas product through pipes and connected to thermal loads of buildings (via ground source heat pumps). VGS is beginning to examine this opportunity with Efficiency Vermont and other distribution utilities and will look to work with developers to launch a community-scale project in the next few years. The initial market focus is on new construction, specifically housing or small commercial developments off our existing gas system.

When compared to retrofitting existing buildings, designing geothermal systems amid new construction is generally less expensive and therefore a more cost-effective strategy for this scalable solution. 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. For networked geothermal systems that serve multiple customers, VGS is exploring what utility ownership of the outside loop system would look like, in a model where VGS would provide operation and maintenance of that system to customers. In that model, VGS may direct capital expenditure to invest in these networked geothermal systems.

### 3.3. GREENHOUSE GAS EMISSIONS REDUCTION VALUATION

Since embarking on the VGS Climate Plan articulated in our 2021 IRP, we have been taking steps to develop and apply a valuation of a greenhouse gas emissions reduction framework to inform resource procurement decisions. It is our objective to accurately measure net carbon reductions consistent with emerging State policy and to use those measurements to inform procurement decisions to take into account least-cost planning as well as achievement of climate goals.

We anticipate that such policy will ultimately rely on a life-cycle analysis like the GREET model, which is a widely accepted methodology developed by Argonne National Laboratory and a suggested methodology in Act 18. Thus, for fuel solutions such as renewable natural gas, carbon reductions would be calculated based on the difference between the life-cycle analysis of the fuel being replaced (traditional natural gas) and the life-cycle analysis of the replacement fuel (renewable natural gas).

In order to determine the appropriate amount of any particular resource, such as RNG, we evaluate resources for several qualities so that they can be ranked on a comparable basis. For this purpose, the primary basis of evaluation is the incremental cost of a resource above the baseline alternative expressed as a function of the amount of equivalent carbon emissions avoided, measured in metric tons. In other words, we evaluate the cost of avoided carbon for a given resource, which allows us to compare the cost-effectiveness of different resources. This type of analysis is sensitive to the cost of delivery for each resource, and the relative carbon impact, such that lower-cost and lower-carbon resources are elevated in rank.

Importantly, this ranking also allows VGS to objectively evaluate resources that may otherwise draw inadequate attention but could in fact provide cost-effective carbon reduction. Such resources often appear in the outer bands of a particular technology. For example, resources with very high carbon abatement at a very high cost (examples might include carbon capture systems or projects that capture and repurpose methane emissions as is often associated with a farm-based RNG project), and those with modest carbon abatement that are widely deployable at a very low cost (such as certain heat pump and electric boiler technologies, and commercial efficiency projects).

Ranked in such a manner, resources are further evaluated for deliverability based on actual or estimated limitations relevant to each. In the case of RNG, such limitations may include those on feedstock availability or physical location that influence the viability of a particular source. While these tend to be highly specific to each development, we can make some generalizations about the RNG market in Vermont based on the in-state RNG potential study detailed above in Section 3.2.

VGS evaluates carbon intensity of existing and potential resources using calculations based on the GREET model. We had not yet considered a cap on the cost of avoided carbon until discussions with the Department during several regulatory proceedings. The issue first arose in Case No. 22-2230-PET, in which the Commission approved a long-term RNG contract with Archaea Energy Marketing, LLC. Pursuant to the

Department's analysis of the cost-effectiveness of the contract, the Department proposed, and VGS agreed to, a condition of approval that the effective cost of avoided carbon under the contract be limited to the social cost of carbon, which the Vermont Climate Action Plan has established at \$128 per short ton (or \$141 per metric ton or "tonne"). The Commission held that: "To the greatest extent practicable, VGS shall manage its options under the Contract so that the price paid for emission reductions from volumes of RNG delivered to VGS customers (net of any proceeds from VGS's sales into the renewable transportation fuel market) does not exceed the social cost of carbon. The management of options may consider the price paid per ton of carbon over multiple years and in connection with other parts of the alternative supply portfolio."<sup>45</sup>

This social cost of carbon consideration was also embedded into our currently effective Alternative Regulation Plan, which became effective in October 2023 and will remain in effect for at least three years. The Purchased Gas Adjustment portion of our ARP allows VGS to adjust gas costs quarterly, maintaining the true pass-through cost of gas for our customers, and it provides for increases to renewable natural gas and other alternative fuels in VGS's supply portfolio. Under the ARP, we will assess the potential environmental benefit of VGS's alternative supply portfolio by comparing the supply source to the social cost of carbon on a portfolio-wide basis. Some resources included in the alternative supply feature may cost more, and other resources may cost less, but the cost of avoided carbon of the portfolio on an aggregate basis should be at or below the social cost of carbon.

Using the social cost of carbon as the metric to gauge cost-effectiveness of alternative fuel sources will ensure that VGS's acquisition of these resources remains consistent with traditional least-cost planning principles, recognizing, however, that "this metric will need to be reexamined as new regulatory mandates governing the thermal sector take effect and the marketplace for alternative fuel sources matures."<sup>46</sup> The social cost of carbon metric has informed our resource procurement decisions for the past year and will continue to act as a primary framework going forward. We also note that this metric may need to be reexamined under future regulatory mandates, including Clean Heat Standard rules.

Our overall decision of the appropriate amount of RNG to include in retail supply during the term of this IRP takes into consideration the cost and carbon benefit analysis described above as well as overall pressure on rates. Prior to GWSA or Act 18, VGS had established a preliminary goal to have 20% of its overall retail supply be provided by RNG by 2030, which is reflected across all scenarios considered in the Scenarios section, including the baseline. In furtherance of that goal, we obtained authorization in the Alternative Supply Feature of our Alternative Regulation Plan to add up to 2% of total supply as RNG or other alternative supply in the Purchased Gas Adjustment for each of the three years of the Plan (FY2024-FY2026).

---

45 Case No. 22-2230-PET, Final Order Approving Contract (Vt. Pub. Util. Comm'n, Nov. 8, 2022) at 39.

46 Case No. 22-5085-PET, Order Approving Alternative Regulation Plan (Vt. Pub. Util. Comm'n, Aug. 18, 2023) at 11-12, 18.

VGS expects to continue to increase the amount of RNG in the PGA accordingly to achieve our 20% goal. Beyond 2030, we will continue to fold increasing amounts of RNG into overall retail supply, as demonstrated in the scenarios above, to achieve State climate requirements on a cost-effective basis. We will continue to evaluate the expected forecast of gas consumption under the preferred Hybrid scenario while considering future policy developments, and will adjust, up or down, based on those developments. We acknowledge that the ever-quickenning pace of decarbonization driven by local and state climate policy will inform the rate at which we will need to accelerate the volume of alternative supply in our overall gas supply.



# INFRASTRUCTURE

## 4. INFRASTRUCTURE

VGS's transmission and distribution infrastructure is the backbone of the essential thermal heating service that we provide to thousands of customers. Our commitment to providing reliable, safe, secure, efficient, and environmentally sound thermal energy services will continue over the term of the 2024 IRP planning horizon even as our customers' needs for energy services change and evolve.

As customer demand for traditional natural gas decreases in line with state and local climate policy, current investments in system infrastructure are expected to be adequate to meet design day requirements. Over the term of the IRP, we expect to invest in maintaining and modernize existing infrastructure, but do not plan for significant transmission or system expansion. Instead, we plan to expand investments needed to meet our customers' demand for low- and no-carbon heating options.

This includes investing in emerging technologies like hydrogen and networked geothermal and infrastructure that is needed to support in-state renewable natural gas production. But it also means leveraging the largest team of thermal energy experts in the state to support our customers' transition from natural gas to lower carbon alternatives. This means investing in the people that are needed to make state and local energy policy a reality in Vermont. In this section of the IRP, we provide an overview of the infrastructure that is needed to ensure design day service, the team we rely upon to ensure continued excellence over the term of the IRP, and emergency preparedness and cybersecurity needed to ensure we protect our people and our communities.

### 4.1. NATURAL GAS TRANSMISSION & DISTRIBUTION

The system through which VGS's supply travels is an interconnected network of pipelines operating at both transmission and distribution pressures. Pipelines that operate above 100 pounds per square inch in gauge ("PSIG") are described as the "transmission" system, while those operating at 100 PSIG or below are described as the "distribution" system. Together, the transmission and distribution systems, 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 during the term of this IRP, both to accommodate modest growth and to ensure the continued reliable delivery of natural gas, including renewable natural gas and other alternative supply. Capital investments related to the transmission and distribution systems are also discussed in this section. It should also be noted that VGS 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, with the exception of RNG injection at the Goodrich Family Farm in Salisbury, Vermont. 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.<sup>47</sup> For transmission planning purposes, all interruptible customers are assumed to be fully curtailed on a design day.

Historically, as customer base grew and natural gas demand increased accordingly, design day requirements also 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, 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 Highgate border station to Sandy Birch Road in Georgia, Vermont.

In this IRP, the scenarios analyzed show an increase in gas demand for a few years, but in later years demand begins to decrease because of energy efficiency and other carbon reduction efforts. The design day forecast does not therefore show a scenario where demand exceeds the capacity of the VGS transmission system. With that, there is no reason to further expand the capacity of the VGS transmission system during the term of this IRP. If anything changes where the design day demand increases or the transmission system capacity decreases, VGS will look into a variety of methods to meet this shortfall, which are discussed in further detail below.

## MEETING DESIGN DAY DEMAND

In ensuring 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

---

<sup>47</sup> The determination of design day requirements is detailed in Section 1.1 above.

- 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 Natural Gas 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 from TC Energy, 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.

**Maximum Velocity of Gas in Pipeline:** 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, as needed, 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 customer natural gas appliances. Consistent with past planning assumptions, for purposes of this Plan, VGS has used a 30% maximum ratio of propane-air to natural gas. 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 on the northern end of the transmission system. The send-out percentages used in the calculations are shown in Figure M and are based on actual, historical, take-off patterns.

**FIGURE M: Gate Station Flow Rates**

Gate Station	Flow as a Percentage of Total System Flow (%)
Carter Hill Road, Highgate	0.03%
Route 78, Swanton	1.55%
Sheldon / WestRock, Sheldon	1.24%
Beebe Road, Swanton	1.15%
Lake Street, St. Albans	5.46%
Nason Road, St. Albans	4.30%
Georgia Plains Road, Georgia	0.16%
Sandy Birch Road, Georgia	0.89%
Murray Road, Milton	0.02%
Christine Court, Milton	0.52%
Milton (Route 7)	2.39%
Catamount Industrial Park, Milton	0.64%
Munson Flats, Colchester	0.03%
Middle Road, Colchester	4.84%
Sunderland Station, Colchester	7.12%
Mallett's Bay Avenue, Colchester	2.84%
Convent Square, Burlington	22.46%
McNeil, Burlington	1.11%
Winooski (Gorge Road)	31.41%
Williston (Route 2)	9.85%
Plank Road, New Haven	0.72%
Middlebury (Route 7)	1.65%

The above assumptions are all entered in VGS’s network-analysis software, DNV’s Synergi Gas hydraulic modelling software, to determine the current pipeline capacity. The resulting current capacity of the transmission pipeline is calculated at 70,681 Mcf/d. This capacity is supplemented with output from 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 that reduced the capacity of the PAP to 6,566 Mcf/d. When added to the pipeline capacity, the total system capacity becomes 77,247 Mcf/d.

When compared to the estimated peak send out of the highest forecasted design day, the current total system capacity is enough to cover the demand needs for the length of this IRP. This can be seen in Figure N below.

**FIGURE N: Design Day Forecast and Transmission System Capacity**

Winter Season	Estimated Design-Day Send Out	Estimated Pipeline Capacity	Estimated Propane/Air Capacity	Total System Capacity	Estimated System Capacity Excess/(Shortfall)
2023-24	75,350	70,681	6,566	77,247	1,897
2024-25	75,414	70,681	6,566	77,247	1,833
2025-26	75,499	70,681	6,566	77,247	1,748
2026-27	75,373	70,681	6,566	77,247	1,874
2027-28	75,176	70,681	6,566	77,247	2,071
2028-29	74,839	70,681	6,566	77,247	2,408
2029-30	74,422	70,681	6,566	77,247	2,825
2030-31	73,913	70,681	6,566	77,247	3,334
2031-32	73,301	70,681	6,566	77,247	3,946
2032-33	72,611	70,681	6,566	77,247	4,636

With no forecasted shortfall in system capacity, there should be no need for transmission system expansion. There are some scenarios that may, however, require VGS to investigate methods of adding capacity to the system. For example, there is the risk that TC Energy can no longer provide the contractual pressure VGS requires at 580 PSIG or that the capacity of the Propane-Air Plant has to be reduced. Another example is if VGS gets a new large firm customer not planned for in the current forecast, or an interruptible customer makes a request for firm service. In any of these cases, VGS would conduct a targeted study to see how the new demand would affect the transmission system, based on the demand amount and the location of the customer.

If any of the above situations were presented, VGS would evaluate different methods for cost effectively adding capacity on the system to meet the greater demand. 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; and
- Additional transmission system looping.

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

The Propane-Air Plant is more than 33 years old and will continue to be relied on for peak periods until FY2037 based on the current forecast. Because of this, VGS has started to make some upgrades to the facility to ensure it is available for supply into the transmission system. VGS conducted a study in 2018 with an outside consultant to review the facility and to recommend any improvements to ensure its continued functionality. In 2021, VGS replaced the gas vaporizer, which vaporizes the liquid propane into a gas, and in 2022, upgraded the computer hardware and software that is used to operate the plant. In the coming years, VGS plans to replace the compressors that supply air to the propane-air mixture that is injected into the system. These compressor replacements are included in our capital expenditure budget.

## DISTRIBUTION SYSTEM

As of December 31, 2022, VGS had 881 miles of distribution mains and 41,626 service lines.<sup>48</sup> This section addresses VGS's additional investment in distribution mains, services, and meters necessary to serve projected customer growth as well as to 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 new customers, 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 by inflation each year. VGS has seen a large increase in the cost per foot to install main over the past few years due to increases in the cost of materials and the cost of labor from our contractors. While the cost-per-foot methodology described above 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 of more than 100 feet are subject to a feasibility assessment. Under the current feasibility model, the ten-year revenues from a projected distribution expansion must cover the ten-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 without customer contribution. 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

<sup>48</sup> Data for the most recent calendar year are finalized in the spring of the following year. Accordingly, data as of December 31, 2023 will be available in Spring 2024.

will not result in upward rate pressure over the ten-year horizon. The average annual investment over the next five years is forecasted to be \$1,500,000 for mains and \$3,900,000 for services to meet customer growth projects.

## SYSTEM OVERVIEW

Below is a summary breaking down each of VGS's distribution systems, as of November 29, 2023. The distribution system details continue through page 64.

**FIGURE O: Distribution System Overview**

Greater Burlington Distribution System				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
633.5	33,746	44,794	7	Burlington, Colchester, Winooski, Essex, South Burlington, Shelburne, Richmond, Williston, Hinesburg

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Winooski Gate Station	Winooski	605	99
2	Convent Square Gate Station	Burlington	605	99
3	Williston Gate Station	Williston	605	99
4	Middle Road Gate Station	Colchester	605	99
5	Sunderland Gate Station	Colchester	605	99
6	Mallet Bay Avenue	Colchester	605	99
7	McNeil Gate Station	Burlington	605	99

Saint Albans Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
64.64	3,574	5,133	2	Saint Albans, Swanton

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Nason Street Gate Station	Saint Albans	1440	90
2	Lake Street Gate Station	Saint Albans	605	90

Milton - Georgia Distribution System				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
65.29	2,572	3,281	4	Milton, Georgia, Colchester

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Sandy Birch Gate Station	Georgia	605	90
2	Milton Gate Station	Milton	605	90
3	Catamount Gate Station	Milton	605	90
4	Christine Court Gate Station	Milton	605	90

Swanton Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
31.5	1,306	1,591	2	Swanton, Highgate

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Route 78 Gate Station	Swanton	1440	90
2	Beebe Road Gate Station	Swanton	1440	90

Middlebury Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
43.5	734	839	2	Middlebury, Salisbury, Weybridge

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Middlebury Gate Station	Middlebury	1440	99
2	Goodrich Farm/Salisbury Gate Station	Salisbury	200	99

Vergennes Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
25.44	524	608	1	Vergennes, Ferrisburgh, Waltham, New Haven

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Plank Road Gate Station	New Haven	1440	99

Sheldon - Enosburg Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
18.2	458	554	1	Sheldon, Enosburgh

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Sheldon/West Rock Gate Station	Sheldon	605	90

Georgia Plains Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
2.08	51	68	1	Georgia

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Plains Road Gate Station	Georgia	605	80

Carter Hill Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
1.5	37	37	1	Highgate

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Carter Hill Gate Station	Highgate	605	80

Murray Avenue Distribution System				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
0.49	14	16	1	Milton

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Murray Avenue Gate Station	Milton	605	80

Munson Flats Distribution Area				
Miles of Distribution Main	Number of Services	Active Customers	Number of Gate Stations	Towns Served
0.17	8	8	1	Colchester

#	Gate Station	Town / City	Maximum Inlet Pressure (PSI)	Maximum Outlet Pressure (PSI)
1	Munson Flats Gate Station	Colchester	605	80

## PLANNING INITIATIVES

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:

- 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
- Ongoing 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. In years prior, VGS completed multiple 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 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, VGS would install distribution reinforcements.

More recently, VGS has been focused on distribution networks other than the Burlington network. For example, VGS has made multiple improvements to the distribution network in Milton. Prior to 2021, the Milton distribution network was comprised of five individual systems, each fed by a single gate station. Over the past few years, VGS has completed projects to connect four of these systems together with

distribution main, along with connecting to the distribution system in Georgia fed by the Sandy Birch Gate Station. This work provides redundancy to the otherwise single-feed systems and will allow us to remove gate stations no longer needed, which reduces maintenance costs. So far, VGS has retired the Quail Hollow Gate Station and will retire the Milton Gate Station once the Catamount Gate Station is replaced, which is described in more detail below. There is still one system to connect, fed by the Murray Avenue Gate Station, to the now larger Milton distribution network. VGS plans to make this connection in the next two years, which will allow us to retire the Murray Avenue Gate Station as well.

Although not specifically planned for in the next five years, there are other areas where VGS has the potential to connect single-fed systems to larger distribution networks or to connect two larger networks together. These types of projects increase reliability by adding redundancy with multiple stations feeding into the network, and can reduce the number of gate stations needed, which reduces maintenance costs, as in the Milton example above. Another benefit is gained when performing certain maintenance activities on both the distribution and transmission system. If a particular part of the system or a facility needs to be shut down, the network interconnectivity and the multiple gate stations allow us to do so without having to set up temporary facilities to maintain gas operation. Distribution networks that will be analyzed in future years are in Georgia, St. Albans, and Swanton.

**Gate & Industrial Station Improvements:** Some of the existing gate and industrial stations in the system are more than thirty years old and it is therefore appropriate to proactively plan for replacement that may be needed. New technology available will provide better information, enhanced flexibility, and improved safety and security. VGS plans to continue upgrading several gate and industrial measurement stations. 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 prior IRPs it was discussed that this station would need replacement. As mentioned in the 2021 IRP, VGS was evaluating whether this station can be retired altogether. Based on the work that has already been completed on the Milton Distribution Network and the plan to fully replace the Catamount Gate Station, VGS intends to retire the Milton Gate Station after Catamount is replaced.
- **Catamount Gate Station:** This station in Milton 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 connected systems together within the Milton distribution network, including connecting the Catamount Gate network to the Milton Gate network. With this connection completed, a larger station at Catamount Station is necessary to be able to

handle the entire load of the larger combined network while retiring the Milton gate Station. 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 \$2,043,000 and would be offset by deferred replacement costs of the Milton station that would need attention in the coming years. The plan is to replace the station in FY2025.

- **Mallets Bay Ave Gate Station:** This station was built in 1990 and incorporated 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 Testing:** VGS conducts meter testing through an annual program that began in 2005. The program takes a random sample of in-service meters within each meter class that are performance tested for accuracy at a third-party testing facility. The size of the sample depends on the number of meters within the meter class. If certain meter classes have unacceptable performance, a remediation plan will be developed.

**Meter Replacement:** Through the meter testing process, VGS has identified several classes of meters to be replaced. VGS has determined that it is appropriate to proactively replace meters when they have been in the field for a certain number of years. This IRP assumes the continuation of this practice, which VGS calls the Meter Remediation Program. VGS currently remediates approximately 1,600 meters per year and envisions this to continue over the next few years. VGS will need to increase the number of meters remediated per year starting in approximately FY2030 for two reasons. First, in the 2000s VGS experienced a large growth period of new customers and the meters installed during this period will need to be replaced. Second, the Meter Remediation Program began in approximately 2006 and the meters installed as part of the program will start to have to be replaced again.

**Distribution Replacement Program:** The Distribution Replacement Program enables VGS to continue to modernize our distribution system through replacements of typically older mains and services. VGS previously completed the replacement of all of its cast iron and bare steel pipe in 2004 and has since focused on steel replacement and problem fittings and materials. Unlike other gas utilities in the U.S., VGS has a very modern system with no cast iron or bare steel pipe because of these efforts. The Distribution Replacement Program 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. MLVs that are more than fifty years old 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. VGS has replaced four MLVs and retired one MLV that was not needed over the last five years. The IRP assumes the continued replacement of these valves. There are a total of four valves that need replacement in Georgia, Milton, and Colchester. Each replacement costs approximately between \$500,000-\$900,000.

**Cathodic Protection Upgrade Program:** VGS operates a cathodic protection system which prevents the steel pipe in the transmission and distribution networks from corroding. This system is operated and maintained by VGS’s Corrosion Technician and is comprised of rectifiers, ground beds, and anodes. These facilities routinely need upgrading and replacement because anodes and ground beds wear out and become less effective. For this reason, VGS plans on completing small projects each year to proactively improve the cathodic protection system to ensure it protects the steel pipes.

**Automated Meter Reading:** VGS has an Automated Meter Reading System in place for its service territory. Usage data is stored at a customer’s premise within the meter, and it can be retrieved through handheld and mobile units installed in vehicles when in proximity to the location of the meter. This allows for an efficient method of collecting usage data from customers. The next level of meter reading is an Advanced Metering Infrastructure, which is an integrated network system that allows for two-way communication between the company and its customers. The system can collect, store, and analyze usage data, providing the ability to monitor usage in real time. Although VGS can do some of this through its SCADA system for its largest customers, it is not available to the entire system. VGS has looked into this technology, but as of now there is not enough benefit compared to the cost it would take to implement. VGS will continue to monitor the technology and its costs.

## INEGRITY MANAGEMENT PROGRAMS

**Transmission Integrity Management Program:** VGS maintains a plan to address transmission integrity, which was developed in accordance with the requirements of the U.S. Department of Transportation’s (“DOT”) Integrity Management Rule, 49 CFR Part 192 Subpart O – Pipeline Integrity Management. The initial program was implemented in 2004 and its primary purpose is to identify threats, analyze risk, conduct assessments, and remediate as necessary. VGS has a baseline assessment plan which is a long-term schedule of assessments on certain portions of the transmission system based on the prescribed intervals in the plan. Various assessments are conducted on an annual basis and can include in-line inspection, pressure testing, and direct assessment. VGS reviews the plan annually and continuously looks for ways to improve the integrity of its transmission system. Throughout the twenty-year interval

of this IRP, VGS will continue to conduct assessments on the transmission system and remediate any issues found.

**Distribution Integrity Management Program ("DIMP"):** VGS maintains a plan to address distribution integrity, which was developed in accordance with the requirements of DOT's Integrity Management Rule, 49 CFR Part 192 Subpart P – Gas Distribution Piping Integrity Management. The initial program was implemented in 2011 and its primary purpose is to enhance safety by identifying and reducing gas distribution pipeline integrity risks. Operators must integrate reasonably available information about their pipelines to inform their risk-based decisions. The rule requires that operators identify risks to their pipelines where an incident could cause serious consequences and focus priority attention to those areas. The rule also requires that operators implement a program to provide greater assurance of the integrity of their pipeline. VGS reviews the plan annually and adds in new pipeline data as it becomes available to inform where resources can be used to reduce risk on the distribution system.

**Flood Hazard Management:** The majority of VGS's system is located below ground, which reduces the likelihood of damage to its facilities in flood hazard areas. VGS has a Flood Patrol Program as part of DIMP to look at areas prone to flooding during and after a flooding event. There are two major areas of concern. First, aboveground meters and regulators at customer premises can be damaged if subjected to flooding. If this does occur where equipment is underwater, the service would be shut off and the equipment would be inspected and may be replaced. Second, erosion, due to the flooding, can expose and undermine the underground pipes. If an eroded area is found during a patrol, a plan to inspect and rebury the pipe would be developed. VGS does have two gate stations that are located in a 100-Year Flood Hazard Area, Mallets Bay Gate Station and McNeil Gate Station.<sup>49</sup> These stations are monitored during flooding events and can be shut down since they are part of the greater Burlington distribution area with five other gate stations, except on the coldest days of the year. On these days, flooding would not be expected because of the below freezing weather.

## RNG INJECTION & OTHER ALTERNATIVE SUPPLY INVESTMENTS

Renewable natural gas can be safely injected into our physical infrastructure with minimal effect on our physical system. We receive RNG from sources outside of Vermont and have been successfully injecting RNG directly from the Goodrich Family Farm in Salisbury, Vermont since August 2021, in conformance with our Biomethane Gas Quality Plan. We ensure the local distribution system that receives the RNG can accommodate the additional supply and that the chemical composition of the RNG has no adverse effect on any of the pipeline components or customer equipment.

In Salisbury, we addressed these issues by constructing a gate station 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

---

<sup>49</sup> This flood hazard area is according to the Federal Emergency Management Agency Map Service Center dated Dec. 2, 2015.

necessary; and odorize the gas. We would likely install a similar gate station for each new supply location for any RNG delivered directly into the pipeline. For example, we have developed plans for a gate station monitoring the gas planned to flow from the proposed Bellevue RNG production facility in Berkshire. In the case of this second facility, consistent with investments made for the Goodrich Family Farm project, we anticipate certain capital expenditures to interconnect with the RNG production facility.

Although we do not anticipate broad system expansion, we do anticipate discrete expenditures on extending our system to meet future RNG production facilities in-state. Because RNG, including locally sourced RNG, is a critical element of our long-term strategy to achieve emissions reductions required by State policy, we will continue to explore ways to develop local RNG and inject directly into our system to serve our customers with increasingly decarbonized energy.

Additionally, VGS expects capital investment in other forms of alternative supply, as discussed in more detail above, during the term of this IRP. Currently, under VGS's Alternative Regulation Plan, we have a Climate Action and Innovation Budget to help fund exploration of new forms of alternative supply, which provides \$1.5 million in innovation capital expenditure for each of the three years of the Plan. While these funds will prove useful for exploration, VGS anticipates additional significant capital spending during the term of this IRP to develop use of alternative supply technologies on a broader scale for Vermont customers. Specifically, VGS sees hydrogen and synthesis natural gas as near-term opportunities to provide decarbonized supply that, like renewable natural gas, could be seamlessly blended into our traditional gas supply. VGS anticipates that, as with the GlobalFoundries project described above, VGS would likely invest in the infrastructure and equipment needed to bring these alternative supply sources online. Likewise, VGS anticipates investing in networked geothermal systems during the term of this IRP. In such cases, VGS is exploring utility investment in the outside loop system, which could provide heating and cooling to Vermont customers. Similarly, VGS is exploring how the utility can support development of other district energy systems, including the Burlington District Energy System. As part of our overall transition to an integrated energy services provider offering low- or no-carbon energy to our customers, VGS expects that capital investment in the coming years will be focused on these decarbonization systems and initiatives.

## 4.2. PEOPLE

VGS's success is intricately woven into the fabric of its two most invaluable assets: its robust infrastructure, described above, and its dedicated workforce. The significance of the latter cannot be overstated, as people are at the heart of everything we do. VGS employs over 140 employees who are committed to delivering climate-forward energy services safely and affordably to our customers.

The people at VGS function as the driving force across diverse sectors, from Operations and Gas Control to Customer Service, Energy Efficiency, Engineering, Construction, Maintenance, and beyond. Additionally, crucial support functions such

as IT, Human Resources, Regulatory, and Finance contribute to the organization's seamless functioning. Beyond mere job roles, employees at VGS embody grit, humor, and a collaborative spirit that forms the bedrock of the overarching culture. As discussed more fully below, VGS cares for its people through intentional emphasis on culture and change management. This focus will be key for ensuring VGS's success as we transition our business during the term of this IRP.

## CULTURE

The impact of organizational culture on success is undeniable, serving either as a catalyst or a hindrance. Cultures within organizations may evolve organically or be deliberately shaped. At VGS, we recognize the influence of culture and approach it with intentionality to ensure that our organizational culture aligns with VGS's vision and mission.

Our deliberate approach to cultivating organizational culture centers around three pivotal areas: (1) employee engagement, (2) diversity, equity, and inclusion, and (3) employee well-being.

In terms of employee engagement, we believe in the profound importance of connections. These connections manifest in various dimensions: a meaningful connection to the work itself, a sense of belonging and connection with colleagues, and a shared connection to the broader vision and direction of our organization. By emphasizing these interconnections, we aim to foster an environment where every team member feels not only valued but also integral to the collective success and purpose of our organization.

VGS's dedication to employee engagement extends to a strong emphasis on continuous employee development. We believe in the importance of investing in our talented workforce, recognizing that ongoing learning and growth not only benefit individuals but also contributes significantly to the collective success of our organization. By fostering a culture that values and supports professional development, VGS aims to empower employees to reach their full potential, enhancing their skills, knowledge, and capabilities.

Another pivotal focus within VGS's culture is diversity, equity, and inclusion. VGS is a vibrant community of people that welcomes diverse perspectives, experiences, and backgrounds while fostering an environment that is inclusive and just for all. We strive to create a work environment where employees can bring their authentic selves to work each day. We acknowledge that humans are ever evolving. Therefore, we continuously seek to learn, grow, and become better than we were before. This means identifying and recognizing behaviors or policies and practices that may have led to exclusion, racism, or oppression and replacing them with more inclusive and equitable ones. Embracing diversity strengthens our ability to navigate a dynamic business landscape, enriching our perspectives and capabilities. Our dedication to inclusivity is not just a reflection of our values but a key driver for sustained success, reflecting our belief that a diverse and equitable workplace is fundamental to achieving excellence and maintaining a leadership position within our community and industry.

VGS's commitment to a thriving workplace culture extends to its third cultural tenet, emphasizing employee well-being. Recognizing that the health and welfare of our employees are fundamental to both personal fulfillment and professional success, this tenet underscores our dedication to fostering a work environment that prioritizes physical, mental, and emotional well-being. From comprehensive wellness programs to supportive paid time off policies, VGS is committed to providing resources that empower employees to maintain a healthy work-life balance. By placing a premium on employee well-being, we not only nurture a positive and supportive workplace but also acknowledge the integral role that individual wellness plays in building a resilient and high-performing organization.

## CHANGE MANAGEMENT

As discussed throughout this IRP, the energy landscape is changing rapidly and VGS is a committed partner in meeting Vermont's climate mandates. As a result, we are balancing organizational transformation without compromising the values of safety, reliability, and affordability that customers have come to depend on. This has required VGS to embrace effective change management strategies to navigate these dynamic times with our employees. Here are a few key strategies we have adopted:

**Communication is key:** We are committed to keeping employees informed and encourage open, candid two-way communication between all levels of the organization. We provide regular updates to employees using video, email, direct message, and regular meetings.

**Inclusive decision-making:** We empower decision-making at the frontline of the company by granting direct authority to employees at a level matching their skills, training, and experience. We encourage collaboration among employees to create a sense of ownership.

**Set a clear vision and goals:** We communicate the reason behind the change and link the outcome to our vision. We provide employees with a roadmap for the future.

**Training and development:** We provide training and development opportunities to equip employees with the skills needed to adapt to new processes and technologies.

**Promote continuous learning:** We encourage a growth mindset, emphasizing that change is an opportunity for learning and development. We seek critical feedback to improve and grow.

With this emphasis on wellness and intentional change management, our people are fueled to arrive for work every day (and night) ready to deliver the warmth and service our customers expect. In addition, our people are empowered to innovate for the future.

### 4.3. EMERGENCY PREPAREDNESS

VGS continuously prepares for emergency events. Our physical infrastructure and people infrastructure intersect in times of emergency. To prepare for any eventuality, we regularly train and follow federal and state best practices. Federal Department of Transportation regulations detail specific operating, maintenance, and emergency response functions a company must address to operate a gas pipeline system<sup>50</sup> and VGS complies with these regulations.

VGS maintains Emergency Response Plans as required by national pipeline regulation 49 CFR Part 192.615. The plans are comprehensive and cover all gas-related hazards. VGS's emergency procedures also address response to climate events that could potentially affect our system. When a large storm is forecasted, department managers ensure adequate emergency response coverage is enhanced and maintained throughout VGS's operational territory. As discussed above, although our infrastructure is primarily underground, instances of flooding or other climate events can potentially affect its operation.

For all classes of emergencies, our main objective is to ensure the safe, fast, and reliable restoration of gas service to our customers throughout the VGS operational territory. Our top priority is always protecting human life, along with securing property. In the event of an emergency, VGS will make safe hazardous conditions and coordinate activities with applicable local and state public safety officials. Once the repairs have been completed and the gas system is energized, service restoration begins.

If an event were to occur that resulted in widespread loss of service at a scale that exceeds VGS's ability to restore service utilizing our own resources, mutual aid assistance from other gas utilities would be requested through the Northeast Gas Association, of which VGS is a member.<sup>51</sup>

VGS employs principles of the Incident Command System. Appointed officers are responsible for establishing and maintaining communications with the public, local officials, and the media during an emergency or large-scale outage. Establishing effective communications with local media resources is crucial to restoration efforts. VGS conducts routine exercises to test the effectiveness of our emergency communications, as well as overall response to all types of gas emergencies. Lessons learned are incorporated into our procedures. Every effort is made to provide media contacts with timely, accurate, and detailed information concerning restoration of service. Information provided to the media during an emergency may, as appropriate, include the following:

- Safety precautions pertaining to gas leaks and odor complaints.

---

<sup>50</sup> See 49 C.F.R. 192.

<sup>51</sup> The VGS pipeline is underground and not directly exposed to adverse climatic conditions. Thus, weather related damages to the VGS system are infrequent, typically localized and limited in scope. To date there has never been a large-scale outage due to weather-related damage.

- A request that calls be limited to odor complaints, service interruptions, or safety concerns.
- Estimated outage times.
- A statement explaining that service is being restored systematically, following a priority restoration procedure.
- Information directed towards the Company's gas customers about how to reestablish service and any special requirements to reestablish service.
- The names of any other utilities that are providing assistance.
- Lists of areas where progress is being made and where service has been restored and what special difficulties are being faced.
- Information about emergency shelter locations.
- Information about frozen pipes and dangers of hypothermia.
- Dangers of using gas ranges as space heaters and carbon monoxide poisoning.
- Safeguards and protections when using portable electric generators.
- Information about conserving gas usage to help maintain the system.
- A statement thanking customers for their patience and support during the emergency.

The VGS website is also an important resource for event information. GIS-based maps will be displayed on the website showing outage areas and providing updated information regarding service restoration activities. The website will be updated regularly and provide other pertinent safety information related to the event including where customers can find shelter locations, etc. Use of the website is promoted through news releases and social media posts. VGS Facebook, Instagram, and X accounts are used as outreach communication tools during emergencies. The types of information released are meant to supplement official media releases. The following information would typically be distributed via social media:

- Hyperlinks to official media releases by VGS.
- VGS telephone number used to report outages.
- Safety information.
- Restoration progress.
- Retweets from elected officials, emergency operations centers, and the media.

## 4.4. CYBERSECURITY

In addition to maintaining safe, reliable physical infrastructure and healthy, prepared people, we also prioritize technological security. Safety is always top of mind for VGS and it is no different when it comes to the safety and security of our Information Technology (“IT”) and Operational Technology (“OT”) systems. VGS will continue to invest in cybersecurity and IT Infrastructure resilience measures to ensure that its IT systems are secure and available. These investments will be made in three areas: education and training, systems and tools, and infrastructure modernization. VGS strives to meet or exceed evolving cyber security standards and requirements including the US Department of Homeland Security Transportation Security Administration’s Pipeline Security Guidelines and Pipeline Security Directives.

Similar to workplace and infrastructure safety, good protection starts with people. VGS provides regular cybersecurity awareness training and reminders for all employees. Some of the best protections start with employee vigilance, which is rooted in frequent training and heightened awareness. In addition, we employ best practices in authentication and access controls for employees and contractors.

As it relates to systems and tools, VGS’s cybersecurity systems are variable and multi-layered, and calibrated to specific requirements for the utility sector. Broadly speaking, we have a mix of user-level policies and practices, application-level protections, and active system-wide measures with a combination of hardware and software solutions, including measures in place to protect customer information and OT Systems. Wherever possible, security is designed into the architecture of our business and OT systems and networks. We monitor 24/7/365 for threats in real-time. We are also in constant contact with our vendors about potential security threats and issues with their equipment or software. VGS routinely evaluates our cybersecurity posture and policies and is continually improving security measures using a Plan/Do/Check/Adjust methodology.

Part of a strong cyber-defense is having actionable information in a timely manner. We work closely with industry peers, including other local utilities, other gas utilities, and the American Gas Association (of which VGS is a member) to share information about cybersecurity. These partnerships and collaborations are one way that VGS stays apprised of threats and incidents. We also participate voluntarily with other Vermont utilities in the Department’s cybersecurity working group, which was formed out of Commission Docket No. 7307. We believe that collaboration and information sharing on both the state and federal level are key to cybersecurity preparedness.

Finally, it is important to acknowledge that despite all best efforts and protection, any organization could be subject to a cybersecurity-related incident or attack. VGS has policies and procedures in place to guide incident response and disaster recovery. Just as we do with emergency response as it relates to our operations, we train to ensure that employees are prepared in the event of an attack.



## **INTEGRATED ANALYSIS AND ACTION PLAN**

## 5. INTEGRATED ANALYSIS AND ACTION PLAN

The 2024 IRP provides a path forward amid unprecedented changes in the thermal energy sector occasioned by carbon reduction efforts driven by state and local policy and customer demand. This section of the IRP considers the wide range of factors that are influencing our ability to provide thermal energy service at least-cost over the term of the IRP and charts a path forward that offers our customers significant greenhouse gas emissions reductions, continued investment in energy efficiency, and expansion of alternative supply options. In this section of the IRP, we assess existing and planned supply resources, examine the implications of the scenario analysis conducted in Section 3, and evaluate an action plan that will provide customers with essential thermal energy at least-cost while also pursuing ambitious carbon reductions.

### 5.1. REDUCING OUR RELIANCE ON TRADITIONAL NATURAL GAS

As discussed at length throughout this IRP, VGS expects that traditional natural gas load will decline over the term of this IRP under all scenarios, including the baseline case where it is assumed that VGS's greenhouse gas emissions reductions are limited to current RNG and energy efficiency plans. This reduction in demand has been driven in part by VGS's sustained energy efficiency efforts, which will continue to reduce demand in all VGS rate classes.

With load decline on the horizon, current transmission and distribution infrastructure will suffice to continue to meet design day requirements during the term of this IRP without significant additional capital investment; VGS does not plan for any significant transmission expansion in the term of this IRP. That said, capital expenditures will continue to support the maintenance and modernization of existing infrastructure, as reflected in Section 4 and the Financial Assessment in Section 6, according to best practices for the safety and reliability of our system. So long as any portion of the system remains active serving customers, which we envision for the foreseeable future, VGS will continue to operate and maintain that system with the highest level of focus on safety and reliability. VGS also envisions that its infrastructure will increasingly serve renewable alternative supply to customers, including through injection of locally sourced RNG into our system in Vermont, as well as provision of RNG to our customers from outside the state. VGS expects that it will invest capital in the coming years to bring alternative supply sources online in Vermont that will serve hydrogen, synthesis natural gas, and renewable natural gas to customers. VGS also expects to offer new forms of decarbonized services, such as geothermal and district energy, that are likely to require additional utility investment.

With respect to procurement of traditional natural gas, VGS expects to continue to apply its least-cost planning to procedures, as it has done for decades, and will continue to evaluate least-cost methods under the State's evolving paradigm to internalize the value of carbon within energy costs. VGS's proven track record of rate smoothing through hedging will continue into the foreseeable future as VGS continues to serve some portion of traditional natural gas to customers. Likewise, the Purchased Gas

Adjustment in VGS's Alternative Regulation Plan will ensure customers pay for gas on a pass-through basis, as they have for many years.

While some things will remain the same during the term of this IRP, many more will change. This is a time of significant uncertainty for VGS and its customers with respect to state and local policy. The passage of Act 18 and its attendant rulemaking will determine over the next year how obligations will be carried out under the potential Clean Heat Standard. Although that process is ongoing, and while VGS has been preparing for aggressive emissions reductions since the launch of its Climate Action Plan in 2019, the costs associated with those efforts have yet to be fully determined. And if the Vermont General Assembly does not endorse the Clean Heat Standard rules in 2025, VGS expects other emissions reduction policy to take its place. This means that while the precise contours of VGS's emissions reduction efforts have yet to be determined, it is clear that the combination of the Company's decarbonization vision, shifting customer demands, and evolving state and local policy will continue to reduce traditional natural gas usage.

Though the trend away from fossil fuels creates uncertainty for the gas industry, with that uncertainty comes great opportunity. VGS has a long history of providing customers with safe, affordable, and reliable energy, along with excellent customer service. VGS is also committed to an equitable transition for all customers, especially those with the least ability to make the energy transition. VGS will continue to leverage these qualities and commitments as it expands its portfolio of products and services.

VGS has already begun that transition, offering heat pump water heaters and centrally ducted heat pumps to customers, along with our signature energy efficiency services. VGS's efforts in this regard have already proven that customer demand is high and that VGS is capable and well positioned to meet that demand. VGS will also continue to pioneer climate solutions for harder-to-decarbonize large industrial loads, such as the electric boiler deployed at the Jay Peak Pump House Water Park, just as it has for many decades in the commercial arm of its energy efficiency efforts. Developing new sources of revenue for VGS from these new services going forward will help ensure that the increasingly renewable energy mix that VGS serves customers remains affordable. In this way, VGS's future least-cost portfolio will include electrification services, renewable supply, and traditional natural gas to meet customers' needs in light of the State's ambitious climate goals.

## 5.2. PATHWAYS TO CARBON REDUCTION

With overall reduction in natural gas use as a backdrop, VGS designed the scenarios described in this IRP to reflect different pathways to the Global Warming Solutions Act's 2050 greenhouse gas reduction targets. VGS knows that achieving such aggressive emissions reductions will depend upon three specific areas: (1) energy efficiency efforts, including weatherization; (2) fuel switching from natural gas to electric, or electrification of current thermal load served by fossil fuels; (3) use of renewable alternative supply such as renewable natural gas. Because all three scenarios reflect the same energy efficiency savings, which are set forth in VGS's DRP, the two

pathways that VGS tested were variations on the levels of alternative supply/RNG and electrification. The High Electrification scenario envisions a future where VGS's residential and small commercial customers cycle off gas to electric at a rapid rate. In that scenario, any additional required emissions reduction would be accomplished through use of alternative supply, specifically RNG. The High Fuels scenario illustrates a future where VGS relies heavily upon alternative supply, specifically RNG, to meet its emission reduction goals.

Both the High Electrification and High Fuels scenarios, however, entail significant risk for VGS and its customers. They represent two extremes that, while possible, are unlikely paths for VGS to take. The High Electrification scenario presents a significant decline in load for VGS overall: 38% over the term of the IRP. Under current rate design, which allocates a significant portion of VGS costs among ratepayers based on usage, a substantial load decrease like that shown in the High Electrification scenario would mean customers remaining on the VGS system would see increased rates as the costs are spread over a decreasing amount of gas sold.

The High Fuels scenario, although depicting a lesser load loss over the term of the IRP, would still entail significant cost risk, as the prices for RNG and other alternative supply are expected to remain at a significant cost premium over the term of this IRP. Also, at such a high rate of RNG usage, there are procurement risks related to the ability to secure needed quantities of RNG at a desirable CI. RNG is produced from organic feedstocks that fluctuate in volume, while geologic gas is delivered under controlled conditions that result in greater consistency. Additionally, RNG production has operational risks that could threaten VGS's ability to maintain sufficient RNG supply. The in-state RNG potential study indicates that VGS would not be able to rely solely on in-state supply, and the broader North American RNG markets are likely to see fluctuation and change as other states enact emission reduction mandates in the thermal sector. There is no guarantee that VGS could secure RNG volumes at sufficient quantity, manageable price, and desirable CI.

Considering the extremes that these two scenarios present, VGS believes the Hybrid scenario is the preferred course of action. The Hybrid scenario has a mix of electrification measures alongside increasing use of alternative supply (RNG). Paths similar to the Hybrid scenario have been suggested across several studies as a path to reduce necessary infrastructure investments, leverage existing infrastructure, diversify energy demand, and lower ratepayer costs, while still achieving emissions reductions as required under state climate action regulation. One such study that has been recently published is the Long-Term Vision Analysis for New England completed by ERM.<sup>52</sup> Many studies have attempted to evaluate the likely cost of deep electrification but ignore the cost of electrical capacity investments due to the complexity of modeling such requirements. Ignoring any major cost component, whether on the gas or electric systems, skews results, making conclusions incomplete and uninformed. The Long-Term Vision Analysis captures major investments required to effectuate a

---

52 The Analysis was prepared independently by ERM based on engagement with members of the Downstream Natural Gas Initiative ("DSI"), which is a group of utilities focused on energy transition in natural gas. VGS is a member of the DSI. The Analysis may be accessed at: <https://www.erm.com/contentassets/65dcaedb758f44358d835eeb4152ada4/dsi-long-term-vision-new-england-report.pdf>

High Electrification scenario, as well as a Hybrid scenario, and concludes the latter is considerably more cost-effective. Based in part on that analysis, VGS would likely pursue a Hybrid scenario as among the three scenarios shown. But this scenario, too, has its risks. The risk of load loss creating higher costs for existing customers presents in this scenario as well, with a 22% load loss over the term of the IRP. Likewise, the need to procure increasing amounts of alternative supply, specifically RNG, is also presented in this scenario, with its associated risks both financial and operational.

### 5.3. CONCLUSION

VGS's least-cost integrated portfolio, therefore, will include traditional natural gas as well as renewable natural gas and other alternative supply. On a pure cost basis, traditional natural gas will continue to be the cheapest option in the foreseeable future, but that cost does not take into account the environmental costs of pursuing a portfolio of solely traditional fossil fuels. When the societal cost of the carbon emitted from that supply is added, it shows that traditional fossil gas, on its own, will not remain a least-cost alternative as we look to achieve State climate goals. The lens, therefore, for understanding supply procurement must shift to one that considers both actual cost along with carbon benefit or detriment. In this way, we will evaluate the cost of avoided carbon of a given renewable supply and aim to have a portfolio of alternative supply that is at or below the social cost of carbon established by the Vermont Climate Council. VGS will continue to serve traditional natural gas as well, to ensure the transition to deep emissions reductions is accomplished affordably, especially for customers least able to transition off fossil fuels. This cost-benefit analysis will continue into the future as VGS considers other alternative supply resources such as hydrogen, district energy, and geothermal.



## **FINANCIAL ASSESSMENT**

## 6. FINANCIAL ASSESSMENT

Financial forecasting and analysis are critical to presenting a strategic direction for the business. For this financial assessment, VGS utilized the “Hybrid” scenario as described in Section 2.4 for our preferred action plan. We considered the impact of the Hybrid scenario on revenues, expenses, income, financing, cash flow, and capital expenditures. Additionally, VGS included the results of financial metrics and ratios during the five-year period. This financial forecasting strikes a balance among the key assumptions detailed below and reflects the potential directional impact regarding our strategic priorities to advance reduction of greenhouse gas emissions in line with State policy, 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. Notably, the financial planning is intended to demonstrate the potential directional impacts of various outcomes rather than a precise forecast of specific financial outcomes. 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.

### 6.1. FINANCIAL STATEMENTS

Financial Statements below utilize the following assumptions:

**Purchased Gas Costs/Renewable Natural Gas:** Refer to “Hybrid Scenario” described in Section 2.4.

**Energy Efficiency Utility:** Consistent with the Demand Resource Plan.

**Customers:** Customer projections are detailed in Section 1.1.

**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, based on current customer projections and associated load, we do not anticipate significant system expansion and therefore have not included the transmission or distribution infrastructure investment that would be needed for such expansion. Instead, we modeled based on the need to continue making repair/replace investments to maintain the existing system and meet the customer growth reflected in each scenario. This includes, but is not limited to, investments in meters, encoder receiver transmitters, general gate station maintenance/replacement, mains replacement, and investments to complete non-transmission customer growth. Additionally, VGS assumes climate innovation investments of \$1.5M per year, which is consistent with our current Alternative Regulation Plan. Any additional capital expenditures on decarbonization-related efforts during the term of the ARP would be addressed through that plan’s process for Additional Innovation Capital, which allows VGS to petition the Commission for additional capital spending to be included in rates.

**Inflation:** We utilized the Federal Open Market Committee’s “Personal Consumption Expenditures Inflation, Median” projections for 2025 forward. We utilized the VGS cost of service and budget for 2024.

**Depreciation Expense:** The depreciation expense is based upon projected plant-in-service. We utilized the rates in the Company's current Depreciation Study, which took effect for rates in effect November 1, 2020. While VGS will have an updated study in FY2026, we assumed rates remain constant in these projections.

**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 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 4.0-5.5% based upon current markets.

**Return on Equity:** The Company modeled the five-year financials based upon a Return on Equity of 9.24%.

**Capital Structure:** The financials were projected assuming the Company’s current authorized equity ratio of 50%.

**System Expansion & Reliability Fund:** The financial forecast reflects the System Expansion & Reliability Fund fully returned to customers in 2024.

The tables below present the output from the five-year financial forecast:

**FIGURE P: Five-Year Financial Forecast**

Income Statement (in thousands)	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
<b>Operating Revenues</b>					
Customer Gas Sales	130,308	137,064	146,208	153,822	162,179
Expansion Fund Withdrawals	675	-	-	-	-
Cost of Gas	(67,143)	(69,919)	(75,424)	(82,948)	(89,886)
Rental and Other Revenue	2,147	2,152	2,140	2,136	2,131
<b>Gross Margin</b>	<b>65,987</b>	<b>69,297</b>	<b>72,924</b>	<b>73,011</b>	<b>74,424</b>
<b>Operating Expenses</b>					
Responsibility Areas	23,007	23,062	23,622	23,470	23,816
Depreciation	12,682	13,521	14,329	15,036	15,579
Regulatory Amortization	(1,461)	456	3,541	604	584
Taxes Other Than Income	9,422	9,896	10,441	10,932	11,481
Total Other Operating Expenses	43,650	46,935	51,932	50,042	51,460
<b>Operating Income</b>	<b>22,337</b>	<b>22,362</b>	<b>20,992</b>	<b>22,968</b>	<b>22,964</b>
<b>Other (Income) and Expense</b>					
Interest on Long Term Debt	5,519	5,443	6,656	6,413	6,337
Other Interest	1,691	1,805	531	903	885
Total Other Expenses, Net	7,209	7,247	7,187	7,317	7,222
<b>Income Before Taxes</b>	<b>15,128</b>	<b>15,114</b>	<b>13,805</b>	<b>15,652</b>	<b>15,742</b>
Federal and State Income Taxes	3,807	3,804	3,441	3,953	3,977
<b>Net Income</b>	<b>11,320</b>	<b>11,311</b>	<b>10,364</b>	<b>11,699</b>	<b>11,764</b>

<b>Balance Sheet - Assets (in thousands)</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>
Utility Plant in Service	493,741	507,311	527,567	540,868	554,792
Accumulated Depreciation	(151,182)	(162,060)	(173,646)	(185,801)	(198,404)
Construction in Progress	2,103	3,927	2,103	2,103	2,103
<b>Total Utility Plant</b>	<b>344,662</b>	<b>349,178</b>	<b>356,025</b>	<b>357,170</b>	<b>358,491</b>
<b>Current Assets</b>					
Cash and Temporary Investments	943	899	1,007	860	707
Accounts Receivable, net	8,762	9,429	9,731	9,988	10,312
Inventories	5,758	5,948	5,905	5,815	5,748
Prepaid Expenses & Other Current Assets	1,935	1,935	1,935	1,935	1,935
Derivative Financial Instruments	468	468	468	468	468
<b>Total Current Assets</b>	<b>17,866</b>	<b>18,679</b>	<b>19,046</b>	<b>19,066</b>	<b>19,170</b>
<b>Other Assets</b>					
Regulatory Assets	18,444	17,460	17,288	18,788	20,322
Other	7,365	7,365	7,365	7,365	7,365
<b>Total Other Assets</b>	<b>25,808</b>	<b>24,825</b>	<b>24,653</b>	<b>26,153</b>	<b>27,687</b>
<b>Total Assets</b>	<b>388,337</b>	<b>392,682</b>	<b>399,725</b>	<b>402,389</b>	<b>405,347</b>
	(0)	(0)	0	(0)	0

<b>Balance Sheet - Capitalization &amp; Liabilities (in thousands)</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>
<b>Capitalization:</b>					
Common Stock	0	0	0	0	0
Additional Paid-In Capital	77,601	77,601	77,601	77,601	77,601
Retained Earnings	67,245	67,556	63,920	66,619	66,383
<b>Total Stockholders Equity</b>	<b>144,846</b>	<b>145,157</b>	<b>141,521</b>	<b>144,220</b>	<b>143,984</b>
<b>Long Term Debt</b>					
Long Term Debt	114,000	113,000	127,000	126,000	125,000
Unamortized Debt Expense	373	333	299	273	247
<b>Total Long Term Debt</b>	<b>113,627</b>	<b>112,667</b>	<b>126,701</b>	<b>125,727</b>	<b>124,753</b>
<b>Current Liabilities</b>					
Accounts Payable	9,783	9,816	11,347	10,675	13,275
Short Term Debt	35,375	35,075	24,200	21,000	19,900
Accrued Interest and Expenses	4,819	4,793	5,192	5,159	5,131
Due to Affiliates	(49)	(49)	1,083	3,458	3,554
Other Current Liabilities	2,096	2,096	2,096	2,096	2,096
Derivative Financial Instruments	3,500	3,500	3,500	3,500	3,500
<b>Total Current Liabilities</b>	<b>55,523</b>	<b>55,231</b>	<b>47,418</b>	<b>45,888</b>	<b>47,455</b>
<b>Other Liabilities</b>					
Asset Retirement Obligation	3,316	3,483	3,659	3,834	4,010
Deferred Income Taxes (long term)	33,975	37,874	40,545	41,354	42,091
Regulatory Liability-Expansion	55	-	-	-	-
Regulatory Liabilities	36,995	38,271	39,880	41,366	43,053
<b>Total Other Liabilities</b>	<b>74,340</b>	<b>79,627</b>	<b>84,084</b>	<b>86,554</b>	<b>89,154</b>
<b>Total Capitalization and Liabilities</b>	<b>388,337</b>	<b>392,682</b>	<b>399,725</b>	<b>402,389</b>	<b>405,347</b>

Cash Flow (in thousands)	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
<b>OPERATING ACTIVITIES:</b>					
Net income	11,320	11,311	10,364	11,699	11,764
Adjustments to net income:	-	-	-	-	-
Depreciation and amortization	12,881	13,728	14,539	15,237	15,781
Amortization of regulatory assets	3,967	1,750	768	219	198
Deferred income taxes	4,080	3,899	2,672	808	737
Changes in working capital					
(Inc)/Dec in accounts receivable	586	(666)	(303)	(257)	(324)
(Inc)/Dec in inventories	2,846	(190)	43	90	68
(Inc)/Dec in prepaid expenses and other current assets	-	-	-	-	-
Inc/(Dec) in regulatory assets and liabilities	(6,038)	(1,460)	(989)	(2,359)	(2,251)
Inc/(Dec) in accounts payable and accrued expenses	(453)	246	792	522	762
Inc/(Dec) in inter-co account	90	-	1,132	2,375	96
Inc/(Dec) in pension and supplemental executive retirement plan	(158)	(158)	(158)	(158)	(158)
<b>Net Cash Provided by Operating Activities</b>	<b>29,121</b>	<b>28,459</b>	<b>28,862</b>	<b>28,178</b>	<b>26,673</b>
<b>INVESTING ACTIVITIES:</b>					
Capital expenditures	(20,424)	(16,203)	(17,879)	(15,124)	(12,726)
<b>Net Cash used in Investing Activities</b>	<b>(20,424)</b>	<b>(16,203)</b>	<b>(17,879)</b>	<b>(15,124)</b>	<b>(12,726)</b>
<b>FINANCING ACTIVITIES:</b>					
Proceeds from issuance of L.T. Debt	-	-	40,000	-	-
Payment of deferred financing costs	-	-	-	-	-
Repayment of L.T. Debt	(1,000)	(1,000)	(26,000)	(1,000)	(1,000)
Net Borrowings / (Repayments) on revolving lines of credit	(2,300)	(300)	(10,875)	(3,200)	(1,100)
Dividends Paid	(6,000)	(11,000)	(14,000)	(9,000)	(12,000)
Proceeds from Capital contribution	-	-	-	-	-
<b>Net Cash used in Financing Activities</b>	<b>(9,300)</b>	<b>(12,300)</b>	<b>(10,875)</b>	<b>(13,200)</b>	<b>(14,100)</b>
<b>INC/(DEC) IN CASH AND CASH EQUIVALENTS</b>	<b>(603)</b>	<b>(44)</b>	<b>108</b>	<b>(147)</b>	<b>(153)</b>
Restricted Cash Activity	668	61	-	-	-
CASH AND CASH EQUIVALENTS, BEGINNING OF PERIOD	550	615	632	740	593
CASH AND CASH EQUIVALENTS, END OF PERIOD	615	632	740	593	440
	-	-	-	-	-

Financial Metrics	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
Capital Spending	21,107	16,064	19,116	13,997	14,636
Interest Coverage Ratio	314%	313%	297%	319%	323%
EBITDA Ratio	496%	506%	503%	531%	545%
Capitalization Ratio (13 month average)	50%	50%	50%	50%	50%
Allowed ROE (held constant)	9.24%	9.24%	9.24%	9.24%	9.24%
Actual ROE	7.74%	7.66%	7.07%	7.97%	8.00%

Outstanding Debt Instruments:	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
Maturity Date:					
December 15, 2025	10,000	10,000	-	-	-
August 1, 2026	15,000	15,000	-	-	-
June 1, 2028	4,000	3,000	2,000	1,000	-
July 14, 2036	10,000	10,000	10,000	10,000	10,000
January 30, 2044	35,000	35,000	35,000	35,000	35,000
December 15, 2045	25,000	25,000	25,000	25,000	25,000
August 1, 2046	15,000	15,000	15,000	15,000	15,000
Assumed New Issuance	-	-	40,000	40,000	40,000
<b>Total Long Term Debt</b>	<b>114,000</b>	<b>113,000</b>	<b>127,000</b>	<b>126,000</b>	<b>125,000</b>

## 6.2. COST OF SERVICE

VGS is under an Alternative Regulation Plan that will set rates through FY2026. Our ARP provides for fixed base rates, quarterly Purchased Gas Adjustments, service quality and reliability reporting, and a Climate Action and Innovation Program budget.<sup>53</sup> The fixed base rates mechanism will smooth rate adjustments over the next several years. Accordingly, the first three years below are consistent with FY2024 approved rates and our current projections under the ARP.<sup>54</sup> FY2027 and FY2028 are projections based on the financial analysis performed above related to the Hybrid scenario. Note that while this articulates our expected revenue requirement over the next five years, it is meant to be directional rather than precise as to what we expect in the coming years. Circumstances are likely to change that will affect these projections.

**FIGURE Q: Determination of Firm Rates Change**

<b>Vermont Gas Systems Determination of Firm Rates Change</b>					
<b>Required Revenue</b>	<b>FY2024*</b>	<b>FY2025**</b>	<b>FY2026**</b>	<b>FY2027</b>	<b>FY2028</b>
Operating Costs					
Production	32,131	32,774	33,429	33,764	34,439
Transmission	1,979,631	2,019,224	2,059,608	1,956,628	1,995,761
Distribution	5,005,220	5,105,324	5,207,430	5,259,505	5,364,695
Customer Accounts	2,166,391	2,209,719	2,253,913	2,276,452	2,321,981
Sales	(405,571)	(413,682)	(421,956)	(426,176)	(434,699)
Admin & General	13,733,203	14,007,867	14,288,025	14,430,905	14,719,523
Other Income	(2,170,155)	(2,213,558)	(2,257,829)	(2,136,260)	(2,130,686)
SERF	(670,163)	-	-	-	-
<b>Total Operating Costs</b>	<b>19,670,687</b>	<b>20,747,667</b>	<b>21,162,620</b>	<b>21,394,818</b>	<b>21,871,014</b>
Non-Operating Costs					
(Depreciation, Taxes, cost of	46,512,944	\$48,022,384	\$48,793,464	\$50,045,342	\$51,114,913
Reg Asset	(2,295,000)	(1,090,000)		-	-
Reg Asset Amort		688,500	2,696,500	-	-
<b>Total Required Non-Gas Revenue</b>	<b>63,888,631</b>	<b>68,368,551</b>	<b>72,652,585</b>	<b>71,440,160</b>	<b>72,985,927</b>
Current Non-Gas Revenue	60,101,869	64,349,658	68,368,551	71,000,000	70,300,000
Non-Gas Rate Change Supported	6.30%	6.25%	6.27%	0.6%	3.8%
Indexed Market Adjustment	n/a	2%	2%	n/a	n/a
 Rate Base	 270,687,293	 272,778,169	 268,883,493	 280,301,505	 280,048,394

\* This is based on the approved Cost of Service in Case No. 23-0561-TF.

\*\* This will be adjusted per the Alternative Regulation Plan approved in Case No. 22-5085-PET.

53 In addition to ARP reporting, VGS submits an annual filing related to “untariffed services,” which reports on programs and services offered by VGS that are not subject to a tariff but have costs and revenues included in VGS’s cost of service. It lists the current price charged to customers for each service and a description of how VGS determined the appropriate charge for each service. See Case No. 23A-4372.

54 See ARP Attachment 4 filed October 26, 2023 in Case No. 22-5085-PET.



## APPENDICES



# **Triennial Plan**

**(2024 – 2026)**

Prepared for the  
Public Utility Commission  
December 1, 2023

## Table of Contents

I.	<b>Introduction and Background</b> .....	<b>1</b>
II.	<b>Strategies to Achieve Efficiency Goals</b> .....	<b>4</b>
III.	<b>Total VGS Energy Efficiency program budgets and savings goals</b> .....	<b>6</b>
IV.	<b>Resource Acquisition Program Descriptions</b> .....	<b>9</b>
	<b>PROGRAM DESCRIPTIONS</b> .....	<b>11</b>
	1. Residential Retrofit/Weatherization Program .....	11
	2. Residential New Construction Program .....	17
	3. Residential Equipment Replacement .....	19
	4. Commercial Retrofit Program .....	20
	5. Commercial New Construction Program .....	22
	6. Commercial Equipment Replacement Program.....	23
V.	<b>Development and Support Service Program Descriptions</b> .....	<b>24</b>
	1. Education and Training .....	25
	2. Applied Research & Development .....	26
	3. Planning and Reporting.....	26
	4. Evaluation .....	26
	5. Policy and Public Affairs .....	26
	6. Information Technology.....	27
	7. General Administration.....	27
VI.	<b>Quantifiable Performance Indicators (“QPI”) and</b> .....	<b>27</b>
VII.	<b>Minimum Performance Requirements (“MPR”) .....</b>	<b>27</b>
VIII.	<b>Department Evaluation and Fiscal Agent budgets</b> .....	<b>33</b>
IX.	<b>Conclusion and Total EEU related budgets and savings for this Plan</b> .....	<b>34</b>
	Detail of RA Peak Day Annual Savings (Mcf) by Program .....	36
	Detail of RA Lifetime Savings (Mcf) by Program.....	36
	Detail of RA Incentive Budgets by Program .....	37
	Detail of DSS Categories by Program 2024-2026 .....	38

## Introduction and Background

Vermont Gas Systems, Inc. (“VGS” or “Company”) is a nationally recognized leader in the effort to decarbonize gas infrastructure and develop affordable renewable energy. In 2019, VGS



announced an aggressive strategy to eliminate greenhouse gas (“GHG”) emissions by 2050. The Company has since taken bold steps to evolve its products and services to support Vermont State energy policy and reduce emissions in line with the Global Warming Solutions Act of 2020 (“GWSA”) requirements. Taken together, this strategy is known as the Company’s “Climate Plan.”

To achieve the Climate Plan’s ambitious objectives, VGS has focused its efforts on three key areas: 1) reducing energy usage, 2) increasing access to the latest and most efficient in-home heating solutions, and 3) displacing fossil fuels with cleaner alternatives. VGS has steadily launched new initiatives to support these efforts. Examples include expanding weatherization incentives for income-qualified customers, launching a heat pump water heater (“HPWH”) program and beginning development of hybrid heating solutions, and procuring increasing volumes of alternative supply to displace traditional gas.<sup>1</sup> Reducing energy usage by delivering thermal efficiency services through its Energy Efficiency Utility (“EEU”) is a key strategy of the Company’s efforts. These improvements support affordability and reduce demand across the system, providing financial benefit in the form of lower energy bills, along with reduced GHG emissions that contribute to Vermont’s climate objectives.

VGS submits this Triennial Plan (“Plan”) covering the three-year period from 2024-2026 with a focus on 2024. VGS outlines its goals to increase its investment in energy efficiency, including a substantial increase in the number of homes weatherized. This is a cornerstone of VGS’s Climate Plan in advancement and support of Vermont’s requirement of 80% reduction in GHG by 2050.<sup>2</sup>

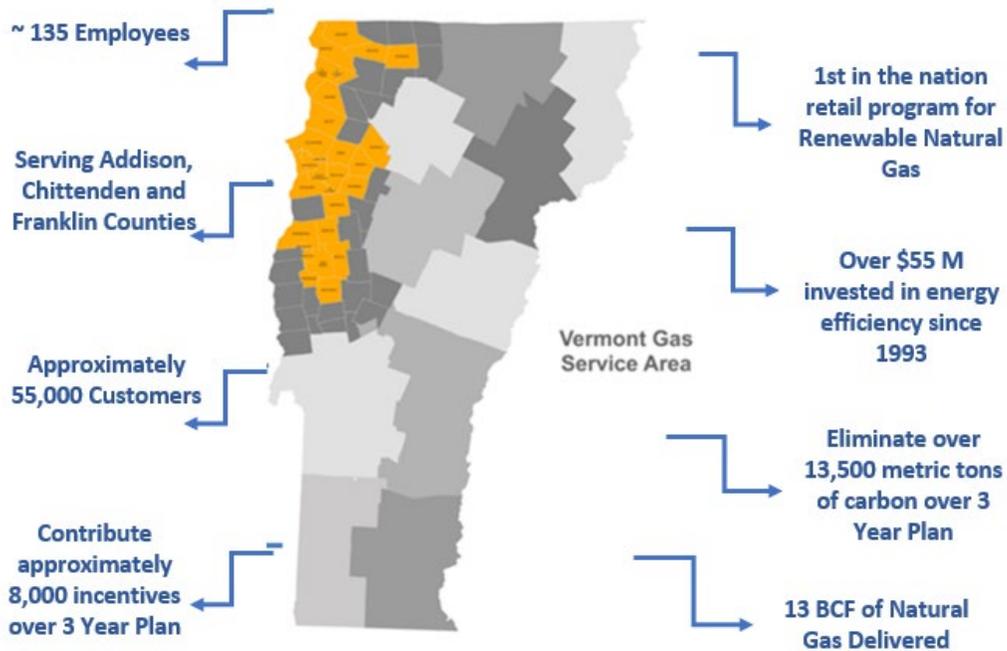
By way of background, VGS has provided customers safe, reliable, and affordable heating since 1966 and serves over 55,000 customers in three counties in Northwestern Vermont. The

<sup>1</sup> Examples of initiatives taken within both VGS’s distribution utility and energy efficiency utility.

<sup>2</sup> The Global Warming Solutions Act (“GWSA”) is an effective path to cut climate pollution and build resilient communities in Vermont. The GWSA builds on the success of other New England states that have cut climate pollution while growing their economies. The law ensures that Vermont takes coordinated and strategic action to reduce greenhouse gas emissions to net zero by 2050 and build climate resilient communities. It also allows Vermonters to hold the state accountable to ensure real action is taken to reduce our state’s polluting emissions.

company expanded its product offerings in 1992 when it began offering efficiency services to customers. This service offering was formalized in 2016 when VGS was appointed an an EEU.

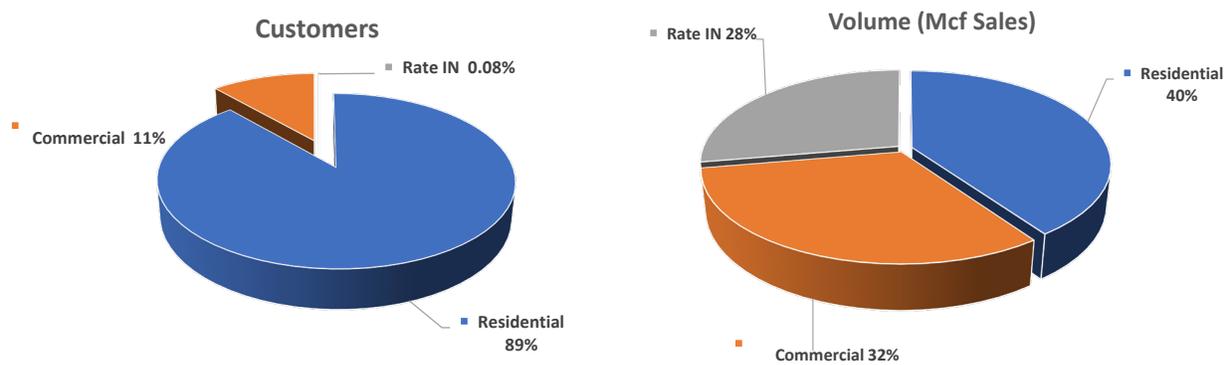
### VGS At-A-Glance



VGS has strong customer relationships with homeowners, renters, builders and developers, large and small commercial customers, and institutional customers such as K-12 schools, hospitals, colleges, and municipalities. The Company is committed to customer safety, exceptional service, supporting Vermont climate policy, and keeping rates affordable, especially for low- and moderate-income customers who are most energy burdened. In addition to its energy efficiency programs, VGS offers a range of supports for customers. Examples include help with managing bills, income-eligible discounts, equipment rentals, and service contracts to assist customers in maintaining the safe operation of their heating equipment.

Consistent with its Climate Plan, VGS has embraced innovation to ensure a smooth transition to decarbonized energy. In 2021, the Company was the first gas-only utility in the country to offer HPWHs alongside its gas water heating appliances. VGS was also the first natural gas utility in the nation to offer its customers the opportunity to purchase renewable natural gas (“RNG”) created from digesters at farms, waste-water treatment plants, and landfills. VGS has since prioritized affordable alternative supply to displace fossil gas, including local RNG and green hydrogen development.

Residential VGS customers comprise almost 90% of the customer base and from a sales volume perspective they represent approximately 40% of natural gas sales.<sup>3</sup> The firm commercial and industrial customers that fall under the EEU make up about 10% of the customer base and almost 60% of gas sales as reflected in the following two charts.<sup>4</sup>



VGS fully participated in the Demand Resource Proceedings<sup>5</sup> (“DRP”) update process. This included the potential study conducted by the Department, resource acquisition (“RA”) modeling scenarios and budgets, rate and bill impacts, quantifiable performance indicators (“QPI”), minimum performance requirements (“MPR”) as well as development and support services (“DSS”), and culminated in this Plan. VGS submits this Plan with a focus on the three-year period for 2024-2026 pursuant to the responsibilities of VGS to deliver EEU services. This Plan is designed to benefit Vermonters, contribute towards Vermont’s energy and environmental goals, as well as support the state’s economy through offering a comprehensive and evolving suite of energy services.

This Plan will continue the Company’s commitment to aggressive energy efficiency in Addison County, VGS’s newest market, via an array of comprehensive thermal energy efficiency programs to achieve a minimum 30% participation rate in the Addison market.<sup>6</sup> VGS will continue to increase the focus on education, outreach, and tailored marketing in Addison

<sup>3</sup> VGS customers eligible for participating in EEU activities refers to those customers that are charged EEC rates on their natural gas bills, pursuant to 30 V.S.A. § 209(d)(3), the proceeds from which are used to fund energy efficiency services delivered in multiple natural gas distribution utility service territories. The customers included in the VGS EEU portfolio pertain to all retail customers including all residential, firm commercial as well as retail interruptible customers. Customers excluded from EEU activities are those receiving wholesale sales of natural gas as well as those opting out to participate in the Self-Managed Energy Efficiency Program “SMEEP”.

<sup>4</sup> These charts reflect only those customers participating in EEU programs.

<sup>5</sup> Pending final PUC approval in Case 22-2954 PET. VGS filed a compliance filing with tables of budgets on 10/26/2023 and a revised compliance filing on 11/7/2023.

<sup>6</sup> See Order dated February 4, 2021 in Case No. 19-3272-PET approving MPR #14. VGS only counts an Addison County participant once even if they participate more than once, for example, by installing high efficiency equipment and weatherizing their home. VGS engages both new customers and existing customers in Addison County.

County to encourage those customers to implement energy efficiency measures at a more aggressive pace than has been realized in past expansions into new communities.

VGS will also continue its integrated energy service programs beyond our EEU, working closely with our sales and marketing team along with the field services and customer care departments. This ensures that VGS can create a holistic customer experience based on an individual's energy, financial, comfort, or climate goals.

To meet the needs of our diversified customer base, VGS is committed to serving all customers through its energy efficiency programs, with a growing priority given to low- and moderate-income customers who are energy burdened. VGS currently offers six energy efficiency programs, distinguished between the markets they serve: residential and commercial/industrial ("C&I") customers. The three residential programs are offered to residential properties (tenant 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.<sup>7</sup> In each market, VGS's programs cover retrofit/weatherization, new construction, and equipment replacement. Further program descriptions with more detail are contained later in this report.

VGS's successful efficiency programs strive to improve building performance and deliver tangible benefits to the customer such as lower energy burden, improved comfort, healthier indoor environments, lowering greenhouse gas emissions, and adding appreciable value to the customers' property.

To achieve the QPIs and MPRs approved by the PUC and set forth in this Plan, VGS will build on the strong foundation of these successful programs, as well as develop new and innovative ways to deliver energy efficiency, including developing new local, state, and national partnerships. VGS is committed to further the State's Energy Goals set forth in 10 V.S.A. § 578, 580, and 581 by decreasing greenhouse gas emissions, reducing the annual fuel needs in customer's served by VGS, and prioritizing the needs of low-to-moderate income Vermonters. This Plan expands upon our past efforts with a targeted focus on enhancing equity, access, and participation in our programs for income-qualified customers and underserved businesses.

## Strategies to Achieve Efficiency Goals

To achieve our efficiency goals VGS will perform on these key strategic objectives:

<sup>7</sup> Excludes Wholesale CNG served under one of the VGS CNG tariffs and customers participating in SMEEP.

**Partnership Development:** Advancing energy efficiency programs will be achieved through partnerships, collaboration, and creatively addressing the many market barriers that exist for our customers and trade allies. VGS will work closely with existing and potential customers, trade allies, utilities, and other market actors to ensure we can explore and contribute to mutually beneficial ideas, projects, and initiatives. VGS will continue its investment in these relationships to leverage the diversity of skills, experience, perspectives, and resources needed to deliver value to our customers.

**Develop operational resources:** VGS expanded its team of residential energy auditors from two to three full-time staff members in 2021 in efforts to ramp up our residential weatherization efforts. In 2022 VGS expanded its commercial team by adding another energy consultant. This addition brings our commercial team to two full-time energy consultants, a key account manager, and a subcontracted consulting engineer to assist with large projects. We plan to add additional resources to increase our engagement with both residential and commercial customers and to foster productive relationships with trade ally and program partners. VGS will also explore new service delivery methods such as midstream incentive offerings and seek new ways to utilize data to create and deliver customer value. As previously mentioned, the EEU program leverages the myriad ways we engage directly with customers through our field service team, sales team, and call center. We will continue to advance their education and knowledge around energy efficiency to ensure customers are getting the benefit of VGS's full range of services. In 2024-26, we will continue to make changes to our website and online services (such as MyMeter, which provides customers with easy access to their natural gas cost and consumption data) to provide easy and clear paths to program participation, incentive changes, and new initiative promotion.

**Expand contractor availability:** All efficiency providers face the challenge of a constrained contractor workforce. VGS will work closely with Efficiency Vermont, weatherization contractors, workforce training programs, and local income-eligible opportunity offices, such as Champlain Valley Office of Economic Opportunity (CVOEO), to support the contractor community as it strives to meet the expected increase in thermal efficiency work in the years ahead. VGS will continue to be an active collaborator within the Energy Action Network's "Weatherization at Scale" Coalition, where weatherization workforce continues to be a major topic necessitating broad and cross-functional solutions.

## Total VGS Energy Efficiency program budgets and savings goals

The budgets and savings goals proposed are based on a combination of historical VGS performance data, the potential study conducted by GDS and Cadmus<sup>8</sup>, Efficiency Vermont, Burlington Electric Department (“BED”), the Department, federal and state policies and codes, the accelerating electrification of space heating and hot water systems across our service territory, projected data, and rate and bill impacts. The annual Mcf savings goals presented in this Plan directly match those resulting from the above-mentioned potential study. The program costs are based on a combination of current and historical program performance, workforce trends, current market conditions, and the potential study.

A summary of VGS’s RA budgets based on spending, savings, annualized, lifetime, and peak day (Mcf) natural gas savings levels and total resource benefits<sup>9</sup> (“TRBs”) during the performance years outlined in this Plan are shown in the following table.

### Total Proposed Program Sector Budgets, Annual, Lifetime and Peak (Mcf) Savings Budgets

		Budget			(2024-2026)
		2024	2025	2026	3 Yr Total
Natural Gas RA Acquisition	VGS EE Delivery	\$5,898,686	\$5,974,400	\$5,755,794	\$17,628,880
	Mcf Savings	83,696	84,025	81,132	248,853
Summary of Costs	Commercial	\$1,868,240	\$1,794,265	\$1,664,114	\$5,326,619
	Residential	\$4,030,446	\$4,180,134	\$4,091,681	\$12,302,261
	Total	\$5,898,686	\$5,974,400	\$5,755,794	\$17,628,880
Summary of Mcf Savings	Commercial	52,658	51,441	48,512	152,611
	Residential	31,038	32,584	32,620	96,242
	Total	83,696	84,025	81,132	248,853
Summary of Peak Mcf Savings	Commercial	217	214	204	635
	Residential	244	254	251	749
	Total	461	467	455	1,384
Yield Rate (\$/Mcf)	Commercial	\$35	\$35	\$34	\$35
	Residential	\$130	\$128	\$125	\$128
	Total	\$70	\$71	\$71	\$71
<b>Total Resource Benefits (TRB)*</b>		<b>\$9,410,909</b>	<b>\$9,447,879</b>	<b>\$9,122,595</b>	<b>\$27,981,383</b>

<sup>8</sup> Consultants for the Department who performed the 20-year potential study.

<sup>9</sup> \* TRB updated based on most recent PUC approved AESC

The following Table reflects the associated proposed savings (Mcf) and carbon emissions avoided (metric tonnes).

Carbon Emission Savings CO2 metric tonnes	Budget			(2024-2026)
	2024	2025	2026	3 Yr Total
<b>Total Annual lifetime Savings (Mcf)</b>	<b>1,433,585</b>	<b>1,440,320</b>	<b>1,391,337</b>	<b>4,265,242</b>
<b>Lifetime GHG Annual Carbon Emissions</b>	<b>78,896</b>	<b>79,267</b>	<b>76,571</b>	<b>234,733</b>
<b>Annual Mcf Saved</b>	<b>83,696</b>	<b>84,025</b>	<b>81,132</b>	<b>248,853</b>
<b>Annual GHG Carbon Emissions savings</b>	<b>4,606</b>	<b>4,624</b>	<b>4,465</b>	<b>13,695</b>

To achieve our goal of increasing energy efficiency savings, VGS will be creative, nimble, and flexible in response to market conditions and customer demands. With this Plan, VGS has committed to an expanded number of low- and moderate-income program participants and increased collaboration with its trade allies, weatherization contractors, and retail and wholesale distributors across its footprint. Due to increasing energy codes, a significant move towards electrification of thermal energy systems in the new construction market, higher material costs, and labor constraints, VGS has anticipated higher EEU spending when compared to historical performance periods. This spending includes the continuation of the innovative approach of using our own capital resources as a component of the overall budget. Similar to 2021-2023, the capital funding will be treated like an investment and will be recovered in a manner that mitigates the rate impact and puts energy efficiency into a similar recovery framework as other infrastructure investments. VGS retains the ability to adjust strategies to achieve these objectives within its QPI and MPR framework because the EEU regulatory framework is sufficiently flexible to allow this responsive approach.

While specific strategies will evolve over time, we know that continued positive relationships with Efficiency Vermont, Burlington Electric Department, Green Mountain Power, Vermont Electric Cooperative, Vermont Public Power Supply Authority, Champlain Valley Office of Economic Opportunity, the Department, Green Mountain Credit Union, third party contractors, as well as communities within our footprint and associated organizations will be critical to achieving these aggressive goals. These collaborative relationships are instrumental in planning, marketing, implementing, and sharing of costs and services that enable VGS to have successful energy efficiency programs while working to keep costs and rate impacts as low as possible.

During the Plan Period of 2024-2026, VGS's energy efficiency strategies and initiatives include:

- Increasing the number of residential units audited and weatherized with an increased focus on income-eligible customers through increased incentives and low-cost financing, including health and safety measures in a comprehensive package;
- Addressing shifts in economic & social realities due to the COVID-19 pandemic and modifying financing and incentive structures to enable both contractors and customers to have the confidence and financial support to move forward on energy efficiency projects;
- Aggressively marketing all efficiency programs to increase general awareness and participation levels;
- Continuing the partnership with BED on multifamily properties with high energy use intensity, as well as collaborating with BED on their NetZero Energy initiative and District Energy;
- Continuing the partnership with Efficiency Vermont on collaborative efficiency offerings and seamless customer engagement across all of our programs;
- Continuing the partnership with CVOEO to expand resources to serve the low-income households within our service territory;
- Promotion of Weatherization Repayment Assistance Program ("WRAP") to enable customers to weatherize their homes through on-bill financing;
- Continuing our collaboration with income-eligible housing providers to support affordable housing goals by reducing customer energy burdens;
- Exploring new partnerships to extend our engagement on weatherization programs and increasing the weatherization contractor base;
- Transitioning our equipment rebate programs to a midstream incentive model to spur increased program participation through working more closely with distributors and trade allies;
- Expanding our engagement with HVAC contractors, mechanical insulators, and other service providers to drive high-performance equipment installations and energy efficiency upgrades;
- Developing a set of enhanced rebate offers and marketing collateral for small and medium businesses;
- Developing partnerships with the Vermont Office of Professional Regulation, Division of Fire Safety, Home Energy Raters, and other key stakeholders to provide ongoing education to contractors about the requirements of the Residential Building Energy Standards and cost-effective ways to achieve net-zero homes;
- Collaborating with other VGS customer-facing teams, including Sales & Marketing, Field Services, and Customer Care, to deliver upon a model of integrated energy services to

- ensure a holistic customer experience with every VGS interaction;
- Continuing our partnership with Green Mountain Credit Union and exploring new ones with the Vermont Housing Finance Agency to offer a variety of financing options for energy efficiency upgrades;
  - Exploring funding opportunities through the Inflation Reduction Act to help residential and business customers leverage additional funding, tax credits, and deductions to accelerate their energy efficiency investments;
  - Continuing the residential mobile home and condominium initiatives;<sup>10</sup>
  - Continuing partnership with the Burlington International Airport on the implementation of their BTV Sound Mitigation plan;<sup>11</sup>
  - An expanded partnership with NeighborWorks of Western Vermont to support the Weatherization & Health Initiative;
  - Monitoring for opportunities for modifications to the Plan (with PUC approval) specifically on special projects that may require additional funding.

The next section of this Plan addresses the overall RA budgets and savings, followed by the programs the Company will offer to achieve those results.

## Resource Acquisition Program Descriptions

The following section offers program descriptions and more detail regarding incentives, initiatives, and program offerings. While the descriptions and incentives described here reflect VGS's current thinking and plans, VGS will adjust its delivery of efficiency offerings as needed to meet program goals and respond to customer demands. This flexibility, within the parameters of the Commission-approved budgets, QPIs, and MPRs, is critical in maintaining vibrant, responsive, successful programs.

The tables below contain the program level proposed RA budgets and corresponding savings by sector. The residential sector spending is budgeted to be approximately 70 percent of the total resource acquisition spending, which is consistent with the large percentage of the customer base they represent, mature programs, and more challenging markets to serve such as rentals and income-qualified households, that result in higher costs.

<sup>10</sup> See "Program Descriptions – Residential Retrofit/Weatherization" for more detail

<sup>11</sup> See "Program Descriptions – Residential Retrofit/Weatherization" for more detail.

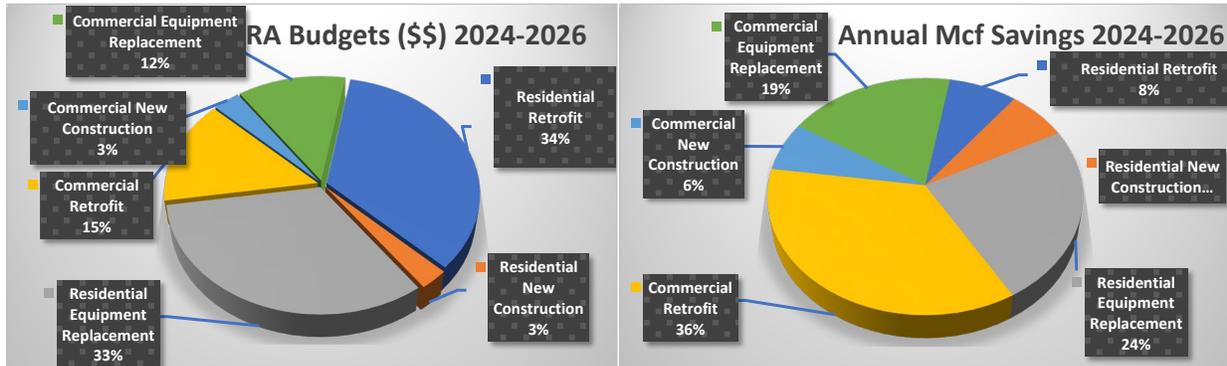
Total VGS RA Proposed Spending Budgets by Program by Sector

VGS EEU RA Budgets	Budget			(2024-2026)
	2024	2025	2026	3 Yr Total
<b>Residential Sector</b>				
Retrofit	\$2,058,959	\$2,070,040	\$1,925,322	\$6,054,321
New Construction	\$172,229	\$165,637	\$154,041	\$491,907
Equipment Replacement	\$1,799,258	\$1,944,458	\$2,012,318	\$5,756,034
<b>Commercial Sector</b>				
Retrofit	\$897,534	\$863,128	\$802,830	\$2,563,491
New Construction	\$194,174	\$186,733	\$173,676	\$554,583
Equipment Replacement	\$776,532	\$744,405	\$687,608	\$2,208,544
<b>Subtotal Residential</b>	\$4,030,446	\$4,180,134	\$4,091,681	\$12,302,261
<b>Subtotal Commercial</b>	\$1,868,240	\$1,794,265	\$1,664,114	\$5,326,619
<b>Total</b>	<b>\$5,898,686</b>	<b>\$5,974,400</b>	<b>\$5,755,794</b>	<b>\$17,628,880</b>

Total Proposed VGS RA Annual (Mcf) Savings by Program by Sector

VGS EEU RA Mcf Savings	Budget			(2024-2026)
	2024	2025	2026	3 Yr Total
<b>Residential Sector</b>				
Retrofit	6,461	6,543	6,121	19,125
New Construction	5,945	5,759	5,387	17,091
Equipment Replacement	18,632	20,282	21,112	60,026
<b>Commercial Sector</b>				
Retrofit	30,981	30,010	28,076	89,067
New Construction	5,745	5,565	5,206	16,516
Equipment Replacement	15,932	15,866	15,230	47,028
<b>Subtotal Residential</b>	31,038	32,584	32,620	96,242
<b>Subtotal Commercial</b>	52,658	51,441	48,512	152,611
<b>Total Annual Savings (Mcf)</b>	<b>83,696</b>	<b>84,025</b>	<b>81,132</b>	<b>248,853</b>

Spending and savings may vary between individual programs and sectors as VGS focuses on achieving the overall QPIs and MPRs described later in this document. The following pie charts reflect a side-by-side comparison of the proposed spending relative to savings by program for the performance period 2024-2026.



## PROGRAM DESCRIPTIONS

### 1. Residential Retrofit/Weatherization Program

The Residential Retrofit/Weatherization Program focuses on reducing the energy use in existing residential homes and buildings. Since residential customers can vary significantly based on energy usage, home ownership, and income levels, VGS has evolved its audit and weatherization offerings to address these various market segments. These services include a comprehensive energy audit and weatherization project management via our “FastTrack” program, access to incentives and financing for projects pursued with Efficiency Excellence Network contractors, prescriptive initiatives for condos and manufactured housing, and “energy coaching” – all aimed at increasing the number of homes weatherized and meeting the customer’s needs. Energy efficiency is an important tool for improving housing affordability and VGS continues to advance more of its focus and resources on income-qualified customers to help support a just transition for all Vermonters.



A VGS Residential Auditor preparing a blower door test on a home. The blower door test provides a baseline measurement for building heat loss. This test is conducted during the audit and after a project is completed.

## Weatherization Services

All VGS residential customers are eligible for participation in our Retrofit/Weatherization program. Residential buildings (single family homes and multi-family with 4 units and under) that meet our high usage criteria are eligible for a comprehensive energy audit from our expert Building Performance Institute (“BPI”) certified staff. VGS will be adapting these energy usage thresholds and program offerings to prioritize serving more income-qualified customers through our in-house program. Residential buildings that fall below our high usage criteria are eligible to participate in our program in partnership with qualified third-party BPI-certified contractors that are part of the Efficiency Excellence Network. Residential buildings occupied by owners or tenants with low natural gas energy intensity qualify for an in-person or virtual “energy coaching” consultation to better understand their heating profile and help identify opportunities for low-cost ways of improving their homes and reducing their energy burden. This consultation may also include the delivery of energy-saving kits that contain water conservation measures, air-sealing materials, and other items designed to reduce energy use.

For customers who pursue a weatherization project, VGS covers up to 50% of the qualified measure costs in cases where the building owner pays the heating bill and up to 75% of the measure cost in cases where the tenant pays the heating bill. An incentive cap will be utilized to manage overall program costs and ensure funding access for all who choose to participate.

To further help customers with the costs of weatherization, VGS will continue to offer low-cost financing through interest rate buydowns and the new Weatherization Repayment Assistance Program. VGS will also allow health and safety measures<sup>12</sup> that impede a project from moving forward to be incorporated into the loan on a case-by-case basis.



A comprehensive home audit requires close inspection of the conditions where heat loss or air infiltration can happen. It's hard to see everything but with infrared technology and sturdy knees the remedy can be determined.

In addition to financial incentives, building owners are provided with technical assistance and project management services to encourage the installation of the efficiency measures identified in the audit report. Once an audit is

<sup>12</sup> Typical health and safety measures included in low-cost financing include vermiculite and asbestos remediation, the removal of knob and tube wiring, moisture mitigation, and upgrading ventilation systems.

completed, customers have the choice of obtaining competitive bids from qualified contractors or using VGS’s “FastTrack” option which provides the customer with an easy hands-off approach to getting their weatherization work completed. The FastTrack option utilizes one of our pre-screened contractors to perform the project work. The VGS auditor serves as the project manager from start to finish. For the past several years, approximately 90% of customers have chosen the FastTrack option.

### **Programs for Low- and Moderate-Income Customers**

Low-income customers will be served primarily through partnerships with CVOEO and 3E Thermal, who will verify the owner/occupant income status and eligibility to perform the energy audit and will coordinate the installation of the recommended measures. VGS will contribute a portion of the project implementation costs along with helping address health and safety issues that may prevent a weatherization project from moving forward. Historically, VGS has budgeted for 30-50 low-income participants annually in the joint income-eligible program. Based on estimates from CVOEO and 3E Thermal, we anticipate that number to effectively double in 2024-26, with an additional 30-50 low-income participants served each year. VGS will also be expanding its offerings for low-income customers with new targeted measures including storm windows, insulating panels, duct sealing, pipe insulation, and optimizing water heating temperatures.

VGS initiated a 2022 program change to assist moderate-income households (80%-120% of area median income) who don’t qualify for reduced low-income assistance program (“LIAP”) utility



reduced rates and who may not have access to other forms of assistance such as the Weatherization Assistance Program (<80% of area median income). For these moderate-income customers, VGS will continue the increased levels of incentive contributions to 75% of the project costs during 2024-26. <sup>13</sup> Of the area VGS serves, 120 percent of the area median income (“AMI”) for a family of four ranges from approximately \$119,000 in Addison County to approximately \$136,000 in Chittenden and Franklin Counties. VGS believes this will help enable more moderate-income customers weatherize their homes and reduce utility bills.

<sup>13</sup> VGS will apply cap amounts on single family homes and continue initiative pending program budgets.

## WRAP On-Bill Financing for Moderate-Income Customers

In late 2021 and 2022, VGS, Efficiency Vermont, the electric distribution utility companies, and Vermont Housing Finance Agency (“VHFA”) all worked together to implement the Weatherization Repayment Assistance Program (“WRAP”). This program was designed to enable income-qualified customers to access on-bill financing of weatherization project costs to reduce or eliminate upfront costs to make these improvements. Energy savings estimated are meant to offset the monthly tariff-on-bill charge utilized to finance weatherization improvements to the home. During 2024-26, VGS will work with customers who have already completed an energy audit but haven’t moved forward due to the upfront costs, in addition to promoting this financing program to new income-qualified weatherization customers. Not only will the customer realize energy savings but also benefit from improved comfort levels by making homes less drafty along with better indoor air quality.



## Prescriptive Initiatives for Condos and Manufactured Housing

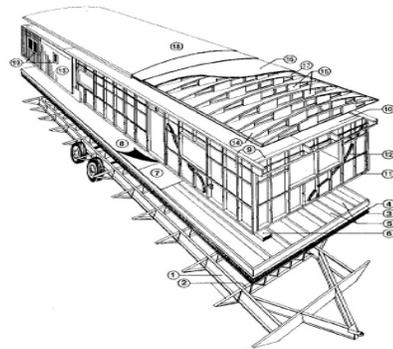
VGS will continue to offer its “Condo Initiative” promoting air-sealing and attic insulation for condominiums. Historically, it has been difficult to cost-effectively provide weatherization services to condominiums. The Condo Initiative has addressed this challenge by streamlining the standard audit approach. The Condo Initiative provides that VGS will:

- Visit the condominium to conduct a “walk-through” audit to look for additional efficiency upgrades beyond air-sealing and attic insulation;
- Review both natural gas and electric usage to compare to other units in the building;
- Offer rebates/financing for air-sealing and attic insulation work completed; and
- Inspect the installation at no cost to the homeowner.



Townhouses and condominiums can be excellent weatherization opportunities, especially when the development can be addressed as a single project.

Similarly, manufactured homes have been a difficult market to reach. VGS is addressing this challenge through its Mobile Home Prescriptive Weatherization Program. Customers who own a mobile home will receive a rebate of 75% of the total implementation costs up to project caps. Low-income customers who are not otherwise participating in the CVOEO program are eligible for 100% of the total implementation costs from VGS.<sup>14</sup> VGS will approve the project with the homeowner, execute an agreement, submit the rebate, and inspect the final job at no extra cost.



Typical components of a mobile home: 1-Steel chassis. 2-Steel outriggers and cross members. 3-Underbelly. 4-Fiberglass insulation. 5-Floor joists. 6-Heating/air conditioning duct. 7-Decking. 8-Floor covering. 9-Top plate. 10-Interior paneling. 11-Bottom plate. 12-Fiberglass insulation. 13-Metal siding. 14-Ceiling board. 15-Bowstring trusses. 16-Fiberglass insulation. 17-Vapor barrier. 18-Galvanized steel one-piece roof. 19-Metal windows.

### Other Residential Strategies

VGS will continue to proactively seek and develop partnerships and strategic initiatives to amplify our program resources and deliver customer value. For example:

- In Addison County, VGS will continue partnering with Heat Squad by NeighborWorks and others to deliver residential weatherization services.
- VGS will support community events such as Button Up as well as Vermont- and Town Energy Committee-sponsored activities throughout the year.
- VGS will promote and incentivize additional weatherization work as an additional component of the BTV Sound Mitigation Program.
- VGS is an active partner with BED and other market actors in the Burlington 2030 District which aims to develop relationships and affect commitments from property owners to achieve clean energy goals.<sup>15</sup>
- VGS is a collaborator with Efficiency Vermont, BED, and the Northeast Energy Efficiency Partnership for the continued development of the Vermont Home Energy Profile to help create visibility around energy use as part of the home-buying experience.<sup>16</sup>
- VGS has served as a partner with Efficiency Vermont, BED, CEDO, and RESOURCE in a weatherization contractor training program, which has now expanded to multiple sites statewide, and will actively seek other innovative models to expand the number of professionals in the weatherization market.

<sup>14</sup> A low-income customer means a customer in the low-income assistance program (“LIAP”) or receiving another form of heating assistance.

<sup>15</sup> See <https://www.2030districts.org/burlington>

<sup>16</sup> See <https://www.efficiencyvermont.com/services/energy-assessments/vermont-home-energy-profile>

## Burlington International Airport (“BTV”) Sound Mitigation Project

Between 1989 and 2019 Burlington International Airport implemented a federally funded program that acquired and removed sound-impacted homes. In late 2020 a new program (BTV Sound Mitigation Program) was formally approved. The new program is focused on sound insulation as the primary noise mitigation measure. Under this program, the Airport will qualify homes for retrofits such as window and door replacements, central air conditioning, insulation, and air sealing. During 2020 VGS pledged to partner with the Airport and provide the local 10% match required for the BTV Sound Mitigation Program. Initially VGS anticipated the BTV Sound pilot program to begin in 2021. However, this pilot timeline was moved forward to 2022 with a small cohort of homes (12) that were provided a VGS energy audit along with projected costs and energy savings to use as a set of baseline metrics for the project. VGS and the Airport are looking for additional partners to comprise the remainder of the 10 percent local funding match and expecting an estimated 50 homes annually during the 2024-26 performance period. VGS will continue its regular meetings with the Airport and partners as this project advances through the following:

- Program formulation
- Identify additional funding partners
- Home eligibility/criteria determinants
- Pre-qualification of 50 home cohort
- Establish program standards
- Implement pilot phase for sound insulation
- Develop and create public outreach campaign that defines the program and qualifications
- Assist the Burlington Airport in reviewing the program and approach with the FAA



## City of Burlington Multi-Family Dwellings & Net Zero Roadmaps



### Burlington Minimum Housing Code Weatherization Ordinance

VGS and BED continue to build upon learnings from the very successful 2016-17 Energy Champ pilot program that focused on addressing weatherization opportunities in tenant-occupied multifamily properties. This will include jointly offering additional incentives for homes that are projected to save both natural gas and electricity through shell improvements that reduce thermal energy needs, whether gas-fired equipment, electric

resistance heat, heat pumps, or air conditioning. In 2024-26 VGS will continue to support Burlington’s update to the Minimum Housing Code to include weatherization and energy efficiency in rental properties by providing incentives and low-cost financing to help defray the upfront costs of pursuing cost-effective weatherization upgrades. Additionally, VGS and BED are working together to help Burlington residents create a net zero road map of their home by utilizing incentives, equipment replacement, and renewable natural gas offerings. VGS and BED will also continue to jointly complete homes with BED offering additional incentives for homes that are projected to save electric usage based on shell improvements (reduction in both electric resistance heat and air conditioning).

### **Residential Weatherization/Retrofit Summary**

The Plan assumes an increase in weatherization participants during this performance period. The results of this Plan along with a goal of increasing participants will further VGS’s path to increase the number and depth of weatherization projects. The weatherization increases will be based on a combination of:

- Single-family homes
- Multifamily properties
- Condominiums
- Mobile homes
- Income eligible services

### **2. Residential New Construction Program**

It is far more cost-effective to build highly efficient homes than to retrofit a structure after it is built. VGS will continue the statewide Residential New Construction (“RNC”) program offered jointly by VGS and Efficiency Vermont. With an increasing number of new construction projects pursuing electric heat pumps as the primary heating and domestic hot water systems, a coordinated approach is important to ensure consistency of program delivery across service territories. The EEU’s jointly serve customers in the VGS footprint with Efficiency Vermont serving the remainder of the state. All residential new construction projects in



As building code for new constructions increase, VGS will continue to provide incentives and technical support for advancing efficiency on equipment and thermal shell measures.

Vermont are eligible for technical assistance and incentives from Efficiency Vermont, but projects that use natural gas are also eligible for enhanced services and rebates from VGS. Efficiency Vermont provides services in support of the construction of homes meeting specific levels of energy performance. Efficiency Vermont and VGS will continue its engagement of builders and developers strategically by providing target levels and types of support based on builders' goals, knowledge, skills, and interests. This will allow for a wide range of engagement up to and including a net-zero ready home standard. VGS is also developing partnerships with the Vermont Office of Professional Regulation, Division of Fire Safety, Home Energy Raters, and other key stakeholders to provide ongoing education to contractors about the requirements of the Residential Building Energy Standards and cost-effective ways to achieve net-zero homes.

This program structure is being modified to a more market-based approach through account management of builders and developers via the Efficiency Excellence Network ("EEN"), which includes direct consultation with Efficiency Vermont Energy Consultants on project design/planning and program-related questions. Members will have access to products and services that allow for market differentiation with a proposed framework that includes two membership tiers: (1) Residential Construction Expert and (2) Efficiency Vermont certified builder. Accordingly, there will be corresponding requirements, benefits, certificates, and incentives based on the membership tier. The program structure has evolved to eliminate what had been perceived by some builders as an "all-or-nothing" approach that allows participation in a wide range of activities.

The VGS multifamily building track is for large, master metered, centrally heated multifamily buildings. For multifamily buildings heated by natural gas, VGS will offer technical analyses of mechanical, thermal, and domestic hot water energy efficiency measures, and will partner with other EEU's when appropriate to maximize the savings opportunities in these projects. VGS is focused on increasing participants by maintaining a relationship with builders and a focus on new developments or major renovations to drive participation. This program is designed to ensure new construction projects do not become lost opportunities for constructing high-performance buildings; engaging architects and builders to participate on the ground level is the most cost-effective way to save energy. Multifamily projects that are designated for occupancy by low-income populations are co-administered with CVOEO or 3E Thermal as described above.

### 3. Residential Equipment Replacement

This program is aimed at encouraging customers to install high efficiency equipment when they are either adding or replacing natural gas-fired equipment. This is an opportunity for influencing choices to reduce usage over the life of the new equipment.

This program encourages customers to install water and space heating equipment that exceeds the standards established by the National Appliance Energy Conservation Act (NAECA) or the *de facto* baseline efficiency for the specific equipment type. These replacements typically occur when the equipment has failed and can no longer be repaired, has reached the end of its useful life, or when the fuel source for heating the home is being switched to natural gas.

VGS is in a unique position to encourage the purchase of high efficiency equipment due to our Field Services team. This team of 20+ technicians visit thousands of in-home service requests each year, providing both tariffed and non-tariffed services, and ensuring that our customers have safe and properly functioning equipment. When our team discovers equipment that has reached the end of its useful life, these technicians encourage customers to install high efficiency equipment and inform customers of the EEU rebates. Income-eligible customers who contact the VGS Customer Care Team who may have high usage will be referred to CVOEO for weatherization services as discussed earlier in this Plan or referred for the EEU department for equipment change outs. These are further examples of the synergies possible in our integrated energy services program.

Customers will receive midstream incentives at the point of purchase at the distributor to help offset the average incremental cost of high-efficiency equipment. VGS plans to monitor participant levels and revise incentives as needed based on participant levels and changing markets and budgets. VGS also plans to include low-cost financing for moderate-income households in addition to the midstream rebate. In addition to these prescriptive rebates, VGS will work with wood stove retailers to offer incentives on advanced wood heating systems that displace natural gas heating. VGS is exploring how to work with distributors and contractors to transition many of these incentives to a model where incentives are applied at the point of purchase to help expand our impact to more installations of high-efficiency equipment, streamline our administrative processes, and transform the gas-fired equipment market here in Vermont.

Because customers have different financial situations, VGS also offers a range of incentives to best fit customer needs. In lieu of the rebates listed above, customers may elect low- interest

loans for high-efficiency equipment through VGS's partnership with Green Mountain Credit Union.

VGS will continue its partnership with Efficiency Vermont to incentivize "Smart Thermostats" to all VGS customers. VGS will monitor advances in Smart Thermostats, Smart Meter, and Smart Grid (for natural gas systems) to determine if these technologies can increase customer engagement, reduce consumption, and shave peak periods.



Smart thermostats provide customers with value on multiple fronts: easy time-of-day scheduling for desired temperatures and ensuring cost-savings during unoccupied periods.

To better track participation by the income-eligible sector, VGS will internally flag participants who receive fixed rebate incentives in the equipment replacement program that are also enrolled in VGS's low-income assistance program (LIAP) or receive other forms of heating assistance. Income-eligible customers who have high usage will be referred to CVOEO for weatherization services as discussed earlier in this Plan.

#### **4. Commercial Retrofit Program**

The Commercial Retrofit Program helps customers reduce natural gas consumption and peak day demand in their buildings. VGS will engage with commercial customers to install cost-effective, natural gas-saving measures for their spaces, and water and process heating measures. Every business is unique, which presents distinct challenges such as identifying customized solutions, competing for capital dollars, and other business priorities related to project development and project management capacities. Additionally, the pandemic brought forth a general sense of economic uncertainty resulting in inertia with respect to facility upgrades, growth, and financial stability. To succeed, VGS will perform on the following key strategic objectives:

##### **General Services**

VGS will continue its partnerships with Efficiency Vermont, BED, and the other distribution utilities (DUs) to provide Vermont's commercial and industrial utility customers with optimal energy value and services. VGS will coordinate walk-through audits for all commercial buildings whose owners are looking for assistance in identifying cost-effective energy efficiency measures. VGS will provide engineering assistance for natural gas-related measures identified from the audits. If a project needs external engineering assistance, VGS will be available to assist with the cost of that engineering study.

## Services to Small Businesses

VGS is committed to serving Vermont's many small businesses. The Small Business Efficiency Program will include a series of targeted initiatives for foodservice operations, beverage manufacturers, lodging establishments, and grocery/convenience stores. Other small and medium business types will also be eligible for this program. VGS offers interested small business owners a customized energy audit to determine potential weatherization and other gas-saving opportunities and incentives. Commercial initiatives being ramped up for 2024-26 include:

- Subsidized steam trap audits for beverage manufacturers being delivered by a local partner, with prescriptive incentives committed to fix or replace steam traps that are leaking or blowing by;
- Deeper engagement with foodservice operations to promote midstream incentives for Energy Star commercial kitchen equipment, kitchen hood controls, and reductions in domestic hot water use;
- Enhanced incentives for insulating and installing controls on domestic hot water loops within lodging and multifamily buildings;
- Opportunity identification and increased incentives for the addition of doors to open coolers and refrigerated cases at grocery and convenience stores;
- On-site assessment and additional incentives for the addition or upgrade of dock seals for heated loading docks.



Installing mechanical insulation on steam pipes can result in a dramatic decrease in heat loss.

## Services to Large Businesses

The largest businesses among VGS's customers are assigned a Key Account Manager. The Key Account Manager, with DU partners and EEU partners, helps large businesses identify energy-saving projects and create mid- to long-term energy savings plans. With rapidly rising prices for large boilers and heat recovery systems attributed to volatility in commodities such as steel and aluminum, shortages for controls components and circuit boards, and mechanical contractor constraints, there will be an increased focus on some of the most cost-effective ways to reduce thermal energy waste through building retrofits. VGS is working closely with trade allies who can accelerate the replacement of failed steam traps, the installation of mechanical insulation,

and retro-commissioning of building and process controls, as these services are not experiencing the same supply chain issues, workforce constraints, and price volatility of adding or replacing large mechanical systems.

### **Financial Assistance**

VGS will offer financial incentives, typically as rebates or low-to-zero interest loans, for the installation of natural gas-saving energy efficiency measures. Rebate amounts will be based on each project’s energy savings, payback, and value of the avoided cost savings to VGS ratepayers. VGS will also explore funding opportunities through the Inflation Reduction Act to help business customers accelerate their energy efficiency investments.

### **Special Projects and Energy Savings Accounts**

Occasionally, large commercial customers pursue the development of unique projects that involve both efficiency and generation. For example, VGS may assist projects that involve customer-sited generation including Combined Heat and Power (“CHP”) and distributed renewable generation if the projects meet certain technical and economic performance criteria.

VGS will jointly work with any commercial customer who is participating in the Energy Savings Account pilot (ESA). VGS will collaborate with Efficiency Vermont and ESA participants on establishing incentive splits on a project-by-project basis.

## **5. Commercial New Construction Program**

The Commercial New Construction Program (CNC) helps customers reduce natural gas consumption and peak-day demand when constructing new buildings. VGS will partner with commercial, institutional, and industrial building owners to incorporate cost-effective natural gas saving measures in both the design and construction of new buildings and in the expansion, renovation, or remodeling of existing buildings. As more new buildings electrify their primary heating and domestic hot water systems using electric heat pumps, VGS will continue partnering with the other EEU and electric DUs to ensure customers are provided with



Involving VGS Energy Leads in the new construction process can lead to unexpected natural gas savings opportunities like using the waste heat generated by refrigerator condensers to heat a grocery store.

technical expertise and available incentives from a variety of sources to design and construct high-performance buildings across our service territory.

VGS will review commercial building plans and conduct energy analysis of cost-effective natural gas saving measures. In addition, VGS will supply the customer and/or their design team with energy efficient equipment information, technical assistance, and manufacturer referrals. For measures that exceed the energy code baseline, VGS may provide financial incentives of up to 50% of the incremental cost of the measure. Local, state and/or federal energy and building construction codes establish the baseline for comparing the cost-effectiveness of the proposed natural gas saving measure(s). The *2020 Vermont Commercial Building Energy Standard*<sup>17</sup> as well as ASHRAE 90.1 -2016 establish the current baseline. The *2023 Vermont Commercial Building Energy Standard* will establish the baseline for projects after its effective date.

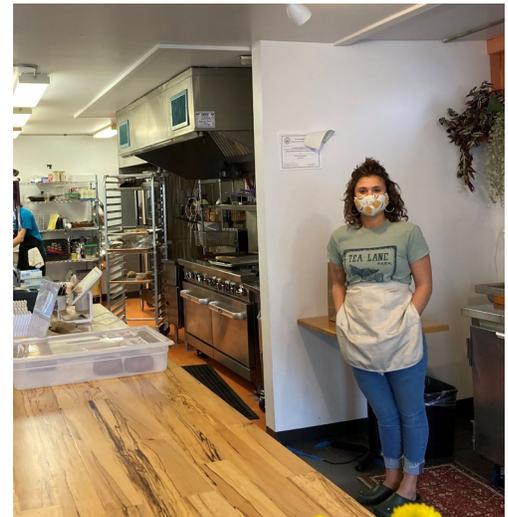
VGS will continue to collaborate with its EEU and DU partners to ensure seamless service to customers. VGS and partners will provide the customer with a holistic approach to energy efficiency savings throughout the construction process.

## 6. Commercial Equipment Replacement Program

The Commercial Equipment Replacement Program (CER) supports customer costs related to high efficiency equipment installations when the customers are either adding or replacing natural gas-fired equipment. Reaching customers at this key time can result in significant reductions in customer energy use over the life of the new equipment. This VGS program encourages commercial and industrial customers to cost-effectively install equipment that exceeds minimum energy efficiency standards.

### Eligibility

Customers wanting to participate in VGS's equipment replacement program must ensure their proposed equipment meets eligibility criteria. Large manufacturing or other types of process equipment to be installed must either be listed on VGS's fixed rebate schedule or pass VGS custom screening for cost-effectiveness. Smaller, residential-sized equipment must meet minimum standards set by the



With a rebate from VGS, a new EnergyStar certified piece of commercial kitchen equipment is cost comparable to a standard, inefficient model. A small business walk thru with a VGS Energy Lead can result in natural gas savings for both building owner and tenant.

National Appliance Energy Conservation Act (NAECA). These energy efficiency standards apply to furnaces, hot water and steam boilers, and tank-type water heaters. VGS energy specialists use the *2020 Vermont Commercial Building Energy Standard* and ASHRAE 90.1-2016<sup>18</sup> to compare energy use baselines against the minimum efficiency levels of a project's proposed piece of replacement equipment. The *2023 Vermont Commercial Building Energy Standard* will establish the baseline for projects after its effective date.

### **Financial Assistance**

VGS will offer cash rebates to reduce the incremental cost of purchasing and installing cost-effective, high-efficiency natural gas equipment as well as financing with interest buydown options.

For high-efficiency natural-gas equipment not listed in the fixed rebate schedule or when a special circumstance arises, VGS will custom-screen measures for cost effectiveness. Large-scale equipment not on the list might not have certified AFUEs and thus can be custom screened by VGS. Equipment with a benefit-to-cost ratio of greater than 1:1 will be eligible for a custom rebate.

In addition to rebates, VGS will provide engineering and analytical support at no charge to customers. For projects where specialized engineering assistance is required, VGS will assist customers in finding qualified consulting engineers, and may be able to offer additional financial incentives to offset the cost of engineering analyses.

Energy efficiency projects for interruptible customers will be treated no differently than projects for firm customers, with the exception that no peak day savings will be claimed or projected in the cost-effectiveness screening.

## **Development and Support Service Program Descriptions**

VGS spending categories are allocated into two categories: (1) Resource Acquisition ("RA"), which typically leads to some level of energy savings and (2) Development and Support Services ("DSS") that are not directly responsible for savings but contribute and support the portfolio as a whole. DSS activities are intended to advance, improve, or support energy efficiency but do not necessarily result in direct energy savings. The DSS categories in this Plan are: Education &

Training, Applied Research & Development, Planning & Reporting<sup>19</sup>, Evaluation, Policy & Public Affairs, Information Technology, and General Administration.

Further description of each category is provided below with the budgets for the 2024-2026 in the following Table.

### Development and Support Service Budgets by Category

<b>Total EEU Natural Gas EEC funded budgets 2024-2026</b>				
VGS DSS	2024	2025	2026	Total
1. Education & Training	\$80,030	\$80,731	\$81,438	\$242,199
2. Applied Research & Demonstration	\$10,621	\$10,727	\$10,834	\$32,182
3. Planning and Reporting	\$66,787	\$67,355	\$67,928	\$202,070
4. Evaluation	\$36,404	\$36,768	\$37,136	\$110,308
5. Policy and Public Affairs	\$15,610	\$15,766	\$15,924	\$47,300
6. Information Technology	\$36,880	\$37,049	\$37,217	\$111,146
7. General Administration	\$36,168	\$36,505	\$36,845	\$109,518
<b>Subtotal DSS VGS Funded</b>	<b>\$282,500</b>	<b>\$284,901</b>	<b>\$287,322</b>	<b>\$854,723</b>

#### 1. Education and Training

While VGS has knowledgeable and experienced staff and contractors, in the rapidly changing energy world it is critical to invest in education and training to ensure VGS remains current on codes, efficiency best practices, and emerging technologies. The training may include Efficiency Vermont’s annual Better Buildings by Design conference, Building Performance Institute trainings, and industry-vital seminars offered by CEE and ACEEE.

This Plan includes a continuation of our partnership with Vermont Energy Education Program (VEEP). Promoting energy literacy with K-12 students will produce more informed consumers of energy for the next generation of Vermonters.

VGS will make new efforts in support of expanding the weatherization and heating contractor base and developing the skills of the existing workforce and continue its minimum of two contractor trainings per year.

<sup>19</sup> VGS rolled the costs associated with Fiscal Agent Reporting into the DSS Planning and Reporting category.

## **2. Applied Research & Development**

This work will include those VGS efforts pertaining to keeping current with emerging new technologies, analytics, or data services geared around new concepts and technologies that are not yet proven or widely accepted. VGS's bilateral agreement with Efficiency Vermont includes a share of costs related to research and development for technology and demonstrations.

## **3. Planning and Reporting**

This DSS category represents costs associated with VGS's work to provide the Commission with monthly reports, quarterly reports, Annual Plans, Annual Reports, Fiscal Agent Reports, and the DRP process. Reporting or planning to either the Department or the Commission pursuant to the Process and Administration and Order of Appointment documents falls into this category. Work associated with energy efficiency planning pertaining to the development of VGS's Integrated Resource Planning also falls within this category.

## **4. Evaluation**

The Department annually verifies VGS savings claims. The process requires the delivery of the annual savings claims by VGS to the Department along with a sample of individual project files for review. Throughout the process, there will be a regular exchange of information and discussion regarding savings quantification methods and documentation. This process will include evaluation of methods of calculations and characterizations around basis for savings claims—whether customized or prescriptive for forecasting or claimed savings—to continuously improve savings estimates.

VGS undertakes informal evaluations of projects and periodically evaluates the cost effectiveness of new equipment and measures. VGS staff will continue its work with the Department in the development of a Technical Resource Manual ("TRM") as well as participate in Technical Advisory Groups and initiatives that pertain to benchmarking VGS programs that may result in changing baselines or savings claims.

The costs included in this category reflect VGS's costs and the cost of any consultants VGS retains to help with the evaluation process – excluding the DPS's evaluation-related costs.

## **5. Policy and Public Affairs**

VGS work that supports participation in broad energy efficiency related discussions fall under this category. Areas under this category include any regulatory matters that overlap with energy efficiency, such as Integrated Resource Planning, unregulated fuels efficiency programs, updating Process and Administration documents, Order of Appointments, as well as any policy

cases requiring tracking, filing, or commenting related to energy efficiency. The VGS internal staff time expected to be spent on that type of initiative is budgeted here.

## **6. Information Technology**

VGS's energy services database is referred to as "DSMPro." DSMPro is a Windows application that provides a structured interface for the collection of building envelope data and savings calculations in support of its energy efficiency portfolio of programs. The DSMPro database is regularly improved to help in the collection and reporting of measure, project, and program metrics. This is critical for planning, reporting, forecasting, and overall tracking. There is a regular need to modify existing tools, add new tools, and improve functionality to the system, all of which serves to better understand and respond to changes and new initiatives. VGS will also be exploring the modernization of existing software systems to lower administrative costs while improving overall program performance. Any advancement of tools or application-driven processes will be allocated in this category.

## **7. General Administration**

The overall management of the VGS costs for EEU programs that are not specific to individual programs are included under General Administration. This includes general staff meetings, coordination of program implementation across all program functions, managing and monitoring overall performance, and collaboration with other EEUs.

## **Quantifiable Performance Indicators ("QPI") and Minimum Performance Requirements ("MPR")**

The following sections describe the proposed QPIs and MPRs. The descriptions and weighting on these QPIs and MPRs were previously approved by the PUC in the previous DRP proceeding, Case No. 19-3272-PET. QPIs and MPRs are critical metrics to gauge the on-going performance of VGS's efficiency programs. These QPIs and MPRs are intended to provide a well-balanced portfolio to ensure all markets are served while providing customer benefits that contribute to policy and performance objectives.

For ease of reference, the general descriptions are detailed below and followed by the populated QPIs and MPRs in table format.

- QPI #1: The annual incremental savings QPI requires VGS to design and implement efficiency initiatives that will maximize energy savings. This QPI target includes two components: the total of the incremental annual Mcf savings achieved each year of a performance period and the greenhouse gas emissions covered over the same time

period. Each of the two parts of this QPI are weighted at 1a) 15% and 1b) 10%.

- QPI #2: The lifetime natural gas savings QPI requires VGS to design and implement efficiency initiatives that will maximize the lifetime natural gas benefits. This QPI target includes two components: present worth of lifetime natural gas avoided costs and lifetime Mcf savings. Each of the two parts of this QPI are weighted at 15% each.
- QPI #3: The peak day savings QPI requires VGS to design and implement efficiency initiatives that will maximize the capacity reduction coincident with peak day demand. The metric will measure incremental peak-day savings each year of the performance period. This QPI target is weighted at 15%.
- QPI #4: The residential single-family comprehensiveness QPI ensures that energy efficiency initiatives are designed and implemented to acquire comprehensive savings. This QPI target contains two components: the percentage of home energy audits that have cost-effective measures that are converted to measures installations within one calendar year and the percentage of installations of audit-identified, cost-effective measures within one calendar year. Each of the two parts of this QPI are weighted at 5% each. VGS tracks results for this QPI for just Addison County as well and received Commission approval to weight 4a) and 4b) at 3% Existing Footprint and 2% for Addison County.<sup>20</sup>
- QPI #5: VGS is focused on increasing the number of homes that are weatherized. This QPI identifies the number of buildings receiving an audit, which is the first step towards a weatherization project. This QPI is weighted at 5%. This QPI is based on an annual number and will help ensure VGS is on track to helping the State of Vermont achieve its weatherization goals. Through our staff and BPI contractors, audits will be available to income-eligible, moderate income, single family, multi-family, condominiums, and mobile homes.
- QPI #6: The long-term market transformation QPI encourages VGS to design and implement efficiency initiatives that lead to market transformation. The metric will measure the number of energy efficiency trainings offered to contractors to advance market transformation by having these contractors perform quality work regardless of the geographical region they are performing services within. This QPI target is weighted at 5%.

<sup>20</sup> Order dated February 4, 2021 in Case No. 19-3272-PET.

- QPI #7: The business comprehensiveness QPI requires that energy efficiency initiatives designed and implemented for commercial retrofit projects include a diverse range of installed measures. The QPI assumes the measures installed during the prior 12-months will be 5% control-related; 20% heating systems, heat recovery, or domestic hot water systems; 5% process-related; and 15% shell/other. VGS received Commission approval to split the weighted targets between the existing footprint and Addison County at 4% and 1% respectively.<sup>21</sup>
  
- QPI #8: The administrative efficiency QPI is designed to encourage administrative cost reductions as a percent of total budget. The 5% reduction remains unchanged from prior Commission approved DRP Plans. This is an indicator intended to assess operations and keep administrative costs in check. This indicator is designed to measure the administrative efficiency of program delivery. This metric offers definitions of administrative costs and requires annual reporting. The ratio of incentive costs to non-incentive costs and total administrative costs as a percent of total budget will be reflected for each reporting year. The average administrative costs for RA budgets during 2019-2021 was 10.57 percent of total RA budgets. For 2024-2026, VGS estimated that administrative costs would be 10.57 percent of the total RA budgets. Similar to 2021-2023, VGS allocated a 5% reduction of this 10.57 percent of total RA budgets.<sup>22</sup>

The following descriptions pertain to the MPRs and as such do not contain percent weighting.

- MPR #9: This indicator encourages equity for all Vermont natural gas ratepayers by ensuring that the overall natural gas benefits are greater than the costs incurred to implement and evaluate the VGS efficiency programs. This metric requires that the total verified gas benefits divided by total costs be greater than 1.2.
  
- MPR #10: This indicator encourages equity for residential customers by ensuring that a minimum level of overall efficiency effort, as reflected by spending, is dedicated to residential customers.
  
- MPR #11: This indicator is to encourage efforts to ensure that spending for low-income customers is equitably dedicated.

<sup>21</sup> See Order dated February 4, 2021 in Case No. 19-3272-PET.

<sup>22</sup> See Order dated February 4, 2021 in Case No. 19-3272-PET.

- MPR #12: This indicator encourages equity for smaller non-residential customers by ensuring that a minimum level of overall efficiency effort will be dedicated to small commercial accounts. This metric requires a minimum level of participation by customers whose annual natural gas usage is 600 Mcf per year or less. This metric aligns with commercial customers that are classified as Rate G1 or G2 on the VGS rate classification.
- MPR #13: This indicator encourages VGS to design and implement efficiency initiatives that will maximize the lifetime natural gas, other fossil fuels, and water benefits. This metric is designed to encourage VGS to calculate and track all components of total resource benefits (“TRB”), including water savings and delivered fuel savings associated with measures. VGS works with other EEU and distribution utility partners to ensure these benefits are not double counted.
- MPR #14: This Addison County indicator encourages VGS to maximize the percentage of Addison County customers that benefit from VGS energy efficiency programs. This metric requires VGS to meet minimum program participation rates for customers in Addison County by aggressively marketing and promoting its energy efficiency programs. VGS customers can participate in multiple programs (install high efficient equipment in the residential equipment replacement program and weatherize their home in the residential retrofit program) and in some cases multiple times in one program. VGS only counts an EEU Addison customer once in this metric and engages new customers as well as continues to engage customers that have already participated in its energy programs.<sup>23</sup>

Please see the following tables for the VGS QPIs and MPRs described above along with the corresponding targets and weighting.

<sup>23</sup> See Order dated February 4, 2021 in Case No. 19-3272-PET approving continued Addison County penetration at 30%.

VGS QPIs

QPI #	Title	Performance Indicator	Target (2024-2026)	Policy Goal Advanced	Weight
<b>Quantifiable Performance Indicators ("QPI")</b>					
1	Savings	a. Annual incremental net Mcf expected savings	248,853	Annual incremental Mcf savings indicator intended to encourage EEU to design and implement efficiency initiatives that will maximize natural gas energy savings	15%
		b Green house Gas emissions (carbon savings metric tons)	14,797	Annual incremental GHG emission indicator intended to encourage EEU to design and implement efficiency initiatives that will maximize greenhouse gas emissions	10%
2	Lifetime Natural Gas Savings	a. Present worth of lifetime natural gas avoided costs	\$ 27,981,383	Encourage an EEU to design and implement efficiency initiatives that will maximize lifetime natural gas benefits	15%
		b. Lifetime Mcf Savings	4,265,242		15%
3	Peak Day Natural Gas Savings	Peak day incremental expected savings	1,384	Cumulative peak day savings indicator intended to encourage EEU to design and implement efficiency initiatives that will maximize the capacity reduction coincident with peak day demand	15%
4	Residential Single Family Comprehensive	a. Percent of home energy audits converted to a measure installation within 12 months	30%	Intended to ensure that energy efficiency initiatives are designed and implemented to acquire comprehensive savings	3%
		a. Percent of home energy audits converted to a measure installation within 12 months (Addison)	30%		2%
		b. Percent of all cost effective measures as well as those measures recommended by the audit and	70%	Intended to ensure that energy efficiency initiatives are designed and implemented to acquire comprehensive savings	3%
		b. Percent of all cost effective measures as well as those measures recommended by the audit and Energy audits	70%		2%
5	Residential Audits	completed; including comprehensive, home performance, customer, energy snap shots, low	600 Annually	Encourage customers to have energy audits performed, including comprehensive, home performance, custom, energy snap shots, low income, condominiums and mobile homes	5%
6	Long-term Market Transformation	Offer energy efficiency training for contractors	Two Per Year	Encourage EEU to design and implement efficiency initiatives that maximize market transformation	5%
7	Business Comprehensive Savings	Diversity of measures implemented in commercial retrofit projects (Existing)	A minimum of measures installed during the prior 12-months will be: 5% control-related, 20% heating systems, heat recovery or domestic hot water systems, 5% process-related and 15% shell or other-related	Intended to ensure that energy efficiency initiatives are designed and implemented to acquire comprehensive savings	4%
		Diversity of measures implemented in commercial retrofit projects (Addison)			1%
8*	Administrative Efficiency	Administrative Cost reductions as a percent of total budget - proposal reflects 5% reduction goal	\$97,707	This indicator is intended to encourage the program administrator to continually assess its operations to continue to deliver services that maximize ratepayer value	5%

VGS MPRs

MPR #	Title	Performance Indicator	Target (2024-2026)	Policy Goal Advanced	Weight
<b>Minimum Performance Requirements ("MPR")</b>					
9	Minimum Natural Gas Benefits (Equity for all Natural Gas Ratepayers)	<b>Total natural gas energy efficiency benefits divided by total utility costs</b>	<b>Equal or greater than 1.2 cost benefit ratio</b>	Equity for all Vermont natural gas customers as a group by assuring that the overall natural gas benefits are greater than the costs incurred to implement and evaluate the natural gas EEU and the natural gas EEC	0% (Minimum Requirement)
10	Equity for Residential Ratepayers	<b>A minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to residential customers</b>	<b>\$8,611,583</b>	Equity for residential customers by assuring that a minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to residential customers	0% (Minimum Requirement)
11	Equity for Low-income Customers	<b>A minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to Low-income customers</b>	<b>\$875,240</b>	Equity for low-income customers by assuring that a minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to low-income households	0% (Minimum Requirement)
12	Equity for Small Business Customers	<b>Percent of commercial (non-residential) installed end uses that are classified as Rate G1 or G2 (use 600 Mcf/yr. or less)</b>	<b>30%</b>	Equity for small business customers by assuring that a minimum level of overall efficiency efforts, as reflected in participation, will be dedicated to small business accounts	0% (Minimum Requirement)
13	Total Resource Benefits	<b>Track and report non natural gas TRB</b>	<b>Annually</b>	Encourage EEU to design and implement efficiency initiatives that will maximize the lifetime benefits	0% (Minimum Requirement)
14	Addison County Aggressive DSM	<b>Meet minimum energy efficiency program participation rate for customers in Addison County</b>	Achieve 30% energy efficiency participation in Addison County by Year 3	This indicator is intended to maximize the percent of Addison County customers that benefit from VGS energy efficiency programs	0% (Minimum Requirement)

## Department Evaluation and Fiscal Agent budgets<sup>24</sup>

Energy efficiency charge (“EEC”) rates are set separately for Efficiency Vermont, BED, and VGS customers and are a volumetric charge by rate classification based on the total costs to operate the efficiency programs and the projected load. In addition to the previously mentioned RA and DSS categories, the total costs that drive the EEC rates also include the Department’s EEC-funded evaluation and verification of the VGS portfolio of programs, the fiscal agent-associated costs, as well as VGS’s share of the Thermal Energy Process Fuels (“TEPF”) fund. The TEPF was established for access to both regulated and unregulated TEPF services for effective coordination across all services with each respective agency contributing to its share of the funding.<sup>25</sup> The Department evaluation occurs annually based on the savings claims for the prior calendar year. Projected costs associated with VGS’s responsibility for administration and reporting of the related costs of the natural gas EEU fund were previously allocated under the fiscal agent heading, however the VGS proposal has rolled these associated internal VGS labor costs into its DSS Planning and Reporting category.<sup>26</sup> VGS included an estimate for the potential study costs associated with the next DRP proceeding. These categories do not contribute to the day-to-day operations of the VGS energy efficiency programs and therefore are not classified as either RA or DSS but are required as part of EEU services and therefore are included in overall EEU budgets and recovered in the EEC. The following table outlines non-RA and non-DSS associated budgets.

<sup>24</sup> Pending PUC approval in Case 22-2954 PET. VGS filed a compliance filing with tables of budgets on 10/26/2023 and a revised compliance filing on 11/7/2023.

<sup>25</sup> Order Re Framework for a Thermal Energy and Process Fuels Statewide Information Clearing House, pursuant to 30 V.S.A. § 209(g)(2). The Commission determined that the costs of the TEPF Information Clearinghouse shall be allocated between unregulated and regulated fuel sectors. VGS revised Compliance filing on 11/7/2023 in Case 22-2954 included TEPF proposed budgets.

<sup>26</sup> VGS became the Fiscal Agent in charge of the natural gas EEU fund effective January 1, 2020. VGS proposed the costs associated with the Fiscal Agent Audit will remain in this category, but transferred Fiscal Agent reporting to DSS Planning and Reporting. Based on VGS compliance filing in Case 22-2954 fiscal audit was separated out into fiscal audit and triennial audit.

## VGS EEU natural Gas EEC funded budgets for this Plan

<b>VGS EEU Natural Gas EEC funded Budgets for 2024-2026</b>				
Other EEU Costs	2024	2025	2026	Total
<b>DPS Evaluation</b>	\$195,710	\$250,080	\$291,890	\$737,680
<b>TEPF Clearing House</b>		\$15,178	\$15,178	\$30,356
<b>Potential Study</b>	\$0	\$0	\$125,000	\$125,000
<b>Fiscal Agent Audit</b>	\$3,500	\$3,550	\$3,600	\$10,650
<b>Triennial Audit</b>	\$4,000	\$4,050	\$4,100	\$12,150
<b>Total</b>	<b>\$203,210</b>	<b>\$272,858</b>	<b>\$439,768</b>	<b>\$915,836</b>

### Conclusion and Total EEU related budgets and savings for this Plan

This Plan represents a comprehensive strategy for energy efficiency savings and investments through the 2024-26 performance period with a focus on low- and moderate-income households. This trajectory puts VGS and its customers on a path to drastically reduce GHG emissions. The programs are designed to be inclusive, customer-focused, and help set the pace towards VGS achieving its ambitious Climate Plan of Net Zero by 2050. The savings and EEU budgets are supported through the VGS financing mechanism approved by the Commission in the last DRP proceeding to enable a relatively smooth rate trajectory.<sup>27</sup> The programs have been designed to be nimble, flexible, and responsive to customer demands. This Plan takes into consideration the effects of increasing energy codes, accelerated electrification of heating and hot water systems within new construction projects, rising costs, and workforce constraints, and balances with strategies to eliminate customer participation barriers by increasing our collaboration and partnerships, to continue advancing Vermont’s clean energy and climate goals.

The following table reflects the total VGS EEU budgets required to achieve this Plan along with the percent allocation by category. The subsequent tables provide other key metrics.

<sup>27</sup> See Order dated October 22, 2020 in Case No. 19-3272-PET. The loan amounts are designed to balance business as usual EEC collections based on load along with EEU budgets. Pending PUC approval in Case 22-2954 investments will not exceed \$10.5 M over the 2024-2026 period.

Total VGS EEC funded budgets for this Plan<sup>28</sup>

Total EEU Natural Gas EEC funded budgets 2024-2026					% of total
Vermont Gas RA and DSS budgets	2024	2025	2026	Total	Total
Resource Acquisition					
Residential Retrofit	\$2,058,959	\$2,070,040	\$1,925,322	\$6,054,321	31.2%
Residential New Construction	\$172,229	\$165,637	\$154,041	\$491,907	2.5%
Residential Equipment Replacement	\$1,799,258	\$1,944,458	\$2,012,318	\$5,756,034	29.7%
Commercial Retrofit	\$897,534	\$863,128	\$802,830	\$2,563,491	13.2%
Commercial New Construction	\$194,174	\$186,733	\$173,676	\$554,583	2.9%
Commercial Equipment Replacement	\$776,532	\$744,405	\$687,608	\$2,208,544	11.4%
<b>Subtotal RA VGS Funded</b>	<b>\$5,898,686</b>	<b>\$5,974,400</b>	<b>\$5,755,794</b>	<b>\$17,628,880</b>	<b>90.9%</b>
Development & Support Services					
1. Education & Training	\$80,030	\$80,731	\$81,438	\$242,199	1.2%
2. Applied Research & Demonstration	\$10,621	\$10,727	\$10,834	\$32,182	0.2%
3. Planning and Reporting	\$66,787	\$67,355	\$67,928	\$202,070	1.0%
4. Evaluation	\$36,404	\$36,768	\$37,136	\$110,308	0.6%
5. Policy and Public Affairs	\$15,610	\$15,766	\$15,924	\$47,300	0.2%
6. Information Technology	\$36,880	\$37,049	\$37,217	\$111,146	0.6%
7. General Administration	\$36,168	\$36,505	\$36,845	\$109,518	0.6%
<b>Subtotal DSS VGS Funded</b>	<b>\$282,500</b>	<b>\$284,901</b>	<b>\$287,322</b>	<b>\$854,723</b>	<b>4.4%</b>
<b>SubTotal VGS Funded</b>	<b>\$6,181,186</b>	<b>\$6,259,301</b>	<b>\$6,043,116</b>	<b>\$18,483,603</b>	<b>95.3%</b>
DPS Evaluation	\$195,710	\$250,080	\$291,890	\$737,680	3.8%
TEPF Clearing House	\$0	\$15,178	\$15,178	\$30,356	0.2%
Potential Study	\$0	\$0	\$125,000	\$125,000	0.6%
Fiscal Agent Audit	\$3,500	\$3,550	\$3,600	\$10,650	0.1%
Triennial Audit	4000	4050	4100	\$12,150	0.1%
<b>SubTotal Other EEU Costs</b>	<b>\$203,210</b>	<b>\$272,858</b>	<b>\$439,768</b>	<b>\$915,836</b>	<b>4.7%</b>
<b>Total Natural Gas EEC Funded</b>	<b>\$6,384,396</b>	<b>\$6,532,159</b>	<b>\$6,482,884</b>	<b>\$19,399,439</b>	<b>100.0%</b>

<sup>28</sup> The Non-RA and Non-DSS budgets are pending PUC approval in Case 22-2954 PET. VGS filed a compliance filing with fiscal agent audit, triennial audit and TEPF line items pending PUC approval in Case 22-2954 PET.

Detail of RA Peak Day Annual Savings (Mcf) by Program

VGS EEU RA Peak Mcf Savings	Budget			(2024-2026) 3 Yr Total
	2024	2025	2026	
<b>Residential Sector</b>				
Retrofit	64	65	61	189
New Construction	59	57	53	169
Equipment Replacement	121	132	137	390
<b>Commercial Sector</b>				
Retrofit	100	98	94	292
New Construction	37	36	34	107
Equipment Replacement	80	79	76	235
<b>Subtotal Residential</b>	<b>244</b>	<b>254</b>	<b>251</b>	<b>749</b>
<b>Subtotal Commercial</b>	<b>217</b>	<b>214</b>	<b>204</b>	<b>635</b>
<b>Total Annual Peak Savings (Mcf)</b>	<b>461</b>	<b>467</b>	<b>455</b>	<b>1,384</b>

Detail of RA Lifetime Savings (Mcf) by Program

VGS EEU RA lifetime Mcf Savings	Budget			(2024-2026) 3 Yr Total
	2024	2025	2026	
<b>Residential Sector</b>				
Retrofit	116,298	117,774	110,178	344,250
New Construction	111,078	105,676	96,923	313,677
Equipment Replacement	335,376	365,076	380,016	1,080,468
<b>Commercial Sector</b>				
Retrofit	464,711	450,150	421,140	1,336,001
New Construction	103,410	100,170	93,708	297,288
Equipment Replacement	302,713	301,474	289,372	893,558
<b>Subtotal Residential</b>	<b>562,752</b>	<b>588,526</b>	<b>587,117</b>	<b>1,738,395</b>
<b>Subtotal Commercial</b>	<b>870,834</b>	<b>851,794</b>	<b>804,220</b>	<b>2,526,847</b>
<b>Total Annual lifetime Savings (Mcf)</b>	<b>1,433,585</b>	<b>1,440,320</b>	<b>1,391,337</b>	<b>4,265,242</b>

Detail of RA Incentive Budgets by Program

VGS EEU RA Incentive Budgets	Budget			(2024-2026)
	2024	2025	2026	3 Yr Total
<b>Residential Sector</b>				
Retrofit	\$1,429,655	\$1,437,349	\$1,336,863	\$4,203,867
New Construction	\$92,428	\$88,890	\$82,667	\$263,985
Equipment Replacement	\$1,638,636	\$1,770,873	\$1,832,675	\$5,242,184
<b>Commercial Sector</b>				
Retrofit	\$512,819	\$493,161	\$458,709	\$1,464,689
New Construction	\$94,548	\$90,925	\$84,567	\$270,039
Equipment Replacement	\$406,569	\$389,748	\$360,011	\$1,156,328
<b>Subtotal Residential</b>	<b>\$3,160,718</b>	<b>\$3,297,112</b>	<b>\$3,252,205</b>	<b>\$9,710,036</b>
<b>Subtotal Commercial</b>	<b>\$1,013,936</b>	<b>\$973,834</b>	<b>\$903,287</b>	<b>\$2,891,056</b>
<b>Total</b>	<b>\$4,174,654</b>	<b>\$4,270,946</b>	<b>\$4,155,492</b>	<b>12,601,092</b>

Detail of DSS Categories by Program 2024-2026

<b>VGS EEU DSS Budget Category Details</b>				<b>3 Year</b>
	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2024-2026</b>
<b>1. Education &amp; Training</b>				
1 Energy Code and Standards Support	\$3,000	\$3,000	\$3,000	\$9,000
2 Vermont Energy Literacy Program	\$22,000	\$22,000	\$22,000	\$66,000
3 Customer Support	\$6,000	\$6,000	\$6,000	\$18,000
4 Energy Efficiency Education	\$39,830	\$40,531	\$41,238	\$121,599
5 Better Buildings by Design Conference, ACEE, CEE	\$9,200	\$9,200	\$9,200	\$27,600
Annual Total	\$80,030	\$80,731	\$81,438	\$242,199
<b>2. Applied Research &amp; Demonstration</b>				
1 New Technology	\$2,621	\$2,727	\$2,834	\$8,181
2 Technology Demonstrations	\$4,500	\$4,500	\$4,500	\$13,500
3 Emerging Data Services and Analytics	\$3,500	\$3,500	\$3,500	\$10,500
Annual Total	\$10,621	\$10,727	\$10,834	\$32,181
<b>3. Planning and Reporting (EEU only)</b>				
1 Annual/Monthly/Quarterly Plans/Fiscal Agent Reports	\$16,787	\$18,182	\$19,621	\$54,590
2 Demand Resource Plan, Integrated Resource Plan	\$10,000	\$10,305	\$10,085	\$30,390
3 Coordination/planning with partners/EEU's	\$20,000	\$18,258	\$18,053	\$56,311
4 Reporting on EEU related matters	\$20,000	\$20,610	\$20,170	\$60,780
Annual Total	\$66,787	\$67,355	\$67,928	\$202,070
<b>4. Evaluation (VGS EEU)</b>				
1 Annual Savings Verification	\$16,904	\$16,989	\$18,105	\$51,999
2 Technical Advisory Group	\$5,000	\$4,837	\$4,733	\$14,570
3 Technical Resource Manual	\$5,000	\$5,153	\$5,042	\$15,195
4 Quality management of program	\$5,000	\$5,153	\$5,042	\$15,195
5 Evaluation informal program	\$4,500	\$4,637	\$4,212	\$13,349
Annual Total	\$36,404	\$36,768	\$37,136	\$110,308
<b>5. Policy and Public Affairs (EEU only)</b>				
1 Public Affairs	\$2,233	\$1,926	\$1,689	\$5,848
2 Financial/Leveraged Product Development (Bilateral agreement)	\$1,500	\$1,546	\$1,513	\$4,559
3 Regulatory Affairs	\$11,877	\$12,294	\$12,722	\$36,893
Annual Total	\$15,610	\$15,766	\$15,924	\$47,300
<b>6. Information Technology</b>				
1 Information Technology	\$36,880	\$37,049	\$37,217	\$111,146
Annual Total	\$36,880	\$37,049	\$37,217	\$111,146
<b>7. General Administration</b>				
1 General administration of programs	\$36,168	\$36,505	\$36,845	\$109,518
Annual Total	\$36,168	\$36,505	\$36,845	\$109,518
<b>Total</b>	<b>\$282,500</b>	<b>\$284,901</b>	<b>\$287,322</b>	<b>\$854,722</b>

**VGS**  
**GAS SUPPLY AND RENEWABLE NATURAL GAS REPORT**  
**July 1, 2023**



This report is filed in compliance with the Company's Alternative Regulation Plan and its Renewable Natural Gas ("RNG") program.<sup>1</sup>

## I. INTRODUCTION AND BACKGROUND

To support the Company's business objectives, the objectives of the gas supply function are:

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-Effectiveness:** Ensure the resulting portfolio is cost-effective under a variety of scenarios with due consideration given to reliability, flexibility, and stability.
5. **Sustainability:** Continue to add more renewable natural gas ("RNG") and other renewable energy sources into the portfolio and procure fossil gas from suppliers using more sustainable production practices.

The Company's gas supply costs consist of capacity (demand) and commodity costs. Demand costs are associated with the cost of transporting the natural gas to the point of interconnection between the TC Energy ("TC") system and the VGS system at the Canada/U.S. border in Highgate, Vermont. Commodity costs reflect the cost of the physical supply of natural gas purchased. Each of these components is discussed further in this document.

<sup>1</sup> See Exhibit VGS-JMP-5 filed May 21, 2021 in Case No. 19-3529-PET and *Petition of Vermont Gas Systems, Inc. for a Renewable Natural Gas Program and Optional Tariff*, Docket No. 8667 (Vt. Pub. Util. Comm'n, Sept. 6, 2017).

## II. CURRENT UPSTREAM CAPACITY AND SUPPLY CONTRACTS

VGS's current supply portfolio (FY23)<sup>2</sup> includes base load, storage, and spot market supply. The capacity contracts are outlined in Table 1 and the corresponding supply contracts are outlined in Table 2. Both tables use a 1.044 Btu conversion factor to convert MMBtu to Mcf.<sup>3</sup>

**CAPACITY CONTRACTS**  
**TABLE 1**

Capacity Provider	Receipt Point	Delivery Point	Type of Service	MDQ (Mcf)	Expiration	Comment
TC Firm Short-Haul Transportation	Parkway	Philipsburg	Firm, year-round	27,236	10/31/26	
TC Firm Short-Haul Transportation	Parkway	Philipsburg	Firm, year-round	22,243	10/31/31	
TC Firm Short-Haul Transportation	Parkway	Philipsburg	Firm, year-round	18,411	10/31/32	
TC Firm Short-Haul Transportation	Parkway	Philipsburg	Firm, year-round	5,447	11/30/32	
TC Firm Short-Haul Transportation	Parkway	Philipsburg	Firm, year-round	3,631	10/31/33	
Enbridge Firm Transportation	Dawn	Parkway	Firm, year-round	18,157	10/31/25	Linked to storage transportation
Enbridge Firm Transportation	Dawn	Parkway	Firm, year-round	454	10/31/25	Linked to storage transportation
Enbridge Firm Transportation	Dawn	Parkway	Firm, year-round	7,354	10/31/25	Linked to storage transportation
Propane Air Plant	On-system		Peaking	6,667	N/A	
Total Capacity (to VGS)				83,635		
FY 2024 Peak Day				75,555		
Excess/(Deficit)				8,080		

<sup>2</sup> VGS's fiscal year is October 1 to September 30.

<sup>3</sup> 1.044 represents the average TC heat rate to Philipsburg for the prior year.

**SUPPLY CONTRACTS  
TABLE 2**

<b>Supplier</b>	<b>Type of Service</b>	<b>MDQ (Mcf)</b>	<b>Pricing</b>	<b>Expiration</b>
ARC Resources (EO Certified)	Annual	2,874	Dawn	10/31/23
United Energy Trading (EO Certified)	Annual	2,874	Dawn	10/31/23
Freepoint (2)	Monthly	Various	Parkway	9/30/23
BP Canada	Annual	4,071	Parkway	10/31/23
Emera	Annual	2,874	Parkway	10/31/23
Macquarie (2)	Monthly	Various	Parkway	10/31/2024
Macquarie (2)	Monthly	Various	Parkway	9/30/2024
Macquarie (2)	Monthly	Various	Parkway	09/30/23
Emera (2)	Monthly	Various	Parkway	09/30/23
US Ventures (3)	Annual	Up to 36,000 MMBtus/yr	Dawn	01/31/27
Archaea Energy Marketing LLC (3)	Annual	100,000 MMBtus/yr <sup>4</sup>	Dawn	06/30/37
BP (3)	Annual	Up to 120,000 MMBtus/yr	Dawn	05/31/38
Vanguard Renewables (3)	Annual	40,000 Mcf/yr	Salisbury, VT	07/31/41
Tenaska Marketing Canada	Storage	14,368	Storage WACOG	3/31/24
Enbridge	Storage	2,874	Storage WACOG	3/31/24

<sup>4</sup> This volume is based on our current nomination under the contract; VGS has the option to increase the volume in subsequent years of the contract.

Propane Air Plant (1)	Peaking	6,667	Propane WACOG	N/A
-----------------------	---------	-------	---------------	-----

- (1) The propane air facility has an installed compressor capacity of 9,000 Mcfd and the ability to expand to 12,000 Mcfd. The actual capacity available from the plant depends on the load passing through the plant. Propane is purchased at market prices.
- (2) For the Interruptible Lock Price Program
- (3) For Renewable Natural Gas

It should be noted that the supply contracts listed in Table 2 above were entered into pursuant to a competitive bid request process or received PUC review and/or approval, as applicable. It should also be noted that the above table does not include spot purchases or supply contracts of a month or shorter duration.

### III. UPSTREAM CAPACITY FY24 – FY26

VGS has contracts totaling 84,779 GJ (76,968 Mcf) with TC from Parkway, Ontario, to Phillipsburg, Quebec. As shown in Table 1 above, one of these contracts expires during the FY24-FY26 period, which VGS plans to renew to maintain adequate capacity to meet its peak day requirements. No new TC contracts are expected to be executed in the FY24-FY26 timeframe. The three contracts on the Enbridge system, which are used to move supply from the Dawn, Ontario market point (also the point of VGS’s storage contract described later), will mature during the period covered by this Plan. The contracts have renewal rights that VGS intends to exercise.

To maximize the value of its TC capacity, VGS enters into Asset Management Agreements (“AMAs”) with gas marketers. AMAs are negotiated through an RFP process, under which VGS offers to assign its TC capacity to a marketing firm that will seek opportunities to optimize the capacity during times when VGS is not using it. VGS generally, but not always, reserves the right to recall the capacity on a day-to-day basis as needed to serve customers.

The daily process to optimize the capacity requires the Company’s Gas Supply and Gas Control Departments to forecast the natural gas requirements (i.e., amount of natural gas required to meet customer demand) for its firm and interruptible customers. The Company then notifies the AMA gas marketer of the capacity available for optimization, if any. If market conditions allow, the marketer will utilize the available assigned capacity, thereby generating revenue. These capacity optimization revenues are shared with VGS on either a fixed or variable basis depending on the AMA. All revenues generated by the AMAs flow through the Company’s Purchased Gas Adjustment (“PGA”) benefiting firm customers by reducing the total firm gas costs.

#### IV. PHYSICAL NATURAL GAS SUPPLY FY24-FY26

Approximately 13.8 Bcf of physical natural gas supply is required to serve VGS's customers annually. The supply is purchased on an annual, monthly, and daily basis. For firm customers, approximately 75% of the annual firm requirements (5.4 Bcf) plus a portion of summer storage injection is purchased through a competitive bid process in the summer and/or fall preceding the fiscal year. For example, RFPs will go out during summer 2023 for supply purchases for FY24. Beginning in 2019, with the RFP issued that year, VGS has also been asking potential suppliers to provide it with information regarding their sustainability initiatives. Further, VGS has several "on the shelf" contracts with potential suppliers and continues to expand the pool of potential suppliers to include suppliers who have met various standards, such as the EO100 Standard for Responsible Energy<sup>5</sup>. The standard is based on a consensus from industry, NGOs, affected communities, and governmental agencies that incentivizes excellence in social and environmental performance. To date, VGS has entered into three contracts for Responsibly Sourced Gas ("RSG") from ARC Resources, Repsol, and Emera, and will continue to be a leader in promoting RSG as the standard.

Certified RSG includes not only the EO100 Standard noted above, but also the Trustwell Standard<sup>6</sup> from Project Canary and the MIQ standard<sup>7</sup>. These standards all require a third party to certify that the production practices meet the standard, and in some cases include live monitoring of methane emissions to ensure that the standard is continually being met beyond the initial certification process.

VGS is also a member and active participant in the Natural Gas Supply Collaborative ("NGSC"). The NGSC is a group of natural gas purchasers that are promoting safe and responsible practices for producing natural gas supply. The NGSC is also promoting standards for reporting of Environmental, Social, Governance ("ESG") metrics to assist natural gas purchasers in making informed decisions when sourcing natural gas for its customers.

Due to the seasonality of VGS's customer requirements, VGS "layers in" purchased volumes to meet total customer requirements. In other words, the annual "baseload" supply purchase includes purchases that are not for an entire year. Annual "baseload" requirements are constant volumes of gas that VGS can use every day to either serve market demand or inject into storage. VGS then purchases additional volumes on a

<sup>5</sup> [https://energystandards.org/wp-content/uploads/2022/10/EO100-Standard-for-Responsible-Energy-Development\\_2017\\_PT.pdf](https://energystandards.org/wp-content/uploads/2022/10/EO100-Standard-for-Responsible-Energy-Development_2017_PT.pdf)

<sup>6</sup> <https://www.projectcanary.com/wp-content/uploads/2021/01/IES-TrustWell-Ratings-Definition-Doc.pdf>

<sup>7</sup> <https://miq.org/document/miq-standard-carbon-intensity-standard/>

monthly or daily basis to match its market demand.

VGS's annual baseload supply is market-based and generally priced at NYMEX plus or minus basis differential. NYMEX-based pricing refers to the monthly closing cost of a natural gas contract on the New York Mercantile Exchange, plus or minus an adder to account for purchasing at Union-Parkway or Union-Dawn on the Enbridge Gas system. Since NYMEX-based pricing will fluctuate with wholesale natural gas markets, that portion of the supply costs is "fixed" or "locked" with VGS's hedging program as described below.

VGS also utilizes storage contracts to serve firm customers. These contracts allow VGS to "inject" natural gas during the summer and shoulder season months when demand is lower and "withdraw" it during winter. This also allows VGS to maintain flexibility to respond to varying customer demand during the critical winter heating season. VGS has two storage contracts. Its main storage contract allows for storage of 1.2 Bcf and allows for winter injections and summer withdrawals. VGS also has a smaller supplemental storage contract for 0.24 Bcf, which allows for winter injections, summer withdrawals, and multiple "turns" during the year. A "turn" is a complete fill and empty of the storage volume. This increased operational flexibility mitigates the impact of unexpected price spikes throughout the year and helps maintain stable natural gas rates for customers. The current VGS storage contracts are expiring in March 2024. VGS will be seeking contract bids to replace these contracts during the fall of 2023.

Interruptible customers are also served with annual, monthly, and daily purchases. The pricing of these purchases is designed to closely match the commodity component of the interruptible tariff rate paid by the customer. Under the interruptible tariffs, interruptible customers' commodity rates are indexed to the Canadian Gas Price Reporter Parkway index.

The remainder of the physical supply, for both interruptible and firm customers, is purchased daily using a competitive-bid fixed-priced contract. Daily requirements are determined and matched with available supply. The Company will go out to at least two suppliers on business days where additional supply is needed to procure the lowest cost supply.

## **V. RENEWABLE NATURAL GAS ("RNG")**

VGS has a Commission-approved voluntary Renewable Natural Gas program.<sup>8</sup> This program allows VGS customers to elect that a certain percentage of their monthly usage

<sup>8</sup> See *Petition of Vermont Gas Systems, Inc. for a Renewable Natural Gas Program and Optional Tariff*, Docket No. 8667 (Vt. Pub. Util. Comm'n, Sept. 6, 2017).

be matched with RNG Attributes for a premium on cost (the “RNG Adder”). Customers can choose to purchase as little as 10 percent to as much as 100 percent of their monthly usage in RNG Attributes. The Commission also approved the S-RNG Adder Tariff on November 30, 2018. The S-RNG Tariff allows customers to purchase a fixed amount of RNG Attributes each month on a per ccf basis. These S-RNG or “Standalone” RNG Adder purchases are unbundled from the metered gas service. The program is designed to assist customers in achieving their sustainability goals and to provide VGS with a pathway toward the State of Vermont’s renewable energy policy objectives as stated in the Vermont Climate Council Initial Vermont Climate Action Plan<sup>9</sup> and the Department of Public Service’s 2022 Vermont Comprehensive Energy Plan.<sup>10</sup>

Expanded use of RNG, including incorporation of RNG into VGS’s overall retail supply portfolio, is a cornerstone of VGS’s Climate Action Plan. VGS has included small amounts of RNG in its base portfolio, and in its current Alternative Regulation Plan by the Commission, VGS is authorized to include up to 2% of additional RNG in the PGA during each year of the plan.<sup>11</sup> This is a key element to achieving VGS’s climate goals to reduce greenhouse gas (GHG) emissions, consistent with the Global Warming Solutions Act. RNG plays a critical role in that path.

The Commission’s September 6, 2017 approval of the RNG program in Docket No. 8667 requires the Company to make an annual report on RNG that includes the following information:

1. Number of subscribers by customer class – See Table 3
2. Sales volume by customer class – See Table 3
3. Sales revenues – See Table 3

Table 3 (Blended RNG) Voluntary Adder-Based on Current Customers			
Rate Class	# of Customers	Expected Annual RNG Sales	Expected Annual RNG Revenue
Rate R	131	2,947	\$34,443
Rate G1	7	1,302	\$15,213
Rate G2	5	487	\$5,686
Rate G3	2	1,482	\$17,318

<sup>9</sup> <https://climatechange.vermont.gov/readtheplan>

<sup>10</sup> [https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan\\_0.pdf](https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf); <https://climatechange.vermont.gov/readtheplan>.

<sup>11</sup> See Exhibit VGS-JMP-5 filed May 21, 2021 in Case No. 19-3529-PET. In Case No. 22-5085-PET currently pending before the Commission, VGS has requested the ability to include up to 6% of alternative supply in the PGA relative to VGS’s overall retail sales during the three-year term of the plan and up to 4% over the term of the two-year extension.

Rate G4	2	2,483	\$29,015
S-RNG	7	33,018	\$385,848
Total	154	41,718	\$487,522

Table 3a (Local RNG) Voluntary Adder-Based on Current Customers

Rate Class	# of Customers	Expected Annual RNG Sales	Expected Annual RNG Revenue
Rate R	19	675	\$10,151
Rate G1	0	0	\$0
Rate G2	1	91	\$1,368
Rate G3	1	536	\$8,067
Rate G4	0	0	\$0
S-RNG	2	210	\$3,160
I	1	50,000	\$752,350
Total	24	51,512	\$775,095

4. Any sales of purchases of carbon offsets – VGS has not needed to purchase carbon offsets to meet program obligations.
5. Supply/consumption matching portfolio including any shortfall or excess supply of RNG – See Tables 4(a) and 4(b) below

Table 4(a) (Blended RNG Balance, including some locally produced RNG) Customers using RNG Adder, VGS Company Use and RNG used as part of VGS's Firm Portfolio (fiscal year)

Fiscal Year	RNG Purchases (Mcf)	RNG Sales/Use on VGS System (Mcf)/VGS Portfolio	End of Year Balance
18(Actual)	9,657	784	8,873
19(Actual)	32,823	10,474	31,222
20(Actual)	33,810	28,221	36,811
21(Actual)	45,690	82,156	345
22(Actual)	161,126	140,572	20,899
23(Projected)	209,903	204,818	25,984
24(Projected)	311,168	301,723	35,429

Table 4(a)(1) (Local RNG Balance) Customers using LRNG Adder (fiscal year)

Fiscal Year	RNG Purchases (Mcf)	RNG Sales	End of Year Balance
21(Actual)	0	0	0
22(Actual)	10,783	10,470	313

23(Projected)	40,000	34,870	5,443
24(Projected)	62,000	61,630	5,813

Table 4(b) (Blended RNG Balance, including some locally produced RNG) Customers using RNG Adder, VGS Company Use and RNG used as part of VGS's Firm Portfolio (calendar year)			
Calendar Year	RNG Purchases (Mcf)	RNG Sales/Use on VGS System (Mcf)/VGS Portfolio	End of Year Balance
18(Actual)	9,657	2,555	7,102
19(Actual)	41,494	15,384	33,212
20(Actual)	29,578	42,169	20,621
21(Actual)	77,094	93,170	4,545
22(Actual)	157,625	153,095	9,075
23(Projected)	247,897	226,719	30,253
24(Projected)	336,668	330,525	36,396
Table 4(b)(1) (Local RNG Balance) Customers using LRNG Adder (calendar year)			
Calendar Year	RNG Purchases (Mcf)	RNG Sales	End of Year Balance
21(Actual)	10	16	-6
22(Actual)	16,073	15,755	318
23(Projected)	55,200	44,960	10,558
24(Projected)	64,000	68,630	5,928

6. True-up schedule for any imbalances – True-ups have not been required.
7. RNG Supply Verification – VGS obtains annual third-party verification for each project in operation.
8. Quantification of the impact of any excess RNG costs flowing through the PGA, if VGS remains under alternative regulation – VGS had not needed to flow excess RNG through the PGA.
9. Accounting of any carbon offsets or other incentives – Not applicable.
10. Status of any contracts for RNG, including plans to acquire new supply contracts – Please see below.
11. Revenue for Renewable Identification Number (“RIN”) sales and impact on the transport tariff, as well as any projections about the RIN market that are available to VGS – VGS has not had a project RIN certified yet but will continue to review opportunities and seek RIN certification as appropriate. VGS is currently in the process of selling RNG volumes, through Archaea Energy Marketing LLC, in the RIN markets. Please see below for a discussion of this contract and an update on the RIN market generally.
12. Complete reports and environment verifications by an independent verifier –

Latest verification attached to the filing.

VGS has the following RNG supply arrangements in place and will continue to pursue additional supply arrangements for reasonably priced RNG both in-state and out-of-state as demand requires:

**US Venture**: As approved in Case No. 20-0384, VGS entered into a seven-year contract with US Venture for RNG sourced from the Dubuque Water and Resource Recovery Center in Dubuque, Iowa, and delivered to VGS at Dawn, Ontario. RNG is produced in Dubuque from wastewater sludge and high organic waste. The contract has various monthly volumes with an annual minimum of 20,000 MMBtus and an annual maximum of 72,000 MMBtus. Delivery began in February 2020 and will conclude January 31, 2027. VGS is expecting to negotiate an extension of this contract.

**BP Canada**: VGS also entered into a long-term RNG supply agreement with BP Canada for additional RNG supply to be delivered to Dawn, Ontario. This contract allows VGS to obtain 100% of the producer's output, at an RNG facility in London, Ontario. At this RNG facility, RNG is produced from high strength waste water that results from the processing of corn. The original contract was approved in Case No. 18-2154 for seven years and up to 120,000 MMBtus/year. In March 2019, VGS filed for PUC approval to extend the contract to 15 years. The amended contract was approved in Case No. 19-0808 on May 10, 2019. This facility began delivery to VGS in May 2023.

**Vanguard Renewables**: In Case No. 18-3449-PET, the Commission approved the construction of an RNG facility by Vanguard Renewables. VGS has committed to purchase up to 40,000 Mcf/year of the projected annual output of 180,000 Mcf. Middlebury College is contracted to purchase 100,000 Mcf/year and Vanguard will market the remaining supply. At the facility in Salisbury, Vermont, RNG is produced from manure and organic waste. As an in-state supply contract, this supply contract did not require PUC under 30 V.S.A § 248. This facility has been operational and flowing RNG since August 2021.

**Archaea Energy Marketing LLC**: As approved in Case No. 22-2230-PET, VGS entered into a 14.5 year contract with Archaea. This contract provides a minimum RNG volume of 300,000 DTH per year, with an option to increase the RNG volume each year. The RNG purchased from Archaea is sourced from the Seneca Meadows Landfill in Seneca, New York. The contract also includes an option to sell some of VGS's nominated volumes into the renewable transportation fuel markets, including the RIN market. VGS is currently exercising its right to sell a portion of the 300,000 DTH into the RIN market. The Federal

Renewable Fuels Standard program recently released its requirement projections for the coming years, increasing the volumes of D3 RINs by over 25%, which resulted in an increase in D3 pricing. This increase will assist VGS as we look to sell some of our RNG volumes in the RIN market. Regarding state markets, the Low Carbon Fuel Standard (LCFS) market in California has declined in the past year, primarily as a result of additional biodiesel being sold in the California LCFS marketplace. Washington and Oregon are implementing their LCFS marketplaces, which should strengthen RNG prices in those western states.

## **VI. HEDGING**

Hedging helps the Company “lock” in the price of natural gas for a set period. As explained above, the Company’s supply purchases are market-based and therefore fluctuate regularly. To reduce rate volatility, the Company utilizes a systematic hedging strategy.

Though hedging practices can come in various forms, the Company generally utilizes “swaps” to lock in a fixed price over a set period despite the changing market prices. Hedging with a fixed price natural gas swap allows the Company to fix natural gas costs, regardless of whether wholesale natural gas prices rise or fall between the dates that VGS enters into the transaction and the expiration date of the transaction. If the price of natural gas increases, the gain on the swap offsets the increase in actual cost. On the other hand, if the price of natural gas decreases, the loss on the swap is offset by a decrease in the actual cost. With the potential for volatility in the energy and natural gas markets, VGS proposes to continue with this hedging strategy to maintain stable natural gas charge rates for its customers.

A description of the Company’s current hedging strategy for its firm customers, which is contained in the Company’s derivative policy, is provided below.

- a. The Company takes six positions per year, hedging approximately 1/6 of its expected firm purchases, including storage injections, for the twelve-month period beginning three months forward with each transaction.
- b. The Risk Management Team at VGS meets every month to discuss its current hedging policy, review the current energy market and its impact to the Company and its customers, and to determine whether the Company should hedge. The Team also confirms the volumes to be hedged and reviews which counterparties should be pursued. In determining which counterparties to pursue, the Team evaluates the diversity of the current hedge portfolio and the

credit status of the counterparties.

- c. Once the Risk Management Team confirms the hedge details, a proposal is drawn up and must be signed by two officers prior to execution.
- d. After the proposal has received the appropriate internal approvals, VGS contacts three counterparties to get competitive hedge pricing.

The Risk Management Team frequently reviews the derivative policy and makes occasional changes. While not part of the systematic hedging described above, interruptible customers can also reduce the potential volatility associated with wholesale natural gas prices. Each summer, VGS offers interruptible customers the option of locking in the commodity charge for a portion of their fiscal year volumes. The program is referred to as the “Lock Price” program. Customers appreciate the opportunity to lock in natural gas prices and the program is frequently used for their budgeting purposes. Unlike the hedging using financial instruments for firm customers, these volumes and locked prices for interruptible customers are backed with monthly fixed-price physical natural gas purchases. During FY23, customers locked in approximately 1.7 Bcf or 26% of the total interruptible gas purchases.

## **VII. GAS SUPPLY COUNTERPARTIES**

The Company currently has nineteen (19) active “on the shelf” gas supply agreements with suppliers. These agreements have no purchase obligations until a transaction is executed. The term, quantity, and price of each transaction are negotiated at the time of purchase. In addition, the Company has several financial derivative agreements in order to execute financial hedge transactions. Like the supply contracts, these financial agreements also have no obligation until a financial transaction is executed.

The Company believes that in order to maintain the most cost-effective and sustainable supply to its customers, while maintaining its flexibility in the market, having multiple potential counterparties for supply and hedge agreements is critical. When the Company has to go out to the market with a RFP for annual supply or go out to the market for daily spot purchases on the coldest day of the year, having numerous potential options to get the most cost-effective, sustainable, and reliable supply is important to the Company and its customers. In addition, having multiple counterparties also helps to mitigate credit risk.

VGS had traditionally entered into these agreements with natural gas marketers, and purchase “pooled supply” in the market to serve its customers. VGS is currently seeking contracts directly with producers that have certified RSG or are seeking to certify their productions. This will provide additional options as VGS increases the RSG in its

portfolio.

# Quantifying the Potential for Production of Renewable Natural Gas in Vermont

---

*Prepared for VGS (Vermont Gas Systems, Inc.) by Stone Environmental*

## **Introduction**

As the need for energy transitions to mitigate greenhouse gas emissions becomes increasingly clear, renewable natural gas (RNG) has been identified as a fuel that can be carbon neutral or even carbon negative. Nationwide studies estimate that existing organic waste streams could generate enough RNG to meet a significant portion of present-day demand for natural gas in the US [1,2]. However, the viability of RNG projects varies considerably by state and region depending on available feedstocks. State-level inventories of RNG potential have been conducted in multiple states including California, Oregon, Washington, and New York [3,4,5,6]. Building on this body of research, in this report we evaluate the potential of three possible feedstocks for generating RNG in Vermont: landfills, wastewater treatment facilities and dairy farms. It should be noted that this study is intended for broad, policy-level planning purposes only – it is based on the limited data on feedstocks that are currently available in Vermont and should not be considered an exhaustive inventory of RNG potential in the state.

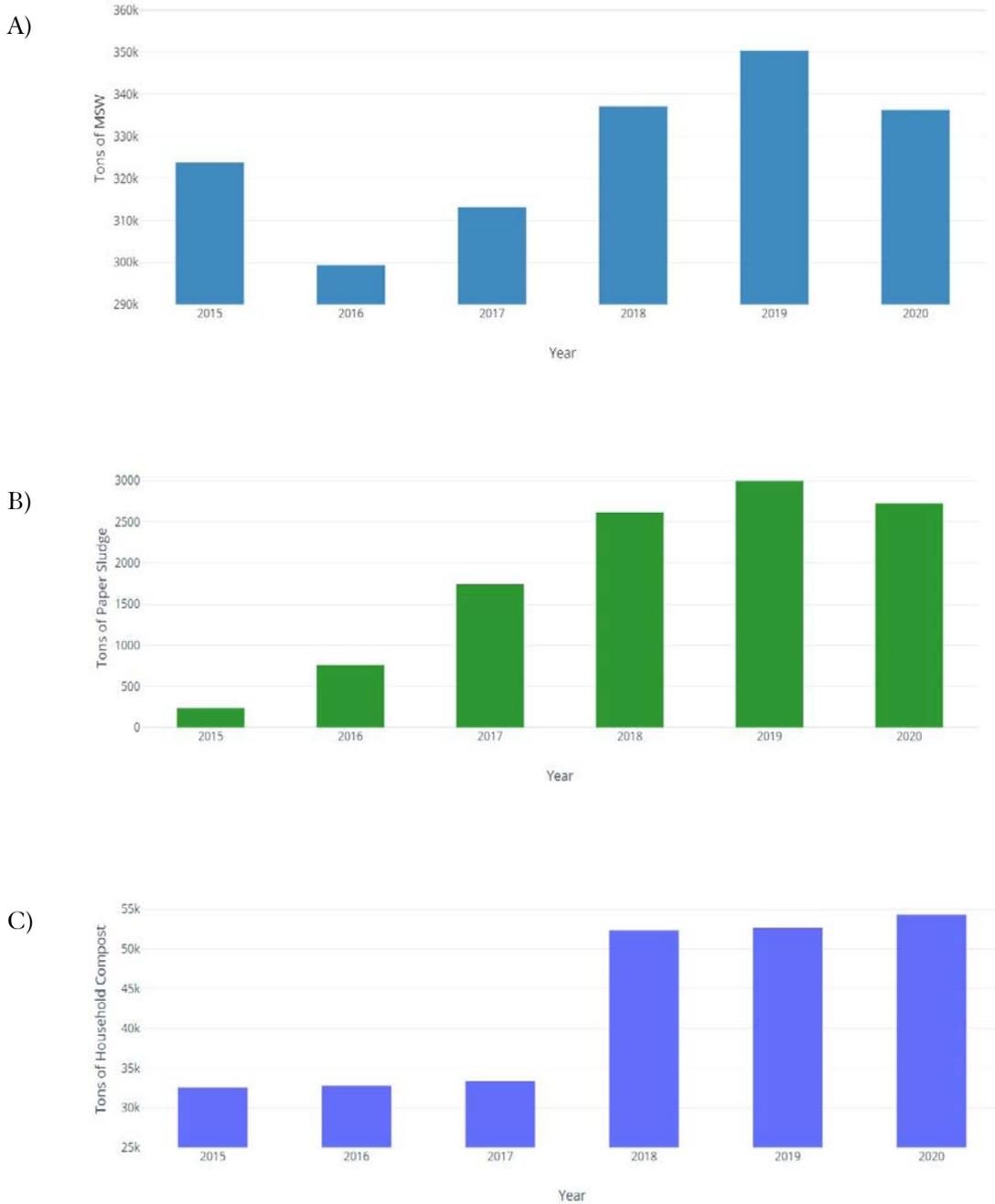
## **Landfills**

Decomposing organic material releases biogas, which can be captured, purified, and upgraded to produce RNG. Consequently, landfills are one of the most economical waste streams for RNG and currently account for over 90% of production in the United States [7]. Unfortunately, the opportunities for RNG development at landfills in Vermont are limited. The only landfill in Vermont that is currently accepting new waste is operated by New England Waste Services of Vermont, Inc. (a subsidiary of Casella Waste Management) at 21 Landfill Lane, Coventry. Despite moderate population growth in Vermont, increases in the amount of organic municipal solid waste (MSW) disposed in the landfill will likely be modest at best due to the passage of Act 148, which bans the disposal of food scraps and other organics in the trash (Figure 1). Additionally, most of the biogas from this landfill is already being utilized to produce electricity for the Washington Electric Co-op. The Coventry landfill received a permit to increase capacity in 2019, this expansion may present additional opportunities for RNG production in the coming years.<sup>1</sup>

The actual amount of Municipal Solid Waste (MSW) disposed in the landfill varies from year to year (Figure 1A). For the purposes of this report, we will only consider the most recent 2020 data as the basis for RNG potential calculations. 336,315 tons of MSW was disposed in the Coventry landfill in 2020 [8]. In Vermont, 24.4% of aggregate MSW is estimated to be organic [9]. We thus estimate that the organic fraction of MSW was approximately 92,307 tons in 2020. Assuming 7.06 MMBtu of biogas can be produced per ton of organic

<sup>1</sup> <https://vtdigger.org/2019/07/23/environment-board-issues-act-250-permit-for-coventry-landfill-expansion/>

MSW [10], and that every MMBtu of biogas from landfilled MSW yields approximately 0.6 MMBtu of RNG after processing and purification [6], we deduce that the Coventry landfill could hypothetically produce at least 391,012 MMBtu of RNG per year.



**Figure 1. Trends in Waste Management in Vermont, 2015-2019.**

*1A: The amount of Municipal Solid Waste (MSW) being landfilled in Vermont varies from year to year but has remained relatively stable between 2015 and 2019. 1B: On the other hand, the amount of paper sludge disposed in the landfill appears to be increasing. 1C: More organic waste is being diverted to household composting in response to the passage of Act 148 (the Universal Recycling Law). Data come from the Department of Environmental Conservation’s Annual Diversion and Disposal Reports (2015 through 2020).*

In addition to MSW, the DEC reports that 2,724 tons of paper sludge were landfilled in Vermont in 2020 [8]. While this represents a small waste stream relative to MSW, paper sludge tonnage appears to have increased more than ten-fold since 2015 (Figure 1B). If this trend continues, the paper sludge could potentially be diverted to an anaerobic digester and harnessed to produce RNG. Paper mill sludge can yield 0.066 tons of volatile solids per 1000 L of sludge, and 250m<sup>3</sup> of biogas per ton of volatile solids [11]. Assuming the sludge has a density of 0.72 kg/L [11] and the biogas-to-RNG yield is about 40% by volume [6], we estimate that paper sludge could produce at least an additional 800 MMBtu of RNG per year.

### Cow Manure

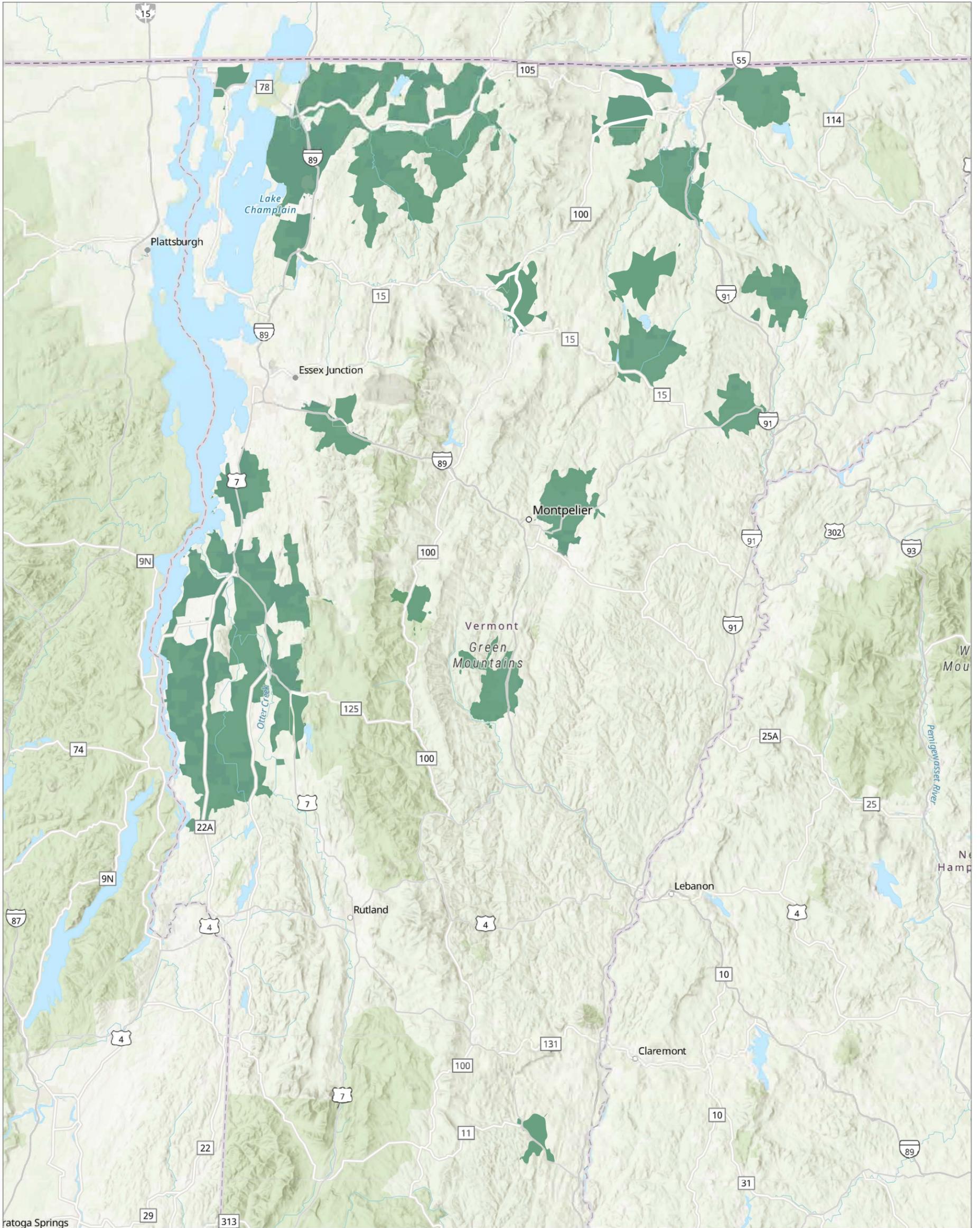
Cow manure has considerable potential as a feedstock for RNG in Vermont, as the state is well-known for its prominent dairy industry. There are currently fifteen operational manure biodigesters in Vermont [14]. Most recently, Vermont Gas partnered with Vanguard Renewables and Middlebury College to establish and connect a new anaerobic digester with an annual RNG production capacity of 180,000 MMBtu at the Goodrich Farm in Salisbury [15].

According to the most recent available annual farm inspection data from the Vermont Agency of Agriculture (Judson Peck, personal communication), there are a total of 208,263 cows on 1096 farms in Vermont. This includes data from certified small, medium and large farm operations as well as organic farms. Assuming each cow produces 0.068 tons of manure per day [16] and each ton of cow manure produces approximately 20 m<sup>3</sup> of biogas [17, 18], we estimate that the Vermont dairy industry generates 1.04 x 10<sup>8</sup> m<sup>3</sup> of biogas per year. Given that biogas from this feedstock is ~40% methane [6], this translates to a total statewide RNG potential of ~ 1,464,106 MMBtu per year. Table 2 shows how this potential breaks down across different geographical scales of analysis. Of the three counties where Vermont Gas already has gas lines, Addison County has the greatest potential for further expansion of manure biodigesters.

*Table 2. Renewable Natural Gas Potential of Vermont Dairy Farms at different geographic scales of analysis*

Scale	Number of Cows	RNG Potential (MMBtu per year)
State	208263	1,464,105.95
Addison County	60746	427,049.36
Chittenden County	6339	44,563.69
Franklin County	54885	385,846.05
Within 5 miles of Existing Distribution and Transmission Lines	75548	531,108.63

To better identify and prioritize potential host farms for development of new RNG-generating manure digesters, a spatial analysis tool was developed to identify clusters of farms under varying parameters (minimum number of cows required for a cluster, maximum driving distance between farms within a cluster, maximum distance from existing transmission or distribution lines). According to the Environmental Protection Agency’s AgSTAR program, biodigesters are only profitable when they can obtain and process manure from at least 500 cattle [19,20]. Transporting manure from nearby farms to a digester is possible in some cases, but both costs and carbon consumption increase with distance between farms. We used the Vermont roads dataset [21] as the basis for a network analysis to identify promising clusters where over 1000 cows are located within a 5-mile driving distance of a host farm. Under this scenario, a total of 557 possible cluster combinations were identified in the state, with the majority being concentrated in Addison and Franklin counties (Table 3, Figure 2). Table 3 shows the number of potential clusters at varying geographic scales under this scenario.



**LEGEND**

- Potential Dairy Farm
- Clusters for New Manure Biogesters



**Figure 2 Locations of Dairy Farm Clusters (1000 cows within 5 miles of potential host farms)**

Sources: Esri World BaseMaps, Vermont Gas, Vermont Agency of Agriculture, Vermont DEC  
 Path: O:\PROJ-21\GDS\20211163-VT Gas RNG  
 Potential\Data\MapDocuments\DataDevelopment\Initial\_data\_layer\_development\Initial\_data\_layer\_developm

*Table 3. Renewable Natural Gas Potential of Vermont Dairy Farm “Clusters” where 1000 cows are located within a 5-mile drive of potential host farms.*

Scale	Number of Potential Clusters	Number of cows that fall within clusters	RNG Potential of all clusters (MMBtu per year)
State	557	130415	916,828.13
Addison County	204	53547	376,439.80
Chittenden County	9	1476	10,376.40
Franklin County	232	46878	329,556.18
Within 5 miles of Existing Distribution and Transmission Lines	269	61871	434,958.20

### Wastewater Treatment Facilities

Vermont has over a hundred permitted wastewater treatment facilities (WWTFs) that have the potential to produce RNG through digestion of wastewater sludge. Locations and wastewater processing rates of permitted WWTFs in Vermont were obtained from the Vermont Department of Environmental Conservation (Amy Polaczyk, personal communication). Only WWTFs associated with sanitary waste outfalls, food/beverage processing, dairy products, fish hatcheries or paper manufacturing were considered as viable RNG generators. Based on the most recent available wastewater monitoring data from 2019, the 106 facilities that meet these criteria cumulatively process a total of ~217.65 million liters of wastewater per day.

1000L of wastewater produces ~ 0.0002 tons of sludge [12], of which biogas-producing volatile solids constitute about 3.25% [13]. A ton of volatile solids produces 210m<sup>3</sup> of biogas [6], which in turn produces 2.97MMBtu of RNG after purification [6]. Based on these assumptions, we estimate that the maximum RNG potential of wastewater sludge from WWTFs in Vermont is ~1,534.69 MMBtu per year. Table 1 shows how this breaks down across scales. Given the municipal locations of many WWTFs, food waste/organics drop off sites could potentially be set up to further increase feedstock supply and RNG production capacity at WWTFs.

*Table 1: RNG Potential of Wastewater Treatment Facilities in Vermont at different geographic scales.*

Scale	Average Wastewater processed (MGD)	RNG Potential (MMBtu per year)
State	57.50	1,534.69
Addison County	2.49	66.38
Chittenden County	12.27	327.54
Franklin County	4.29	114.45
Within 5 miles of Existing Distribution and Transmission Lines	18.79	501.40

Notes:

MGD = millions of gallons per day

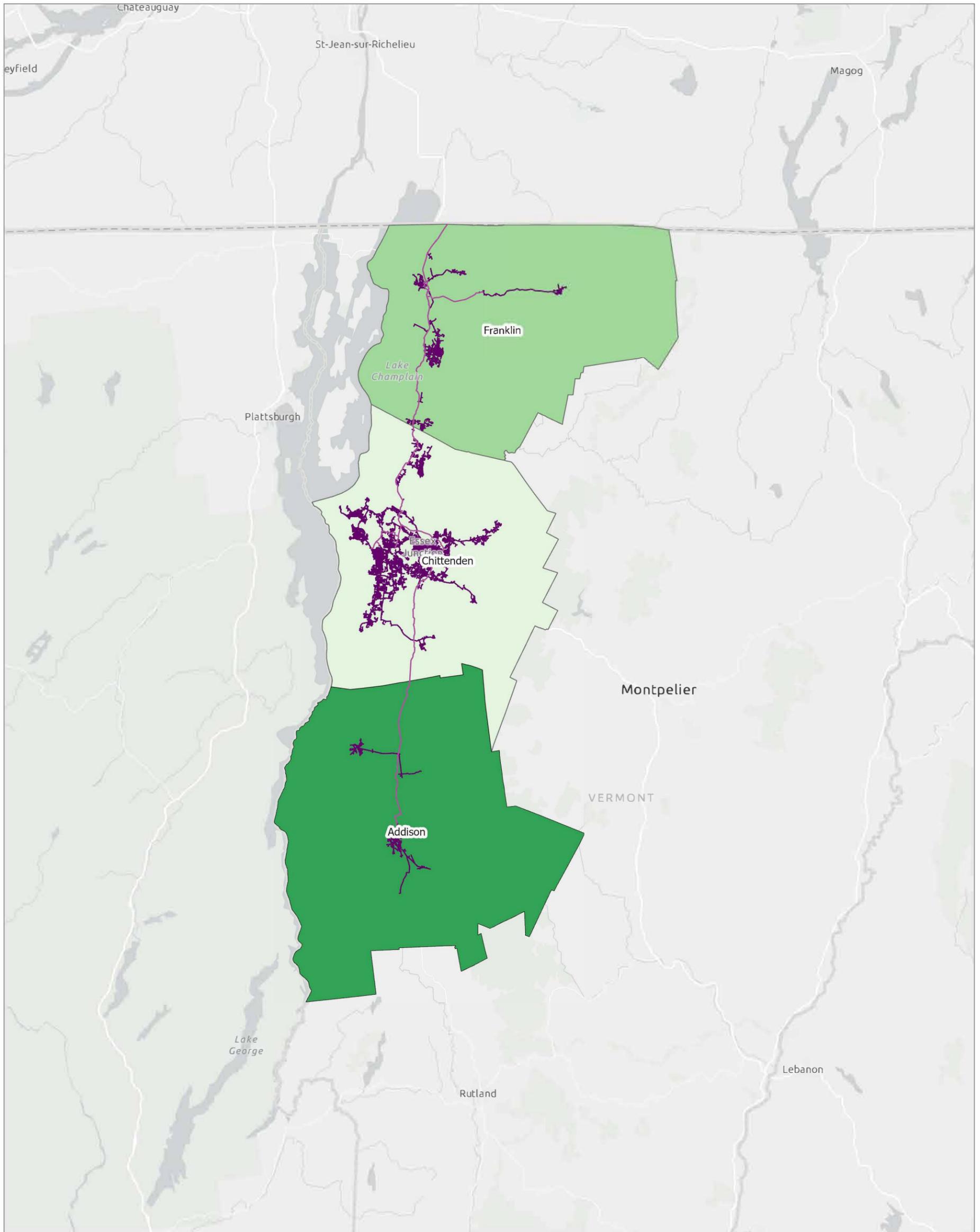
### Conclusions

VGS’ retail customers consumed ~11 million MMBtu of natural gas from VGS in 2019 (Tom Murray, VGS, personal communication). The vast majority of this gas was extracted from fossil fuel resources in North America. Meeting some of this demand with locally produced renewable natural gas will take significant investment but ultimately could help the state make substantial progress towards meeting greenhouse gas emission reduction targets as required by the 2020 Global Warming Solutions Act. Summing the total RNG

potentials for the three feedstocks described above, we conservatively estimate that the state has a maximum RNG potential of 1,873,927 MMBtu per year (Table 4). If all this potential was harnessed, Vermont could meet approximately 17% of current in-state demand for natural gas with locally produced RNG. In low and high use scenarios, locally produced RNG would meet 12% and 5% of existing demand respectively (Table 4). In addition, VGS currently have several contracts for RNG that is produced out of state. These resources will be essential to achieving VGS's goal of 20% RNG by 2030.

*Table 4 Total RNG potential of Vermont feedstocks across geographic scales.*

Scale	Total RNG Potential (MMBtu per year)	High Use Scenario - 70% Utilization (MMBtu per year)	Low Use Scenario - 30% Utilization (MMBtu per year)
State	1,873,926.64	1,311,748.65	562,177.99
Addison County	427,115.73	298,981.01	128,134.72
Chittenden County	44,891.23	31,423.86	13,467.37
Franklin County	385,960.49	270,172.35	115,788.15
Within 5 miles of Existing Distribution and Transmission Lines	531,610.03	372,127.02	159,483.01



**LEGEND**

- Existing distribution lines
- Existing transmission lines

**RNG Potential (MMBtu per year)**

- 44891
- 385960
- 427115.732617276

Sources: Esri World BaseMaps, Vermont Gas, Vermont Agency of Agriculture, Vermont DEC



**Figure 3 Total RNG Potential by County**

## Carbon Intensity

Replacing fossil natural gas with RNG provides a climate benefit which can be quantified using “carbon intensity” ratings. Carbon intensity refers to the mass of CO<sub>2</sub> emitted per MJ<sup>2</sup> of energy produced - it provides a measure of the greenhouse gas emissions associated with producing, distributing and consuming a fuel. The lower the carbon intensity of a fuel, the greater its climate benefit. RNG’s carbon intensity ranges from -271 g CO<sub>2</sub> e/MJ to 46 g CO<sub>2</sub> e/MJ depending on its source [23], with compressed RNG extracted from digested manure being the most carbon negative (Table 5). This is in sharp contrast to fossil natural gas, which has a carbon intensity of 80 to 90g CO<sub>2</sub> e/MJ [23].

*Table 5 Carbon Intensity Ratings of compressed RNG from different feedstocks..*

Feedstock	Carbon Intensity (g CO <sub>2</sub> emitted / MJ)
Landfill gas	46
Digested manure	-271
Wastewater sludge	30
Food and green waste	-11

*Source: US EPA LMOP [23]*

## Study limitations

It should be noted that this study is intended for broad policy and planning purposes and is only as accurate as the data upon which it relies. Notably, the dairy farm data we used was last updated in March 2020 and does not reflect livestock changes that may have occurred since then. Furthermore, the available data for Wastewater Treatment Facilities did not capture seasonal fluctuations in wastewater volume – we simply extrapolated single-day snapshots of wastewater processing volumes over time. For all feedstocks, we based RNG potential estimates on present-day feedstock volumes and did not consider how availability may change in the future. In situations where there was ambiguity as to the meaning of data fields or questions about whether a particular category of farm animal or Wastewater Treatment Facility should be included in RNG potential calculations, we opted for decisions that yielded the more conservative RNG potential values. We therefore believe that if anything, our estimates are likely to be lower than actual values.

## Other Potential Sources for RNG and Opportunities for Further Research

In addition to the three feedstocks described above, there are several emerging technologies that could allow Vermont to produce RNG from other sources. Three novel but growing clean gas production methods are particularly note-worthy: green hydrogen production, Syngas with carbon capture and gasification of woody biomass. Green hydrogen refers to hydrogen gas that is generated by electrolyzing water using renewable electricity. The gas can be directly used to fuel cars and ships or mixed with natural gas for combustion in heating plants [24]. Carbon capture refers to the capture and conversion of carbon dioxide from flue pipes or other emitters to produce synthetic gas (syngas), which can be blended with natural gas and is a precursor in the production of many value-added chemicals and liquid transportation fuels [25]. Syngas can also be sustainably produced through the gasification of wood chips under high temperature and pressure [26].

The viability of each of these novel methods for RNG production in Vermont depends on further technological advancement as well as changes in funding and energy policies at both the federal and state level. For example, at the federal level, the Department of Energy recently announced the hydrogen "earth

<sup>2</sup> 1 MJ = 0.000948 MMBtu

shot", which includes over \$8 billion in funding for research and development of hydrogen's potential as an energy source and could result in significant innovation and deployment of demonstration projects across the country [27]. While an in-depth exploration of the feasibility and potential of these emerging technologies is beyond the scope of this report, they warrant consideration and further research as their evolution could potentially transform the clean energy landscape as we know it.

## Literature Cited

1. Cyrs, T., Feldmann, J.; Gasper, R. Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers. Working Paper. Washington, DC: World Resources Institute. Available online: <http://www.wri.org/publication/renewable-natural-gas-guidance> (accessed on 12 November 2021).
2. Dodge, E. 2014. How much Renewable Natural Gas can be produced? Breaking Energy. December 18, 2014. Available online: <https://breakingenergy.com/2014/12/18/how-much-renewable-natural-gas-can-be-produced/> (accessed on 7 November 2021).
3. Jaffe, A., Dominguez-Faus, R.; Parker, N.; Scheitrum, D.; Wilcock, J.; Miller, M. The Feasibility of Renewable Natural Gas as a Large-Scale, Low Carbon Substitute. California Air Resources Board Final Draft Report Contract No. 13-307. Available online: <https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/13-307.pdf> (accessed on 15 November 2021).
4. Oregon Department of Energy. Biogas and Renewable Natural Gas Inventory, SB 334. 2018. Available online: <https://www.oregon.gov/energy/Data-and-Reports/Documents/2018-RNG-Inventory-Report.pdf> (accessed on 15 November 2021).
5. Washington State University Energy Program. Harnessing Renewable Natural Gas for Low-Carbon Fuel: A Roadmap for Washington State. Olympia, Washington, USA, 2017. Available online: <http://www.commerce.wa.gov/wp-content/uploads/2018/02/Energy-RNG-Roadmap-for-Washington-Jan-2018.pdf> (accessed on 15 November 2021).
6. Taboada, S.; Clark, L.; Lindberg, J.; Tonjes, D.J.; Mahajan, D. Quantifying the Potential of Renewable Natural Gas to Support a Reformed Energy Landscape: Estimates for New York State. *Energies* **2021**, *14*, 3834. DOI: 10.3390/en14133834
7. Cyrs, T. and J. Feldmann. 2021. 7 Things to know about renewable natural gas. GreenBiz. January 7, 2021. Available online: <https://www.greenbiz.com/article/7-things-know-about-renewable-natural-gas> (accessed on 7 November 2021).
8. Vermont Department of Environmental Conservation. 2020 Diversion and Disposal Report. Prepared by Waste Management & Prevention Division, Solid Waste Management Program, Montpelier, Vermont, USA, 2021. Available online: <https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/2020-Diversion-and-Disposal-Report.pdf> (accessed on 16 June 2020).
9. DSM Environmental Services, Inc., MSW Consultants, Castleton Polling Institute. 2018 Vermont Waste Characterization: Final Report. Prepared for Vermont Department of Environmental Conservation, Solid Waste Management Program. Available online: <https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/2018-VT-Waste-Characterization.pdf> (accessed on 6 December 2021).
10. Tyagi, V.; Fdez-Güelfo, L.A.; Zhou, Y.; Álvarez-Gallego, C.J.; Garcia, L.I.R.; Ng, W.J. Anaerobic co-digestion of organic fraction of municipal solid waste (OFMSW): Progress and challenges. *Renew. Sustain. Energy Rev.* **2018**, *93*, 380–399.
11. Priadi, C.; Wulandari, D.; Rahmatika, I.; Moersidik, S.S. Biogas Production in the Anaerobic Digestion of Paper Sludge. *APCBEE Procedia* **2014**, *9*, 65–69.

12. National Research Council. Use of Reclaimed Water and Sludge in Food Crop Production. The National Academies Press: Washington, DC, USA, 1996; p. 192. ISBN 978-0-309-05479-9.
13. Wightman, J.; Woodbury, P. Current and Potential Methane Production for Electricity and Heat from New York State Wastewater Treatment Plants. New York State Water Resources Institute: Ithaca, NY, USA, 2014. Available online: [https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/2/7553/files/2017/08/Wightman2014\\_Current-and-potential-methane-production-for-electricityand-heat-1uqp5ry.pdf](https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/2/7553/files/2017/08/Wightman2014_Current-and-potential-methane-production-for-electricityand-heat-1uqp5ry.pdf) (accessed on 10 December 2021).
14. U.S Environmental Protection Agency. AgSTAR Livestock Anaerobic Digester Database. Available online: <https://www.epa.gov/agstar/livestock-anaerobic-digester-database> (accessed on 11 November 2021).
15. Thibault, R. Goodrich Farm Receives National U.S Dairy Sustainability Award for Regional Partnership to Create Renewable Energy. Vermont Farm to Plate, June 14, 2021. Available online: <https://www.vtfarmtoplate.com/announcements/goodrich-farm-receives-national-u-s-dairy-sustainability-award-for-regional-partnership-to-create-renewable-energy#.YZLXe2DMJPY> (accessed on 15 November 2021).
16. PennState Extension. Biogas from Manure. Available online: <https://extension.psu.edu/biogas-from-manure> (accessed on 15 November 2021).
17. Ciborowski, P. Anaerobic Digestion of Livestock Manure for Pollution Control and Energy Production: A Feasibility Assessment. Minnesota Pollution Control Agency: St. Paul, MN, USA, 2001. Available online: <https://www.pca.state.mn.us/sites/default/files/p-gen4-02.pdf> (accessed on 15 November 2021).
18. U.S Environmental Protection Agency. Increasing Anaerobic Digester Performance with Codigestion; United States Environmental Protection Agency: Washington, DC, USA, 2012. Available online: <https://www.epa.gov/sites/production/files/2014-12/documents/codigestion.pdf> (accessed on 15 November 2020).
19. Vermont Dairy Promotion Council. Milk Matters: The Role of Dairy in Vermont, An Economic Assessment [Brochure]. Vermont, USA, 2015. Available online: [http://vermontdairy.com/wpcontent/uploads/2015/12/VTD\\_MilkMatters-Brochure\\_OUT-pages.pdf](http://vermontdairy.com/wpcontent/uploads/2015/12/VTD_MilkMatters-Brochure_OUT-pages.pdf) (accessed on 20 November 2021).
20. Lazarus, W. Farm-Based Anaerobic Digesters as an Energy and Odor Control Technology: Background and Policy Issues. Agricultural Economic Report 843; Office of Energy Policy and New Uses, USDA, 2008. Available online: <https://ageconsearch.umn.edu/record/308484> (accessed on 20 November 2021).
21. Vermont Agency of Transportation. VT Road Centerline dataset. Last updated June 1, 2021. Vermont Open Geodata Portal. Available online: <https://geodata.vermont.gov/datasets/VTrans::vt-road-centerline> (accessed on 2 November 2021).
22. U.S Environmental Protection Agency Landfill Methane Outreach Program. An Overview of Renewable Natural Gas from Biogas; EPA 456-R-20-001; United States Environmental Protection Agency Landfill Methane Outreach Program: Washington, DC, USA, 2020. Available online: [https://www.epa.gov/sites/default/files/2020-07/documents/lmop\\_rng\\_document.pdf](https://www.epa.gov/sites/default/files/2020-07/documents/lmop_rng_document.pdf) (accessed on 24 March 2022).
23. Deign, J. So, What Exactly Is Green Hydrogen? Greentech Media, June 29, 2020. Available online: <https://www.greentechmedia.com/articles/read/green-hydrogen-explained> (accessed on 9 December 2021).
24. Iyer, S.S., Bajaj, I.; Balasubramanian, P.; Faruque Hasan, M.M. Integrated Carbon Capture and Conversion To Produce Syngas: Novel Process Design, Intensification, and Optimization. *Industrial & Engineering Chemistry Research* **2017**, 56, 8622-8648. DOI: 10.1021/acs.iecr.7b01688

25. Elder, T.; Groom, L. Pilot-scale gasification of woody biomass. *Biomass and Bioenergy* **2011**, *35*, 3522-3528. DOI: 10.1016/j.biombioe.2011.04.053
26. U.S Department of Energy. 2021. Energy Earthshots: Hydrogen. Available online: <https://www.energy.gov/eere/fuelcells/hydrogen-shot> (accessed on 24 March 2022).