FORTISBC ENERGY INC.

2022 Long-Term Gas Resource Plan

May 2022

Territorial Acknowledgement

FortisBC acknowledges and respects Indigenous People in Canada, on whose traditional territories we all live and work. FortisBC is committed to Reconciliation with Indigenous Peoples and is guided by our Statement of Indigenous Principles.

https://www.fortisbc.com/in-your-community/indigenous-relationships-and-reconciliation/our-statement-of-indigenous-principles

FortisBC Energy Inc.
2022 LTGRP

Executive Summary

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EXECUTIVE SUMMARY

1. INTRODUCTION

FortisBC Energy Inc. (FEI) files this 2022 Long-Term Gas Resource Plan (LTGRP) under section 44.1(2) of the *Utilities Commission Act* (UCA) and is respectfully seeking acceptance by the British Columbia Utilities Commission (BCUC) of the LTGRP as being in the public interest pursuant to section 44.1(6). Consistent with the UCA, the BCUC's Resource Planning Guidelines, and prior BCUC directives, the 2022 LTGRP presents FEI's long-term plan for meeting the forecast peak demand and energy requirements of customers with demand-side and supply-side resources over a 20-year planning horizon (2023 to 2042). FEI's 2022 LTGRP objectives are to:

- Ensure cost-effective, secure and reliable energy for customers;
- Provide cost-effective Demand-side Management (DSM) initiatives and lower-carbon solutions;
- Ensure consistency with provincial energy objectives; and
- Address prior BCUC directives.

The 2022 LTGRP serves as a foundation for further evaluation of gas supply and system infrastructure options for meeting forecast customer needs under different scenarios. The LTGRP is not a substitute for the analysis done to support specific supply or expansion projects, programs or rate design in the future, but rather helps to inform the process of other initiatives. FEI will further evaluate any specific resource projects that are identified within the LTGRP that require BCUC approval and file separate applications with the BCUC as needed in the future.

This 2022 LTGRP is profoundly shaped by the developments in climate change policy in recent years and, in particular, the Province's 2018 CleanBC plan and CleanBC Roadmap to 2030 (Roadmap) which set out ambitious targets for reducing greenhouse gas (GHG) emissions. In response to these policies and the need to reduce GHG emissions, this 2022 LTGRP provides FEI's plan to transition to a low-carbon energy future and transition toward distributing renewable and low-carbon gas. Future resource plans will build on this plan as innovation in low-carbon gas production, supply and use advances.

The foundation for the 2022 LTGRP and this transformational reduction in GHG emissions is FEI's existing infrastructure, service offerings, workforce and logistics, as well as the regional gas supply infrastructure that is vital to serving the energy needs of British Columbians. Table ES-1 provides a summary of FEI customer, demand and pipeline characteristics. Table ES-2 presents the renewable and low-carbon gas resources included in the 2022 LTGRP that, over the planning horizon, along with increased DSM and growth in fuel service for the low-carbon transportation (LCT) sector, are pivotal in reaching BC's GHG emission reduction goals.

Table ES-1: FEI Service Statistics

	2016	2021	Percentage Increase Since 2017 LTGRP
Number of Customers	994,004	1,064,800	7.1%
Annual Demand (PJ)[1]	197	228	15.7%
Peak Day Demand (TJ/day)[2]	1,334	1,399	4.9%
Length of Transmission Pipeline (km)	2,959	2,970	0.4%
Length of Distribution Pipeline* (km)	45,741	47,523	3.9%

** Includes both distribution and intermediate pressure pipelines.*

Table ES-2 Fuel Types and Decarbonization Technologies Used in the 2022 LTGRP

Fuel Type	Description[3]	Life cycle Emission Factor (tCO_2e/GJ)	End use cycle Emission Factor (tCO_2e/GJ)
Natural gas	Natural gas is a naturally occurring hydrocarbon. Hydrocarbons are a class of organic compounds consisting of carbon and hydrogen. Raw natural gas (before processing) is composed primarily of methane.[4]	0.0598	0.04987[5]
Renewable natural gas (RNG)	Upgraded biogas produced from farm or municipal organic biomass. Upgraded synthesis gas (syngas) produced from wood biomass at pulp mills and some municipal organic biomass.	0.0100	0.0003
Syngas	Produced from wood to displace natural gas used in lime kilns at pulp mills. Can also be upgraded to green hydrogen.	0.0100	0.0000
Lignin	Produced from black liquor to displace natural gas used in lime kilns at pulp mills.	0.0100	0.0000
Green Hydrogen	Produced via water electrolysis using renewable electricity feedstock.	0.0000	0.0000
Blue Hydrogen	Reformed from hydrocarbon feedstock with up to 90 percent carbon sequestered.	0.0200	0.0000[6]
Natural Gas with Associated Carbon Capture, Utilization and Storage (CCUS)	Applying the carbon reduction benefits of CCUS to the delivery of natural gas on FEI's gas network.[7]	0.0148	0.0148

1 1 PJ (petajoule) = 1,000,000 GJ.
2 1 TJ per day (terajoule/day) = 1,000 GJ per day.
3 All definitions for fuel types are sourced from FEI except where specified.
4 Online at: https://www.nrcan.gc.ca/energy/energy-sources-distribution/natural-gas/natural-gas-primer/5641.
5 GHG emission factor consistent with that used by the Province as discussed in Section 9.2.
6 Updated values for the carbon intensity of hydrogen production are currently under development and will be provided in the next LTGRP.
7 The International Energy Association describes CCUS as a suite of technologies that can play an important and diverse role in meeting global energy and climate goals. CCUS involves the capture of CO_2 from large point sources,

The resource planning process begins by closely examining the planning environment in which FEI operates and by identifying expectations for future customer and demand growth. The demand- and supply-side resource alternatives for meeting future demand are then assessed, and actions recommended to ensure that the proper resources are in place to deliver the preferred energy solutions to meet future customer needs. Finally, FEI presents a four-year Action Plan, which identifies the near-term activities needed to meet the long-term resource requirements identified in the LTGRP.

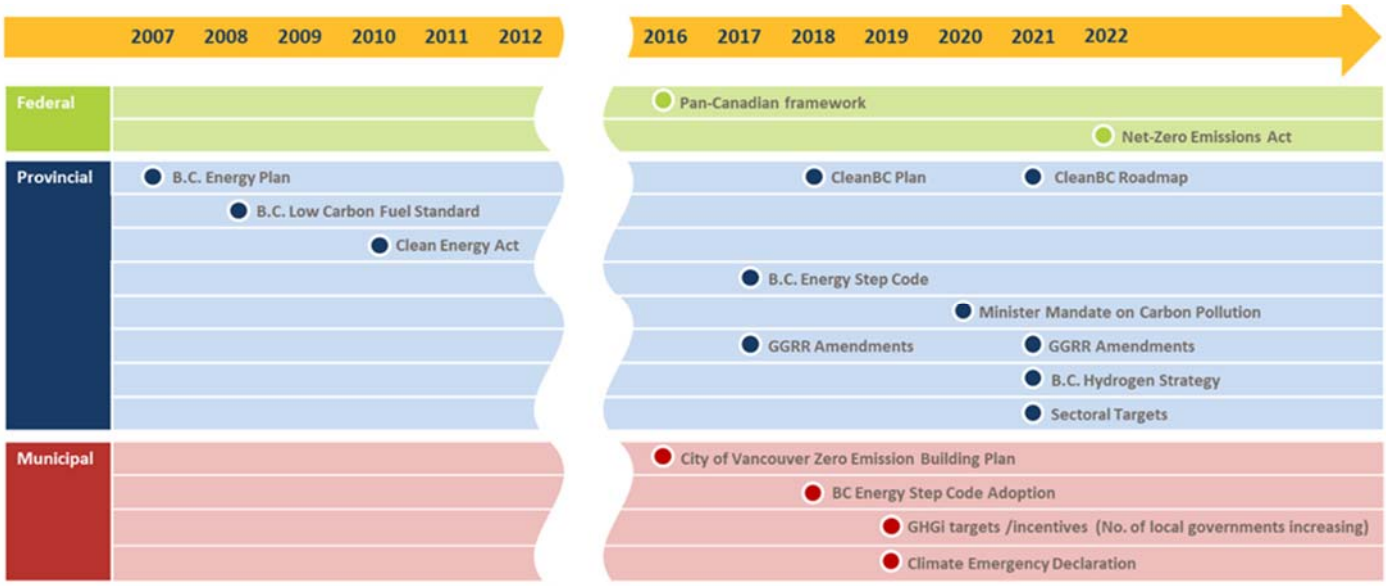
2. PLANNING ENVIRONMENT

This LTGRP involves forecasting and planning to 2042, during a time of rapid change and uncertainty in market forces, energy technologies and government policy, and at the early stages of FEI's journey to a low-carbon energy future. British Columbians, represented by all levels of government, Indigenous groups, and community representatives have been clear that a new path to a secure and low-carbon energy future must be developed. The 2022 LTGRP represents FEI's vision for how it will respond to this changing planning environment and participate in solutions to the imperatives placed on energy utilities like itself. This LTGRP represents FEI's long-term view of its transition to a low-carbon energy future, and is intended to be the catalyst for rapid progress in meeting the ambitious GHG reduction targets established by the provincial and federal governments.

Climate change is dramatically impacting the physical, political, social and economic environment in which FEI operates. Governments at all levels are enacting environmental policies and regulations aimed at reducing GHG emissions. These evolving energy and environmental policies are key factors in the LTGRP planning environment and help inform FEI regarding potential impacts on future customer demand and supply over the planning horizon. An overview of the major policies influencing FEI's planning environment and their evolution over time is illustrated in Figure ES-1.

including power generation or industrial facilities that use either fossil fuels or biomass for fuel. The CO_2 can also be captured directly from the atmosphere. If not being used on-site, the captured CO_2 is compressed and transported by pipeline, ship, rail or truck to be used in a range of applications, or injected into deep geological formations (including depleted oil and gas reservoirs or saline formations) which trap the CO_2 for permanent storage: CCUS Technology Report (2021), online at: https://www.iea.org/reports/about-ccus.

Figure ES- 1: Major Policies Adopted by All Levels of Government Demonstrate the Complexity of FEI's Planning Environment



There have also been significant legislative and policy developments with respect to the engagement with Indigenous groups since the 2017 LTGRP that have broad impacts on FEI's long-term planning. FEI recognizes and respects the constitutional rights of Indigenous peoples, and FEI's Statement of Indigenous Principles aims to ensure FEI's business operations are conducted with respect for Indigenous people's social, economic and cultural interests. Feedback and input from Indigenous groups during the development of this LTGRP emphasized the need for FEI to consider the key principles of the *United Nations Declaration on the Rights of Indigenous Peoples* and to ensure FEI considers Indigenous energy perspectives within its broader utility planning processes.

The competitive environment for FEI's products has grown more complex as a multitude of pricing and non-price considerations are influencing customer energy choices. Capital costs, installation requirements, operating and maintenance costs, government policies and public perception all play a role in this regard.

Gas markets continue to be volatile. With the anticipation of increased demand in the Pacific Northwest (PNW) and limited pipeline infrastructure becoming further constrained, regional price disconnects are expected to continue. Geo-political risk, and strained supply resources in the region during high demand periods, are creating upward price pressure and volatility risk. Infrastructure is needed to meet the pace of future demand growth, provide resiliency, and help support the clean energy transition in the PNW.

Decarbonizing FEI's gas supply in response to climate policy will put upward pressure on gas costs. This rising cost, regardless of specific cost recovery mechanisms or tariffs, will continue to be borne by FEI's customers, reducing FEI's price competitiveness when compared to other low-carbon fuel sources. Gas prices will continue to rise as renewable and low-carbon gas comprises

a larger share of the fuel mix. In parallel, electricity rates associated with electrification may also rise due to the need for more transmission, distribution, and substation infrastructure required to meet increases in electricity peak demand. However, decarbonization is necessary to meet the GHG emission targets set out in the Roadmap and to respond with urgency to climate change. The 2022 LTGRP demonstrates how the Clean Growth Pathway has the advantage of leveraging the resilience and reliability of the provincial energy system as a whole, achieving GHG reductions aligned with the provincial government's objectives, and being a more affordable and practical pathway for BC than relying on electrification alone.

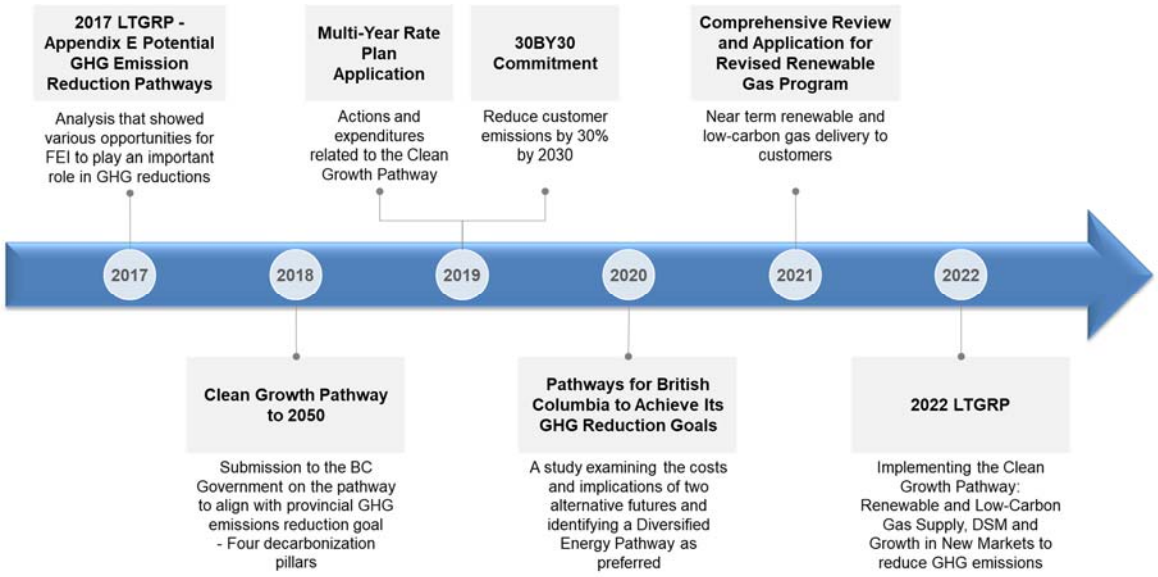
3. CLEAN GROWTH PATHWAY AND FOUR PILLARS TO A LOW-CARBON FUTURE

The 2022 LTGRP provides a comprehensive and long-term view of FEI's transition to a low-carbon future as it responds to a rapidly evolving energy landscape. FEI's Clean Growth Pathway lays the groundwork for this transition and represents FEI's 20-year vision. The Clean Growth Pathway is FEI's approach to supporting increasing government ambition and intervention to reduce GHG emissions and the adoption of policies to take greater climate action. The Clean Growth Pathway report (Appendix A-1) provides FEI's framework to transition to a low-carbon energy future and is supported by four key pillars, which figure prominently in the 2022 LTGRP:

- **Pillar 1:** Transitioning to renewable and low-carbon gases to decarbonize the gas supply;
- **Pillar 2:** Investing in DSM programs in support of energy efficiency and conservation measures to reduce energy use among residential, commercial and industrial customers;
- **Pillar 3:** Support for low-carbon transportation infrastructure to reduce emissions in this sector; and
- **Pillar 4:** Investing in LNG to lower GHG emissions in marine fueling and global markets.

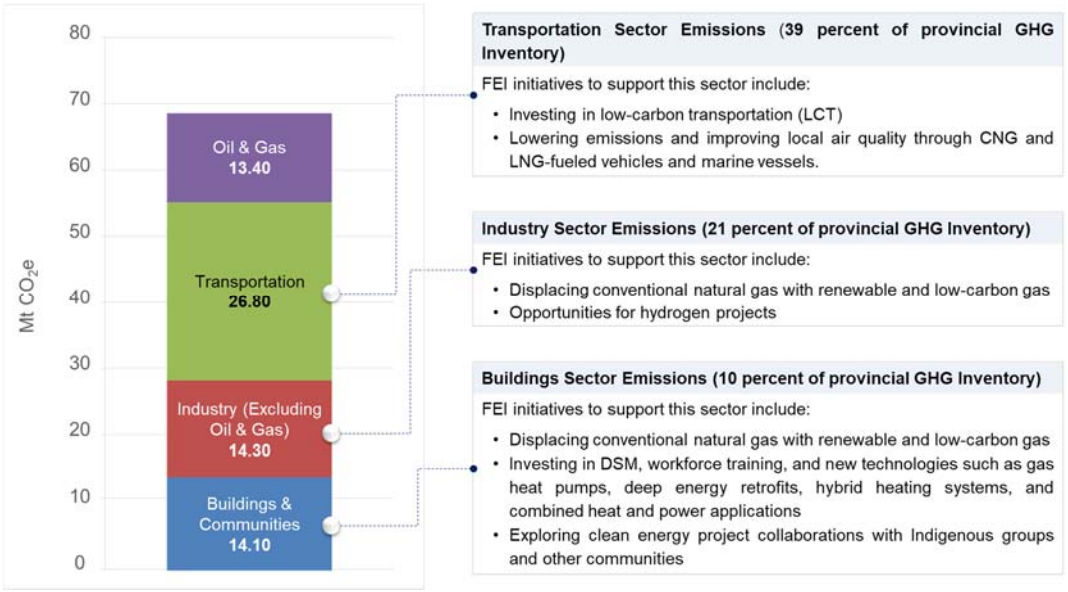
FEI's Clean Growth Pathway is a diversified pathway in that it relies on maintaining and growing both the existing gas and electricity infrastructure networks in BC to reach carbon reduction targets, catalyse energy innovation, and meet BC's growing need for energy over the long term. In addition to achieving GHG reductions aligned with the provincial government's objectives, other benefits include meeting peak demand on the coldest days of the year with the lowest risk, improving energy system resiliency, fostering emerging technologies and innovation, and economic development across the energy services supply chain. Figure ES-2 illustrates key milestones since the 2017 LTGRP that have set the stage for FEI's Clean Growth Pathway.

Figure ES-2. The Evolution of FEI's Clean Growth Pathway from 2017 LTGRP to 2022 LTGRP



The 2022 LTGRP plans for reducing BC's GHG emissions and contributing to global GHG emission reductions. Figure ES-3 illustrates BC's 2019 GHG emissions inventory by sector and describes FEI's initiatives to address these sectoral emissions.

Figure ES-3: 2019 GHG Emissions by Sector in BC[8] and FEI Initiatives to Support Decarbonization



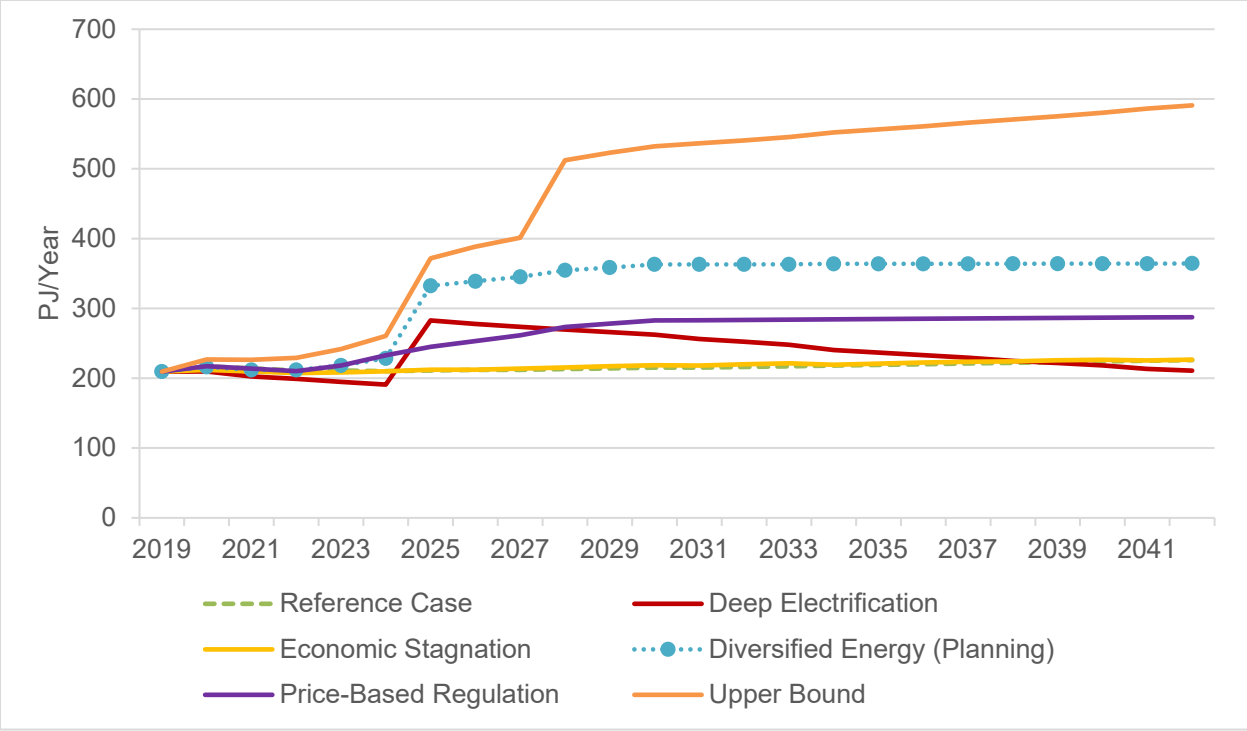
[8] BC's 2019 GHG emissions. Online at https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/progress-targets#emissions.

4. ANNUAL ENERGY DEMAND FORECASTING

Forecasting customer energy demand is a key step in identifying the resources FEI needs to meet the future energy needs of customers. An annual demand forecast is the amount of gas that FEI expects its customers to use over the course of a year. This determines the amount of gas FEI needs to acquire and transport on behalf of its customers on an annual basis. The annual demand forecast also provides the basis for determining energy savings from DSM and for calculating GHG emissions and emission reductions. FEI's peak demand is discussed later in the LTGRP and is a basis for securing shorter duration peaking supply resources and planning to meet system capacity requirements.

For resource planning, FEI uses an End Use Annual Method of demand forecasting to examine different ways that end use trends could unfold over the planning horizon to impact demand for gas. FEI prepares a Reference Case forecast as well as a range of alternate future scenarios that enable FEI to examine how future demand might unfold. FEI has designated the Diversified Energy Scenario as its planning scenario, which enables FEI's Clean Growth Pathway. Figure ES-4 shows the total range of annual demand forecast including all customer categories for each of the Reference Case and alternate future scenarios examined.

Figure ES-4: Total Forecast Annual Demand– All Demand Categories, All Scenarios



FEI's expectation of future annual energy demand for planning purposes is represented by the outputs of the Diversified Energy (Planning) Scenario analysis as shown in Figure ES-4. Observed growth in annual demand in the first half of the planning horizon is driven by load growth in the transportation sector and global LNG market, primarily with the large load step increase for the addition of the Woodfibre LNG project, modelled to begin operation in 2027.

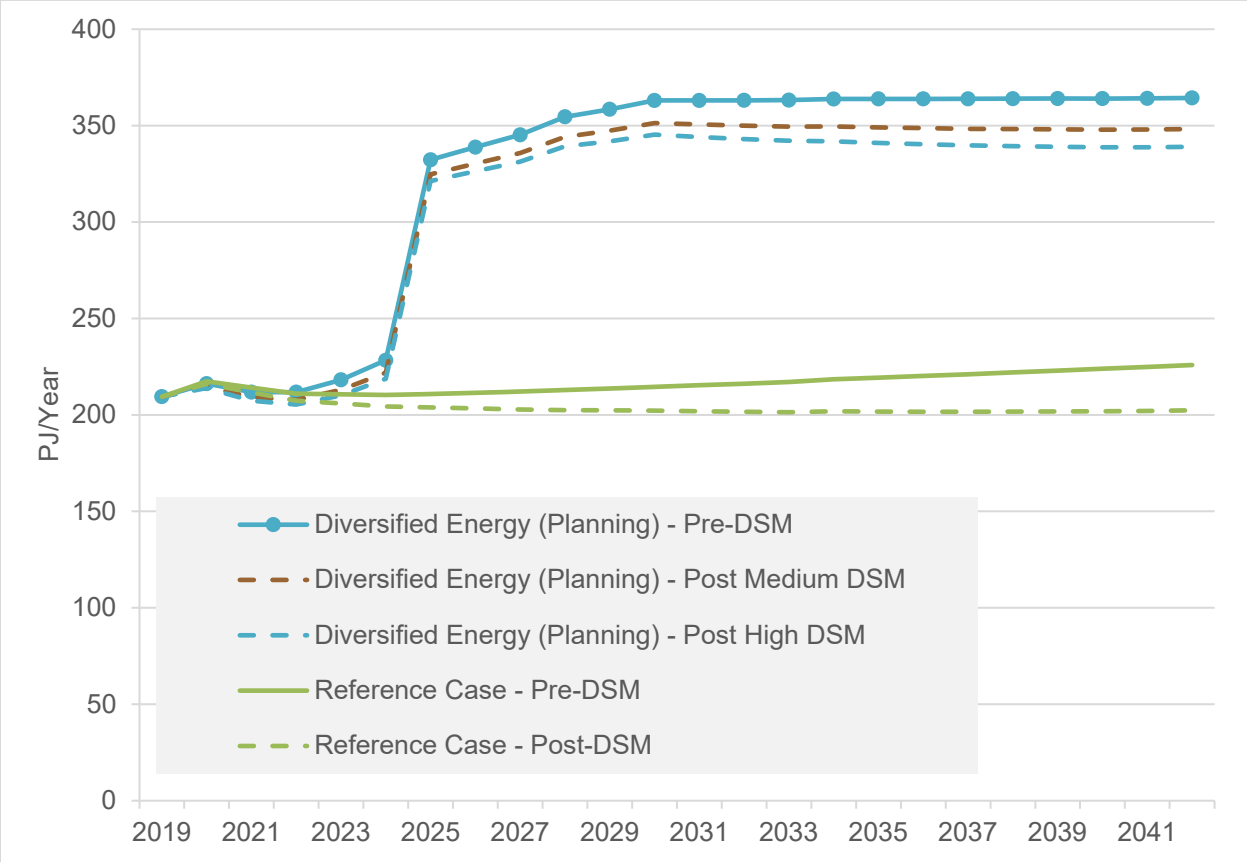
5. DEMAND-SIDE RESOURCES

FEI's adequate and cost-effective portfolio of DSM activities can result in significant energy and GHG emissions reductions over the planning horizon under the range of future scenarios examined for the LTGRP. As a pillar of FEI's Clean Growth Pathway, FEI anticipates expanding its existing DSM activities over the planning horizon to reduce GHG emissions to meet provincial GHG reduction targets. In particular, FEI's future DSM expenditure plans that will be filed with the BCUC for acceptance will be guided by the High DSM Setting analysed in this LTGRP. Under the Diversified Energy (Planning) Scenario with the High DSM Setting, FEI's savings from DSM activities are forecast to be significant, at approximately 25 PJ or 13 percent of annual load in 2042.

As directed in Order G-39-19, FEI's DSM funding scenarios reflect the results of the most recent Conservation Potential Review (CPR) (Appendix C-1), with incentive level, economic screen and budget settings applied to individual scenarios. The Diversified Energy (Planning) Scenario was used as the basis for a sensitivity analysis demonstrating the effects of the Low, Medium and High DSM settings on DSM expenditures, energy savings and cost effectiveness tests. These cost effectiveness tests include Total Resource Cost (TRC), Modified Total Resource Cost (MTRC) and Utility Cost Test (UCT) results expressed as a ratio and the Cost of Conserved Energy (CCE) expressed as $/GJ. FEI also provides a directional view of delivery rate and bill impacts for residential customers under the Low, Medium and High DSM Settings in the Diversified Energy (Planning) Scenario.

The final step in the DSM analysis is to develop total annual demand post-DSM to demonstrate the resulting energy savings effects of projected DSM activity. Figure ES-5 below illustrates the energy savings associated with DSM. In 2042, the Diversified Energy (Planning) Scenario – High Setting is 7 percent lower and the Medium Setting is 5 percent lower than the pre-DSM Annual Demand when taking into account the impact of both forecast LCT and also DSM activity. This results in 25 PJ of annual energy savings for the High DSM Setting and 16 PJ of annual energy savings for the Medium DSM Setting. In conclusion, this Diversified Energy (Planning) Scenario total annual demand after DSM (shown as Diversified Energy (Planning) – Post High DSM in the figure below) represents the annual demand that FEI is planning to in the 2022 LTGRP.

Figure ES-5: Total Annual Demand Before and After DSM for all Demand Categories



6. GAS SUPPLY PORTFOLIO

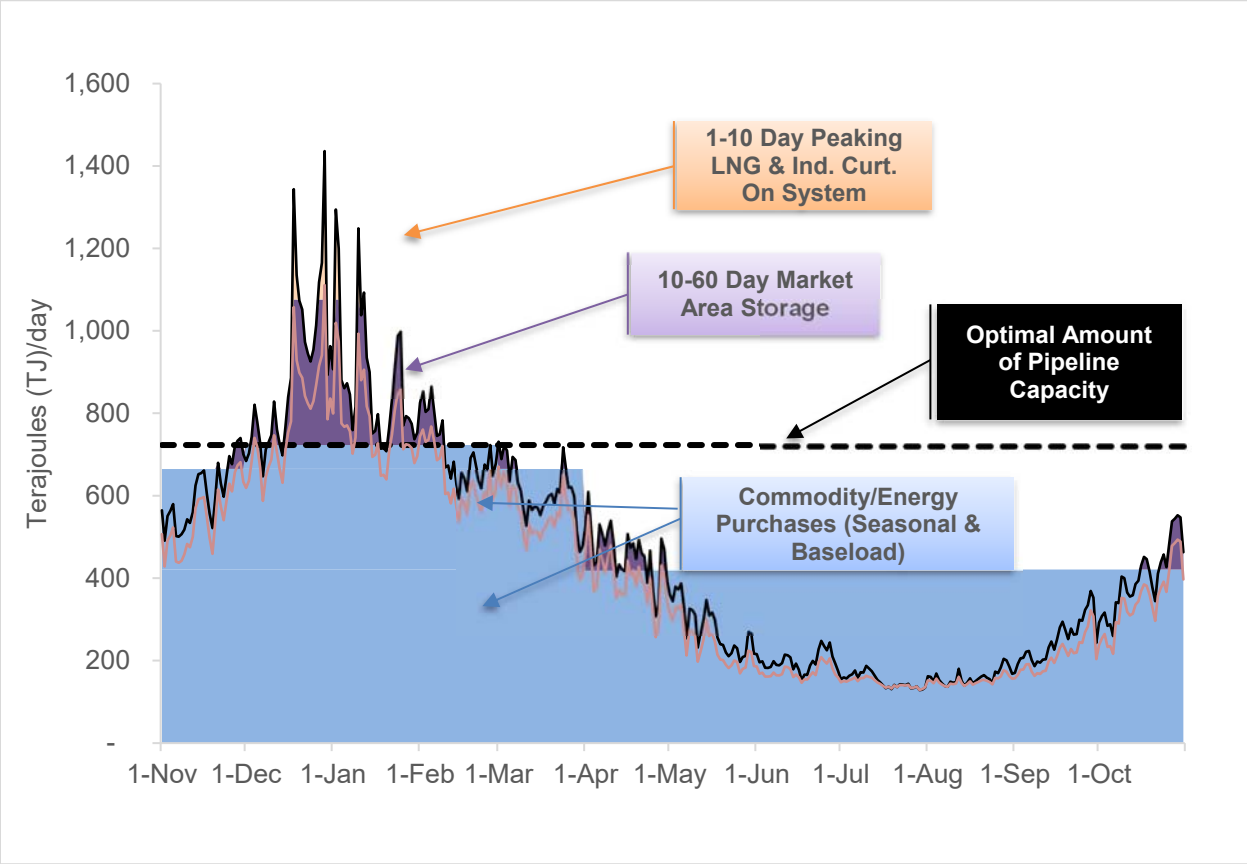
FEI's energy supply portfolio planning ensures that the forecast normal and peak day demand of core market (Core)[9] customers can be met. The planning process begins with considering the locations where FEI can purchase its gas supply resources and the physical gas storage and pipeline resources to which FEI has access. Other steps include planning for price risk management, pipeline and storage resources, potential changes in demand or market conditions, and the transition to renewable and low-carbon gas supplies through the Clean Growth Pathway.

The fundamental design principle of constructing an efficient gas supply portfolio of resources is to match the resource characteristics to the demand characteristics. Figure ES-6 provides an illustrative example of FEI's gas supply portfolio. Demand exhibits pronounced seasonality (i.e., high load in winter and low load in summer), and therefore a low annual load factor. This figure

[9] Core customers refer to Rate Schedules 1, 2, 3, 5, 6, 46 included; and Rate Schedule 4 (seasonal) excluded. FEI's gas supply portfolio includes the forecast normal, design, and peak day demand of these customers. Transportation Service customers arrange for their own supply that is then transported by FEI to their premises. System capacity planning (Section 7) needs to consider total system throughput to ensure that sufficient capacity exists on FEI's system to reliably deliver gas supply to meet the demand for both Core and Transportation service customers.

illustrates how the duration of supply resources fits the forecast annual normal and design load for Core customers.

Figure ES-6: 2021/2022 FEI Forecast Design and Normal Loads vs. Resources[10]



Constrained pipeline and storage resources in the PNW during the winter season continues to be a major concern, and market developments have caused significant supply and pricing risks in the region. Geo-political risks have added greater market uncertainty at this time. FEI has increased resiliency to a degree within the existing portfolio by holding contingency resources; however, resiliency needs to be further improved through new infrastructure projects. With the advancement of renewable and low-carbon gas supply resource in the region, FEI's future infrastructure is being planned to support the transition to a lower-carbon future by providing increased resiliency and supporting a broader range of supply resources.

Additional infrastructure and storage have been a major focus for FEI in light of recent supply disruptions, growing demand in the region, and the necessary requirements to transition to a renewable and low-carbon energy future. FEI has applied to the BCUC for a Certificate of Public Convenience and Necessity (CPCN) for the Tilbury LNG Storage Expansion (TLSE) project, which includes the construction of a new LNG storage tank and increased regasification capacity. The TLSE project would significantly increase the resiliency of FEI's gas system in the event of a

[10] This forecast is for Core requirements and does not represent total system throughput.

critical disruption of regional pipeline supply by allowing FEI to continue to serve a much larger portion of the daily system in the event of a supply emergency and by providing sufficient storage to meet that load for a longer period of time. Similarly, FEI's Regional Gas Supply Diversity (RGSD) project would involve expanding the Southern Crossing Pipeline (SCP) to diversify FEI's gas supply on a separate pipeline path from those with constrained capacity.

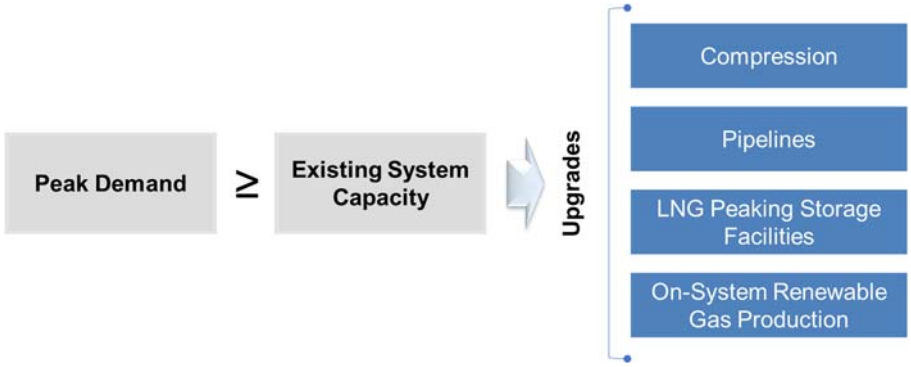
Implementing the RGSD project and expanding on-system storage resources (i.e., the TLSE project) are the most cost-effective ways to enhance resiliency, facilitate load growth opportunities, support the transition to renewable and low-carbon gas and also create diversity and flexibility within FEI's energy supply portfolio. Ultimately, the continued use of the gas infrastructure is a critical component of decarbonizing the province's energy system and, over the long term, will mitigate the cost of the low-carbon energy transition to British Columbians.

7. SYSTEM RESOURCE NEEDS AND ALTERNATIVES

A key aspect of ensuring safe, reliable, and secure delivery of gas to customers is identifying when and where any capacity constraints may appear and planning for the infrastructure and system resources that FEI requires to construct over the planning horizon. Growth in peak demand is among the most significant challenges for FEI's long-term planning. When the forecast for peak demand exceeds available capacity, a gas system expansion is required. The system resource needs discussed in the 2022 LTGRP also reflect the need to deliver renewable and low-carbon gases in increasingly larger volumes over the planning horizon and discusses the infrastructure changes required to accommodate this transition.

System planning includes system sustainment and renewal, integrity upgrades, and system expansion contributing to overall system resiliency. There are three primary resource options to evaluate when planning system expansions: pipelines, compression and storage as shown in Figure ES-7. Over time, FEI expects on-system renewable gas production to grow in importance as a fourth resource option. Often, some combination of the resource options leads to an optimal solution. Infrastructure projects on transmission systems to address system capacity constraints are often large and take many years to plan and execute, demonstrating the benefits of the long-term resource planning process.

Figure ES-7: Options for Gas System Reinforcements



To address specific local and regional demand, FEI considers the peak demand requirements for each of the three main transmission systems: Vancouver Island Transmission System (VITS); Coastal Transmission System (CTS); and Interior Transmission System (ITS). For each regional system, higher or lower than expected load growth could shift the timing of system expansion requirements either ahead or further out in time.

For the VITS, at this time, capacity upgrades are not required. Two pressure control station additions are currently proposed for installation in the next few years to serve the growing distribution systems of Greater Victoria and Nanaimo. The Woodfibre LNG project will require reinforcement of the existing VITS with pipeline looping and added compression near Squamish. This would match the capacity contracted by the project proponent under peak demand, while also preserving available capacity for existing customers and allowing large volumes of interruptible capacity to be available for much of the year.

For the CTS, the TLSE and RGSD projects would address demand and resiliency requirements. The Tilbury site in Delta, located on the CTS, is the location of the LNG liquefaction and storage facility used to serve demand for conventional gas from LCT initiatives, which is forecast to grow over the next 20 years. Based on FEI's demand forecasts for LNG, future phases of Tilbury LNG expansion beyond the current phase will need to be constructed. The RGSD project would expand the SCP from Oliver to the Lower Mainland to increase the CTS's supply diversity. The RGSD has also been developed in consideration of the Clean Growth Pathway and will have the capacity and capability to support FEI's plans to deliver hydrogen across the PNW, including BC.

For the ITS, capital expansion is required to meet forecast demand. FEI currently has a CPCN Application for the Okanagan Capacity Upgrades (OCU) Project in progress. The proposed OCU project would offer sufficient capacity to meet the future peak demand requirements. The preferred alternative is an approximately 30-kilometre NPS[11] 16 pipeline loop between Penticton and Kelowna, reinforcing the existing NPS 12 pipeline currently in service. Reinforcement alternatives have been identified to meet the demand forecast and would be required, in addition to completion of the OCU Project, by the winter of 2038 to 2039.

As FEI incorporates renewable gases into the gas distribution and transmission systems, the physical properties of these gases, such as density and energy content per standard volume, can have an impact on capacity. Gases with physical properties within the range of conventional gas, such as RNG, will have no net impact on delivery capacity. Delivering hydrogen or a blend of hydrogen and natural gas or hydrogen and RNG, where the gas density and energy content are different from traditional natural gas supply, will change the energy delivery capacity. Table ES-3 provides an overview of FEI's system planning considerations for integrating renewable and low-carbon gas into the individual regional transmission systems.

[11] Nominal pipe size, in inches.

Table ES-3: Overview of Considerations for Integrating Renewable and Low-Carbon Gas in FEI Systems

Fuel Type / Other Considerations	Regional Transmission and Distribution Line Considerations		
	VITS	CTS	ITS
RNG (on-system)	• Supply potential • No detrimental impact on transmission system capacity • Reliable supply from local on-system hubs will reduce upstream supply requirements and improve available capacity	• Supply potential • No detrimental impact on transmission system capacity • Reliable supply from local on-system hubs will reduce upstream supply requirements and improve available capacity	• Supply potential • No detrimental impact on transmission system capacity • Reliable supply from local on-system hubs will reduce upstream supply requirements and improve available capacity
Hydrogen	• Supply potential from blue or turquoise production potential may require system upgrades • Green hydrogen hub will reduce upstream supply requirements and improve available capacity, but reduce available capacity downstream	• By 2030, hydrogen production anticipated with hydrogen and RNG in similar proportions. • By 2042, hydrogen supplied from upstream of Huntington Control Station and comprises a much larger portion of the fuel mix • With upstream supply, hydrogen separation facility at Huntingdon anticipated • Dedicated hydrogen "backbone" pipeline likely	• Supply potential from blue or turquoise production potential may require system upgrades • Green hydrogen hubs will reduce upstream supply requirements and improve available capacity, but reduce available capacity downstream
Syngas and Lignin	• Supply potential	• No supply potential currently identified	• Supply potential
LNG and Industrial Project Impacts	• Woodfibre LNG project may preclude hydrogen blending upstream (at Eagle Mountain) • Management of hydrogen at FEI's Mount Hayes LNG facility would be required	• Flow of hydrogen likely to be separated from transmission system at Huntingdon control station due to large scale LNG production at Tilbury and Woodfibre LNG project	• Management of hydrogen at any future LNG facilities would be required

Fuel Type / Other Considerations	Regional Transmission and Distribution Line Considerations		
	VITS	CTS	ITS
System Upgrade Requirements	• Scope and location of system upgrades not yet feasible to determine as supply volumes and locations are currently in early stages of development	• Local supply hubs and small dedicated systems eventually connected to upstream by dedicated hydrogen "backbone" • Scope and location of system upgrades not yet feasible to determine as supply volumes and locations are currently in early stages of development	• Renewable and low-carbon projects could offset the need for upgrades • RGSD project under development could provide significant support for delivery of hydrogen and other renewable gas • Scope and location of system upgrades not yet feasible to determine as supply volumes and locations are currently in early stages of development

FEI's gas system must be expanded to meet future demand growth and optimize operation of the whole system. With annual increases in forecast peak demand, potential new sources of demand from LCT and industrial sources, and the introduction of renewable and low-carbon gases in significantly increasing quantities, the VITS, CTS and ITS transmission systems could all require capacity-enhancing projects to meet peak demand forecasts while enabling FEI's Clean Growth Pathway.

8. STAKEHOLDER INDIGENOUS AND COMMUNITY ENGAGEMENT

Connecting with customers, communities, Indigenous groups, and other stakeholders on long-range planning issues is of critical importance to FEI. FEI undertook a number of initiatives to offer interested participants the opportunity to contribute to the discussions that informed the 2022 LTGRP and FEI's Clean Growth Pathway initiatives. These activities continued into the first quarter of 2022 and included:

- Workshops with the dedicated Resource Planning Advisory Group (RPAG) engaged strategic representatives of municipalities, government, customers, associations, and organizations with interest, experience and/or significant industry knowledge in energy planning in the development of the LTGRP.
- Engagement workshops with First Nations community representatives provided feedback on how engagement can be strengthened for the ongoing LTGRP planning process, the development of clean energy projects, and other FEI initiatives.
- Community Engagement workshops recognizing the importance of considering diverse community perspectives and energy planning needs with respect to developing BC's energy future and FEI's role in the low-carbon transition across its service territory.

- FEI's other engagement activities that directly or indirectly inform the resource planning process, such as discussions with advisory groups, government, industry associations, customers and other stakeholders.

Through the RPAG workshop sessions, stakeholders have been able to provide FEI with input on many important factors, such as demand forecasting and scenario analysis methods, demand drivers and scenarios and feedback on FEI's Clean Growth Pathway. The workshops with Indigenous groups highlighted the need to further evolve engagement processes and in response FEI developed an Action Item accordingly. The Community Engagement workshops assisted FEI in identifying energy issues and planning opportunities in municipalities and communities throughout BC. The information gained through these activities informs FEI's market research and analysis, identifying long-term planning issues of concern to a number of stakeholder groups, feedback on FEI's transition to renewable and low-carbon gas, interest in local clean energy projects and identifying interested stakeholders who may become more engaged in the LTGRP process.

9. OUTCOMES OF THE CLEAN GROWTH PATHWAY

FEI's vision for the future of energy in BC is that of a diverse, integrated and resilient network of energy infrastructure and services, building on the strength and benefits of both the existing gas and electric energy delivery networks in the province. FEI's role in this future is to utilize, grow and strengthen its gas transmission and distribution systems for the continued delivery of safe, secure and reliable energy to customers, while reducing GHG emissions for customers through the four pillars of its Clean Growth Pathway. As FEI proceeds down this pathway, the continued commercialization of existing technologies, advancements in new technology and innovation will enable deeper carbon emission reductions, while putting BC at the forefront of emerging industries such as those that will drive BC's future hydrogen economy.

One of the key impacts of the Clean Growth Pathway is GHG emission reductions to meet the Roadmap's cap on emissions for natural gas utilities for residential, commercial and industrial customers, to be implemented as the Greenhouse Gas Reduction Standard (GHGRS). Through the Clean Growth Pathway, and based on end use demand in the Diversified Energy (Planning) Scenario, FEI's GHG emission reductions for the following categories are described below and illustrated in Figure ES-8:

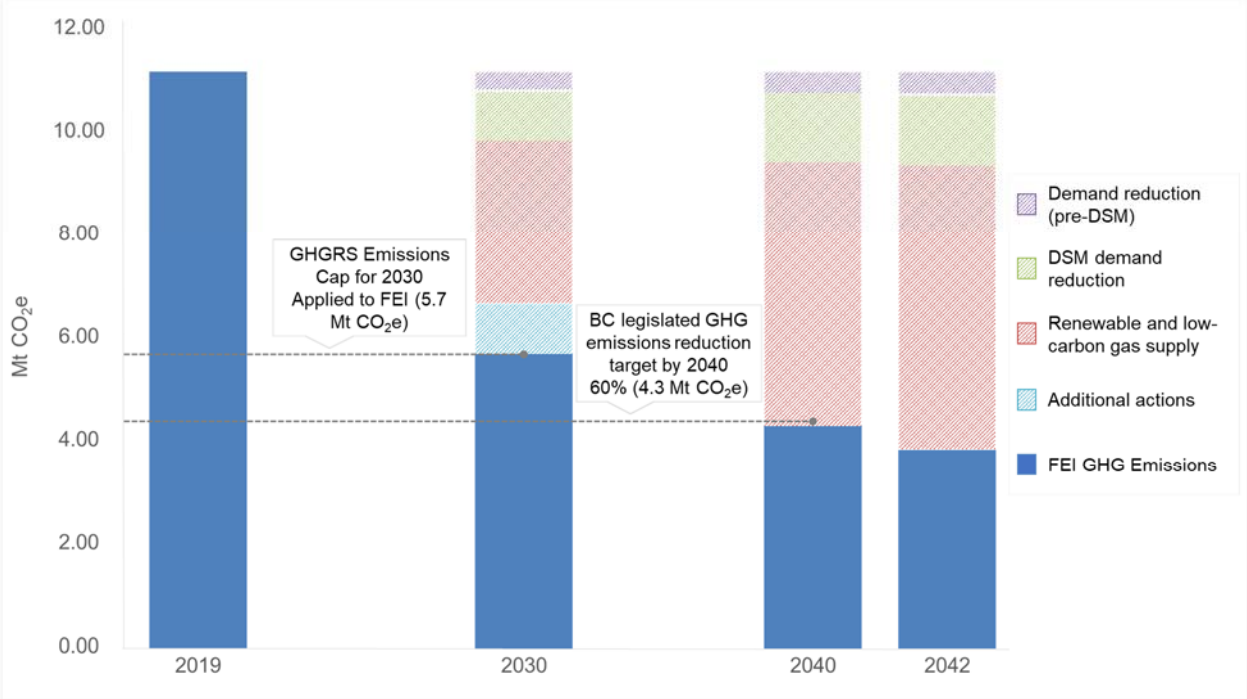
- **Changes in demand (pre-DSM)** describes the impact of natural efficiency[12] combined with a degree of electrification discussed in Section 4. This demand reduction corresponds to GHG emission reductions of 0.3 Mt CO_2e per year in 2030 and 0.4 Mt CO_2e per year in 2040;

[12] Efficiency improvements that occur through the natural replacement of older, less efficient equipment with newer, more efficient equipment as influenced by market transformation by DSM programs, regulations and other factors.

- **FEI's DSM programs** result in energy savings at the High DSM setting discussed in Section 5. This high level of energy savings results in 0.9 Mt CO_2e reductions in 2030 and 1.3 Mt CO_2e reductions in 2040;
- **The renewable and low-carbon gas supply transition** has the largest impact on GHG emission reductions as discussed in Sections 4, 6, and 7. Acquiring and allocating 60.2 PJ of renewable and low-carbon gas supply by 2030 to this group of customers' demand results in emission reductions of approximately 3.0 Mt CO_2e. In 2040, the allocation of 99 PJ of renewable and low-carbon gas to these customer groups result in 4.9 Mt CO_2e of GHG emission reductions; and
- **Additional GHG emissions reductions initiatives** were identified by FEI after completion of the demand and supply modelling for the 2022 LTGRP. Examples of these additional opportunities include further DSM opportunities and further renewable and low carbon gas reductions such as CCUS technology development. FEI expects these opportunities to result in a further 0.9 Mt CO_2e reductions or more by 2030. FEI is still considering how these additional opportunities feed into the emissions reductions later in the planning horizon and so has not included them in its assessment of 2040 emission reductions at this time. FEI will formally include these additional opportunities in its demand and GHG emission modelling for the next LTGRP.

FEI anticipates that as it proceeds along its Clean Growth Pathway, additional new opportunities and technology advancements will continue to arise for further potential GHG emission reductions for residential, commercial and industrial customers. The Roadmap states that the GHGRS emissions cap on gas utilities will be approximately 6 Mt CO_2e in 2030. Accounting for the fact that FEI is not the only gas utility in BC, the portion of the cap that applies to FEI is approximately 5.7 Mt CO_2e. Figure ES-8 shows the GHG emission reductions required to meet the GHGRS cap for gas utilities. FEI's modelling of GHG emissions reductions for the Diversified Energy (Planning) Scenario meets the Province's 2040 target emission reductions and puts net-zero GHG emissions by 2050 for these customer groups within reach. Over the long term, the Diversified Energy (Planning) Scenario has similar emission reductions to the Deep Electrification Scenario, with a somewhat deeper reduction driven by growth in the supply of renewable and low-carbon gases.

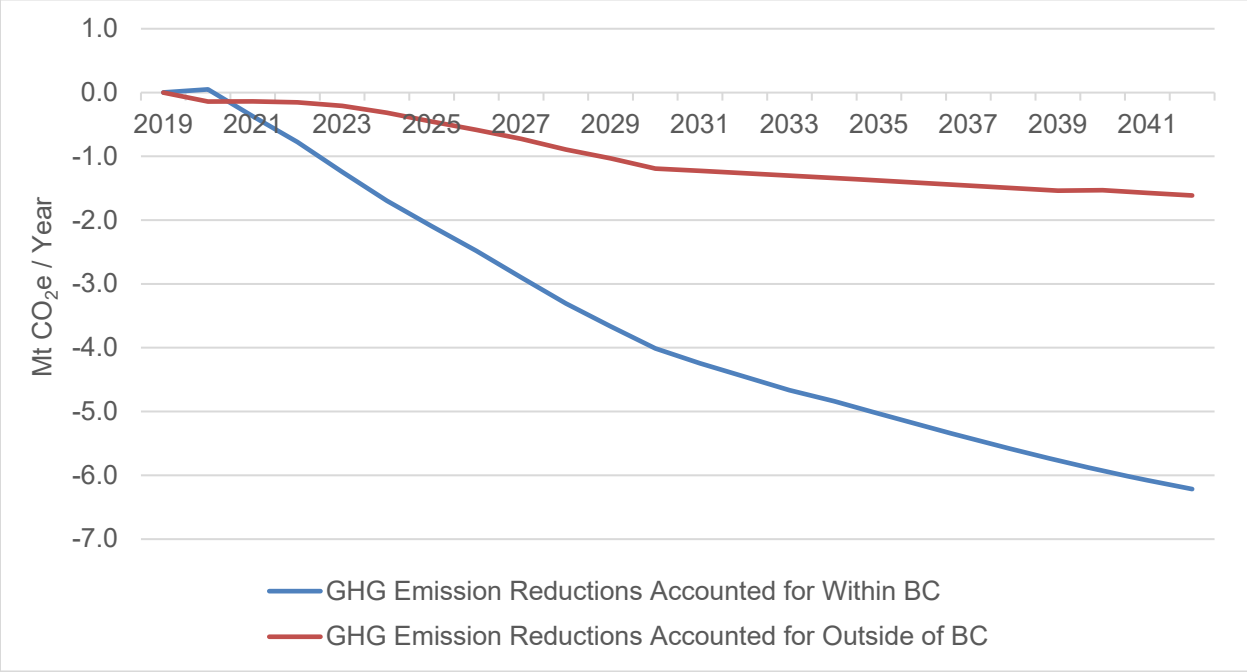
Figure ES-8. GHG Emission Reductions for Residential, Commercial and Industrial Customers Meets the GHGRS for the Diversified Energy (Planning) Scenario [13]



The total GHG emission reductions modelled in the Diversified Energy (Planning) Scenario represent the outcome of implementing initiatives outlined in the pillars of the Clean Growth Pathway. In order to provide a complete picture, GHG emission reductions from serving both the residential, commercial and industrial customer groups, and the low-carbon transportation and global LNG customers throughout the planning horizon are illustrated in Figure ES-9 (based on life-cycle emission factors). Figure ES-9 illustrates the total emissions resulting from Diversified Energy (Planning) Scenario broken out into reductions accounted for within BC and those that are accounted for outside of BC.

[13] GHG emissions reductions based on end-use emission factor in order to align with the GHGRS.

Figure ES-9: Total GHG Emission (Life Cycle) Reductions for the Diversified Energy (Planning) Scenario - BC and Outside of BC



To provide context for FEI's long-term volume forecasts and their influence on customer rates, FEI analysed the cost impacts of decarbonization initiatives and variations in demand over the planning period. Table ES-4 below summarizes the cumulative effective rate impact projections as well as the equivalent annual rate impact over the 20-year period for each select scenario.

Table ES-4: Summary and Comparison of Average Projected Delivery Rate Changes

		Effective Rate Change (2022 - 2042, %)							
	Average UPC (2022 - 2042)	Reference		Upper Bound		Diversified Energy (Planning)		Deep Electrification	
		Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual
Residential (RS 1)	60	73%	2.8%	77%	2.9%	118%	4.0%	235%	6.2%
Small Commercial (RS 2)	293	41%	1.7%	64%	2.5%	102%	3.6%	207%	5.8%
Large Commercial (RS 3)	3,253	40%	1.7%	69%	2.6%	107%	3.7%	206%	5.7%
General Firm Service (RS 5)	18,542	44%	1.9%	80%	3.0%	114%	3.9%	150%	4.7%

These cumulative effective rate impacts are made up of individual impacts in all components of FEI's rates, including delivery, cost of gas, storage & transport, and carbon tax. Using Residential (RS 1) as an example, the total residential bill is estimated to increase from approximately $1,029 in 2022 to $1,958 in 2031, and to approximately $2,215 in 2040 under the Diversified Energy (Planning) Scenario. The 118 percent cumulative effective rate impact by 2042 under the Diversified Energy (Planning) Scenario is made up of approximately 50 percent delivery rate impact, 41 percent commodity-related impact (cost of gas and storage & transport), and 9 percent carbon tax. More detailed discussion on rate impacts is presented in Section 9.4

10. ACTION PLAN

The Action Plan describes the activities that FEI intends to pursue over the next four years based on the discussion and conclusions provided in this LTGRP. The specific Action Items include the following:

1. Accelerate the development and acquisition of renewable and low-carbon gas supplies to meet customer energy needs and contribute to provincial emission reduction targets;
2. Pursue approval of DSM funding for the period beyond 2022 by submitting for BCUC approval a DSM expenditure plan in 2022;
3. Continue pursuing FEI's LCT and global LNG initiatives to address market opportunities for load growth in support of customer rates and reducing local and global GHG emissions;
4. Continually improve engagement processes and activities associated with FEI's long-term gas resource planning;
5. Seek BCUC approval for a deferral account to capture the costs of advancing the development of the RGSD project;
6. Continue to develop and implement FEI's Gas System Resiliency Plan;
7. Plan for and prepare CPCN applications for near-term system requirements identified in Section 7 to support safe, reliable and cost effective gas delivery to FEI's customers;
8. Continue monitoring, analysing, and contributing to the energy planning environment while working with government on policy framework for deep decarbonization;
9. Protect and promote the interests of FEI's customers by securing reliable, cost-effective, long-term gas supplies that include increasing proportions of renewable and low-carbon gas;
10. Continue monitoring for and evaluating system expansion needs across FEI's service regions; and
11. Prepare and submit FEI's next LTGRP.

In conclusion, FEI's Clean Growth Pathway will support BC's decarbonization initiatives by transforming and influencing energy supply service markets. Maintaining BC's gas and electric infrastructure will enable ongoing innovation and accelerate decarbonization such that provincial GHG emission reduction targets will be met at a more rapid pace. In this pathway, the gas infrastructure continues to grow and thrive by adding new customers, communities, and commercial and industrial processing. Sharing costs across a diverse set of customer segments ensures that individual customers can more readily absorb the additional costs incurred through the low-carbon transition.