

1) ENVIRONMENTAL IMPACT AND COSTS:

The IRP reflects Vermont Gas' three-pronged approach to reducing environmental impact and costs: energy efficiency, customer conversions and renewable natural gas. The largest reduction in carbon emissions is achieved through the company's energy efficiency programs. Next, the Company plans to add nearly 15,000 customers over the next 20 years under the base case model during the IRP period. Without access to natural gas, it is assumed that these new customers would primarily use heating oil or propane, therefore, by converting to natural gas aids in reducing carbon emissions and environmental costs. Finally, Vermont Gas has also received regulatory approval to launch its voluntary Renewable Natural Gas program, or "EcoGas", giving customers the opportunity to further reduce their carbon footprint by using renewable natural gas. The environmental impact of each is discussed more fully below.

Energy Efficiency

Since its inception in 1994 through December 13, 2017, Vermont Gas' energy efficiency programs have resulted in a reduction of natural usage of almost 16 Bcf. This converts to a reduction of over 870,000 metric tonnes of carbon dioxide released to the atmosphere. The programs' lasting effects provide continuing savings of over 1.3 Bcf per year and a corresponding reduction of 73,000 metric tonnes of carbon dioxide.

As presented in the IRP, these programs will continue throughout the IRP period, resulting in additional energy and environmental savings. The combination of the impact of previously installed measures (adjusted for useful life) and projected investments in energy efficiency will maintain annual savings at over 1.3 Bcf per year and 73,000 metric tonnes of avoided carbon dioxide.

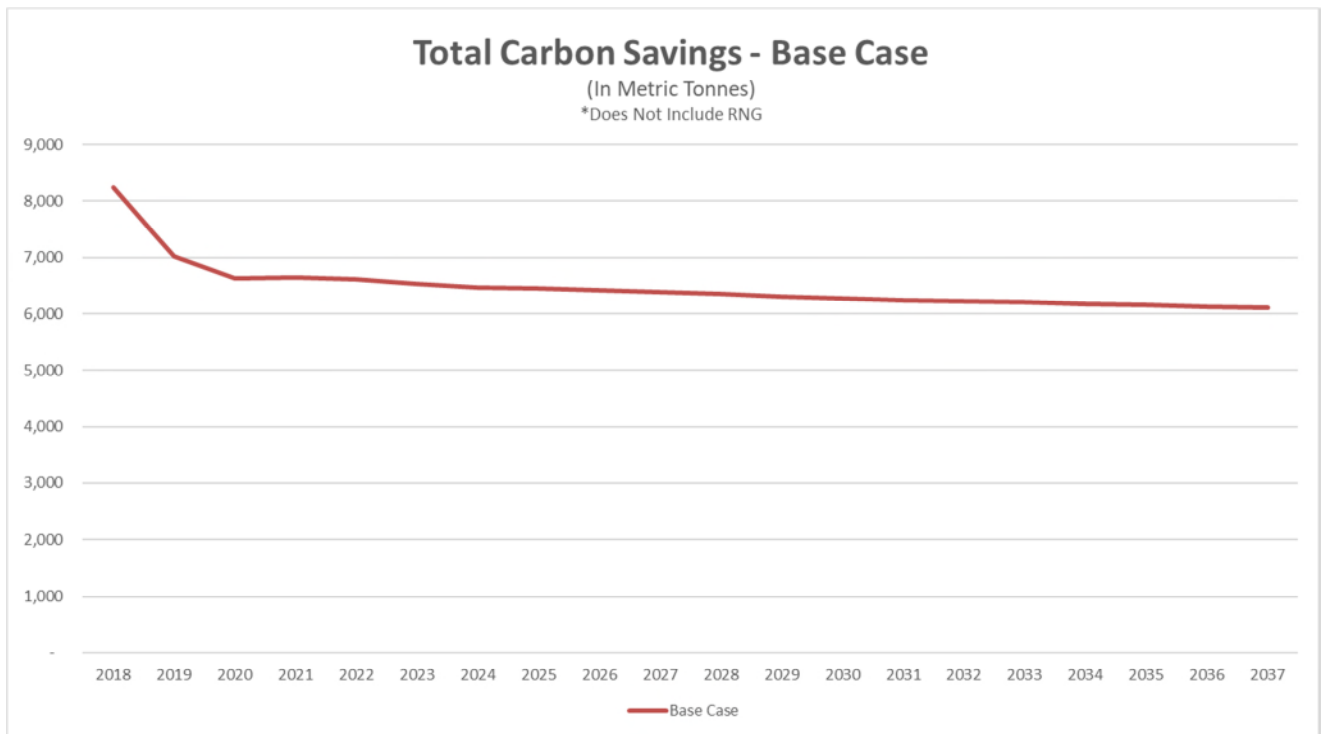
For purposes of evaluating energy efficiency measures, this IRP incorporated and utilized the avoided costs that were approved by the Commission for 2016-2017 time period. Avoided costs are estimates of what it would cost a utility to purchase and deliver natural gas over the life of the energy efficiency measure being evaluated. The avoided costs are used by the Company to determine whether it is cost effective (on a NPV basis) to invest in an energy efficiency measure

that avoids the purchase of natural gas. In addition to avoided natural gas costs, the cost effectiveness evaluation also includes a monetized consideration of environmental costs. The cost effectiveness screening in the IRP monetized environmental impacts at a value of \$5.88/MMbtu, equivalent to \$100 cost per ton of carbon per the most recent avoided energy cost study. Stated differently, every investment in energy efficiency is assumed to avoid both direct natural gas costs and environmental impacts with the environmental impacts monetized at \$5.88/MMbtu.

CUSTOMER CONVERSIONS

The addition of new customers using natural gas also provides a benefit to the environment. During the IRP period, the 15,000 planned customer additions over the next 20 years under the “base” case will result in additional avoidance of nearly 21,000 tonnes of carbon dioxide, on the assumption that those customers would otherwise have burned heating oil or propane.

The table below shows the cumulative avoided carbon dioxide over the IRP period. It should be noted that the significant environmental benefit from RNG is *not* included in the table since the program is voluntary and therefore RNG supplies are not included in VGS’ supply portfolio.



RENEWABLE NATURAL GAS

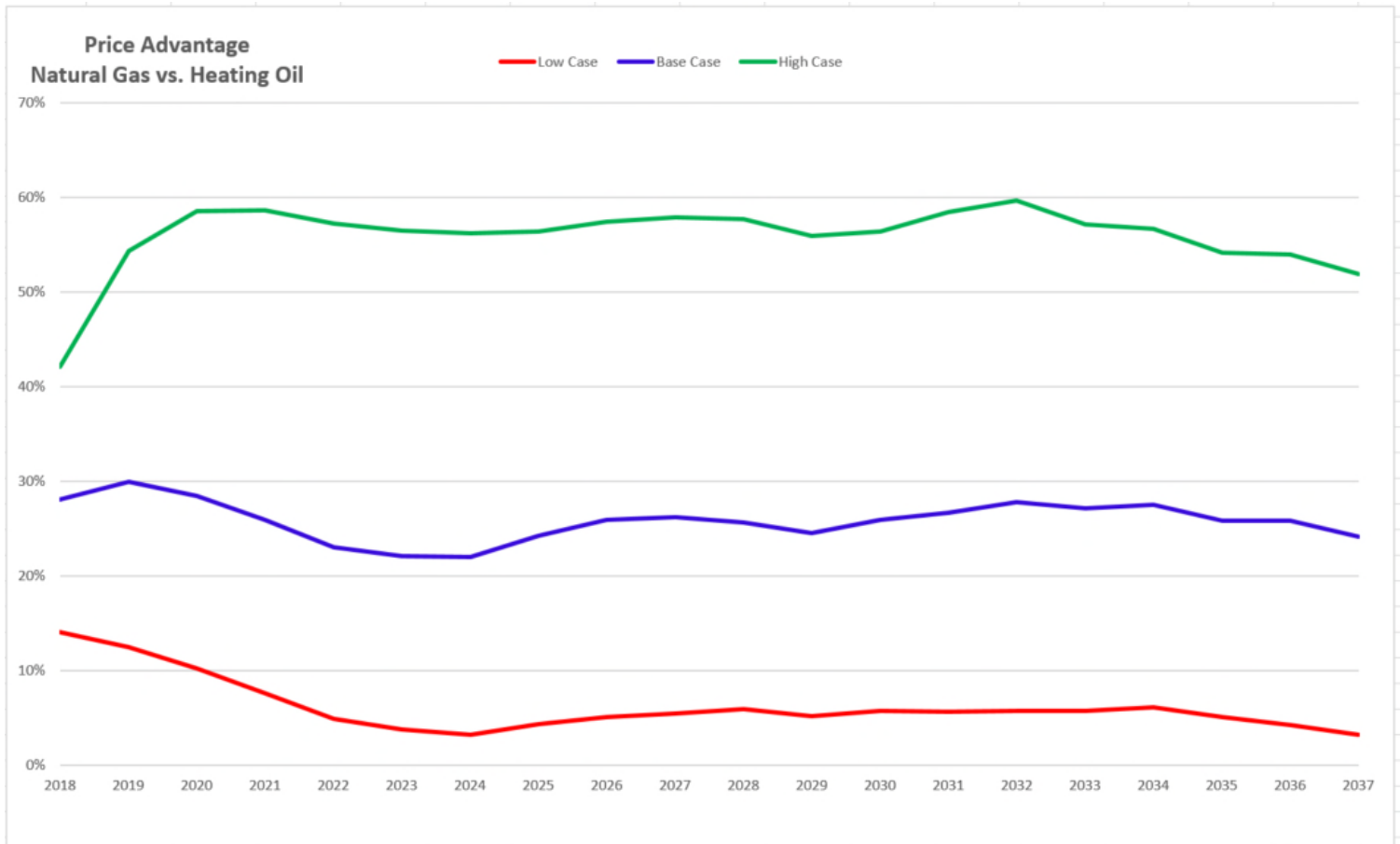
As described in the Addendum to the Chapter 3-Supply, Vermont Gas received approval from the Public Utility Commission to offer RNG to its customers. The Company is currently in negotiations with renewable natural gas suppliers for both on-system and off-system supply. In addition to environmental benefits at the source of the renewable supply, customers who sign up for the voluntary program will displace the natural gas from a fossil fuel source. For every 1% of Vermont Gas' current portfolio, EcoGas would reduce carbon emissions by 6,521 metric tonnes of CO². Vermont Gas is proud to be a leader in helping the State of Vermont reach its energy goals, which includes getting 40% of its energy from renewable sources by 2030 and 90% by 2050.

2) OTHER:

At the public information session prior to the public hearing, Vermont Gas' presentation included an outdated slide, which reflected the competitive fuel position of natural gas for each of the scenarios. That graph was not used in the analysis of the IRP and was prepared before the Company updated its competitive position to reflect changes in the energy market.

Please see below for the updated graph showing the Company's competitive fuel position for each of the three scenarios discussed in the IRP.

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SECTION 3: SUPPLY-SIDE PLANNING

HEDGING:

The MOU established in April, 2013 between the Department of Public Service and Vermont Gas Systems, Inc. regarding the 2012 IRP included language around the Company's hedging practice and request that in its subsequent IRP the Company shall discuss the outcome of any negotiations between the Department and the Company around its hedging practices. The Company and the DPS have discussed hedging since the last IRP. No changes to the hedging program resulted. The Company reports on its hedging activities to the Department quarterly.

The Company uses hedging to reduce the rate volatility to customers. The Company has a well-developed derivative policy that guides its hedging activity¹. The policy outlines the credit requirements of counterparties, the review and approval processes that must be followed, and the risks that may be hedged. Specifically, the policy provides for "hedging" by stating that VGS may enter into derivative transactions to partly offset any financial impact to customers' rates or to the Company that would result from movement in the value of the key input. The Company's hedging policy provides implementation guidelines, which generally guide the Company, but still allows the Company to deviate if necessary, as long as the derivative policy guidelines and credit risk limitations are maintained.

The hedging program is generally as follows:

- 1) The Company systematically hedges 1/6 of its expected firm gas purchases, including storage, for a 12-month period beginning 3 months in advance. If this method is followed, 100% of firm gas purchases are hedged in advance of the purchase month, in six "tranches". For example, in February, Vermont Gas would hedge 1/6 of the expected purchases for its firm market for the period May to April.
- 2) VGS will normally use fix-price swaps to implement the hedging strategy, with the ability to use other instruments if the Company chooses to do so.
- 3) The fixed-price swaps are entered into at market pricing points that closely mirror the market pricing points for Vermont Gas' physical supply purchases.
- 4) Once a year, Vermont Gas offers its interruptible customers the option to lock a portion

¹ Vermont Gas uses financial derivative to implement its hedging strategy.

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(up to 90%) of their expected annual usage. This is referred to as the “Lock Price Program”. Participation is voluntary and Vermont Gas works closely with the interruptible customers in implementing the Lock Price Program.

When it is a “hedge” month, the Company’s risk management committee, which is comprised of representatives from gas supply, marketing, finance and accounting, meets to discuss and recommend the hedging transactions to be executed. Prior to the execution, a written authorization that reflects the recommendation of the committee is prepared and includes information regarding the specific volumes and markets being hedged and the potential Counterparties; and evidence that the recommended transaction reflects the prevailing market price for obtaining a similar risk-mitigation position. The authorization must be signed by two Officers of the Company.

Officers of the Company, Gas Supply Manager or the Accounting Manager may enter into a derivative transaction consistent with the volumes, markets, and Counterparties stated on the signed authorization. The Company shall only enter into a hedge or “swap” with a qualified Counterparty, meaning Vermont Gas must have the underlying financial agreements in place with the counterparty and the Counterparty must meet specific creditworthiness criteria.

In order to ensure that the authorized credit limit for each Counterparty is not exceeded and to further diversify financial risk, the Company requests hedging bids from three different Counterparties for the specific volumes and markets listed on the authorization form. The Company normally selects the lowest priced option which helps in keeping customers rates competitive and stable and protective of price volatility. Once the Company awards the transaction to the Counterparty, the Company and Counterparty each sign a confirmation of the transaction deal to memorialize the terms of the transaction.

Before the evolution of the Company’s supply portfolio, the Company purchased a significant amount of supply at Empress, Alberta and its pricing was indexed to a market point referred to as AECO. The Company’s hedges were therefore priced off of AECO. Since the Company switched from long-haul to short-haul supply at the end of 2016, 100% of the firm gas are purchased at Union-Parkway or Union-Dawn and are generally NYMEX-based. Accordingly,

the Company's hedging is now all NYMEX-based. The Company no longer has any AECO-based hedges and does not anticipate doing so within the timeframe of the IRP.

SUPPLY RESOURCES:

As discussed in Section 3.0 of the IRP, the Company relies on the following four objectives to guide development of its supply plan and in making supply resource decisions: reliability, flexibility, stability, and cost-effectiveness. The Company aims to ensure the resulting supply portfolio is cost-effective under a variety of scenarios. The tables below illustrate the “all in” cost of supply using long-haul vs. short-haul capacity and demonstrates why the Company has migrated its portfolio to short-haul capacity. To provide a basis of the review, the cost of LNG is provided in a similar format for design day resource planning.

See Table 3.1.a below for a breakdown in the cost of long-haul pipeline capacity. This information is used to analyze the best supply option for the Company and their customers to provide reliable, flexible, stable, and cost effective supply.

Table 3.1.a. Cost of Long-Haul Pipeline Capacity

Assumptions (\$ per MMBtu)

Season	Load Factor	Demand	NYMEX – Henry Hub	Basis	Variable Charges	Net Unit Charge
Design Day	<1%	\$658	\$3.46	-\$0.82	\$0.12	\$661
Winter	40%	\$4.51	\$3.12	-\$0.77	\$0.11	\$6.97
Annual	100%	\$1.80	\$3.07	-\$0.78	\$0.11	\$4.20

See Table 3.1.b. below for the costs of short-haul pipeline capacity. As stated above, the Company uses this information to analyze the best supply options for the Company and its customers for Design Day, winter season, and on an annual supply basis.

Table 3.1.b. Cost of Short-Haul Pipeline Capacity

Assumptions (\$ per MMBtu)

Season	Load Factor	Demand	NYMEX – Henry Hub	Basis	Variable Charges	Net Unit Charge
Design Day	<1%	\$198	\$3.46	\$10	\$0.24	\$212
Winter	40%	\$1.36	\$3.12	\$0.41	\$0.04	\$6.97
Annual	100%	\$0.54	\$3.07	\$0.22	\$0.04	\$3.87

Table 3.1.c below focuses on the cost of Liquefied Natural Gas (“LNG”) for Design Day purposes.

Table 3.1.c. Cost of LNG Capacity

Assumptions (\$ per MMBtu)

Annual	Supply cost	O&M	Fixed Costs	Total Cost
Design	\$10	\$3.00	\$200	\$213

Comparing the costs of long-haul compared to short-haul pipeline capacity, short-haul is the most cost-effective supply resource option. For Design Day needs, short-haul and LNG have

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similar pricing, however LNG has other considerations that result in short-haul being the preferred alternative at this time. The largest consideration is that short-haul capacity has the capability of off-setting all or part of its costs by its utilization by interruptible customers on days other than a design day, whereas LNG is generally not cost effective for interruptible customers. In addition, the Company can also reduce the cost of the capacity through the use of asset management. These options provide additional revenues to help keep firm customers' rates lower.

It is also important to consider the environmental impact of siting an LNG facility versus utilizing existing infrastructure to satisfy the Company's design day requirements. The permitting, construction and general societal costs are all considered when the Company is determining its supply resource option. Finally, Vermont Gas also considers the length of a short-haul capacity pipeline contract commitment compared to the number of years a LNG facility would be in service, capitalized, and maintained.

RENEWABLE NATURAL GAS:

On September 6, 2017 the Public Utility Commission approved a voluntary renewable natural gas (RNG) program for Vermont Gas' customers. Under the program, customers may elect to have a portion of their natural gas usage met by RNG. The RNG will be priced at a premium to "traditional" pipeline supply. Vermont Gas is working with both in-state and out-state RNG developers for this program.

Because this is a new voluntary program and the cost of the RNG supply is intended to be paid for by customers opting in the RNG program, Vermont Gas has not included the impact of RNG in its supply modeling scenarios. The Company discusses the RNG program and its environmental benefits further in the generic section of the addendum to the IRP.