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December 22, 2022

BC Solar & Storage Industries Association
PO Box 33019, West Vancouver, BC
V7V 4W7

Attention: Mr. Steve Davis

Dear Mr. Davis:

Re: FortisBC Energy Inc. (FEI)

2022 Long Term Gas Resource Plan (LTGRP) – Project No. 1599324

Response to the BC Solar and Storage Industries Association (BCSSIA) Information Request (IR) No. 1

On May 9, 2022, FEI filed the LTGRP referenced above. In accordance with the amended regulatory timetable established in British Columbia Utilities Commission Order G-287-22 for the review of the LTGRP, FEI respectfully submits the attached response to BCSSIA IR No. 1.

In its responses, FEI has identified responses which were provided by, contributed to, or developed with its consultants, the Posterity Group and Guidehouse.

For convenience and efficiency, FEI has occasionally provided an internet address for referenced reports instead of attaching lengthy documents to its IR responses. FEI intends for the referenced documents to form part of its IR responses and the evidentiary record in this proceeding.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.

Original signed:

Diane Roy

Attachments

cc (email only): Commission Secretary
Registered Parties

1.0 Topic: Resource Planning Advisory Group – FEI Presentations

Reference: Exhibit B-1, Section 8.2 THE RESOURCE PLANNING ADVISORY

GROUP (RPAG) PROVIDED KEY INSIGHTS AND FEEDBACK TO FEI.

Section 8.2.1 states that FEI Held Six Workshops with the RPAG

> "The RPAG is a technical working group that engages representatives of municipalities, provincial government, customers, public interest associations, environmental organizations and intervener groups in the development of the LTGRP. RPAG members bring significant knowledge and experience to the process and provide key insight and feedback to FEI."

> "FEI held six RPAG workshops between 2021 and 2022 to review key steps in the LTGRP process, discuss plan inputs, gather feedback on the results of the LTGRP process to date, and provide input into FEI's decision to use the Diversified Energy (Planning) Scenario as the planning scenario in the LTGRP. Attendees participated by asking questions and providing discussion throughout each presentation. An overview of presentation content is outlined in Table 8-2. An interactive tool (discussed in Section 8.2.3) was also utilized to gather crowd-sourced feedback regarding demand drivers and scenarios."

1.1 Please provide the six presentations listed in Table 8-2 that FEI gave to the RPAG. (i.e., on January 25, 2021, February 12, 2021, June 17, 2021, November 3, 2021, December 1, 2021, and on February 10, 2022)

<u>Response:</u>

Please refer to Attachment 1.1 for copies of the requested presentations.

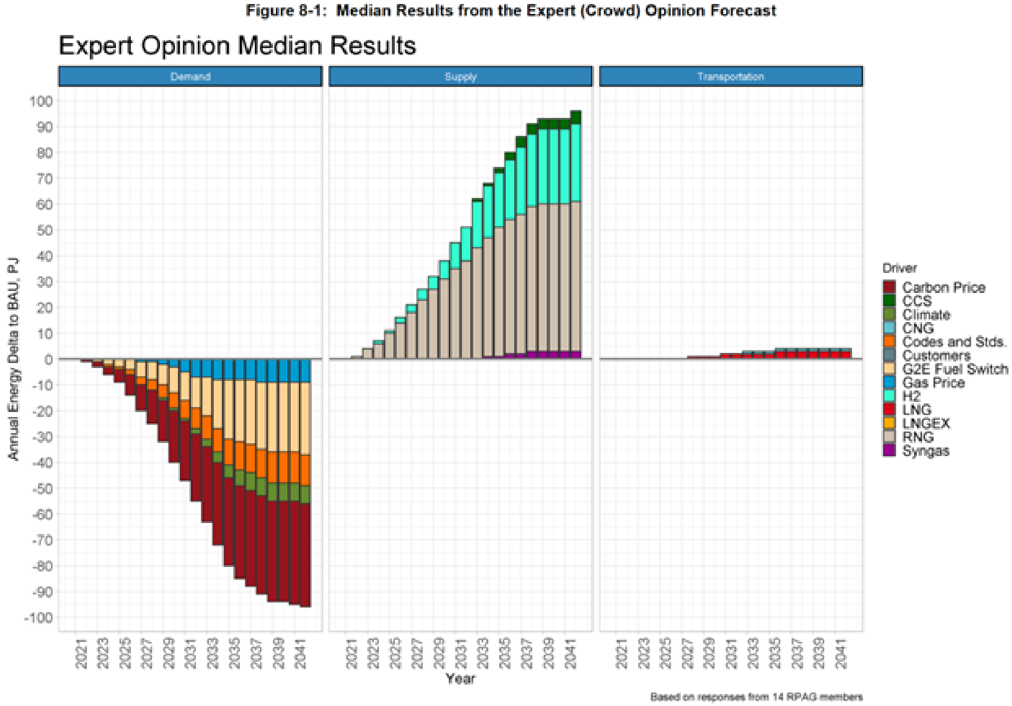
2.0 Topic: Expert (Crowd) Opinion Forecast Tool

Reference: Exhibit B-1, Section 8.2 THE RESOURCE PLANNING ADVISORY GROUP (RPAG) PROVIDED KEY INSIGHTS AND FEEDBACK TO FEI.

Section 8.2.3 Stakeholder Expert (Crowd) Opinion Forecast states:

> "At the June 21, 2021 RPAG meeting, FEI introduced the Expert (Crowd) Opinion Forecast and "Slider" forecasting tool (Expert Opinion Tool). Stakeholders were given an introduction to the exercise and a website link via email after the session. Stakeholders were invited to use the tool to develop their own forecast scenario and to then submit the results to FEI. The exercise was anonymous, but an option was made available for participants to identify their affiliation. The invitation was sent to 31 stakeholders. FEI received responses from 14 RPAG members.
>
> The exercise asked participants to estimate the impact of a number of drivers216 over the 20-year period of the LTGRP. FEI selected those drivers that were not reflected in the historical data used to develop the BAU forecast at the level that would likely be experienced in the future. Drivers were provided to explore the impacts of variations in demand, supply, transportation and the Woodfibre LNG project."
>
> Once the data was collected, FEI prepared the following figure using the median of each of the 14 responses."

Figure 8-1: Median Results from the Expert (Crowd) Opinion Forecast

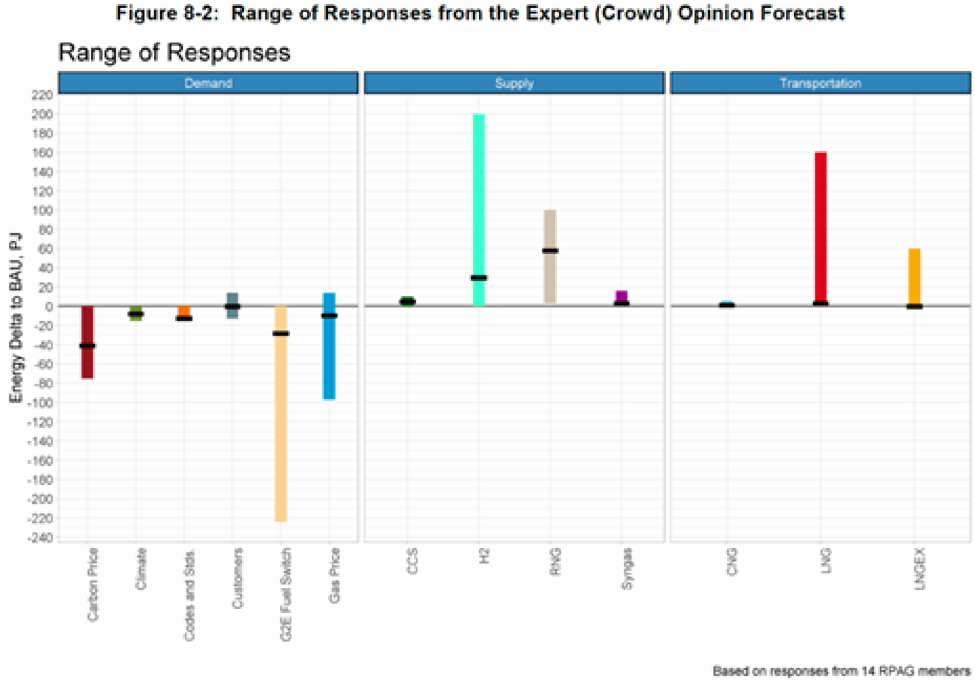


"FEI makes the following observations from the Expert (Crowd) Opinion Tool Median Results:

- From the Demand plot, the largest impact in 2042 is expected to come from increased carbon prices at 40 PJ, and gas-to-electricity fuel switching at 28 PJ;
- By 2041, the median aggregate reduction in demand is forecast to be 96 PJ, relative to the BAU forecast;
- From the Supply plot, the largest contributors are RNG at 58 PJ, and Hydrogen at 30 PJ;
- By 2042, the median aggregate supply from non-traditional sources is forecast to be 96 PJ; and
- The median impact from transportation is 4 PJ. In the LTGRP, this demand category is referred to as 'Low-carbon Transportation and Global LNG' and in this analysis includes CNG, LNG and LNG export from FEI.

Of the 14 responses, eight felt that the Woodfibre LNG project would not go ahead and therefore the median demand from the Woodfibre LNG project driver is 0 (and not shown on the chart). The following figure shows the ranges of the responses for each driver. This plot indicates where there is both uncertainty and agreement across the drivers. The black "tick" indicates the median response for each driver."

Figure 8-2: Range of Responses from the Expert (Crowd) Opinion Forecast



"The key observations from the Range of Responses include the following:

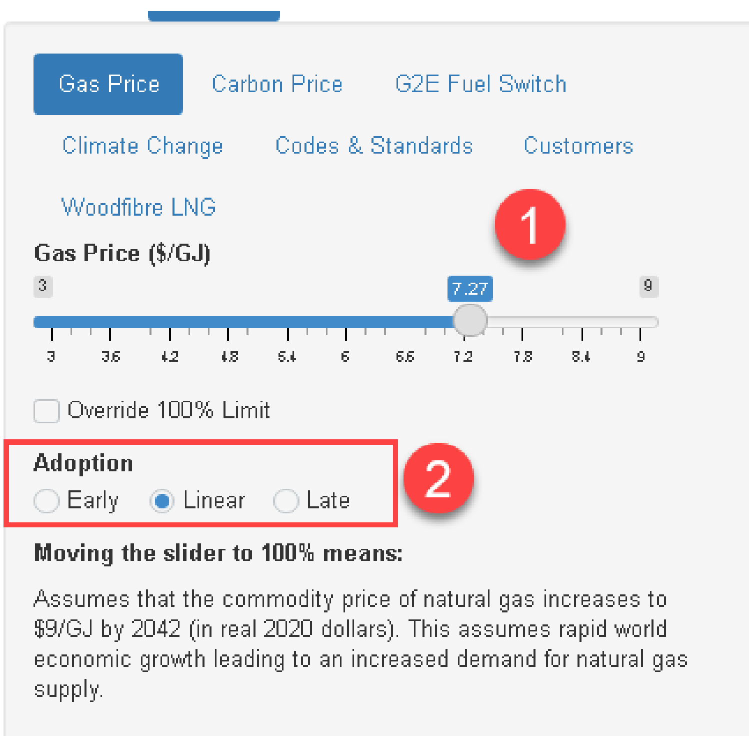
- The responses for gas to electric fuel switching showed the widest range of all the drivers, ranging from no impact up to a reduction of 225 PJ. The median response was lower at 28 PJ;
- The impact from adding hydrogen to the supply also showed a very wide range of responses, topping out at 200 PJ. Once again, the median response was a more modest 30 PJ, and less impactful than the median response from RNG at 58 PJ; and
- Finally, the LNG driver also showed a significant range, from zero to 160 PJ. For this driver, the median response was close to zero at just 3.5 PJ."

2.1 Were the participants asked to provide their estimates of the impacts of the various drivers only at the end of the 20-year period (i.e., 2041), or were they also asked to estimate the impacts at intermediate benchmark years (such as 2025, 2030, 2035)? If not by the participants, then how were those intermediate values derived?

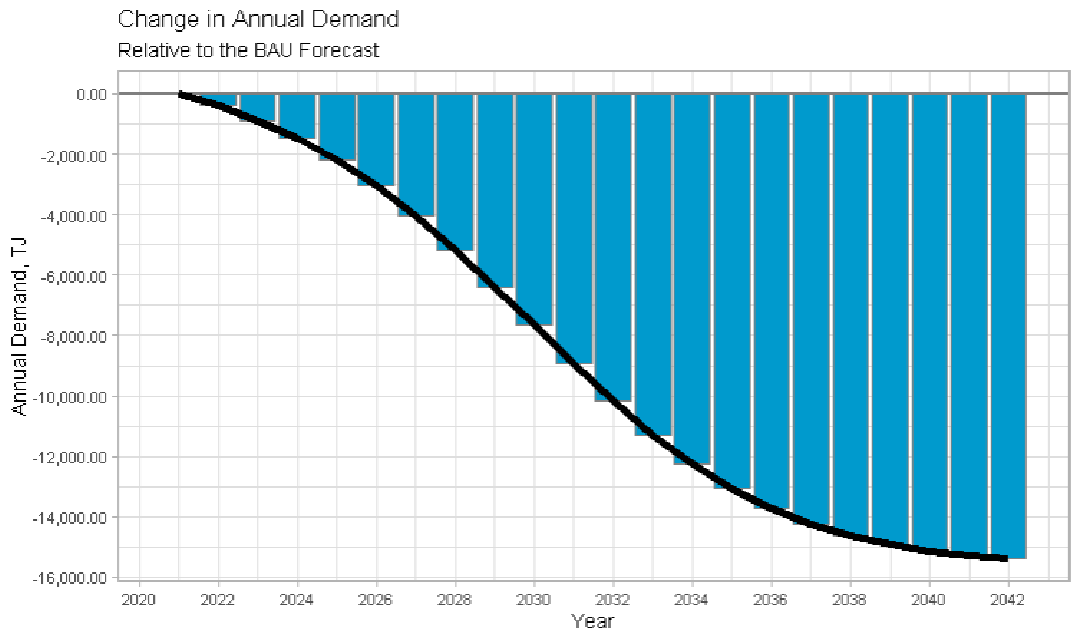
Response:

Participants were asked for driver estimates at the end of the 20-year period, and were then provided three adoption path end points: early adoption, linear adoption, or late adoption.

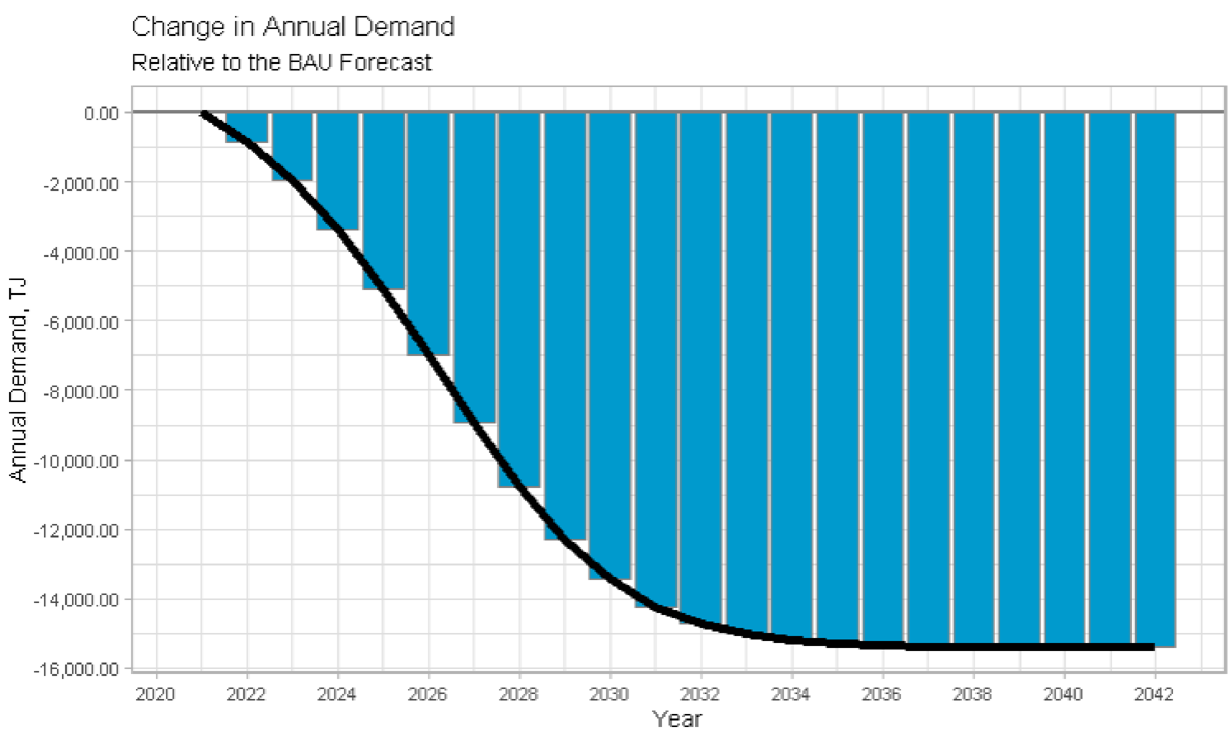
The following image demonstrates the options available to a participant in estimating the impact of gas price. The gas price slider has been moved to select a higher price, reducing demand. The "linear" adoption path to the final gas price is selected.



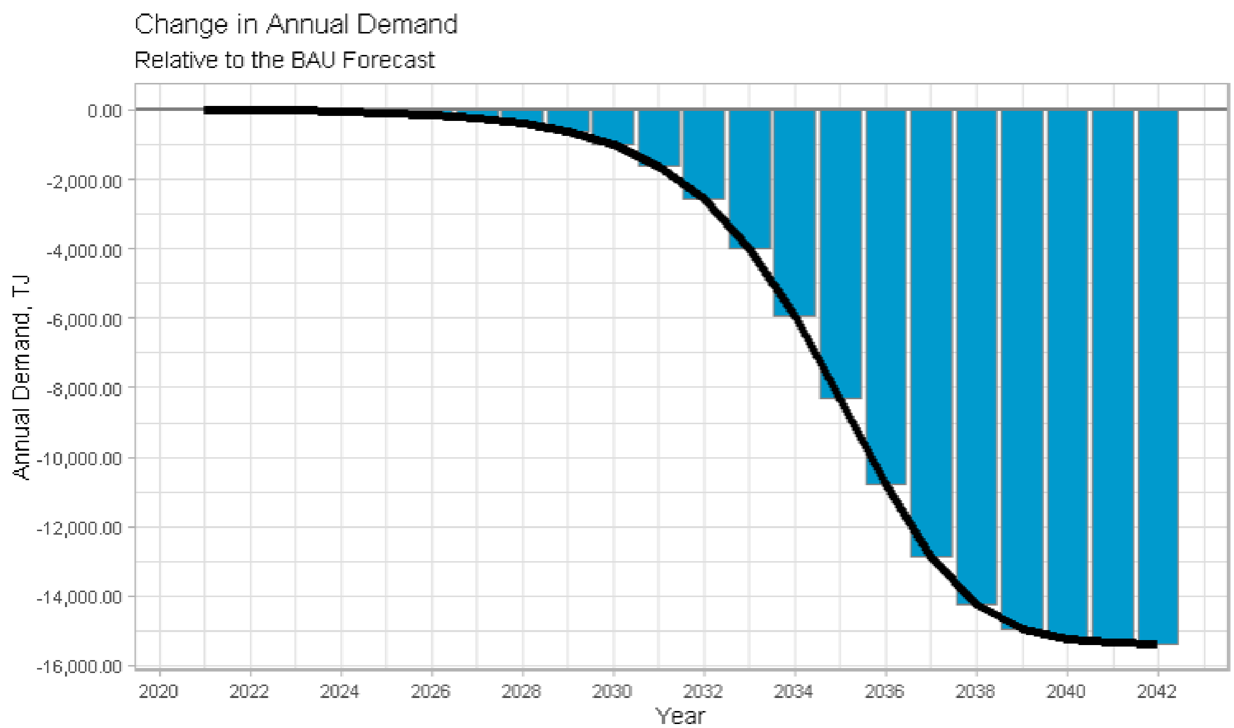
These selections would result in the following default adoption curve:



If the participant decided that the end point would be achieved earlier, then they were able to select the "early" adoption option. This selection would result in the following early adoption curve:



If the participant selected the "late" adoption option, the following late adoption curve would result:



With many slider options available to participants, this level of manipulation was viewed as more appropriate than supplying multiple midpoint sliders that would then require significant manipulation by the user to achieve the desired shape of the adoption curve.

2.2 Please confirm the following understandings of the results shown in Figures 8-1 and 8-2, or explain the correct interpretation:

2.2.1 The axis label indicates that the respondents' forecast estimates are incremental to the BAU forecasts. If that is correct, what are the BAU and the Reference Case forecasts for the same three outcomes, Demand, Supply, and Transportation, and which Application sections describe these?

Response:

The respondents' estimates for each slider were aggregated and added to the BAU forecast. The BAU forecast was not developed at the demand, supply and transportation level, and as a result, discrete BAU forecasts cannot be provided, nor do they exist in the Application.

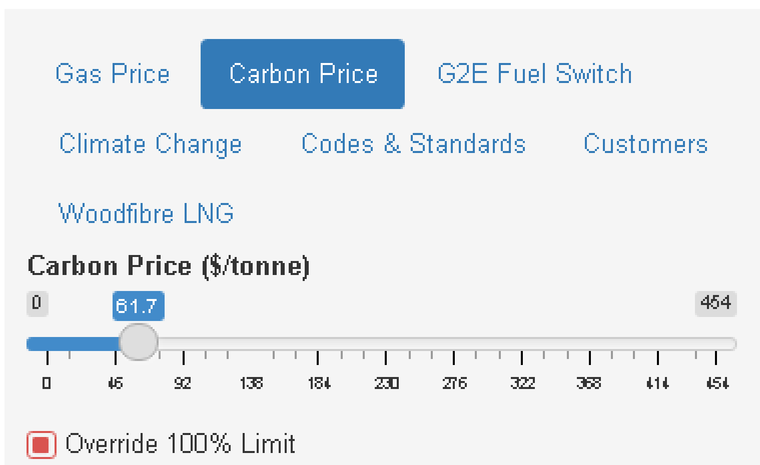
FEI notes that the respondents' forecast estimates were not added to the Reference Case forecast. The Reference Case forecast is discussed starting at Section 4.4.1.2 of the Application.

2.2.2 In terms of the impact of the carbon price on demand in 2040, it appears that 7 of the participants gave estimates between 0 and 40 PJ of demand reduction by 2040, while the other 7 gave estimates of between 40 and approximately 75 PJ. The median of the 14 estimates was, therefore, 40 and that was used as the value shown in Figure 8-1.

2.2.2.1 Were the participants free to assume their own values for the carbon price increases up to 2040? If not, what values were they told to assume?

Response:

Participants were able to select a carbon price of their choosing. Future carbon price was an input to the model, supported by a "slider", as the below image demonstrates. By using the "Override" check box, users were able to choose a carbon price between $0 and $454 per tonne.



2.2.2.2 What values for the carbon price were assumed for the BAU, the Reference Case and the Diversified Energy (Planning) Scenario forecasts produced by FEI?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

As set out in Section 4.5.3 of the Application, the setting for carbon price applied to the Reference Case scenario was 'Reference' and the setting for carbon price applied to the DEP Scenario was 'Planning'.[1] The values that correspond with these settings are presented in Appendix B-3, Section 1.1.1.1.3 (page 8) and Figure 3-8 (page 9). Please also refer to BCUC IR1 24.3 for a description of the Reference and Planning settings for the carbon price critical uncertainty.

For the BAU forecast, carbon price is not a separate driver or input into that model. Rather, the impacts from the carbon price are intrinsic to the historical actual demand used and captured in both the use rates and customer additions. This is an example of why FEI has moved from using the BAU modelling method to using an end use modelling method for the annual demand forecast. The BAU model does not facilitate the inclusion of known or possible future changes to the critical uncertainties over the long term in the various scenarios. So, while appropriate for short-term forecasting, a long-term forecast using the BAU method is only presented in the Application as a reference point with which to compare other scenarios.

2.2.2.3 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the demand reduction that due to the carbon price?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

Separating out the impacts of the specific critical uncertainty of increases in carbon tax would require a very difficult and complex analysis due to the interactive effects between critical uncertainties. In general, FEI expects that an increase in carbon price will tend to decrease demand, all else being equal. As each scenario has a combination of settings for all critical uncertainties, it is not feasible to provide the exact impact on demand or GHG emissions from a specific critical uncertainty in a scenario.

To develop the Expert Opinion Tool, each critical uncertainty was set to its highest and lowest setting while holding all other variables constant to identify the direction and relative magnitude of impact on demand and emissions. Section 8.2 of the Application discusses the results of the Expert Opinion Tool in terms of the impact a critical uncertainty has on demand and emissions relative to a baseline and without interactive effects from other critical uncertainties. The result of the Expert Opinion Tool was that an increase in carbon price decreased demand and carbon emissions, albeit with a lesser impact on demand relative to some other critical uncertainties.

[1] There is an error on page 4-22 of the Application that states the 'Reference' setting was used in the DEP Scenario, whereas the 'Planning' setting was actually used.

2.2.3 In terms of the impact of gas to electric fuel switching (G2E), it appears that 7 of the participants gave estimates between 0 and 28 PJ of demand reduction by 2040, while the other 7 gave estimates of between 28 and approximately 225 PJ. The median of the 14 estimates was, therefore, 28 and that was used as the value shown in Figure 8-1.

2.2.3.1 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the demand reduction due to G2E fuel switching?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

Separating out the impacts of a specific critical uncertainty, such as the non-price-driven gas to electric fuel switching, is a very difficult and complex analysis due to the interactive effects between critical uncertainties.

As each scenario has a combination of settings for all critical uncertainties, it is not feasible to provide the exact impact on demand or GHG emissions from a specific critical uncertainty in a scenario. Please refer to the response to BCUC IR1 69.1, in which FEI was asked to provide a breakdown of the reductions in demand due to natural gas efficiency and electrification, in volume (PJ) and GHG emission reductions (Mt CO_2e). BCUC IR1 69.2 discusses the methodology and assumptions used to develop these estimates.

2.2.3.2 What cause and effect linkage does the Reference Case and FEI's Diversified Energy (Planning) Scenario assume between the carbon price and the G2E fuel switching?

Response:

The following response has been provided by Posterity Group in consultation with FEI.

The G2E fuel switching (i.e., the 'non-price driven fuel switching' critical uncertainty) in the scenarios was designed to reflect energy users switching away from gas to electricity for reasons other than prices, such as due to policies and incentives (other than DSM). Therefore, price-driven reasons for fuel switching, such as changes in carbon price or natural gas price, are not linked to the non-price driven fuel switching critical uncertainty.

When carbon pricing increases relative to the Reference Case price, demand decreases by reducing gas fuel shares in the model. The modelling approach is to estimate the change in gas demand using the percentage change in price along with a price elasticity value, which reflects how sensitive demand is to changes in price. In other words, when customers begin replacing gas equipment with electric alternatives in response to price signals, gas fuel shares are reduced and electric fuel shares are increased.

The non-price driven fuel switching modelling mechanics are similar, in that gas fuel shares are reduced and electric fuel shares are increased. The approach, however, is different: for the scenarios, non-price driven fuel switching 'targets' were created for 2042 for specific end uses, and those targets were reached by decreasing gas fuel shares in the preceding years of the forecast.

When the scenario includes both non-price driven fuel switching and fuel switching driven by increases in gas commodity price or carbon price, the model uses whichever absolute amount of change is larger. This decision is made with respect to each individual end use, so one customer's end use change may be driven by carbon and commodity pricing, and another may be driven by non-price driven fuel switching. In all cases, the larger change is used. The underlying assumption is that policymakers would accept change driven by pricing as contributing towards their policy objectives, and would not insist on adding the policy-driven change on top of the price-driven change.

Please refer to Appendix B-3 for further details of the input assumptions, settings, and modelling approach for the critical uncertainties used in FEI's modelled scenarios, including carbon price and non-price driven fuel switching.

2.2.4 In terms of the impact of gas price on demand, it appears that 7 of the participants gave estimates between about 15 PJ of demand increase to about 10 PJ of demand reduction by 2040, while the other 7 gave estimates of between 10 and approximately 100 PJ of reduction. The median of the 14 estimates was, therefore, 10 PJ of reduction and that was used as the value shown in Figure 8-1.

2.2.4.1 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the forecast of future gas prices and what would be the demand reduction due to the gas price?

<u>Response:</u>

The following response has been provided by Posterity Group in consultation with FEI.

This response first provides the forecast of gas prices used in the Reference Case and DEP Scenarios, then provides a discussion of the impact of price increases on demand.

The Reference Case scenario and the DEP Scenario use the Reference setting for the natural gas price critical uncertainty, which is illustrated in Figure B3-7 of Appendix B-3.

The table below provides the natural gas prices for the Reference setting.

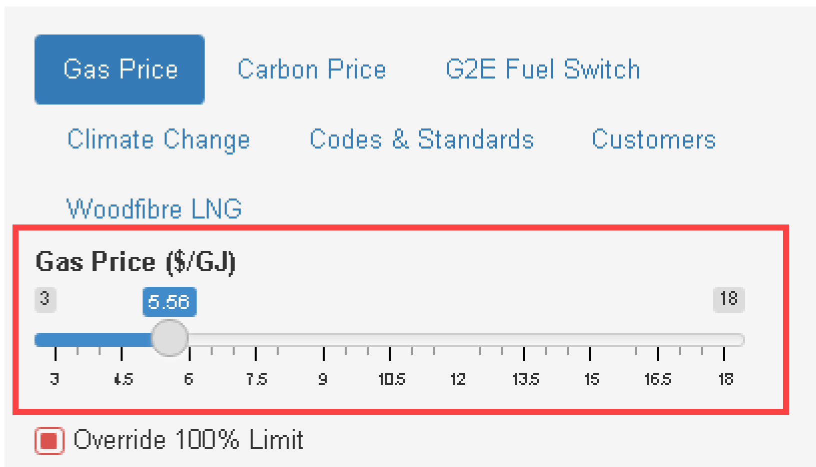
Year	Natural Gas Price (CAD/GJ, 2020$ Real)
2020	3.29
2021	3.91
2022	3.68
2023	3.65
2024	3.88
2025	3.88
2026	3.94
2027	4.09
2028	4.08
2029	4.29
2030	4.44
2031	4.38
2032	4.49
2033	4.67
2034	4.57
2035	4.61
2036	4.68
2037	4.61
2038	4.72
2039	4.89
2040	4.84
2041	4.92
2042	5.01

Regarding the specific impact on demand from a change in natural gas prices, it is very difficult and complex to separate the impacts of each critical uncertainty due to the interactive effects among the critical uncertainties on demand. Section 8.2 of the Application discusses the results of the Expert Opinion Tool in terms of the impact a critical uncertainty has on demand and emissions relative to a baseline and without the interactive effects from other critical uncertainties. The result of the Expert Opinion Tool was that an increase in gas prices decreased demand and emissions, all else being equal.

2.2.4.2 What forecast of future gas prices were the participants told to assume?

Response:

Participants were not told to assume a future gas price. Future gas prices are an input to the model, supported by a "slider" application. By using the "Override" check box, participants were able to choose their own forecast gas price between $3 and $18 per GJ.



2.2.4.3 What cause and effect linkage does the Reference Case and FEI's Diversified Energy (Planning) Scenario assume between the carbon price and future gas prices, and where is this dealt with in the Application?

Response:

The following response has been provided by Posterity Group in consultation with FEI.

FEI did not make any assumption about the linkage between carbon prices and future gas prices. For the purposes of creating the demand scenarios, they were assumed to be independent variables. Both variables, however, acted in the same way, in that increases in the carbon tax or gas prices caused an increase in the cost of natural gas and a corresponding decrease in demand. Appendix B-3 provides details on how the future values of carbon prices and natural gas price were developed and implemented.

2.2.5 In terms of the impact of Hydrogen production (H2), it appears that 7 of the participants gave estimates between 0 and 30 PJ of supply increase by 2040, while the other 7 gave estimates of between 30 and approximately 200 PJ. The median of the 14 estimates was, therefore, 30 and that was used as the value shown in Figure 8-1.

2.2.5.1 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the supply increase due to Hydrogen production?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

Please refer to the response to BCUC IR1 52.6 for the component makeup of the renewable and low-carbon gas forecast that FEI modelled in the DEP Scenario and BCUC IR1 71.8.1 for the Reference Case and all alternate scenarios. For the Reference Case Scenario, FEI considers that hydrogen supply would be nominal, increasing to no more than 2 PJ by the end of the planning period. FEI notes that its demand forecast is presented in terms of energy and not gas volumes, so the lower energy density of hydrogen has no impact on the forecast of energy needs. Please also refer to page 7-36, lines 17-26 and Appendix D-3 of the Application for further discussion on system planning considerations.

2.2.5.2 What cause and effect linkage does the Reference Case and FEI's Diversified Energy (Planning) Scenario assume between the carbon price and Hydrogen production?

Response:

The following response has been provided by Posterity Group in consultation with FEI.

FEI did not make any assumption about the linkage between carbon price and hydrogen production or between carbon price and RNG production. For the purposes of this analysis, hydrogen and RNG were treated as supply resources and did not change customers' demand for energy. Please refer to Appendix B-3, page 8 for a discussion of how carbon price forecasts were selected and modelled. Please refer to Section 6.2.3 of the Application and the response to BCUC IR1 52.6 for a discussion of how renewable and low-carbon gas supplies (including hydrogen and RNG) were modelled.

2.2.6 In terms of the impact of RNG on gas supply, it appears that 7 of the participants gave estimates between 0 and 58 PJ of supply increase by 2040, while the other 7 gave estimates of between 58 and approximately 100 PJ. The median of the 14 estimates was, therefore, 58 and that was used as the value shown in Figure 8-1.

2.2.6.1 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the supply increase due to RNG?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

Please refer to the response to BCUC IR1 52.6 for the component makeup of the renewable and low-carbon gas forecast that FEI modelled in the DEP Scenario. The Reference Case modelled RNG contracts that were completed or in advanced stages of supply agreement and very certain of being finalized at the time the scenarios were developed, so that RNG supply was modelled to grow to 11.5 PJ by 2028 and remain constant thereafter.

2.2.6.2 What cause and effect linkage does the Reference Case and FEI's Diversified Energy (Planning) Scenario assume between the carbon price and RNG?

Response:

Please refer to the response to BCSSIA IR1 2.2.5.2.

2.2.7 In terms of the impact of CNG, LNG, and LNG export from FEI, it appears that 7 of the participants gave estimates below 3.5 PJ by 2040, while the other 7 gave estimates ranging from 3.5 to about 160 PJ. The median of the 14 estimates was, therefore, only 3.5 PJ and that was used as the value shown in Figure 8-1.

2.2.7.1 Figure 2 shows as an upward bar for LNG, similar to the Supply bars. How should this be interpreted? Does this mean that LNG would create a demand increase, as opposed to the demand decreases depicted in the left-hand segment of the Figure?

Response:

Figure 8-1 uses the median response for all the drivers. The interpretation presented in BCSSIA IR1 2.2.7 is correct that 3.5 PJ represents the middle, or median, of all the responses. An equal number of responses were both greater and less than 3.5 PJ. The use of the median is appropriate when the data exhibits a wide range of values, such that using a different statistic (e.g. the mean) would be misleading.

Figure 8-2 reflects levels of demand relative to the BAU levels of demand. The bars above the "zero-line" indicate an increase in demand whereas the bars below the "zero-line" indicate a decrease in demand. While the colored bars in Figure 8-2 show the range of responses, FEI notes that the median response for CNG, LNG and LNG export are all near zero.

2.2.7.2 What did FEI's Reference Case and FEI's Diversified Energy (Planning) Scenario assume would be the impacts of each of CNG, LNG, and LNG export from FEI?

Response:

The following response has been provided by FEI in consultation with Posterity Group.

The Reference Case scenario has lower amounts of CNG, LNG and LNG Export compared to the DEP Scenario. As explained in Section 4.5.1, in the DEP Scenario, FEI models future changes needed to pursue its Clean Growth Pathway and meet decarbonization targets. The DEP Scenario includes essential elements of the Clean Growth Pathway, such as accelerated acquisition of renewable gas supply, growth in the use of low-carbon gas as a transportation fuel, and electrification initiatives in BC that impact gas demand. As these elements were not established within the trends present in 2019, they are not reflected in the Reference Case demand forecast.

The impact of CNG, LNG and LNG Exports on the DEP Scenario are to increase demand on FEI's system while reducing GHG emissions, as these fuels are assumed to displace more carbon intensive fuels.

Please see Appendix B-3 for more details on the assumptions used for the "planning" settings for the CNG, LNG, and Global LNG Demand critical uncertainties.

2.3 Please provide the “Expert Opinion Results”, in the graphic format of Figure 8-1, for the individual Responses that resulted in:

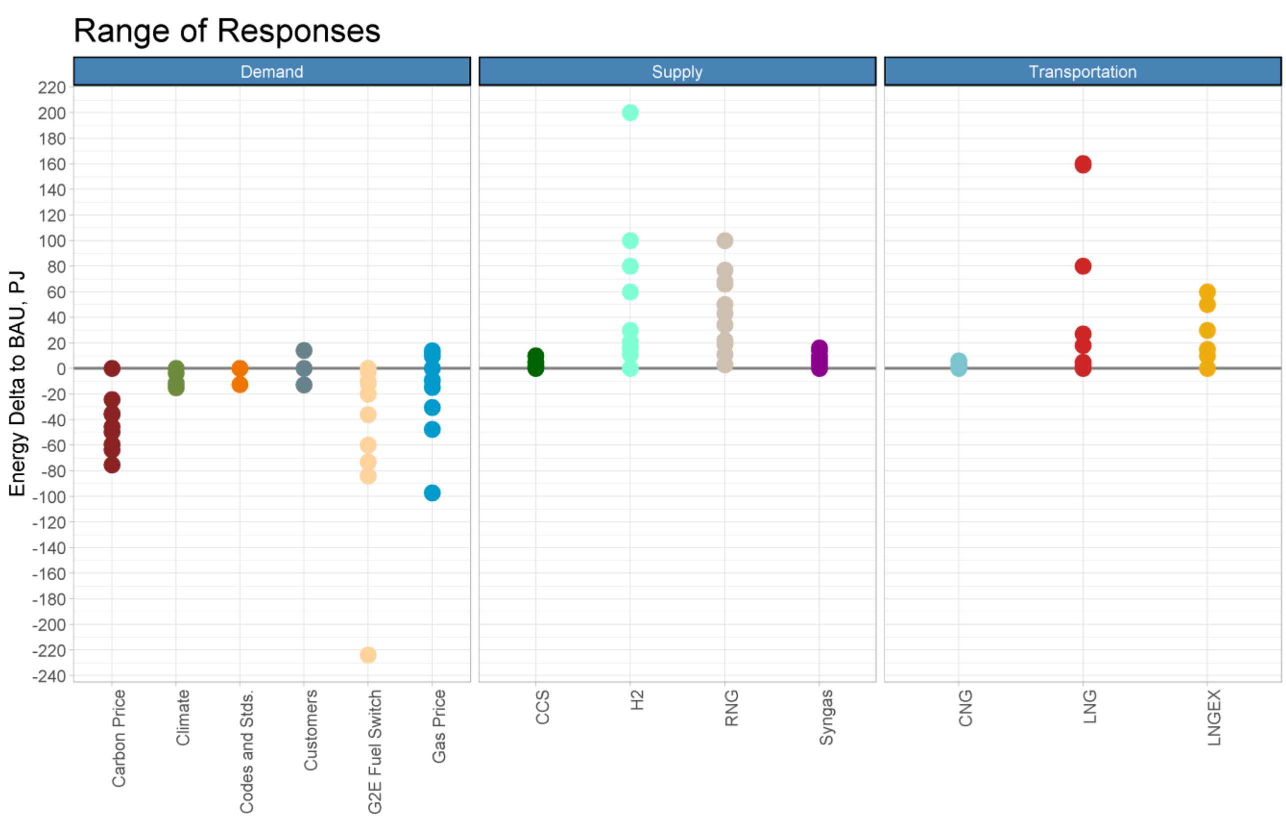
2.3.1 the “reduction of 225 PJ” for the “gas to electric fuel switching”.

2.3.2 “The impact from adding hydrogen to the supply … topping out at 200 PJ.”

2.3.3 “The LNG driver that showed… 160 PJ”

<u>Response:</u>

Since Figure 8-1 displays median results and Figure 8-2 displays individual responses, FEI interprets that the requested data is more appropriately provided in the format of Figure 8-2. The following figure is a reproduction of Figure 8-2 with points for each individual response rather than the original bar that covered the range of responses. Where multiple respondents provide the same value, a single point is shown.



Based on responses from 14 RPAG members

2.4 Please provide a full copy of the Expert (Crowd) Opinion Forecast and also the web link to the "Slider" forecasting tool that was used by the RPAG participants, so that interveners may better understand how it operates.

Response:

Please refer to Attachment 2.4 for a live spreadsheet containing the forecast results.

The following link can be used to access the "Slider" forecasting tool:

https://crowdforecast.shinyapps.io/LTGRP

3.0 Topic: Carbon Price in the Deep Electrification Scenario

Reference: Exhibit B-1, Section 4.5, Alternative Future Scenarios and Critical Uncertainty Settings. Table 4-1, Deep Electrification Scenario

Section 4.5.3 “Critical Uncertainty Input Settings for Each Future Scenario”, states:

> “Table 4-1 below summarizes the six alternate future scenarios that FEI has modelled, including the Diversified Energy (Planning) Scenario described in Section 4.5.1 as FEI’s planning scenario. Scenario descriptions, input settings for each critical uncertainty, and a brief discussion of each scenario’s specific attributes is included … “

Table 4-1: Alternate Future Scenario Summary
Deep Electrification Scenario

Scenario	Description	Input Settings		Discussion
Deep Electrification	The BC government does not increase carbon taxes to avoid electoral backlash but uses all other policy levers to electrify the economy in order to achieve domestic carbon abatement. Government also promotes CCUS for non-electrified sectors. Such policies create constraints for the BC economy and reduce the uptake of LCT solutions and renewable gases. To support economic growth, the BC government supports LNG exports to other jurisdictions. Despite these exports, the domestic shift towards electricity causes a regional conventional natural gas supply glut, leading to low regional gas prices.	**Residential, Commercial and Industrial Demand Category**		In this scenario, electrification is the primary avenue utilized by the BC Government to decarbonize the BC economy. This in turn causes a decrease in annual gas demand. Coinciding with this decrease in annual gas demand are corresponding increases in electricty annual and peak demand that are not fully modelled in FEI’s annual gas demand analysis, and which are anticipated to make a deep electrification not plausible as described in Section 4.6.1.1
		Appliance Standards	Accelerated	
		Carbon Price	Reference	
		Customer Growth	Low	
		Fuel Switching	Accelerated electrification	
		Natural Gas Price	Low	
		New Construction Code	Accelerated	
		Retrofit Code	Accelerated	
		Low-Carbon Transportation and Global LNG Demand Category		
		LCT Demand	Low	
		Global LNG Demand	Planning	
		New Large Industrial Demand Category		
		Industrial Demand Growth	Reference	

3.1 Please specify the Carbon Price ($/tonne) (characterized as “Reference”) that was assumed for the Deep Electrification Scenario. For greater clarity, please specify what the “Reference” Input Setting assumes the per tonne Carbon Price will be for each of the 20 years of the Plan. Please provide in tabular and graphic form the “Low”, “High”, and “Reference” values for the Carbon Price over the planning period.

Response:

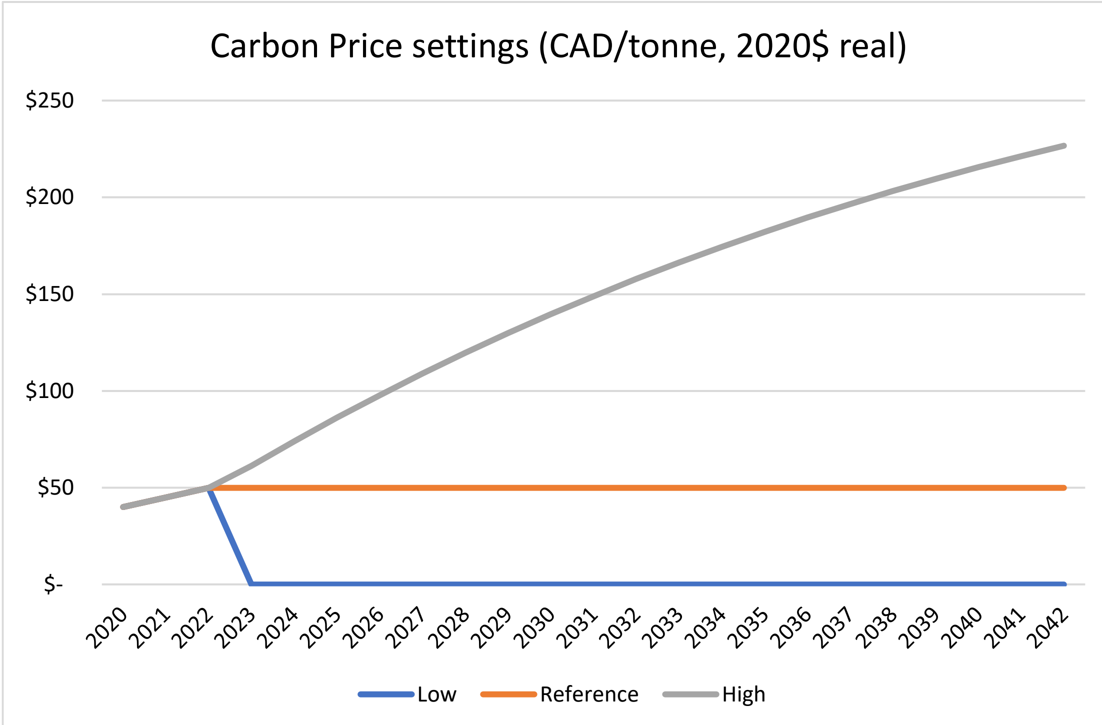
The following response has been provided by Posterity Group in consultation with FEI.

Appendix B-3, Section 1.1.1.1.3, provides details of the carbon price settings, including the Reference setting applied to the Deep Electrification scenario. Please also refer to the response to BCUC IR1 24.3 for a description of the Reference, Planning and High settings for the carbon price critical uncertainty.

The Low setting assumes that the carbon tax, after reaching $50 per tonne in 2022, is removed for the remainder of the planning horizon and not replaced by other carbon pricing mechanisms.

The table and graph below provide the values for the Low, High and Reference settings for the carbon price critical uncertainty over the planning horizon.

	Carbon Price (CAD/tonne, 2020$ Real)		
Year	**Low**	**Reference**	**High**
2020	$ 40	$ 40	$ 40
2021	$ 45	$ 45	$ 45
2022	$ 50	$ 50	$ 50
2023	$ -	$ 50	$ 61
2024	$ -	$ 50	$ 74
2025	$ -	$ 50	$ 86
2026	$ -	$ 50	$ 98
2027	$ -	$ 50	$ 109
2028	$ -	$ 50	$ 120
2029	$ -	$ 50	$ 130
2030	$ -	$ 50	$ 140
2031	$ -	$ 50	$ 149
2032	$ -	$ 50	$ 158
2033	$ -	$ 50	$ 166
2034	$ -	$ 50	$ 174
2035	$ -	$ 50	$ 182
2036	$ -	$ 50	$ 190
2037	$ -	$ 50	$ 197
2038	$ -	$ 50	$ 203
2039	$ -	$ 50	$ 210
2040	$ -	$ 50	$ 216
2041	$ -	$ 50	$ 221
2042	$ -	$ 50	$ 227



3.2 The column "Input Settings" appears to have nine different demand drivers, grouped in three categories. Each of those nine drivers has a number of possible settings, which appear to change from scenario to scenario. Please provide a comprehensive list of the settings used for each of the scenarios, with a description of what each setting assumes.

Response:

Please refer to the response to BCOAPO IR1 3.2.

4.0 Topic: Vancouver Island Energy Demand

Reference: Exhibit B-1, Section 7.3.1 Vancouver Island Transmission System

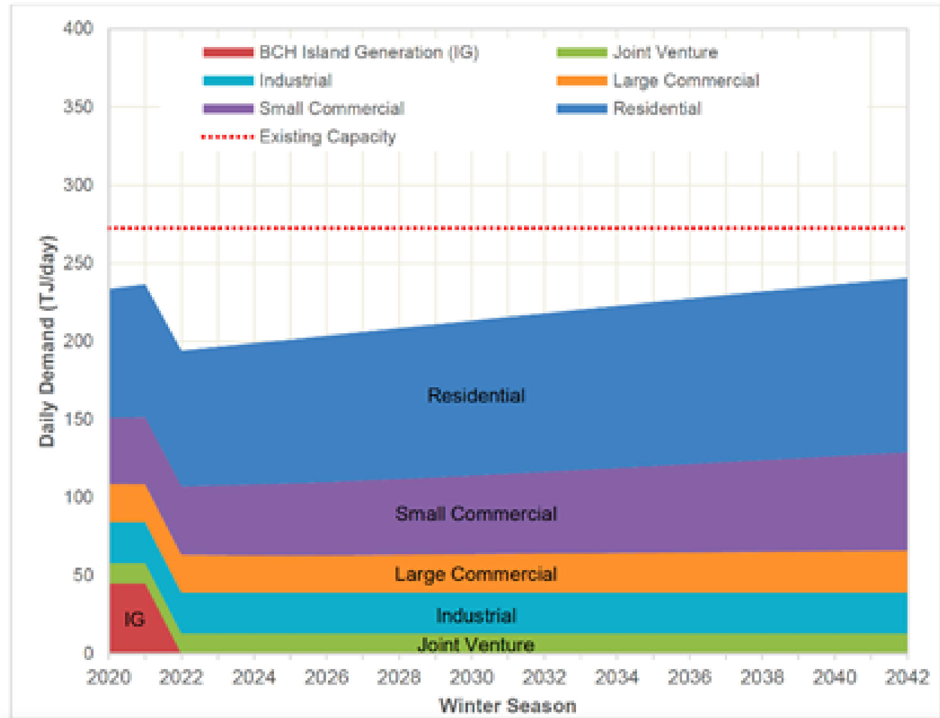
Section 7.3.1 Vancouver Island Transmission System, states:

> "The VITS serves Vancouver Island, the Sunshine Coast and feeds the communities of Squamish and Whistler. … "

Specifically, 7.3.1.1 VITS Configuration and Capacity, states:

> "The VITS needs to serve the natural gas capacity requirements for the following customers:
>
> - Core residential and small commercial customers located on Vancouver Island and the Sunshine Coast, and in Squamish and Whistler;
> - Pulp and paper mills represented by the Vancouver Island Gas Joint Venture (shown as the green factory symbol at various communities in Figure 7-2);
> - BC Hydro for its Island Generation Plant (shown as the red factory symbol at Campbell River in Figure 7-2); and
> - The proposed Woodfibre LNG project (The green factory symbol at Woodfibre in Figure 7-2).
>
> … Figure 7-3 shows the peak demand for the VITS with the 2020 Traditional Peak Demand forecast, and with the various customer types represented, and daily transportation requirements for Vancouver Island Gas Joint Venture mills (13 TJ per day) and BC Hydro Island Generation (45 TJ per day, until 2022)."

Figure 7-3: VITS Traditional Peak Demand Forecast



4.1 Please confirm (from Table 7-3) that the VITS Peak Demand in 2020 was approximately 240 TJ/day.

Response:

Peak Demand in 2020 was forecast in the referenced figure as 234 TJ per day.

4.2 Please provide the 2020 Peak Demand (TJ/day) for Vancouver Island only (i.e., VITS excluding the Sunshine Coast and the communities of Squamish and Whistler).

Response:

The requested 2020 Peak Demand for Vancouver Island is 207 TJ per day, excluding the Sunshine Coast and the communities of Squamish and Whistler. Note that this includes the 45 TJ per day attributed to BC Hydro Island Generation that is excluded in 2022 and beyond.

4.3 Please provide the 2020 Peak Demand (TJ/day) for electricity consumers on Vancouver Island. (i.e., energy consumed by electricity customers in BC Hydro's Vancouver Island Transmission Region)

Response:

FEI does not have BC Hydro's Vancouver Island Transmission Region and historical peak day demand on that system.

4.4 Please estimate the 2020 Peak Demand (TJ/day) for gasoline and diesel consumers on Vancouver Island.

Response:

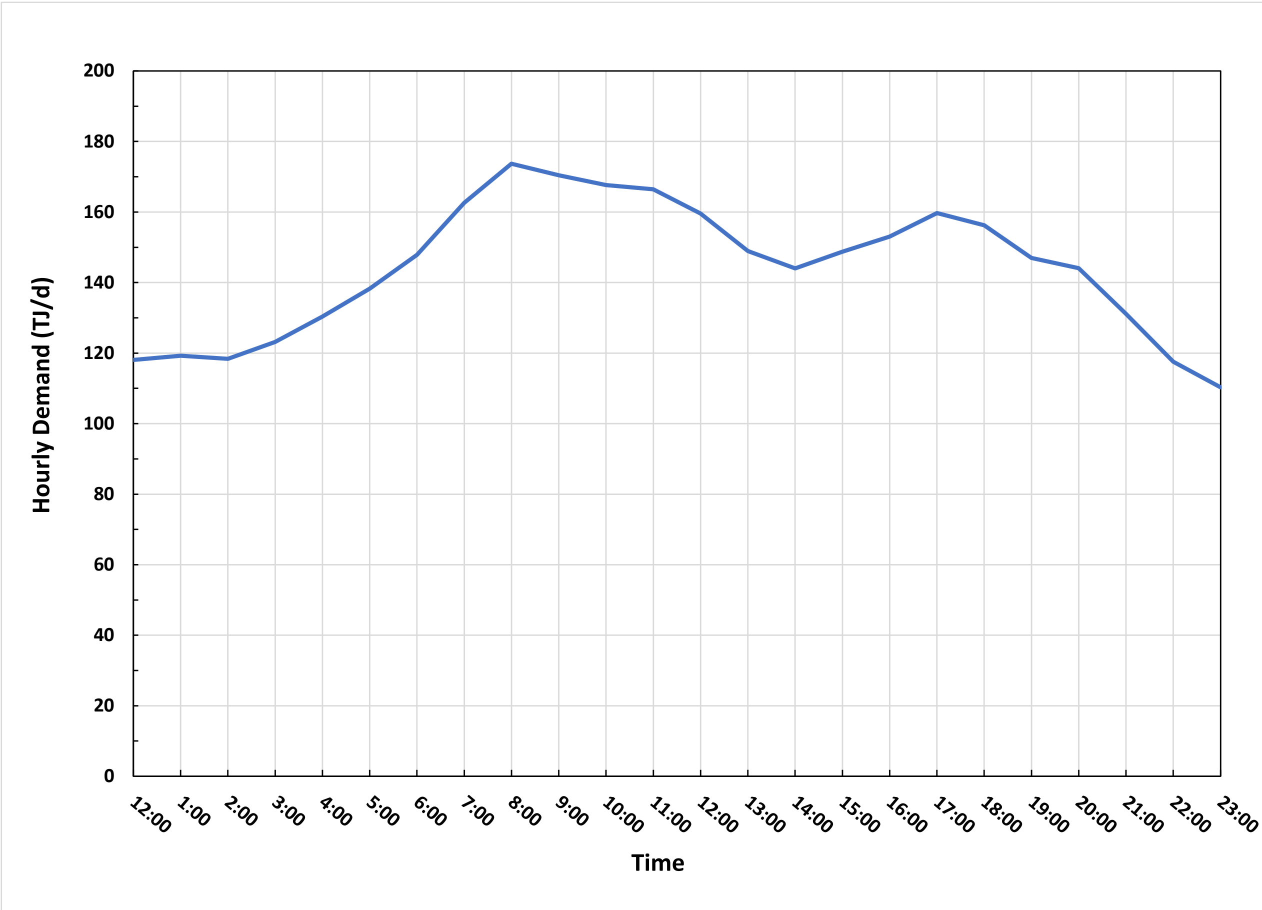
FEI does not have information on peak demand for gasoline and diesel consumers on Vancouver Island.

4.5 Please provide the daily aggregate gas demand profile for FEI customers on Vancouver Island – for a typical peak demand day. (i.e. a cold winter day)

Response:

The requested daily aggregate gas demand profile for FEI customers on Vancouver Island for the coldest day in the winter of 2021-2022, December 27, 2021, is provided in the figure below. The region experienced a daily average temperature of minus 7.3°C (25.3 degree day) recorded at the Victoria Airport weather station.

Figure 1: Daily aggregate gas demand profile of VITS on Dec 27, 2021



5.0 Topic: Green Hydrogen Production

Reference: Exhibit B-1, Appendix D-2, B.C. Renewable and Low-Carbon Supply Potential Study, by EVINT, CBER & Associates, Section 4.3 Feedstock and resource availability.

Section 4.3.1, B.C. Potential for Green Hydrogen Production, states:

> "The primary parameters determining the potential for green hydrogen production via electrolysis include:
>
> - The availability of renewable electricity. Focusing on BC Hydro's most recent draft 2021 Integrated Resource Plan (IRP) that addresses both demand-side efficiency improvements and demand response programs, additional capacity needs are not foreseen until 2032 (however, a high electrification ['accelerated'] scenario indicates a need for power imports as early as 2025 and new power plants being added as of 2029, despite the commissioning of the Site C hydro facility, as per Table 18 in the plan's appendix). No mention is made in this draft report about the use of electricity for the electrolytic hydrogen production. Transmission from electricity production sites or large substations will play a role in site selection.
> - Availability of potable water as an electrolyser feedstock. Each megawatt of electrolyser load capacity requires about 1.4 million litres of water per annum. This subject was addressed for a number of sites up to 300 MW plants.[92] Water availability was not an issue. The addition of a potable water filtration plant was the only requirement identified.
>
> Hydrogen injection into the natural gas grid is faced with a number of challenges and barriers that include:
>
> - Critical pipeline system components including embrittlement of steel.
> - End-user equipment tolerances and operating considerations.
> - Engineering assessments that would examine the safety, integrity and reliability of the gas company and end-user-owned assets.
> - Updates to pipeline standards and policy.
> - The establishment of mixed (hydrogen/methane) gas tariffs and insurance (the gas blend still needs to meet tariff requirements).
> - Pipeline capacity (including locating hydrogen-producing facilities near major pipelines to inject it into the B.C. grid).
> - Hydrogen separation technology.
> - Gas metering for blended gases, purity and requisite specifications.

- Finally, the upper hydrogen concentration limit in the B.C. grid needs to be determined."

5.1 What is the price of "renewable electricity" ($/MWh) that FEI is assuming/forecasting for the production of green hydrogen?

Response:

The price of "renewable electricity" to produce renewable (green) hydrogen from the electrolysis of water will depend on several considerations that are presented and modelled in the BC Renewable and Low-Carbon Gas Supply Potential Study[2], which assumed an average price of $65 per MWh. FEI is also evaluating potential green hydrogen projects on a case-by-case basis including an assessment of opportunities to source lower-cost power, which would reduce the overall cost to produce green hydrogen in BC.

5.2 What are the main sources of the renewable electricity that FEI is assuming/forecasting for the production of green hydrogen? (i.e., what amounts or proportions of hydro power, wind power, or solar power)

Response:

FEI is assessing potential sources of renewable electricity including hydro, wind and solar power. The BC Renewable and Low-Carbon Gas Supply Potential Study speaks to the potential availability of these resources to produce green hydrogen.

5.3 What are the prices of electricity from each of the main sources of the renewable electricity that FEI is assuming/forecasting for the production of green hydrogen? (i.e., $/MWh for hydro power, $/MWh for wind power, $/MWh for solar power)

Response:

Please refer to the response to BCSSIA IR1 5.1. FEI has not calculated separate assumptions from different technologies and instead is using an average price across all renewable sources of electricity.

[2] Exhibit B1-1, 2022 LTGRP Application, Appendix D-2.

5.4 How much electricity per kg of hydrogen is FEI assuming for the production of green hydrogen. (kW/kg or kWh/kg)

Response:

The electricity consumption for green hydrogen production will depend on the technology and efficiency of the system. A completely efficient electrolysis system would require approximately 30-40 kWh of electricity to produce 1 kg of hydrogen. A typical power consumption rate for electrolysis is 50-60 kWh per kg of hydrogen. Please also refer to the response to BCUC IR1 62.10.1 and for additional discussion on electricity requirements for hydrogen production please refer to the responses to BCUC IR1.62.10 and 62.11.1.

5.5 How much of FEIs pipeline grid is steel pipe vs plastic pipe? (i.e. polyethylene or polyvinylchloride)

Response:

FEI's pipeline grid is comprised of transmission, intermediate, and distribution pressure assets. The only material type used for transmission and intermediate pressure pipelines is steel; it is the distribution pressure (DP) mains, service pipe, and header pipe that may be either polyethylene (PE) or steel. The portion of PE to steel pipe for DP mains, services and headers, by Business Zone, is as follows:

Km of DP Mains, Services, and Headers by Business Zone				
Business Zone	**PE**	**Steel**	**% PE**	**% Steel**
Zone 1 - Lower Mainland West	4,402	5,867	43%	57%
Zone 3 - Lower Mainland East	7,154	5,775	55%	45%
Zone 4 - Interior North	4,253	2,144	66%	34%
Zone 5 - Interior South	6,995	3,190	69%	31%
Zone 6 - Vancouver Island	7,008	162	98%	2%
Total	29,813	17,137	63%	37%

As provided in the above table, Business Zone 6 (Vancouver Island) contains the most PE pipe (versus steel) on FEI's pipeline grid, with 98 percent of the pipe being PE and 2 percent steel.

5.6 Which regions of FEIs pipeline grid contain the most plastic pipe (as opposed to steel pipe)?

Response:

Please refer to the response to BCSSIA IR1 5.5.

5.7 What are the main “critical pipeline components”, other than the pipe material (steel or plastic) that pose the “challenges and barriers” to delivering green hydrogen through the pipeline system?

Response:

Other “critical pipeline components” could include equipment such as valves, compressors and meters that are required to operate the pipeline system. FEI is currently planning to undertake the BC Gas System Hydrogen Blending and Technical Assessment Study that will leverage available data and inputs from existing literature, studies, research, and testing. FEI will also complete technical and safety assessments and further testing of BC gas system assets, including critical pipeline components, which will be required to determine appropriate hydrogen concentration limits in the system. Please also refer to the response to BCUC IR1 61.8.

5.8 Please describe the status of determining “*the upper hydrogen concentration limit in the B.C. grid*.” What studies have/are being performed? What tests have/are being conducted or planned?

Response:

Please refer to the response to BCSSIA IR1 5.7.

6.0 Topic: Compressor Station Electrification

Reference: Exhibit B-1, Section 6.3.3, Regional Gas Supply Diversity (RGSD) Project, page 6-27 lines 12 – 15

FEI states:

> "To protect the interests of FEI and its customers, FEI needs to influence which regional pipeline infrastructure gets built, thereby maximizing the value obtained from it. The RGSD project would involve an expansion of SCP through construction of additional compressor stations and a new pipeline connecting SCP near Oliver, BC to the Huntingdon/Sumas market. …"

6.1 How many compressors stations are on FEIs entire B.C. system and what are their sizes (i.e., in MW or hp)?

Response:

There are 12 compressor stations on FEI's transmission system. The total horsepower by site is referenced in the table below.

Compressor Station Common Name	Rated Power Available by Station (horsepower)
Savona Compressor Station	3,200
Kingsvale Compressor Station	3,200
Hedley Compressor Station	3,200
Midway Compressor Station	1,400
Trail (Warfield) Compressor Station	2,600
Kitchener A Compressor Station	3,200
Kitchener B Compressor Station	11,000
Armstrong Compressor Station	850
Langley (Fraser Valley) Compressor Station	14,800
V1 (Coquitlam) Compressor Station	21,900
V3 (Port Melon) Compressor Station	7,300
V4 (Texada) Compressor Station	7,300

6.2 How many of those compressor stations run on gas vs electricity?

Response:

The Hedley Compressor Station is the only FEI compressor station with an electric driver configuration.

6.3 How much GHG emissions do FEIs gas-fired compressors stations produce? Both in total (tonnes CO2e/year) and in performance terms (tonnes CO2e/bcf gas throughput and tonnes CO2e/station).

Response:

The table below summarizes the total combustion GHG emissions from FEI gas-fired compressors and total gas throughput for the past five years.

	GHG Combustion Emissions from FEI Compressor Stations (tCO2e)	Total Throughput (PJ)	GHG Combustion Emissions from FEI Compressor Stations: Total Throughput ratio (tCO2e/PJ)
2017	45,899	221	208
2018	42,536	212	201
2019*	61,684	227	272
2020	45,472	219	208
2021	47,026	228	206

*Notes: * Higher value is the result of the Enbridge pipeline rupture in Q4 of 2018.*

6.4 How many compressor stations does FEI plan to add, expand and retrofit in the next 20 years, and what are their sizes (i.e., in MW or hp)? If those compressor stations were run on electricity rather than gas how many tonnes of GHG emissions would be reduced?

Response:

This information is not available at this time; however, FEI continues to examine all options for reducing GHG emissions related to its operations.

7.0 Topic: Cost of New Electricity Generation

Reference: Appendix A-2 Pathways for British Columbia to Achieve its GHG Reduction Goals, by Navigant, a Guidehouse Company, Prepared for FortisBC, Section 4 Study Approach, page 16, Table 2, Row 1

And Appendix A-9.5 Decarbonization of the building heating system in Metro Vancouver: comparison of two transition pathways, by University of Victoria, Section 3 Methods, Page 17 and Table 2 on page 19.

And Appendix A-7, Building a Resilient Energy Future: How the Gas System Contributes to US Energy System Resilience, Section B.1.1, Electric Power Generation, page B-2

And Exhibit B-3 from the FortisBC LTERP proceeding, FBC's response to BCSSIA IR 1.3.4

Table 2 from Appendix A-2 states:

TABLE 2. SELECT MODELLING INPUTS

Input	Assumption/Description
Cost of New Electricity Generation	$126/MWh was assumed in both pathways. This value represents an estimate of the expected cost of Site C[14] and is considered a conservative estimate of new renewable power costs. It is conservative because solar, wind, and energy storage costs are significantly higher and do not provide the same level of inter-seasonal storage. These higher priced renewable assets may need to be deployed due to the difficulty of developing large hydro in Canada. It is assumed that hydro resources will be available at the levels modelled in the pathways, which further assumes the deployment of multiple large hydro facilities (similar in size to Site C) in both pathways.

Appendix A-9.5, Page 17 and Table 2 on page 19, states: [emphasis added]

> "Seven scenarios investigate energy system costs and capacity requirements across a range of possible futures. Technology costs, technology performance, energy demand, or renewable energy supply varies between each scenario. Table 2 summarizes the defining variation of each scenario.
>
> • The Reference scenario applies 2030 lithium-ion battery storage costs, and present-day wind and <u>solar costs determined by the latest resource options report performed by BC Hydro</u>…"

Table 2. Seven scenarios determine low-carbon energy system costs and capacity requirements for a broad range of future technology costs, technology, performance, energy demand, and renewable energy resource potential.

Scenario	Description	Rationale
Reference	a) 2030 Li-Ion battery cost b) BC Hydro Wind/Solar cost c) 2030 Biogas target (30 PJ x 53%) d) 1996 temperature profile (high heat demand)	a) (Schmidt et al., 2019) b) (BC Hydro, 2020) c) Personal correspondence with FortisBC Inc. d) Section 3.2

Appendix A-7, page B-2, states:

> "This is in-line with EIA projections for non-dispatchable technologies such as onshore wind ($40/MWh) and solar PV ($33/MWh), and cheaper than projections for offshore wind ($122/MWh) and hydroelectric ($53/MWh)." Source: EIA. 2020. Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2020.

FBC (electric), in its response to BCSSIA IR 1.3.4 in the FBC LTERP proceeding, provided a calculation of the UEC and UCC for a composite project of a dozen actual sites that BCSSIA members hold secured land tenders for. This calculated UEC was $74.82/MWh.

7.1 Please advise if the $126/MWh quoted in Table2 of Appendix A-2 is a calculated UEC, or some other metric.

Response:

Please refer to the response to BC Hydro IR1 6.4.

7.2 Please confirm that BC Hydro IRP and FortisBC 2021 LTERP anticipate that the majority of new electricity supply would come from on-shore wind and solar.

Response:

Not confirmed. FBC's 2021 LTERP includes plans to procure the majority of the incremental energy requirements from the Mid-C wholesale market and the BC Hydro Power Purchase Agreement (PPA Tranche 1 Energy). FBC has identified a portfolio containing incremental resources that are collectively able to meet the capacity gaps within the planning horizon. These incremental resources, which include solar and on-shore wind, do generate energy, but are, comparably, an insignificant component of future energy resources at this time.

In regards to BC Hydro, FEI is not in a position to comment other than by referring to Appendix L of BC Hydro's 2021 IRP, which identifies wind as a marginal energy resource.

7.3 Please reconcile FEI's much higher $126/MWh with the lower costs of on-shore wind and solar electricity in the other studies. What explains the large disparity in these assumptions about the cost of new electricity generation?

Response:

Please refer to the response to BCH IR1 6.4.

8.0 Topic: Additional Electricity Supply required to meet Electricity Demand Growth driven by Electrification needed to support B.C.'s Carbon Reduction Targets

Reference: Appendix A-9.6 UBC Clean Energy Research Centre (CERC) Clean Energy Pathways to Meet British Columbia's Decarbonization Targets,

On page 1 of the UBC study in Appendix A-9.6, it states: [underlining added]

> **"Executive Summary**
>
> The two phases of CleanBC set out strong policy support for further developing renewable energy in the province as a contribution in achieving BC's 2030 Greenhouse Gas (GHG) mitigation target.
>
> However, the CleanBC framework lacks strong demand-side measures, to reverse the growth of energy demand in BC. Attempts have been made to reduce energy use in land transportation but action plans for other sectors, especially industry, are lacking. As a result, even with moderate energy demand reduction (10%), the CleanBC framework will not reach the 2030 target. Even if demand is reduced more sharply (25%), the current supply of renewable electricity and bioenergy is still insufficient to meet demand: the additional supply of renewable energy will be immense.
>
> Future demand reduction cannot be predicted with precision, but any reduction reduces emissions. Growth in demand is predicted mainly for heating, mobility, and industrial production.
>
> The pursuit of lower cost and higher profit will lead to continuous but slow improvement in energy efficiency. However, decoupling demand from economic and population growth requires transformative change in business models and personal behaviors, and therefore more stringent policy measures.
>
> Electrification is seen as a core strategy for GHG mitigation in BC. However, electricity supply is insufficient to meet the growth in demand inherent in the electrification-centered strategy. Even with Site C and radical demand reduction, about 60 PJ of additional supply will be needed to meet the 2030 target, and 160 PJ for carbon neutrality in 2050. New electricity generation will be needed by 2030 and beyond, comparable in magnitude to the projected output of the current Site C project. This implies installing hundreds of wind turbines and millions of solar panels."

8.1 How does the UBC study's forecast that "about 60 PJ of additional [electricity] supply will be needed" reconcile with FEI's forecast?

Response:

The Application and the UBC Study have different assumptions and scopes, and are therefore not directly comparable. The Application is FEI's long-term plan for meeting the forecast annual and peak demand requirements of its gas customers. Unlike the UBC Study, the Application did not calculate the future capacity of the electric system, nor whether the electric system would be able to supply sufficient electricity to meet the 2030 and 2050 CleanBC targets.

Nonetheless, the Application and the UBC Study share common themes. Both provide the perspective that in the coming years, BC will need to leverage both the gas and electric energy systems to meet provincial emission reduction targets. Both the Application and the UBC Study discuss the risks that arise when planning for an electrification-only decarbonization pathway, rather than planning for a diversified approach to the energy transition.

8.2 Please confirm that 60 PJ of electricity would be approximately 16,670 GWh/year of annual energy, needed by 2030.

Response:

Confirmed. For context, and to understand the scale of energy needed to meet 2030 demand, BC Hydro's Site C plant is expected to bring on 5,100 GWh per year of new generation.[3] In other words, 60 PJ is slightly more than the annual output of three facilities the size of Site C. The analysis by UBC suggested that meeting this 60 PJ gap by 2030 with solar panels and wind turbines was not likely and argued for other methods of meeting the projected energy demand, such as the use of bioenergy.

[3] https://www.bchydro.com/energy-in-bc/projects/site_c.html.

9.0 Topic: Why is the Deep Electrification Scenario deemed not plausible

Reference: Exhibit B-1, Section 4.6.1.1, Lower Bound and Deep Electrification Scenarios for Residential, Commercial and Industrial Demand not Plausible

Section 4.6.1.1 states (page 6-29, line 16): [underlining added]

> "Both the Lower Bound and the Deep Electrification <u>scenarios create technical and logistical requirements for alternative energy systems to be able to manage the scale of shifting energy resources that are not plausible</u>, particularly to support peak energy, reliability and resiliency requirements."

9.1 Please elaborate on what are the "technical and logistical requirements" for the Deep Electrification scenario that are deemed to be not plausible.

<u>Response:</u>

Please refer to the response to BCUC IR1 30.3.

9.2 Where in the Application are these requirements, and their implausibility, studied and explained in detail.

<u>Response:</u>

Please refer to the response to BCUC IR1 30.3.

9.3 Section 4.6.1.1 only appears to deal with Residential, Commercial and Industrial Demand. What are the other sectors of demand? How large are they relative to Residential, Commercial, and Industrial Demand? And is Deep Electrification plausible for those sectors?

<u>Response:</u>

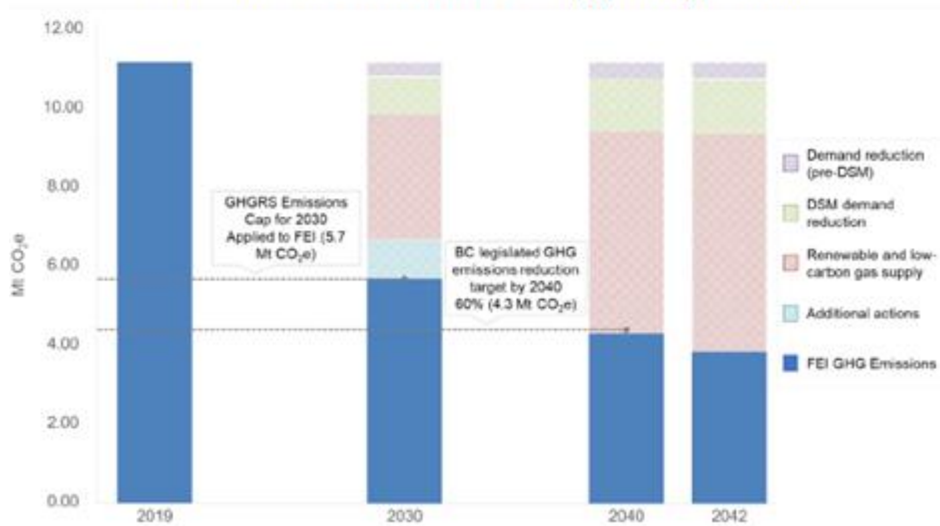
In Section 4.6.1.1 of the Application, FEI illustrates demand profiles for all of FEI's customer types in the built environment (residential, commercial and industrial). It is the emissions of these customers that will be governed by the proposed GHGRS emissions cap. The other sectors that FEI expects to serve over the next 20 years are the transportation sector (through CNG and LNG for heavy duty on-road transportation and LNG for short sea and Trans-Pacific marine transportation), and global LNG. These markets and potential demand are also discussed throughout Section 4, but are not subject to the proposed GHGRS cap (please refer to the response to RCIA IR1 8.1). The extent to which these markets can be electrified over the long-term remains uncertain, both in terms of the technology required to utilize electricity as a transportation fuel and in the ability of electricity storage systems to be able to serve the heavy duty and marine transportation markets. For the overall BC energy delivery systems, FEI does not consider deep electrification of the residential, commercial and industrial sectors, combined with deep electrification of the heavy-duty transportation sectors, to be plausible in the timeframe contemplated, even if affordability was not a consideration. Instead, integration of both electricity and gas infrastructure offers the best opportunity to decarbonize these markets in an efficient and cost-effective manner.

10.0 Topic: How FEI plans to meet the GHG Reduction Standards

Reference: Section 9.2, GHG EMISSION REDUCTIONS IN THE DIVERSIFIED ENERGY (PLANNING) SCENARIO

Figure 9-1 (page 9-4) depicts how GHG emissions will be reduced, under the Diversified Energy Scenario, to meet the GGRS cap of 5.7 Mt CO2e by 2030:

Figure 9-1: GHG Emission Reductions for Residential, Commercial and Industrial Customers Meets the GHGRS for the Diversified Energy (Planning) Scenario



The “Additional Reductions” required by 2030 are described in Section 9.2.1.4 and include

- Additional demand-side measures not modelled in the 2021 CPR, and
- Additional reductions from FEI’s transition to renewable and low-carbon ga supplies – particularly from higher than modelled CCUS implementation:

10.1 Please confirm that the emissions shown in the Figure 9-1 bar chart represent the combustion emissions of residential, commercial, and industrial customers receiving their gas from FEI.

Response:

Confirmed.

10.2 How much additional GHG reduction is expected to be achieved by 2030 by each of the above “Additional Reductions”?

Response:

Please refer to the response to BCUC IR1 74.2.

10.3 Is the increase in CCUS expected to come from industrial sites, which use FEI's natural gas, being able to capture and store their CO2 emissions.

Response:

Please refer to the responses to BCUC IR1 64 series.

As noted under "Additional Reductions" in Section 9.2.1.4 of the Application, implementing Carbon Capture, Utilization and Storage (CCUS) at industrial sites that use natural gas, renewable natural gas, or other fossil fuels for process applications can result in reduced (or even negative) GHG emissions. This is one means of reducing FEI's scope 3 GHG emissions.

However, FEI is not suggesting that all the CCUS-related GHG emission reductions will come solely from industrial customer sites. As described in Section 9.2.1.4, CCUS may, for example, be implemented to complement renewable natural gas production, thereby offering the potential to remove additional carbon from the natural carbon cycle. Please also refer to the responses to the BCUC IR1 64 series for further discussion on CCUS.

10.4 If these "Additional Reductions" can achieve the expected 0.9 Mt CO2e/yr., what are the expected total GHG reductions that FEI will achieve by 2030? By 2040?

Response:

Please refer to the response to BCUC IR1 74.2.

10.5 Figure 9-1 shows FEI's customers had total emissions in 2019 of 11.0 Mt CO2/yr. What is the latest estimate of the emissions in 2022?

Response:

FEI has not developed a GHG emissions estimate for 2022 comparable to the estimate for 2019 in Figure 9.1.

Attachment 1.1

FortisBC Long Term Gas Resource Plan (LTGRP)
Resource Planning Advisory Group (RPAG)
Kick-off Meeting

January 25, 2021

PUBLIC VERSION

Agenda

1. Introductions & Housekeeping **(40 min)**
2. About FortisBC & Long Term Resource Planning **(20 min)**
3. Energy Planning Landscape in BC **(30 min)**
4. Engagement Plan for 2021 **(25 min)**
5. Wrap-up & Next Steps **(5 min)**

Speaker Introductions

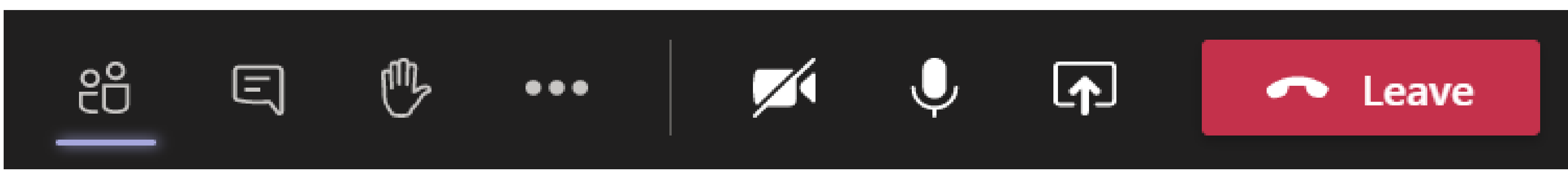
Ken Ross,
Manager, Integrated Resource Planning & DSM Reporting

Paul Chernikhowsky,
Director, Regulatory Projects & Resource Planning

Anda Telman,
Manager, Integrated Resource Planning

Housekeeping

- We encourage you to participate through video, but not required
- When you’re not speaking, mute yourself to reduce background noise
- If you can, we ask that you save your questions until the allocated section breaks
  - We encourage you to use the **hand-up feature** to indicate you’d like to speak
  - When we call upon you, we ask that you un-mute and speak to us directly
  - You may also use the **chat** functionality if you’d prefer
- Please do not use the chat functionality for private conversations



Safety Reminders

- Ensure you’re comfortable at your workstation
- If you need to, stand-up and stretch
- Take breaks as needed

RPAG Member Introductions

- Avista
- BC Hydro
- BC Ministry of Energy, Mines & Low Carbon Innovation
- BC Public Interest Advocacy Centre
- BC Utilities Commission
- Building Owners & Managers Association
- Business Council of BC
- Canadian Institute of Plumbing & Heating
- City of Abbotsford
- City of Burnaby
- City of Campbell River
- City of Kamloops
- City of New Westminster
- City of Prince George
- Clean Energy BC
- Climate Action Secretariat
- Commercial Energy Consumers Association of BC
- Community Energy Association
- Enbridge
- MoveUP
- Northwest Gas Association
- Pacific Northern Gas
- Pembina Institute
- Selkirk College
- SFU Renewable Cities
- Union of BC Municipalities
- Village of Keremeos

Disclaimer for an Open Dialogue

- The input provided during this meeting may become public during our regulatory proceedings
- We will not attribute input to any individual or entity
- We encourage you to provide further input during the formal regulatory proceedings – even if your opinions have changed
- We will provide the presentation and meeting notes online

Meeting Objectives

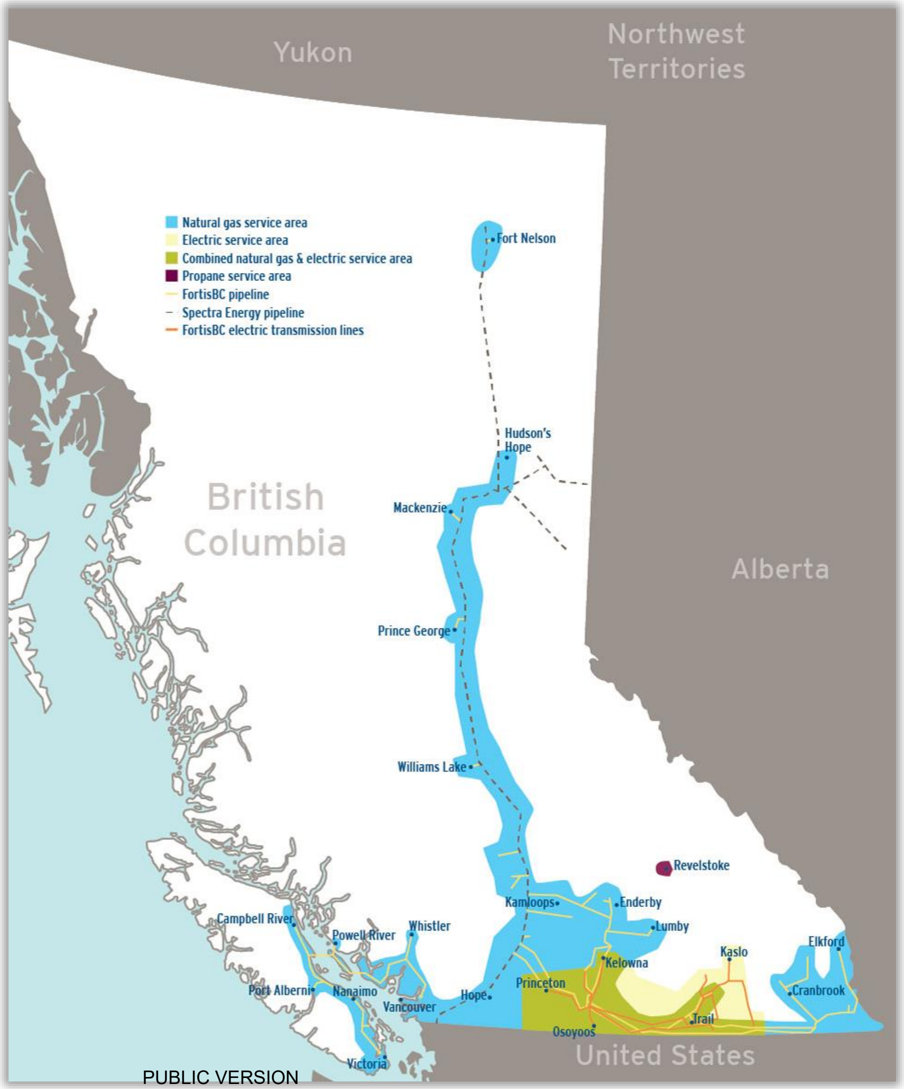
- Formally initiate the RPAG and facilitate the introduction of members
- Highlight the role and importance of the RPAG
- Review relevant background information about long term resource planning
- Provide an overview of what our future engagement will look like and how we will collect your valuable input and feedback

Agenda

1. Introductions & Housekeeping **(40 min)**
2. About FortisBC & Long Term Resource Planning **(20 min)**
3. Energy Planning Landscape in BC **(30 min)**
4. Engagement Plan for 2021 **(25 min)**
5. Wrap-up & Next Steps **(5 min)**

About FortisBC & Long Term Resource Planning

FortisBC Overview



- FortisBC customers span across **135 communities** and **57 Indigenous communities**
- Largest energy provider in the province
- Serving **1.2 million** customers providing:
  - electricity
  - natural gas
  - renewable gas
  - propane
  - alternative energy solutions
- Employing **2,400** people

PUBLIC VERSION

Energy at work FORTIS BC™

Purpose of Resource Planning

- The LTGRP **looks ahead 20 years** and provides a road map for securing safe, reliable and cost-effective energy resources.
- Represents an important component in our **overall strategic planning**
- Requirement of the Utilities Commission Act (UCA)
  - Section 44.1(2) Resource Planning Guidelines
- Seeking **acceptance** from the British Columbia Utilities Commission (BCUC)
- FortisBC files separate applications for Certificates of Public Convenience and Necessity (CPCN), if and as necessary, for any of the identified activities in accordance with the Commission's guidelines.

Resource Planning Objectives

- Ensure cost effective, secure and reliable energy for customers
- Provide cost-effective demand-side management and cleaner customer solutions
- Ensure consistency with provincial energy objectives
  - Example: Clean Energy Act and CleanBC
- Address prior BCUC directives

Resource Planning Engagement Groups

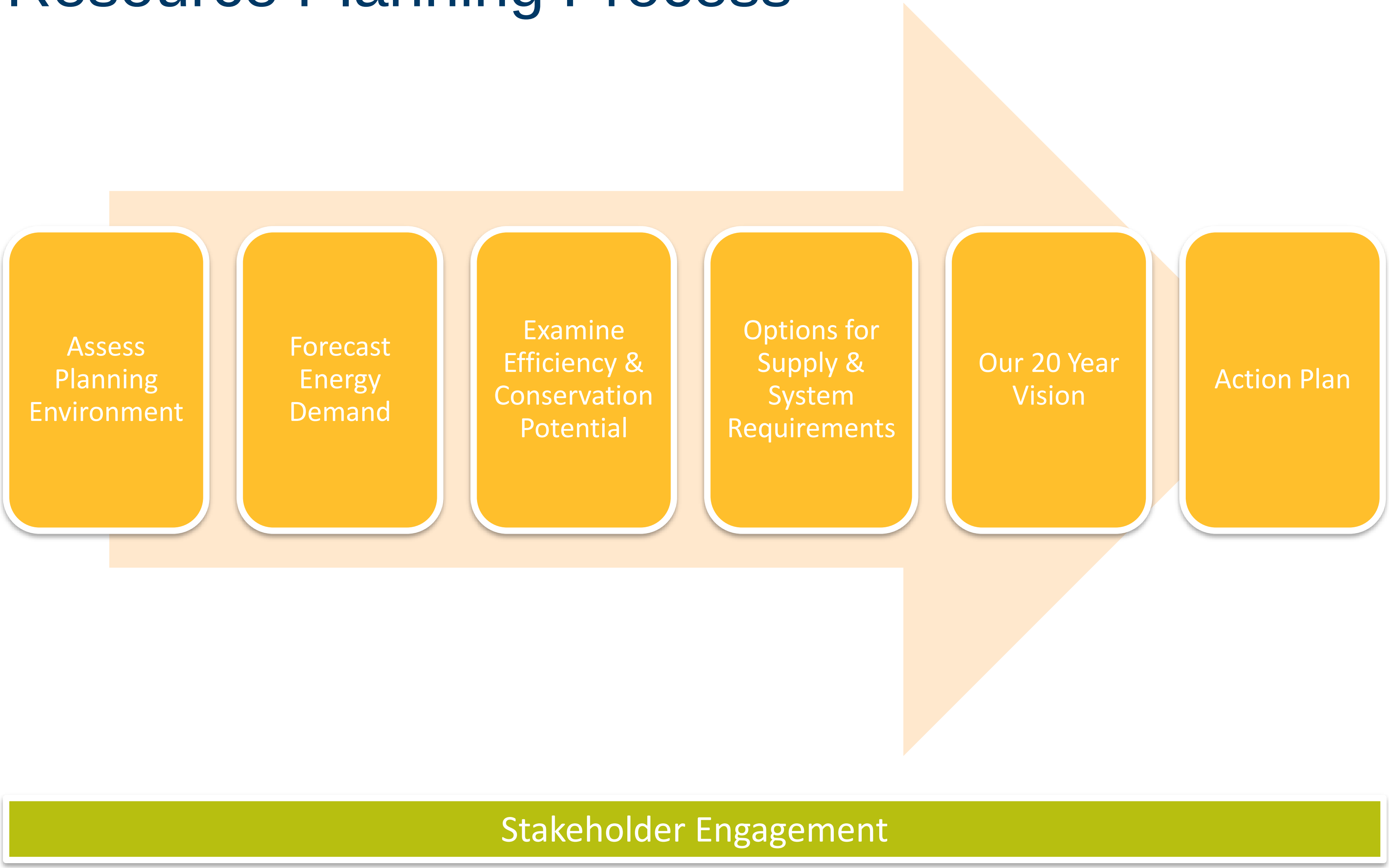
Communities

Indigenous Communities

General Public / Customers

Resource Planning Advisory Group (RPAG)

Resource Planning Process



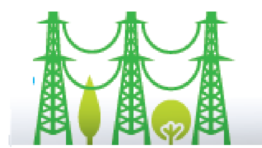
Energy at work FORTIS BC

Gas vs. Electricity Resource Planning

Electricity

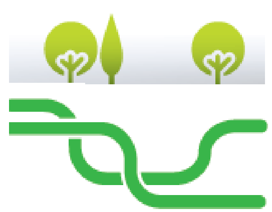
Generation | Market Purchases | Transmission & Distribution | Delivered to Customers | Energy Efficiency & Conservation





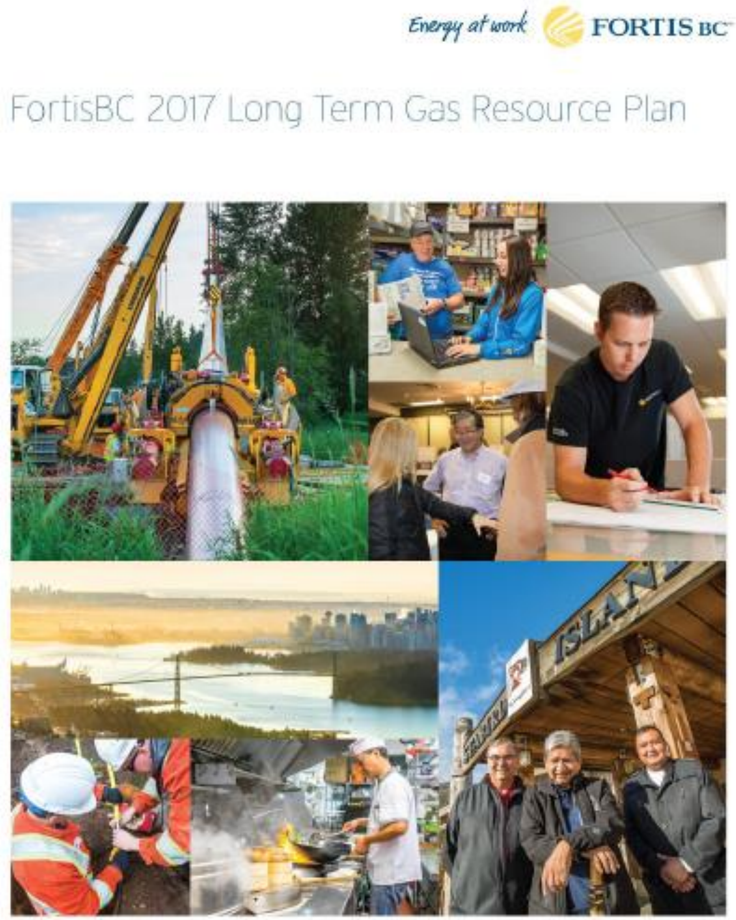
Natural Gas

Generation | Market Purchases | Distribution | Delivered to Customers | Energy Efficiency & Conservation

Previous Long Term Gas Resource Plan

- The last plan was submitted to the BCUC in **December 2017**. The BCUC accepted the plan in February 2019.
  - Available on FortisBC website under About Us > Regulatory Affairs
- The next plan will be submitted to the BCUC in **March 2022**.



2017 Long Term Gas Resource Plan

Overview of the Action Plan

1. Energy planning environment
2. End-use demand forecasting (annual/peak)
3. Securing reliable, cost effective long term gas supply
4. Monitoring and evaluating system expansion needs
5. Applications for near-term system requirements
6. Implement Natural Gas for Transportation (NGT) initiatives
7. Apply for Conservation & Energy Management (C&EM) funding/plan
8. Request funding to support innovative technologies

2017 Long Term Gas Resource Plan

Overview BCUC Directives (Order G-39-19)

- Demand forecasting approach/method
- Demand-side Management (DSM) scenario analysis
- CleanBC and GHG reduction targets
  - Address impacts to FEI of energy efficient buildings, renewable gas, industrial electrification, clean transportation, and other government initiatives
- Impact of DSM in deferring infrastructure
- Security of supply concerns
- File the next LTGRP on or before March 31, 2022

Questions for Clarification

Energy at work FORTIS BC™

Agenda

1. Introductions & Housekeeping **(40 min)**
2. About FortisBC & Long Term Resource Planning **(20 min)**
3. Energy Planning Landscape in BC **(30 min)**
4. Engagement Plan for 2021 **(25 min)**
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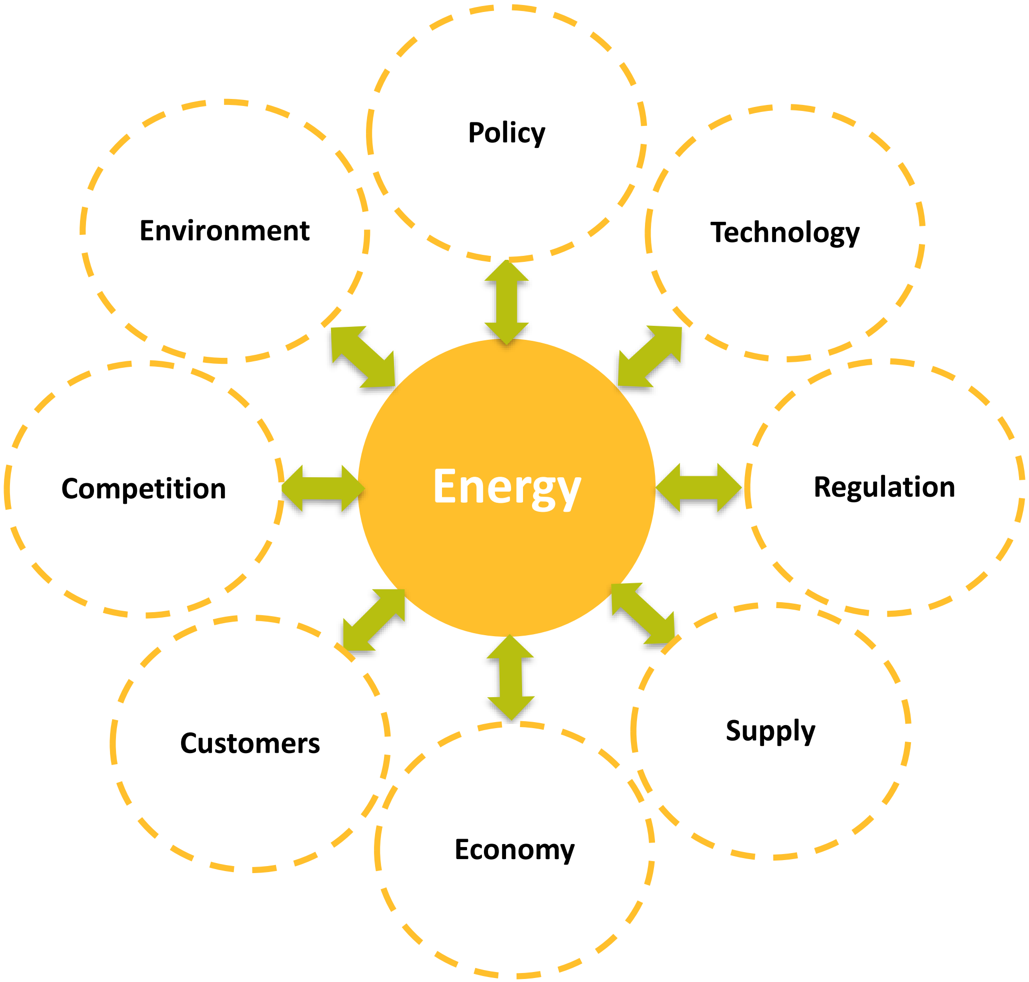
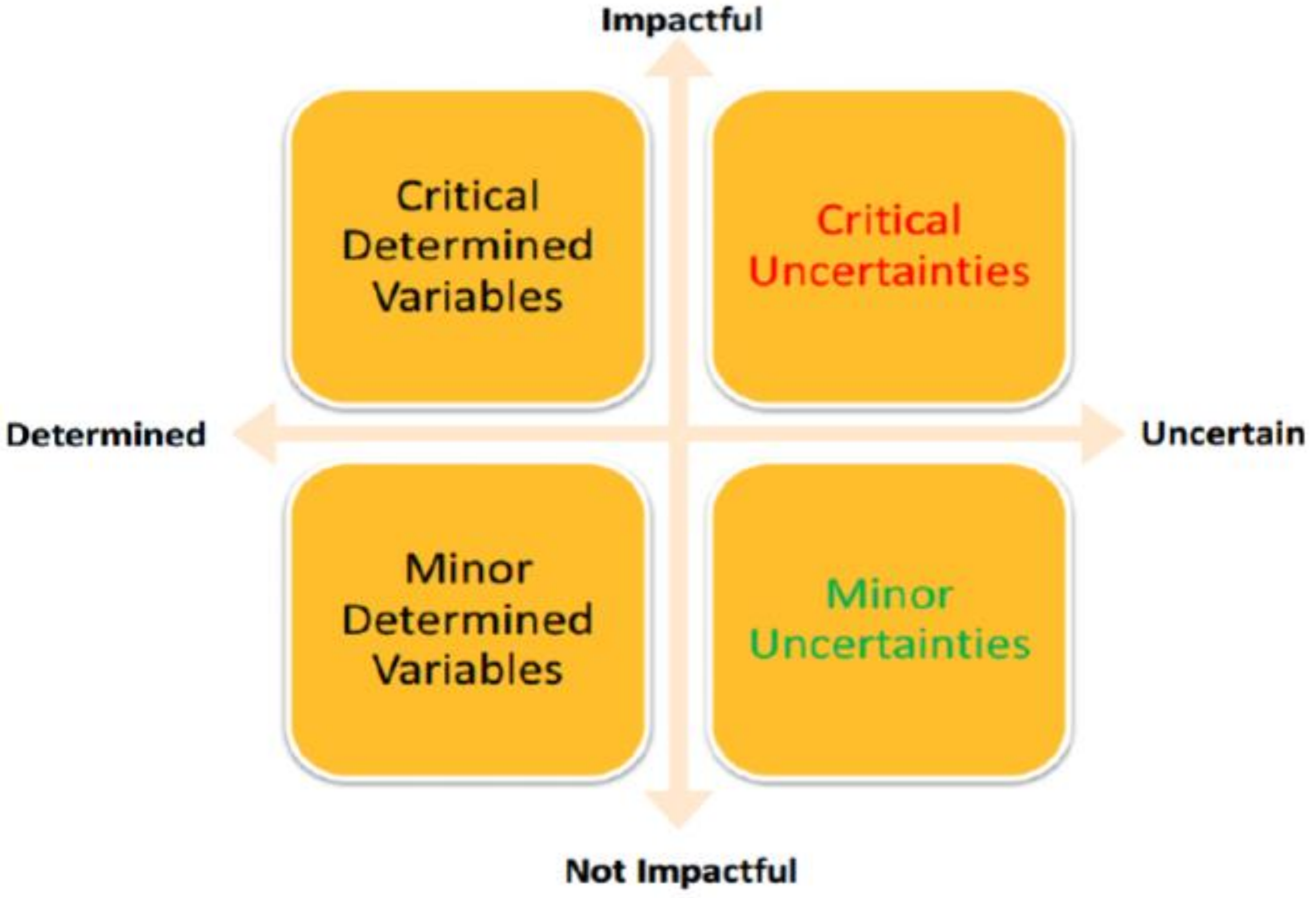
Energy Planning Landscape in BC

Energy at work FORTIS BC™

Energy Planning Framework



Identifying the Critical Uncertainties

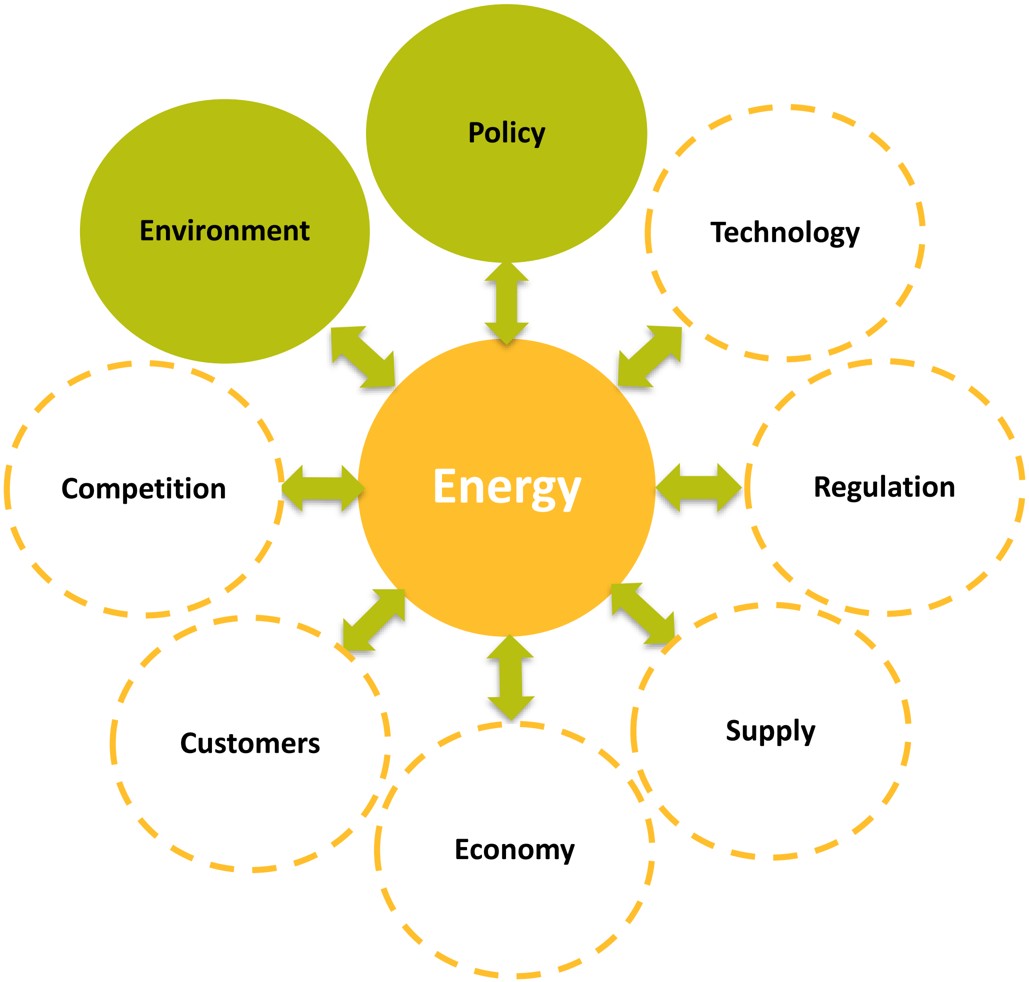


2022 LTGRP Critical Uncertainties

Transportation	• On-Road Market Share • Off-Road Market Share • Marine Market Share – Domestic & International
Energy & Climate Policy	• Carbon Price • New Construction Codes • Retrofit Codes • Appliance Standards • Fuel Switching Mandates & Incentives
Distributed Energy Technologies	• RNG – Production Potential & Cost • Hydrogen – Production Potential & Cost • Carbon Capture, Storage & Utilization – Potential & Cost
Economy	• Economic/Customer Growth • Natural Gas Price • LNG Exports

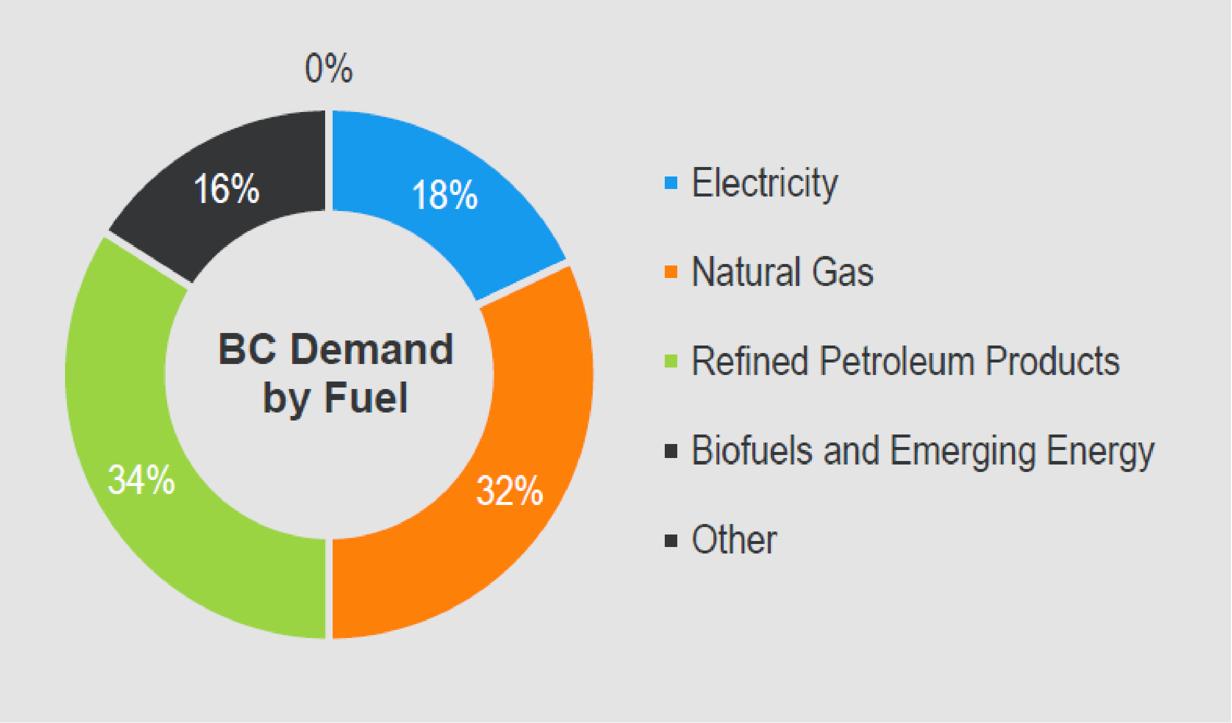
Questions for Clarification

Energy Planning Framework



Energy Demand in BC by Fuel

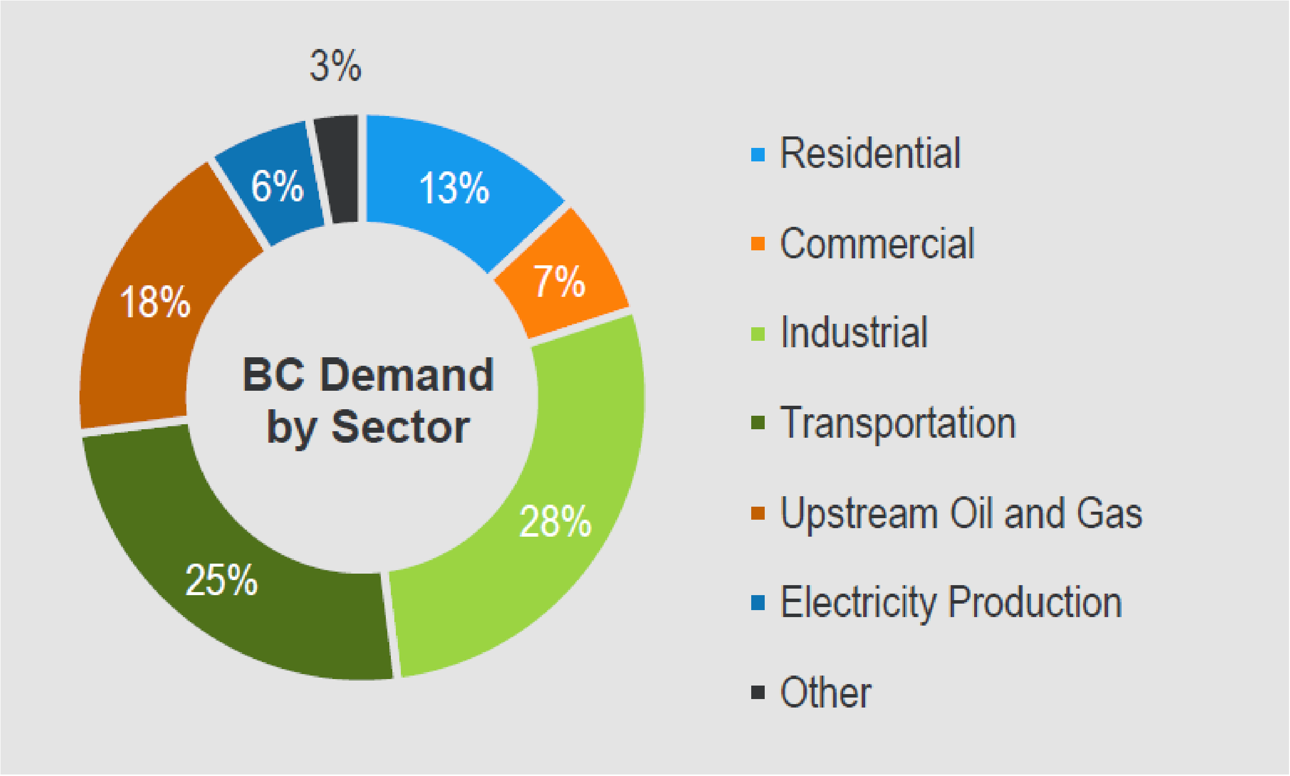
Refined petroleum products account for largest share



Source: Canada Energy Regulator – Canada's Energy Future 2019 and CanESS (CANSIM)

Energy Demand in BC by Sector

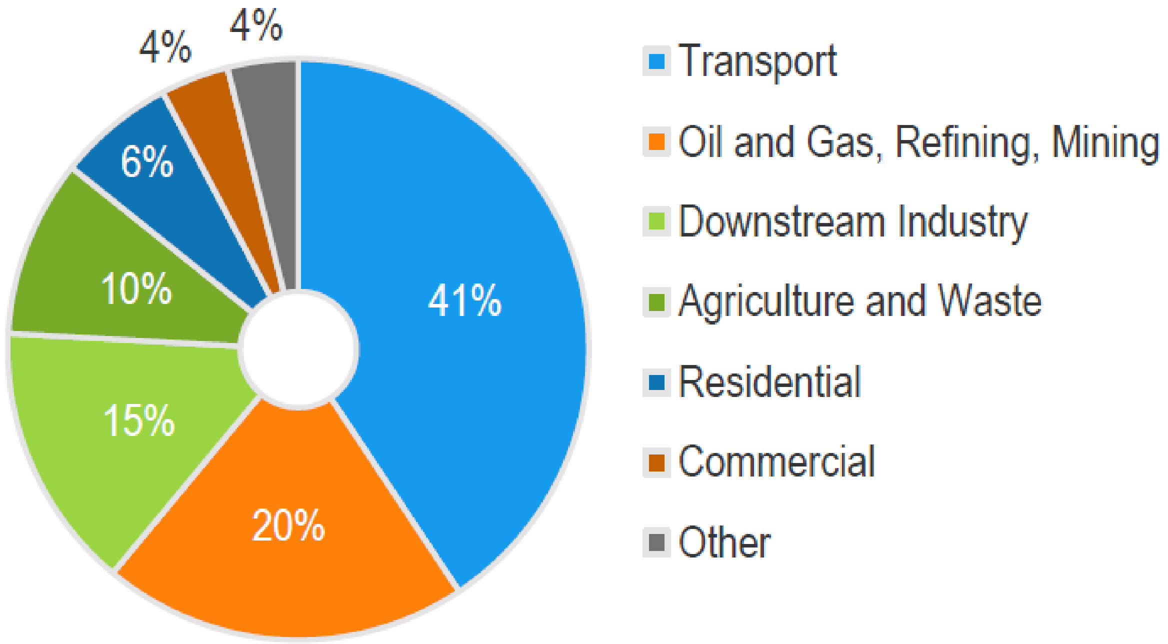
Industry consumes a significant amount of energy



Source: Canada Energy Regulator – Canada's Energy Future 2019 and CanESS (CANSIM)

GHG Emissions in BC by Sector

Industry & transportation are the biggest contributors



Source: BC GHG Inventory

Clean Growth Pathway to 2050

Sharing goals to lower GHGs and drive economic growth

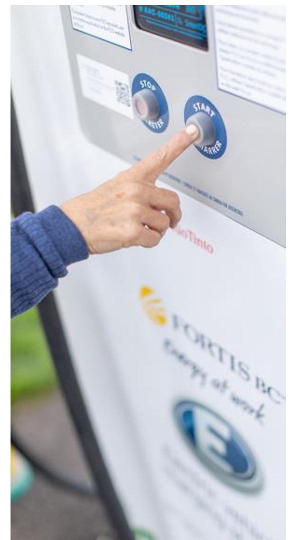
FortisBC has always been:

- offering solutions to help customers reduce GHGs
- collaborating with industry, public, government and regulators
- helping inform the CleanBC consultation process

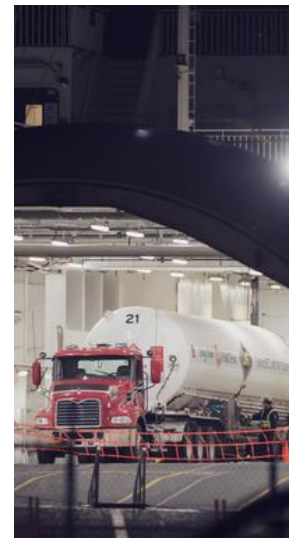
4 Pillars of the Clean Growth Pathway to 2050

Energy efficiency

Renewable gas



Zero and low carbon transportation



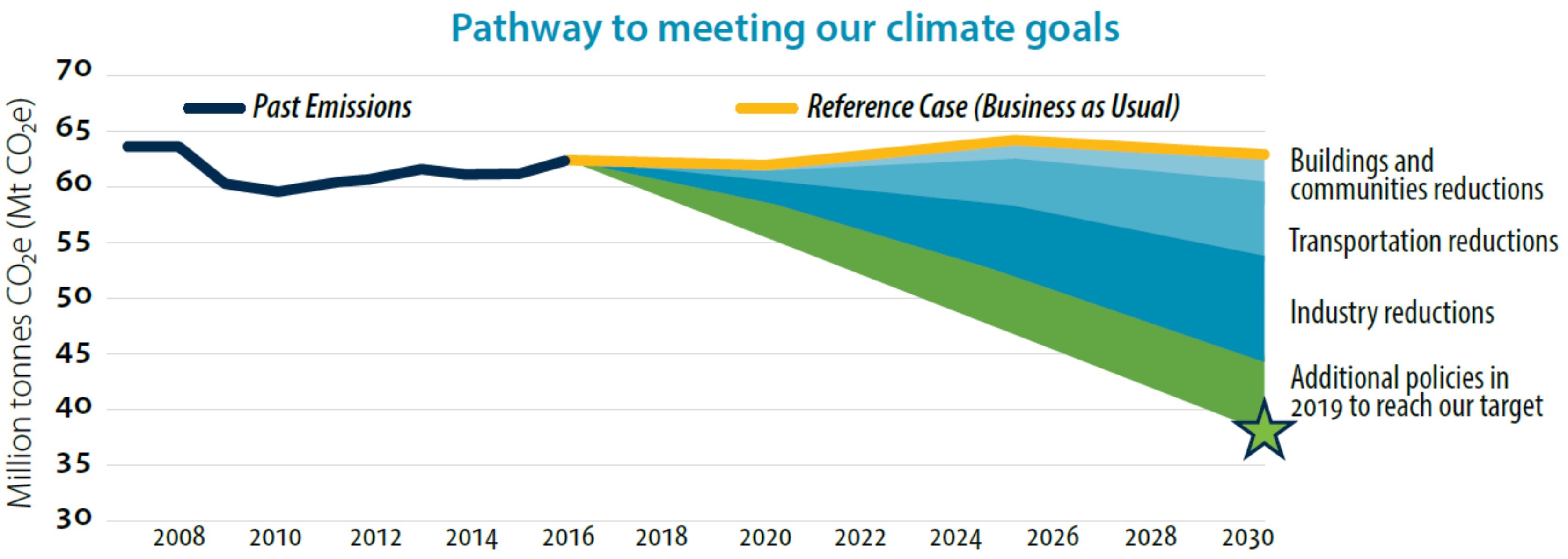
Global LNG

CleanBC

- CleanBC is the provincial climate and economic plan to achieve greenhouse gas emissions by 2030.
- Plan outlines specific actions in the following categories:
  - Better buildings
  - Reducing pollution from industry
  - Cleaner transportation
  - Reducing emissions from waste
  - Clean energy jobs
- FortisBC is a critical partner to achieve the BC Government's goals.

CleanBC GHG Emissions Reduction Target

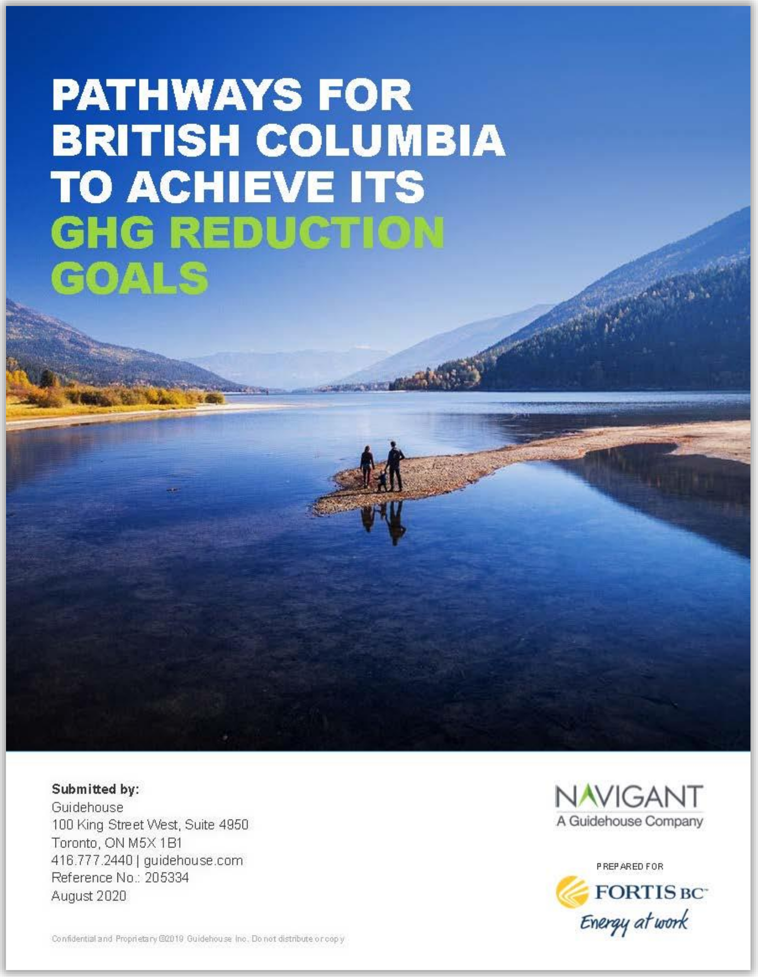
40% reduction in GHG emissions by 2030



Alternative Pathways

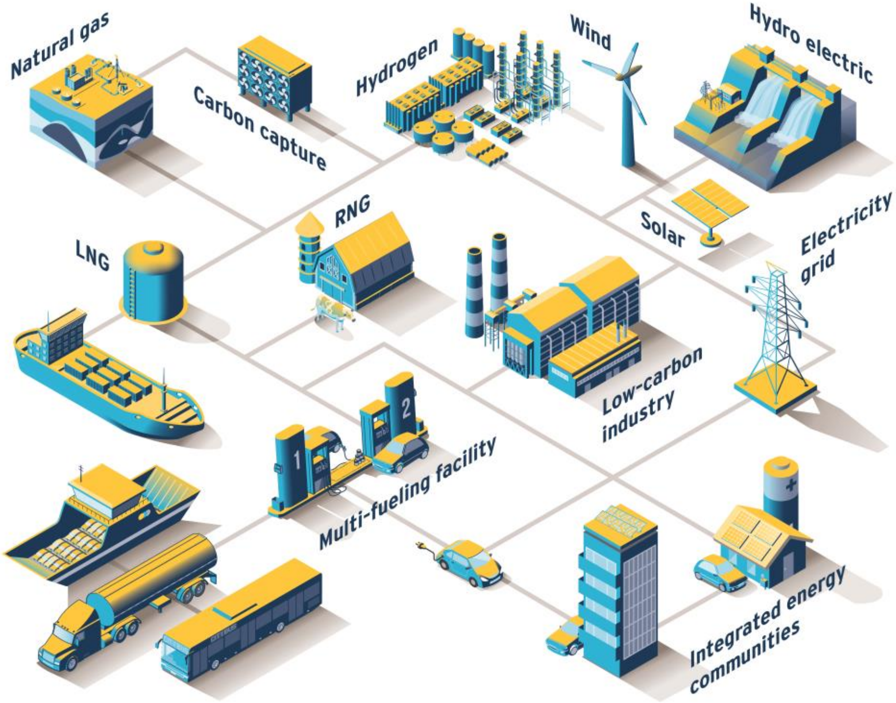
FortisBC commissioned Guidehouse to:

- develop pathways for BC to achieve an 80% GHG reduction
- compare two options to get there including Electrification and Diversified Pathways
- analyze GHG reductions, costs, reliability and risks to British Columbians



A Diversified Approach to Climate Action

- Achieves the Province's **80%** reduction target
- Reduces de-carbonization costs
- Considers peak day demand and related infrastructure
- Provides resiliency and reliability
- It's not either/or, **it's both/and**



Energy at work FORTIS BC

Measuring our Progress to 2050

We set an ambitious emissions reduction target

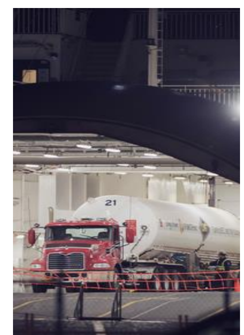
Our **30BY30 target** will:

- reduce our customers' GHG emissions by **30%** by **2030**
- be a milestone that we measure our progress by

Energy efficiency

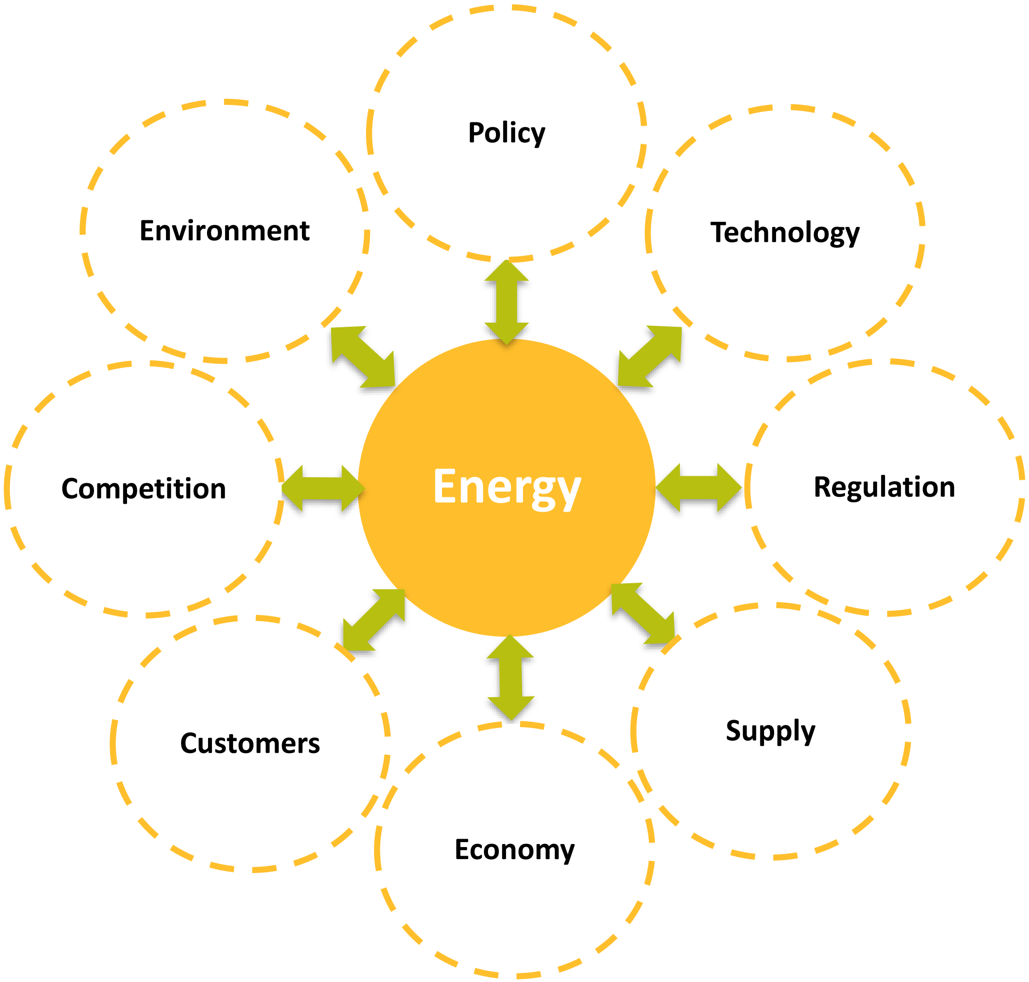
Renewable gas

Zero and low carbon transportation



Global LNG

Energy Planning Framework



Upcoming Session

BC's GHG Reduction Pathways Study & Implications for FortisBC's Long Term Resource Plans
Friday, February 12th
8:00-11:00am PST

Please **RSVP** by emailing irp@fortisbc.com
as soon as possible if you'd like to attend.

Questions for Clarification

Agenda

1. Introductions & Housekeeping **(40 min)**
2. About FortisBC & Long Term Resource Planning **(20 min)**
3. Energy Planning Landscape in BC **(30 min)**
4. Engagement Plan for 2021 **(25 min)**
5. Wrap-up & Next Steps **(5 min)**

Engagement Plan for 2021

Overview of Engagement

- Active throughout 2021
- Input will only be required intermittently
- Encourage participants to make a best effort to participate
  - If other conflicts or priorities come up from time to time, we ask that you let us know if you can no longer participate or would like to designate an alternate in your place
- Approach focused on providing you with greater flexibility by utilizing electronic surveys and reducing the number of meetings

Responsibilities for RPAG and FortisBC

RPAG Members

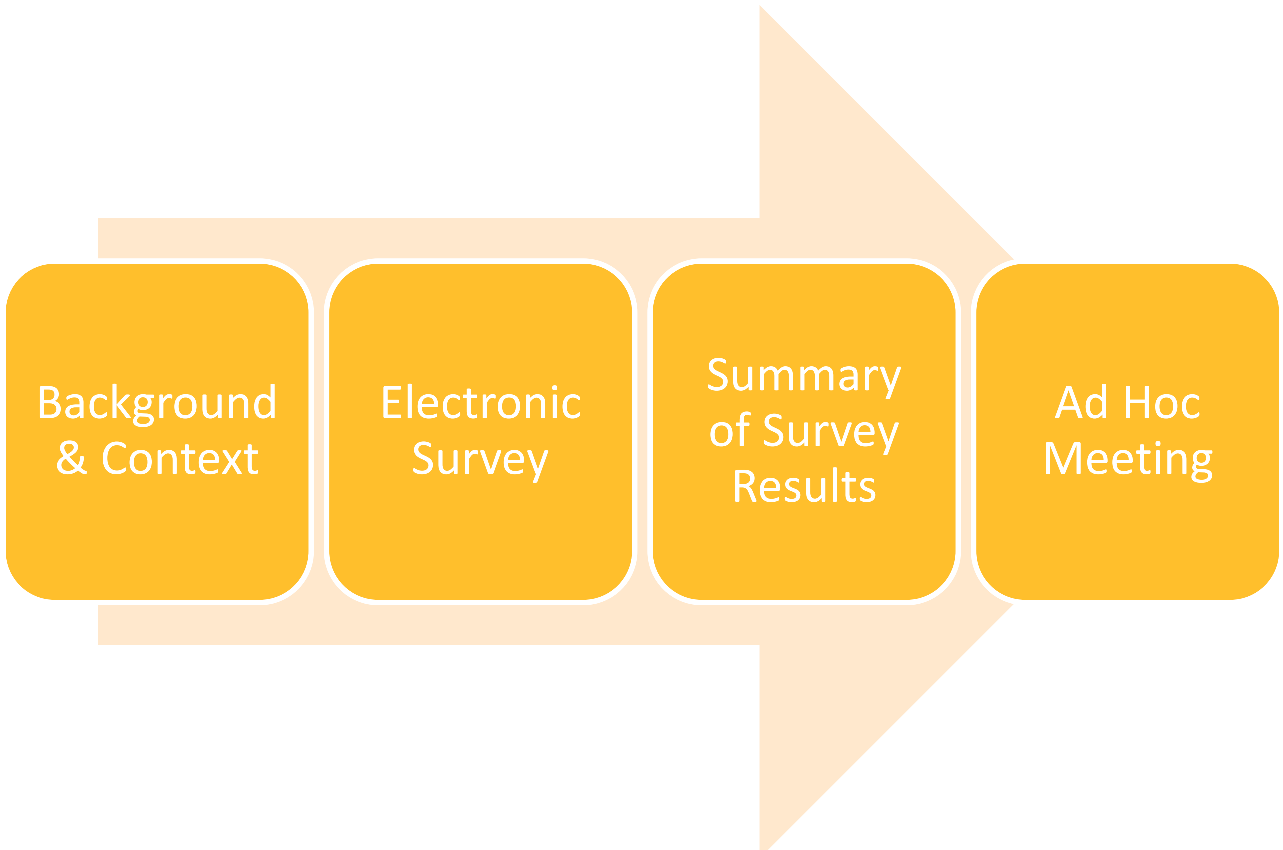
- Provide feedback and advice
- Raise issues and suggest solutions
- Bring forth ideas beneficial to all
- Keep topics within the scope of the LTGRP
- Respond to electronic surveys
- Attend meetings as needed or send an alternate (on an occasional basis only)
- Review preparation materials in advance of meetings or as associated with electronic surveys

FortisBC

- Circulate electronic surveys and survey results
- Host meetings, as needed, and lead discussions
- Set forth agendas and topics for discussion
- Provide preparatory materials in advance of meetings and electronic surveys
- Record and consider suggestions from RPAG members
- Provide planning updates and manage communications

What to expect with electronic surveys?

In order to receive the electronic surveys and provide your input for the 2022 LTGRP, you will need to opt-in to our **Online Input Network**.



Engagement Plan for 2021

January

- Kick-off Meeting (January 25)
- Online Input Network Subscription

February

- BC's GHG Reduction Pathways Study Session (February 12)
- Demand Scenario Analysis

April

- Crowd Forecast Exercise through the Slider Tool

Engagement Plan for 2021

July	• Demand Side Management Analysis
September	• Supply Portfolio and Risks Analysis
November	• System Capacity Planning Analysis
December	• Wrap-up Meeting (Date TBC) • Final Analysis & Input (Topic TBC)

Questions for Clarification

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Wrap-up & Next Steps

Wrap-up and next steps

- Thank you attending the Kick-off Meeting, we appreciate it!
  - We will advise you when the presentation and meeting notes will be posted online
- Don't forget to opt-in to the **Online Input Network** to receive future electronic surveys.
- If you have not done so already, remember to RSVP to **BC's GHG Reduction Pathways Study & The Implications for FortisBC's Long Term Resource Plans** session on **February 12, 2021** from **8:00 to 11:00 am PST**.
- For additional questions, contact us at **irp@fortisbc.com**.

Energy at work FORTIS BC™

Thank you

For further information, please contact:

FortisBC Integrated Resource Planning

irp@fortisbc.com

Find FortisBC at:
fortisbc.com
talkingenergy.ca
604-576-7000

Follow us **@fortisbc**

BC’S GHG REDUCTION PATHWAYS STUDY - IMPLICATIONS FOR FORTISBC’S LONG TERM RESOURCE PLANS

February 12, 2021

PUBLIC VERSION

Housekeeping

- We encourage you to participate through video, at your option
- When you're not speaking, please mute yourself to reduce background noise
- We ask that you save your questions until the allocated section breaks
  - If you would like to ask a question or make a comment, please so indicate in the chat
- Please note, the session audio/video will not be recorded, however, the chat history will be saved solely for note-taking purposes by Fraser Basin Council
- If possible, please include your name and affiliation in your Zoom display name

Safety Reminders

- Ensure you’re comfortable at your workstation
- If you need to, stand-up and stretch
- Take breaks as needed, we also have a break built into the agenda

Agenda

1. **Welcome, Introductions & Session Overview (15 min)**
2. Opening Remarks **(10 min)**
3. Background on Long Term Resource Planning & Demand Side Management Planning **(10 min)**
4. Pathways for British Columbia to Achieve its GHG Reduction Goals & Question Period **(45 min)**
5. Break **(10 min)**
6. Breakout Group Discussions & Report Back **(1 hour)**
7. Implications for FortisBC's Long Term Resource Plans **(25 min)**
8. Wrap-up, Evaluation Forms & Next Steps **(5 min)**

Welcome, Introductions & Session Overview

Energy at work FORTIS BC™

FortisBC Speaker Introductions

Doug Slater,
External & Indigenous Relations Vice President, FortisBC

Ken Ross,
Resource Planning & DSM Reporting Manager, FortisBC

Tyler Bryant,
Low-Carbon Policy Manager, FortisBC

Mike Hopkins,
Resource Planning Senior Manager, FortisBC

Anda Telman,
Resource Planning Manager, FortisBC

Attendee Introductions

- We ask that you take a few minutes to introduce yourself to other attendees in the chat
- If you're able and comfortable, please provide:
  - Your name
  - Affiliation
  - Reason for attending today's session

Disclaimer for an Open Dialogue

- The input provided during this meeting may become public during our regulatory proceedings as part of the session notes
- We will not attribute input to any individual or entity
- We encourage you to provide further input during the formal regulatory proceedings – even if your opinions have changed
- We will provide the presentation and meeting notes online and welcome feedback if you think we missed anything or misrepresented any comments or questions

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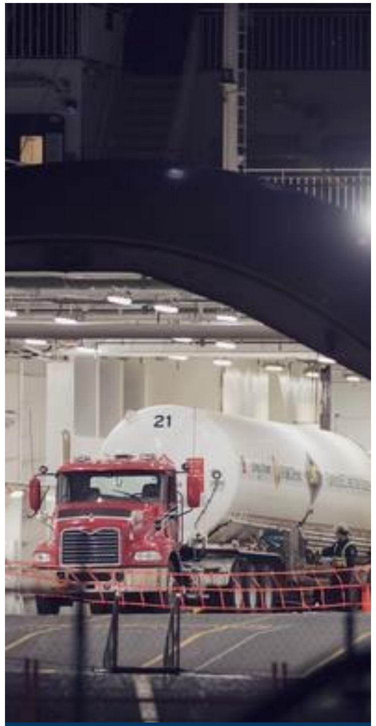
Opening Remarks

4 Pillars Of Our Clean Growth Pathway To 2050

Energy efficiency

Renewable gas

Zero and low carbon transportation



Global LNG

Energy at work FORTIS BC™

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Background on Long Term Resource Planning & Demand Side Management Planning

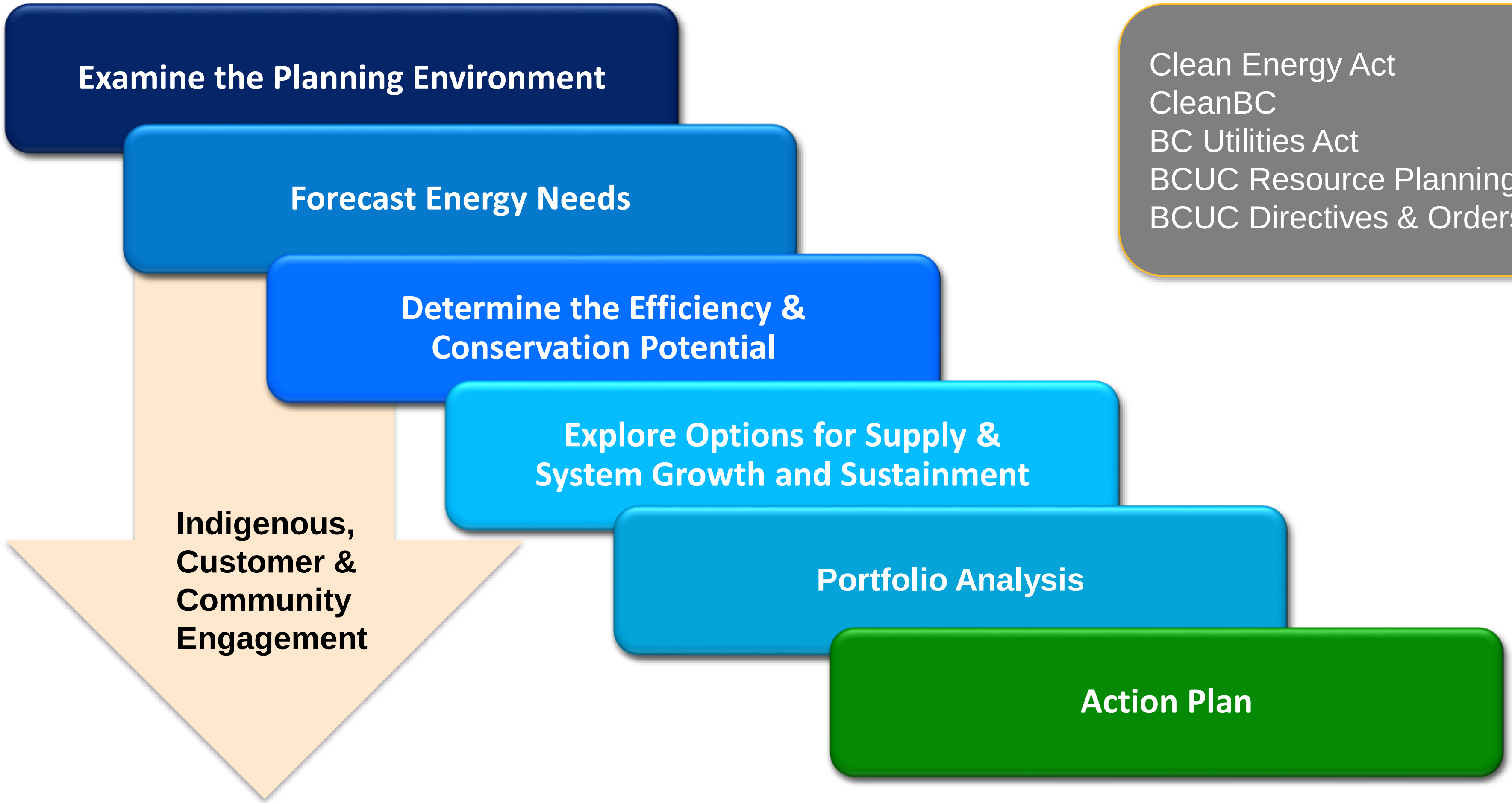
Energy at work FORTIS BC™

Resource Planning Scope & Objectives

The LTGRP **looks ahead 20 years** and provides a road map for securing safe, reliable and cost-effective energy resources.

- Ensure cost effective, secure and reliable energy for customers
- Provide cost-effective demand-side management and cleaner customer solutions
- Ensure consistency with provincial energy objectives
  - Example: Clean Energy Act and CleanBC
- Address prior BCUC directives

Resource Planning Process



Clean Energy Act
CleanBC
BC Utilities Act
BCUC Resource Planning Guidelines
BCUC Directives & Orders

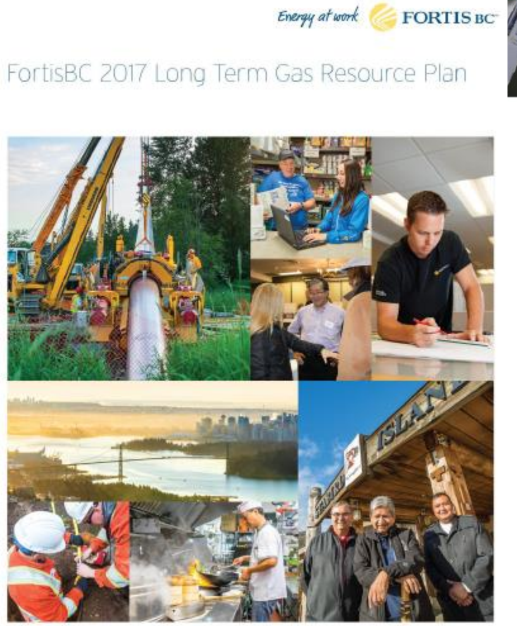
Upcoming Resource Plans

Long Term Electric Resource Plan (LTERP)

- The last plan was submitted to the BCUC in November 2016. The BCUC accepted the plan up to 2024 in June 2018.
- We expect to submit the next plan to the BCUC in June 2021.

Long Term Gas Resource Plan (LTGRP)

- The last plan was submitted to the BCUC in December 2017. The BCUC accepted the plan in February 2019.
- The next plan will be submitted to the BCUC in March 2022.



Questions for Clarification

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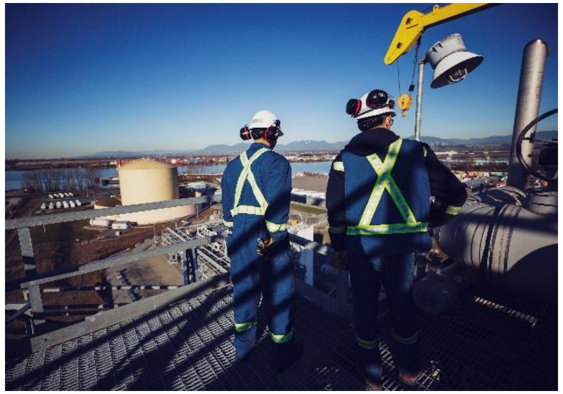
Pathways for British Columbia to Achieve its GHG Reduction Goals – Presentation and Discussion

Energy at work FORTIS BC™

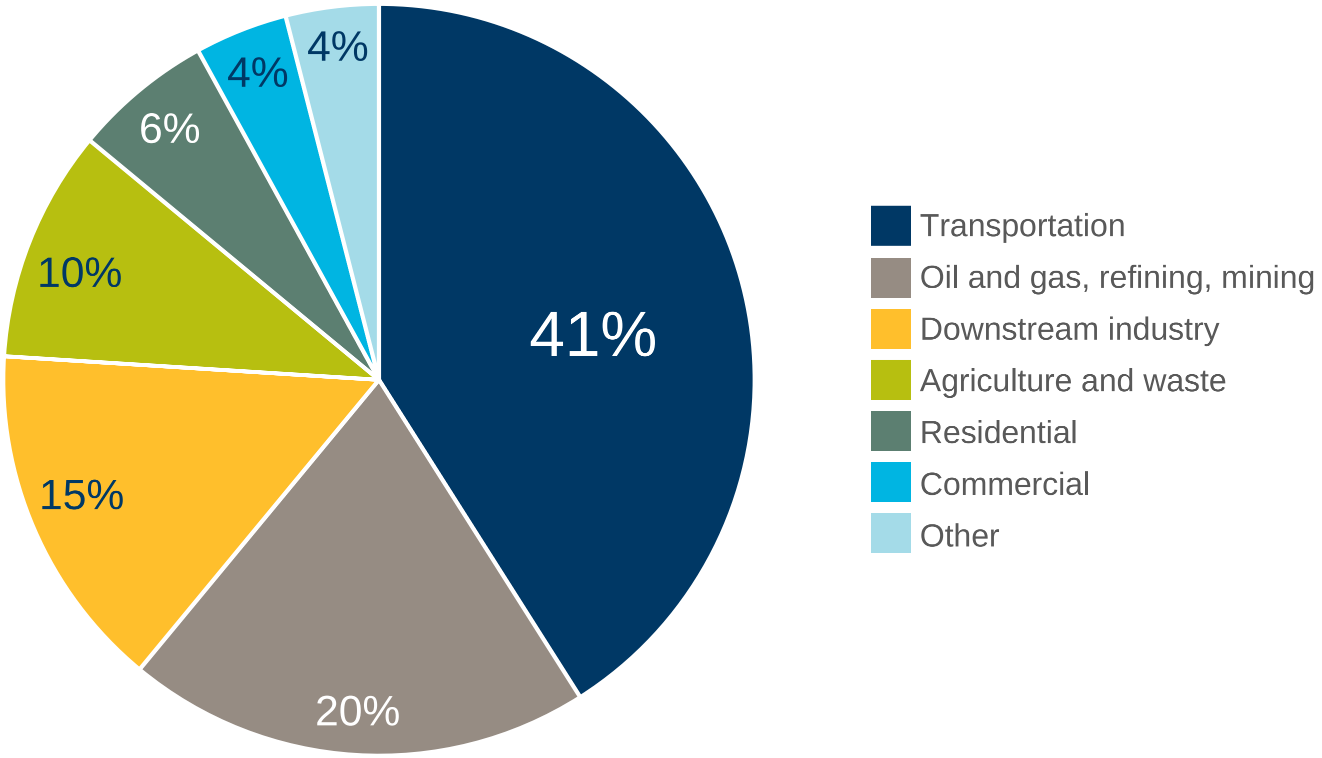
The Need For Made-in-BC, Low-carbon Pathways

- FortisBC has a proven history in BC’s energy industry.
- While BC already has:
  - significant existing energy infrastructure
  - a clean electricity system
  - large renewable, natural gas and biomass resources
  - a relatively large winter heating load



BC's GHG Inventory

Industry & transportation biggest contributors

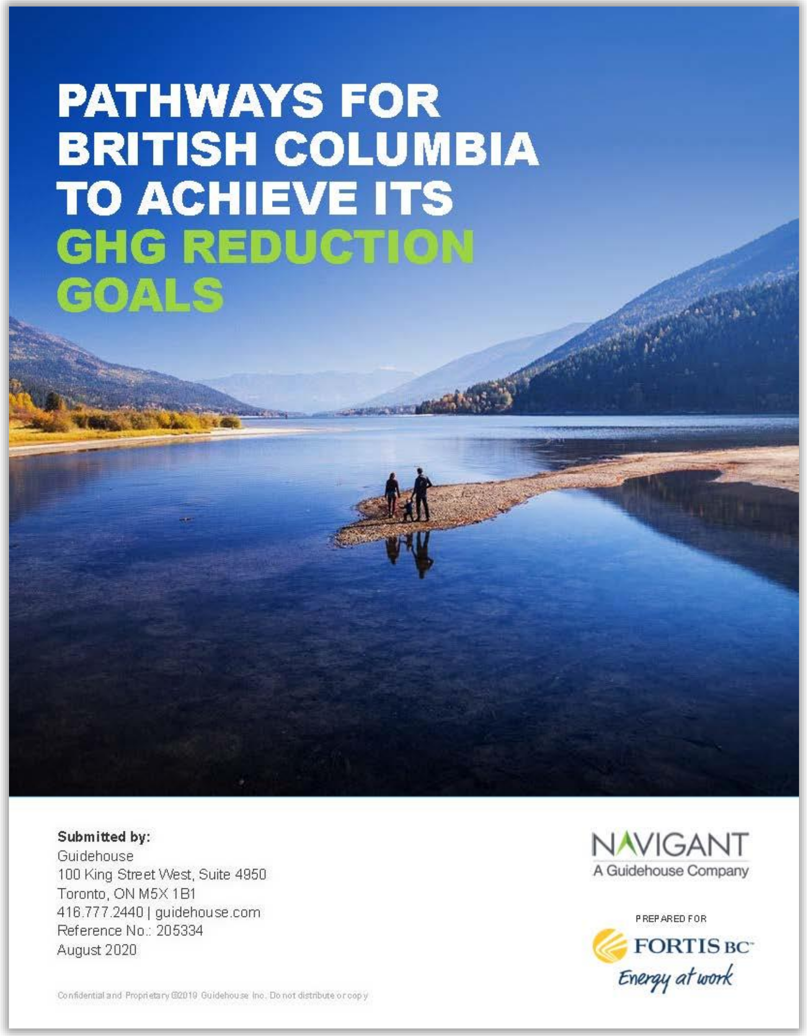


Source: https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory

We’ve Done The Research

FortisBC commissioned Guidehouse to:

- develop pathways for BC to achieve an 80% GHG reduction
- compare two options to get there including Electrification and Diversified Pathways
- analyze GHG reductions, costs, reliability and risks to British Columbians



Energy at work FORTIS BC™

Electric & Diversified Pathways

Electric Pathway

Energy efficiency
- Both pathways have similar energy efficiency assumptions

Fuel switching
- 100% of buildings heat & water to electric. Electric heat pumps key.

Transportation
- Both assume 100% LD vehicles to EV
- Significant role for EVs in medium and heavy duty (MD/HD) vehicles

Energy supply
- 3% renewable gas
- 45% electricity

Diversified Pathway

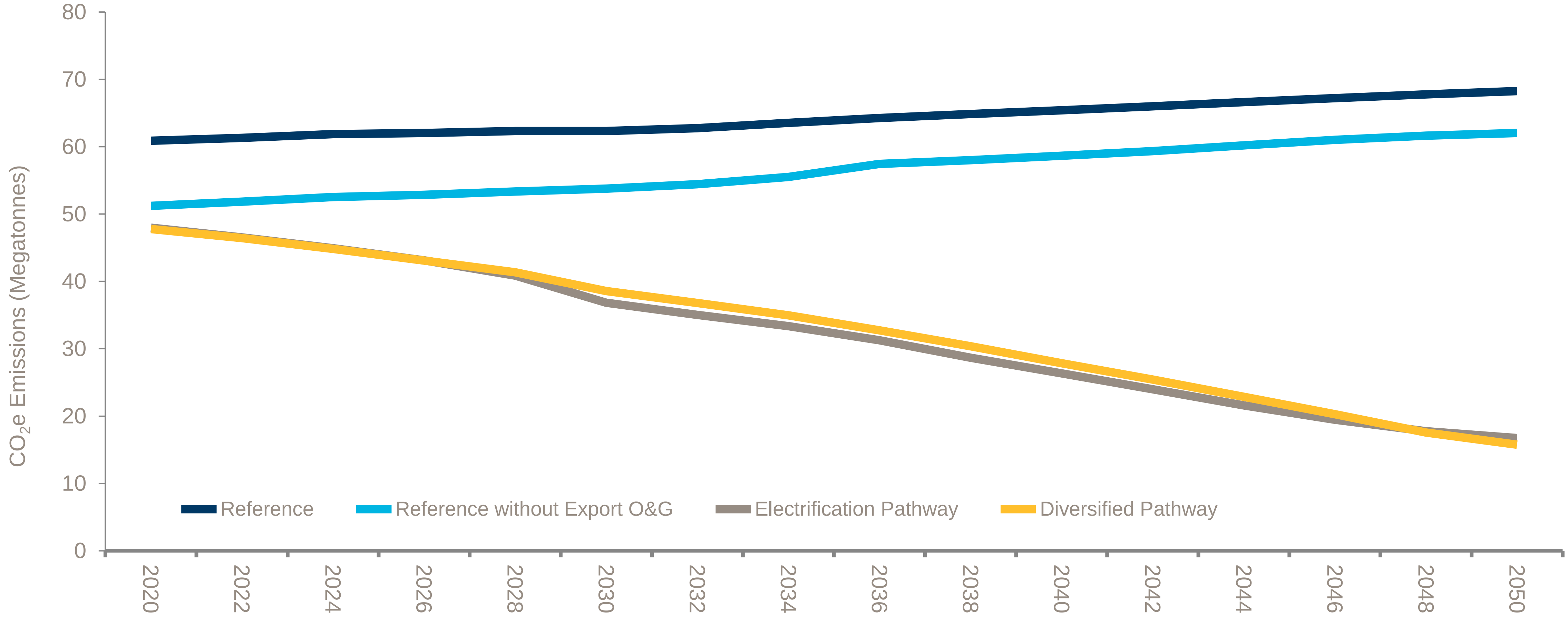
Energy efficiency
- Gas heat pumps key

Fuel switching
- NG to renewable gas
- Small percentage NG to electric

Transportation
- Significant role for NG in MD & HD vehicles

Energy supply
- 14% renewable gas
- 37% electricity

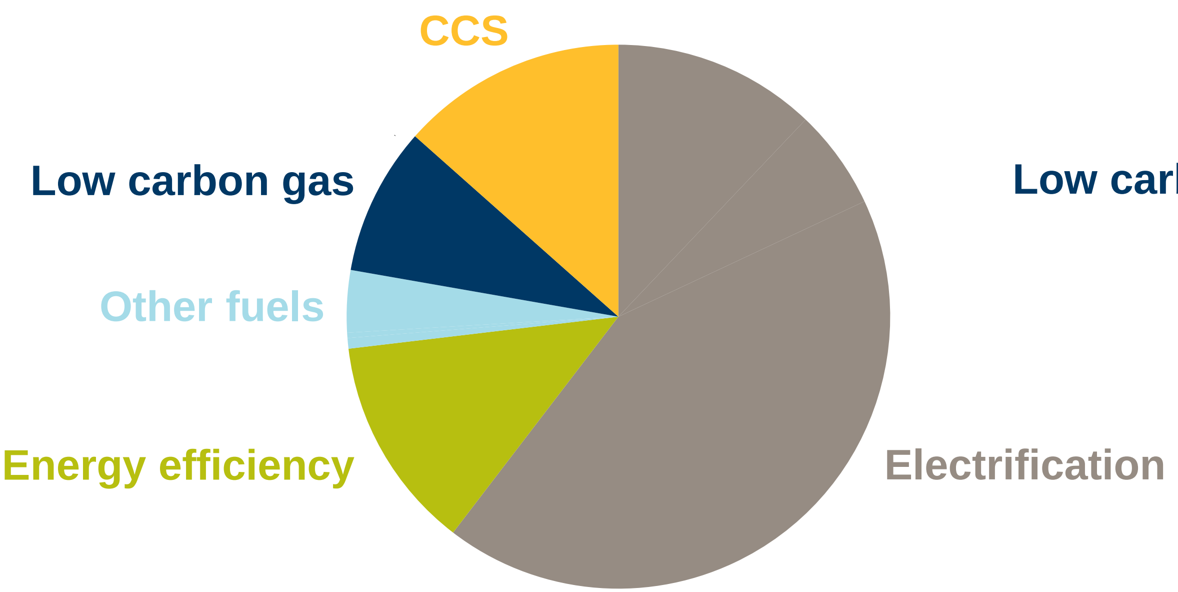
Both Pathways Achieve The Same Level Of GHG Reductions



Oil and Gas sector emissions attributable to exports are excluded from both the Reference Case emissions and Pathway emissions

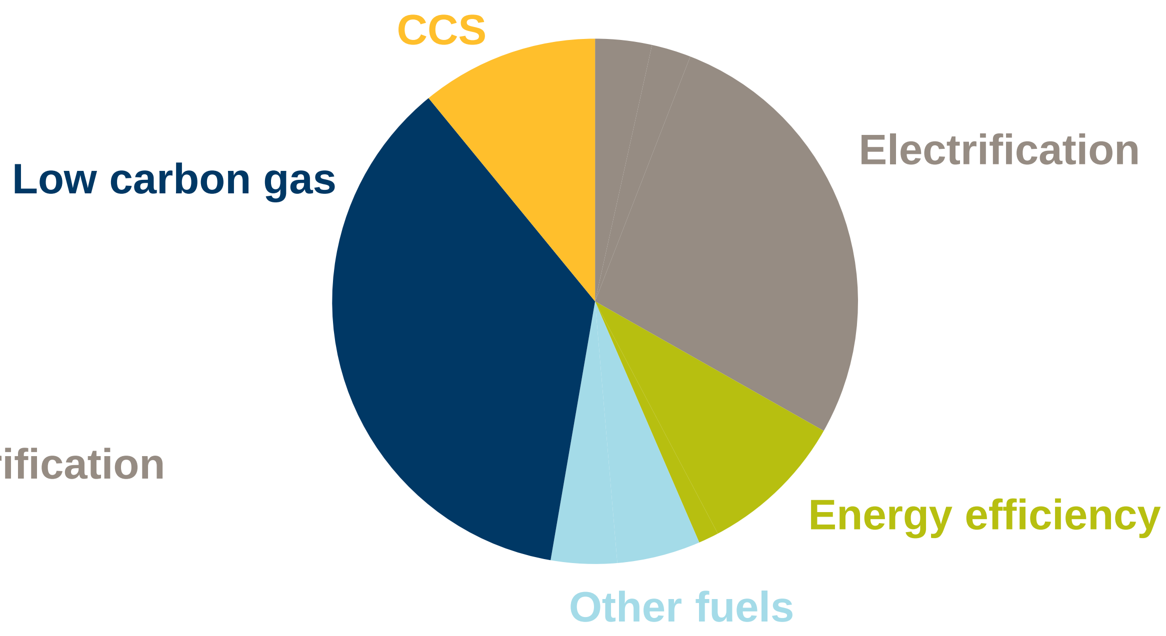
A Diversified Pathway Is A More Resilient Approach

Electric Pathway - 2050



Two-thirds of GHG reductions in the Electrification Pathway requires direct electrification.

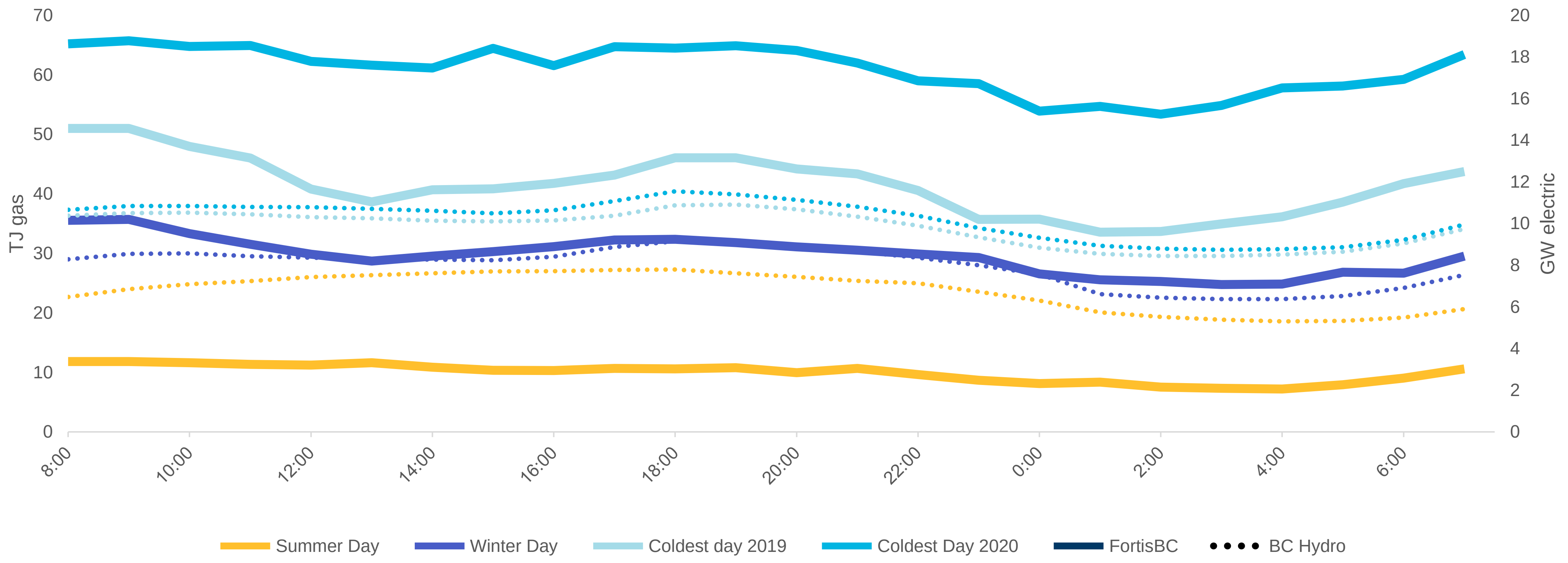
Diversified Pathway - 2050



The Diversified Pathway spreads reduction across more options.

Key Challenge: Peak Heat Demand

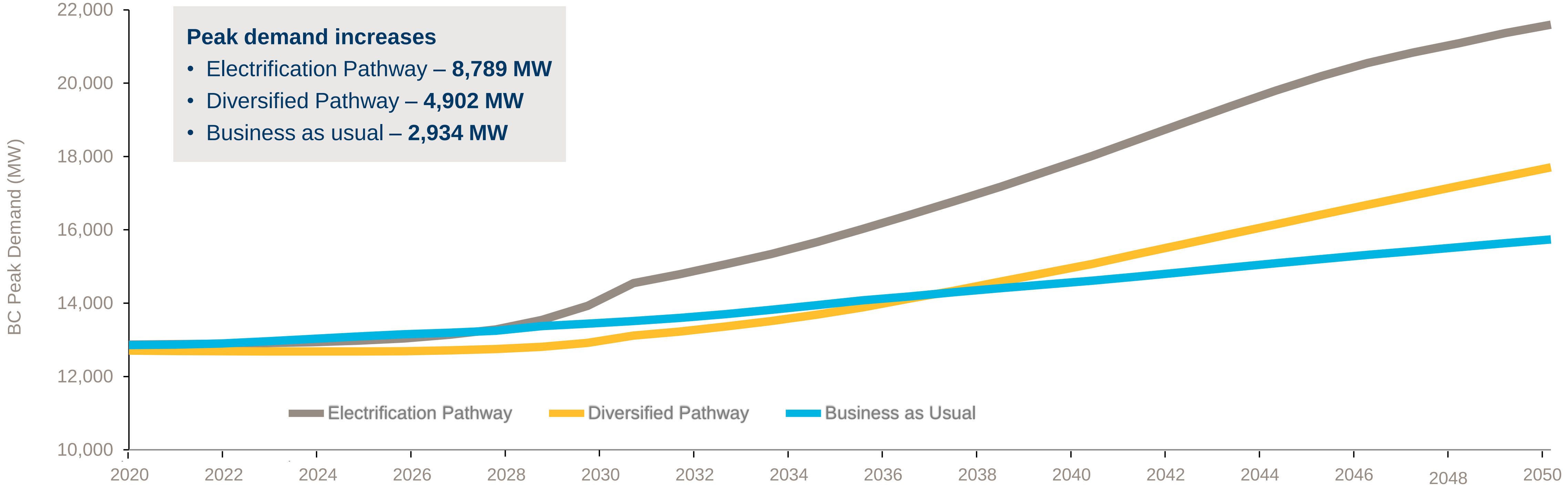
On a very cold day, the energy demand on the natural gas system is **60%** higher than the electric system.



Energy at work FORTIS BC

Key Challenge: Expanding Clean Peak Capacity

Due to the addition of electric vehicles and electric heating, peak demand is expected to increase by approximately **38%** (Diversified Pathway) and **68%** (Electrification Pathway).



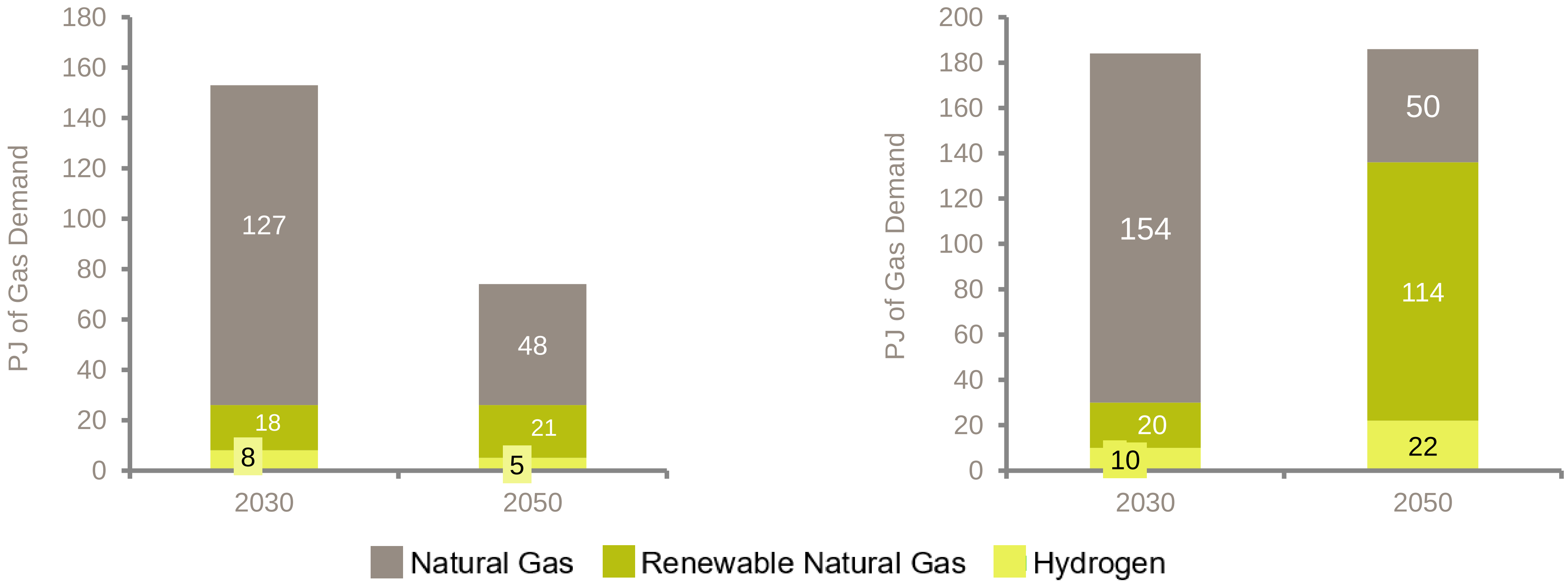
*Peak demand impacts are based on conservative assumptions in both pathways (e.g. majority of MHD vehicle charging occurs in non-peak times)

Key Challenge: Expanding Renewable Gas Supply

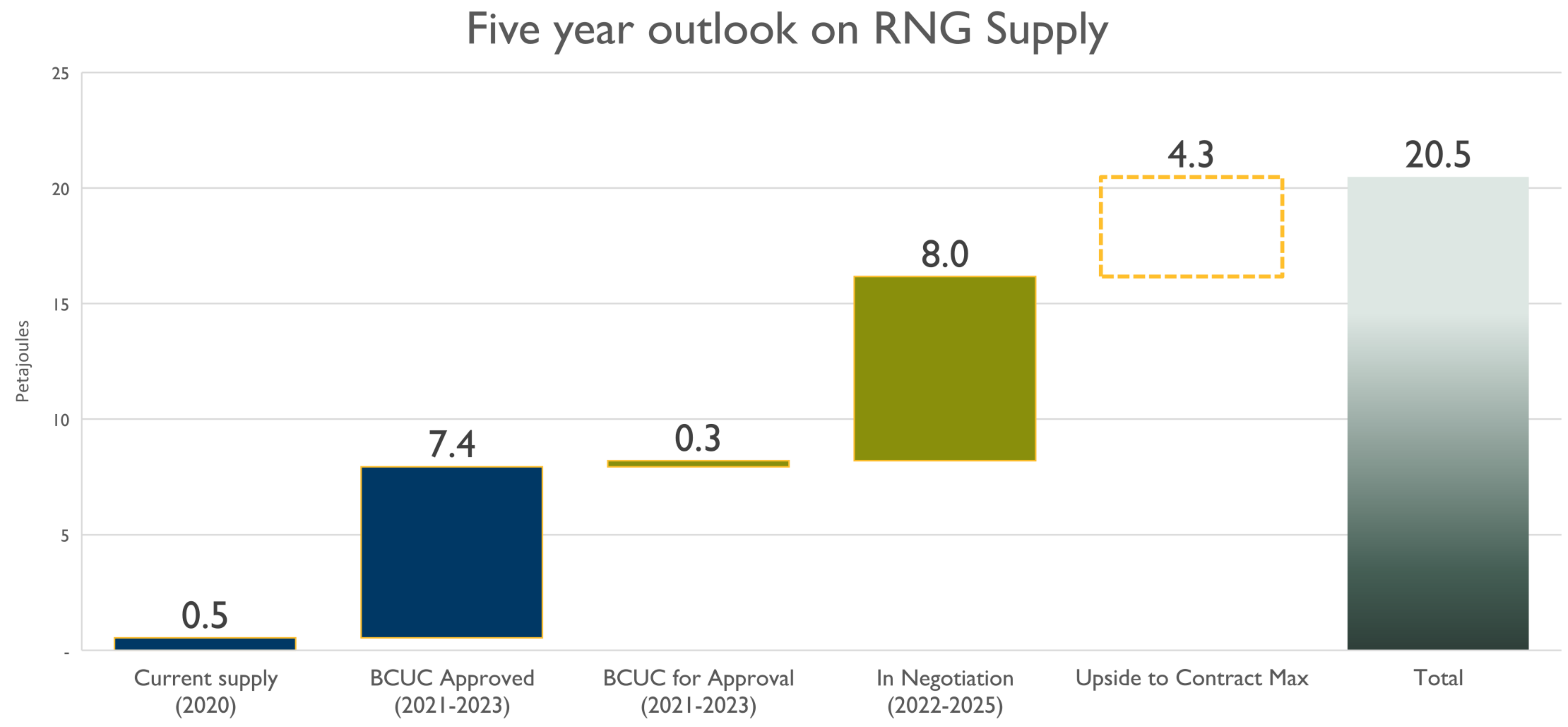
Large potential for renewable gas over the coming decades. Partnerships between governments, industry, Indigenous communities and stakeholders will be key.

Electric Pathway – gas demand

Diversified Pathway – gas demand



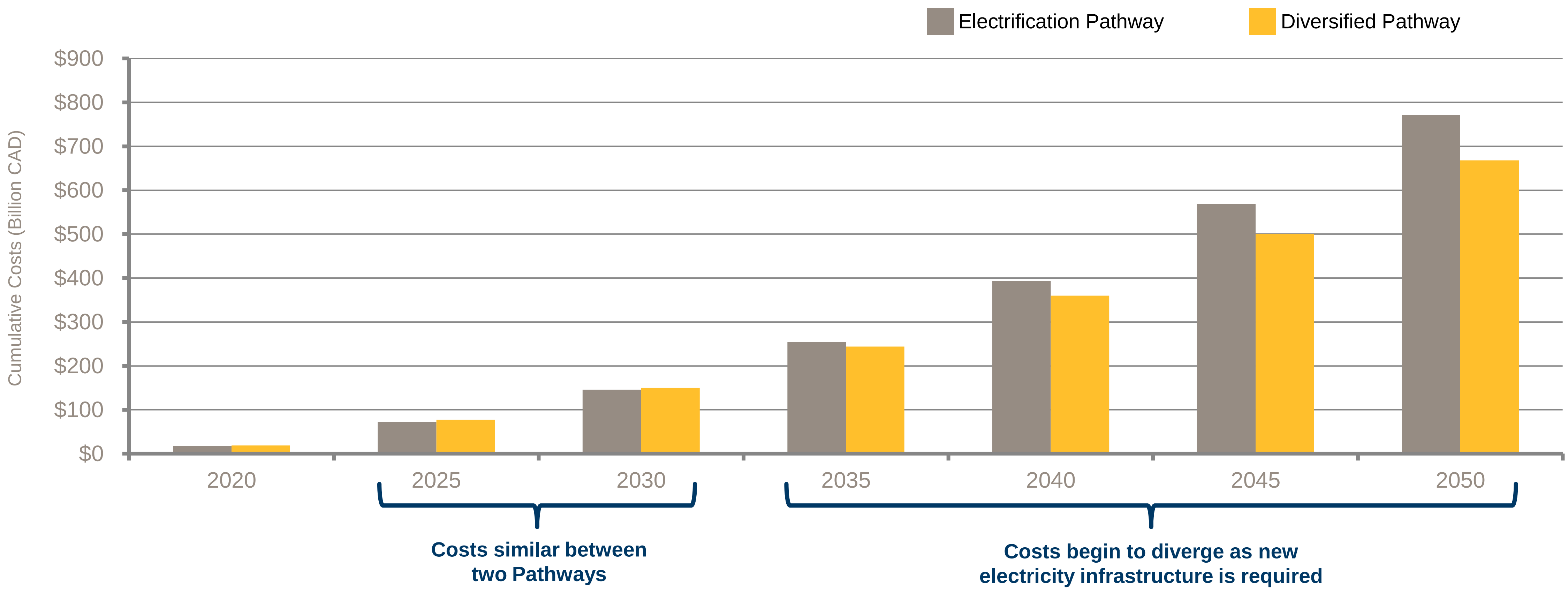
Renewable Gas Short-term Supply Outlook



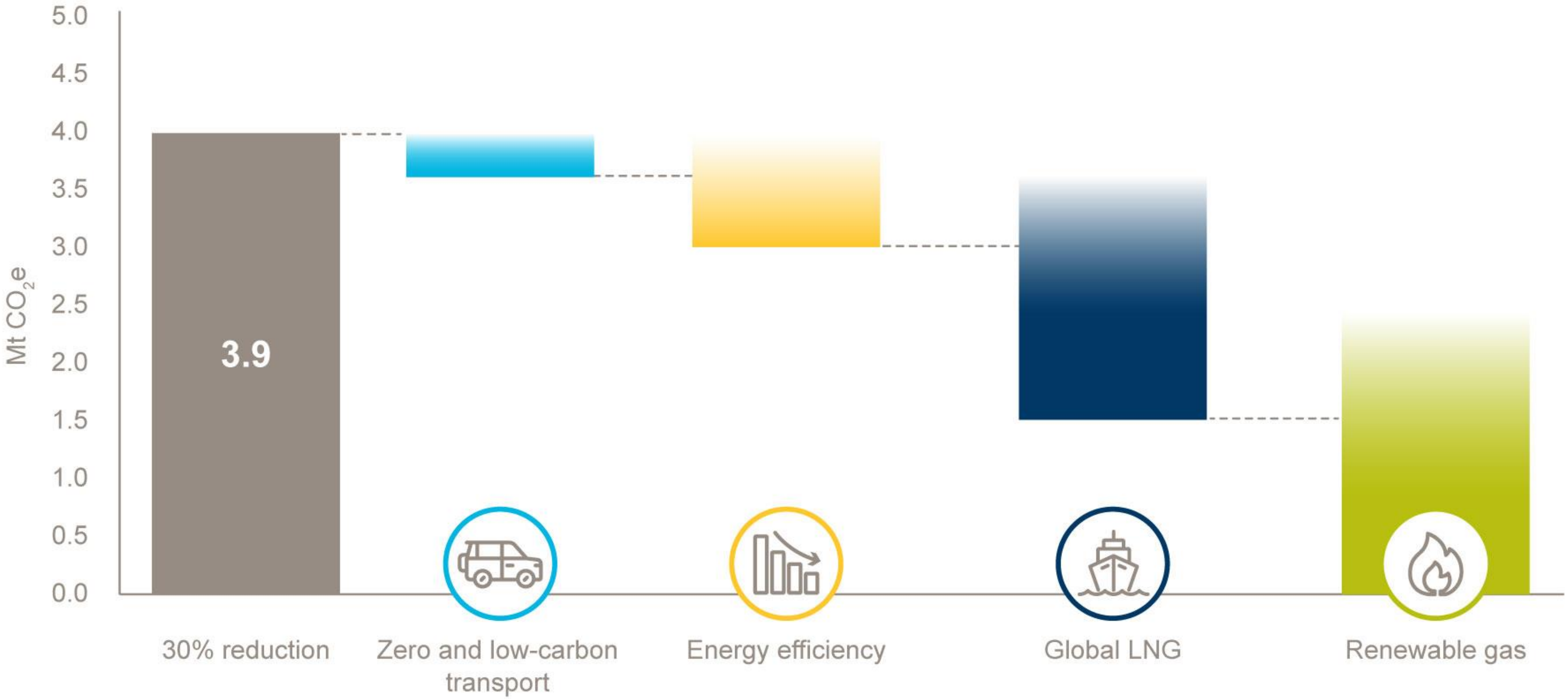
Energy at work FORTIS BC™

Adding Up All The Costs

By 2050, the cost to achieve the Electrification Pathway is expected to be at least **$100B** higher than the Diversified Pathway.

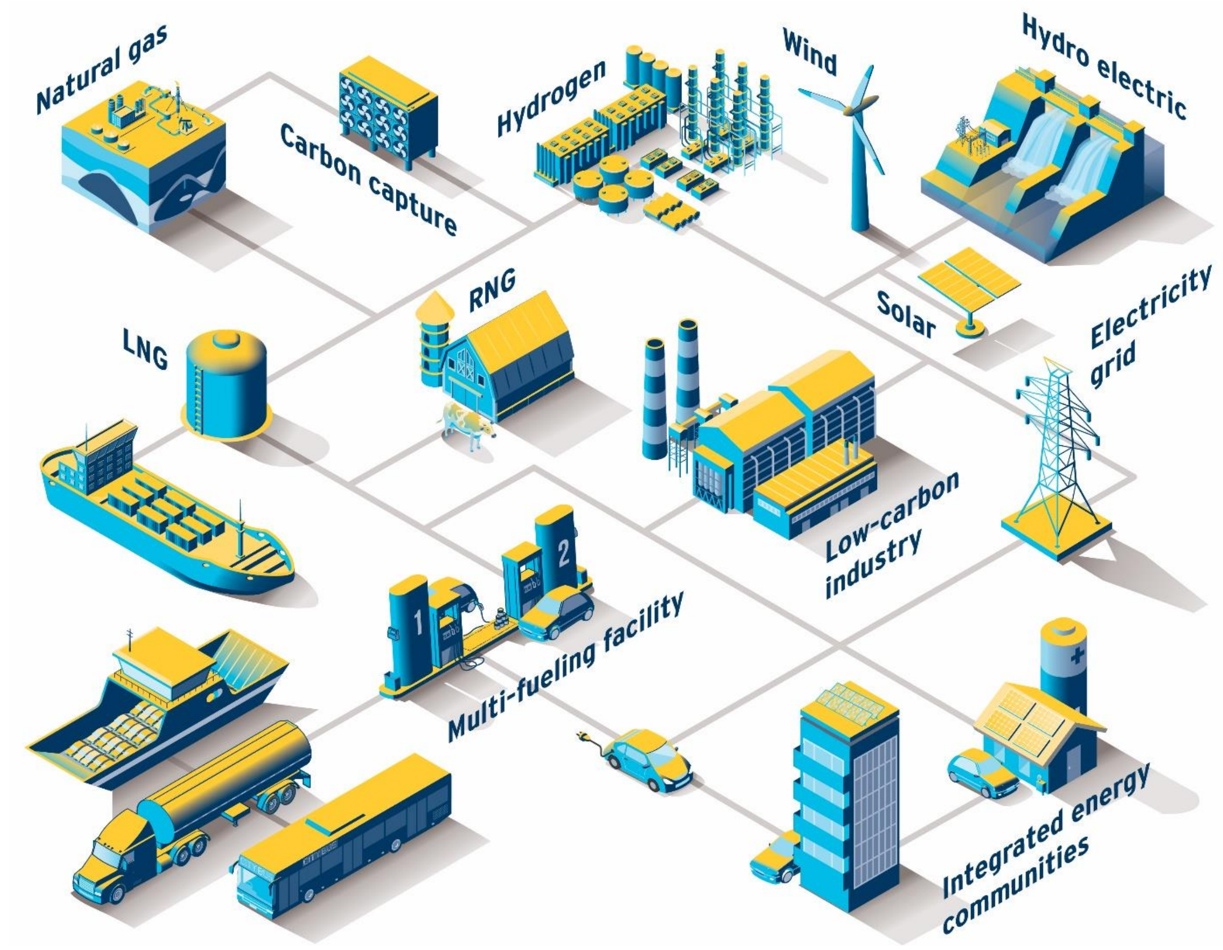


How We'll Measure Our Progress



Our Diversified Approach To Climate Action

- Achieves the Province's **80%** reduction target
- Reduces decarbonization costs by **$100B**
- Considers peak day demand and related infrastructure
- Provides important resiliency and reliability
- It's not either/or, **it's both/and**



Questions for Clarification

Agenda

1. Welcome, Introductions & Session Overview **(15 min)**
2. Opening Remarks **(10 min)**
3. Background on Long Term Resource Planning & Demand Side Management Planning **(10 min)**
4. Pathways for British Columbia to Achieve its GHG Reduction Goals & Question Period **(45 min)**
5. **Break (10 min)**
6. Breakout Group Discussions & Report Back **(1 hour)**
7. Implications for FortisBC's Long Term Resource Plans **(25 min)**
8. Wrap-up, Evaluation Forms & Next Steps **(5 min)**

Break

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Breakout Group Discussions

1. What are your key takeaways from the Energy Pathways Report presentation?

2. What key considerations do you recommend FortisBC explore in planning for a diversified pathway?

Breakout Group Highlights

- What are some of the key highlights from your discussion group?
  - Key takeaways from the Energy Pathways Report presentation
  - Key considerations for FortisBC to explore in planning for a diversified pathway

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Implications for FortisBC's Long Term Resource Plans

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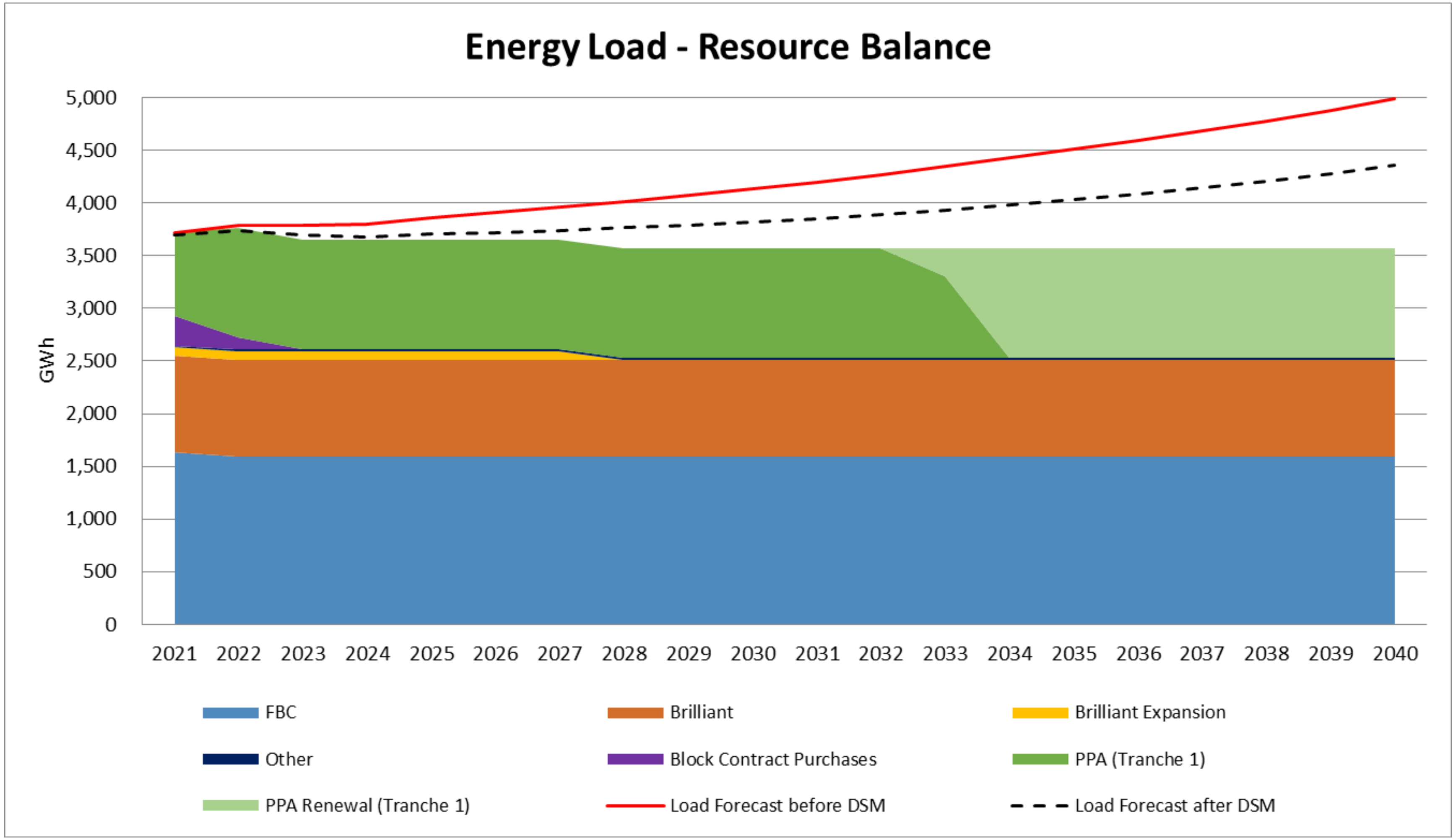
2021 Long Term Electric Resource Plan (LTERP)

LTERP Assumptions

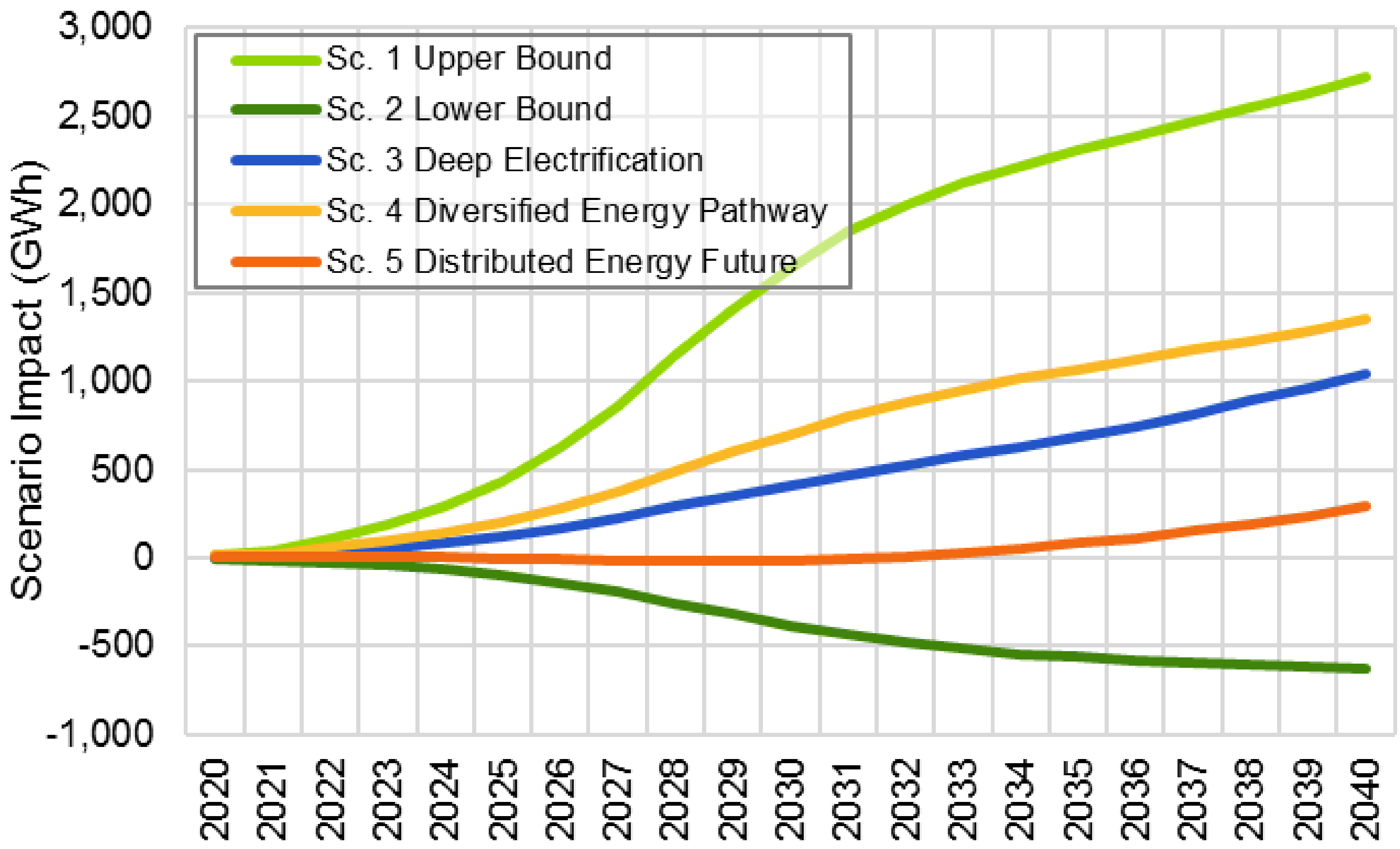
- Light-duty EV charging and renewable gas project included in Reference load forecast
- Medium and heavy-duty EV charging, hydrogen production and carbon capture and storage included in load scenarios
- Conservation Potential Review Update will inform Demand Side Management (DSM) levels
- Global LNG not applicable to LTERP

Reference Load-Resource Balance

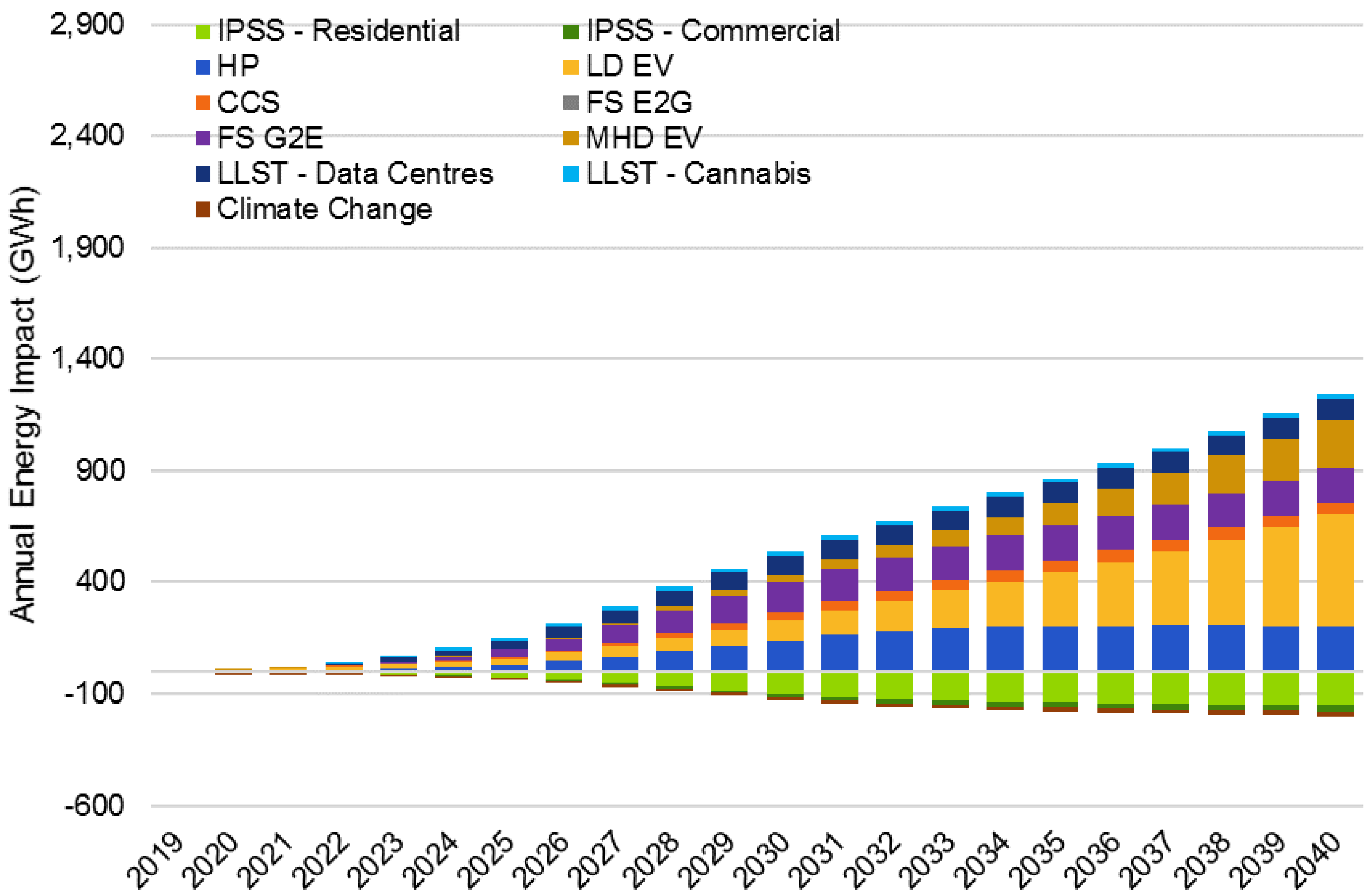


Note: DSM still to be determined

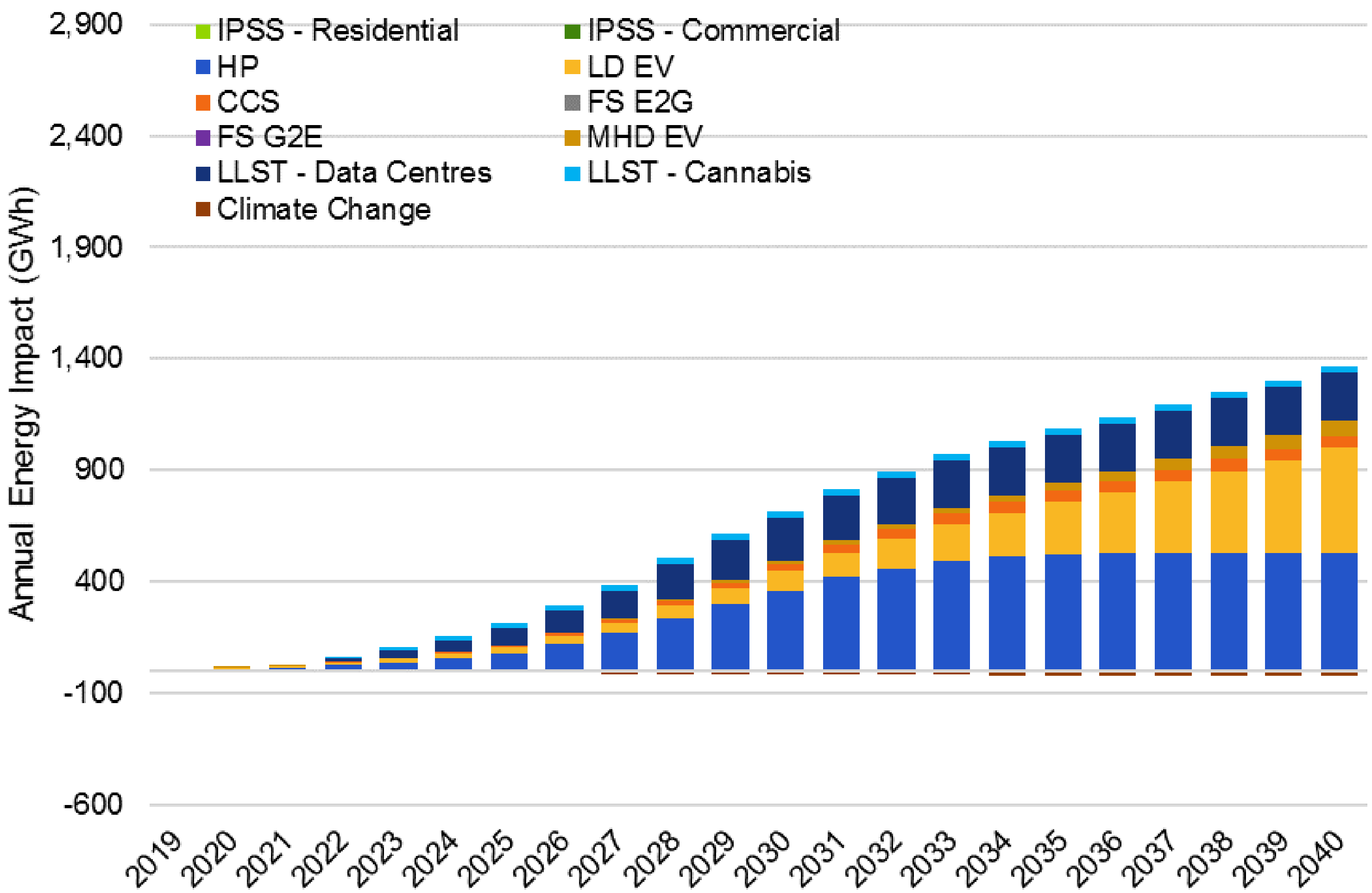
Load Scenarios



Deep Electrification Scenario



Diversified Energy Scenario



2022 Long Term Gas Resource Plan (LTGRP)

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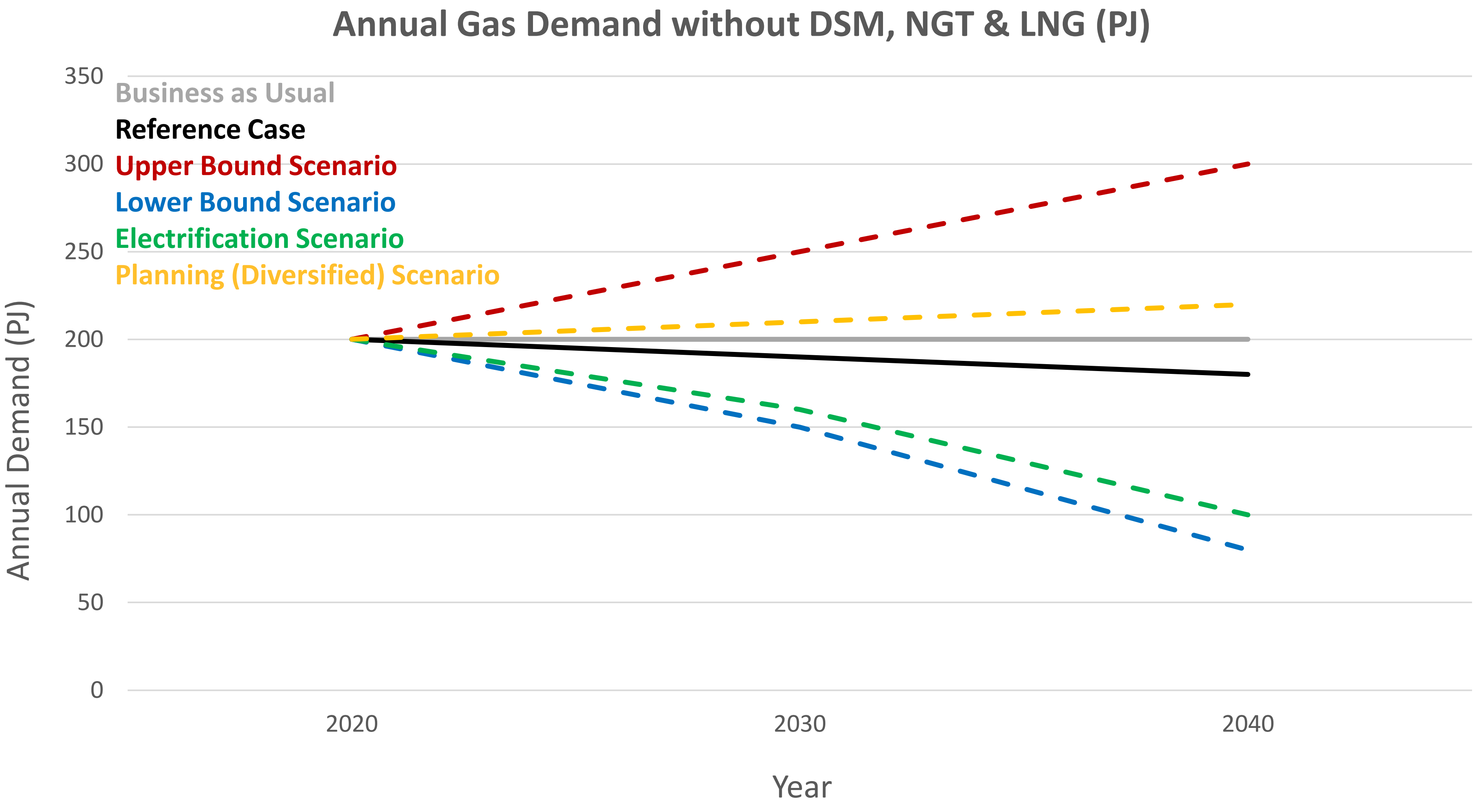
LTGRP Considerations

Illustrative Demand Forecast Scenarios

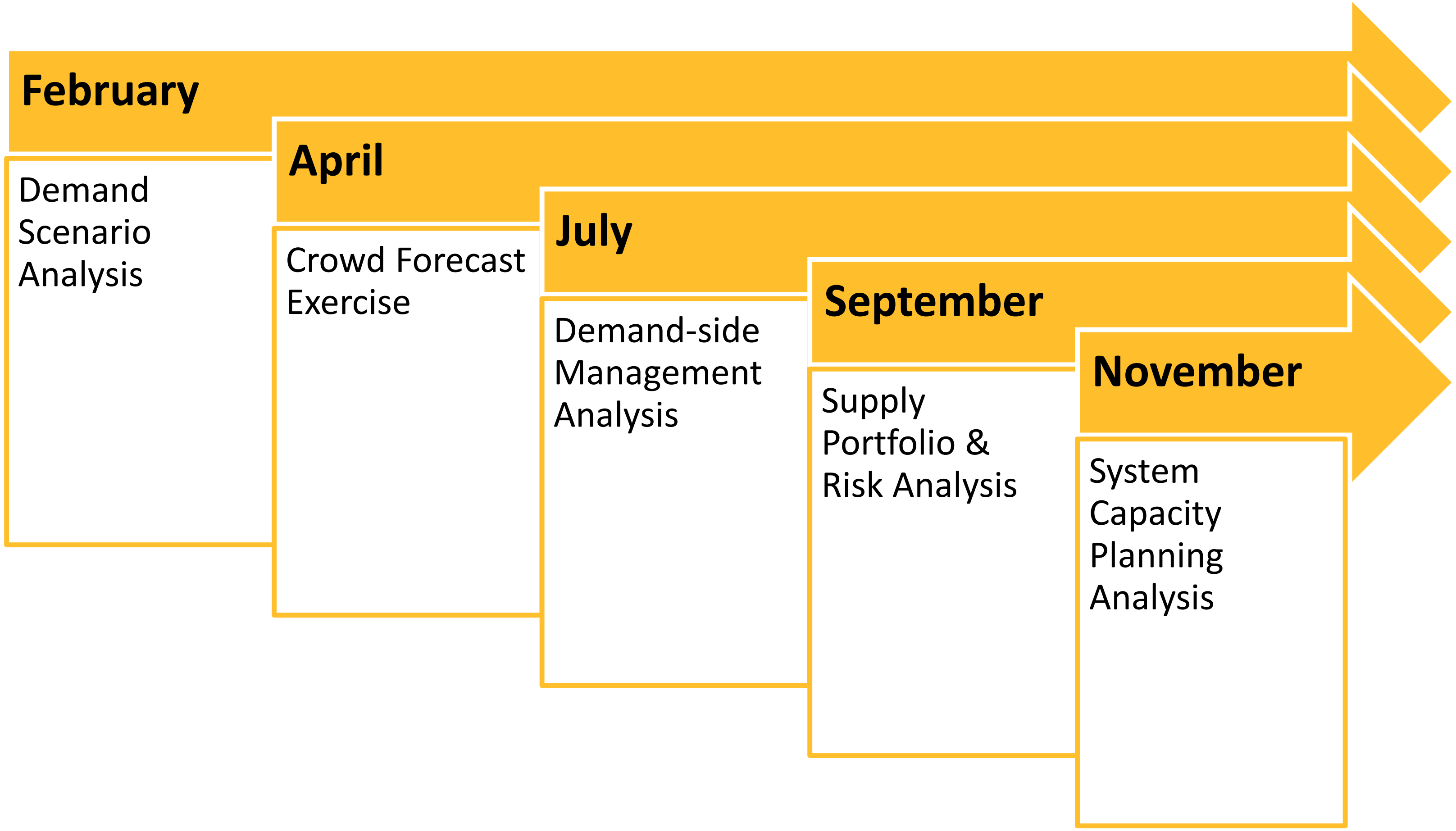


Demand Scenario Drivers

Used to model alternate scenarios

- Natural Gas for Transportation (NGT) Demand
- Fuel Switching
- Carbon Price
- New Construction Codes
- Retrofit Codes
- Appliance Standards
- RNG Production
- RNG Cost
- Hydrogen Production
- Hydrogen Cost
- Carbon Capture & Storage (CCS) Production
- Carbon Capture & Storage (CCS) Cost
- Economic (Customer) Growth
- Liquefied Natural Gas (LNG) Exports
- Natural Gas Price

LTGRP RPAG Engagement



Questions for Clarification

Energy at work FORTIS BC™

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Wrap-up, Evaluation Forms & Next Steps

Wrap-up & Next Steps

- Thank you for attending today's session, FortisBC appreciates your interest and willingness to engage
  - FortisBC will advise when the presentation and meeting notes will be posted online
- In addition, FortisBC will reach out and coordinate on-going engagement activities with each specific advisory group
- Finally, your feedback and input is important to FortisBC, please don't hesitate to send your ideas, comments or questions to **irp@fortisbc.com**

Thank you

For further information, please contact:

FortisBC Integrated Resource Planning

irp@fortisbc.com

Find FortisBC at:

fortisbc.com

talkingenergy.ca

604-576-7000

Follow us **@fortisbc**

2022 LONG TERM GAS RESOURCE PLAN (LTGRP) DEMAND FORECAST & RENEWABLE SUPPLY SCENARIOS

June 17, 2021

Energy at work FORTIS BC™

PUBLIC VERSION

Welcome, Introductions & Session Overview

Meeting Objectives

- Inform you about the status of the 2022 LTGRP
- Present and solicit feedback on the demand forecast and renewable supply analysis conducted to date, including:
  - Forecasting methodology
  - Critical uncertainties and renewable supply alternatives used to generate scenarios
  - Draft scenario results
- Provide information to participate in a crowd forecasting activity to generate your own future scenario

Agenda

Welcome, Introductions & Session Overview
(10 min.)

LTGRP Update & Business As Usual Demand Forecast
(10 min.)

FortisBC Outlook & Considerations for Renewable Gas Supply
(20 min.)

Critical Uncertainties & Renewable Supply Alternatives Modelling
(40 min.)

Break
(10 min.)

Reference Case Demand Forecast & Alternate Scenarios
(65 min.)

Crowd Forecasting Activity Using the Slider Tool
(20 min.)

Wrap-up & Next Steps
(5 min.)

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Housekeeping

Please put yourself on **mute** when you're not speaking to reduce background noise.

Please use the **chat** to provide any general feedback or comments as we go through the session.

We ask that you enter your questions in the **Q&A** or wait until the allocated discussion sections to put your **hand up** to ask your question.

The session audio/video will not be recorded; however, the chat history will be saved solely for note-taking purposes. Session notes will be shared with everyone and posted online.

Reminder that the pre-read document provides additional detail on the information summarized during this session.

Ken Ross
Manager, Resource Planning & DSM Reporting

David Bailey
Manager, Customer Energy & Forecasting

Joe Mazza
Vice President, Supply & Resource Development

Anda Telman
Manager, Resource Planning

FortisBC Speakers

Christine Gustafson
Principal, Harbourgreene Consulting

LTGRP Stakeholder Engagement Facilitator

Chris Pulfer
Principal, Posterity Group

LTGRP Project Director

Dave Shipley
Senior Consultant, Posterity Group

LTGRP Technical Director

Erika Aruja
Consultant, Posterity Group

LTGRP Project Manager

Guest Speakers

Resource Planning Advisory Group (RPAG) Members Registered for this Session

- Avista Utilities
- BC Business Council
- BC Ministry of Energy, Mines & Low Carbon Innovation
- BC Public Interest Advocacy Centre
- BC Sustainable Energy Association
- BC Utilities Commission
- BC Hydro
- Building Owners & Managers Association
- Canadian Biogas Association
- City of Abbotsford
- City of New Westminster
- City of Prince George
- Clean Energy Association of BC
- Commercial Energy Consumers Association of BC
- Community Energy Association
- District of Saanich
- Metro Vancouver
- Midgard Consulting
- MoveUP
- North West Natural
- Pembina Institute
- Roger Bryenton & Associates
- Union of BC Municipalities
- University of Victoria

Introducing Posterity Group

- Posterity Group (PG) is a consulting firm that provides analysis and advice to decision makers on energy efficiency and carbon abatement topics. PG works with utilities, governments and institutions across Canada.
- PG has worked with FEI on previous resource plans and preparing for resource plans between filings.
- PG constructs a model built to meet FEI's needs for the LTGRP to develop the reference case forecast, the scenarios, and peak load analysis.
- PG works closely with FEI to intake data, develop a modelling approach that is robust, and document the LTGRP modelling process.

Safety Reminders

- Ensure you're comfortable at your workstation
- If you need to, stand-up and stretch
- Take breaks as needed; we also have built a ~10-minute break into the agenda

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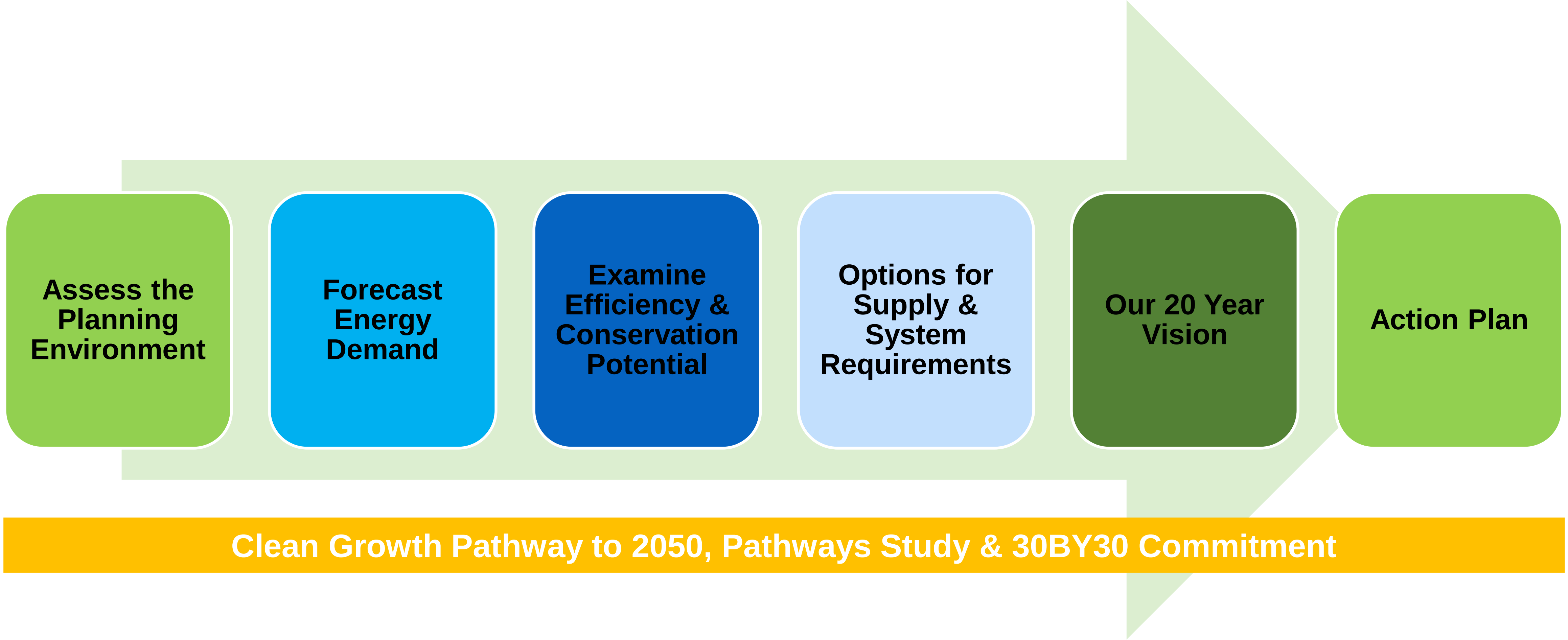
LTGRP Update & Business As Usual Demand Forecast

LTGRP Process Overview



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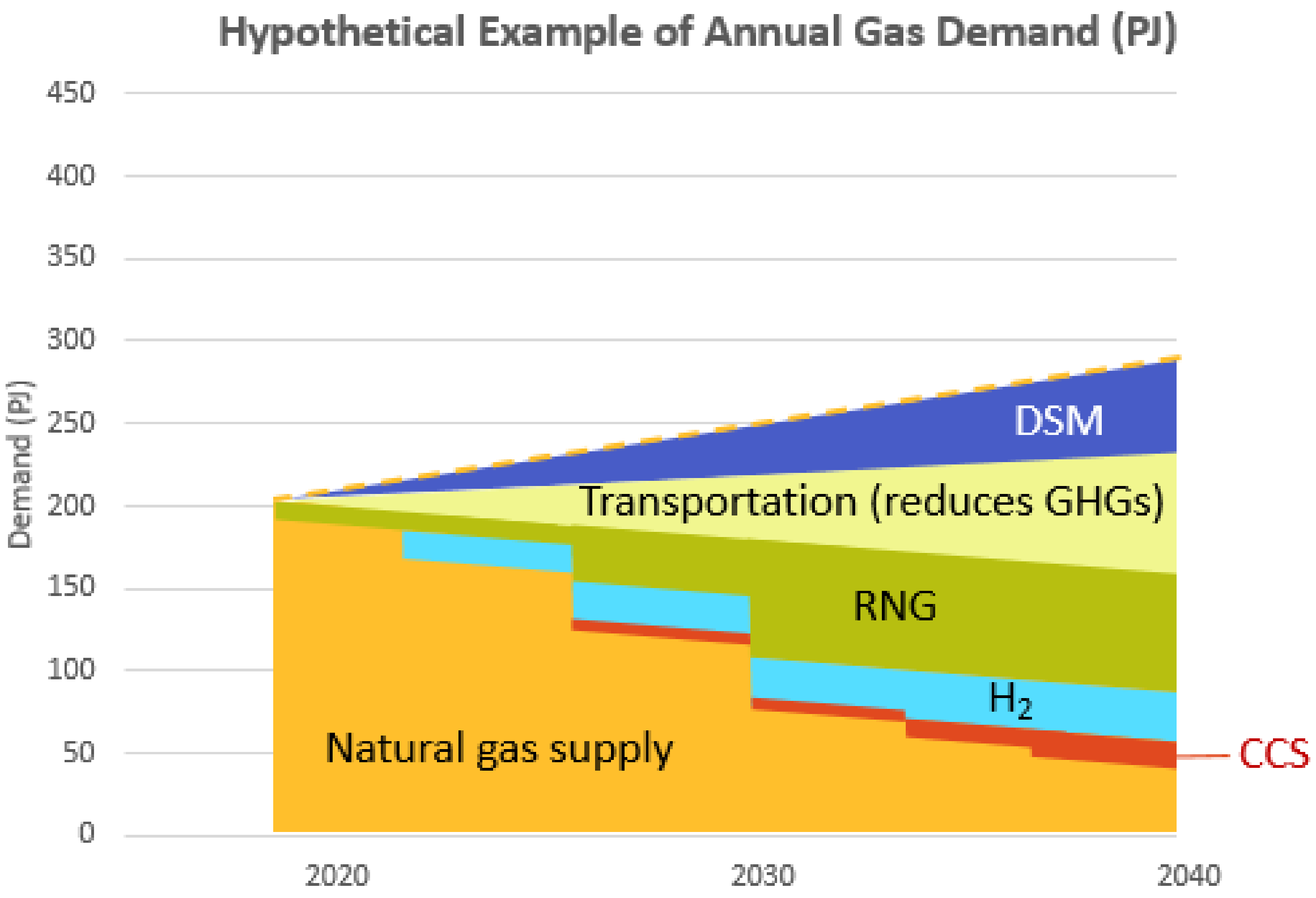
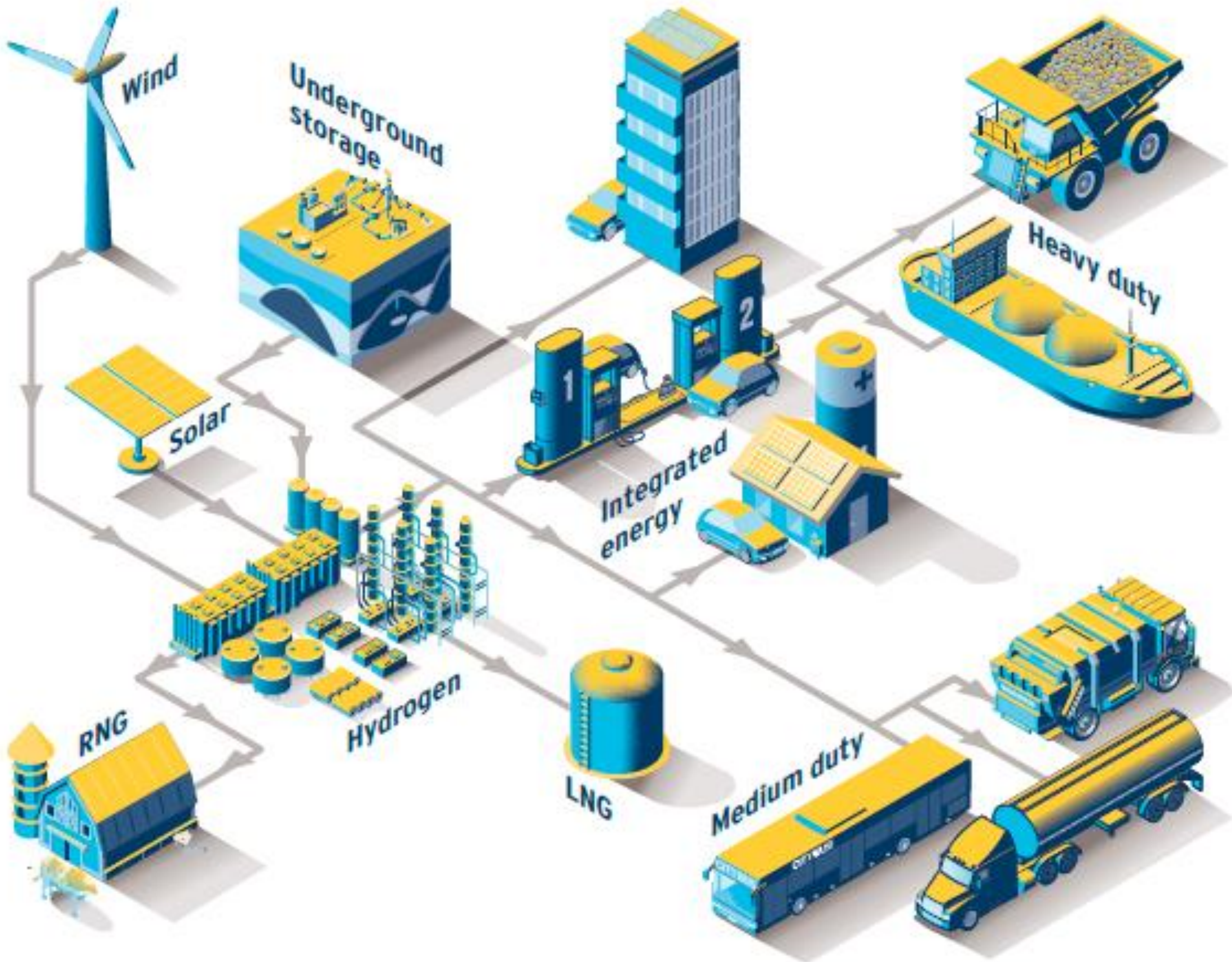
Demand Forecasting: Key Considerations

- Forecast timeline:
  - 2019 – Base Year Actuals
  - 2020-2042 – Forecast Horizon
- Added complexity as we consider demand forecast and how we will supply this demand while still reducing GHG emissions

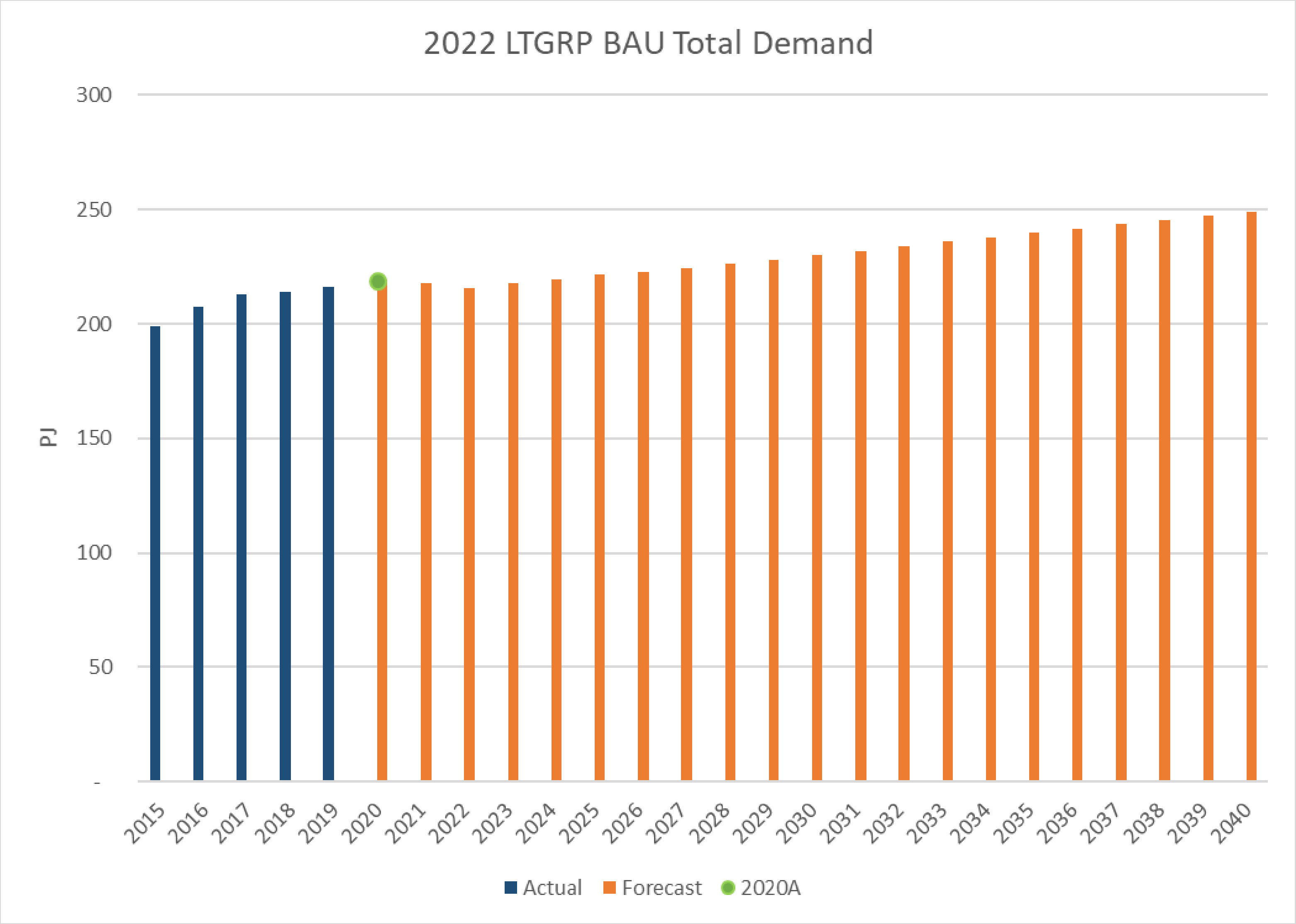


A Diversified Energy Future



Energy at work FORTIS BC

Business As Usual (BAU) Demand Forecast

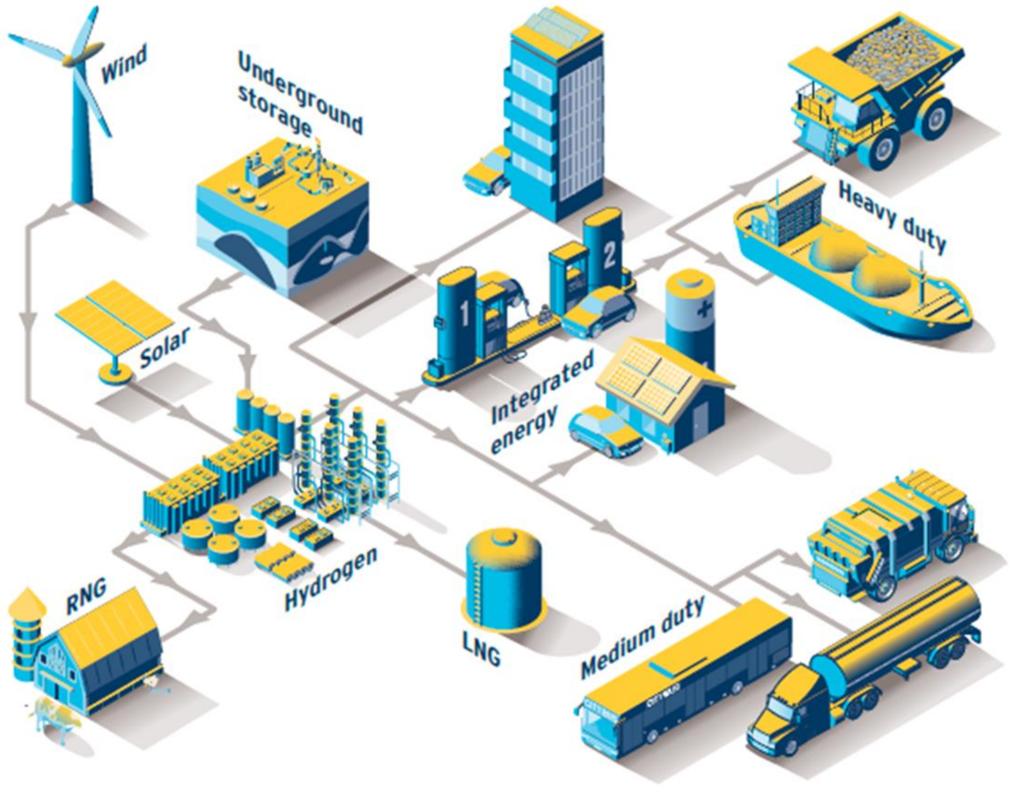


Questions & Discussion

FortisBC Outlook & Considerations for Renewable Gas Supply

Key Messages on Renewable Gas Supply

- Renewable gas is critical to de-carbonization
- There is a practical, logical and cost-effective pathway
- Innovation is underway
- Resiliency of energy networks is paramount
- FortisBC's renewable gas model to acquire supply from real projects is evolving
- Renewable natural gas (RNG) and hydrogen (H2) are leading technologies
- Maintenance and expansion of gas infrastructure will be required



FortisBC’s Renewable Supply Pathway

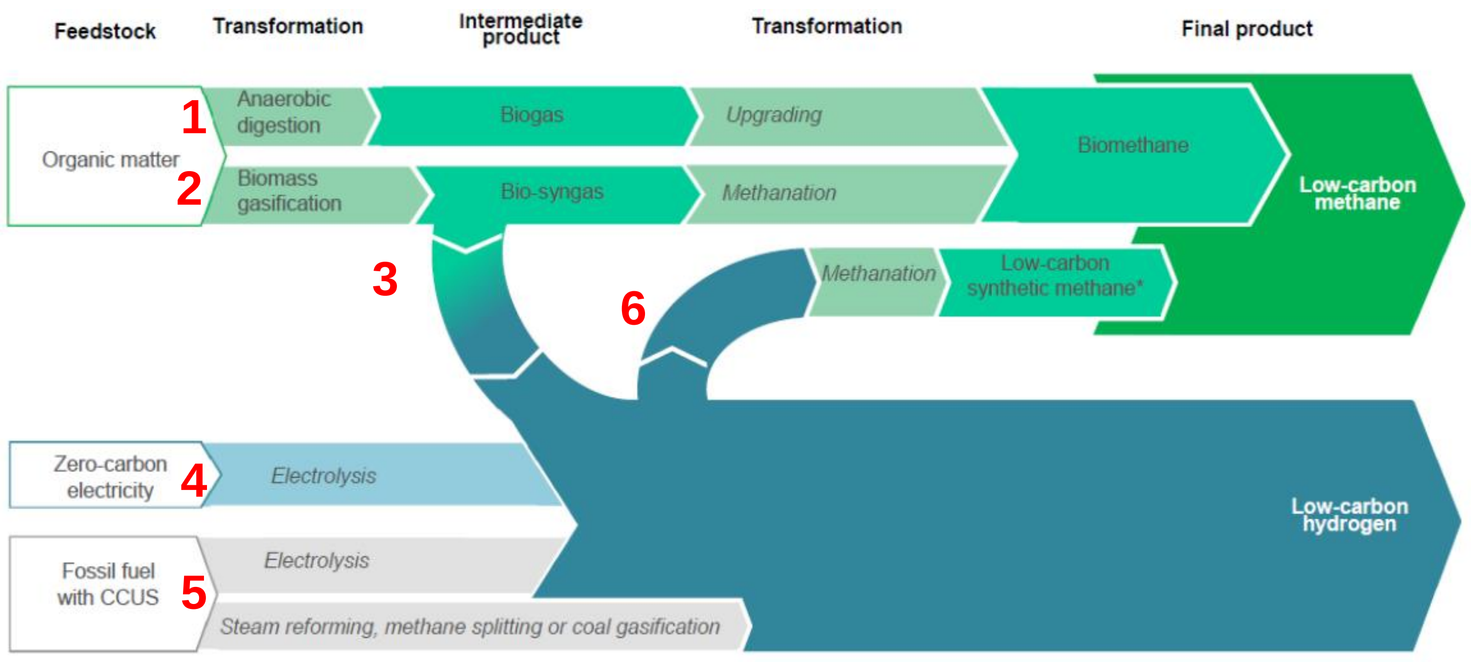
Energy Efficiency

Renewable Gas

Global LNG

Zero &
Low Carbon
Transportation

Renewable Gas Supply Pathways



1. **RNG Biomethane** upgraded biogas produced from farm or municipal organic biomass.
2. **RNG Biomethane** upgraded synthesis gas (syngas) produced from wood biomass at mills.
3. **Syngas** onsite fuel to displace mill natural gas can also be upgraded to green hydrogen.
4. **Green Hydrogen** produced via water electrolysis using renewable electricity feedstock.
5. **Blue Hydrogen** reformed from hydrocarbon feedstock with up to 90% carbon sequestered.
6. **Synthetic Methane** processed from green hydrogen (when opportune).

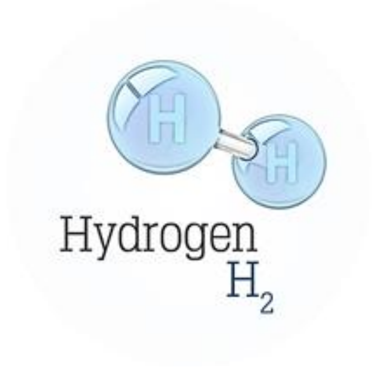
On-system Supply

- RNG and H2 can both be acquired on-system and physically moved to our customers for consumption
- Syngas and lignin can be developed and acquired within BC, but would not physically flow on the gas distribution network
- Over time, clean and renewable gas resources produced and transported in BC will grow

Increasing Renewable Gas supply and advancing hydrogen development

Off-system Resources

- Approval to purchase out-of-province RNG – continuing to seek more supply
- Same principals can be applied to carbon reducing energy projects elsewhere

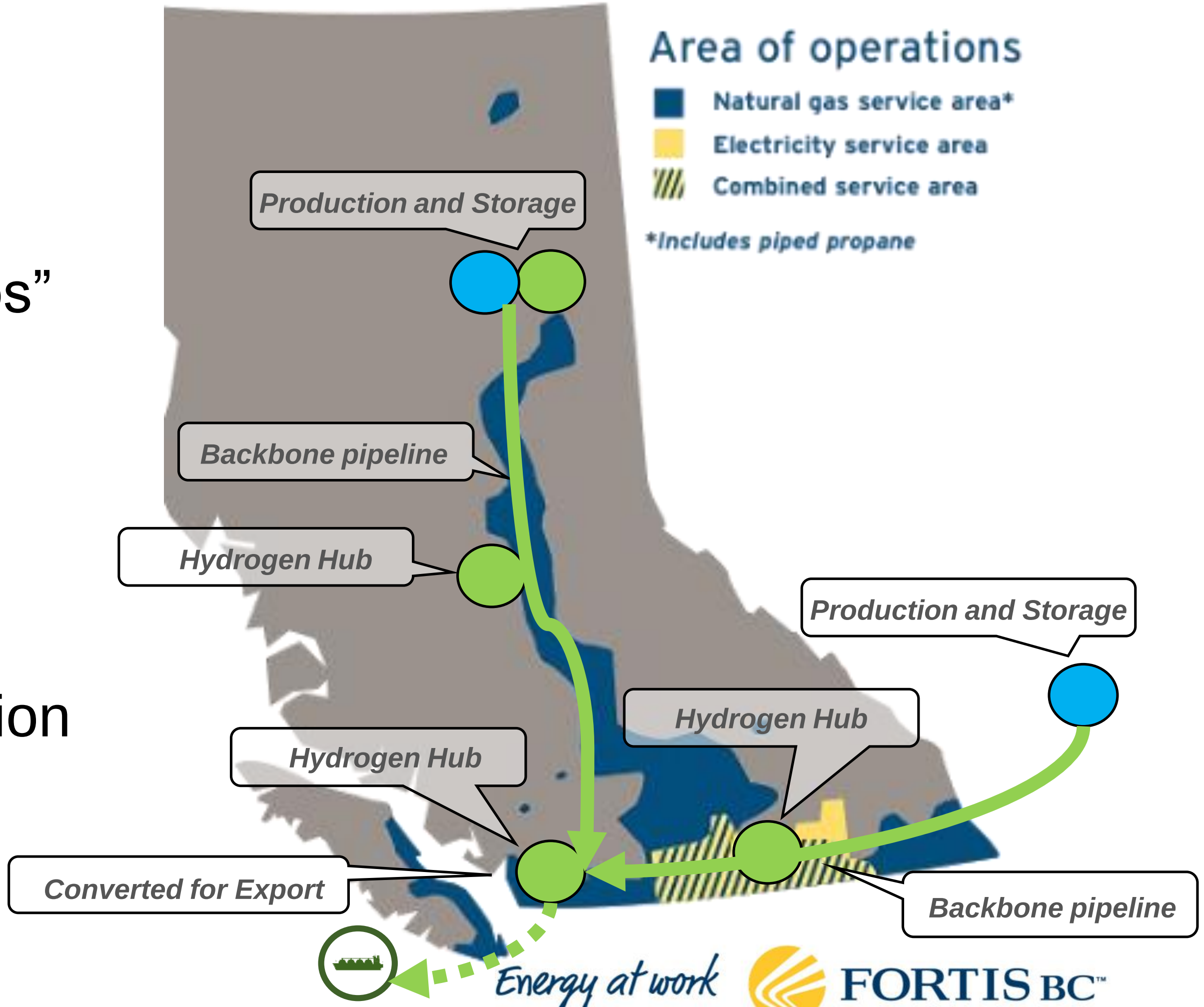


https://www.britannica.com/place/North-America#/media/1/418612/46537

What is Our Vision?

The role of hydrogen & gas infrastructure in a low-carbon BC economy

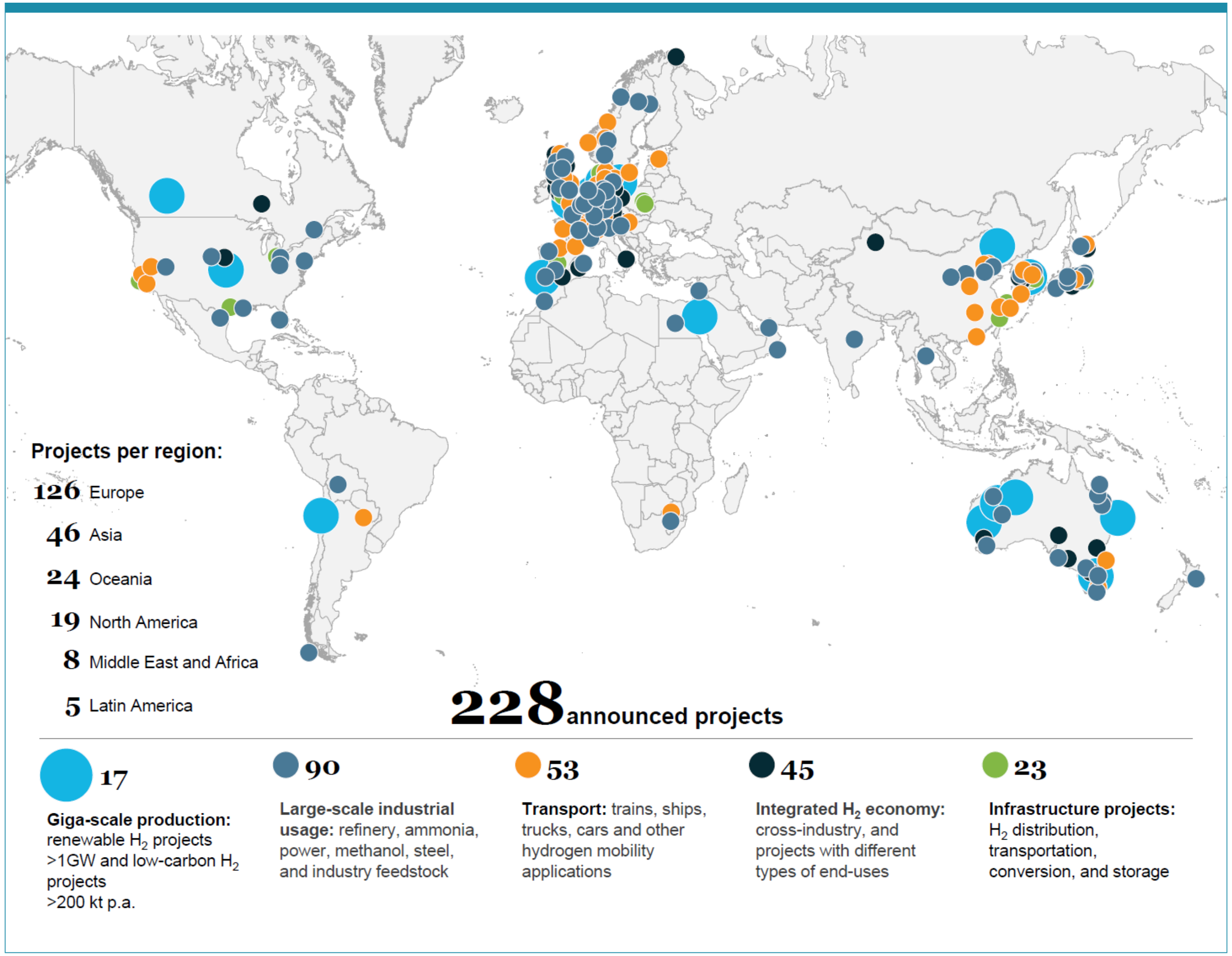
- Resource and technology agnostic
- Clean alternative to displace natural gas
- Supply/demand nodes or “Hydrogen Hubs”
- Low-carbon backbone system
- Connect producers and consumers
- Marine fueling and offshore demand
- Promote regional gas supply transformation



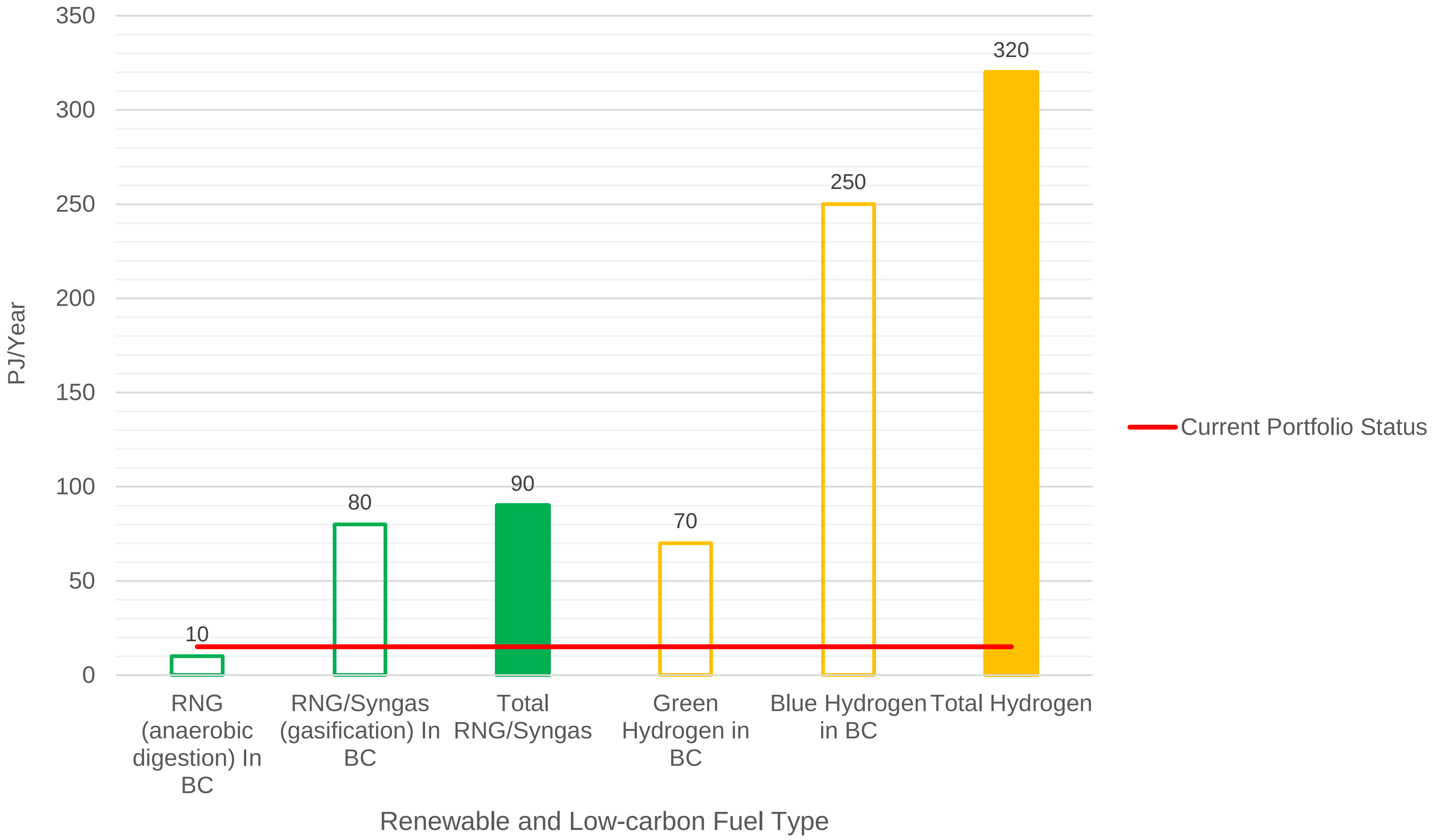
Hydrogen Opportunity

- Hydrogen is versatile and carbon free at point of use
- Multiple commercially available pathways:
  - Distributed in the gas grid at low concentrations
  - Distributed directly to customers that are hydrogen ready, initially large commercial, industrial, power producers
  - Distributed in transportation applications and combusted directly or converted to electricity using fuel cells
- Federal Hydrogen Strategy issued in December 2020
  - https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/environment/hydrogen/NRCan_Hydrogen-Strategy-Canada-na-en-v3.pdf
- BC Hydrogen Study in 2019
  - https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/ministries/zen-bcbn-hydrogen-study-final-v5_executivesummary.pdf
- New opportunities for FortisBC 2025+

Global Hydrogen Projects



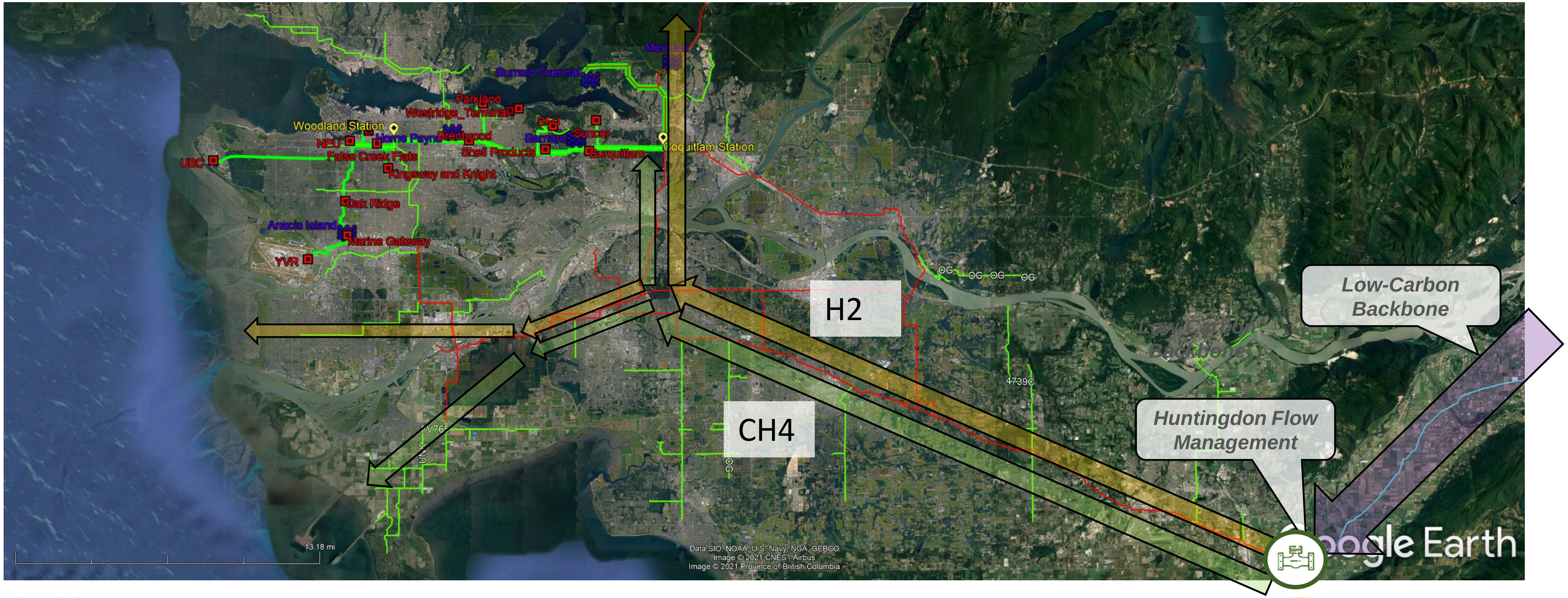
BC Renewable Natural Gas & Hydrogen Potential



1. Hallbar report: B.C. Hydro's forestry feedstock estimation; RNG production potential is estimated to be approx. 50 PJ/year. If Natural Resources Canada's forestry feedstock estimations are used, RNG production potential is estimated to be approx. 90 PJ/year. 2 RNG (anaerobic digestion) In BC max supply potential no tech advancement Hallbar Consulting Report, 3. Syngas (wood) max supply potential with technology advancement Hallbar report, 4. Hydrogen supply potential from BC Hydrogen Study

World Class Opportunity for a BC Hydrogen Hub

- Low-carbon gas would be supplied from the Low-carbon Backbone at Huntingdon-Sumas
- Large volumes would be available to meet export demand



Summary of Renewable Gas Key Messages

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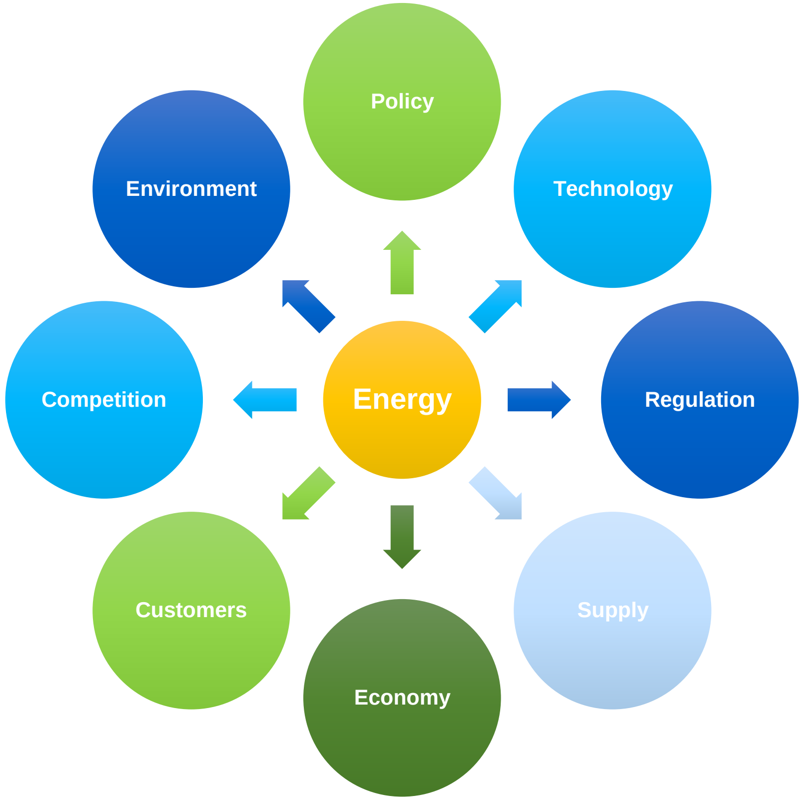
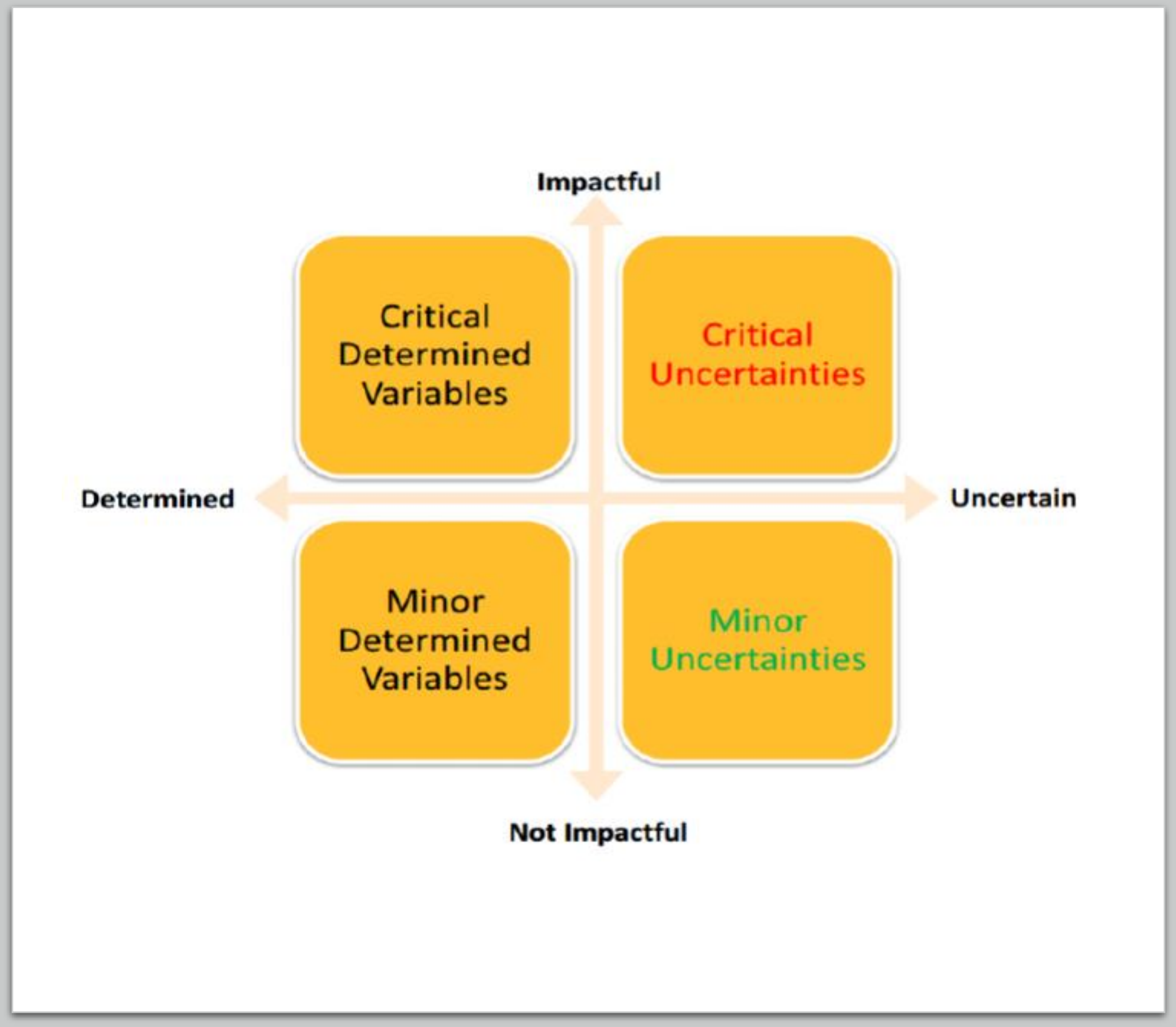
Questions & Discussion

29

Critical Uncertainties (CUs) & Renewable Supply Alternatives (RSAs) Modelling

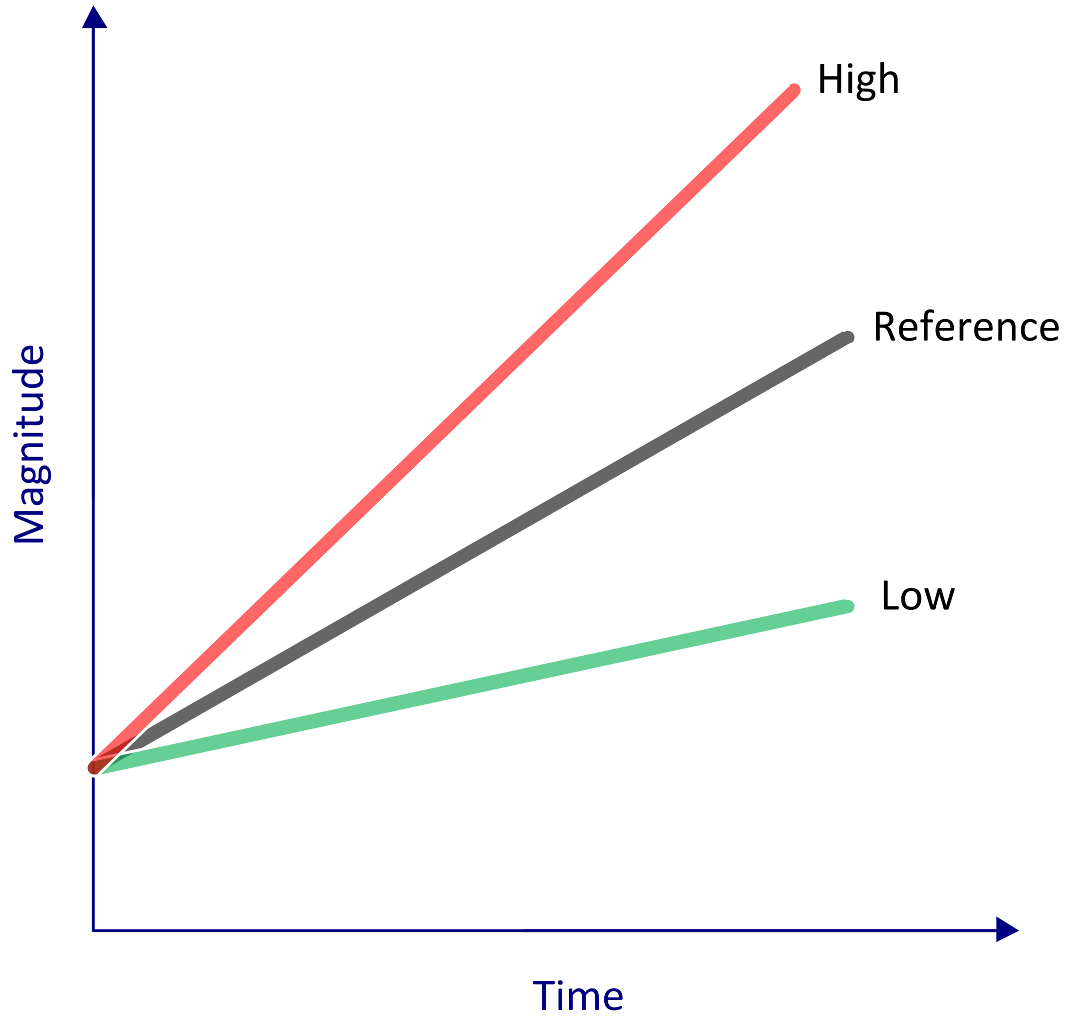
Identifying Critical Uncertainties (CUs) & Renewable Supply Alternatives (RSAs)





Settings for Critical Uncertainties (CUs) & Renewable Supply Alternatives (RSAs)

- Several trajectories, or **settings**, of future possible values are developed for each CU and RSA.
- The various settings capture the uncertainty about the future based on possible conditions.
- The **reference** settings generally reflects what is known and enforced in the market as of 2019. The **high** and **low** are meant to capture maximum and minimum boundaries.
- Scenarios are developed by combining different settings for all the CUs and RSAs.



2022 LTGRP Critical Uncertainties & Renewable Supply Alternatives

Demand Critical Uncertainties: variables that impact the annual load that FEI needs to meet.

Transportation & LNG Export Critical Uncertainties: demand for compressed natural gas (CNG) and liquefied natural gas (LNG) in the natural gas for transportation and power generation. Demand for these fuels impact FEI's system and GHG emissions as CNG and LNG displace fuels with higher carbon intensities.

Renewable Supply Alternatives: variables that impact the supply mix that FEI may use to meet demand while reducing GHG emissions relative to if the demand was met with conventionally sourced natural gas only.

Demand Critical Uncertainties (1/2)

Reference: Pre-read Document Pages 12-16

Critical Uncertainty	Description	Impact
Appliance Standards	Minimum energy performance standards for energy-using appliances.	More stringent standards, demand for natural gas decreases.
Retrofit Code	Estimated impact and timing of a retrofit code based on publicly available information.	Code increases in stringency, demand for natural gas decreases.
New Construction Code	BC Energy Step Code is the relevant building code for new construction. The energy-requirements are applied to relevant building types and end-uses.	Code increases in stringency, demand for natural gas decreases.
Customer Growth	Number of customer accounts by rate class is forecasted by FortisBC. Based on confidence intervals of historical data.	Number of customer accounts increases, demand increases (and vice versa).
Woodfibre LNG	FEI delivers natural gas to the Woodfibre LNG facility through our distribution system. Woodfibre LNG is responsible for securing the natural gas supply, completing the liquefaction, and delivering the LNG to end-use customers. FEI treats this load as a flow-through.	Including Woodfibre LNG increases demand; no impact on GHG emissions.

Demand Critical Uncertainties (2/2)

Reference: Pre-read Document Pages 12-16

Critical Uncertainty	Description	Impact
Carbon Price	BC provincial carbon tax applied to natural gas.	Carbon price increases, demand for natural gas decreases (and vice versa).
Natural Gas Price	Commodity price for traditional natural gas.	Gas price increases, demand for natural gas decreases (and vice versa).
Non-price Driven Fuel Switching	Fuel switching caused by signals other than prices, such as incentives and policies to encourage customers to switch from natural gas to electricity.	As the target for fuel switching increases, demand for natural gas decreases.

Transportation & LNG Export Critical Uncertainties

Reference: Pre-read Document Pages 17-20

Critical Uncertainty	Description	Impact
Natural Gas for Transportation (NGT) Demand	Forecasted demand for compressed natural gas (CNG) and liquefied natural gas (LNG) by the transportation sector.	Increase demand for CNG and LNG increases load while providing GHG mitigation opportunities as CNG replaces diesel and LNG replaces marine bunker fuel.
Liquefied Natural Gas (LNG) Export Demand	Forecasted demand for liquefied natural gas (LNG) exports.	Increase demand for LNG Exports increases load while providing GHG mitigation opportunity when LNG replaces coal.

Renewable Supply Alternatives (1/2)

Reference: Pre-read Document Pages 20-24

Supply Alternatives	Description	Impact
Carbon Capture & Storage (CCS)	A carbon capture system is used to capture carbon at the end-use, from combustion of fossil fuels, or captured directly from the atmosphere. The captured carbon is then sequestered, or stored, underground so it is not emitted.	CCS lowers GHG emissions; no impact on demand.
Syngas & Lignin Supply	Syngas, a biofuel, is a mixture of fuel gases resulting from the thermal decomposition or partial oxidation of more complex organic molecules. The primary fuel gases are carbon monoxide, hydrogen, and methane with some fraction composed of inert gases, primarily carbon dioxide. Lignin, also a biofuel, is a complex organic molecule that provide structure and support to plants, found in significant quantities in wood.	Syngas and lignin lower GHG emissions and contribute to the supply mix to meet annual demand.

Renewable Supply Alternatives: Overview

Reference: Pre-read Document Pages 20-24

Supply Alternatives	Description	Impact
Renewable Natural Gas (RNG) Supply	RNG is biologically derived methane which comes from biogas, a mixture of methane and carbon dioxide produced by the digestion of organic materials by microbes in the absence of oxygen, or through the catalytic reaction of syngas. Biogas or syngas becomes bio-methane when the methane component is concentrated to the point that the resulting gas is functionally equivalent to natural gas.	RNG lowers GHG emissions and contributes to the supply mix to meet annual demand.
Hydrogen (H2) Supply	H2 is an energy-dense fuel that can be produced in several ways. For the LTGRP, we use the conservative assumption that the supply will be from blue hydrogen produced from natural gas through steam methane reforming (SMR) with CCS.	H2 lowers GHG emissions and contributes to the supply mix to meet annual demand.

Questions & Discussion

TREATMENT OF OTHER VARIABLES

There are some variables that are uniquely analyzed:

- **Costs for renewable supply alternatives:** These costs will be used to provide a range of supply costs for the load and fuel mix estimated for each scenario.
- **Climate change impacts:** A higher and lower average annual temperature were used to conduct a sensitivity analysis of demand to changing annual heating degree days.
- **Demand-side Management (DSM)**: Although annual demand can decline from DSM programming, this is not considered a CU. The energy savings potential from DSM, estimated by a **Conservation Potential Review (CPR) study**, is layered onto the scenario results when the scenarios are finalized.

Questions & Discussion

Break

Reference Case Demand Forecast & Alternate Scenarios

Purpose of Scenario Planning & Analysis

Scenarios are not designed to predict the future, but rather to consider possible futures. The result is not an accurate picture of tomorrow, but better decisions about the future.

The purpose of developing several, distinct scenarios is to provide a range of futures to support planning. Probabilities are not assigned to the scenarios.

Scenario Development Process

Develop the Base Year

- 2019 is the base year for the 2022 LTGRP
- Customer consumption data is disaggregated into consumption by end-use

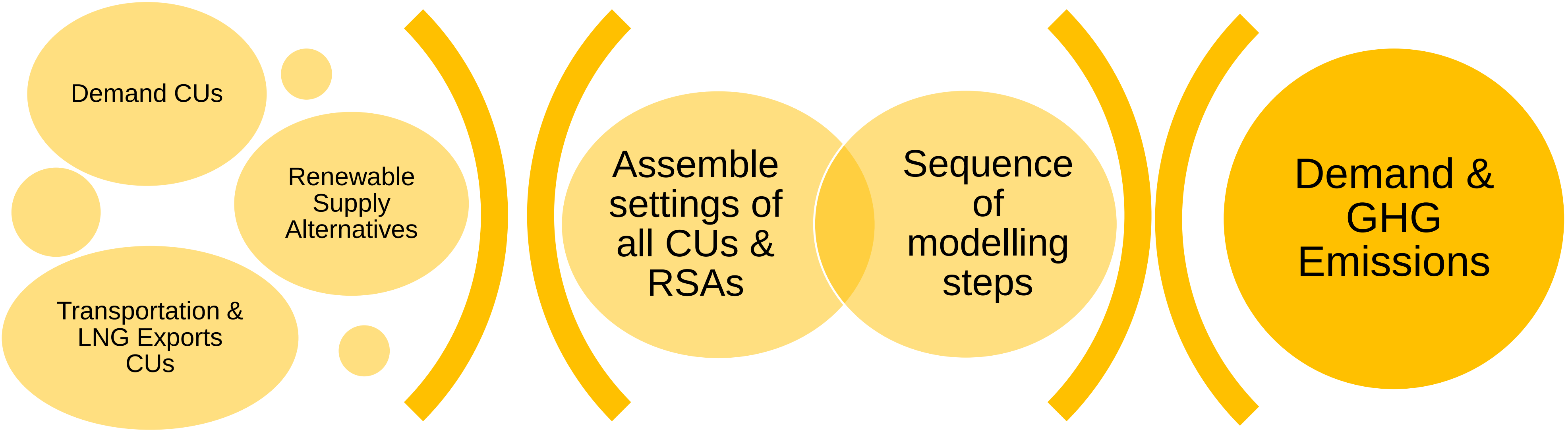
Generate the Reference Case Forecast

- 2020-2042 is the forecast period
- The reference case uses *known* information about expected future conditions to forecast annual demand
- The Reference Case is considered a scenario

Develop Several Scenarios

- Develop scenario narratives, CU and RSA settings
- Model several scenarios of illustrative futures based on combinations of policies and economic conditions

Building Scenarios from Critical Uncertainties



Combinations of CUs and RSAs are established

Modelling conducted by PG

Outputs for every scenario

Presenting Draft Scenario Results

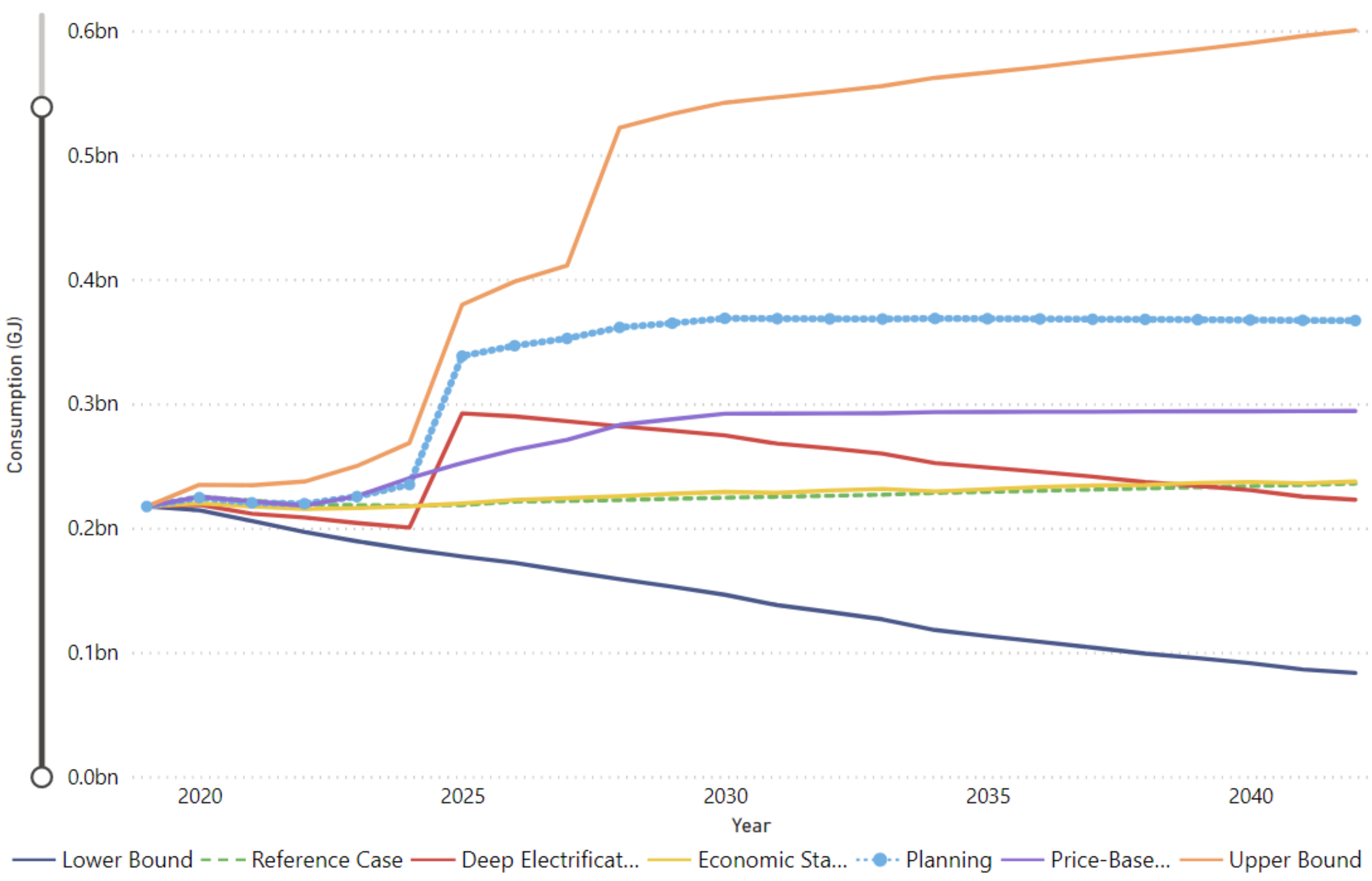
Unless otherwise stated, exhibits of scenario results are for all fuels that could go through FEI pipes. These fuels include:

- Conventional natural gas
- Carbon capture and storage (CCS)
  - Although CCS isn't a "fuel", it's modelled as a gas with a lower emission factor
- Renewable natural gas (RNG)
- Hydrogen
- Compressed natural gas (CNG)
- Liquified natural gas (LNG) (for export and used in BC)
  - Note that the Woodfibre LNG load is included in the demand for conventional natural gas, but the emissions associated with this load and subsequent LNG are excluded.
- Syngas and lignin

2022 LTGRP Scenarios

- FEI has developed the following scenarios:
  - Reference Case
  - Upper Bound
  - Lower Bound
  - Diversified Energy Planning
  - Deep Electrification
  - Price-Based Regulation
  - Economic Stagnation
- An additional scenario will be generated based on the input all of you provide during the crowd forecasting activity using the Slider Tool

Scenario comparison of forecasted demand (GJ)



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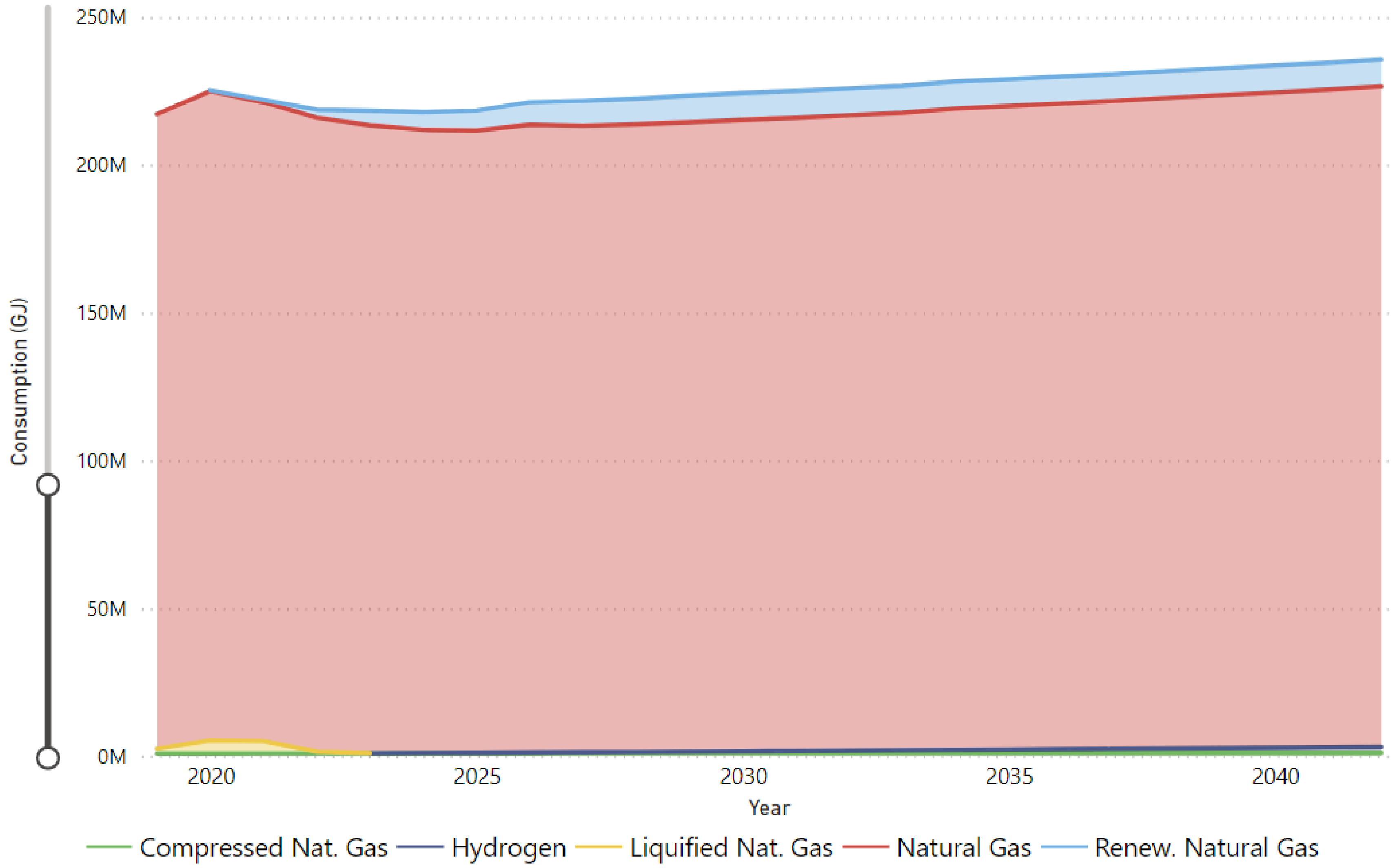
Reference Case Scenario

Incorporates expected continuation of current policies and market conditions, including known expected changes in codes, standards, carbon price, changes in building stock, and more.

Critical Uncertainty/ Renewable Supply Alternative	Reference Case Scenario
Appliance Standards	Reference
CCS	Reference
Carbon Price	Reference
Customer Growth	Reference
Fuel Switching	Reference
H2 Supply	Reference
LNG Export Demand	Reference
NGT Demand	Reference
Natural Gas Price	Reference
New Construction Code	Reference
Retrofit Code	Reference
RNG Supply	Reference
Syngas & Lignin Supply	Reference
Woodfibre LNG	Reference

Reference Case Scenario: Demand by Fuel (GJ)



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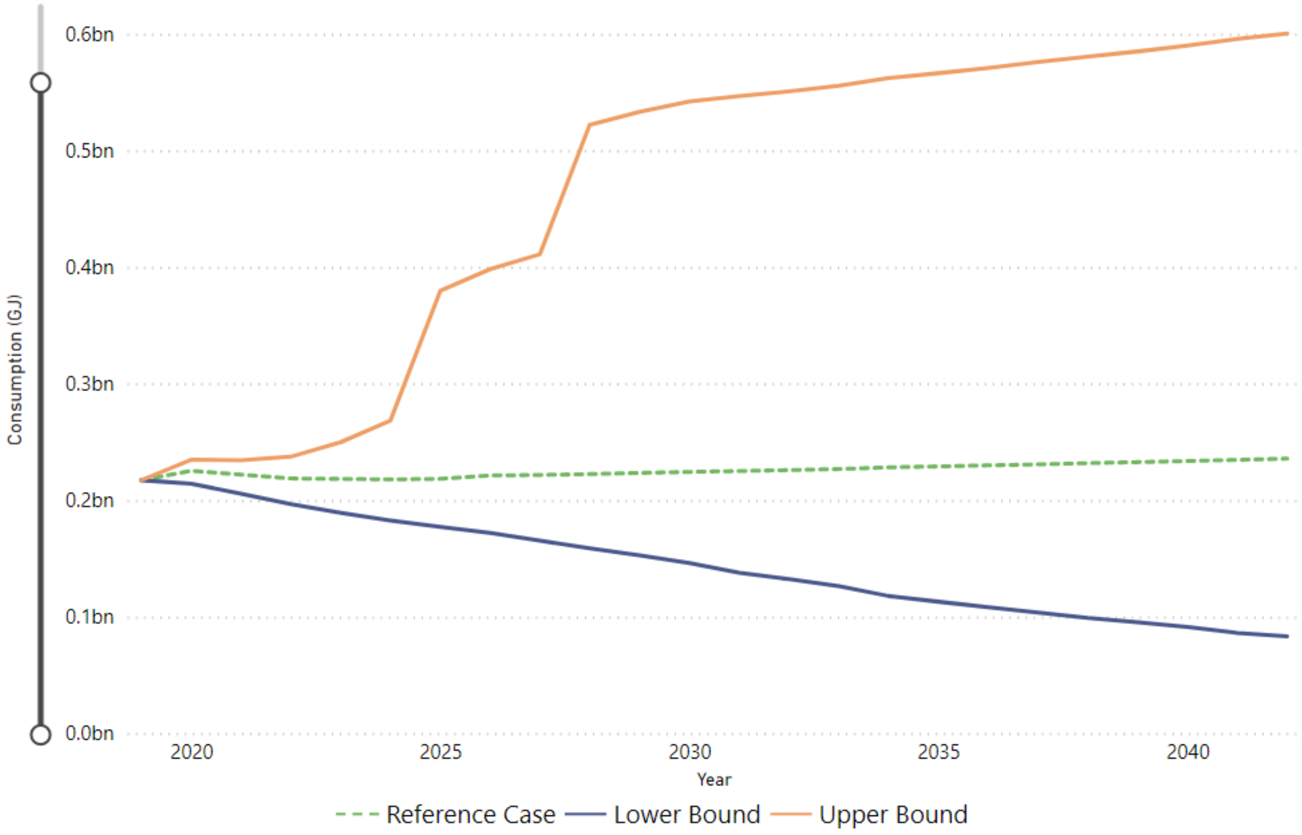
Lower & Upper Bound Scenarios

Do not reflect a single coherent narrative of a future possible world, but rather are the notional upper and lower bound for total volume. These scenarios provide the “jaws” under which the other scenarios fall.

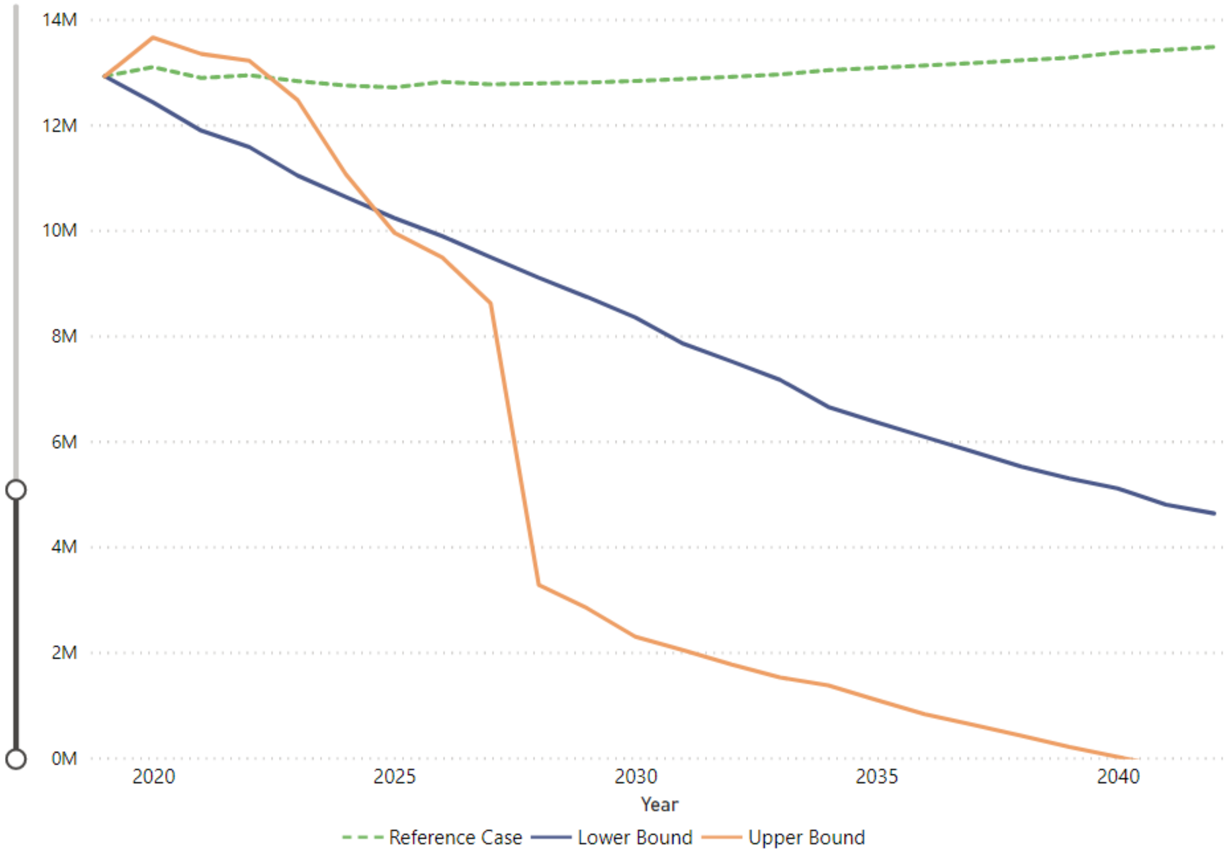
Critical Uncertainty/ Renewable Supply Alternative	Lower Bound Scenario	Upper Bound Scenario
Appliance Standards	Accelerated	Reference
CCS	Reference	High
Carbon Price	High	Low
Customer Growth	Low	High
Fuel Switching	Extensive	Reference
H2 Supply	Low	High
LNG Export Demand	Reference	High
NGT Demand	Low	High
Natural Gas Price	High	Low
New Construction Code	Accelerated	Delayed
Retrofit Code	Accelerated	Reference
RNG Supply	Low	High
Syngas & Lignin Supply	Reference	High
Woodfibre LNG	Reference	Planning

Upper & Lower Bounds

Demand (GJ)



GHG Emissions (t/CO2e)



Questions & Discussion

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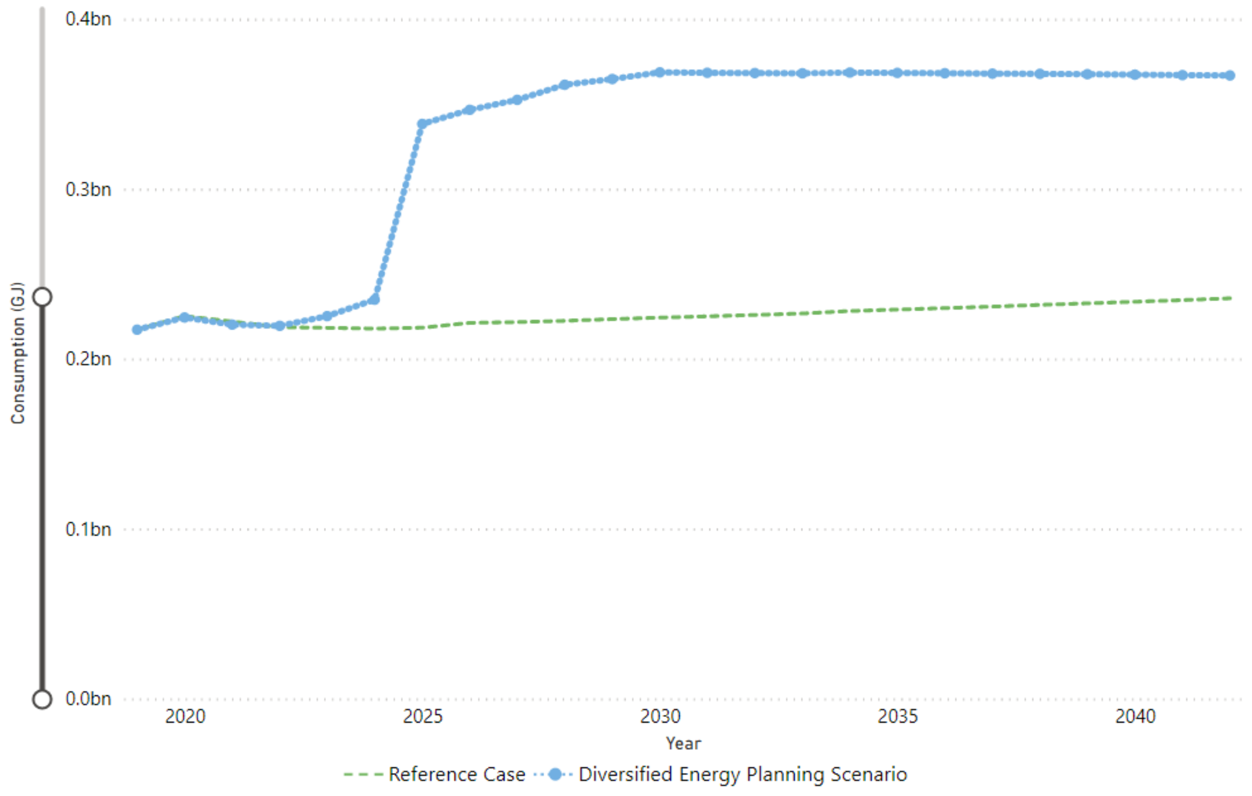
Diversified Energy Planning Scenario

Incorporates expanding electricity use while maintaining the use of the gas distribution system. Emissions reductions are characterized more by de-carbonizing the gas distribution system rather than electrification. This scenario includes expansion of natural gas for transportation while increasingly relying on renewable gas supply. This is the scenario FEI will plan to and incorporates our 30BY30 commitment.

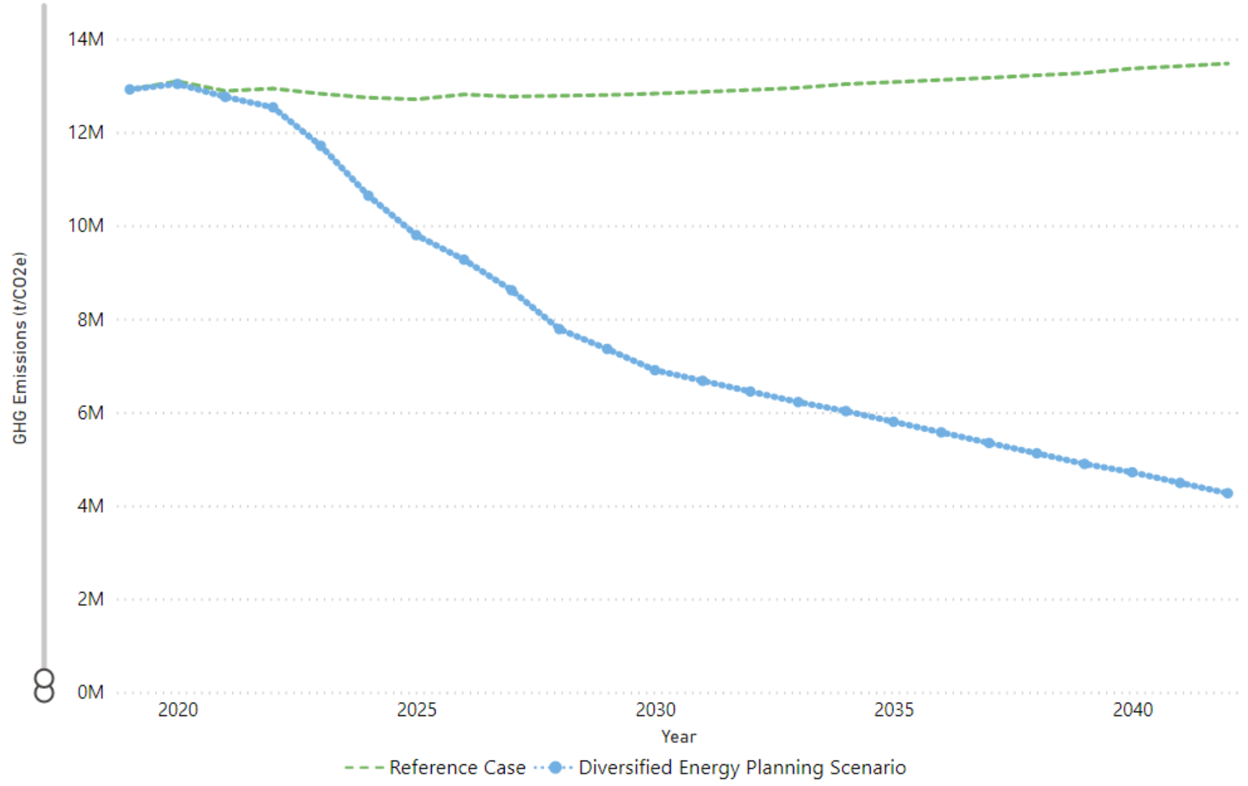
Critical Uncertainty/ Renewable Supply Alternative	Diversified Energy Planning Scenario
Appliance Standards	Reference
CCS	Planning
Carbon Price	Planning
Customer Growth	Reference
Fuel Switching	Moderate
H2 Supply	Planning
LNG Export Demand	Planning
NGT Demand	Planning
Natural Gas Price	Reference
New Construction Code	Reference
Retrofit Code	Reference
RNG Supply	Planning
Syngas & Lignin Supply	Planning
Woodfibre LNG	Planning

Diversified Energy Planning Scenario

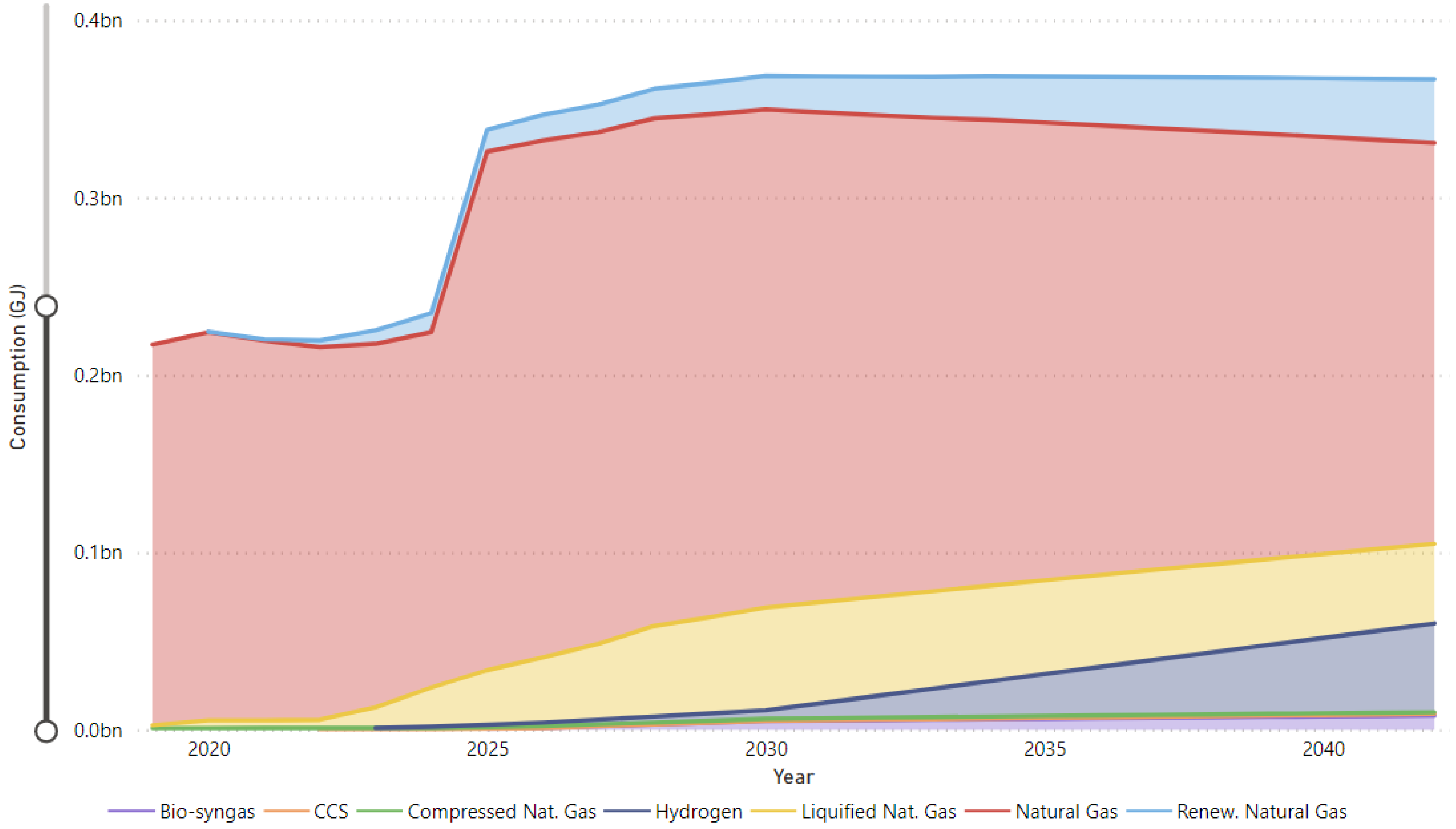
Demand(GJ)



GHG Emissions (t/CO2e)



Diversified Energy Planning Scenario: Demand by Fuel (GJ)



Deep Electrification Scenario

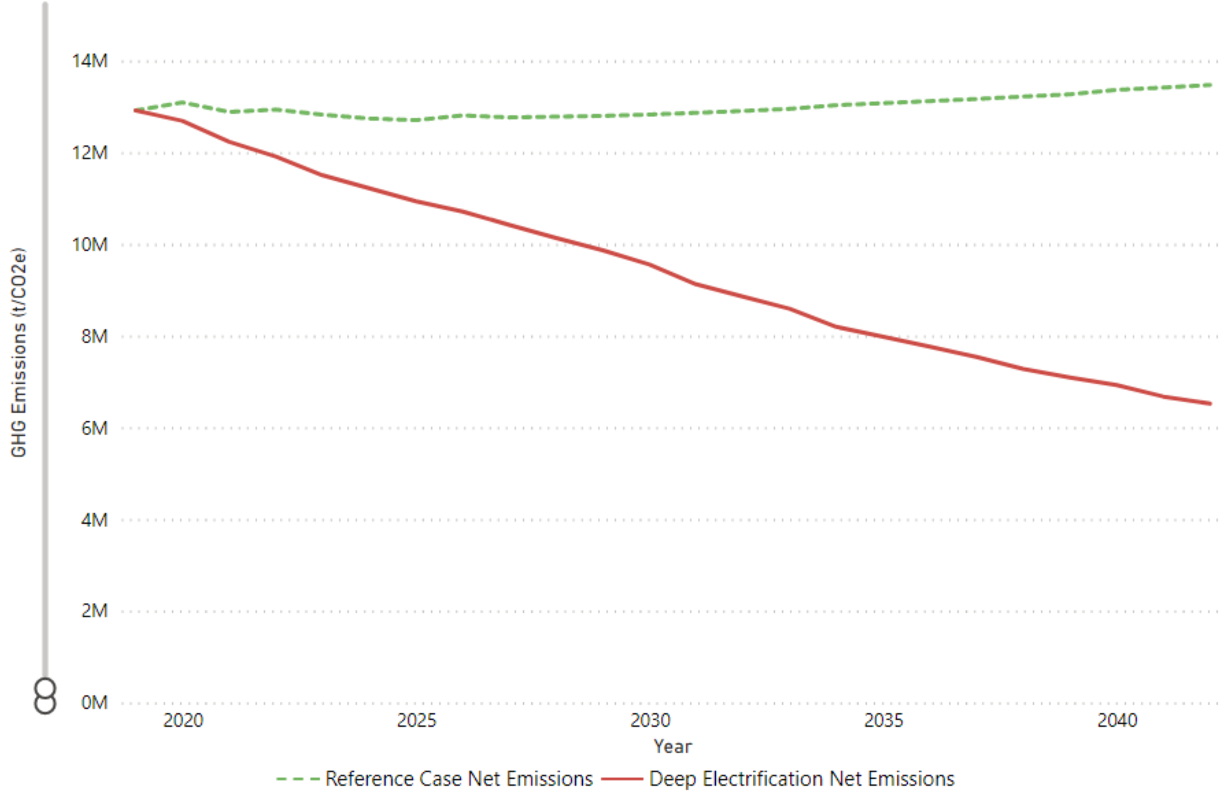
The BC government uses all policy levers to electrify the economy to achieve domestic carbon abatement. The government also promotes CCS for non-electrified sectors. Such policies create constraints for the BC economy and reduce the uptake of NGT solutions and renewable gases. To support economic growth, the government supports LNG exports to other jurisdictions.

Critical Uncertainty/ Renewable Supply Alternative	Deep Electrification Scenario
Appliance Standards	Accelerated
CCS	High
Carbon Price	Planning
Customer Growth	Low
Fuel Switching	Accelerated
H2 Supply	Low
LNG Export Demand	Planning
NGT Demand	Low
Natural Gas Price	Low
New Construction Code	Accelerated
Retrofit Code	Accelerated
RNG Supply	Low
Syngas and Lignin Supply	Reference
Woodfibre LNG	Planning

Deep Electrification Scenario

Demand (GJ)

GHG Emissions (t/CO2e)



Questions & Discussion

Economic Stagnation Scenario

The BC economy experiences lower-than average growth as part of a more sluggish global economy generally over the planning period which reduces excess regional demand for natural gas and keeps BC's gas supply abundant. Global economic performance reinforces trends towards the right of the political spectrum and causes governments to focus on areas other than climate policy. The economic environment has some negative impact on LNG exports and significant negative impact on NGT.

Critical Uncertainty/ Renewable Supply Alternative	Economic Stagnation Scenario
Appliance Standards	Reference
CCS	Reference
Carbon Price	Low
Customer Growth	Low
Fuel Switching	Reference
H2 Supply	Reference
LNG Export Demand	Reference
NGT Demand	Low
Natural Gas Price	Low
New Construction Code	Delayed
Retrofit Code	Reference
RNG Supply	Reference
Syngas and Lignin Supply	Reference
Woodfibre LNG	Reference

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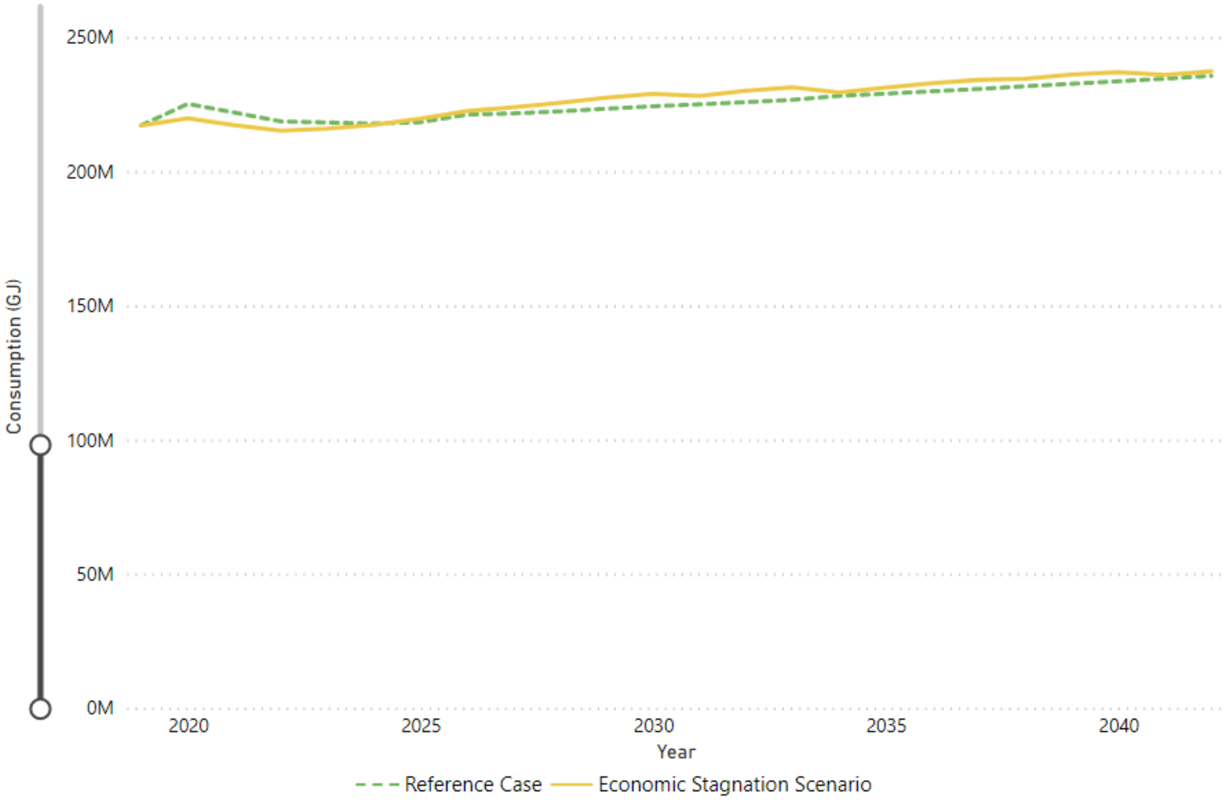
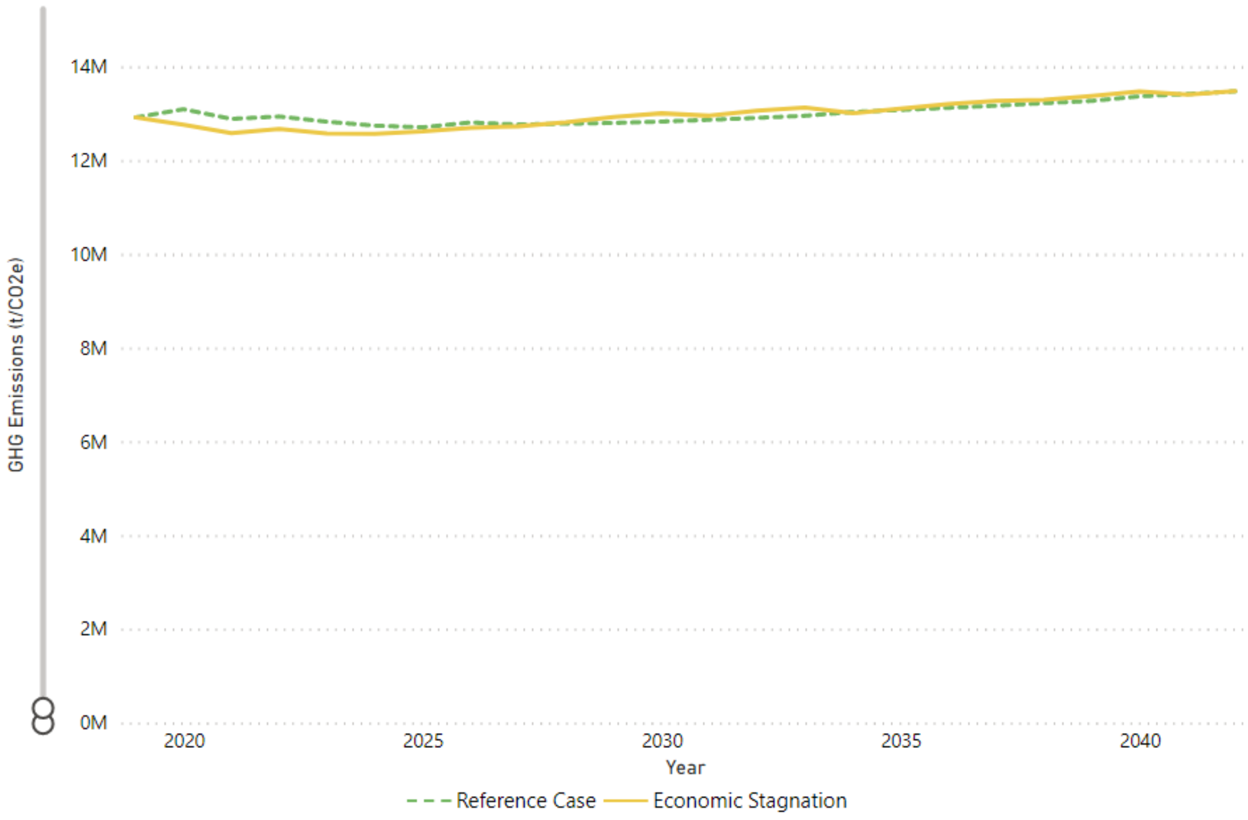
Economic Stagnation Scenario

Demand (GJ)



GHG Emissions (t/CO2e)



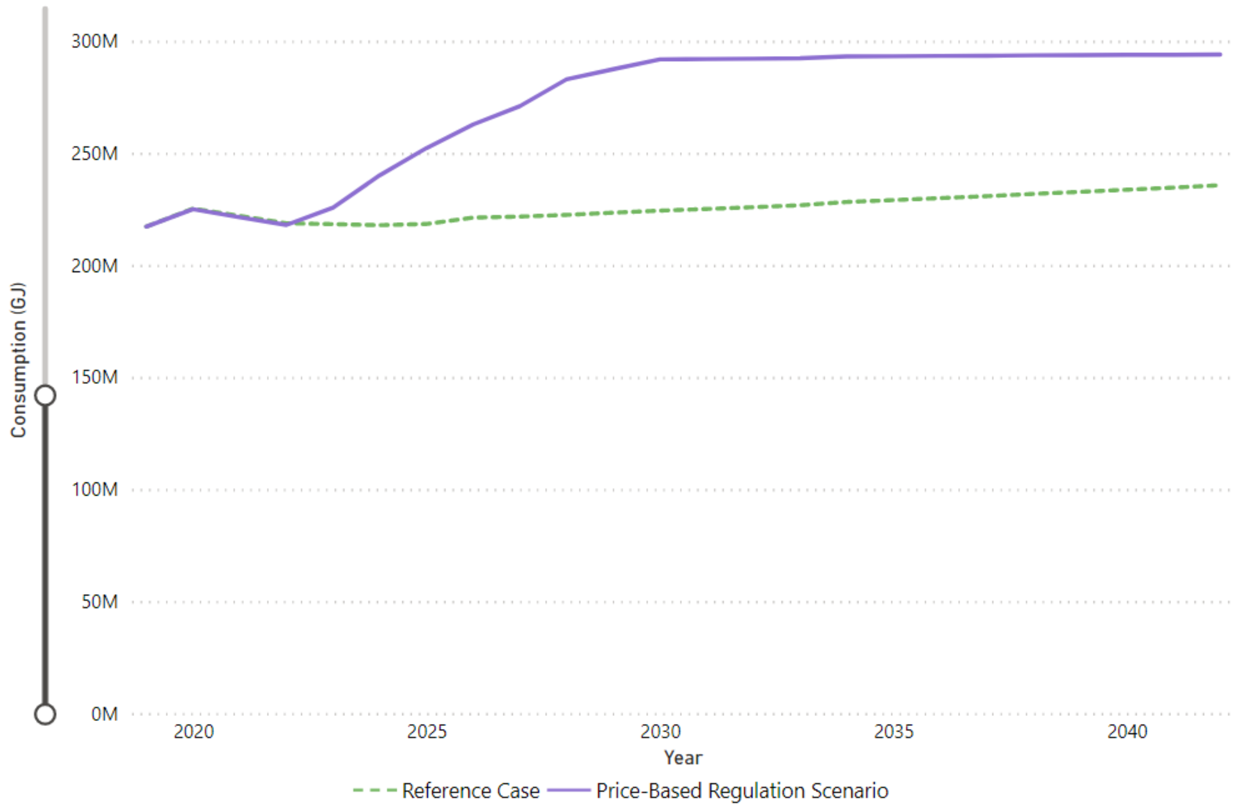
Price-Based Regulation Scenario

The BC government concludes that price signals and more ambitious upstream emissions reductions provide the best solution for carbon abatement and refrains from other forms of regulation. The price signals boost development of renewable gases, CCS, and NGT. Upstream methane emissions regulations increase regional gas commodity costs. The policy environment has limited impacts on economic growth and LNG exports.

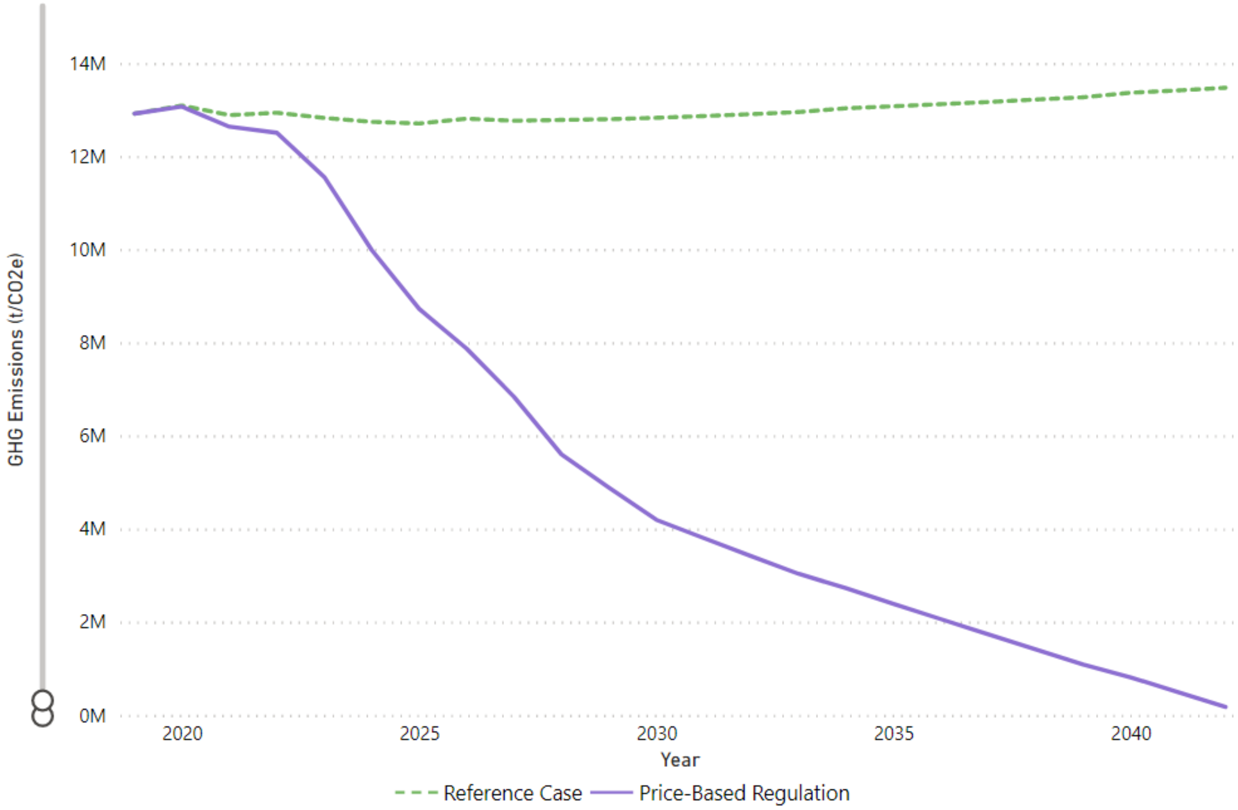
Critical Uncertainty/ Renewable Supply Alternative	Price-Based Regulation Scenario
Appliance Standards	Reference
CCS	High
Carbon Price	High
Customer Growth	Reference
Fuel Switching	Reference
H2 Supply	High
LNG Export Demand	Reference
NGT Demand	High
Natural Gas Price	High
New Construction Code	Reference
Retrofit Code	Reference
RNG Supply	High
Syngas and Lignin Supply	High
Woodfibre LNG	Reference

Price Based Regulation Scenario

Demand (GJ)



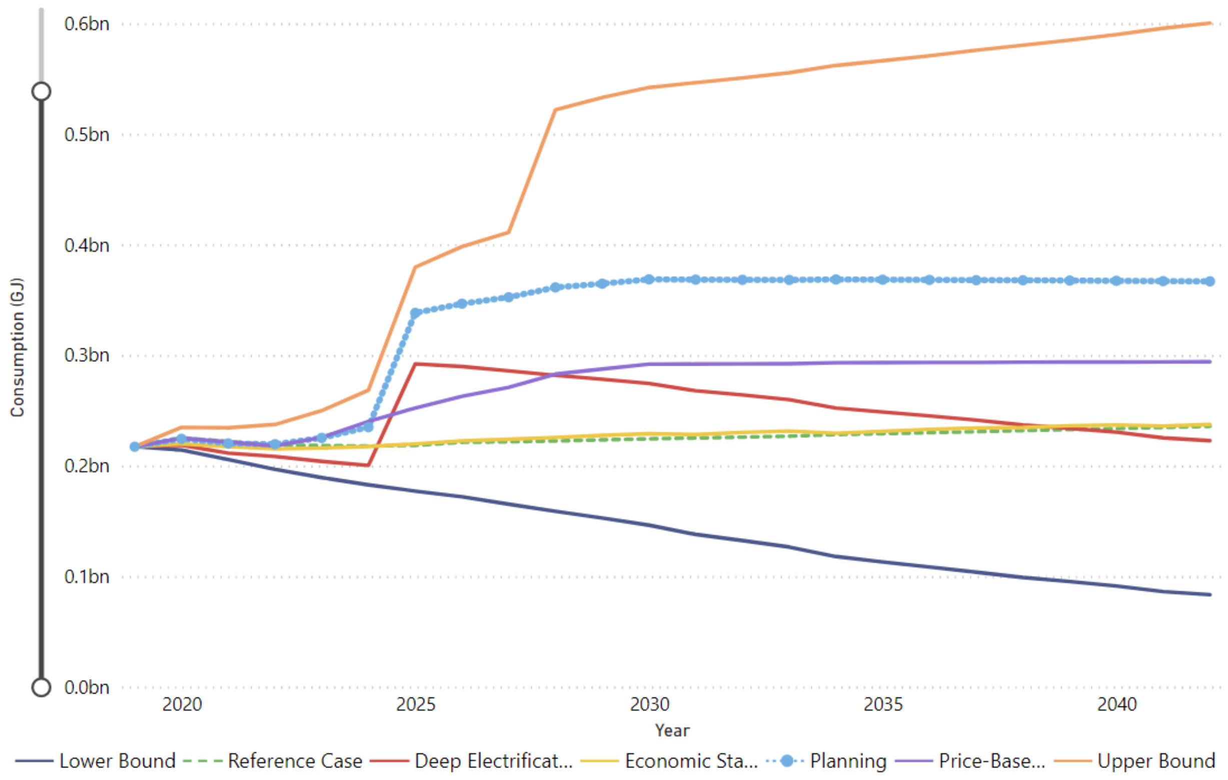
GHG Emissions (t/CO2e)



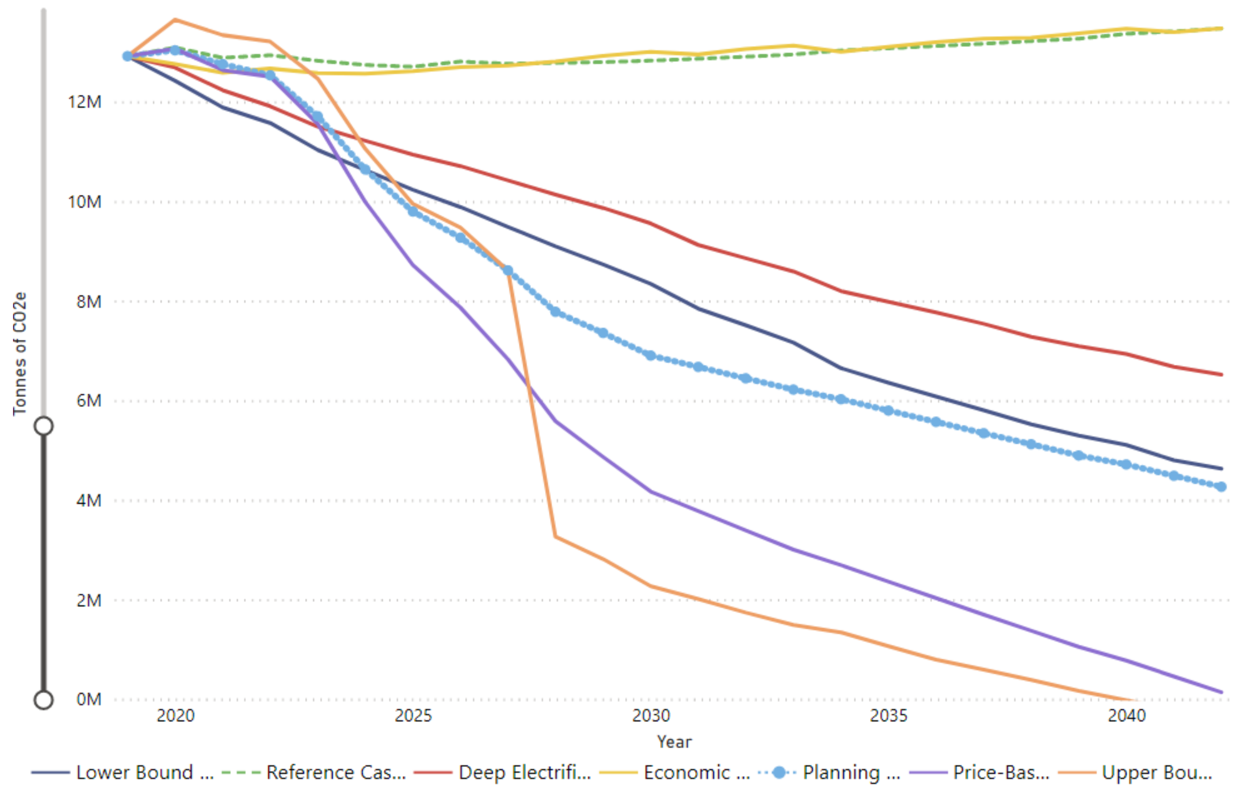
Comparison of All Scenarios

All Scenarios

Demand (GJ)



GHG Emissions (t/COe2)



Questions & Discussion

Crowd Forecast Activity Using the Slider Tool

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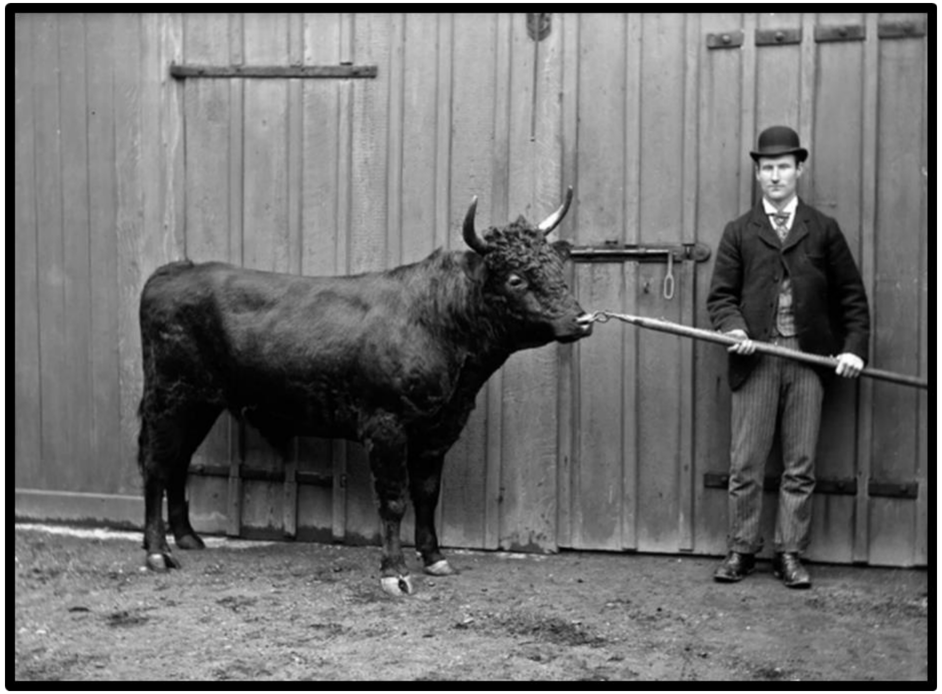
Collective Intelligence – The Crowd Forecast

- A brief history of crowd forecasting
  - Sir Francis and the ox
- We have developed a "Slider Tool" to let us do a somewhat more sophisticated "crowd forecast"
- In the Slider Tool application for the LTGRP you will be able to forecast demand, NGT/LNG and supply and observe the impacts on GHGs
- You will receive an email with a link and we'd appreciate all of you giving it a try and submitting your views
- Walkthrough the application



Questions & Discussion

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Wrap-up & Next Steps

Wrap-up & Next Steps

Thank you for attending today's session, we appreciate your time and input. Additional opportunities to provide feedback will be announced shortly.

The session presentation and notes will be posted online in the next few weeks.

If you have any further feedback or questions, please reach out to the Resource Planning team at **irp@fortisbc.com.**

Please submit your own forecast using the Slider Tool by Friday, June 25th.

Thank you

For further information, please contact:

FortisBC Integrated Resource Planning

irp@fortisbc.com

Find FortisBC at:
fortisbc.com
talkingenergy.ca
604-576-7000

Follow us **@fortisbc**

2022 LONG TERM GAS RESOURCE PLAN (LTGRP) DEMAND-SIDE MANAGEMENT ANALYSIS DRAFT RESULTS

November 3, 2021

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Welcome, Acknowledgment, Introduction

FortisBC acknowledges and respects Indigenous People in this place we call Canada, on whose traditional territories we all live, work and play.

FortisBC is committed to Reconciliation with Indigenous Peoples, using our Statement of Indigenous Principles to guide our words and actions.

Guiding Principles for FortisBC

Contribute to Province's Decarbonization Goals	Integrated, Optimized, and Low-cost GHG Abatement	Support Affordability
Understand and Mitigate Long-Term Impacts to Energy System	Diversified and Collaborative Energy Approach	Strengthen Reliability and Resiliency

Agenda

Welcome, Acknowledgment, Introduction & Sessions Overview
(15 min.)

Demand-side Management Analysis: Context & Approach
(50 min.)

Break
(10 min.)

Demand-side Management Analysis: Draft Results
(60 min.)

Primer on Next Session Topics: System Planning & Gas Supply
(35 min.)

Wrap-up & Next Steps
(10 min.)

Session Objectives

- Inform you about the status of the 2022 LTGRP
- Present and solicit feedback on the demand-side management analysis including:
  - Analysis approach
  - Linkages to the CPR and DSM Plan
  - Draft results
- Introduce the topics for the next session on gas supply and system planning

Housekeeping

Please put yourself on **mute** when you're not speaking to reduce background noise.

Please use the **chat** to provide any general feedback or comments as we go through the session.

We ask that you enter your questions in the **Q&A** or wait until the allocated discussion sections to put your **hand up** to ask your question.

The session audio/video will not be recorded; however, the chat history will be saved solely for note-taking purposes. Session notes will be shared with everyone and posted online.

Reminder that the pre-read document provides additional detail on the information summarized during this session.

Ken Ross
Manager, Resource Planning & DSM Reporting

Terry Penner
System Capacity Planning Manager

Jordan Cumming
Commercial & Planning Lead, Energy Supply

New FortisBC LTGRP Team Members:

Diana Aguilar

Beth Ringdahl

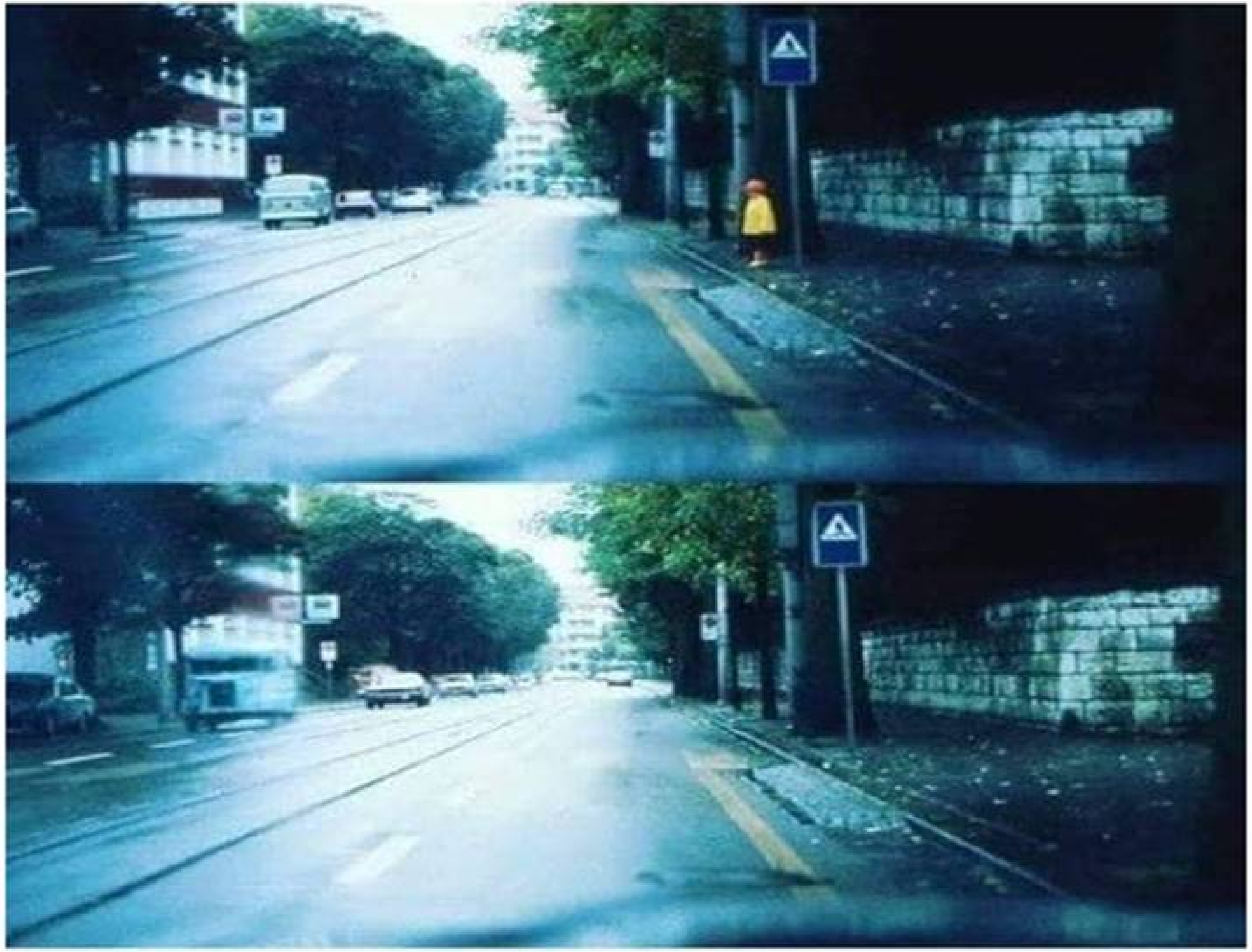
IRP@fortisbc.com

FortisBC Speakers & New Members

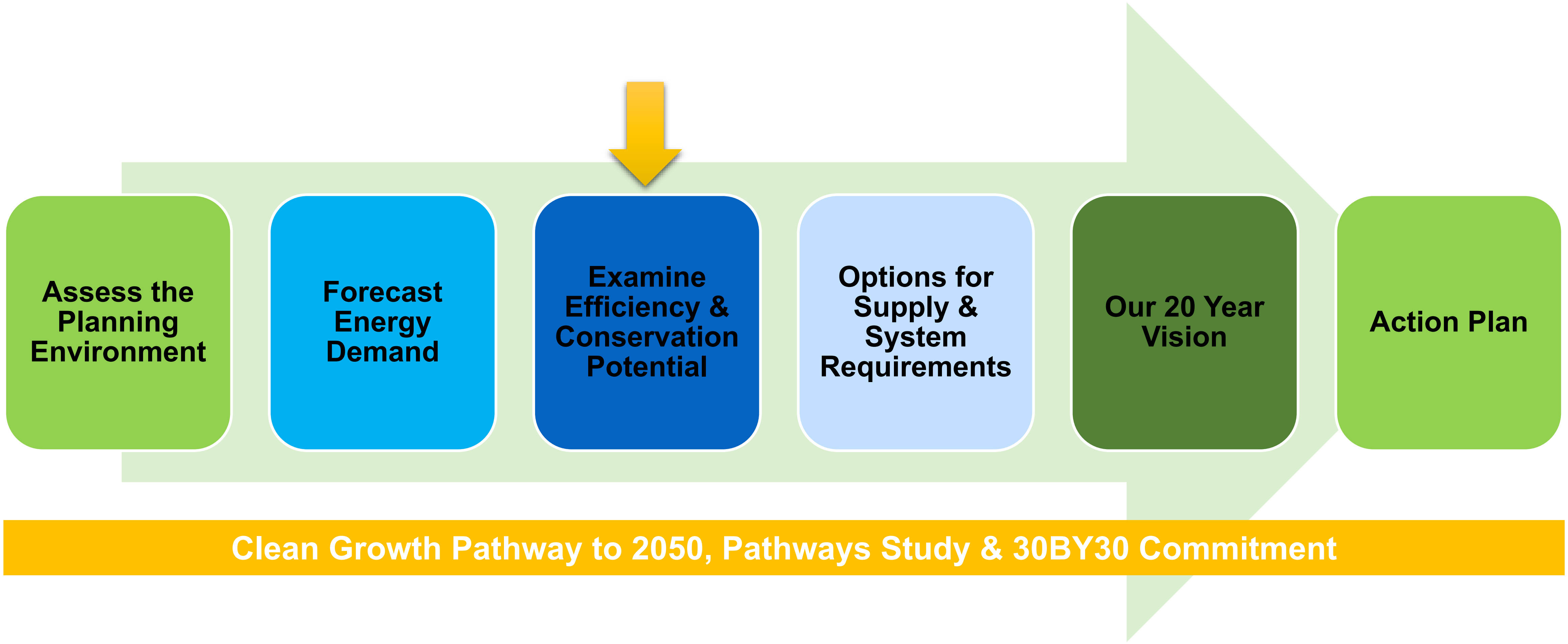
Resource Planning Advisory Group (RPAG) Members Registered for this Session

- Avista Utilities
- BC Business Council
- BC Ministry of Energy, Mines & Low Carbon Innovation
- BC Public Interest Advocacy Centre
- BC Sustainable Energy Association
- BC Utilities Commission
- BC Hydro
- Building Owners & Managers Association
- Canadian Institute of Plumbing and Heating
- Commercial Energy Consumers Association of BC
- City of Abbotsford
- City of Burnaby
- City of Kamloops
- City of Kelowna
- Clean Energy Association of BC
- Commercial Energy Consumers Association of BC
- Community Energy Association
- District of Saanich
- Metro Vancouver
- Midgard Consulting (Representing Residential Consumer Intervener Association)
- MoveUP
- North West Gas Association
- Puget Sound Energy
- University of Victoria

Safety moment

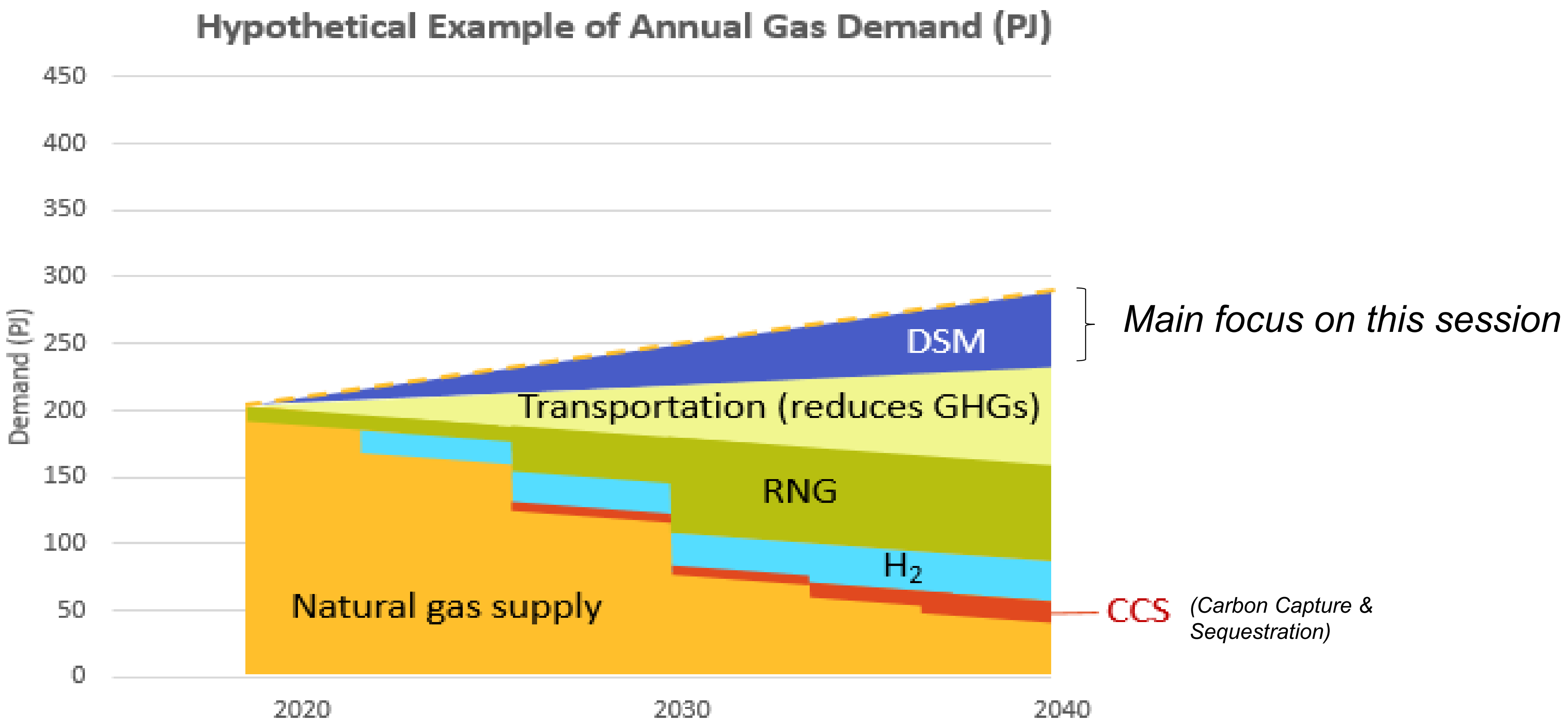


Recall the LTGRP Process

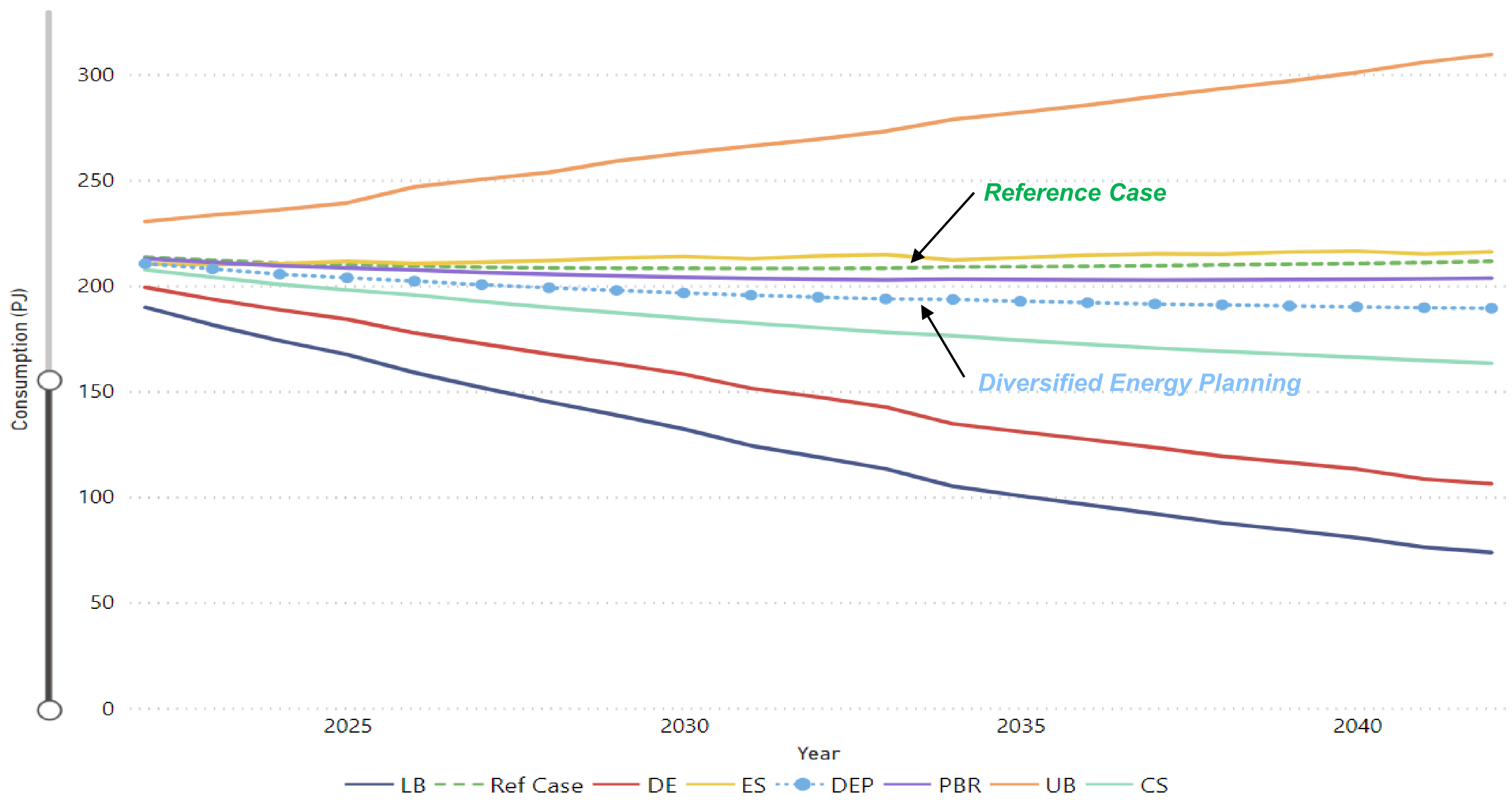


Demand and supply balance

- Key to meeting GHG targets



Scenario comparison of forecasted demand
(residential, commercial, industrial)



Note: *Excludes LNG & CNG*

2022 LTGRP Scenarios

FEI has developed the following scenarios:

UB: Upper Bound

ES: Economic Stagnation

Ref Case: Reference Case

PBR: Price-based Regulation

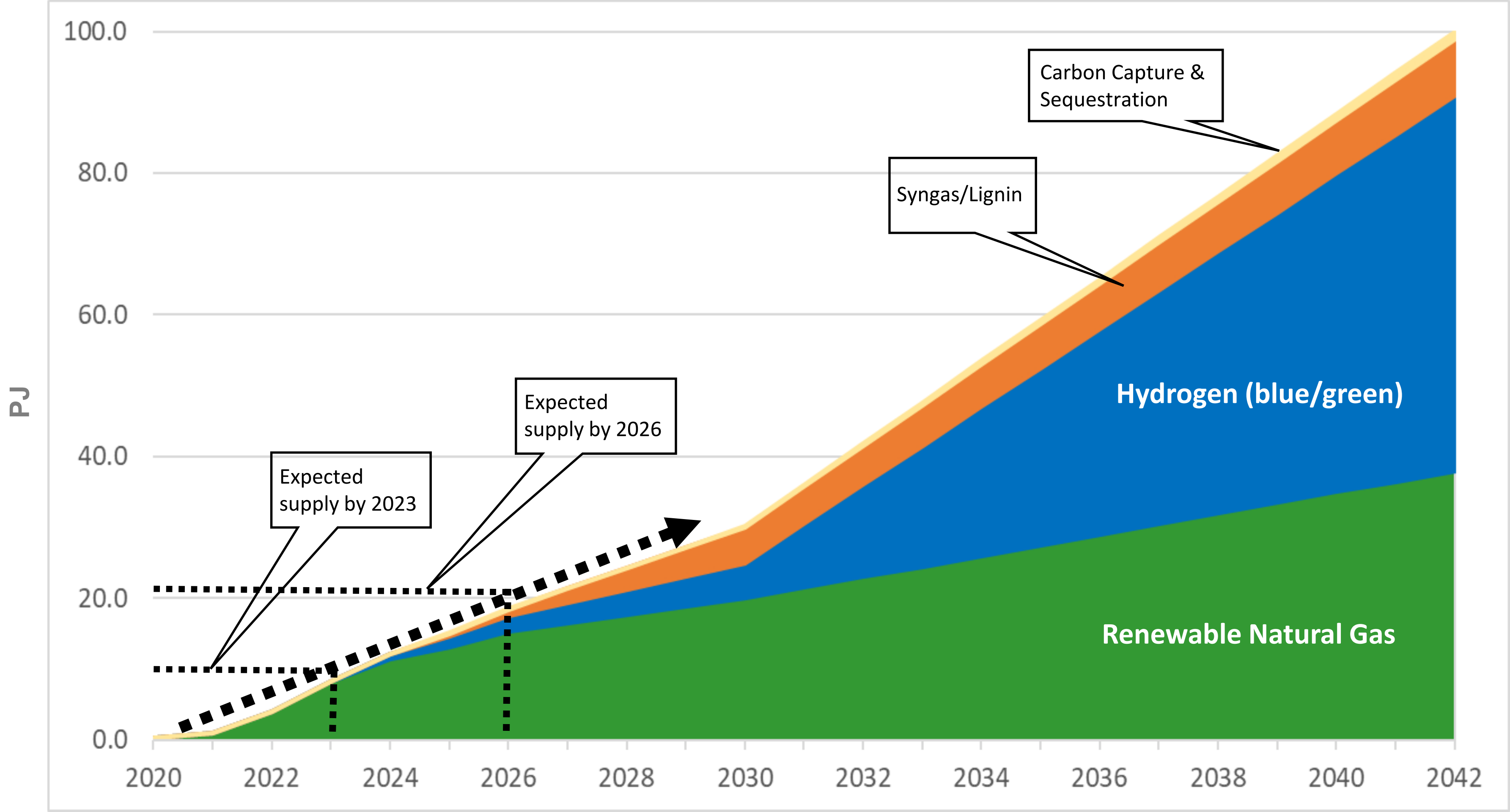
DEP: Diversified Energy Planning

CS: Crowd sourced (via the slider tool)

DE: Deep Electrification

LB: Lower Bound

Renewable and Low Carbon Gas Supply Outlook (Long-Term, Preliminary)



PUBLIC VERSION

Feedback from Previous Session

Demand Forecasting, Renewable Supply and Future Scenarios

- Impact of renewable gases on the gas system
- Cost and timing of renewable supply
- Breakout of transportation sector demand
- Clarification of aspects of the demand and supply critical uncertainties
- Competition for renewable energy resources
- Location of emission reductions and carbon accounting approach
- Approaches to decarbonizing various sectors
- Demand and carbon reductions by end-use
- Costs of decarbonization approaches
- Slider tool for exploring and discussing demand/supply critical uncertainties

Brett Kerrigan
Consultant, Posterity Group

LTGRP Analyst

Chris Pulfer
Principal, Posterity Group

LTGRP Project Director

Dave Shipley
Senior Consultant, Posterity Group

LTGRP Technical Director

Erika Aruja
Consultant, Posterity Group

LTGRP Project Manager

Guest Speakers

Demand-side Management Analysis for the 2022 LTGRP Context & Approach

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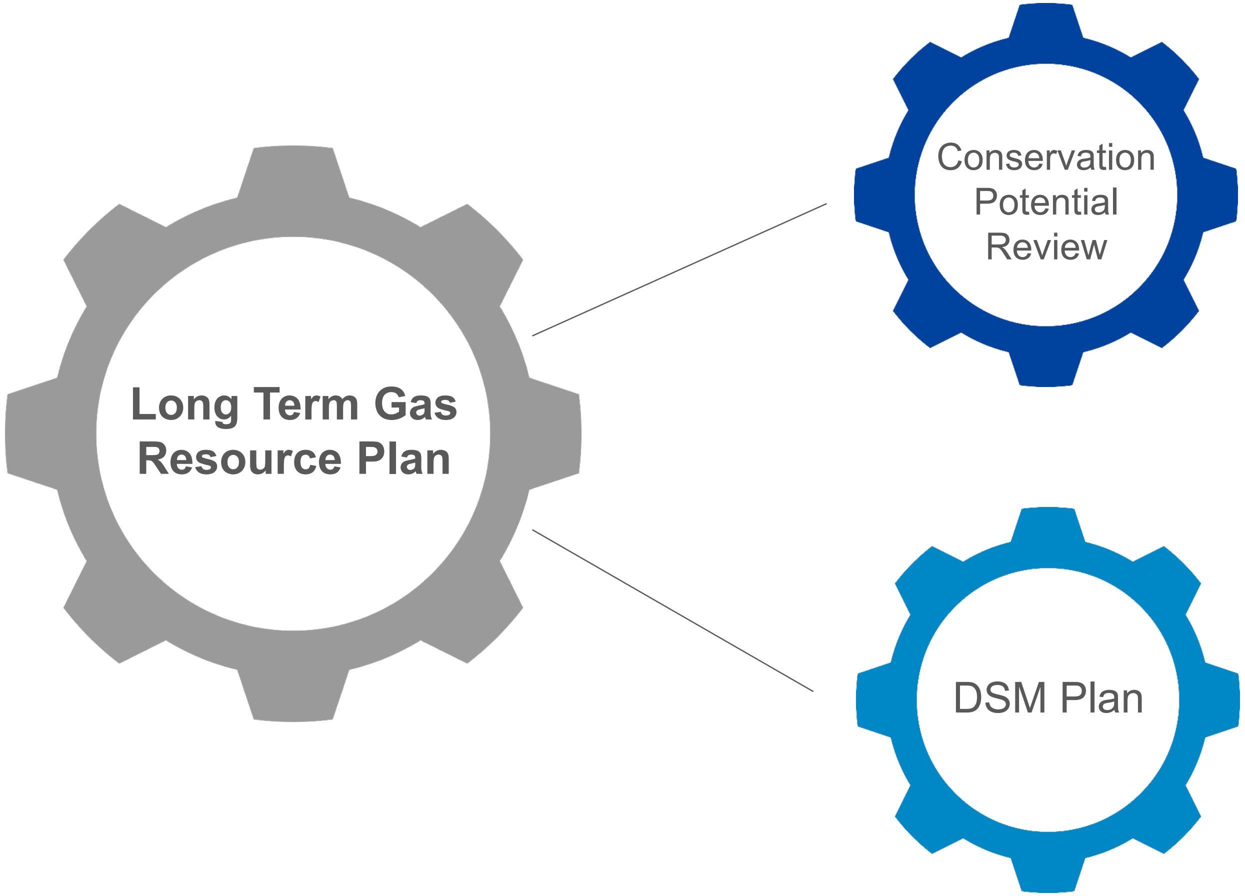
Demand-Side Management: Context



DSM Modelling Method

Use 2022 LTGRP scenarios as base

→

Integrate 2021 CPR savings potential scenarios to reduce demand

→

Develop updated post-DSM demand forecasts

Approach to DSM Analysis in the 2022 LTGRP

DSM energy savings potential modelled from 2022 to 2042.

Draws on the energy conservation measures from the 2021 Conservation Potential Review (CPR).

Developed four DSM spending levels (“settings”) to apply to various scenarios: Taper off, low, medium, high.

DSM savings are applied to residential, commercial and industrial sectors, not transportation or export.

DSM Budget Settings used in the LTGRP Scenarios

- Developed DSM budget “settings” based on:
    - Incentive levels as key driver (cover 50% or 100% of incremental costs),
    - Measures screened through DSM cost effectiveness tests; and/or
    - Budget levels (incentive spending and non-incentive program spending).

DSM Budget Settings

	"Taper Off"	"Low"	"Medium"	"High"
Description	Assumes DSM spending tapers off as the province electrifies	Constrained to include only the most cost-effective measures	Similar to the CPR's medium market potential scenario where adoption of measures is based on incentives covering 50% of a measures incremental cost	Similar to the CPR's high market potential scenario where adoption of measures is based on incentives covering 100% of a measures incremental cost
Incentive Level setting	Any incentive level is permitted	Any incentive level is permitted	50% of measure incremental cost	100% of measure incremental cost
Economic Screen setting	Passes either TRC>1 or MTRC>1	Passes TRC>1 or MTRC>1 and UCT>2	Passes TRC>1 or MTRC>1	Passes TRC>1 or MTRC>1
Budget setting	Budget limited to of 50% of 2022 spending in 2023, declining to 25% of 2022 spending by 2042	No budget limit applied	No budget limit applied	No budget limit applied

DSM Budget Settings in each Scenario

Scenario	DSM Setting
Reference Case	Medium
Diversified Energy Planning	Medium (sensitivity analysis conducted with Low and High settings)
Deep Electrification	Taper
Price-Based Regulation	Low
Economic Stagnation	Medium
Lower Bound	High DSM
Upper Bound	NA – no DSM
Stakeholder Scenario	Medium

Application of DSM to Fuels

Current Approach:

Apply participation in DSM programs based on volume of fossil-based natural gas.

- The impact of this approach is that if there are significant volumes of RNG, H_2 or other fuels in a scenario, DSM savings (GHG reduction) declines.

Proposed Revised Approach:

Apply participation in DSM programs based on volume of all piped fuels but only reduce demand for fossil-based natural gas from measures.

- The logic for this approach is that total piped volume drives DSM participation but savings only affect how much fossil-based natural gas FEI purchases.
- The simplifying assumption we would make is that DSM ends when there is no more fossil-based natural gas in the fuel mix.
- We expect the outcome of this approach is that DSM savings will increase in most scenarios, particularly those with higher volumes of RNG and H_2.

Questions & Discussion

Break

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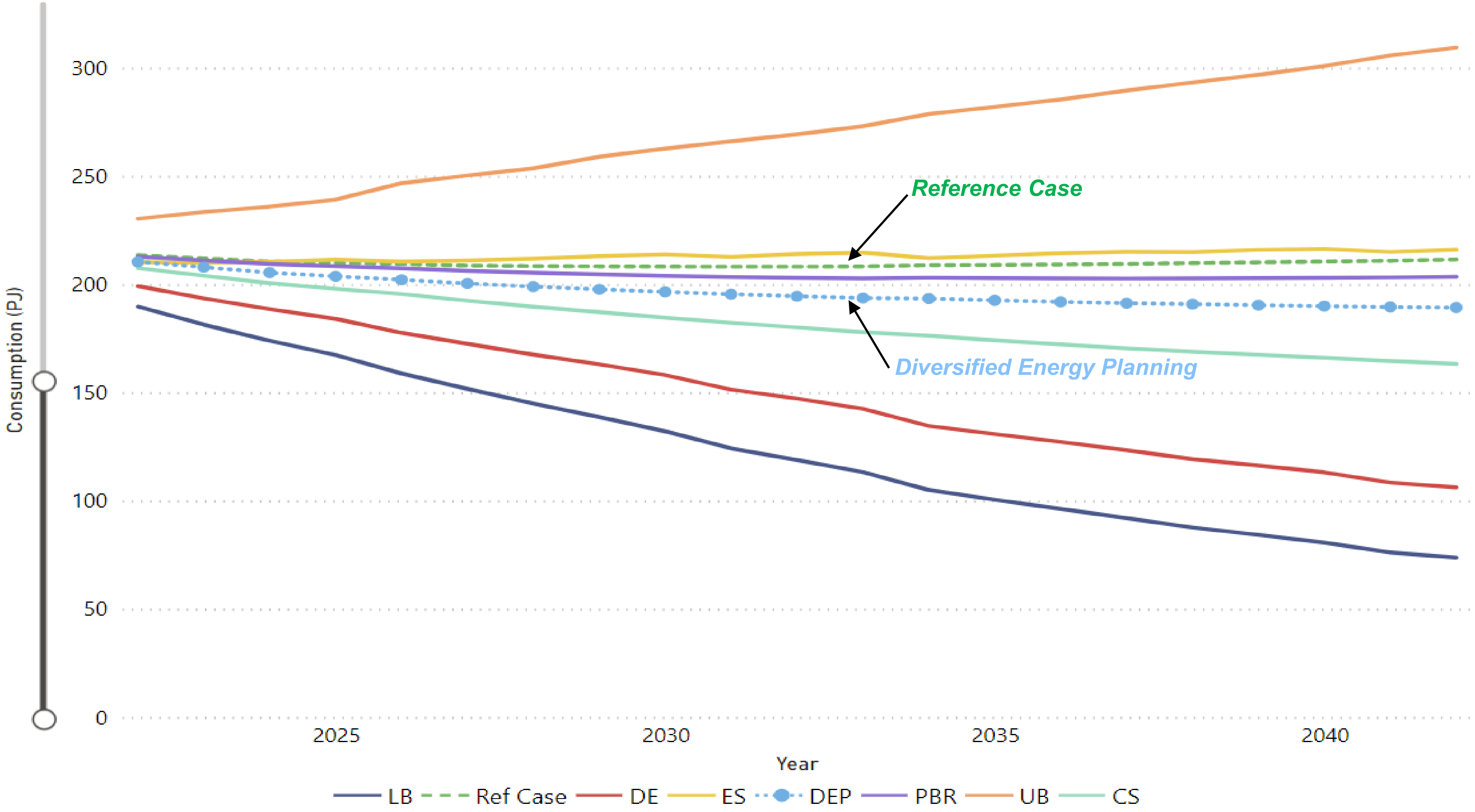
Demand-side Management Analysis for the 2022 LTGRP Draft Results

Consumption, all scenarios (residential, commercial and industrial)



UB: Upper Bound of gas consumption

ES: Economic Stagnation

Ref Case: Reference Case

PBR: Price-based Regulation

DEP: Diversified Energy Planning

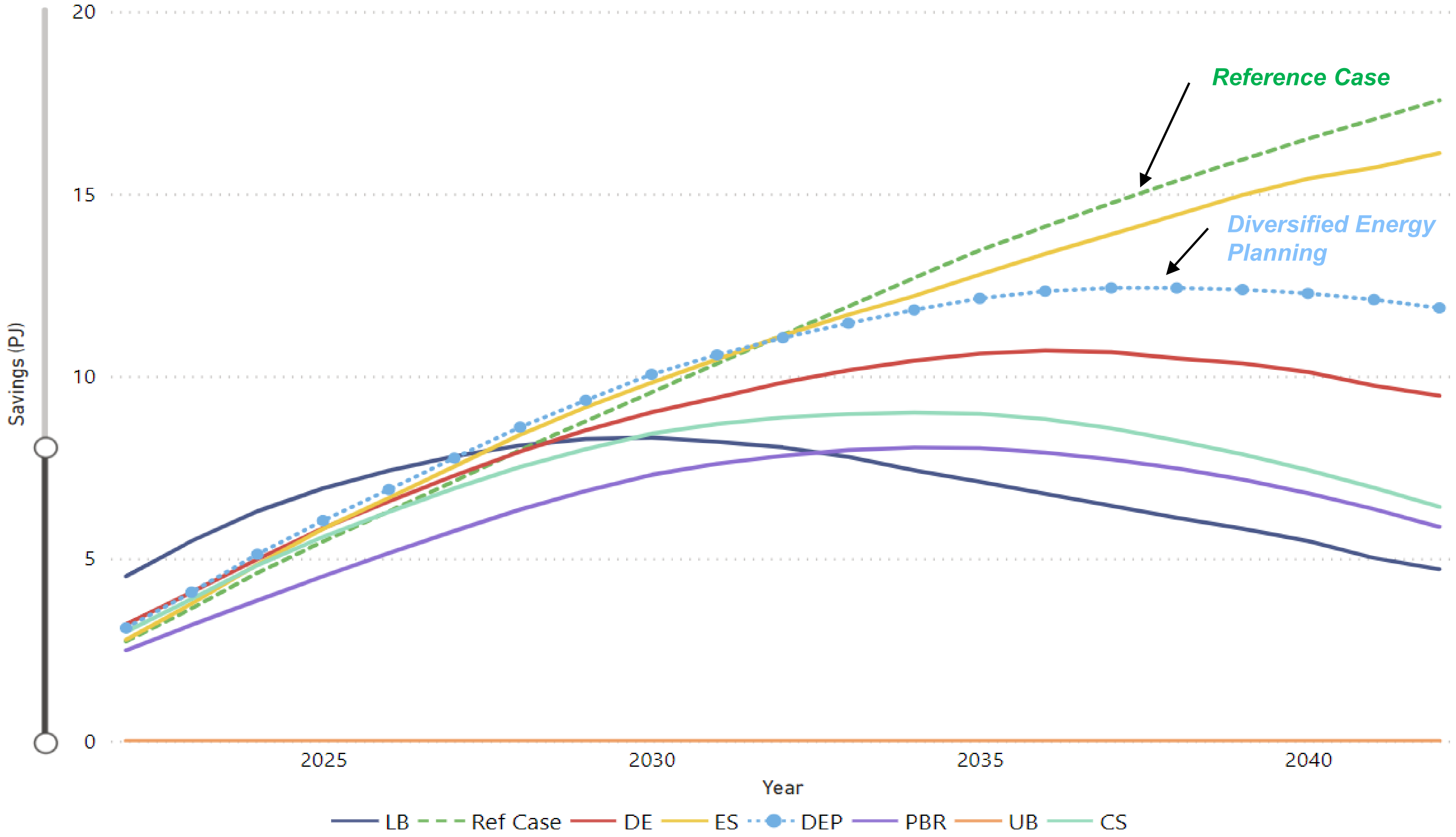
CS: Crowd sourced

DE: Deep Electrification

LB: Lower Bound of gas consumption

Note: *Excludes LNG & CNG*

Energy Savings (PJ), all scenarios



Ref Case: Reference Case

ES: Economic Stagnation

DEP: Diversified Energy Planning

DE: Deep Electrification

CS: Crowd sourced

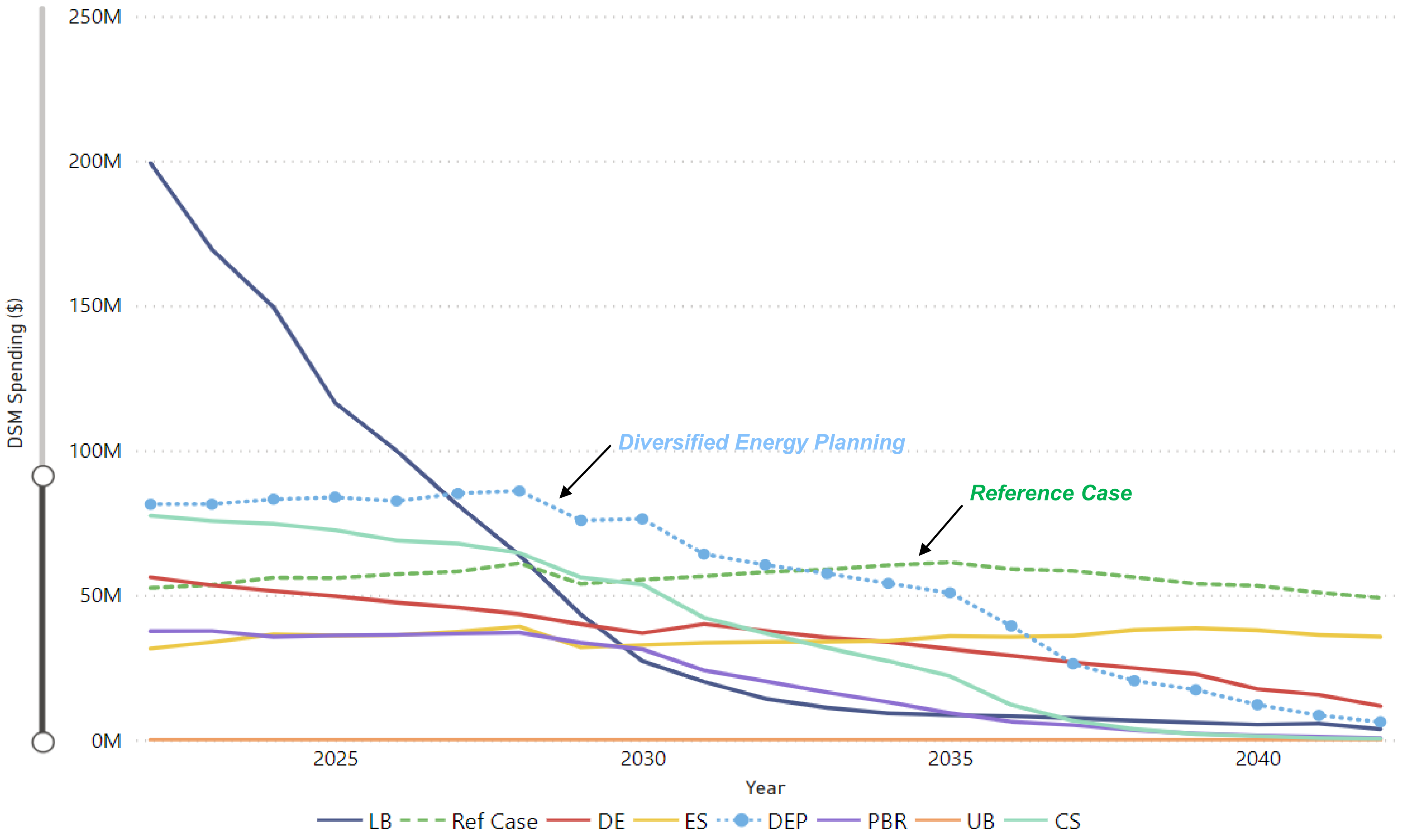
PBR: Price-based Regulation

LB: Lower Bound of gas consumption

UB: Upper Bound of gas consumption

Note: *Excludes LNG & CNG*

DSM Spending ($, incentive program), all scenarios



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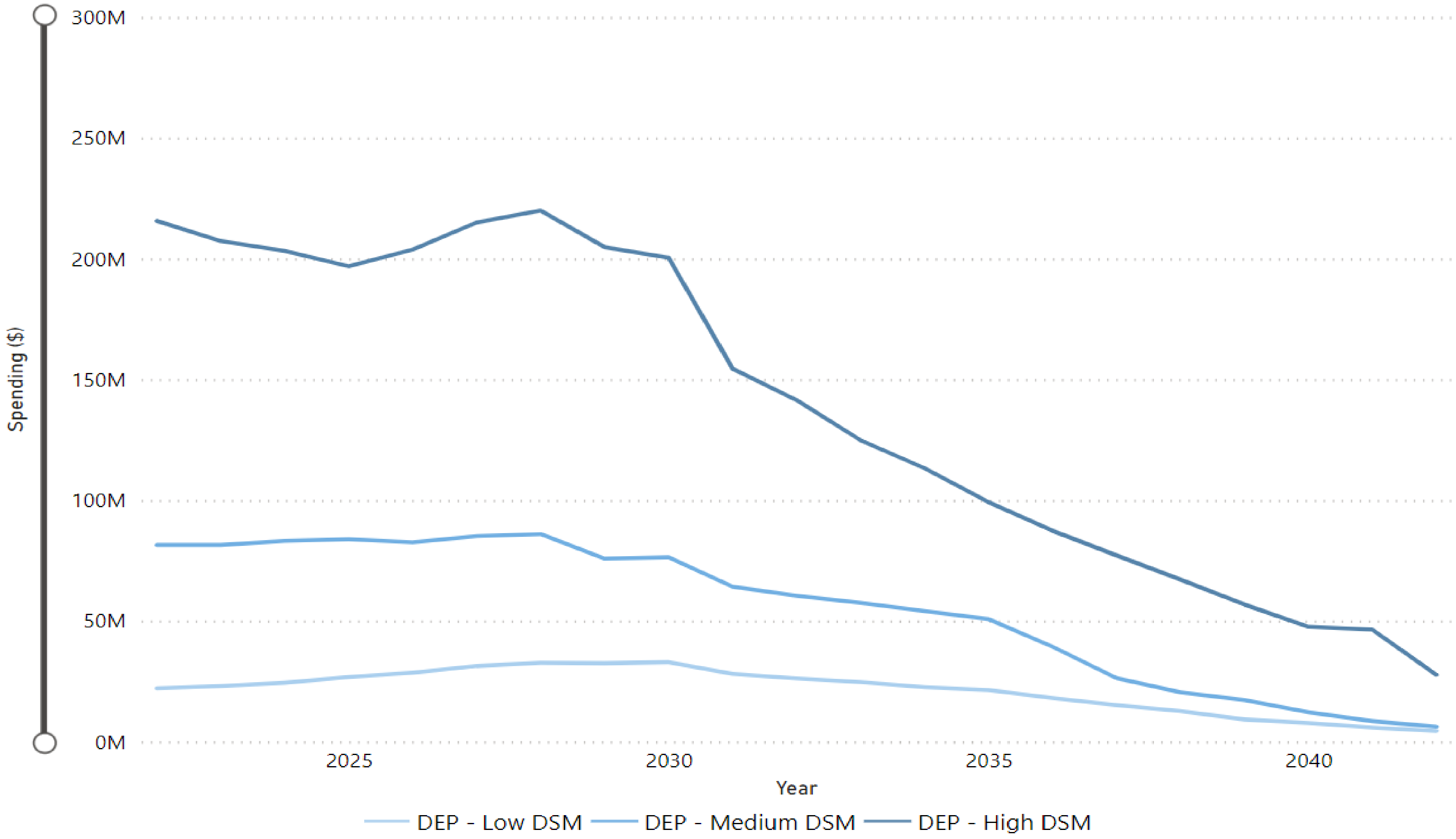
Diversified Energy Planning: Spending ($) in 3 DSM Settings



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Societal Cost-Benefit

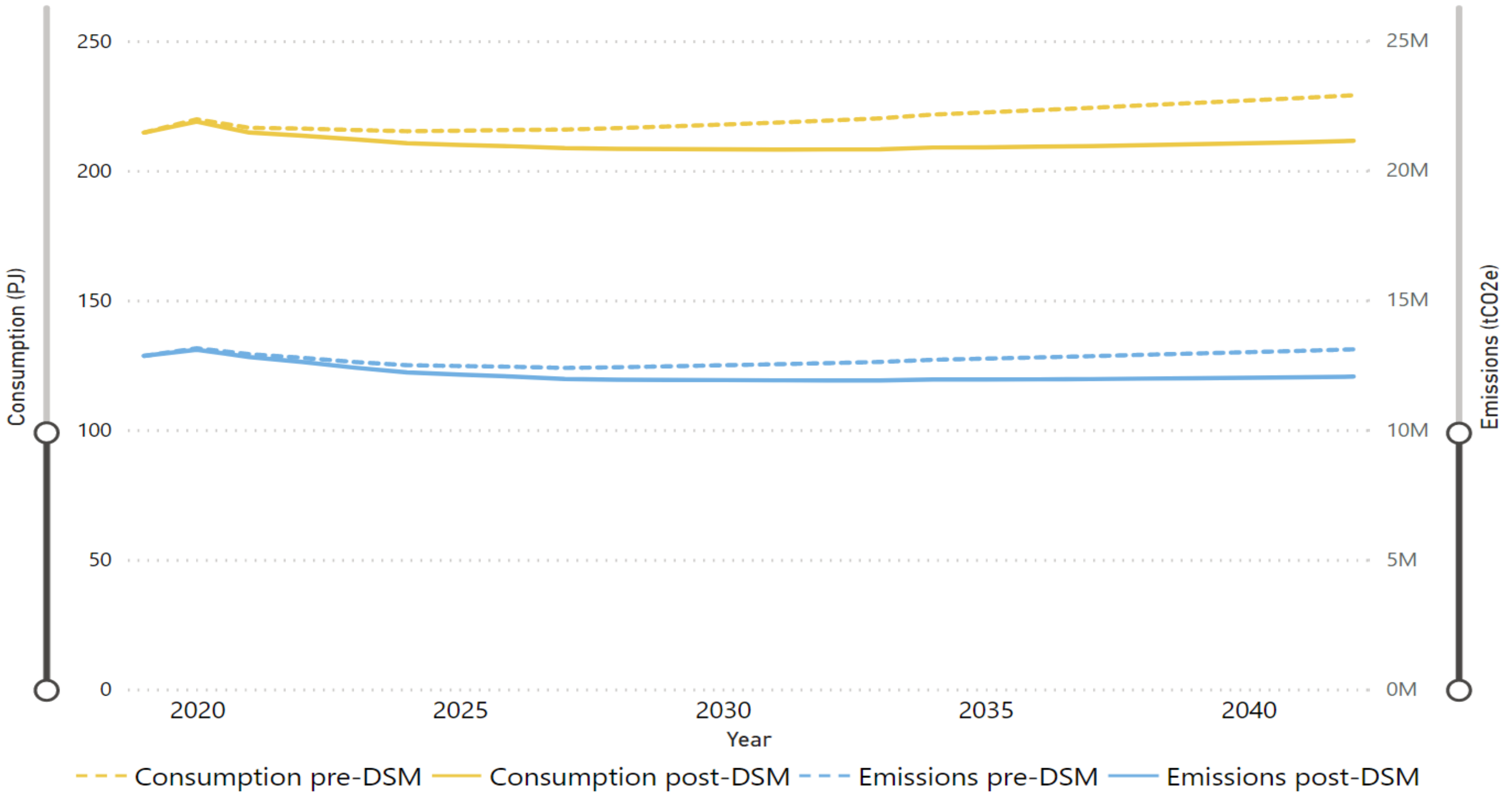
From a societal standpoint, DSM measures are cost effective based on energy savings alone.

As carbon reduction measures, they are more than paid for by energy savings, so **cost per tonne is negative.**

As an example, residential measures in 2030 in the high DSM planning scenario cost approximately -$70/tonne.

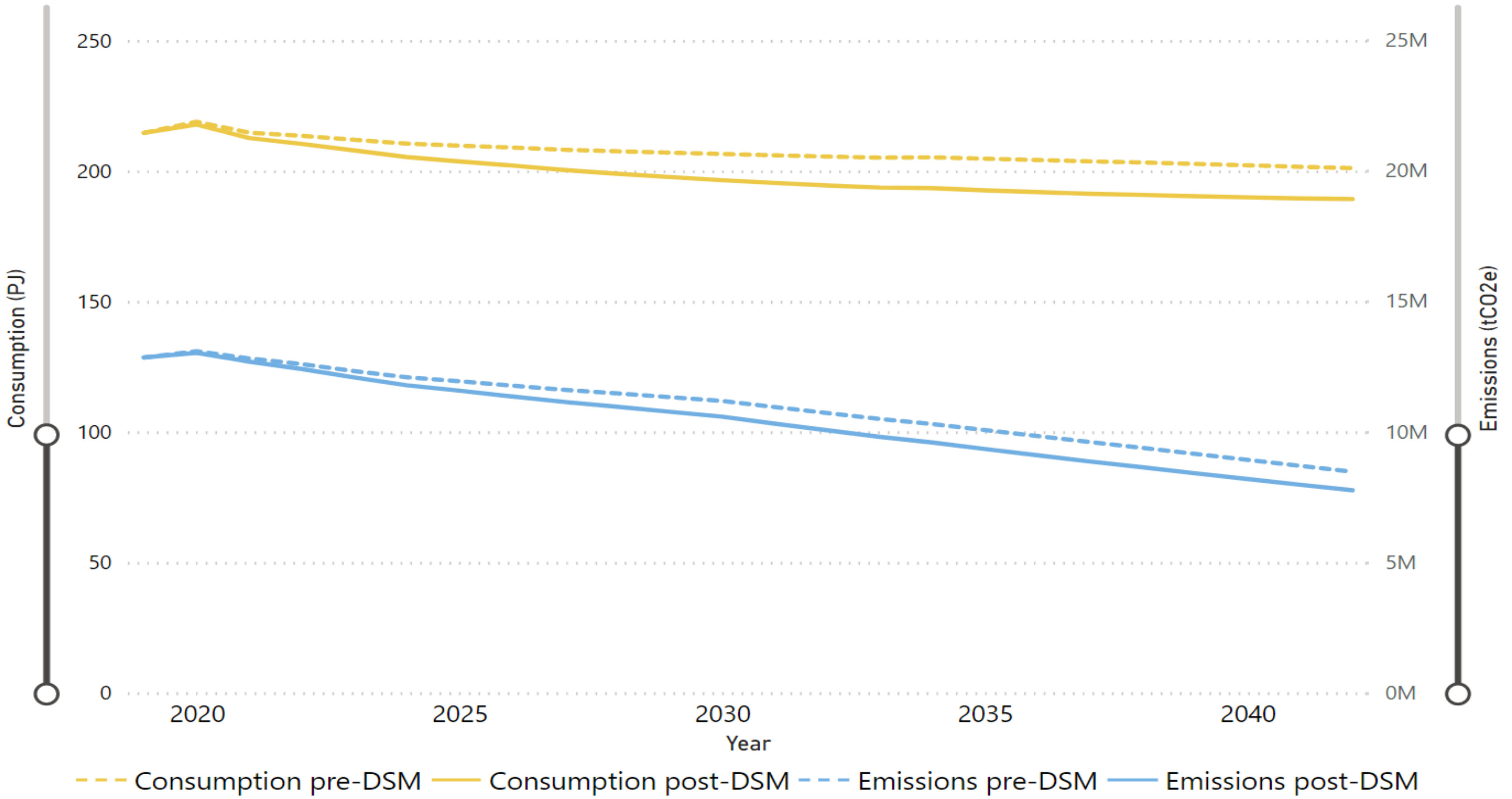
That means their energy benefits exceed their costs by approximately $70 for every tonne of lifetime CO_2e reduction.

Pre- vs Post-DSM Consumption and GHG Emissions: Reference Case Scenario



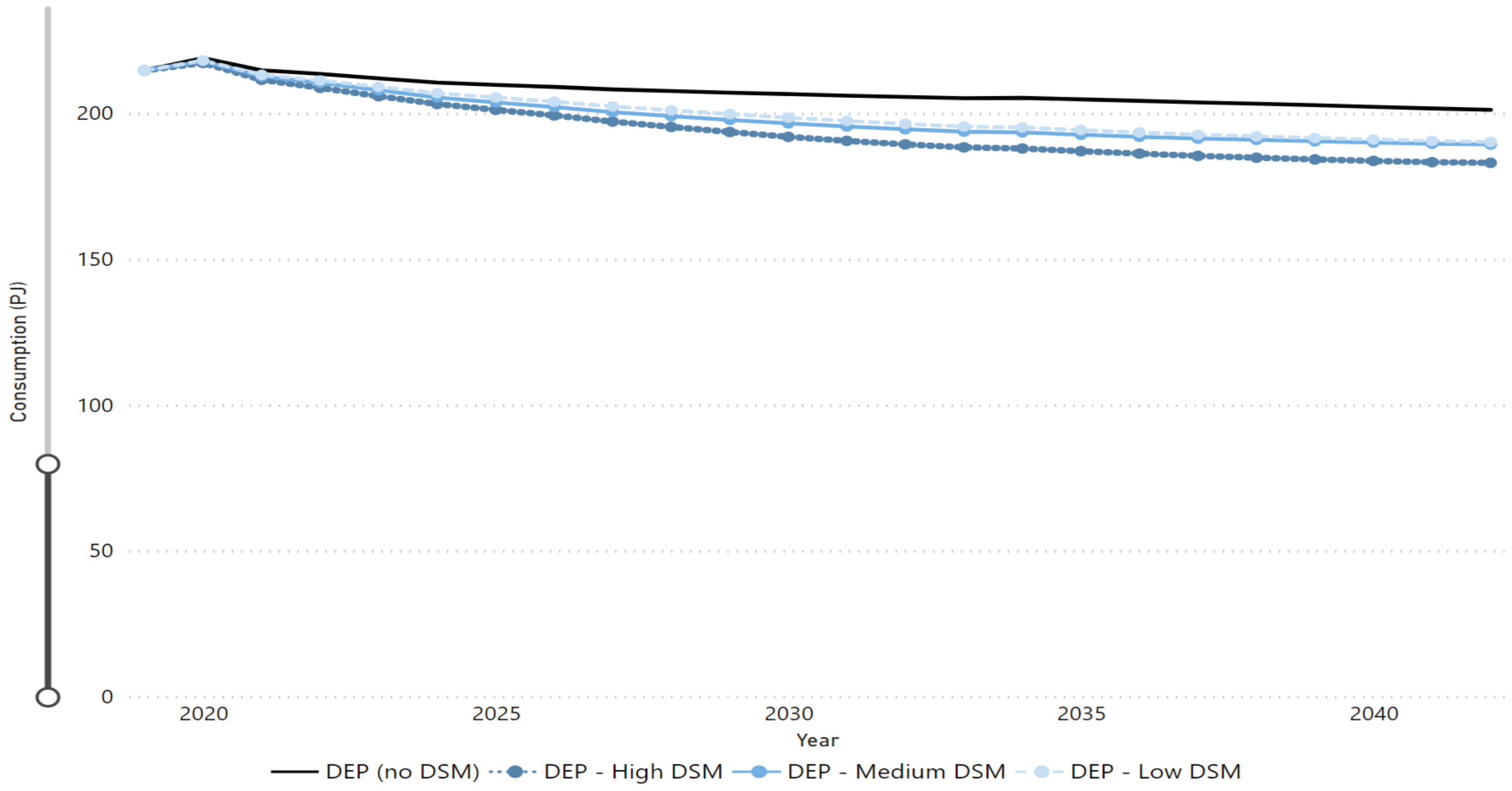
***Note:** Excludes LNG & CNG*

Pre- vs Post-DSM Consumption and GHG Emissions: Diversified Energy Planning Scenario



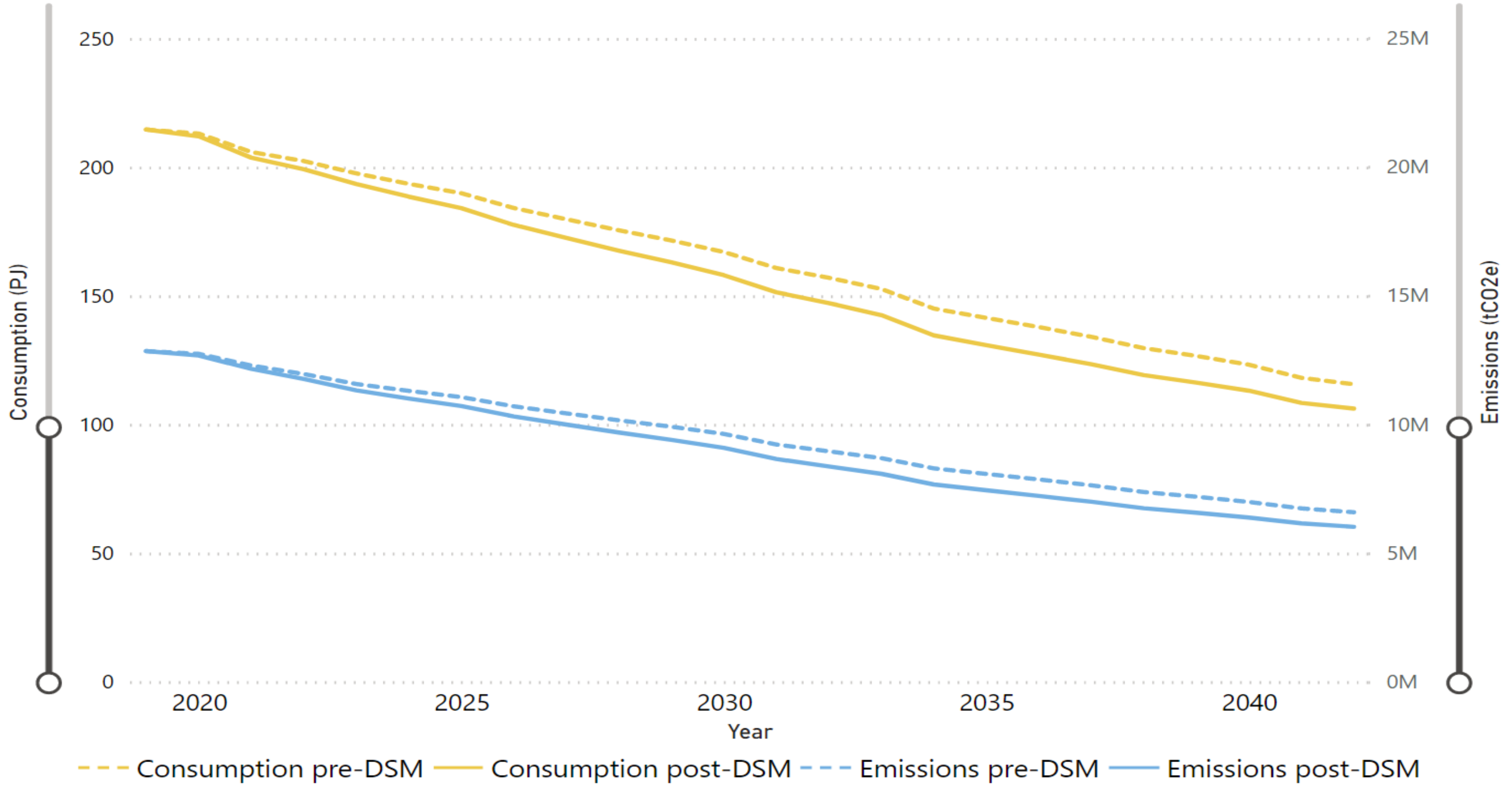
Note: *Excludes LNG & CNG*

Diversified Energy Planning: Consumption of 3 DSM Settings



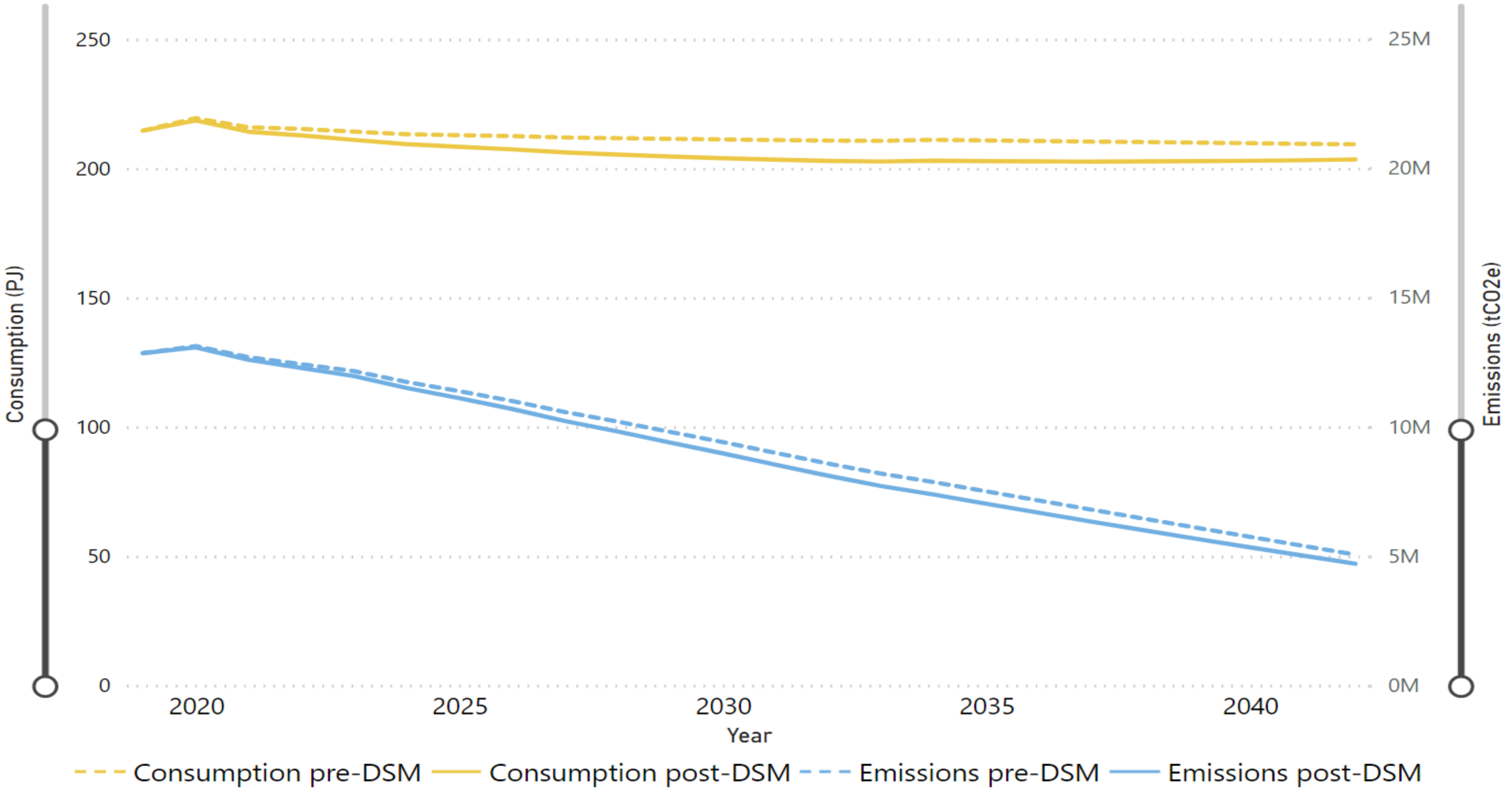
Note: *Excludes LNG & CNG*

Pre- vs Post-DSM Consumption and GHG Emissions: Deep Electrification Scenario



Note: *Excludes LNG & CNG*

Pre- vs Post-DSM Consumption and GHG Emissions: Price-Based Regulation Scenario



Note: *Excludes LNG & CNG*

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Questions & Discussion

Primer on Topics for the Next Session (December 1)

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System Capacity Planning

Peak Demand - System Capacity Planning vs. Gas Supply

Peak Demand – System Capacity Planning

- Determines the FEI infrastructure needed to deliver gas to core customers at a during a peak day or peak hour event
- Infrastructure requirements must also allow delivery of gas to firm transportation customers
- Location and distribution of demand within the transmission and distribution system is a significant factor in determining the available capacity

Peak Demand - Gas Supply Planning

- Determines supply resources needed to serve customers during a peak day event
- Resources/supply for transportation customers are not included

Annual Demand – Gas Supply Planning

- Determines the amount of gas FEI acquires and transports on behalf of customers on an annual basis
- Determines units of energy available to recover costs of service and rate of return

Peak Demand

- Demand is correlated with colder weather
- Peak demand estimated as the maximum hourly or daily consumption during an unusually cold weather event
- FEI designs systems to a cold weather event that might occur once in 20 years to ensure delivery of gas to all firm customers
- 22 weather zones throughout FEI service territory considered in peak planning for system capacity
- Peak demand does not include seasonal and interruptible customer classes

Peak Demand – Forecast Methods

Traditionally:

- Base year peak demand from UPCpeak values derived from currently measured consumption and current customers
- The UPC_{peak} values remain constant.
- Peak demand growth = ∑customer adds x UPC_{peak}
- The current industrial accounts are held constant with no increase or decrease in peak consumption over time

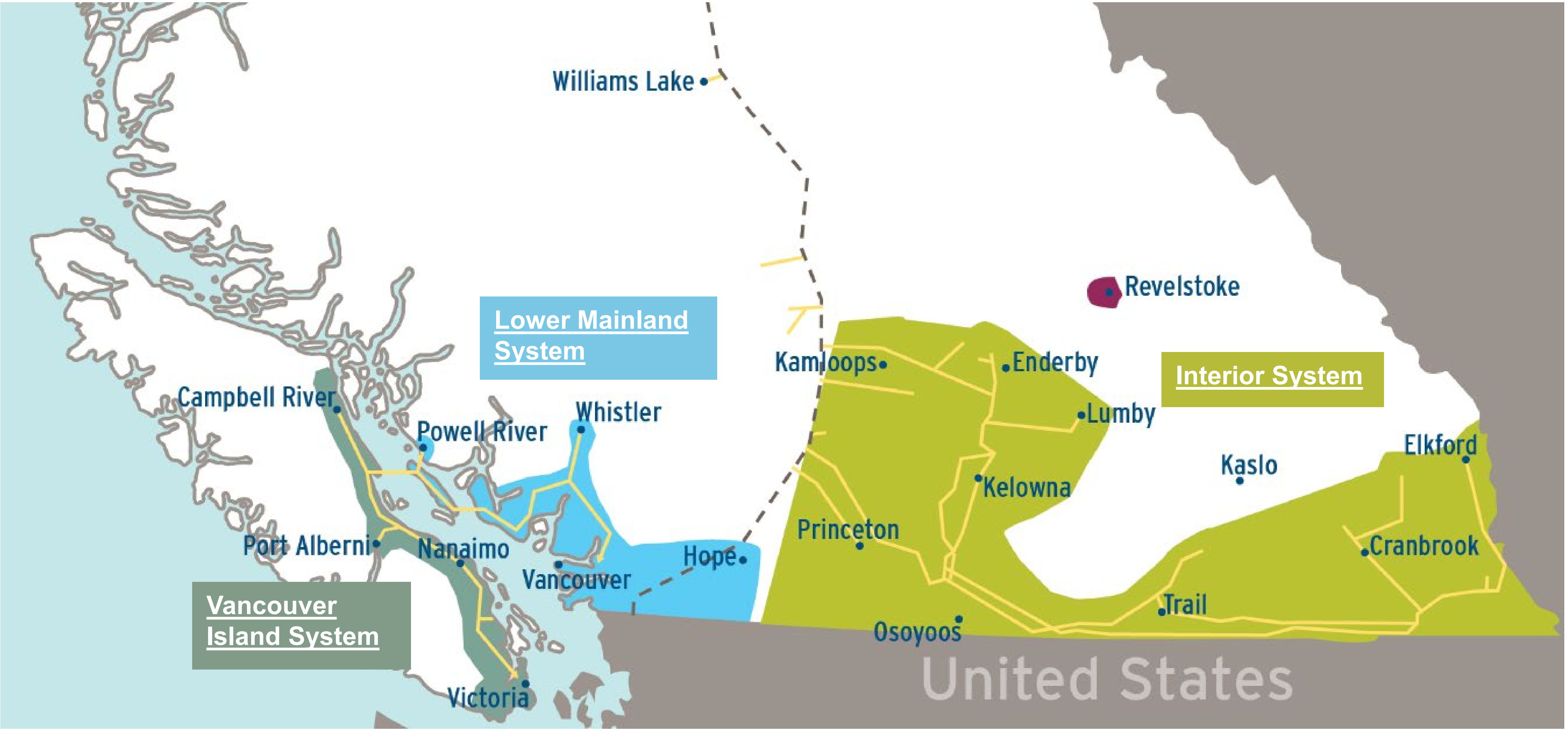
End-Use alternative comparison to the traditional method (conceptual):

- Base year peak demand is determined in the traditional manner.
- The UPC_{peak} values for existing and new customers core and industrial customers are varied over the planning period.
- UPC_{peak} variations are derived considering the same end use factors used to determine annual demand in each scenario.
- Industrial accounts will vary in the high and low forecasts.

FEI Regional Forecasts and Infrastructure

- Peak Demand Forecasts for FEI's three major transmission systems will be presented, reviewing capacity and proposed upgrade requirements to address peak demand.
  - Coastal Transmission System (CTS)
  - Interior Transmission System (ITS)
  - Vancouver Island Transmission System (VITS)

FEI Major Transmission Systems



LNG, RNG and Hydrogen

- Capacity considerations to support LNG, RNG, and Hydrogen delivery will be discussed.
- Requirements for each system are unique and will evolve over time.
  - Coastal Transmission System (CTS)
  - Interior Transmission System (ITS)
  - Vancouver Island Transmission System (VITS)

Infrastructure to support Peak Demand

For upcoming RPAG Session on December 1, 2021:

- Peak Demand Forecasts – Traditional vs Theoretical End Use methods
- Regional forecasts and infrastructure upgrades on FEI systems
- LNG expansion Woodfibre and Tilbury
- RNG and H_2 capacity considerations

Gas Supply

Regional Gas Market Resources

Supply Hubs:
- Station 2
- AECO/NIT

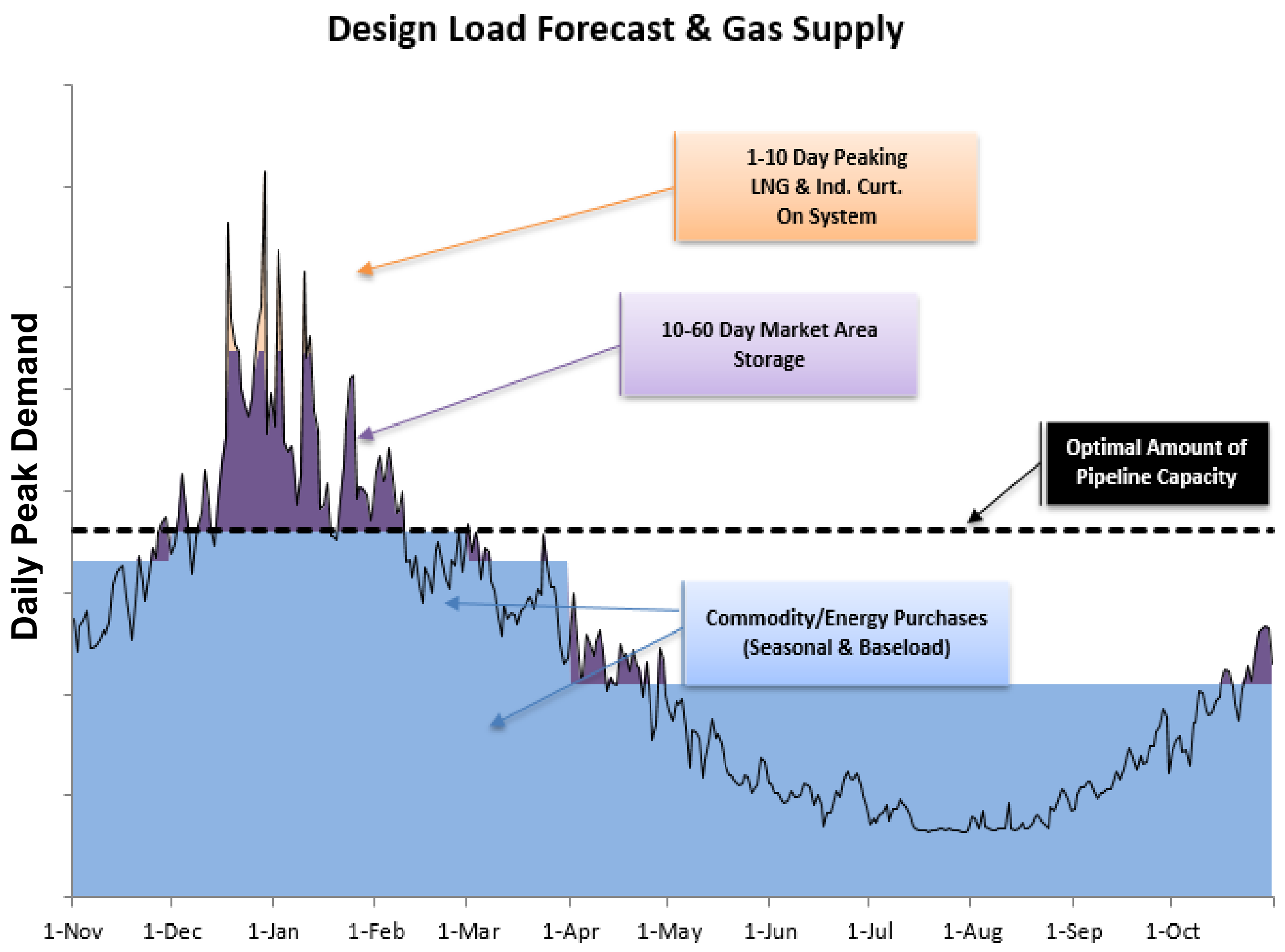
Market Hubs:
- Kingsgate
- Sumas

Seasonal Storage:
- Aitken Creek
- Rockpoint

Market Area Storage:
- Jackson Prairie
- Mist

LNG – Peaking Supply:
- Tilbury
- Mt. Hayes

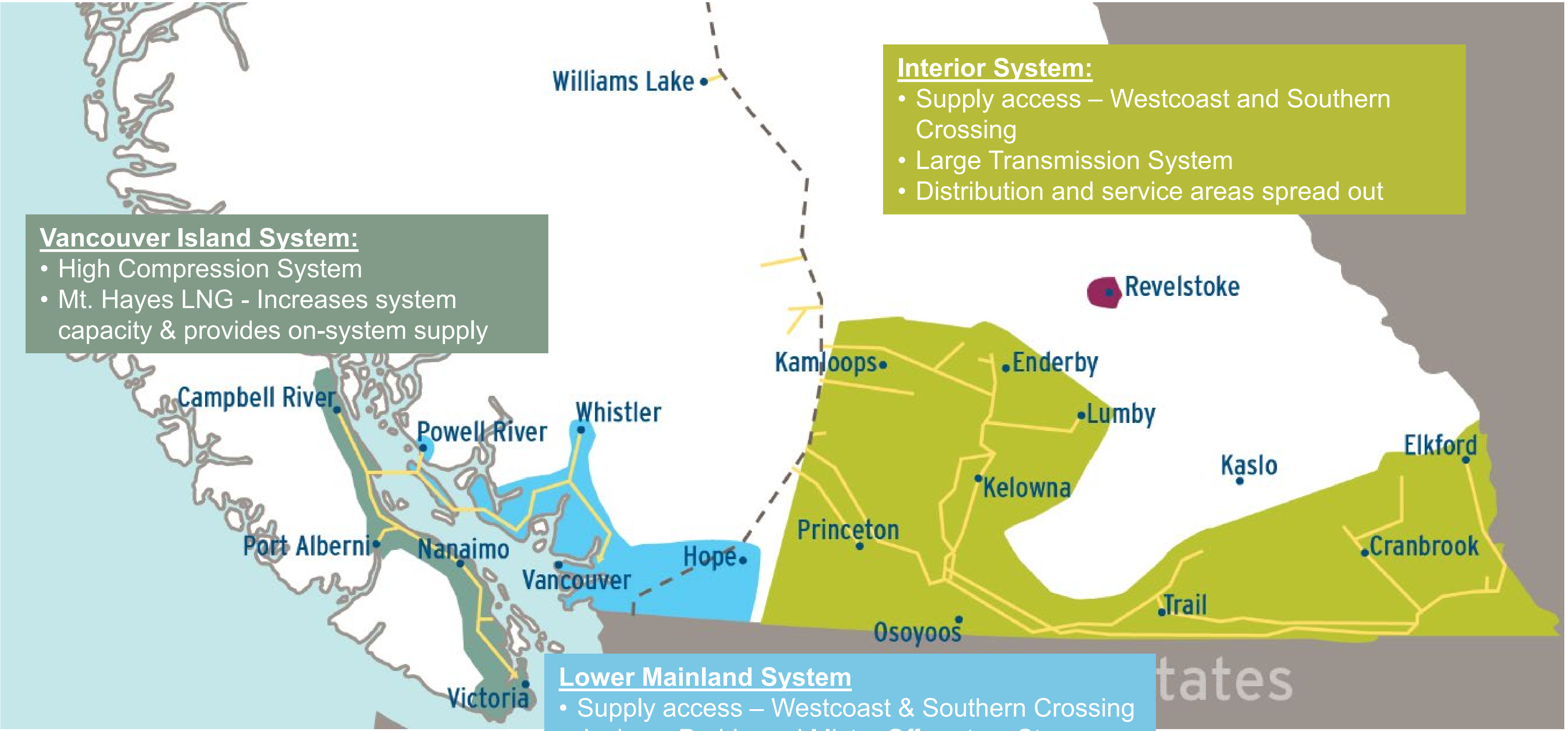
How FEI Meets its Load Requirements



Key objectives include balancing:

- *Security and reliability of gas supply*
- *Diversity of resources, pricing, counterparties*
- *Flexibility*
- *Cost minimization*

FEI's Load Centers and Characteristics

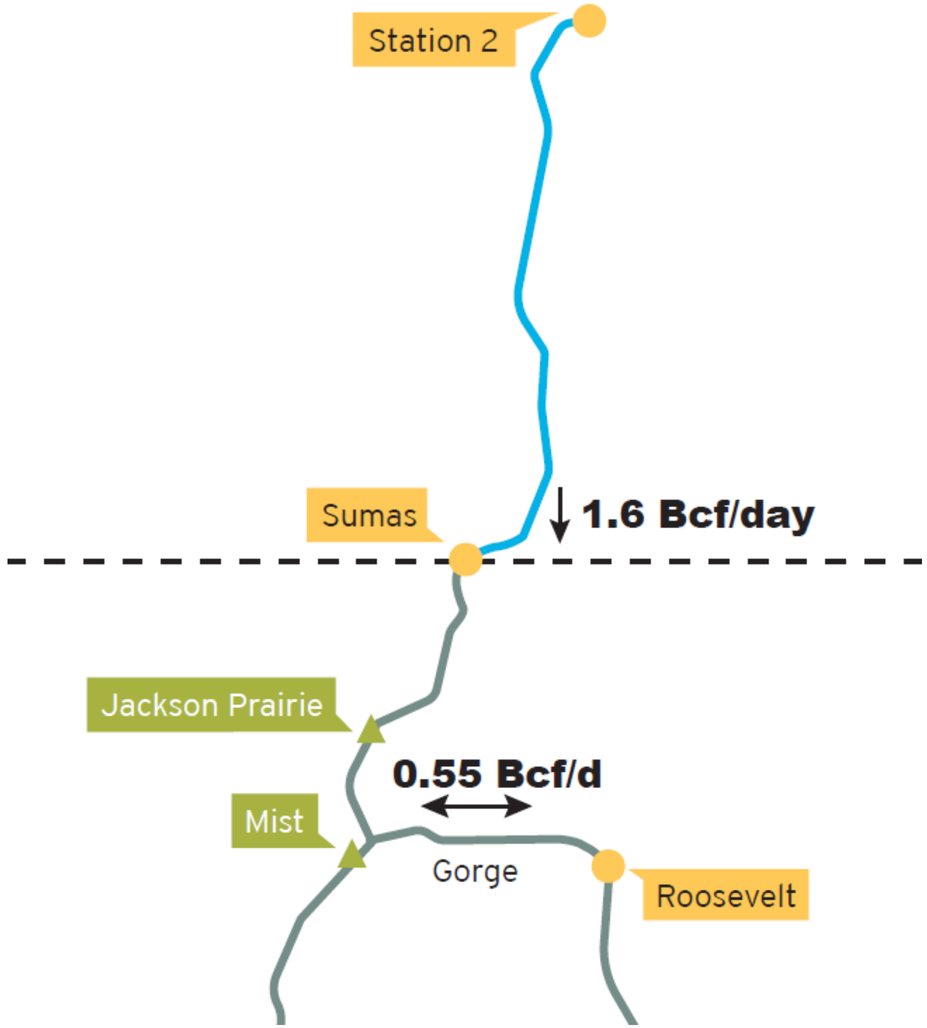


Interior System:
- Supply access – Westcoast and Southern Crossing
- Large Transmission System
- Distribution and service areas spread out

Vancouver Island System:
- High Compression System
- Mt. Hayes LNG - Increases system capacity & provides on-system supply

Lower Mainland System
- Supply access – Westcoast & Southern Crossing
- Jackson Prairie and Mist – Off-system Storage
- On-system LNG (Tilbury & Mt.Hayes) for peak & emergencies

Regional Challenges - Seasonal Constraint



- Coincidental demand and peaks on gas and power systems that are serviced by natural gas infrastructure.
- Baseload Resources - T-South 1.6 Bcf/day and NWP Gorge 0.6 Bcf/day to help meet the baseload supply requirements for the Lower Mainland, Seattle and Portland (I-5 Corridor).
- Short Term Assets (JPS/Mist) help with colder than normal weather.

Key Factors Impacting FEI's Supply Portfolio

Renewable Supply

- Incorporating Renewable Supply into the Portfolio
- Characteristics of On-System vs Off-System Supply

Regional Market Conditions

- Limited Resources in Region (constrained in winter)
- New demand ahead of additional pipeline infrastructure

Supply System Failure

- Hold contingency resources
- Portfolio Approach to Resiliency

New/Potential Regional Infrastructure

- Evaluate pipeline and storage alternatives
- Annual Contracting Plan's contracting strategies are focused on existing resources in region

Questions & Discussion

Wrap-up & Next Steps

Thank you for attending today's session, we appreciate your time and input. Additional opportunities to provide feedback will be announced shortly.

The session presentation and notes will be posted online in the next few weeks.

If you have any further feedback or questions, please reach out to the Resource Planning team at **irp@fortisbc.com.**

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Thank you

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fortisbc.com

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Appendix

Overview of 2022 LTGRP Scenarios: Narratives

Reference Case	Diversified Energy Planning	Deep Electrification	Price-Based Regulation	Economic Stagnation	Lower Bound	Upper Bound
• Expected continuation of current policies and market conditions • Incorporates known expected changes and trends in codes, standards, changes in building stock, carbon price, etc.	• Increased demand for electricity, ren ewables & NGT • Decarbonize gas system • Incorporates 30BY30 targets • FEI will plan to this scenario	• No increase in BC carbon tax but all other policies used to promote electrification • CCS uptake in applications that cannot electrify • Reduced uptake of NGT and renewable gasses	• Price signals boost supply of renewable gasses, CCS and NGT.	• Econ downturn causes refocus of gov't attention • Low carbon & gas prices and customer growth • Low LNG export and demand from NGT sector	• Notional lower bound for total volume; not intended to reflect narrative of a future possible world • CUs set to reduce demand & limit supply	• Notional upper bound for total volume; not intended to reflect narrative of a future possible world • CUs set to increase demand & boost supply

2022 LONG TERM GAS RESOURCE PLAN (LTGRP) SYSTEM PLANNING AND GAS SUPPLY DRAFT RESULTS

December 1, 2021

Energy at work FORTIS BC™

Welcome, Acknowledgment, Introduction

FortisBC acknowledges and respects Indigenous People in this place we call Canada, on whose traditional territories we all live, work and play.

FortisBC is committed to Reconciliation with Indigenous Peoples, using our Statement of Indigenous Principles to guide our words and actions.

Safety moment

- Prepare an emergency kit for your home and vehicle
- Pack enough supplies for 72 hours
- Store your emergency kit(s) in easily accessible locations
- For a full list of emergency kit items, please visit the Public Safety Canada website at: https://www.getprepared.gc.ca/cnt/kts/bsc-kt-en.aspx

Energy at work FORTIS BC™

Guiding Principles for FortisBC

Contribute to Province’s Decarbonization Goals

Integrated Optimized, and Low-cost GHG Abatement

Support Affordability

Understand and Mitigate Long-Term Impacts to Energy System

Diversified and Collaborative Energy Approach

Strengthen and Reliability and Resiliency

Agenda

Welcome, Acknowledgment, Introduction & Sessions Overview
(15 min.)

Renewable Gas – Comprehensive Review Filing
(30 min.)

System Planning
(45 min.)

Break
(10 min.)

Gas Supply
(60 min.)

Infrastructure Transition to Renewables and Resiliency
(45 min.)

Wrap-up & Next Steps
(5 min.)

Session Objectives

1. Report on feedback from previous RPAG session

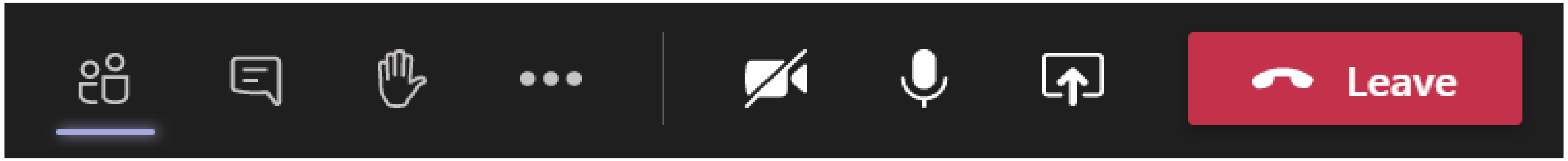
2. Discuss the Renewable Gas Comprehensive Review

3. Discuss the challenges and opportunities for gas system planning and supply

4. Inform you about the status of the 2022 LTGRP and next steps

Housekeeping

- Video participation is not required – presenters will use video
- When not speaking, please mute yourself to reduce background noise
- We will have scheduled breaks for questions and discussion
- We encourage you to use the hand-up function to indicate you'd like to speak
  - When we call upon you, feel free to un-mute, introduce yourself and speak clearly
  - You may also use the chat functionality to enter comments and questions if you'd prefer
- The session audio/video will not be recorded, however, the chat history will be saved for note-taking purposes
- Session participants should be visible by clicking on the participants icon

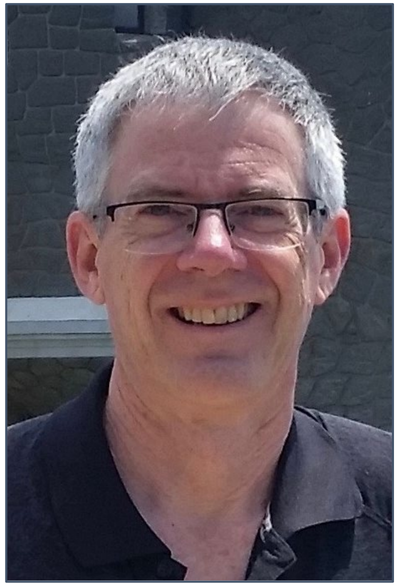


Feedback from November Session - Demand Side Management

- Concern expressed regarding CleanBC Roadmap to 2030 announcement and suggested delaying of the LTGRP:
  - many Roadmap details still to be finalized
  - many aspects of Roadmap already captured in the LTGRP scenarios.
- Recognition that both renewable natural gas and clean electricity are finite resources. Hydrogen offers vast opportunity to supply low carbon energy needs.
- Collaboration will be critical in identifying the right fuel for the right use at the right time.
- Clarification on highest performing DSM measures and other DSM measure details.
- Clarification on the DSM settings used in the scenarios and the alternative spending levels.
- Clarification on the avoided costs used to conduct the DSM cost tests:
  - Modified Total Resource Cost Test (MTRC)
  - avoided cost of renewable/low carbon gas.
- Support for updating the DSM analysis across all fuel supplies.
- Acknowledgment of the critical role of the gas infrastructure in decarbonizing.

Jason Wolfe
Director, Energy Solutions

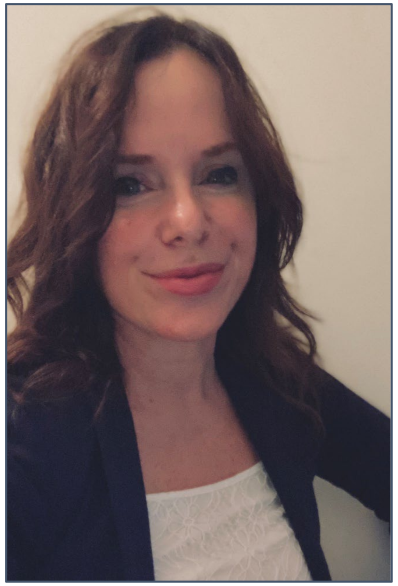
Bea Bains
Manager, Energy Products and Service



Terry Penner
System Capacity Planning Manager

Jordan Cumming
Commercial & Planning Lead, Energy Supply

Jesse Scharf
Energy Supply Market Analyst



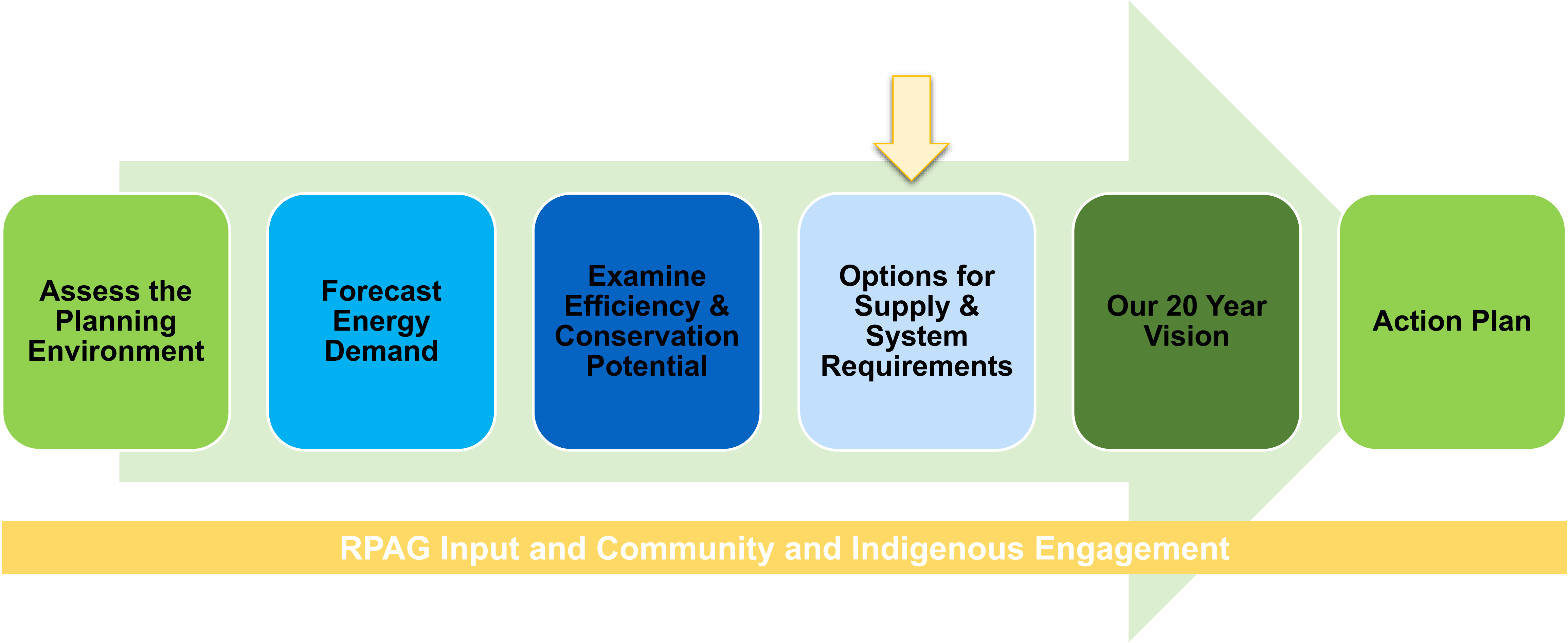
Tania Specogna
Director, Resource Development

FortisBC Speakers

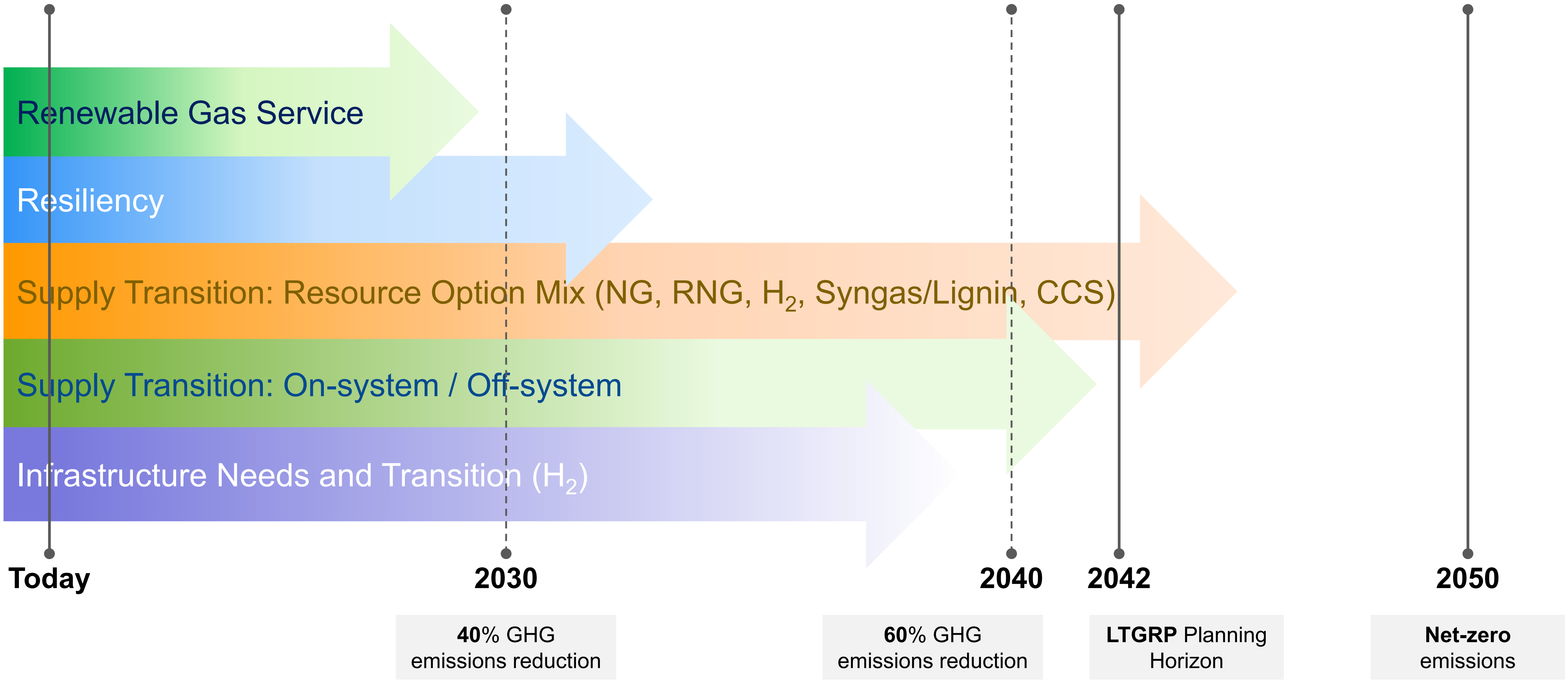
Resource Planning Advisory Group (RPAG) Members Registered for this Session

- Avista Utilities
- BC Business Council
- BC Hydro
- BC Ministry of Energy, Mines & Low Carbon Innovation
- BC Public Interest Advocacy Centre
- BC Sustainable Energy Association
- BC Utilities Commission
- Building Owners & Managers Association
- Canadian Institute of Plumbing and Heating
- City of Burnaby
- City of Kamloops
- City of Prince George
- City of Surrey
- Clean Energy Association of BC
- Commercial Energy Consumers Association of BC
- Community Energy Association
- District of Saanich
- Enbala
- Metro Vancouver
- Midgard Consulting (Representing Residential Consumer Intervener Association)
- MoveUP
- North West Gas Association
- NW Natural
- Northern Alberta Institute of Technology
- Pembina Institute
- Pollution Probe
- Puget Sound Energy
- SFU Renewable Cities
- University of Victoria

Recall the LTGRP Process



Understanding the Transition to Renewable / Low Carbon



Renewable Gas – Comprehensive Review Filing

Background and History of Program and Framework

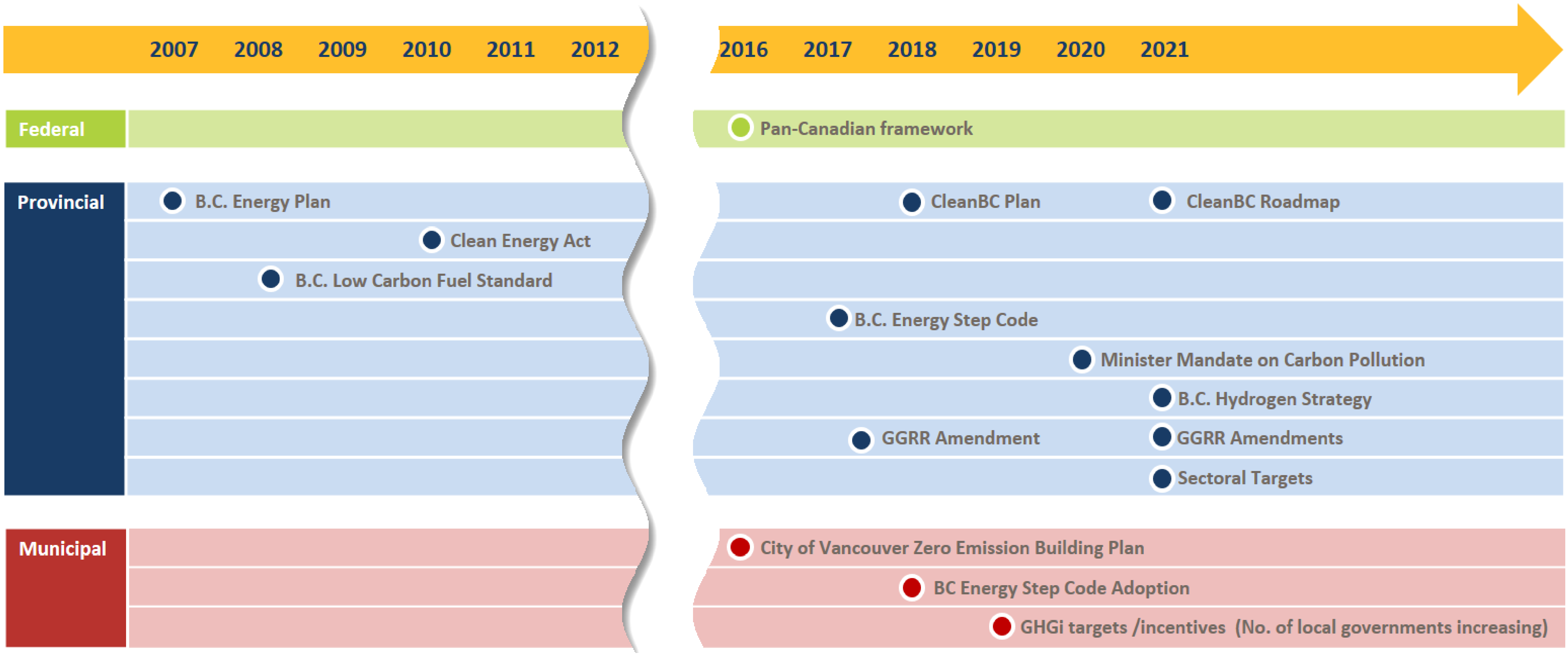
Characteristics	Phase 1 Pilot Program 2010-2013	Phase 2 Permanent Program 2013-	Phase 3 New RG Rate (BERC) 2016 -	Phase 4 GGRR amended to include RG Supply 2017 -	Phase 5 GGRR amended and BERC review 2021-
Volumes and Cost	0.25 PJ/Yr @ $15.28/GJ	1.5 PJ/Yr @ $15.28/GJ	1.5 PJ/Yr @$15.28/GJ	8.9 PJ/Yr @$30/GJ	>31 PJ/Yr @ $31/GJ
Supply Projects	First two projects	Added projects	Continued to add projects	First Out-of-province Supply	Acquisition includes project ownership
Offerings	Customer Program initiated	Expanded Customer Offering	Long Term Contracts Available	No Change	New Proposal
Pricing	BERC = discount to electricity	BERC = discount to electricity	BERC = Market Price	No Change	New Proposal

Scope of Application Review

Operating Environment has Evolved Rapidly

- Operating environment has rapidly evolved since last BERC Rate filing
- Regulations enacted at the Federal, Provincial and Municipal government levels focus on reducing emissions
- Customers are wanting energy choice
- Customer segments have different needs and regulations
- Diversified pathway where utilize both the gas and electric infrastructure is the optimal solutions for BC

All Levels of Government Adopted Policies for Decarbonization

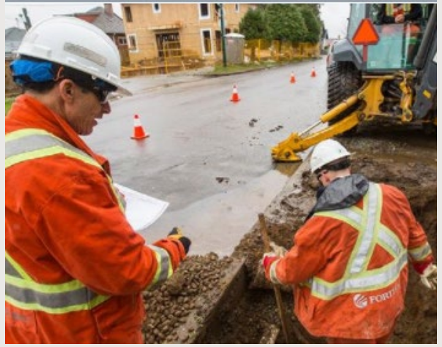


Local Governments Adopted Emissions Reduction Targets in Buildings

Local Governments with GHGi Targets for New Construction

- City of Vancouver
- District of North Vancouver
- City of Burnaby
- City of Richmond
- City of Surrey

Local Governments Providing Incentives for New Construction

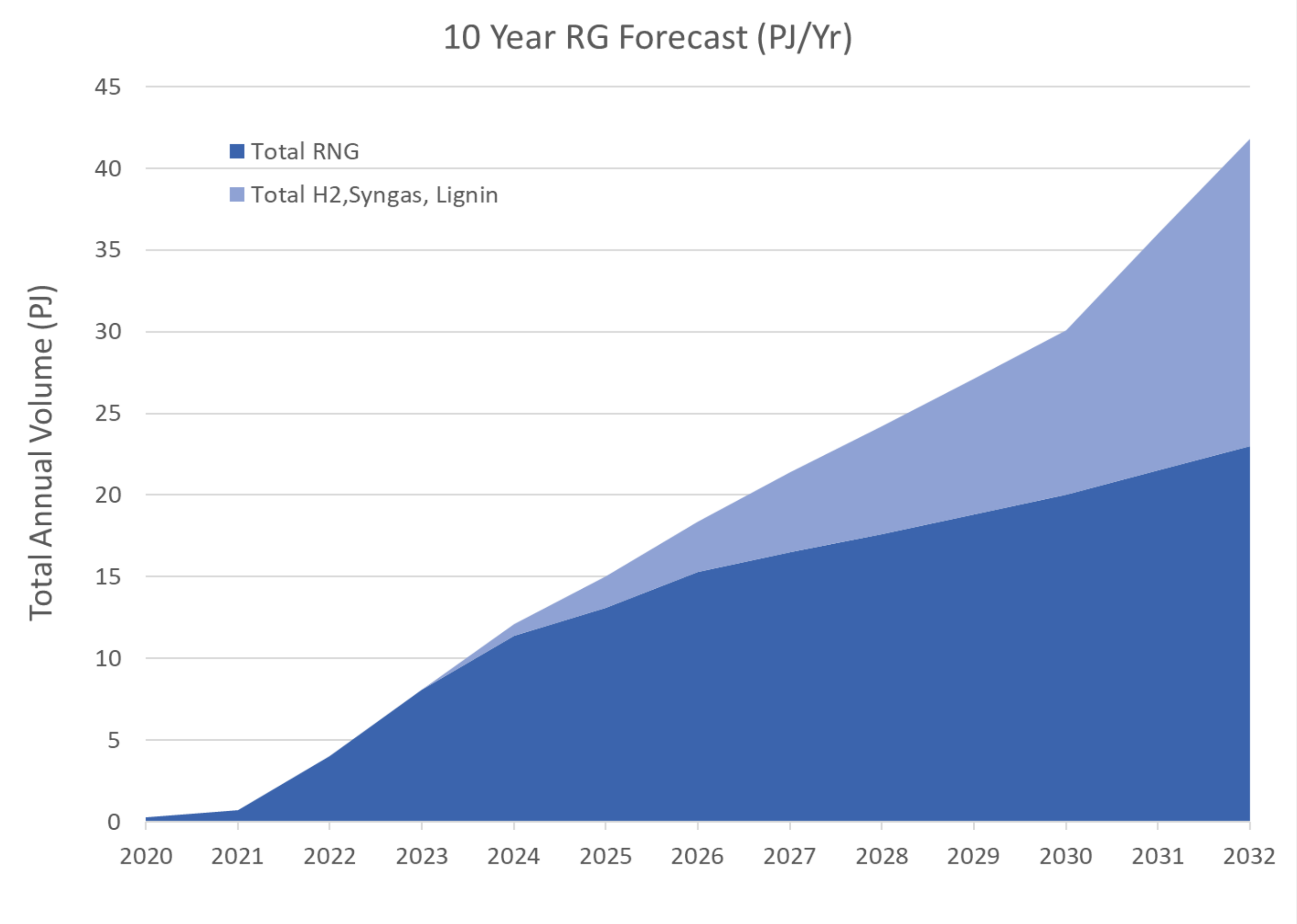


- City of Surrey
- District of Squamish

- Municipalities' decarbonization polices are making it difficult for customers to choose gas in their new development
- Local governments:
  - Adopting greenhouse gas emissions (GHGi) targets in their bylaws/zonings
  - Providing incentives to builders for no gas connection
  - Looking for permanent emissions reduction for the life of the building
- Customers opting for electricity as the easiest path to meet the GHGi targets

10 Year Renewable Gas Supply Forecast

Developed pre-2021 CleanBC Roadmap



- Experience in developing RG projects
- Scale and diversity of supply projects has grown since the program's inception
- Working collaboratively with suppliers in and outside of BC

Proposed RG Service Offerings

New

Decarbonizing existing and new customers' gas supply

All existing sales customers to receive a specified blend of RG targeting 1% in 2024 and increasing over time

New residential gas connection customers to receive 100% RG for the life of their building

Ongoing

Voluntary RG Blends

No change to existing offering*
Blends of 5, 10, 25, 50 or 100 per cent RG

*Except NGV, T-Service and Long Term Contracts

Renewable Gas Program Benefits

- Encourage the efficient use of existing assets for the benefit of all customers
- Responsive to Customer Needs or Requirements
- Responsive to Government Policies
- Price to support uptake in RG offerings to maximize revenue
- Match Supply to Demand

Consultation on Tariff and program design

- **Two Phases:**
  - **First Phase scope:** general awareness and current status of the RG program, RG supply outlook, the development and overarching scope of the Application
  - **Second Phase**: in progress
- **Stakeholders:**
  - Interveners, Customers, Provincial and Local governments, Building Sector – builders/ developers /associations, trades and manufacturers
- **Letters of Support:**
  - To date received 65 letters of support for the Application from a municipality, manufacturer, builders/developers, associations and consultants.

Next Steps: Regulatory Process

December 2021	Mid-January 2022	Late January to February 2022	TBD
File Application with BCUC	**Workshop on Key Elements**	**IRs Round 1**	**Further Regulatory Process**

Questions and Discussion

System Planning

Peak Demand

- Peak Demand Forecasts – Traditional and Theoretical End Use methods
- RNG and H_2 capacity considerations
- Regional forecasts and infrastructure upgrades on FEI systems
    - LNG expansion Woodfibre and Tilbury

Peak Demand

Peak Demand

- Highest demand expected on the system
- Correlated to cold weather
- Does not include seasonal and interruptible customer classes
- Peak demand estimated as the maximum consumption hourly during an unusually cold weather event
- FEI designs systems to ensure delivery of gas to all firm customers in a cold weather event that might occur once in 20 years
- 22 independent weather zone throughout FEI service areas considered in peak planning for system capacity

Peak Demand - Gas Supply vs. System Capacity

Peak Demand - Gas Supply Planning

- Determines supply resources needed to serve customers during a peak day event
- Resources for transportation customers are not included

Peak Demand – System Capacity

- Determines the infrastructure needed to deliver gas to core customers during a peak day or peak hour event
- Infrastructure requirements must also allow delivery of gas to firm transportation customers
- Location of demand within the transmission and distribution system is a significant factor

Peak Demand and Peak Forecast for System Capacity

Peak Demand (base year)

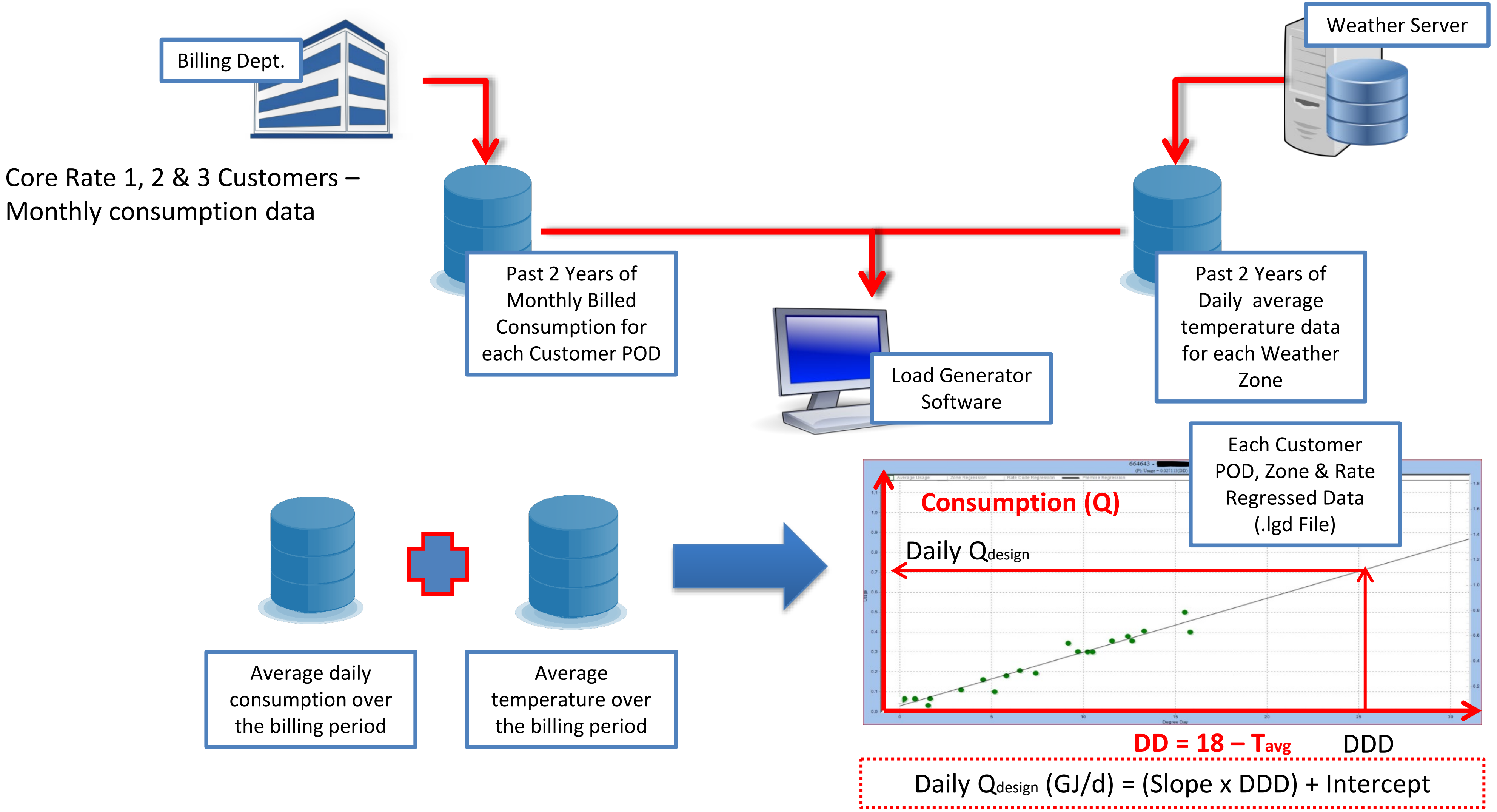
- Peak Demand $=$ UPC_{peak} x Current Accounts $+$ Ind. Demand

Peak Demand Forecast (traditional)

- Peak Demand (year n) $=$ UPC_{peak} x (Current Accounts + $\sum_{1}^{n} New\ Accounts$) $+$ Ind. Demand

Values for UPC_{peak}, industrial demand remains constant over the forecast period

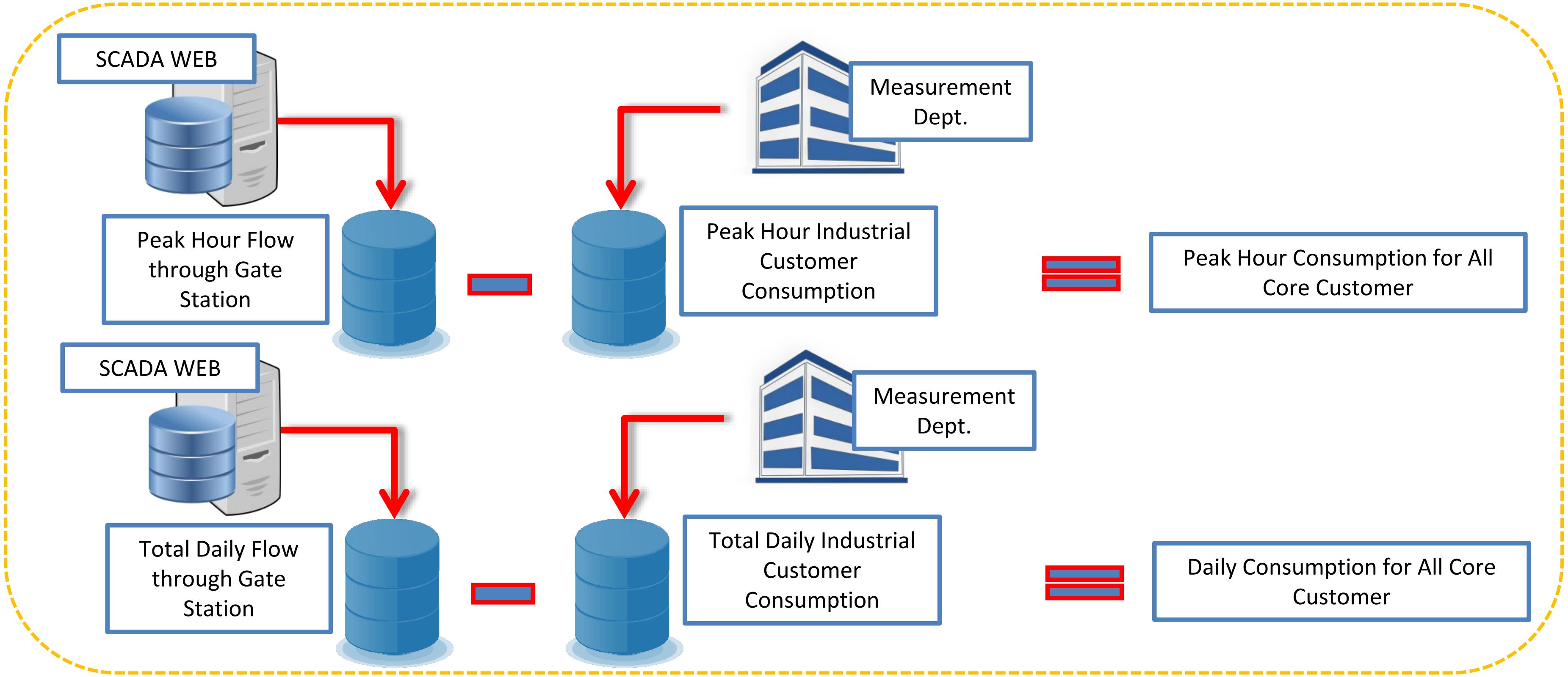
How do we derive Peak Hour Load for our Hydraulic Models and Forecasts ?



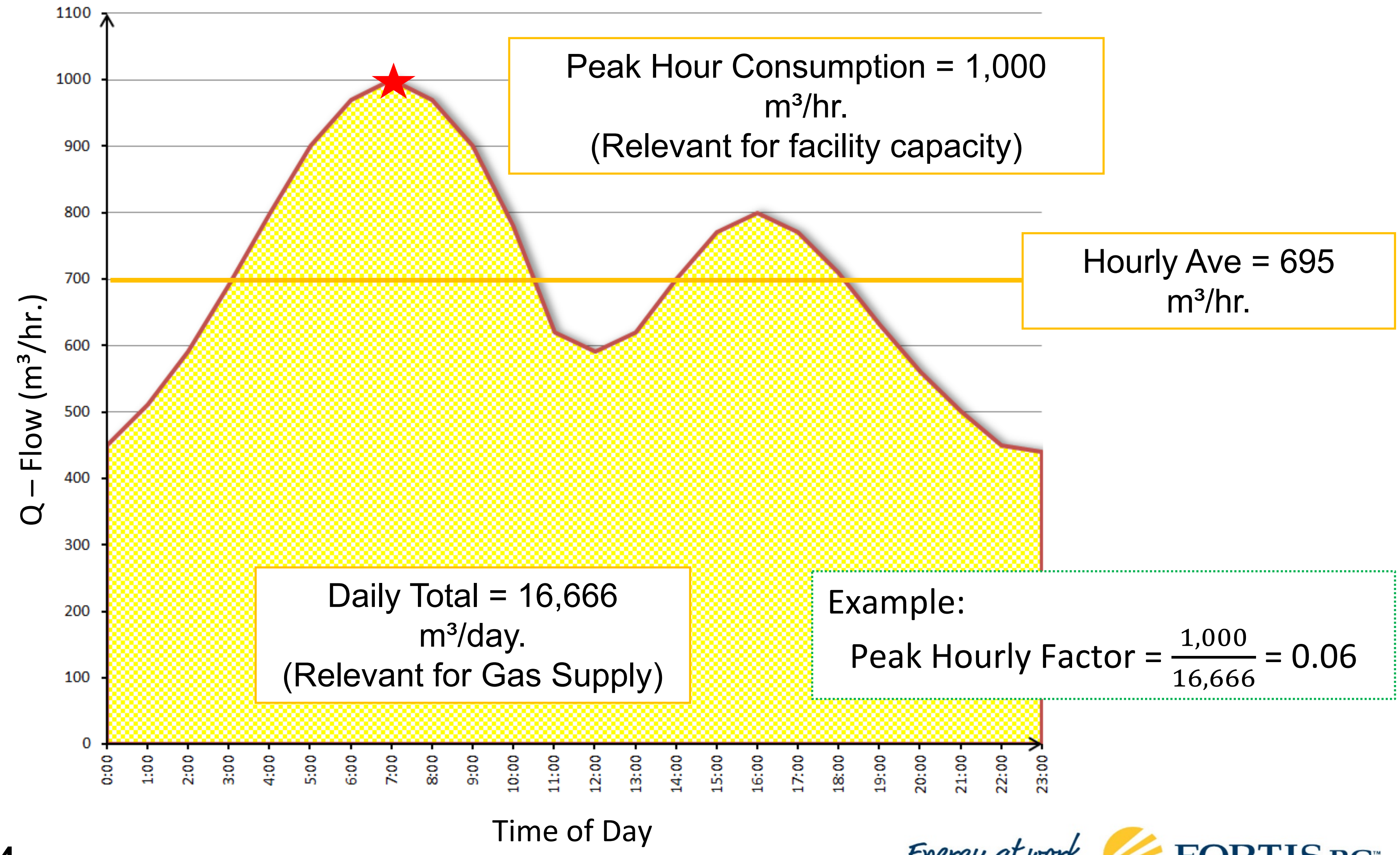
Peak Hour Factor

- Used to convert daily consumption to peak hour consumption for customers with monthly consumption data only. (Rate 1, 2 & 3 Customer)
- Peak Hour typically happen around 7am or 8am

Peak Hourly Factor = Peak Hour Consumption / Daily Consumption



Peak Hour Factor (continued)



Peak Demand Method

Peak Hour Use Per Customer (Std m3/hr)

- UPC_{peak}=Daily Q_{Design} x PHF/HV

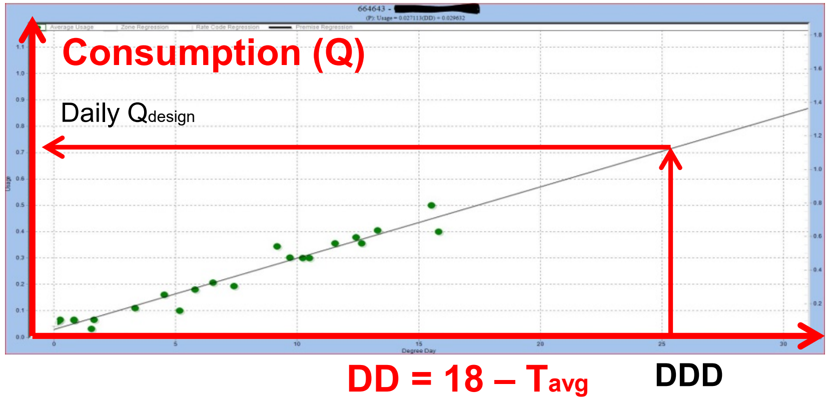
  HV = Heating Value (GJ/std m3)

  Heating value converts energy demand into the equivalent standard volume used for hydraulic modeling

- Average UPC_{peak} values for each region and for each rate class (1,2 & 3) are determined

- Regional UPC_{peak} values are averaged with the results of the previous two years analysis to smooth any atypical changes in UPCpeak that don't sustain year over year

- The resulting 3 year rolling average UPC_{peak} values are used in modeling and forecasting



Daily Q_{design} (GJ/d) = (Slope x DDD) + Intercept

DDD = Design Degree Day

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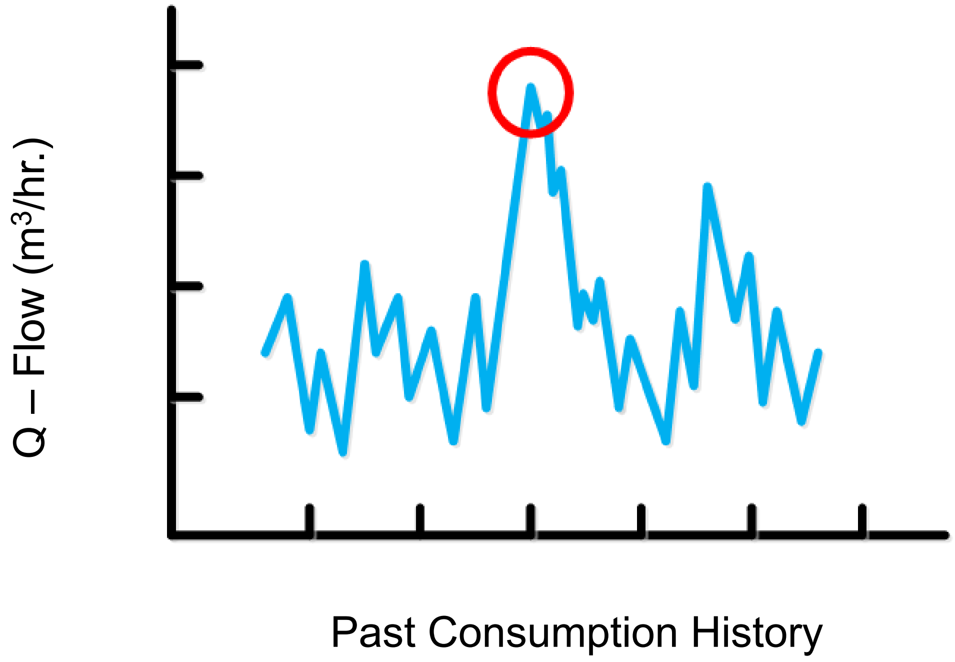
Peak Demand Method

Industrial Customers – Hourly measurement

- For process (non weather sensitive loads) the maximum observed hourly demand is used
- For weather sensitive demand a temperature regressed value is used
- No peak hour factor is applied

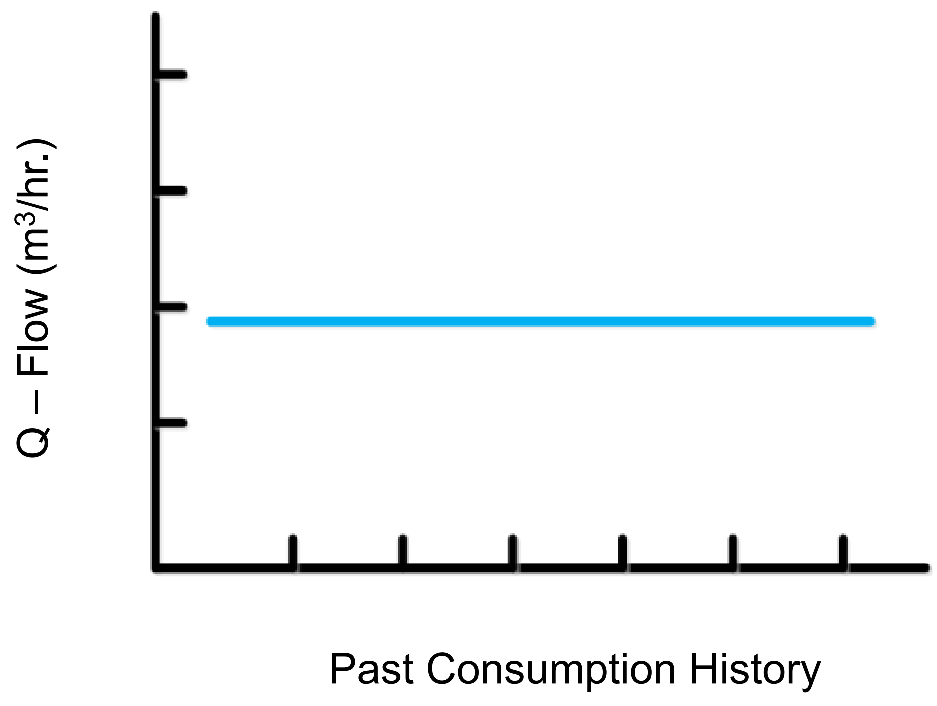


Peak Demand Method

Customers with contract firm– Contract DTQ obligations

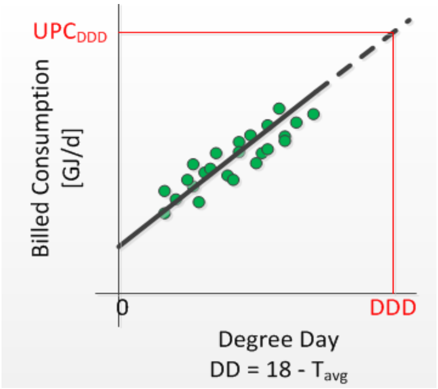
- Large interruptible transportation customers may have a firm contract amount

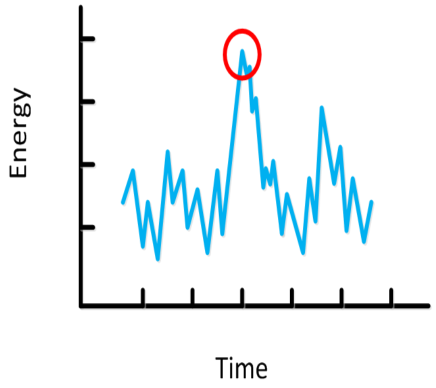
- These customers are limited to 5% of their firm daily total quantity (DTQ) under peak hour conditions

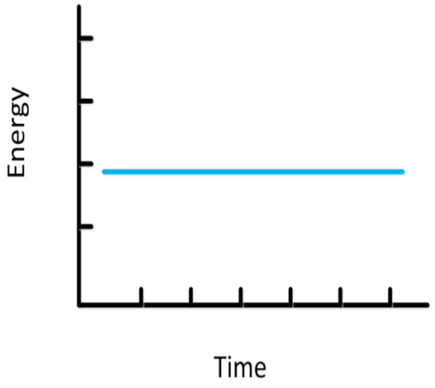


Peak Demand Method

Peak Demand = Demand Rate 1,2,3 + Industrial Maximum Observed + Firm DTQ Contract Obligations







Peak Demand Forecast

Traditionally…

- Base year peak demand for core customers is determined as previously described
- The current UPC_{peak} values are applied new customers over the planning period

  (added peak consumption = $\sum$customer adds x UPC_{peak})

- The current industrial account and firm DTQ contract account numbers are held constant with no increase or decrease in peak consumption

Peak Demand Forecast

Examining alternatives to the traditional method…

- Base year peak demand for core customers is determined as previously described.
- The UPC_{peak} values for existing and new customers core and industrial customers are varied over the planning period.
- UPC_{peak} variations will be derived considering the same end use factors used to determine annual demand in each scenario.
- Industrial accounts will vary in the high and low forecasts.

Peak Demand Forecasts from End-Use Scenarios

Posterity has develop a process linking peak demand forecasts to the end-use scenarios used in the annual forecasting.

- Method relies on applying hours use factors from end-use load shape profiles
- Hour use factors and Days use factors from end use load shapes were applied to sequentially break down:
  - Annual $\rightarrow$ peak daily consumption
  - Annual $\rightarrow$ peak hourly consumption
- End-Use Base Year hourly UPC_{peak} for each rate schedule and region were derived.
- Results corrected to design temperatures for each region
- Calibration factors to match FEI's current values of UPC_{peak} were determined

Capacity Impacts of Renewable Gases

Capacity Impacts of Renewable Gases

- The future of gas delivery on FEI system will include renewable gases such as Bio-methane or RNG and Hydrogen or Hydrogen Natural Gas blends
- Delivery will initially be predominantly off-system and over time incorporate larger scale on-system delivery of renewables
- Delivery within the FEI system will include:
  - Hubs with locally produce RNG, H_2 and/or Syngas delivered to local consumers
  - Renewable gases and gas blends delivered through FEI transmission and distribution systems to a broader customer base

Capacity Impacts of Renewable Gases

Off-System Delivery of Renewable Gases

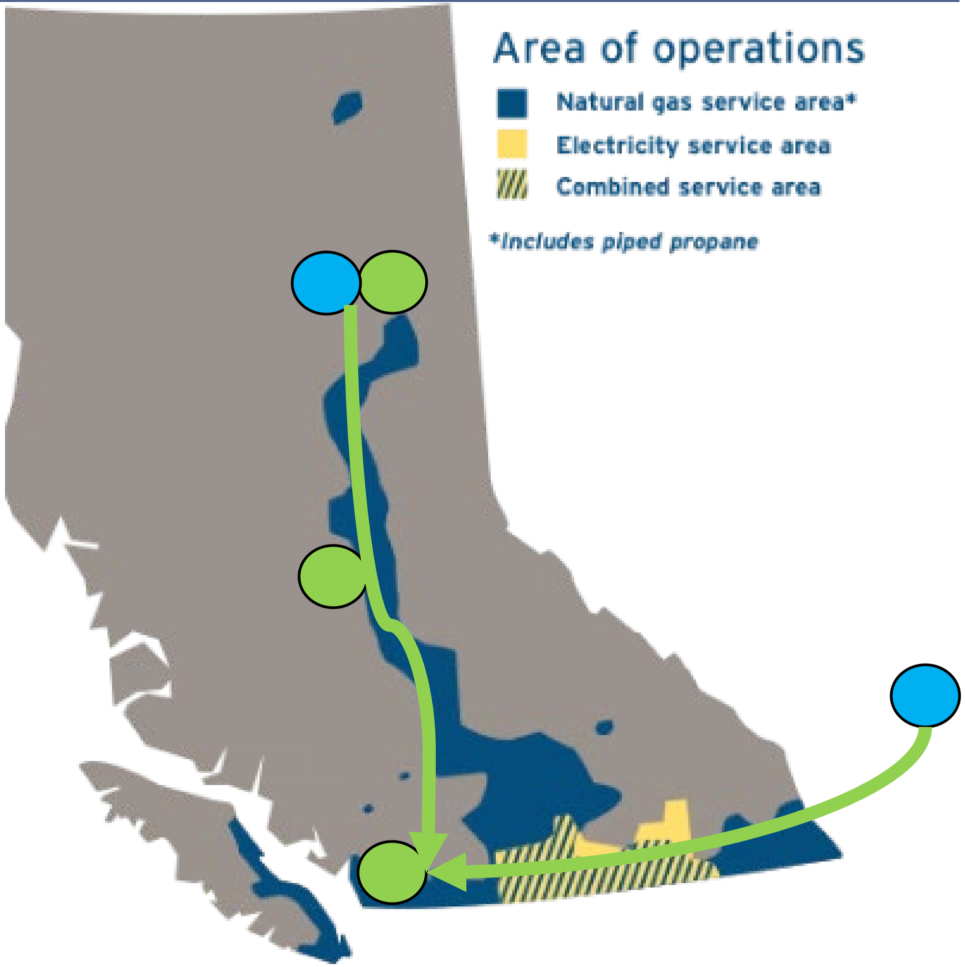
- RNG or H_2 acquired off-system and consumed off-system does not alter FEI Capacity Planning or infrastructure requirements

- FEI continues to deliver the same volume of natural gas on the system

Capacity Impacts of Renewable Gases

On-System Delivery of Renewable Gases - RNG

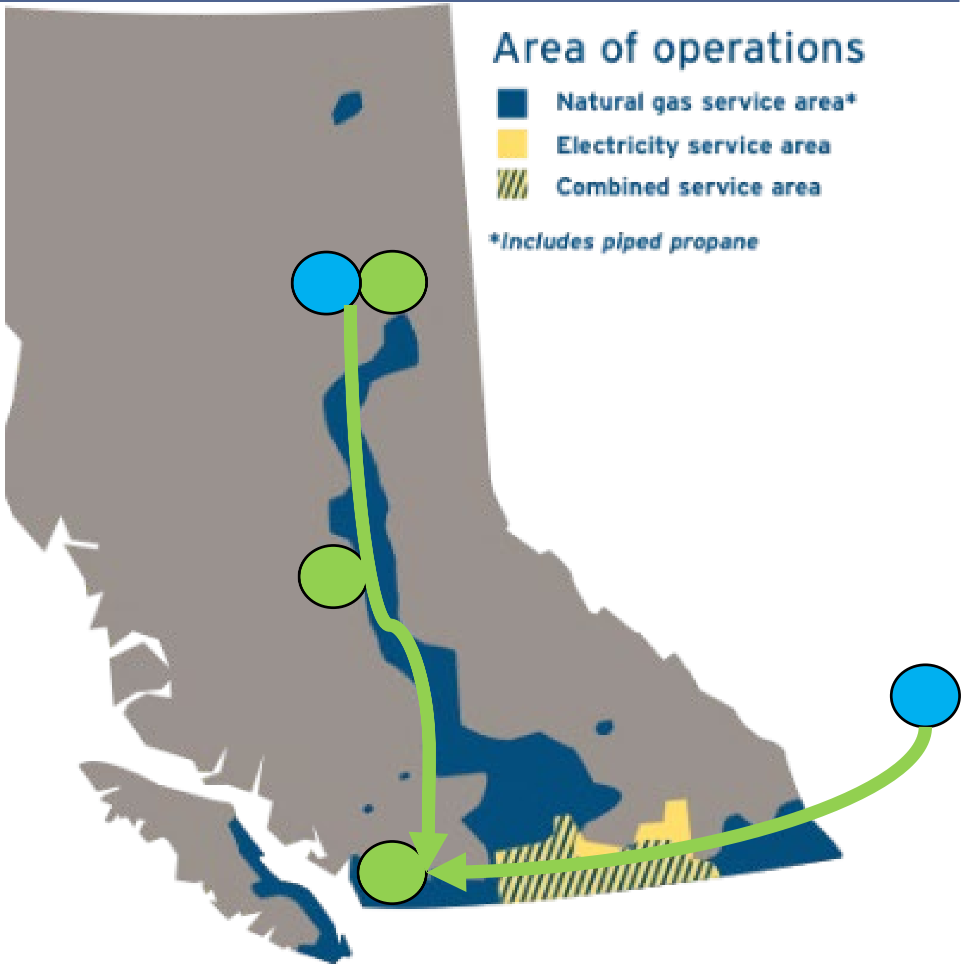
- RNG Hubs within FEI distribution systems often involve some local distribution level system upgrades
- Locally generated supply can incrementally free capacity on upstream transmission system
- RNG delivered into FEI systems from Enbridge or TC Energy will impose the same capacity impacts and upgrade requirements on FEI systems as traditional



Capacity Impacts of Renewable Gases

On-System Delivery of Renewable Gases – H_2

- H_2 Hubs within FEI distribution systems will also involve some local distribution level system upgrades
- Locally generated H_2 supply can incrementally free capacity on upstream transmission system
- H_2 delivered thru FEI transmission systems from Enbridge or TC Energy or generated at some point along FEI's system will be enabled by future capacity upgrades on FEI's systems



Capacity Impacts of Renewable Gases

Delivery Of Hydrogen or H_2 / Natural Gas Blends:

- Consider a hypothetical NPS 30 150 mile long pipeline
- Max. Pres 1440 psig, Del. pressure 500 psig, Velocity Constraint 24 m/s
- Energy content: Natural Gas = 38.9 MJ/m^3, H_2 = 12.1 MJ/m3

Pipeline delivery of Natural Gas and Hydrogen

Hydrogen Blend (% By Volume)	Volume Delivery (MMscfd)	Energy Delivery Hydrogen (%)	Energy Delivery Narural Gas (%)	Energy Delivery Total (TJ/d)	Capacity Limiting Constraint
0	871	0	100	960	Delivery Pressure
50	1095	23.8	76.2	791	Delivery Pressure
100	2347	100	0	805	Delivery Pressure*
100	1943	100	0	666	Gas Velocity**

* Gas velocity reaches 51 m/s

** Delivery pressure of 900 psig

Capacity Impacts of Renewable Gases

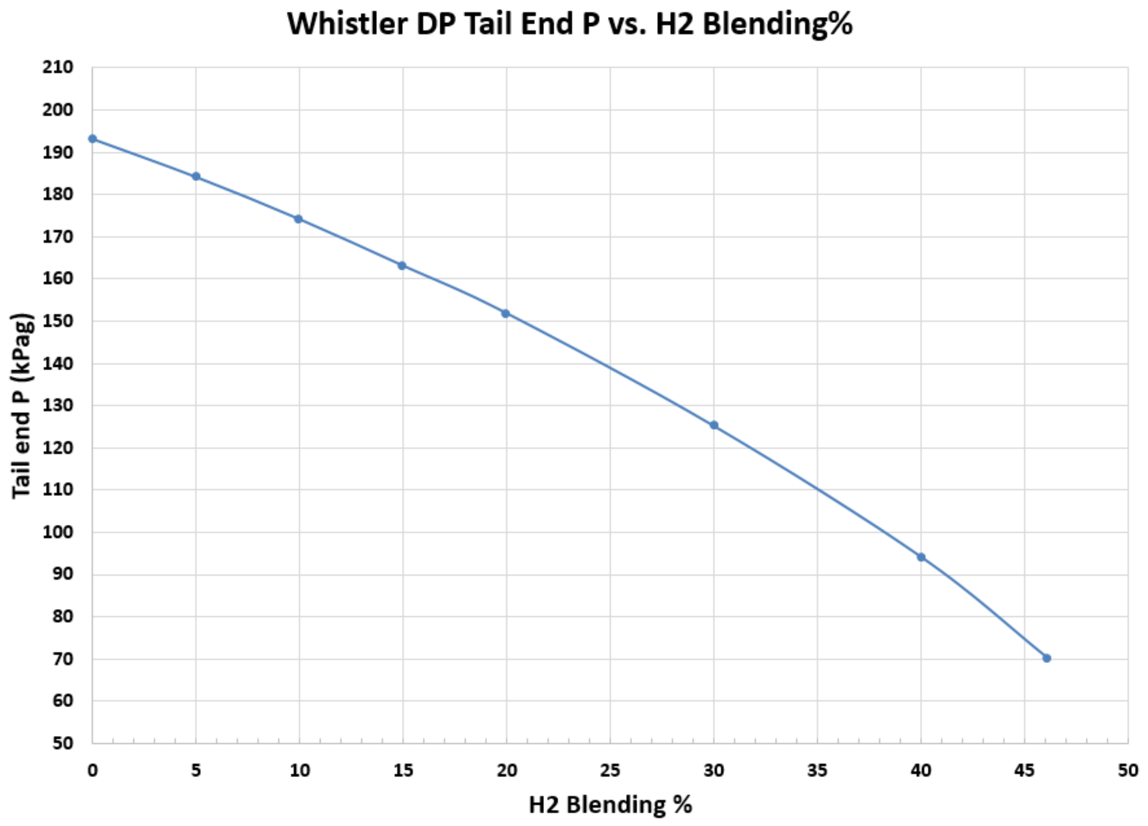
Delivery Of Hydrogen or H_2 / Natural Gas Blends:

- 100% Hydrogen delivery – Distribution system example, Whistler BC

Capacity Impacts of Renewable Gases

Delivery Of Hydrogen or H_2 / Natural Gas Blends:

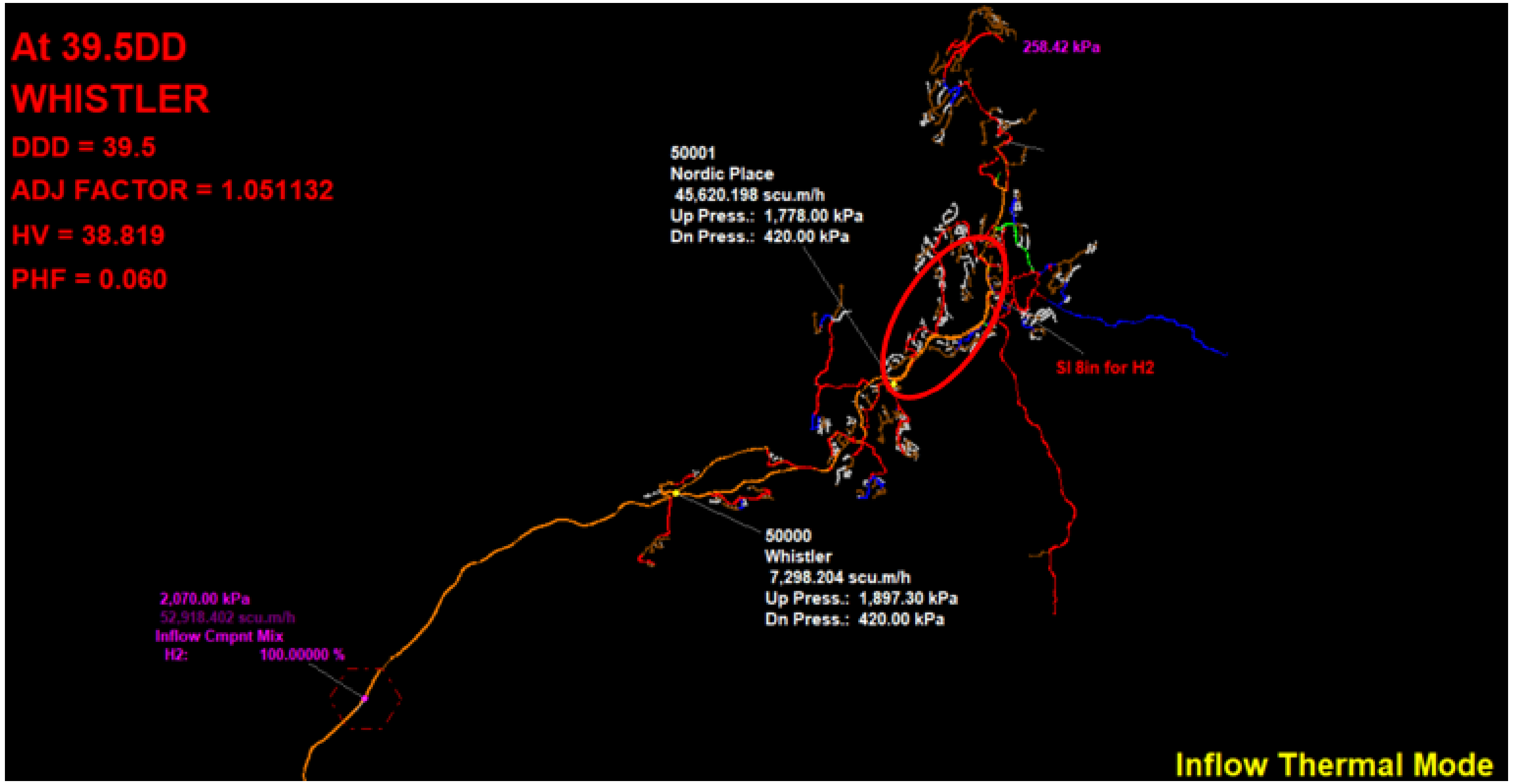
- Example of the existing Whistler distribution system receiving Hydrogen



Capacity Impacts of Renewable Gases

Delivery Of Hydrogen or H_2 / Natural Gas Blends:

- 100% Hydrogen delivery would require ~3300 m of pipeline looping



Capacity Impacts of Renewable Gases

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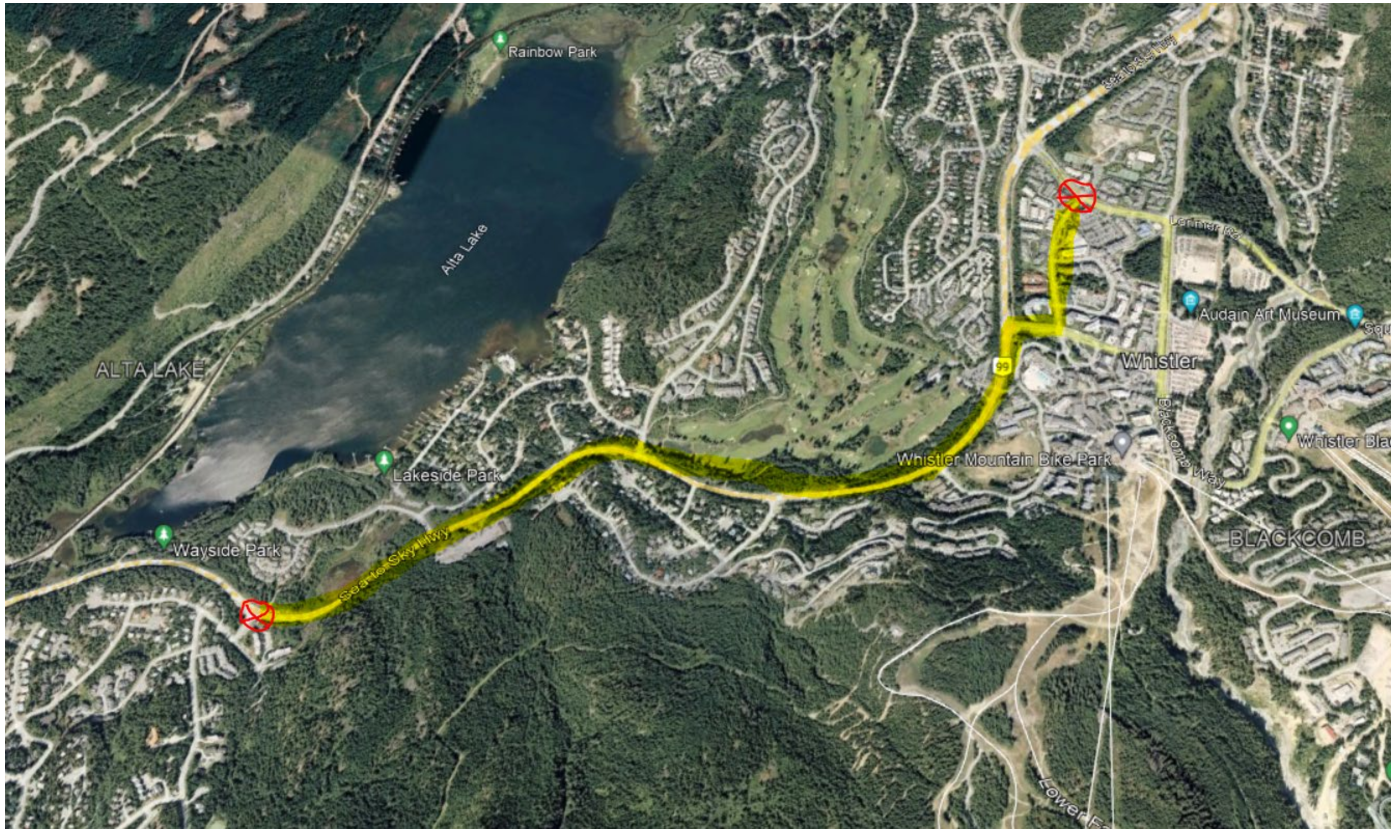


Gas System Reinforcements

Peak Demand ≤ **System Capacity**

Compression

Pipelines

LNG Peaking Storage Facilities

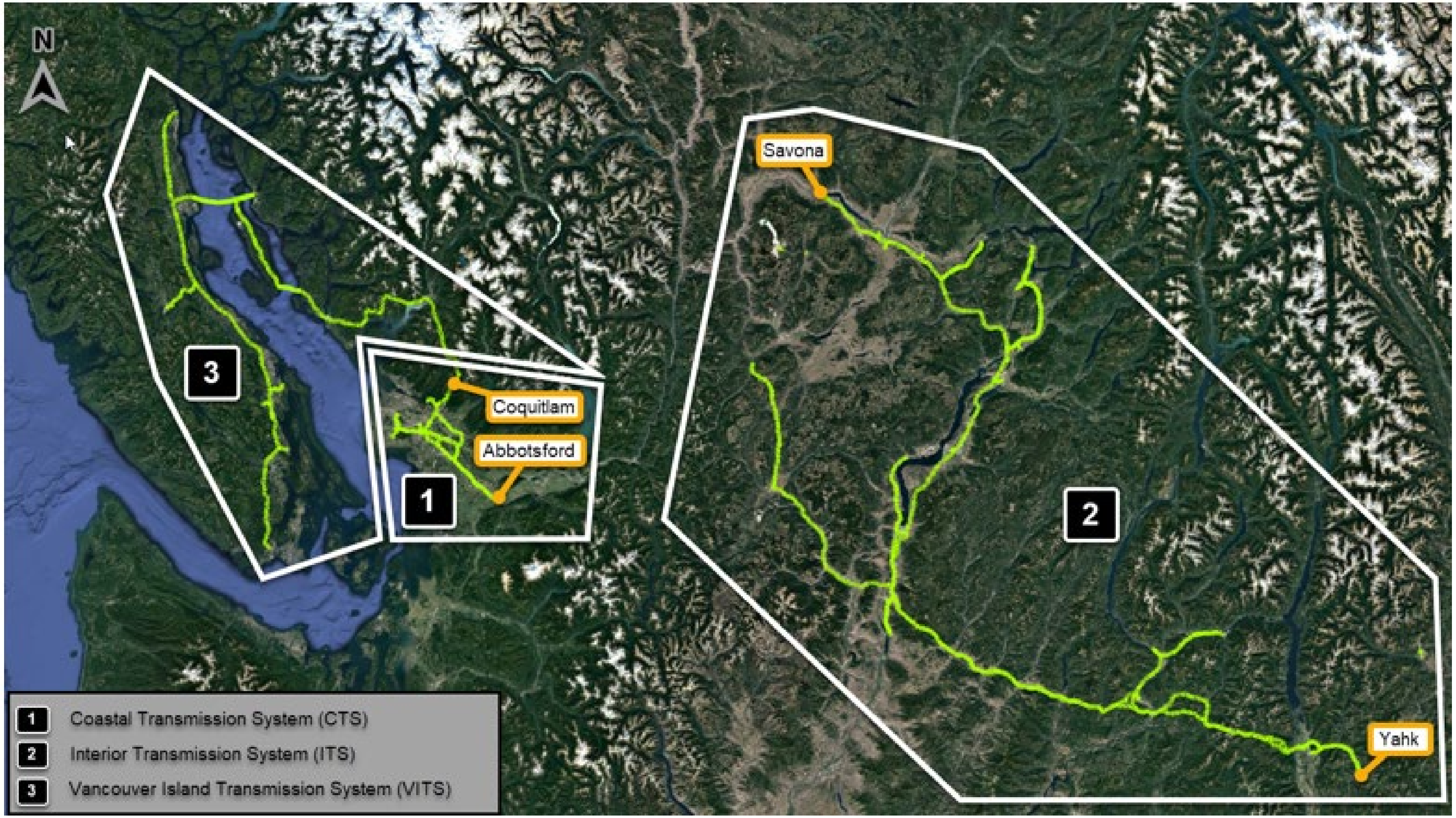
Infrastructure to Meet Peak Demand Forecasts

The following slides will present the infrastructure requirements to meet the regional peak demand

In each region we will:

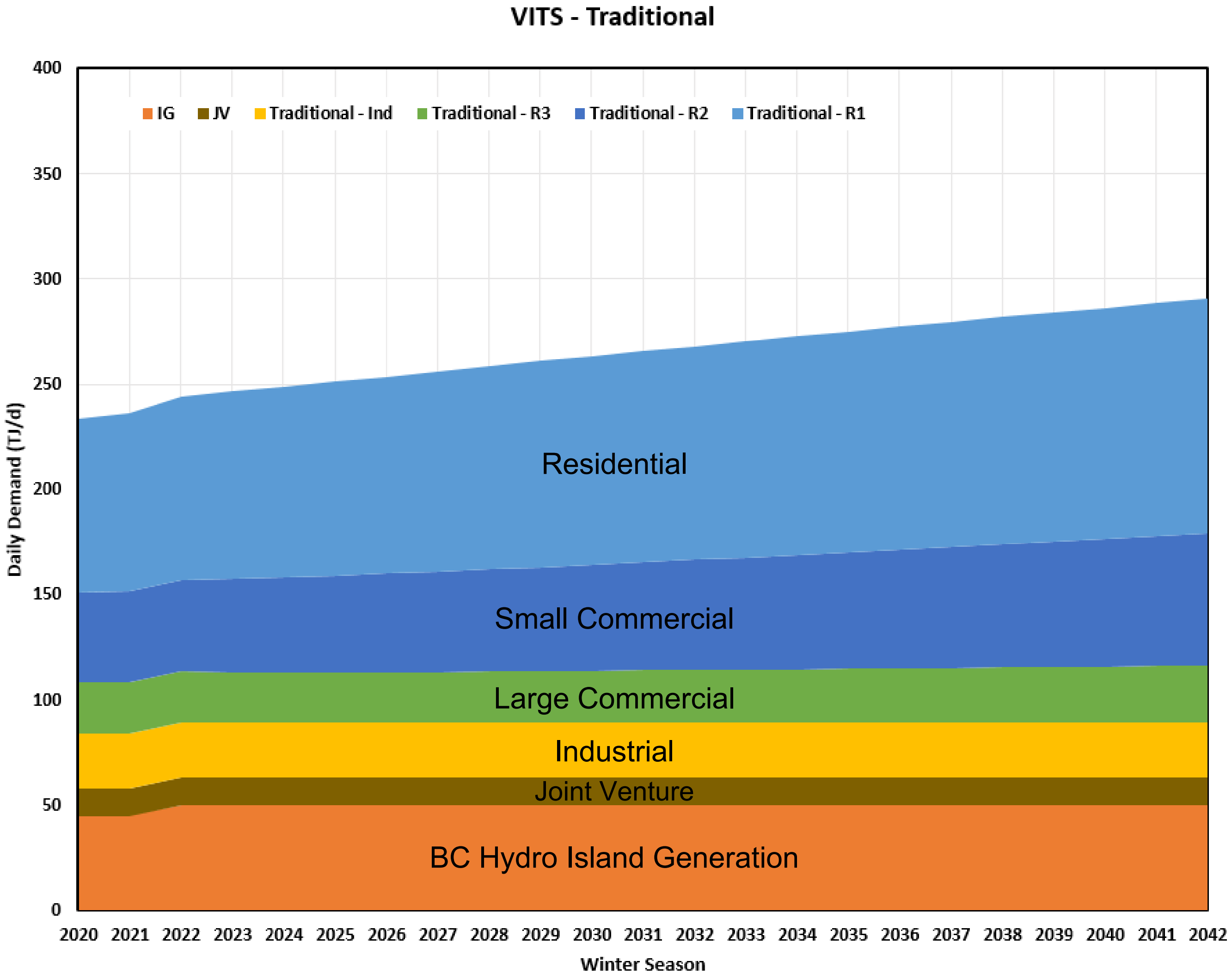
- Briefly review current infrastructure (schematics)
- Review the system capacity constraint using our current traditional peak forecast
- Review system expansion options

FEI Transmission Systems

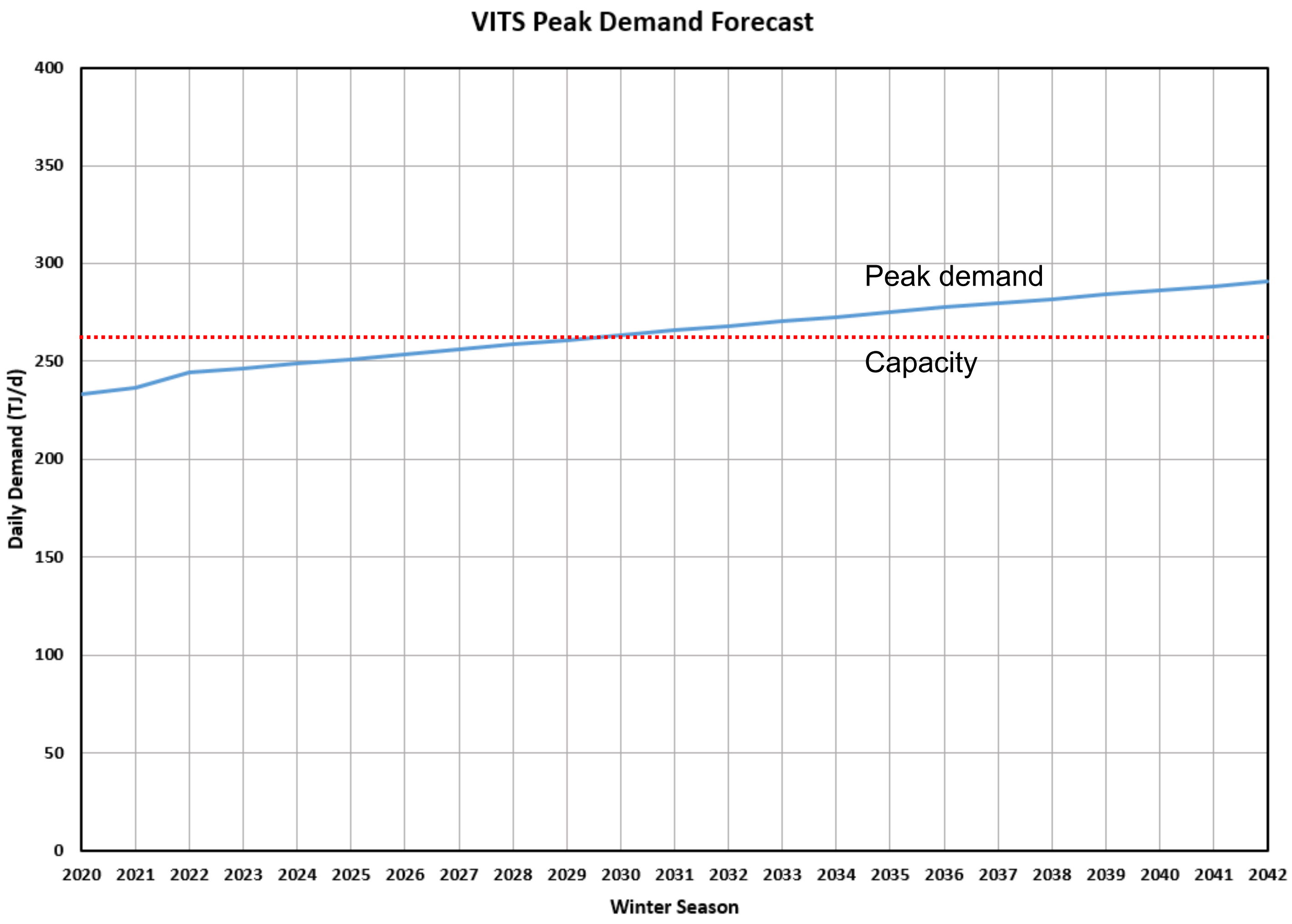


VI Transmission System

VI Capacity Traditional Peak Forecast



VI Capacity Traditional Peak Forecast



VI Infrastructure to meet Traditional Peak Forecasts

System Expansion Alternatives:

Option 1 – Additional Compression

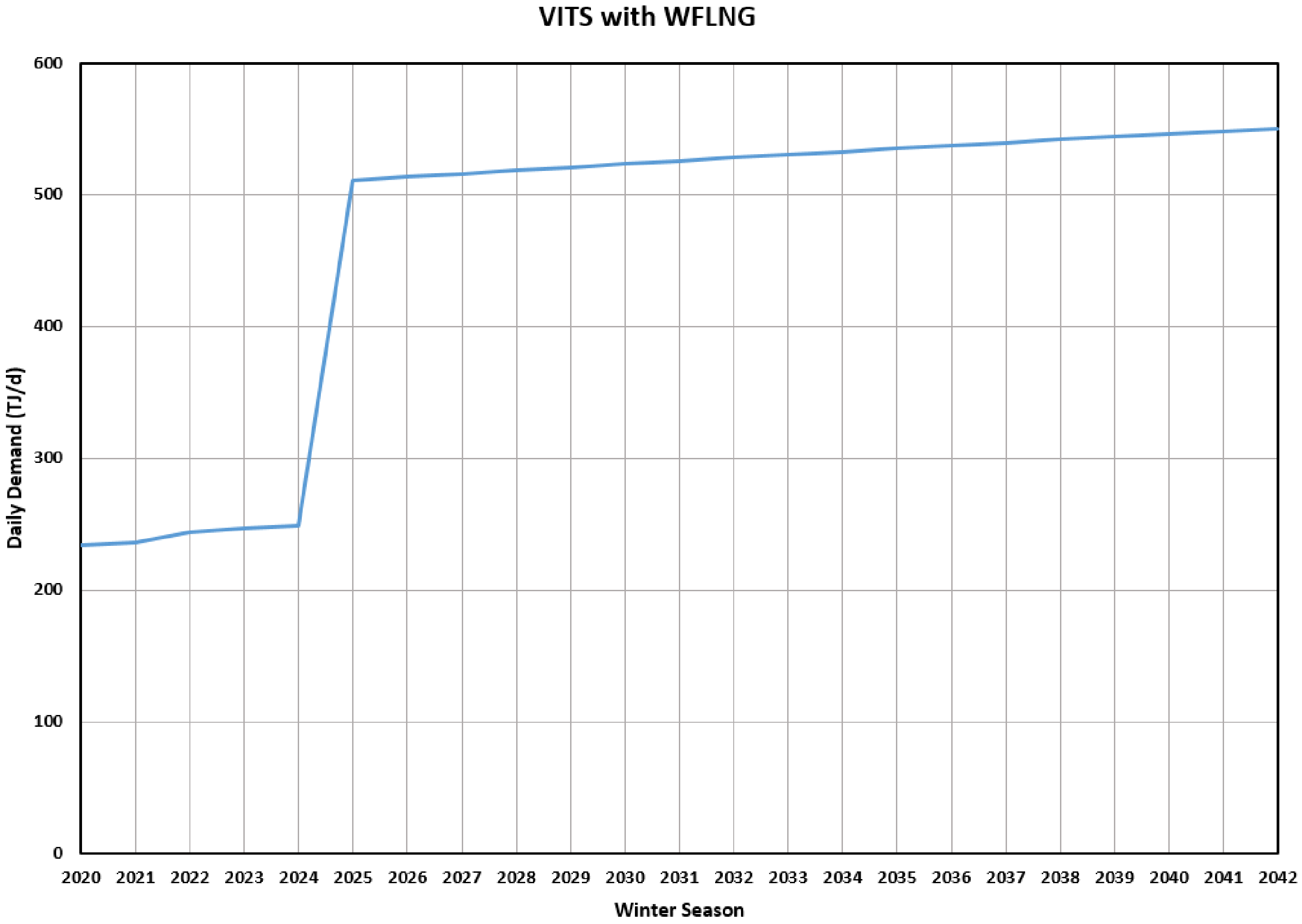
- Construct a new Compressor facility (V2) in the Squamish area beyond 2030 depending on the presence of BC Hydro Island Generation

Option 2 - Additional LNG storage

Key Input – BC Hydro Island Generation peak supply (50 TJ)

- Agreement expires in 2022 - eight years before the expected capacity constraint
- The final form of this agreement could defer the capacity constraint to later in or beyond the 20 year planning horizon

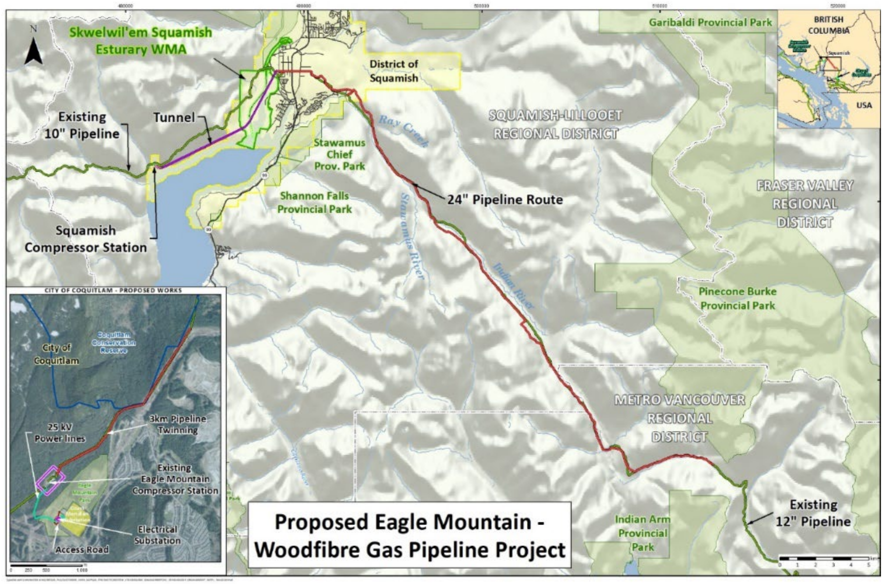
VI Capacity Traditional Peak Forecast with WLNG



Infrastructure for LNG Expansion

Eagle Mountain – Woodfibre Gas Pipeline (EGP) Project

- Approximately 47 km of NPS 24 pipe from KP0 at the exit of the Coquitlam watershed to proposed Woodfibre LNG site southwest of Squamish, generally paralleling the existing NPS 10
- 9 km tunnel from east side of Squamish Estuary to WFLNG site
- 3 km loop of existing NPS 12 at exit of Coquitlam compressor station
- Compression facilities at existing V1 (Coquitlam) and proposed V2 (WLNG site) stations
- 260 TJ/d (237 MMscfd) firm contract demand



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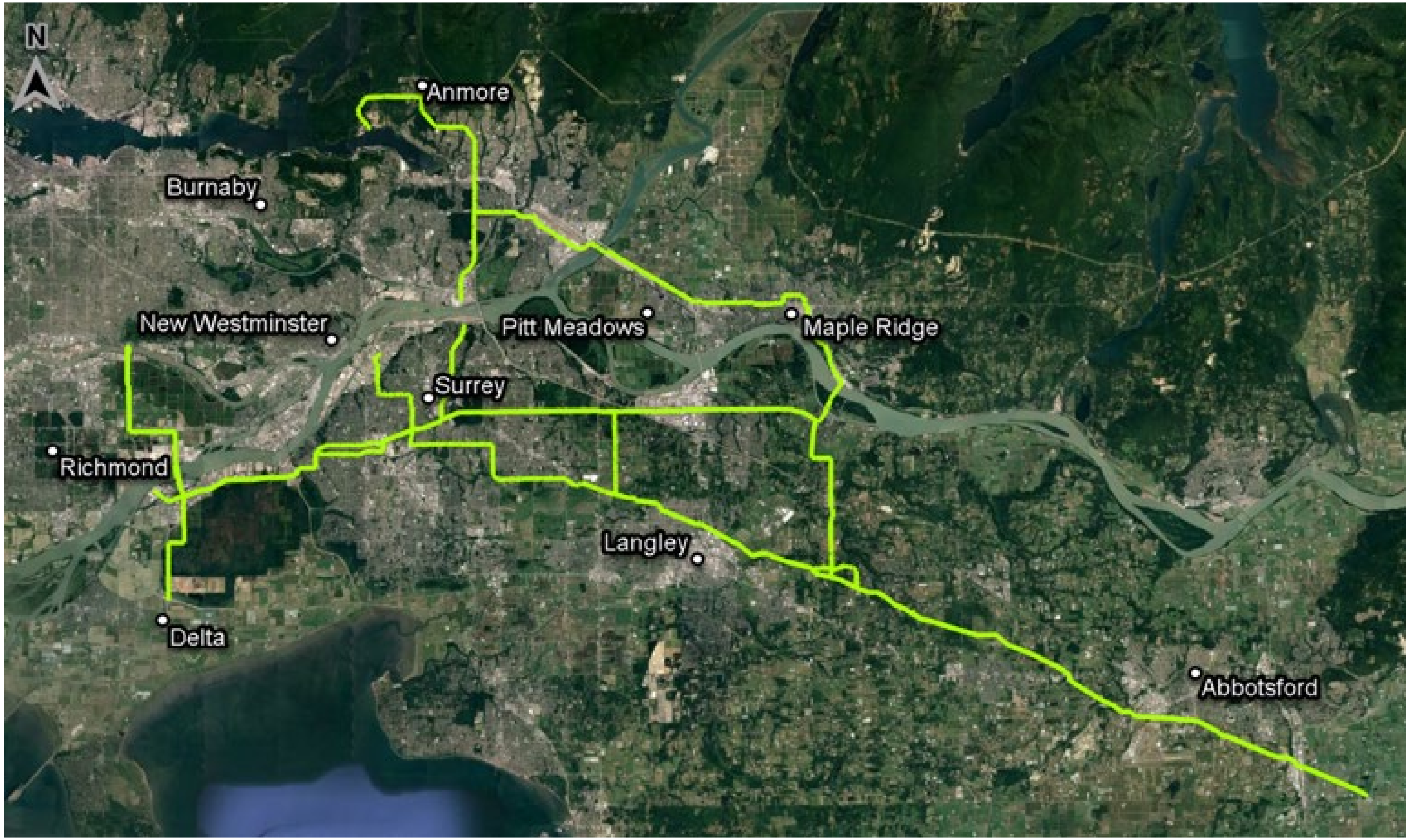
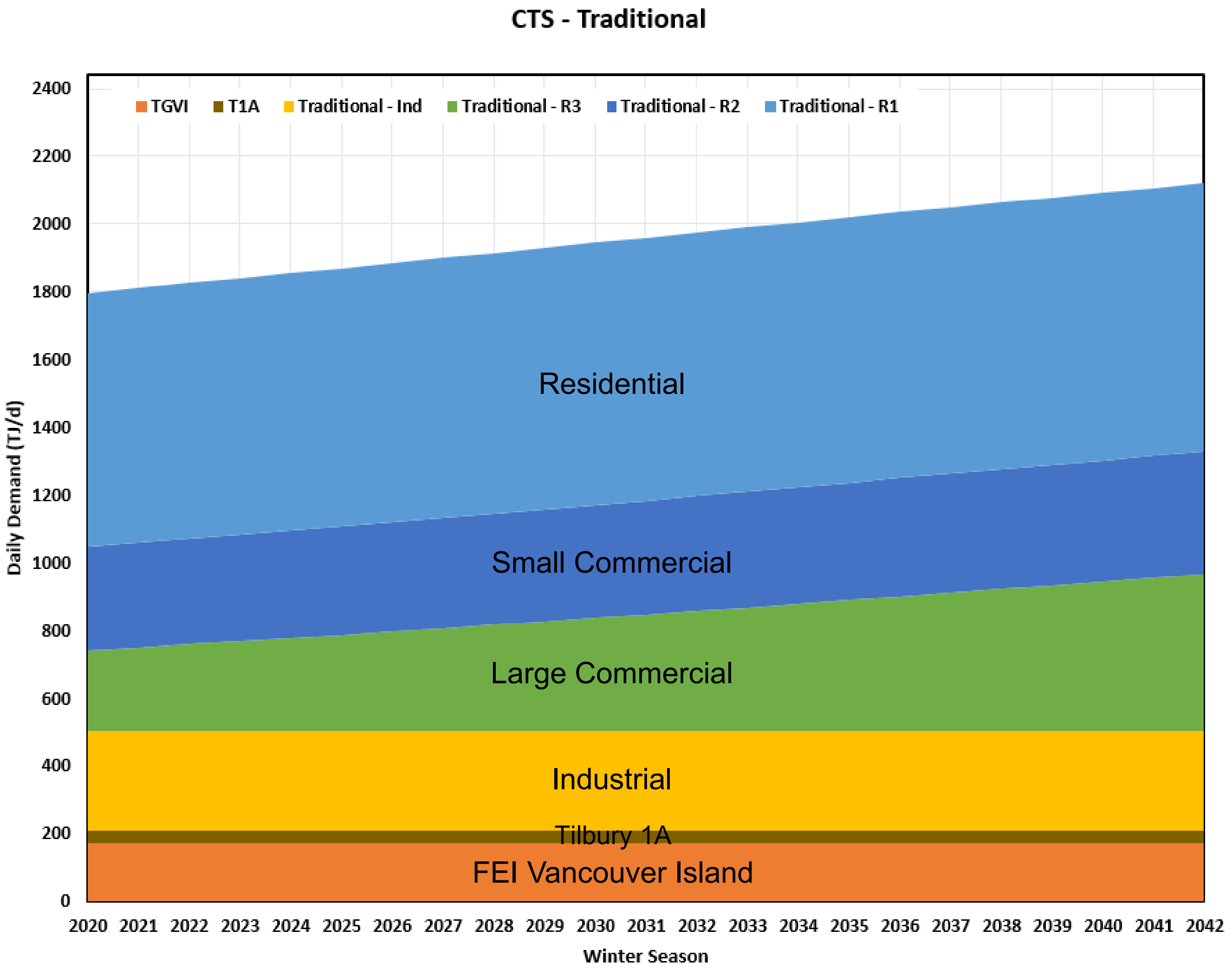
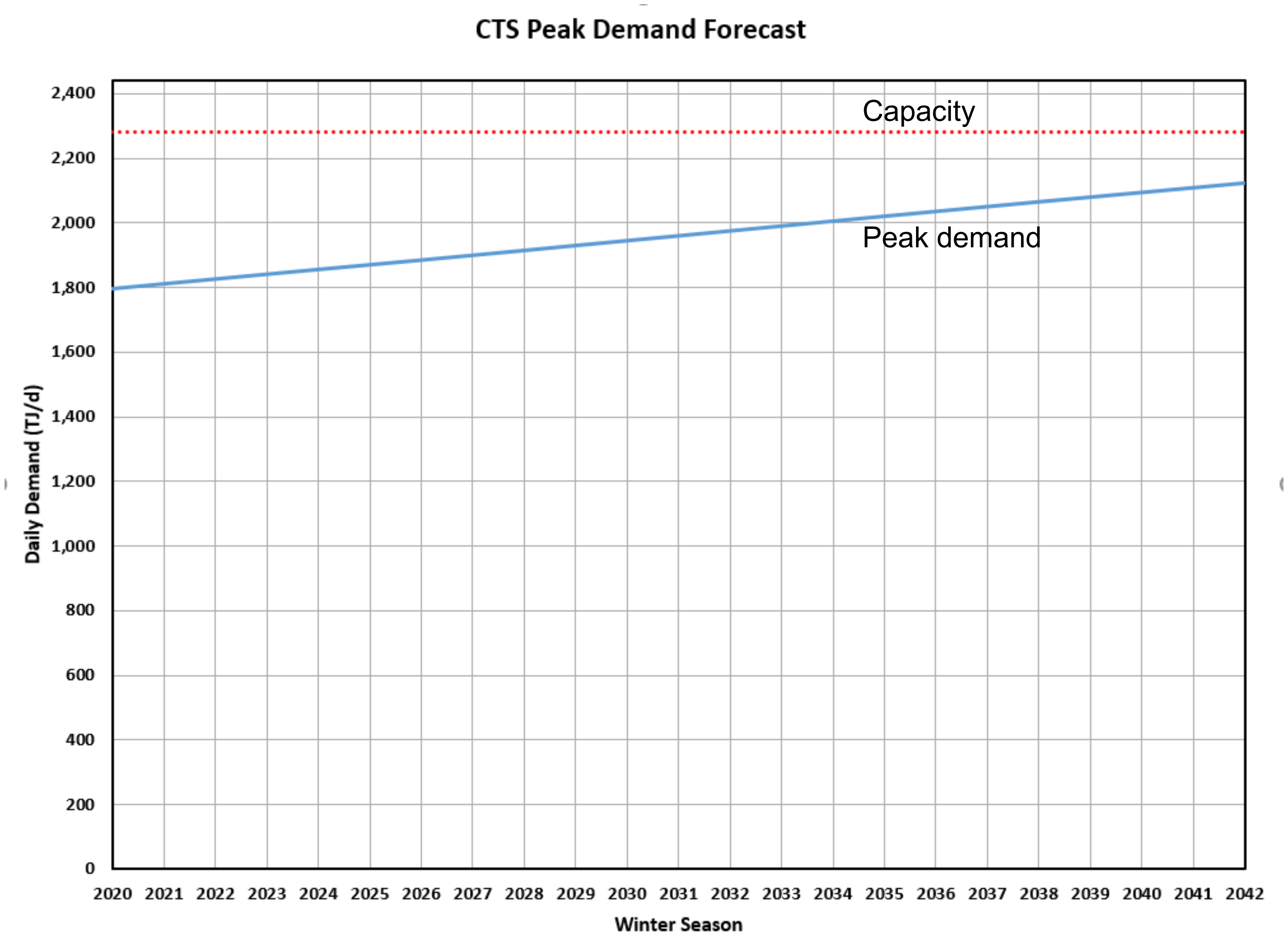
Coastal Transmission System



CTS Capacity Traditional Peak Forecast

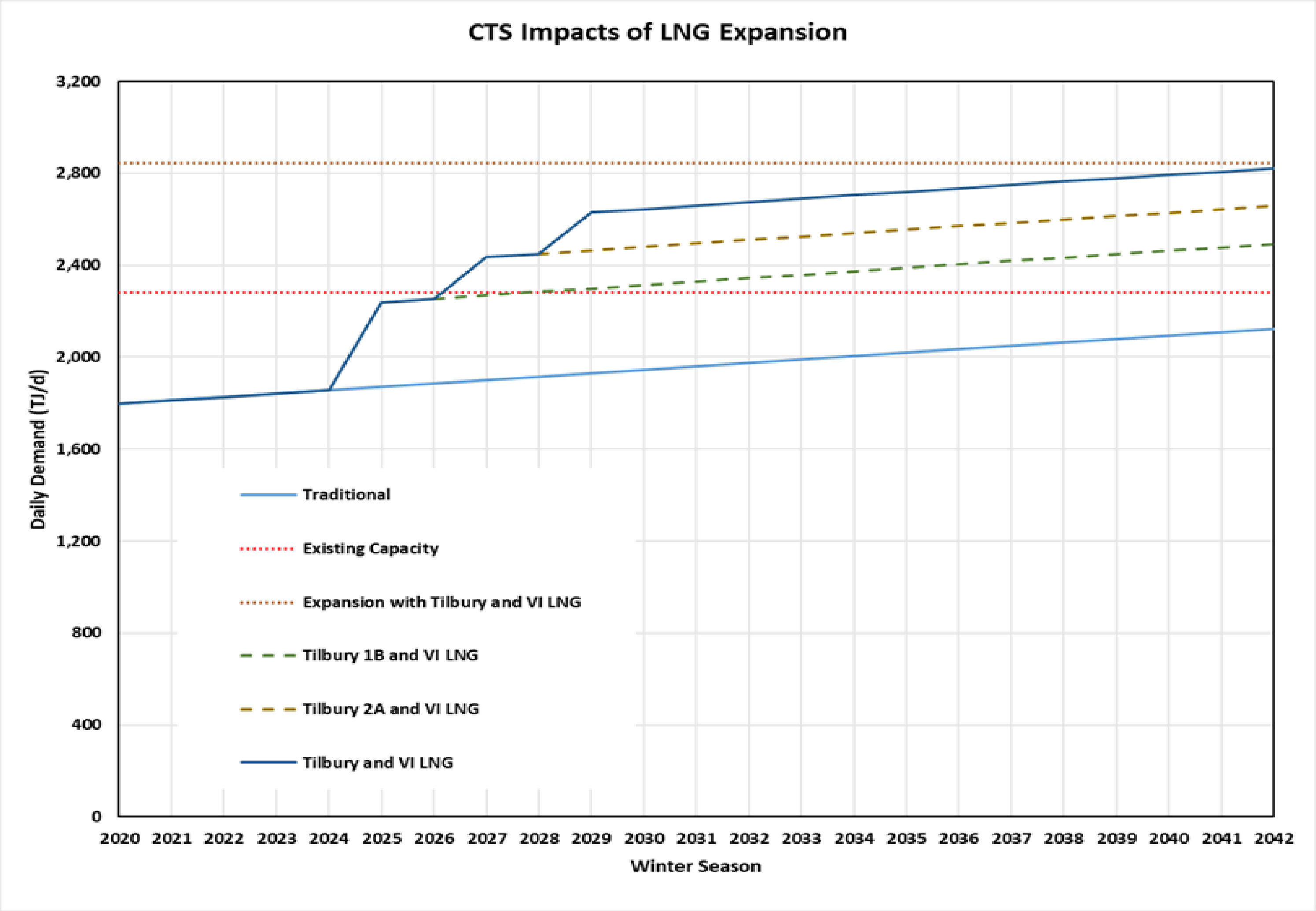


CTS Capacity Traditional Peak Forecast



CTS Traditional Peak Forecast with LNG Impacts

Illustrative examples of LNG expansion



Energy at work FORTIS BC™

Infrastructure for LNG Expansion

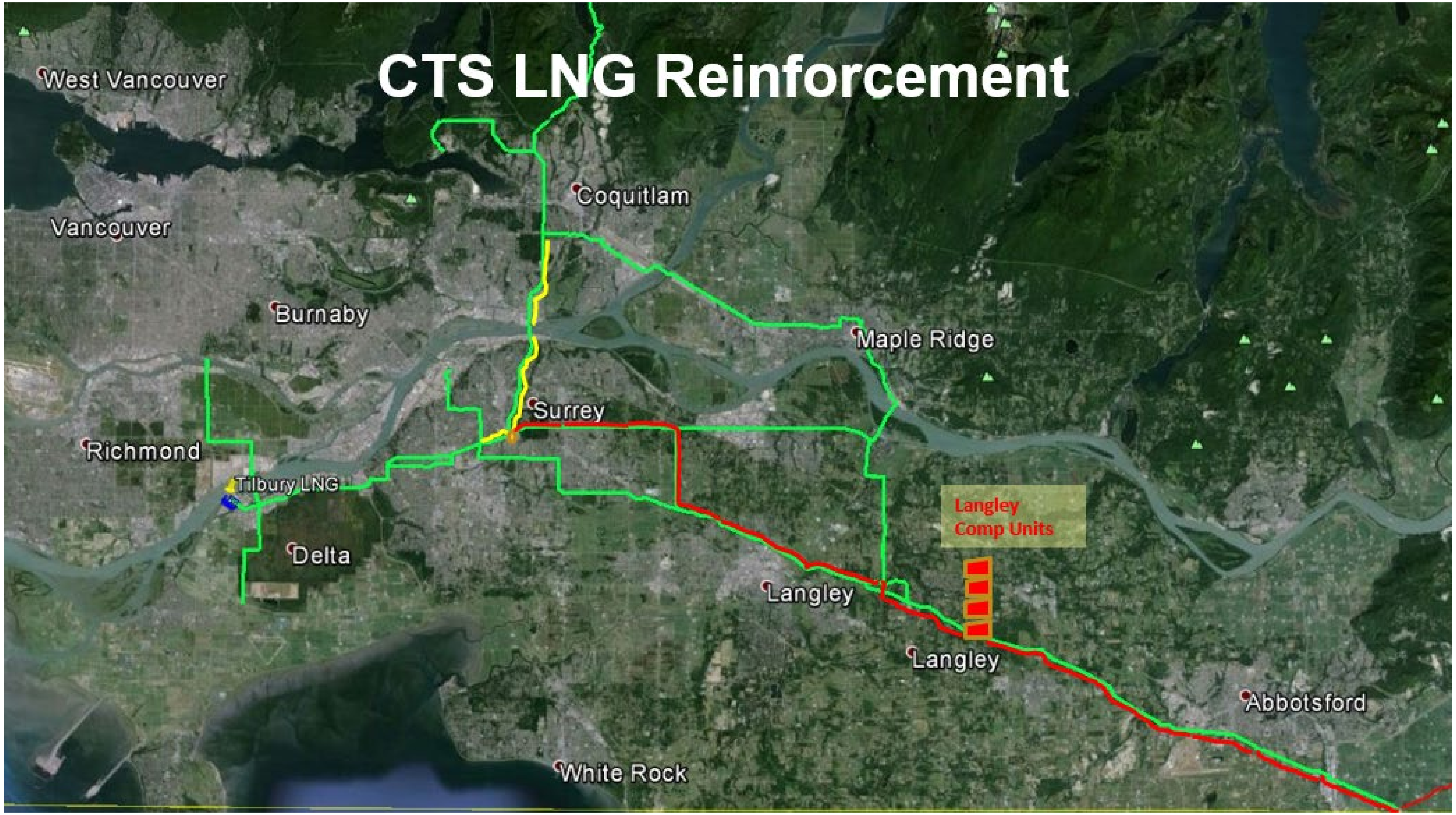
Illustrative examples of LNG expansion

Tilbury

- Supporting additional LNG growth will require some capacity expansion of the CTS system.

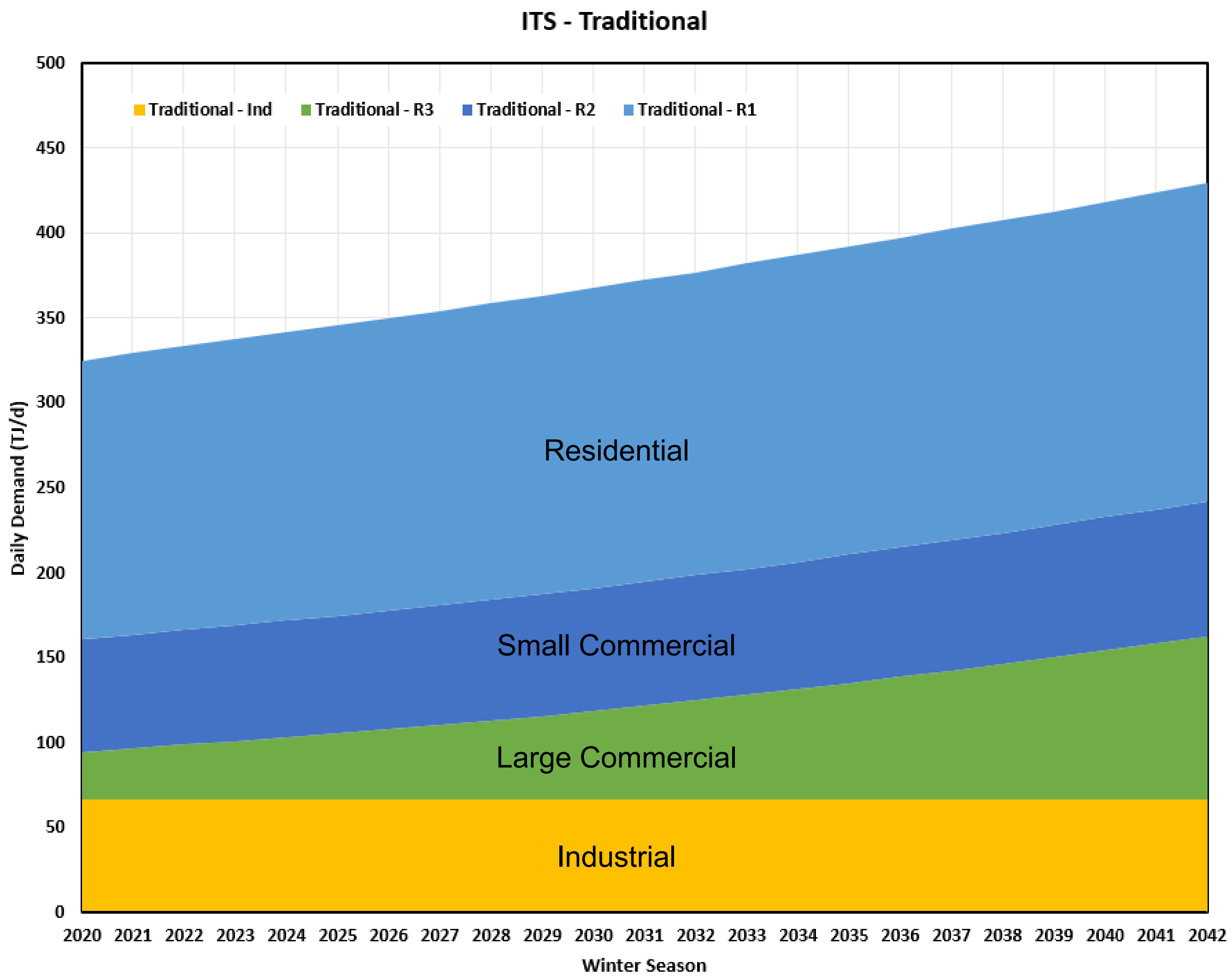
CTS Upgrades	LNG Expansion	Timeframe
2 km NPS30 from Tilbury Plant and 30,000 HP Added or 35 km NPS 42 Pipeline Loop	Up to 99 MMscfd additional Liquefaction at Tilbury Plant Up to 237 MMscfd at WLNG	2025 or later
10,000 HP Added or 13 km Pipeline Loop	Up to 250 MMscfd additional Liquefaction at Tilbury Plant Up to 237 MMscfd at WLNG	2027 or later
10,000 HP Added or 6 km Pipeline Loop	Up to 400 MMscfd additional Liquefaction at Tilbury Plant Up to 237 MMscfd at WLNG	2029 or later

CTS LNG Reinforcement

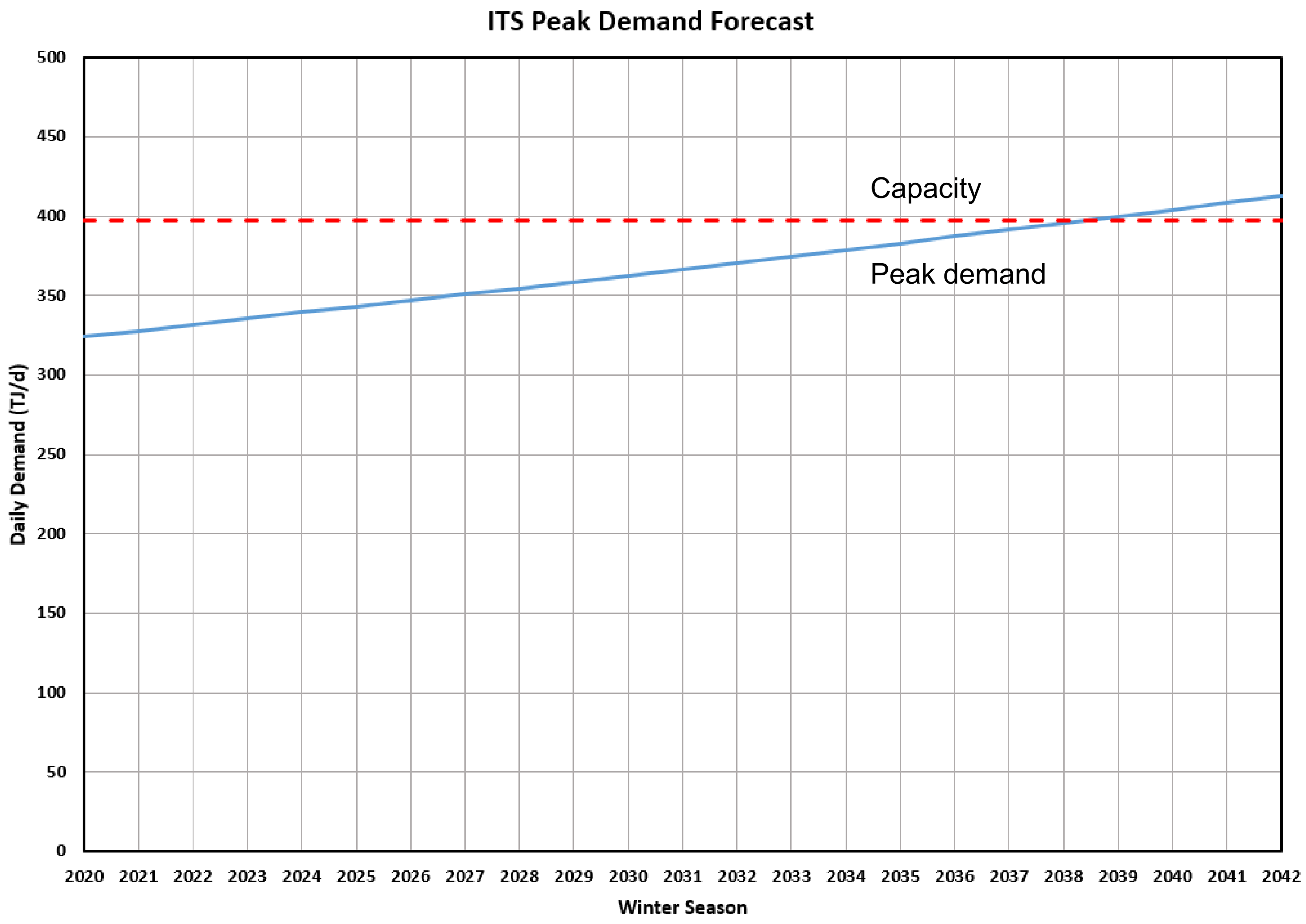


Interior Transmission System

ITS Capacity Constraint Traditional Peak Forecast



ITS Capacity Constraint Traditional Peak Forecast



ITS Infrastructure to meet Traditional Peak Forecast

System Expansion Alternatives:

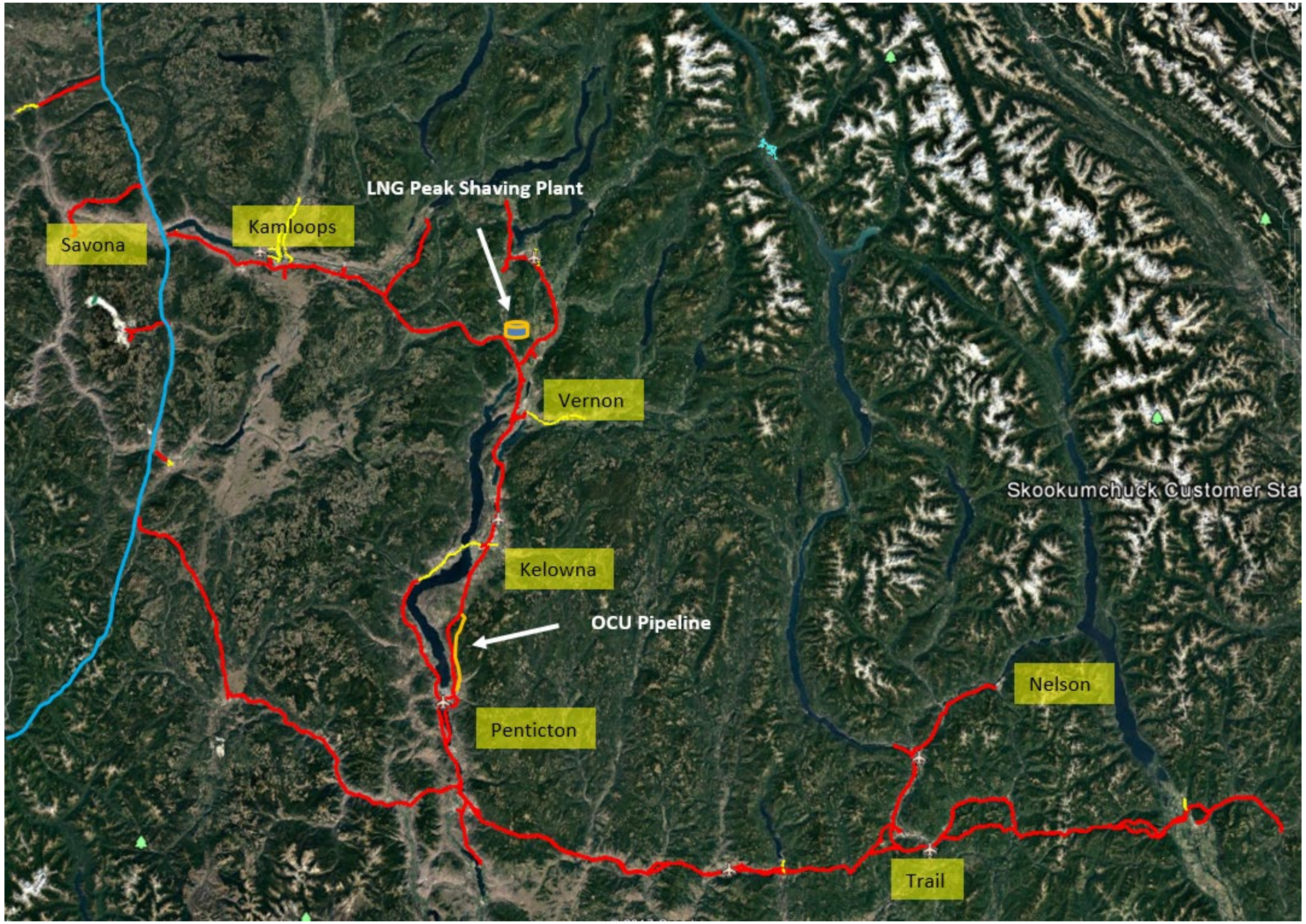
Option 1 – Okanagan Reinforcement - South Loop

- Loop approximately 28 Km of existing NPS12 pipeline with NPS20 pipeline
- Added 1000 HP at Savona Compressor

Option 2 – LNG Peak Shaving Facility

- Approximately 100-150 MMscfd LNG peak Shaving
- Optimum location is near ITS no flow point near Vernon

Okanagan Reinforcement



Questions and Discussion

Break

Gas Supply

Natural Gas Market Forecast and Portfolio Planning

Market Overview

- Short-Term Drivers
- Long-Term Outlook

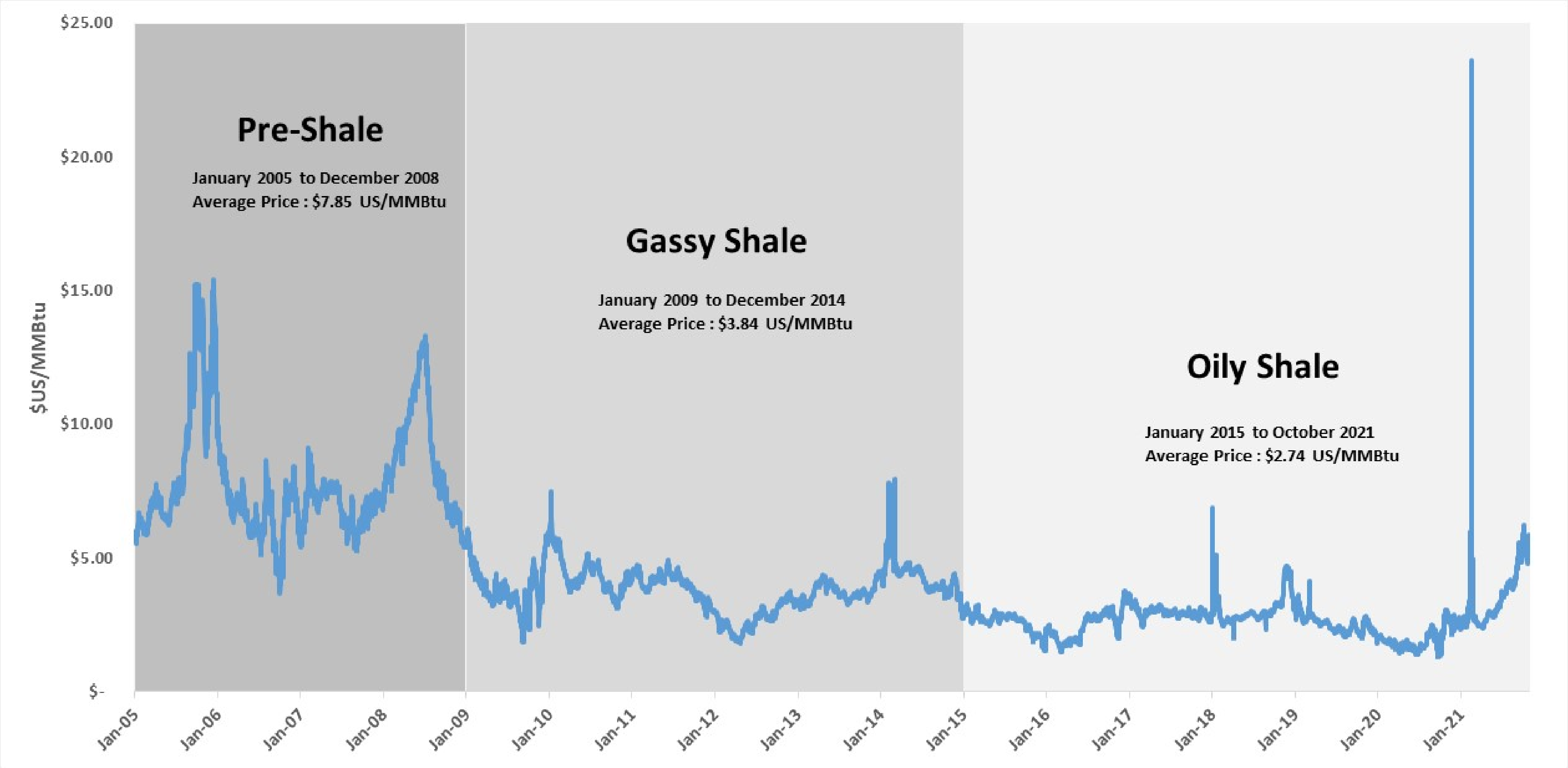
Energy Supply Portfolio

- Portfolio Risks and Management
- Resiliency Considerations
- Incorporating Renewable Natural Gas Supply
- Future Outlook of Portfolio

2022 vs 2017 Gas Supply and Demand

Market Factor	2022 vs 2017	Bcf / day	Impact on Prices
Gas Production	⇧	**+ 20 Bcf**	⬇
Residential Demand	⇨	**+ 0.7 Bcf**	➡
Commercial Demand	⇨	**+ 0.3 Bcf**	➡
Industrial Demand	⇧	**+ 2 Bcf**	⬆
Power Demand	⇧	**+ 4 Bcf**	⬆
US LNG Exports	⇧	**+ 10 Bcf**	⬆
Gas Prices			⬆

Recent Henry Hub prices



Key Factors driving commodity natural gas prices today

- Natural gas production flat in 2021 (92 Bcf/d). Demand outpacing production growth
- Diminished demand elasticity from the electric power sector (between coal and natural gas generation)
- US LNG export capacity at full utilization fuels strong demand
- Over the next few years, associated gas production growth returns as capital discipline eases and crude oil production rises (production to ~100 Bcf/d)

Short-Term – US Demand and Exports

- US demand up 8 Bcf/d in 2024 vs 2020, largely due to exports
- LNG exports up 6 Bcf/d in 2024 vs 2020
- Slightly higher residential, commercial, and industrial demand, slightly lower power sector demand by 2024

Short-Term – Canadian Natural Gas Production

- Steadier production than US, most of production growth within Montney basin
- Canadian gas production increasing through 2024, up 2 Bcf/d compared to 2020
- Montney basin one of the lowest cost gas plays in North America

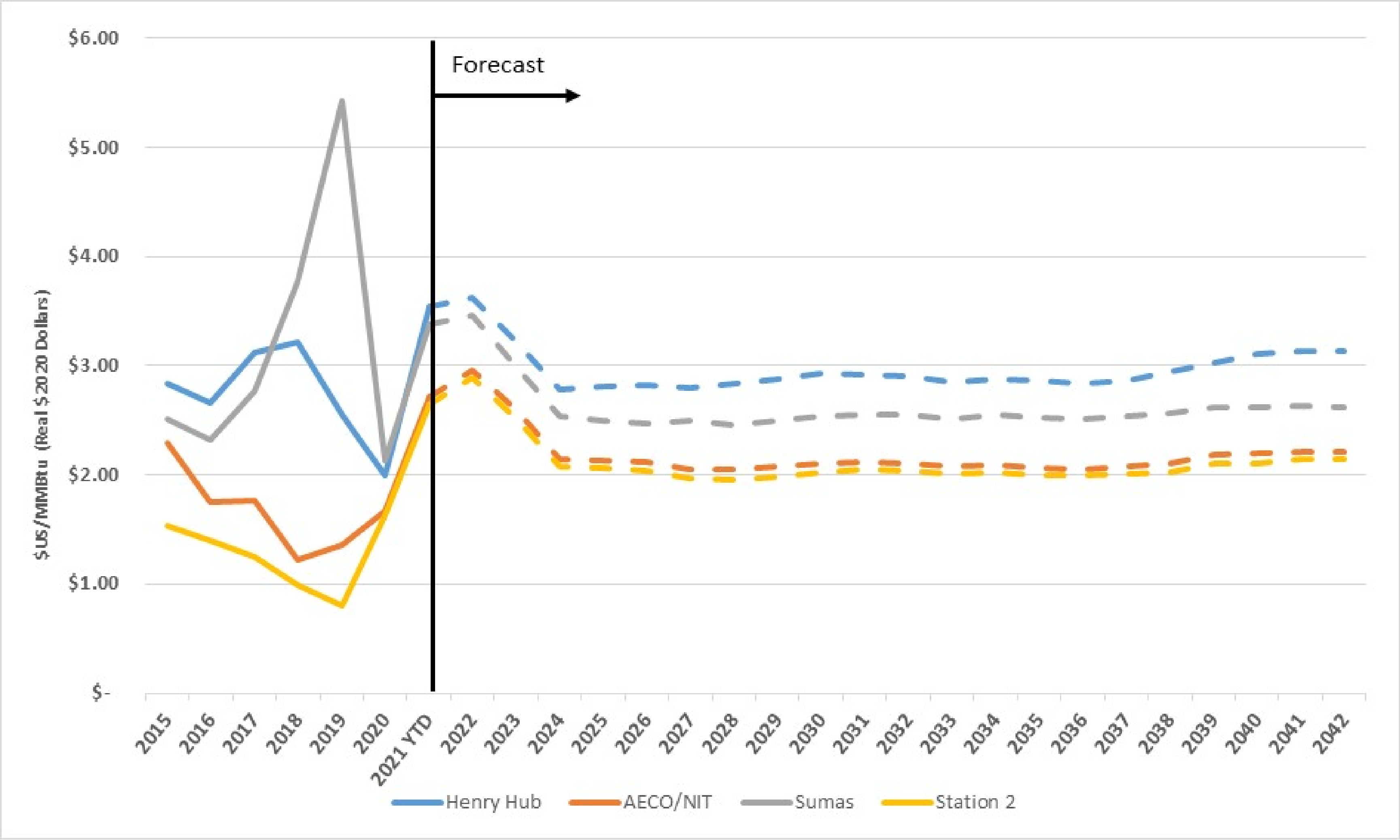
Long-Term Themes

- Demand growth through 2030, mainly due to LNG exports
- Higher associated gas production, forecast Henry Hub below $3.00 (in real $2020) through 2038
- Increased total wind and solar renewable generation for the power sector after 2030, but still need for firm resource requirements

Long-Term – Demand Outlook

- Production (supply) expected to increase as needed to meet demand
- US demand about 95 Bcf/d in 2020, peaking around 111 Bcf/d in 2030, slowly declining afterwards through 2050
- Demand growth primarily due to LNG, power sector main cause for decline after 2030
- Production growth in Canada contingent on LNG exports after 2025, power sector main cause for decline after 2030 as well

Long-Term – Annual Price Outlook



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Recap of Short to Long-Term Market Conditions

- Short-term pain, long-term growth, levelling off after 2030
- $5.00 - $6.00 US/MMBtu Henry Hub winter 21/22, $4.00 2022, then below $3.00 (in real $2020) through 2038
- Continued production growth through associated gas, Haynesville, and Montney basins
- Increased demand through LNG exports, offsetting reduced demand from power sector (occurring after 2030)

Regional Market Factors

01 Regional Constraints

02 Sumas Market Disconnection

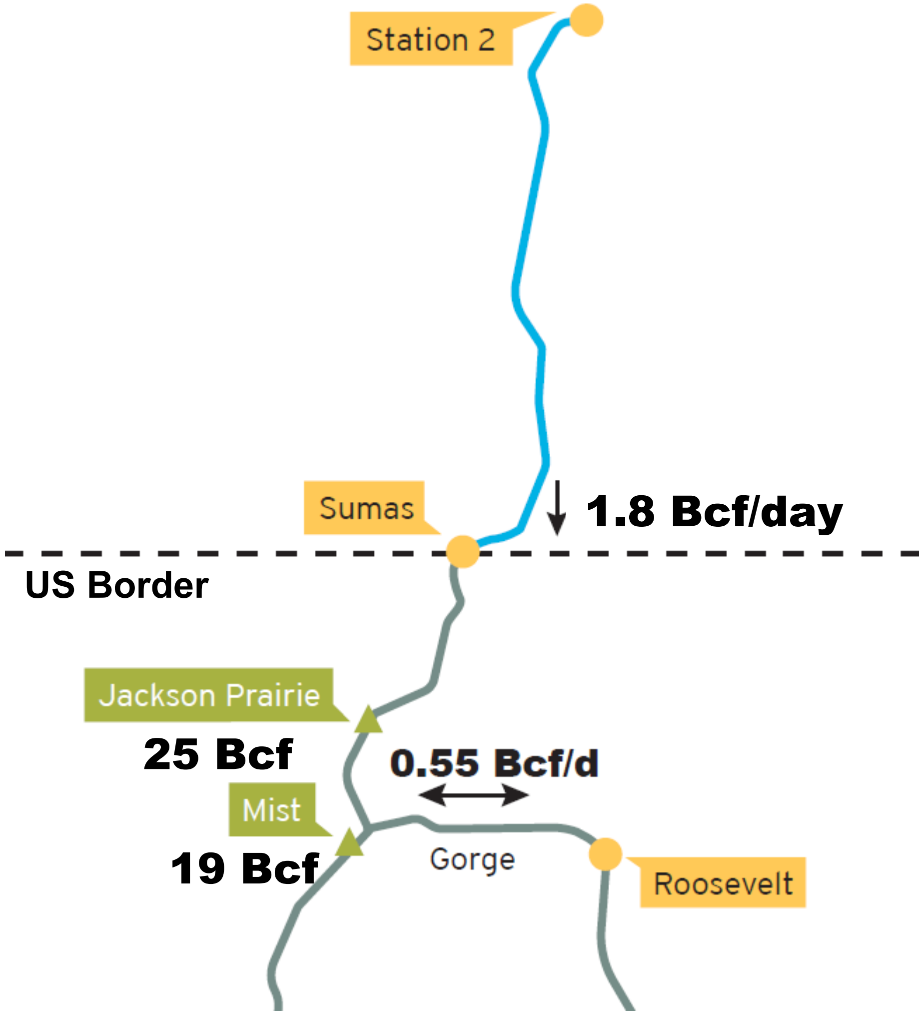
Short to Long Term Strategies

03 Mitigating Market Risks

04 Portfolio Approach to Resiliency

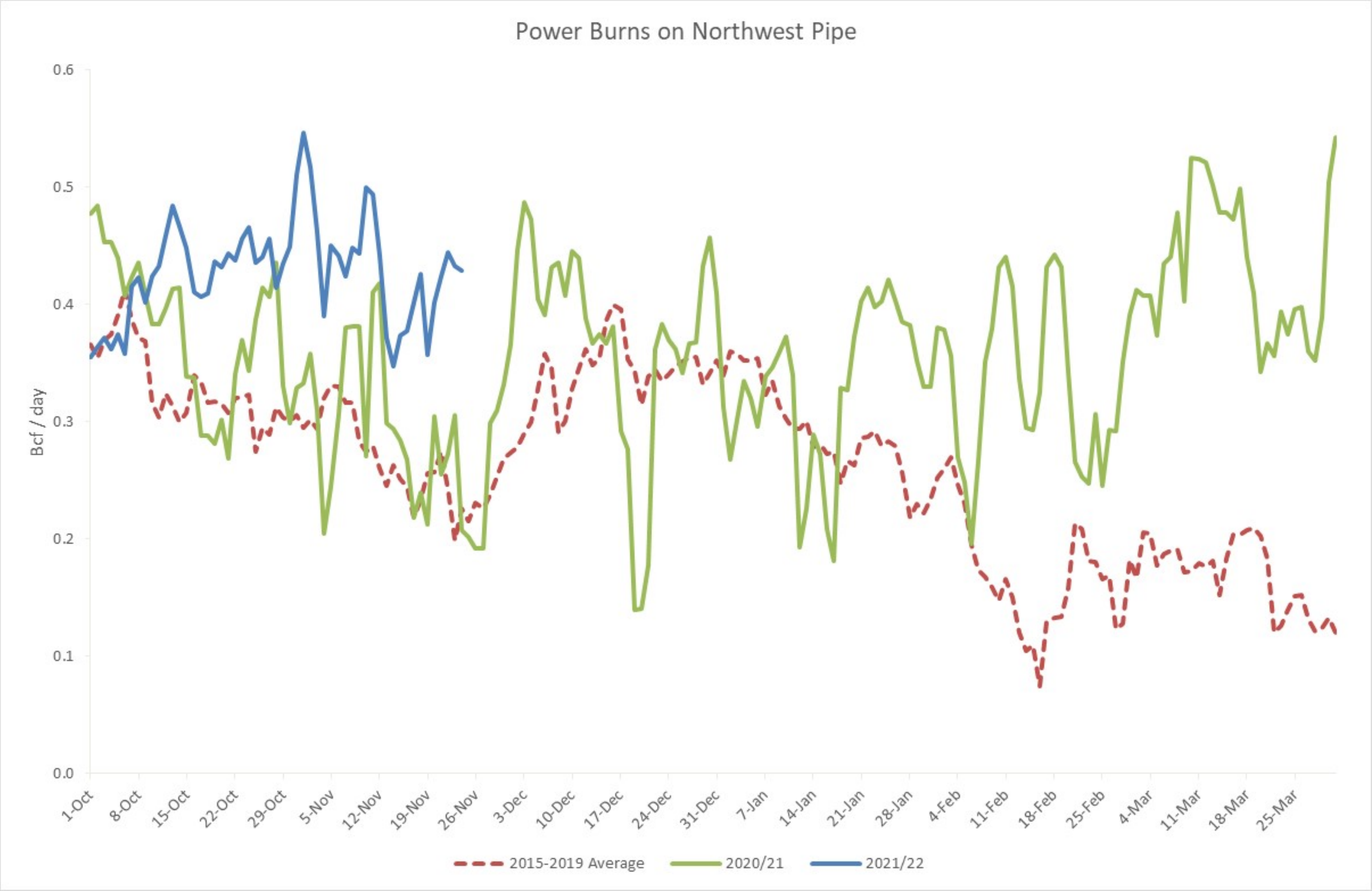
05 Portfolio Approach to Load Scenarios

Regional Challenges – Seasonal Constraint



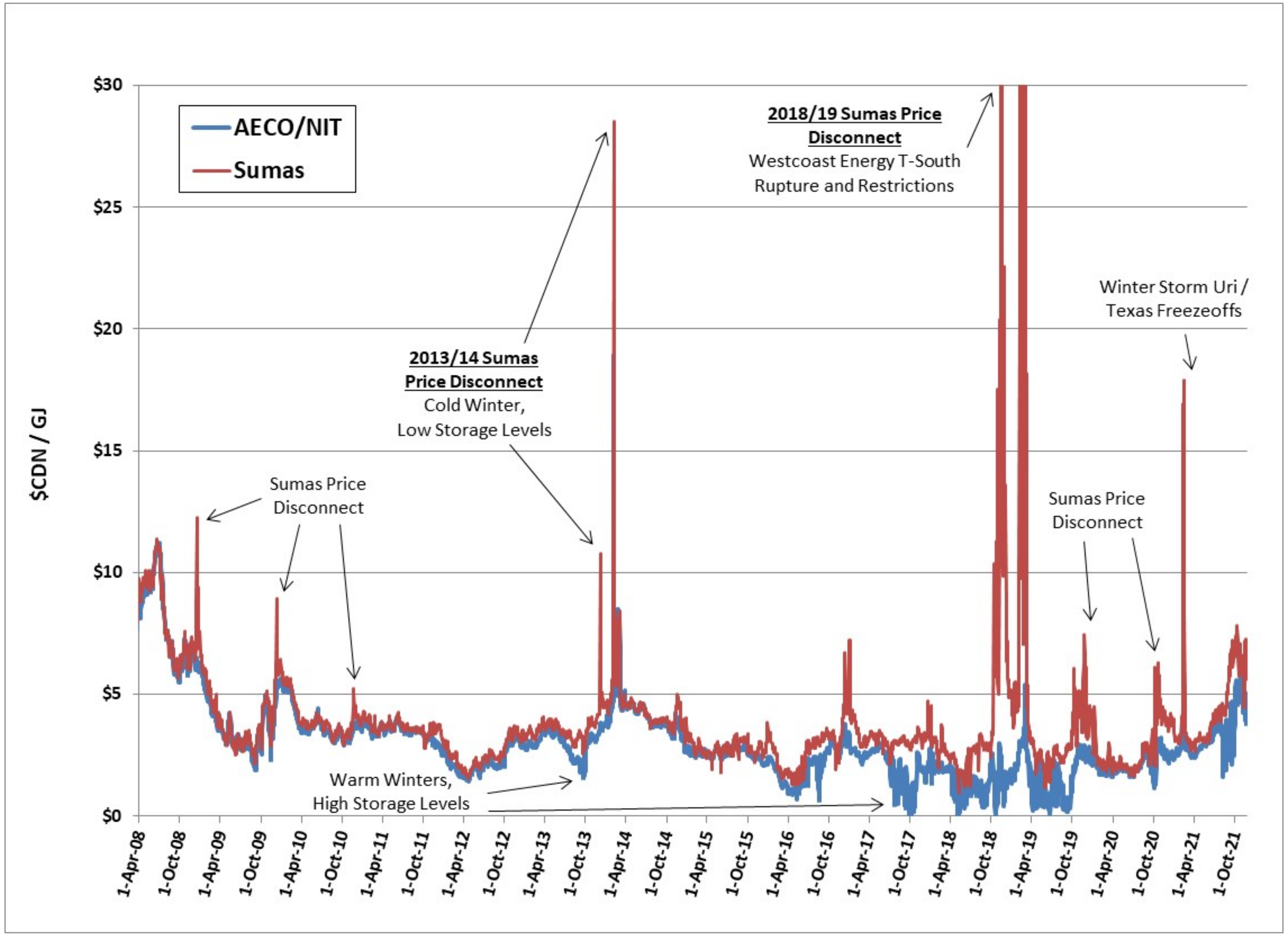
- Limited Resources in the PNW
- Baseload supply requirements for I-5 Corridor (Lower Mainland, Seattle, Portland)
- Short-term assets in the region (JPS & Mist storage, gas-fired power generators)
- Coincidental winter demand on gas and power systems served by natural gas infrastructure

Gas-Fired Power Generation

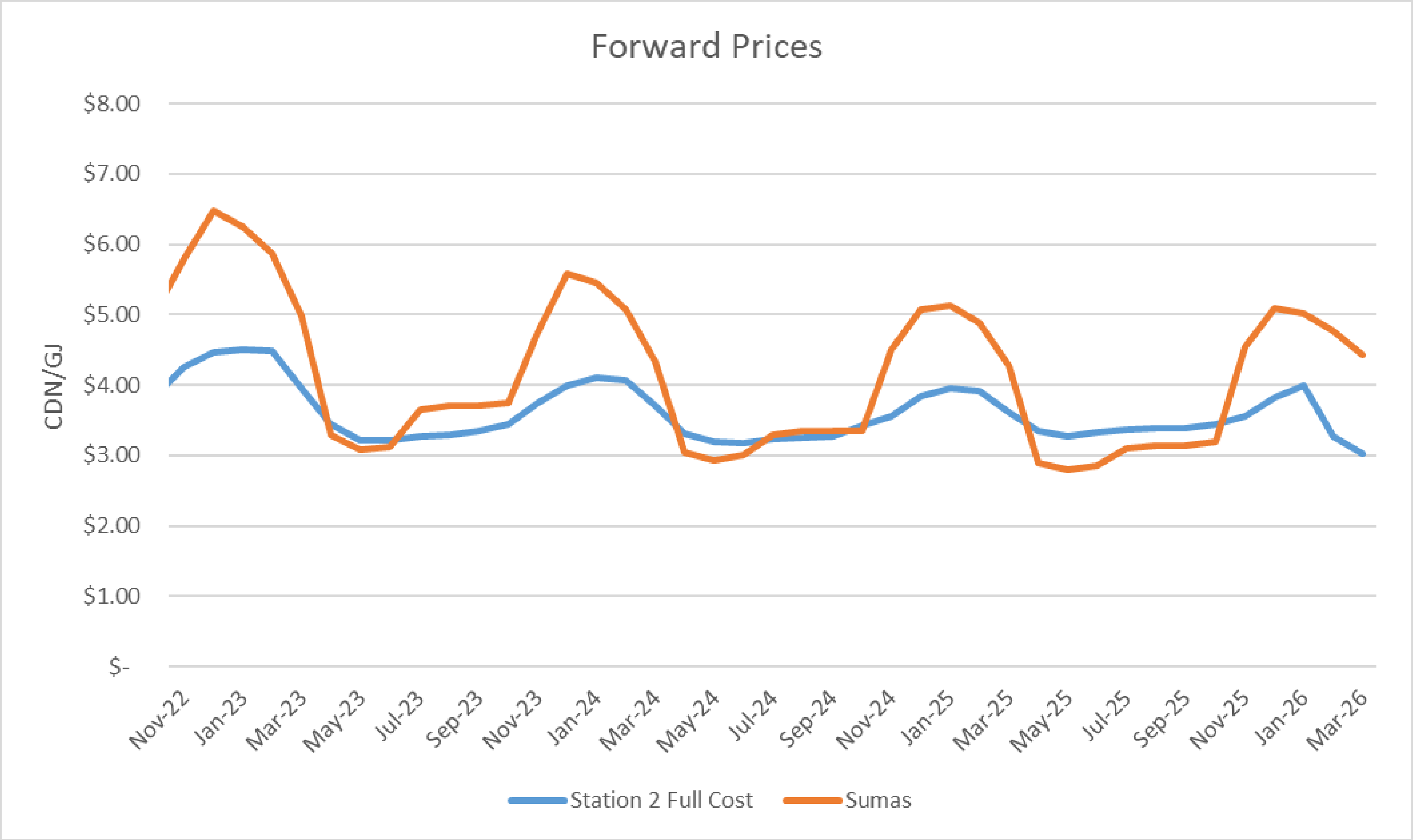


Gas Winter (Nov-Feb)	Bcf / day
15/16	0.28
16/17	0.20
17/18	0.26
18/19	0.24
19/20	0.39
20/21	0.35
Nov 21 MTD	0.43

Huntington/Sumas Market Disconnection



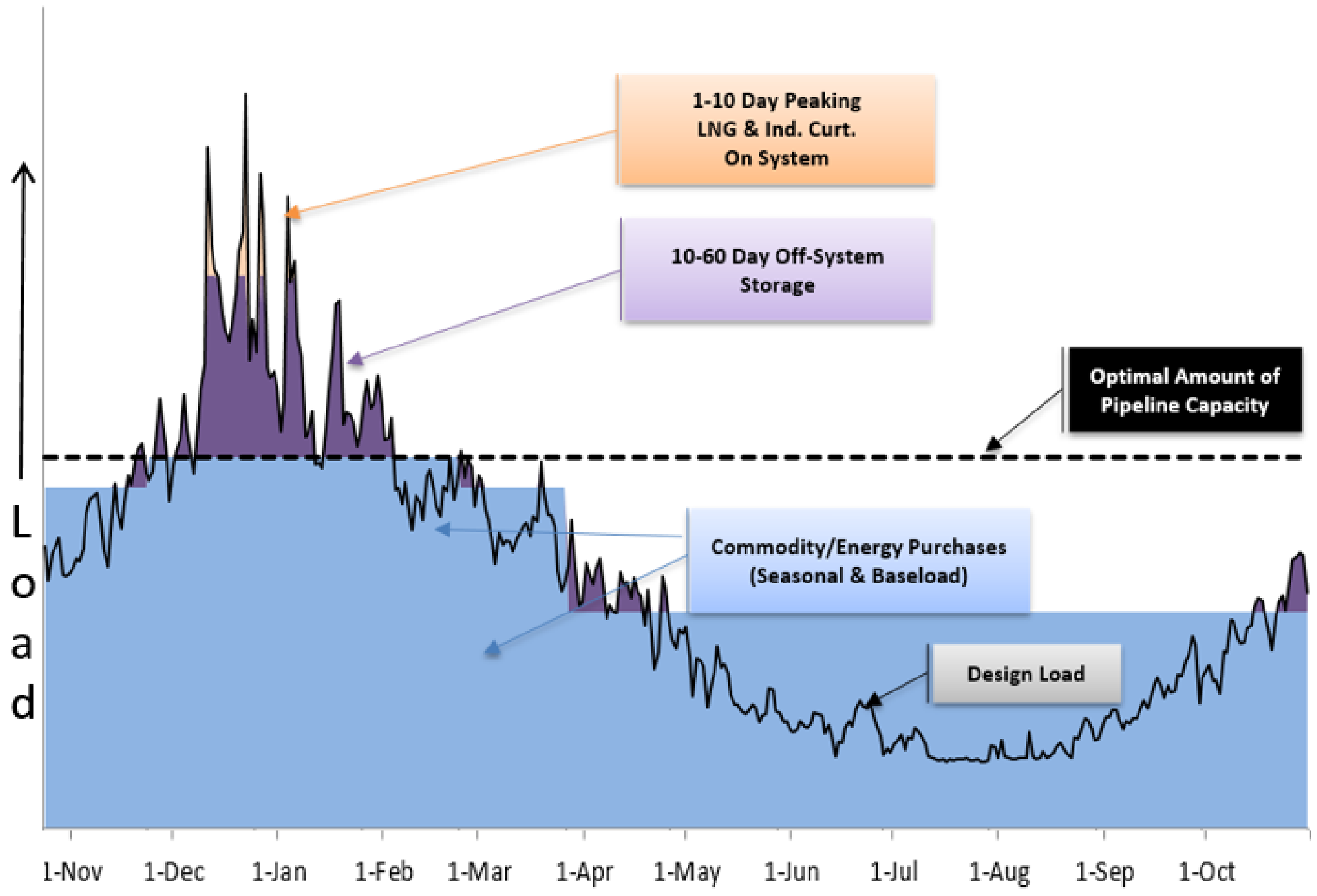
Sumas Forward Market



Regional Market Implications in PNW and Western Canada

- Greater price volatility, increased demand with less increased infrastructure
- Increased reliance (both peaking and baseload) on natural-gas fired power generation (with Sumas input) in PNW
- Contract at Supply hubs (Station 2 and AECO) instead of Market/Demand hubs (Sumas)

Energy Supply Portfolio Planning

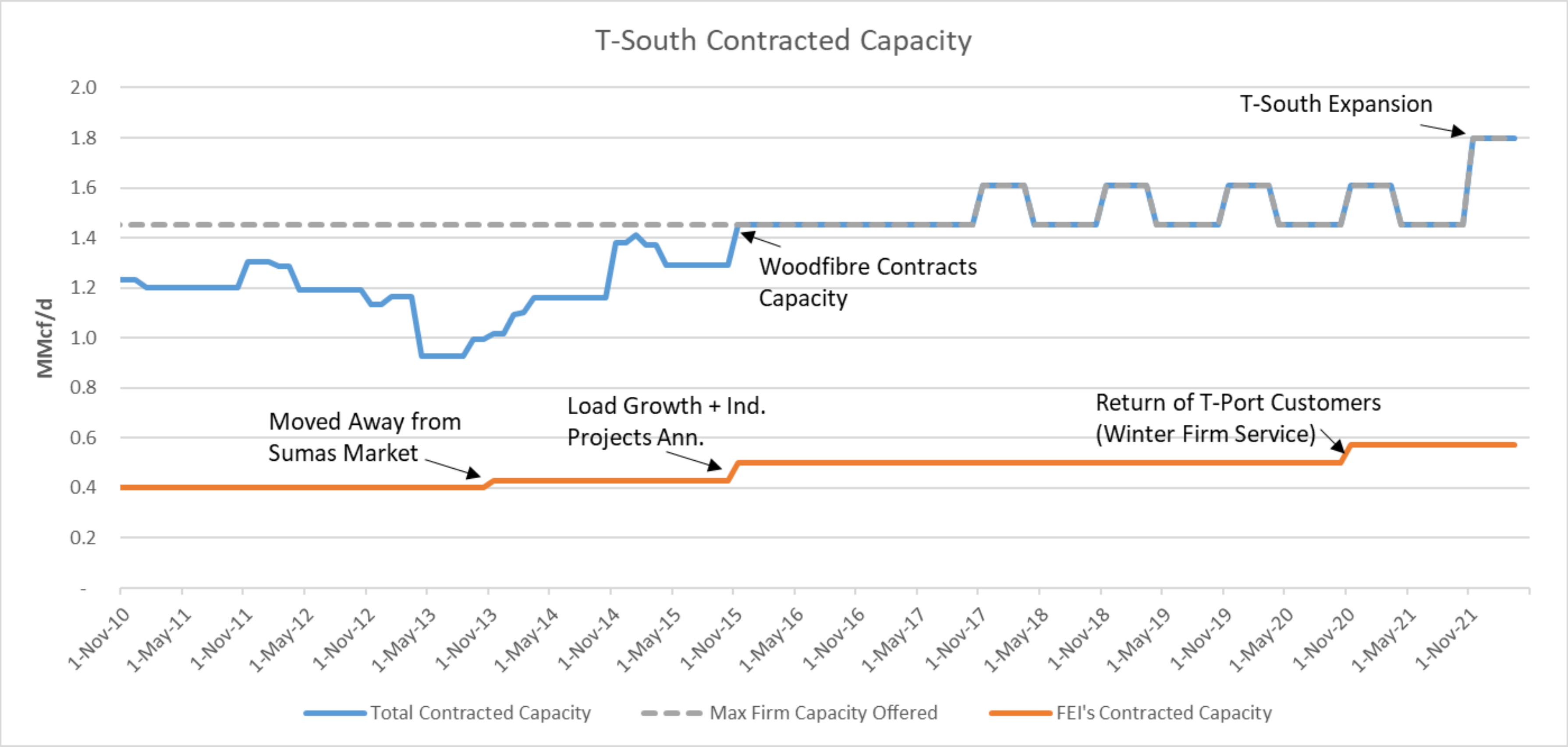


Portfolio Approach to Regional Market Risks:

- Load Requirements met with firm resources;
- Purchase supply at Station 2 and AECO/NIT;

Contracting Firm Resources vs Alternative Solution

- FEI's portfolio approach to physical and financial risk differs from other regional shippers
  - This is reflected in contracted capacity on T-South



Energy at work FORTIS BC™

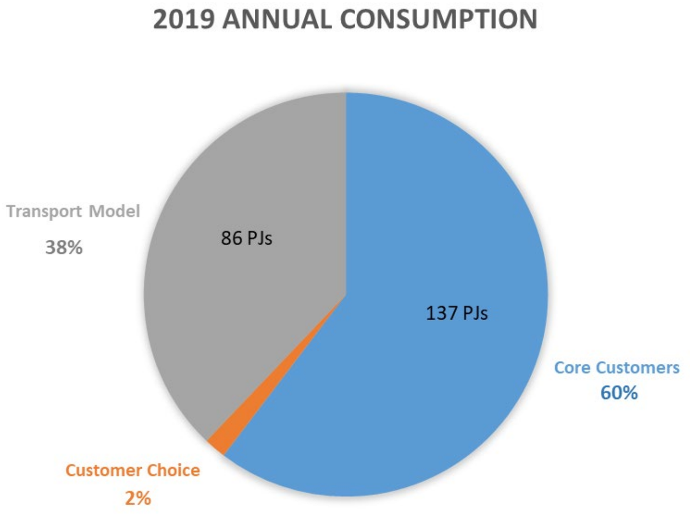
FortisBC (Bundled Service) or Transportation Gas Marketer

Buying from FortisBC:

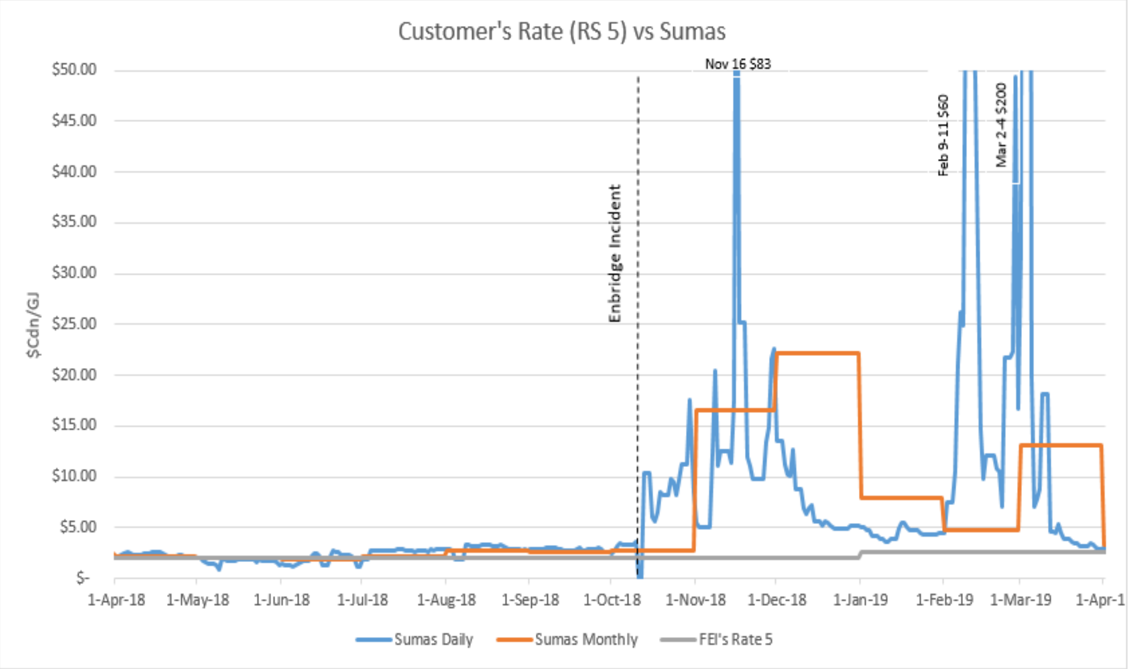
- No fixed rates; Cost of Gas can change quarterly
- Regulated by British Columbia Utilities Commission (BCUC);
  - Regulations Prevents FortisBC from offering fixed-term/fixed rates.

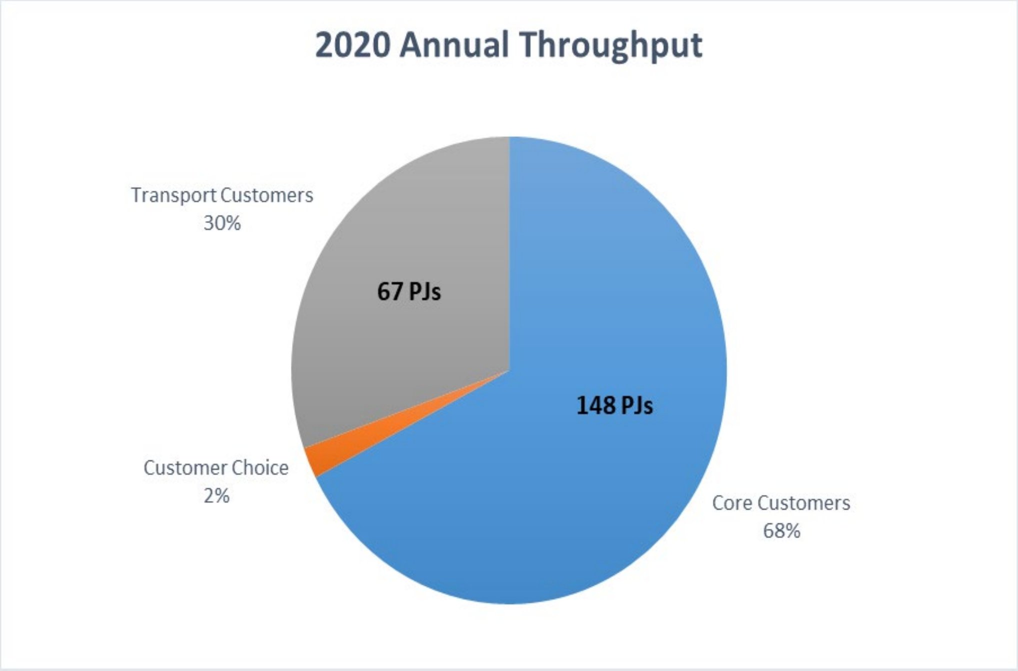
Buying from a Gas Marketer:

- Contracts are Negotiated;
- Not Regulated by British Columbia Utilities Commission (BCUC);
  - Marketers are free to offer different prices and terms to customers.
- Can charge fixed or variable rates, or both;



Customer Movement Between Bundled Service and Transport Model





- After the 2018/19 winter, 40% of the Transportation Customers in the Lower Mainland returned to Bundled Service
- Winter Load Forecast Increased by ~10%

Energy at work FORTIS BC™

Gas Supply Planning – Resiliency Considerations

Diverse Pipelines and Supply

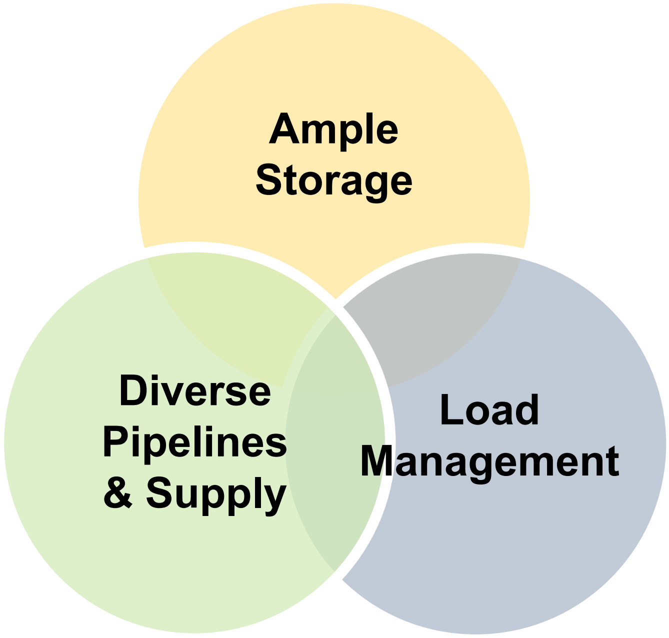
- Access to multiple regional pipelines for continuous supply

Ample Storage

- Preferably on-system storage to manage expected and unexpected changes in supply for a period of time

Load Management

- Ability to manage load during a period of supply constraint allows an operator to shed load in a controlled shutdown, maintaining supply for maximum number of customers



Resiliency in Regional and FEI's Context

Winter (151 day) Pipeline Supply (Bcf)	
T-South to Huntingdon	272
Gorge	81
Total	**353**
Storage Assets	
Jackson Prairie (Washington)	25
Mist (Oregon)	19
On-System Storage (Tilbury & Mt Hayes)	2
Total	**46**

T-South Pipeline Incident (Oct 2018 – Nov 2019)

Phase One

No Flow Event (First 48 hours immediately following the rupture of the 36-inch pipeline)

Phase Two

Refers to 24-day period following first phase where gas supply was severely constrained (~50%)

Phase Three

Refers to 56 week period following second phase where pipeline was restricted to approx. 85% (NEB Order)

Short Term Considerations

- FEI has mitigated a portion of the risk if a future pipeline incident occurs **(phase three of T-South incident)**
  - Secured the only opportunity in the marketplace to diversify its portfolio by taking back NW Natural's portion of Southern Crossing Pipeline capacity effective Nov 1, 2020.
  - Holding contingency resources (15% planning margin) to mitigate future risk of supply disruptions.
- Additional resources in the region required to increase gas supply resiliency

Future Projects to Enhance System Resiliency

Incident shows multiple solutions are required to improve resiliency:

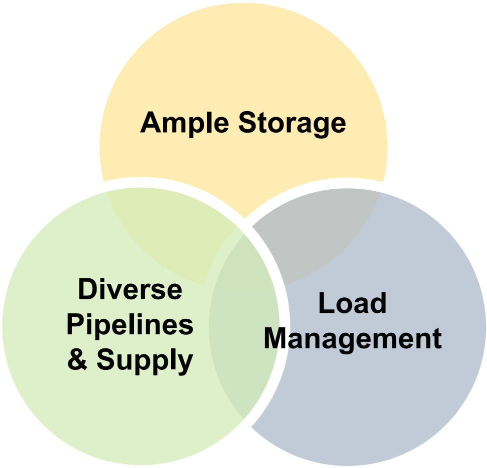
Phase 1 – "No Flow Event" - FEI requires additional on-system physical resource

1. Filed CPCN Application for a Tilbury Expansion (3 Bcf; 800 MMcf/day of vaporization)

2. Filed CPCN Application for Advanced Metering Infrastructure

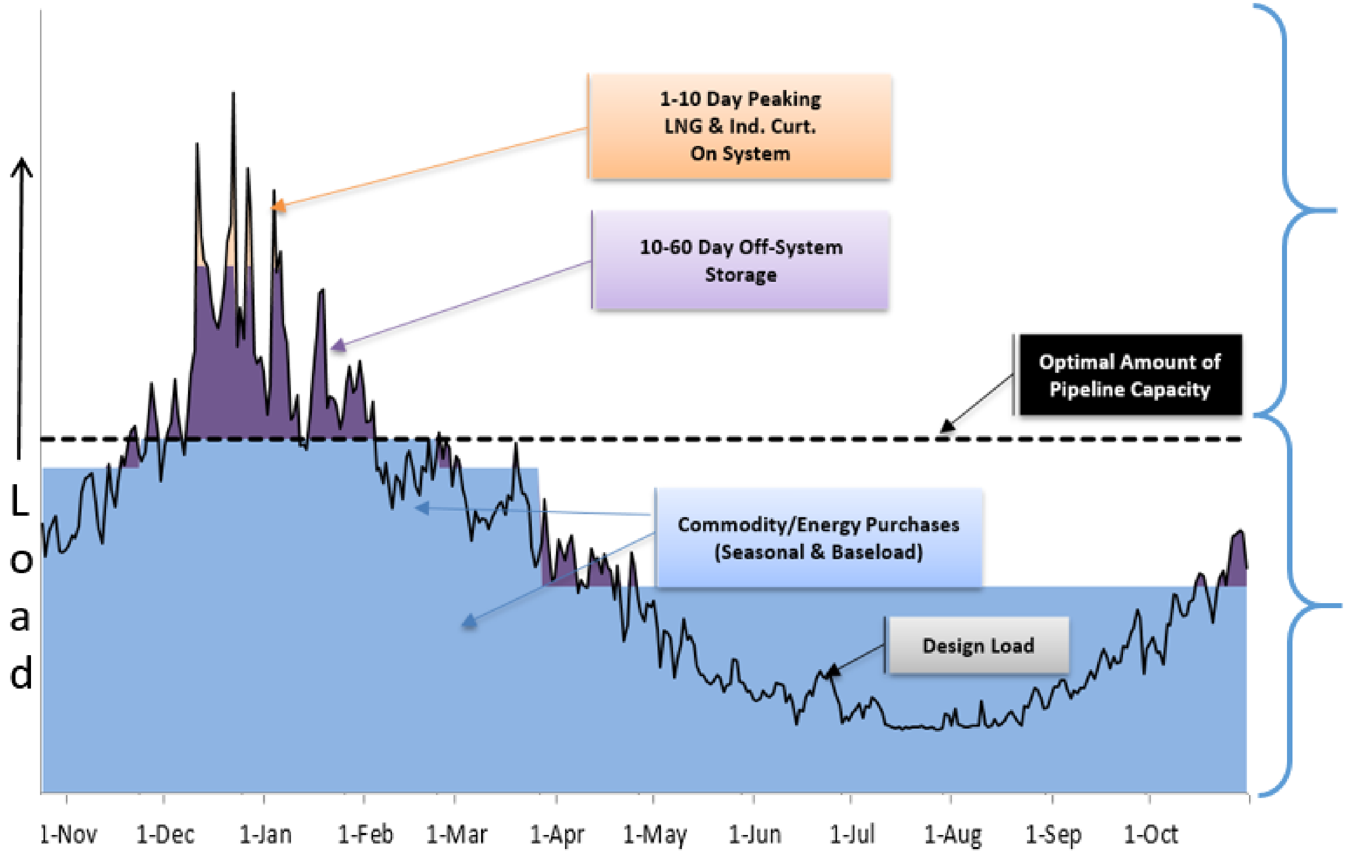
Phase 2 – "Pipeline Capacity Restrictions" - FEI requires additional pipeline infrastructure to manage the duration of the supply disruption.

3. Regional Gas Supply Diversity Solution – FEI's Southern Crossing Pipeline Extension to the Lower Mainland



Portfolio Approach to Resiliency

Resiliency Measures Should Reflect Optimal Annual Contracting Plan Supply Portfolio

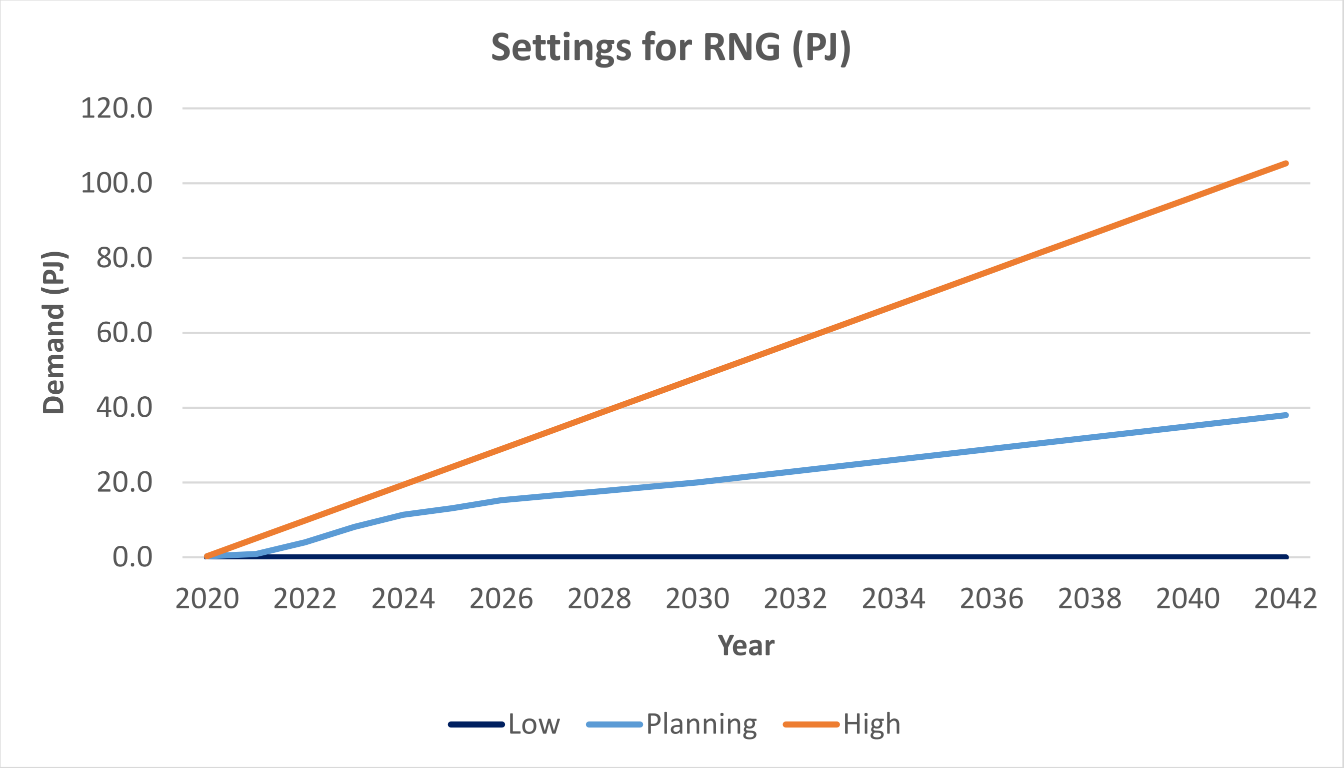


Resiliency for shorter duration load requirements achieved economically by:

- Market Area Storage
- Increased on-system storage/ vaporization
- Load Management Tool
- Commercial Arrangements (Capacity Recall)

Resiliency for longer duration load requirements achieved economically by splitting optimal capacity between existing and new pipelines

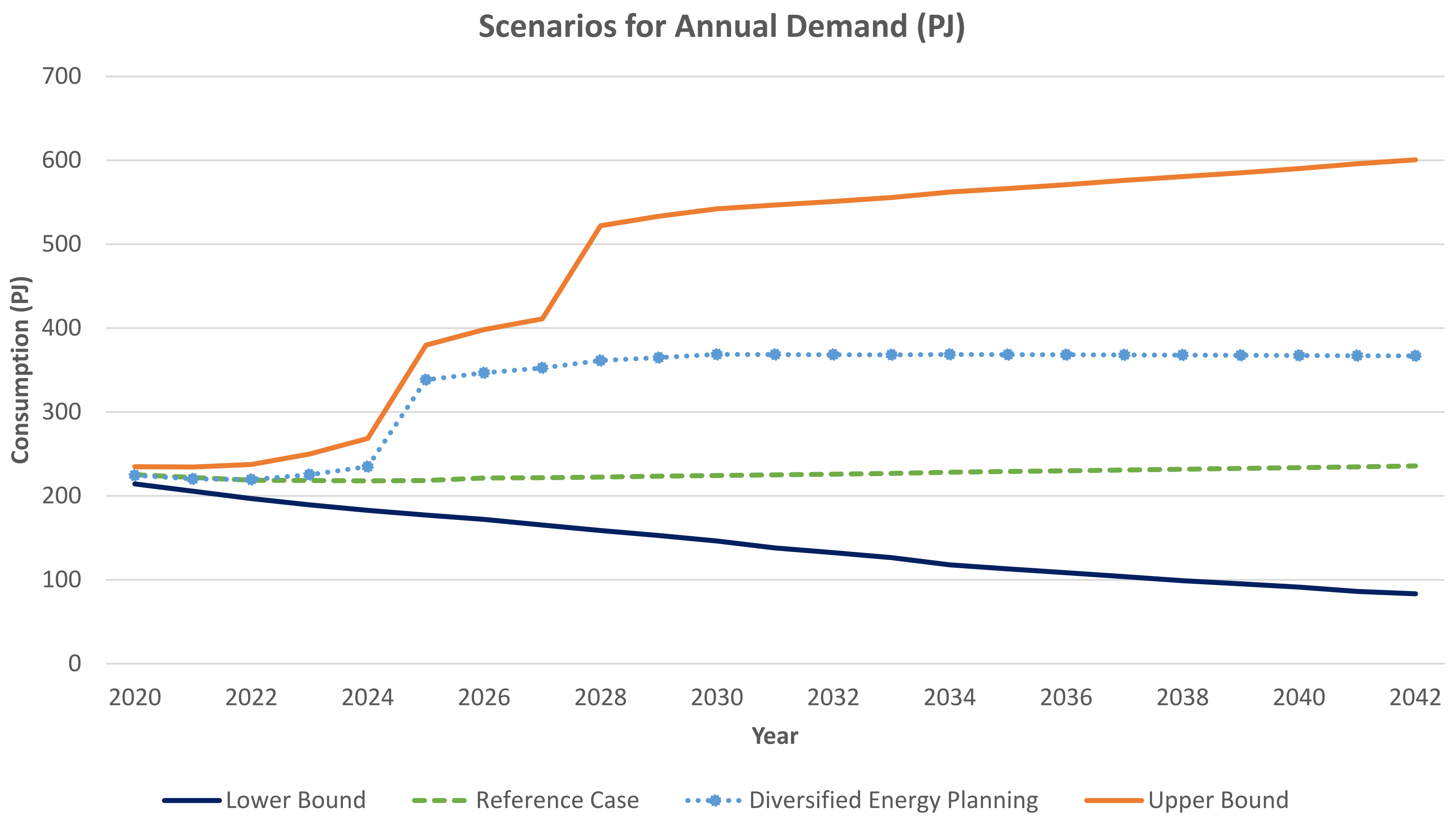
Future Portfolio Planning for Renewable Natural Gas



Gas Supply Planning focused on:

1. Project Location (Off-System vs On-System)
2. Supply Reliability (Firm Requirements)

Portfolio Planning for Different Load Forecasts



Conclusion

FEI will continue with its existing contracting strategies:

- Contract at Supply Hubs (Station 2 and AECO/NIT) instead of Demand Hub (Huntingdon);
- Customer Forecast Load Requirements Met with Firm Resources

Resources in portfolio are flexible enough to handle potential long term supply reductions (Renewable Natural Gas, Lower Demand Scenarios);

FEI's Long Term Supply Planning is focused on the following market factors:

- Resource Constraints (Winter);
- Pricing Risks at Huntingdon/Sumas Market Hub;
- Increasing load forecast scenarios;
- Enhancing supply resiliency

Infrastructure investments in the region are required to respond to these market factors.

Questions and Discussion

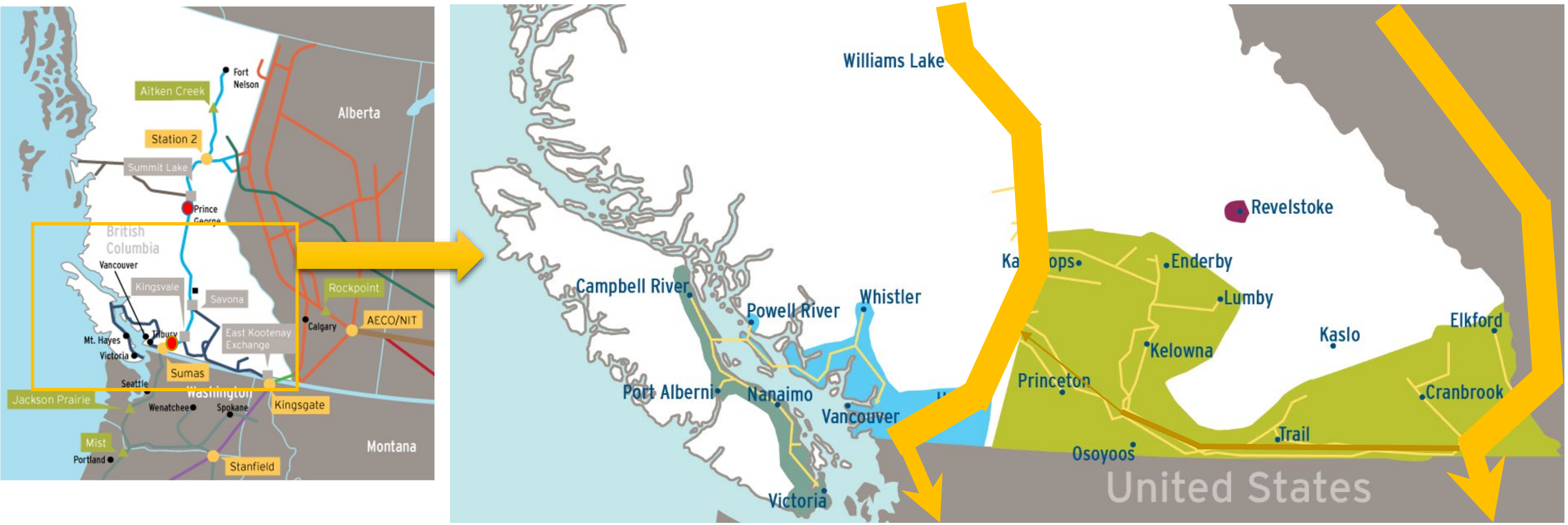
Infrastructure Transition to Renewables and Resiliency

Energy at work FORTIS BC™

Regional Gas Supply Diversity (RGSD)

FEI's Southern Crossing Pipeline Extension to the Lower Mainland

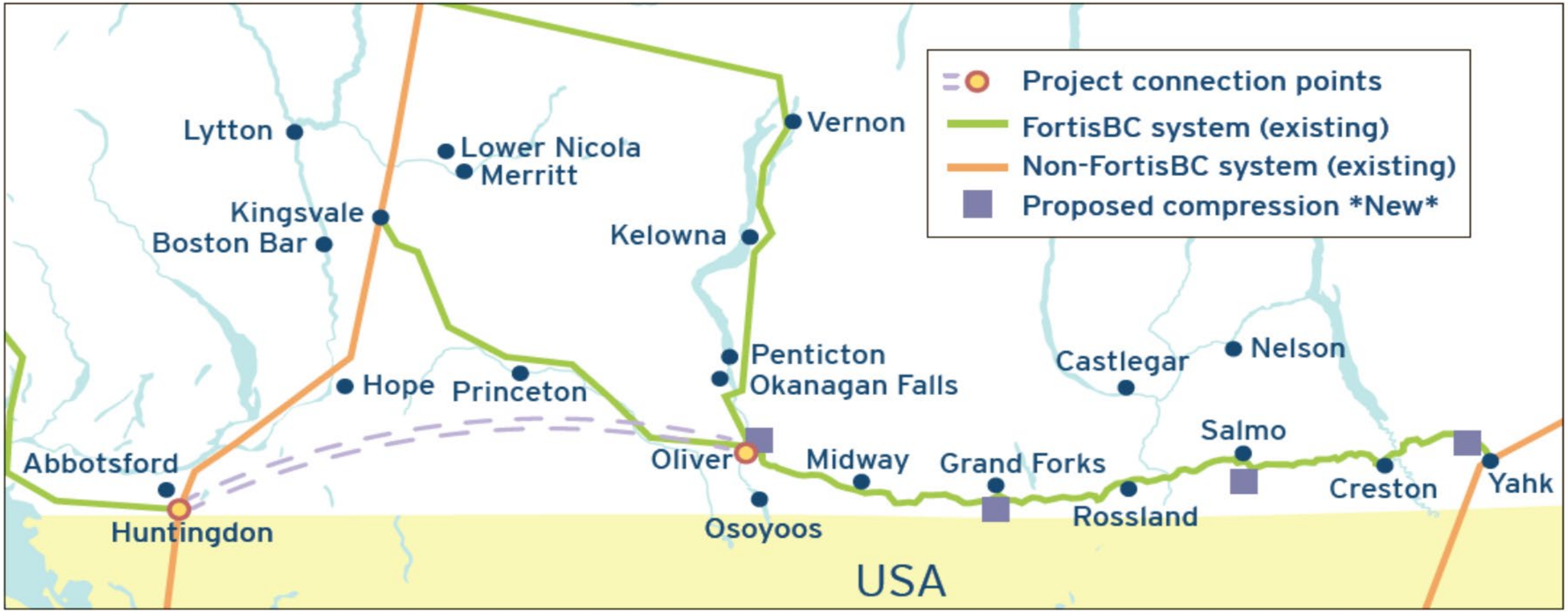
Regional Energy Infrastructure Overview



- Natural gas to majority of FortisBC customers supplied via North-South Enbridge T-south pipeline (2018 outage)
- Existing Southern Crossing pipeline provides a secondary, low capacity East to West supply connection from Alberta – line thicknesses depict relative capacity

Regional Gas Supply Diversity (RGSD) Project Concept

- Extension of **FEI's Southern Crossing Pipeline** at Oliver to the Lower Mainland



Energy at work FORTIS BC™

Regional Energy Infrastructure Need and Vision

Need:

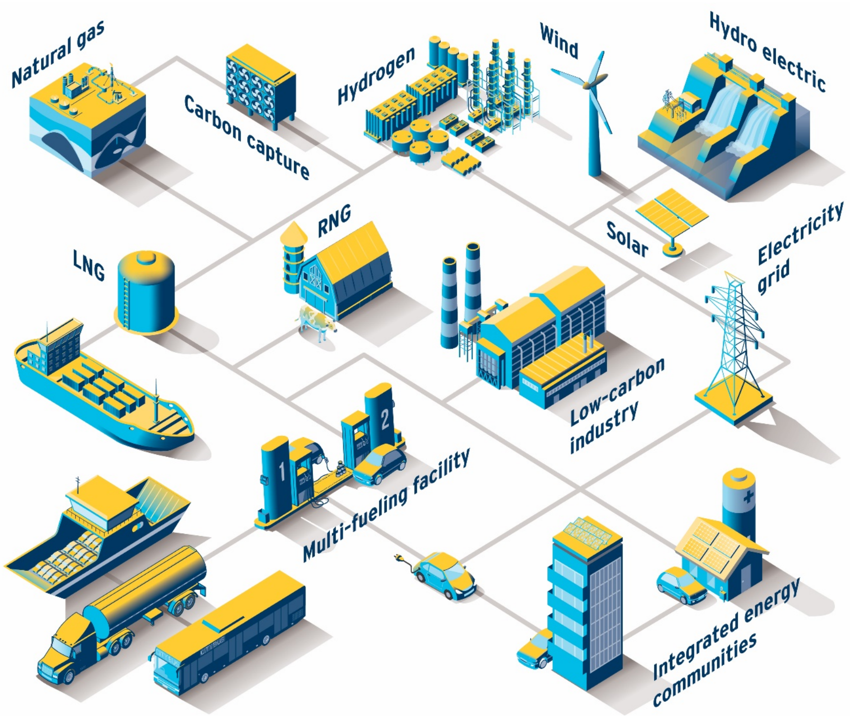
- **Resilient Communities** – provides a second energy source and benefits to on-route communities
- **Clean Energy Transformation** – accelerate the delivery of renewable and low-carbon energy to customers
- **Energy Supply** – supply source to alleviate capacity constraints in the region

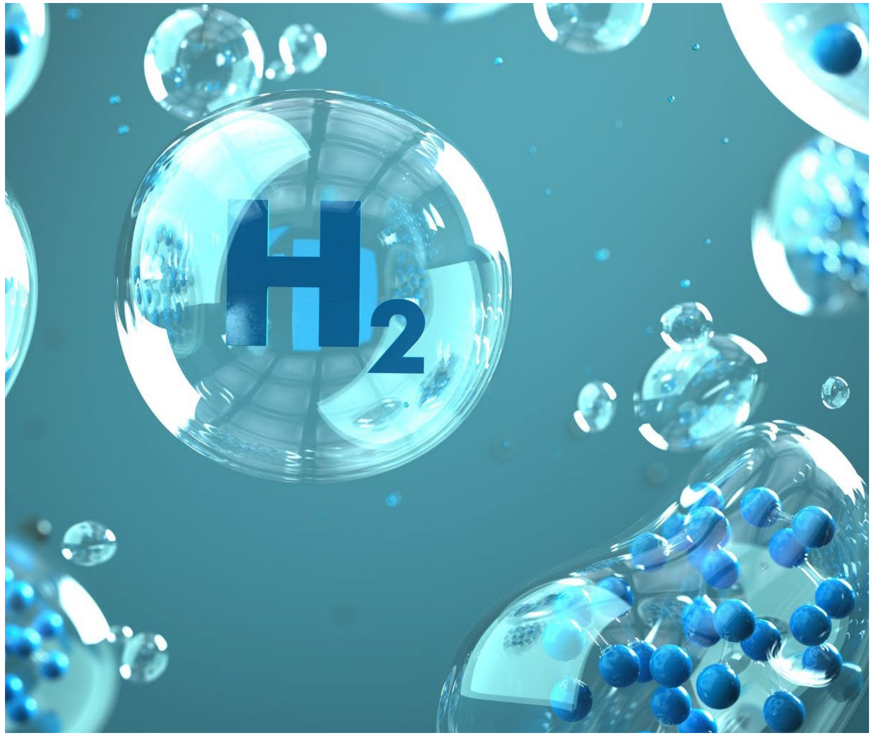
Vision:

- **Regional Clean Energy Solution** – capacity to deliver clean energy to meet expected demand
- **Indigenous Opportunities** – create inclusion and long-lasting partnerships with Indigenous communities

Regional Energy Infrastructure Need and Vision

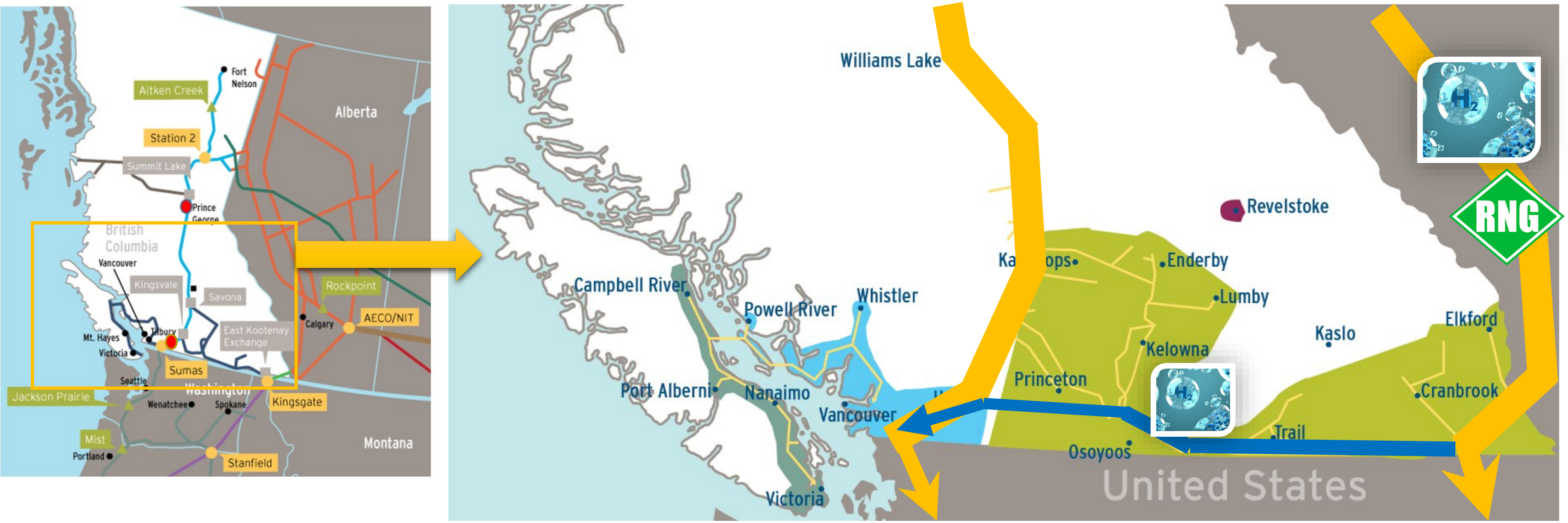
Resilient Communities





Clean Energy Transformation

Resilient Supply and Clean Energy Transformation Concept

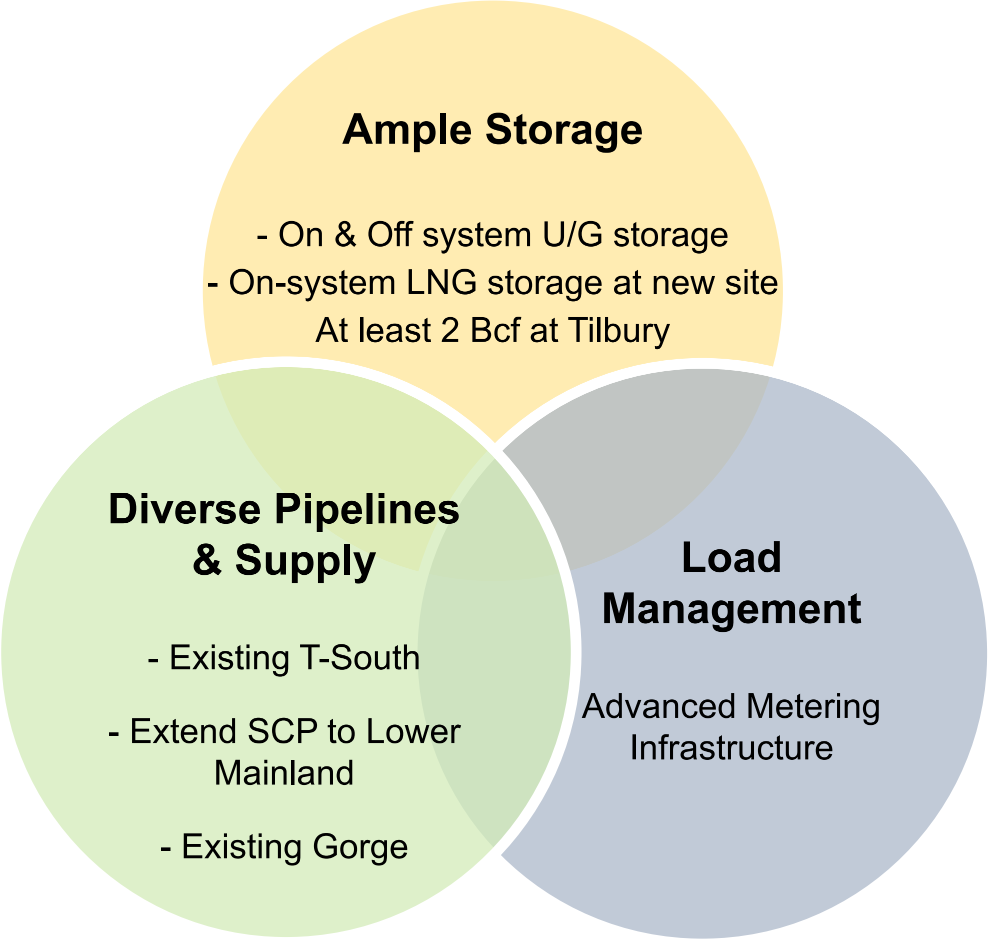


- Increase capacity of East to West supply & connect to Vancouver area; designed to carry Hydrogen
  - Enables supply of Hydrogen from Alberta & capture of on-route Hydrogen & bio-methane
  - Provides significant secondary supply source to Vancouver & Southern Interior to assure supply reliability

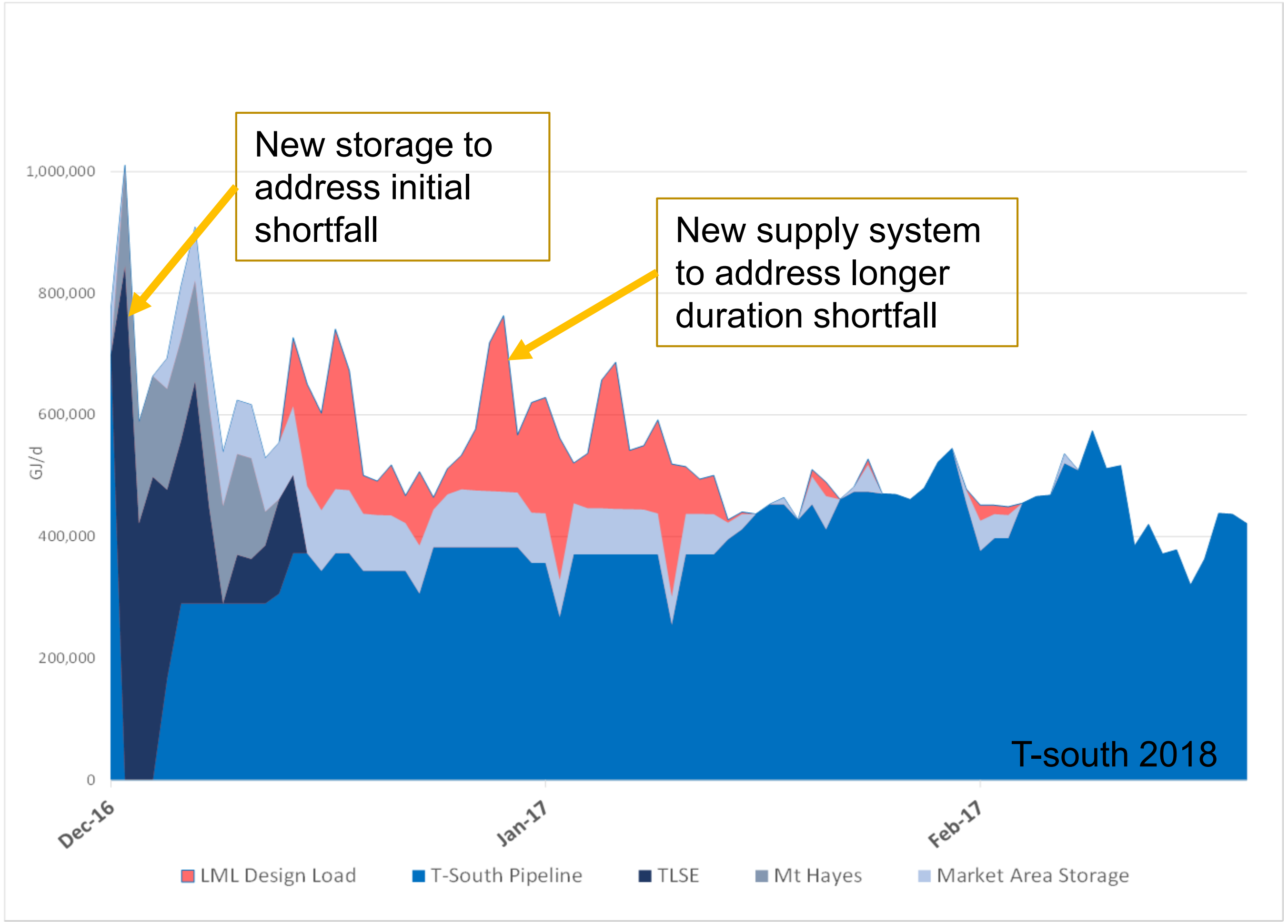
RGSD Will Complement Tilbury Expansion (TLSE)

- In the Tilbury CPCN and with Guidehouse work FEI outlined the **optimal resiliency solution** to include **Tilbury LNG and optimally sized pipeline** for mid and long-term disruptions.

- Recent events last week with mud slides on Coquihalla, cybersecurity breach at Colonial and Texas winter outage highlights the need for a resilient system.

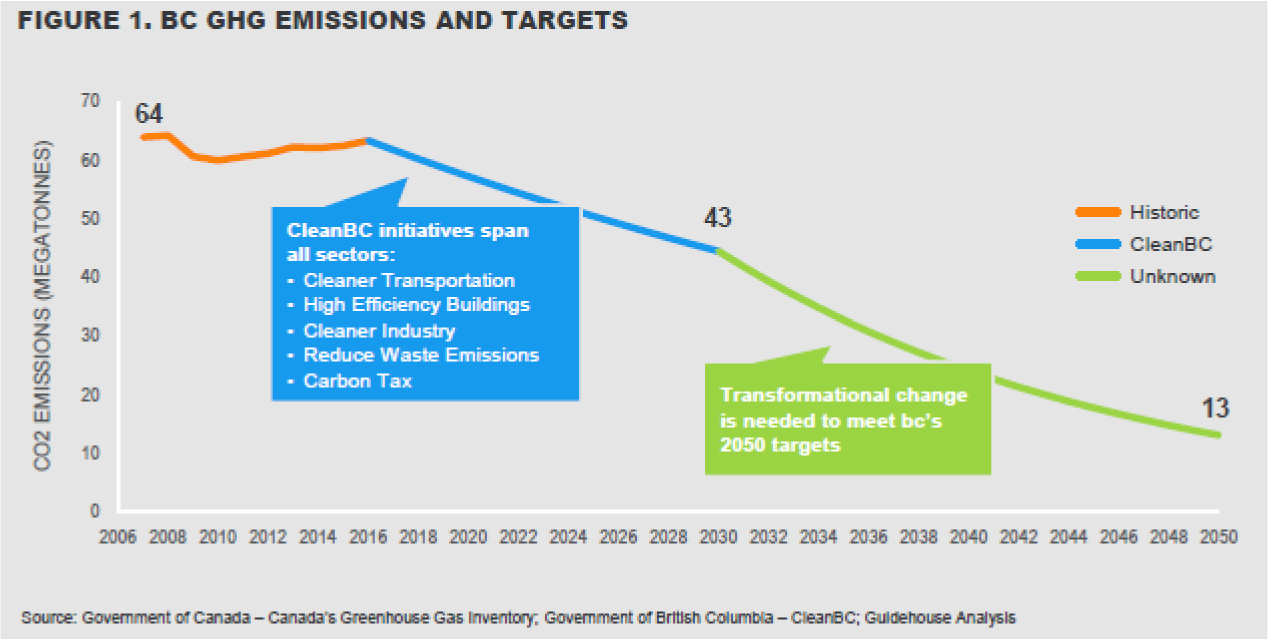


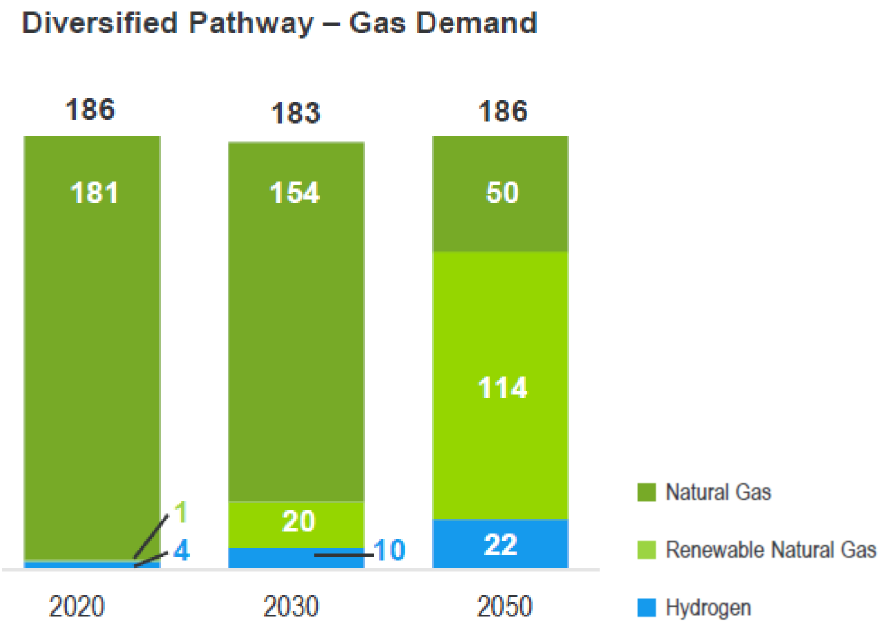
Resilient Supply Challenge



- Chart compares FortisBC cold weather customer load to capacity available during actual T-south event
- Addressing shortfall:
  - More on system storage (application to BCUC for approval underway)
  - Second independent supply system (concept stage)

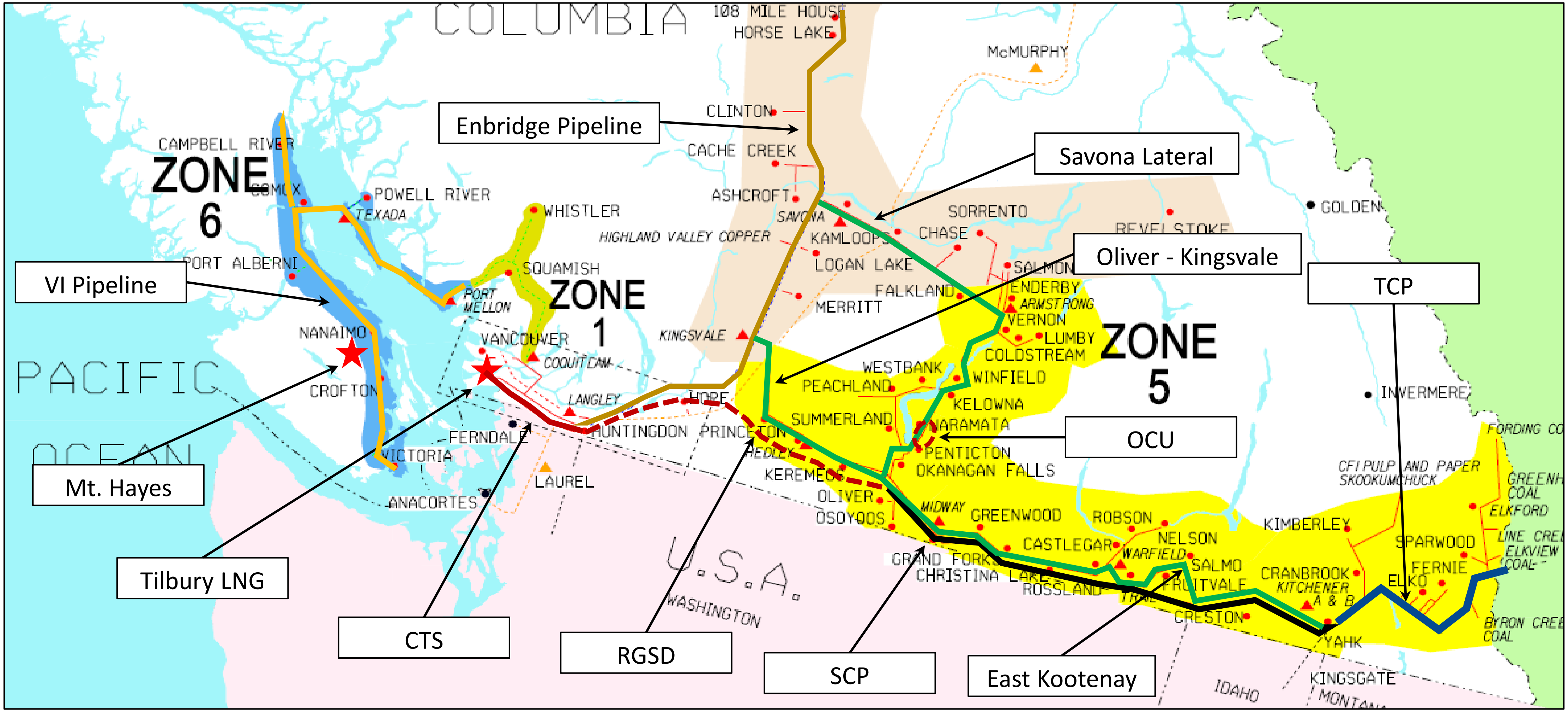
Net Zero by 2050 Challenge





- Transformational change will require significant increase in hydrogen & renewable natural gas supply
  - See **FortisBC Clean Growth Pathway & BC Hydrogen Strategy**
- New hydrogen-ready pipe system
  - strategically located to increase access to hydrogen & renewable natural gas
  - functions as an accelerator for feed-in projects including solar & wind

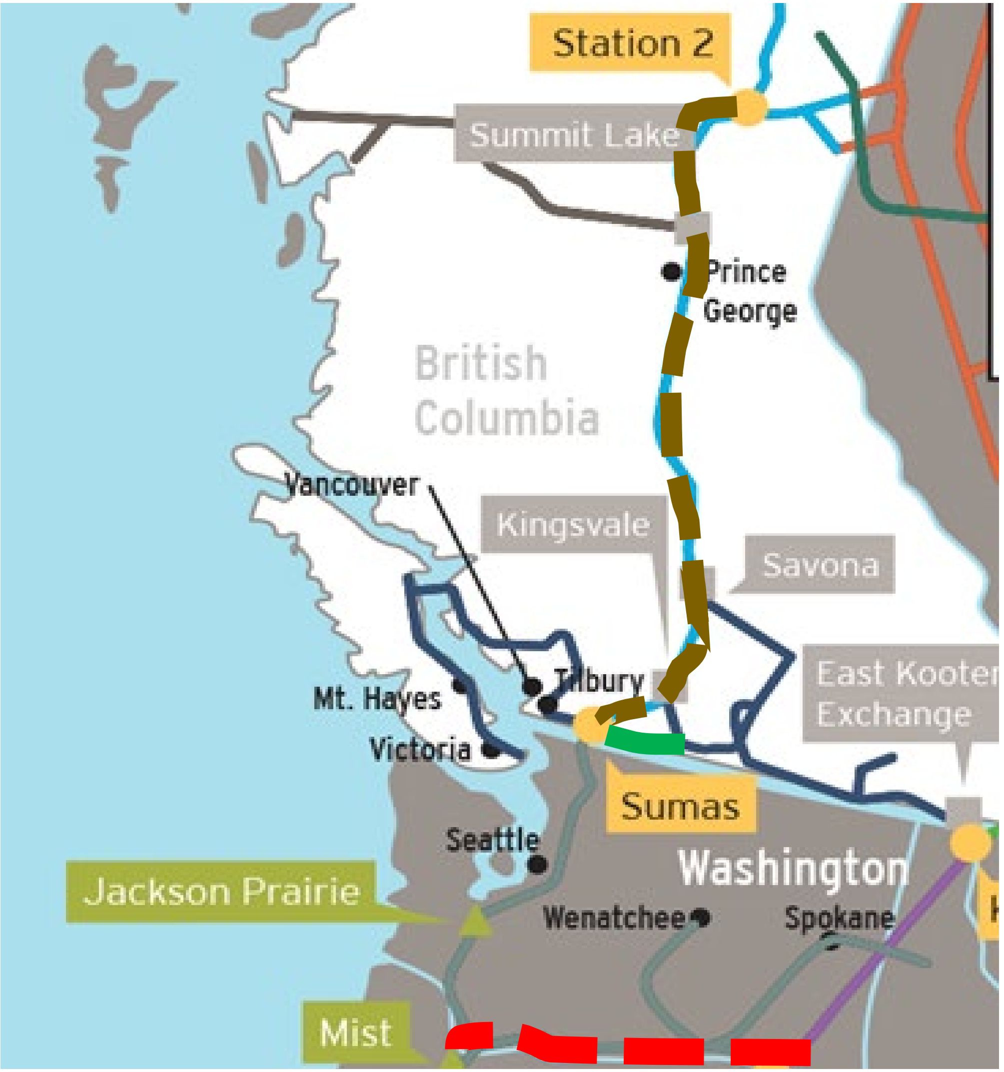
Transmission Network- RGSD Strengthens Entire System



Energy at work FORTIS BC™

Evaluation of Alternatives

Regional Pipeline Options to meet longer duration needs



- T-South Expansion
- SCP Extension
- Gorge Expansion (NWP)

Evaluation of Pipeline Expansion Alternatives

Pipeline Option	Resiliency	Clean Growth Pathway	Energy Supply	Indigenous Opportunities
T-South expansion	▼	▼	▲	▼
SCP to Lower Mainland extension-RGSD	▲	▲	▲	▲
Gorge expansion	▼	▼	▬	▼

Superior Alternative	▲	Acceptable Alternative	▬	Inferior Alternative	▼

FEI 2030 Customer Bill Impact - RGSD vs T-South Expansion

	RGSD (approx. 243 KM Extension) *Preliminary Results*	**T-South Expansion** (900 Km with required looping) (FEI do nothing) - not Hydrogen ready ($0.85/GJ Toll - $1.00/GJ) Impact to FEI 700 TJ/d of capacity
CAPEX	$4B (includes AFUDC)	
Cost of Service (COS) 5 year avg	$0.3B/year	
Gas Supply Benefits (revenues)	$0.1B/year	
Net COS 5 year avg	$0.2B/year	$0.15B/year
Approx. 2030 FEI Customer Bill Impact	Approx. 5.0%	Approx. 4%

Evaluation Criteria (non-quantified)	Resiliency	Clean Growth Pathway	Energy Supply	Indigenous Opportunities	Resiliency	Clean Growth Pathway	Energy Supply	Indigenous Opportunities
	▲	▲	▲	▲	▼	▼	▲	▼

Superior Alternative	▲	Acceptable Alternative	▬	Inferior Alternative	▼

Milestone Development Work

Prior to 2021	2021	2022/23	2027/28	2028	2029
Introduced pipeline solution in LTGRPs, ACPs and Compliance Report	Completed studies on key development components and preliminary business plan	Indigenous Engagement Project Development File CPCN	Approvals ▪ CPCN ▪ EA ▪ BCOGC	Construction	In service

Ongoing Stakeholder and Indigenous dialogue

Questions and Discussion

Wrap-up & Next Steps

Thank you for attending today's session, we appreciate your time and input. Additional opportunities to provide feedback will be announced shortly.

The session presentation and notes will be posted online in the next few weeks.

If you have any further feedback or questions, please reach out to the Resource Planning team at **irp@fortisbc.com.**

Thank you

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2022 LONG TERM GAS RESOURCE PLAN (LTGRP) DIVERSIFIED ENERGY FUTURE

February 10, 2022

Energy at work FORTIS BC™

Welcome, Acknowledgment, Introduction

FortisBC acknowledges and respects Indigenous People in this place we call Canada, on whose traditional territories we all live, work and play.

FortisBC is committed to Reconciliation with Indigenous Peoples, using our Statement of Indigenous Principles to guide our words and actions.

PUBLIC VERSION

Safety moment: Mental wellness

With COVID-19 affecting every aspect of our lives, Canadians are feeling the impact of the pandemic on their mental health. Now more than ever, mental health matters and every action counts.

Helpful information and tips developed by the Canadian Psychological Association can help you, your friends, and your family cope with stress as we look after our collective mental wellness.

1. Recognize signs of stress

2.Take care of yourself

3.Take care of others

4.Connect to help

5. End stigma with these 5 simple ways

6.Listen with empathy

Guiding Principles for FortisBC

Contribute to Province's Decarbonization Goals

Integrated Optimized, and Low-cost GHG Abatement

Support Affordability

Understand and Mitigate Long-Term Impacts to Energy System

Diversified and Collaborative Energy Approach

Strengthen, Reliability and Resiliency

Agenda

Welcome, Acknowledgment, Introduction & Sessions Overview
(10 min.)

Status update on the resource planning process and overview of RPAG feedback
(20 min.)

Overview of the Diversified Energy Scenario - FEI's planning scenario
(60 min.)

Break
(15 min.)

Further Discussion on the Regional Gas Supply Diversity Project and its role in a diversified energy future
(45 min.)

Developing the LTGRP Action Plan
(25 min.)

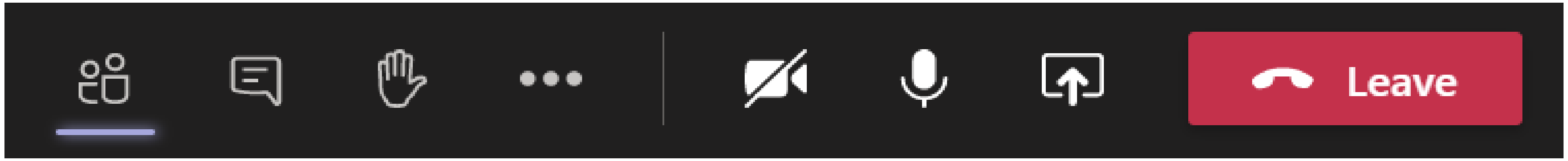
Wrap-up & Next Steps
(5 min.)

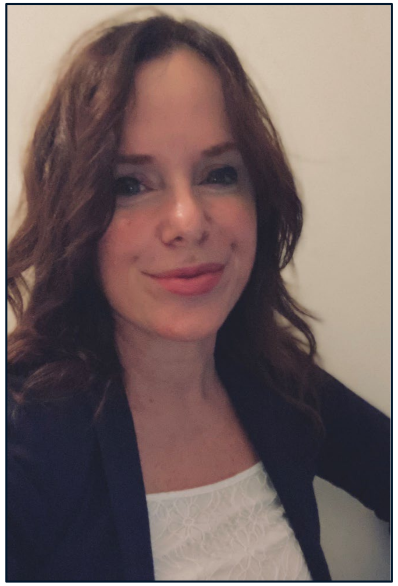
Session Objectives

1. Overview of RPAG feedback and how we used your feedback
2. Discuss the Diversified Energy Scenario - FEI’s planning scenario
3. Discuss the Regional Gas Supply Diversity Project
4. Collect any remaining feedback before the 2022 LTGRP filing
5. 2022 LTGRP status and next steps

Housekeeping

- Video participation is not required – presenters will use video
- When not speaking, please mute yourself to reduce background noise
- We will have scheduled breaks for questions and discussion
- We encourage you to use the hand-up function to indicate you'd like to speak
  - When we call upon you, feel free to un-mute, introduce yourself and speak clearly
  - You may also use the chat functionality to enter comments and questions if you'd prefer
- The session audio/video will not be recorded, however, the chat history will be saved for note-taking purposes
- Session participants should be visible by clicking on the participants icon



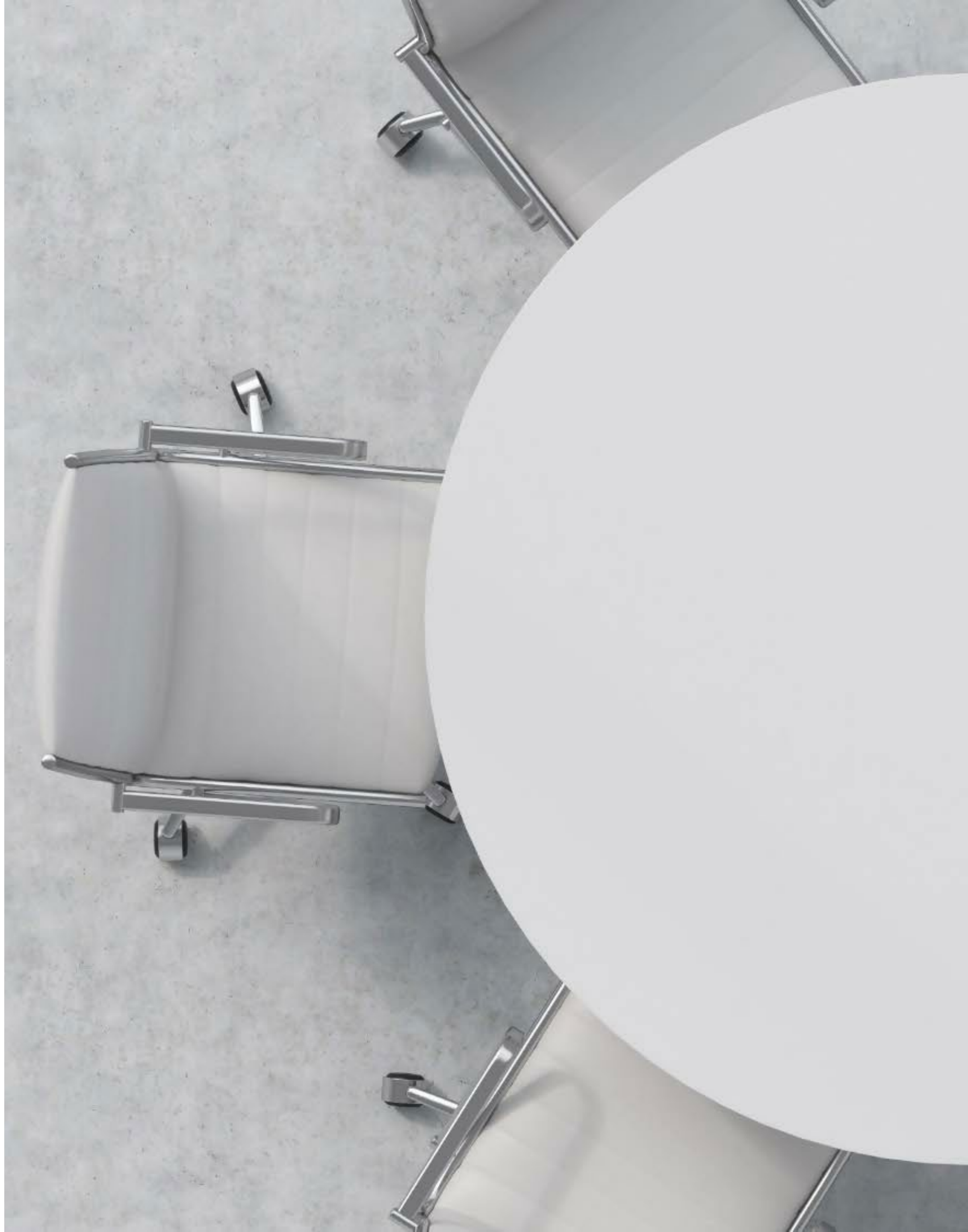


Paul Chernikhowsky
Director, Regulatory Projects & Resource Planning

Ken Ross
Manager, Resource Planning & DSM Reporting

Tania Specogna
Director, Resource Development

FortisBC Speakers

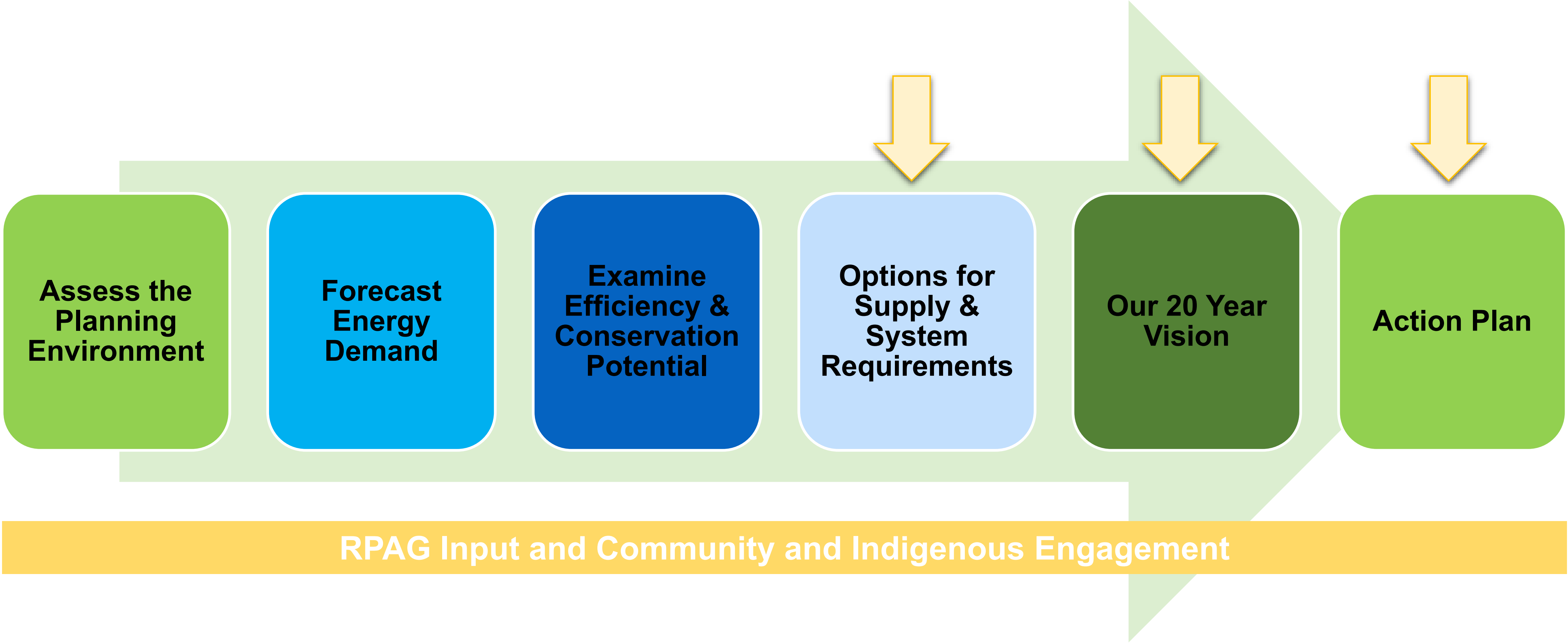


Resource Planning Advisory Group (RPAG) Members & Guests that participated

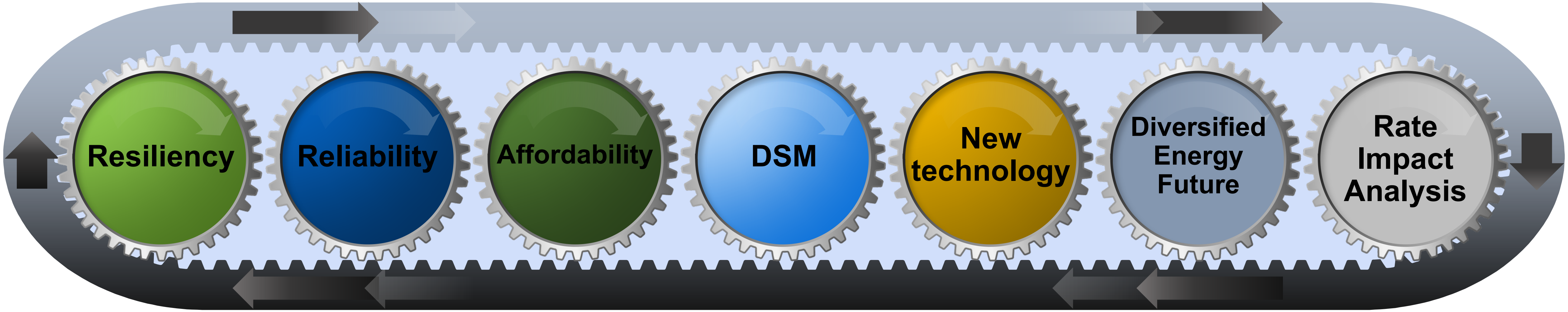
- Avista Utilities
- BC Business Council
- BC Hydro
- BC Ministry of Energy, Mines & Low Carbon Innovation
- BC Public Interest Advocacy Centre
- BC Sustainable Energy Association
- BC Utilities Commission
- Building Owners & Managers Association
- Canadian Biogas Association
- Canadian Institute of Plumbing and Heating
- City of Abbotsford
- City of Burnaby
- City of Campbell River
- City of Kamloops
- City of Kelowna
- City of New Westminster
- City of Prince George
- City of Surrey
- Clean Energy Association of BC
- Climate Action Secretariat
- Commercial Energy Consumers Association of BC
- Community Energy Association
- District of Saanich
- Enbridge
- Enbala
- Metro Vancouver
- Midgard Consulting (Representing Residential Consumer Intervener Association)
- MoveUP
- North West Gas Association
- NW Natural
- Northern Alberta Institute of Technology
- Pacific Northern Gas
- Pembina Institute
- Puget Sound Energy
- Roger Bryenton & Associates
- Selkirk College
- SFU Renewable Cities
- Union of BC Municipalities
- University of Victoria
- Village of Keremeos

Update on the resource planning process and overview of RPAG feedback

Recall the LTGRP Process



Overview of RPAG feedback



Overview of RPAG feedback

The need for urgent climate action in BC as facilitated through FEI's transition to clean energy.

How can FEI bring on sufficient renewable and low carbon gas to meet increased demand to 2042, including:

- Impact of renewable and low carbon gases on the gas system;
- Cost and timing of renewable supply;
- Competition for renewable energy resources;
- Recognition that both renewable natural gas and clean electricity are finite resources in BC;
- Hydrogen offers a vast opportunity to supply low carbon energy needs but more research is needed to bring it to market; and
- Feedback on the Renewable Gas Comprehensive Review filing on December 17, 2021.

Overview of RPAG feedback

General support for ensuring a long life for gas infrastructure, security for employees, while providing affordable energy and resilient energy system for all customer segments; residential (including low-income), commercial and industrial.

Requested more understanding of how FEI will meet the GHG emission reduction targets outlined in CleanBC's Roadmap to 2030. Discussions included:

- An understanding that Roadmap details are still being finalized;
- Many aspects of the Roadmap are already captured in the LTGRP scenarios; and
- Acknowledgment of the critical role of the gas infrastructure in decarbonization.

Overview of RPAG feedback

General agreement for the Diversified Energy Pathway as the planning scenario and comparisons to the Deep Electrification scenario are of interest. Discussions included:

- Clarification of aspects of the demand and supply critical uncertainties;
- Location of emission reductions and carbon accounting approach;
- Approaches to decarbonizing various sectors;
- Breakout of transportation sector demand;
- Illustrated demand and carbon reductions by end-use;
- Costs of decarbonization approaches; and
- Slider tool for exploring and discussing demand/supply critical uncertainties.

Overview of RPAG feedback

Support for high DSM setting in the short and longer term as the proportion of renewables increases. Discussions included:

- Clarification on the DSM settings used in the scenarios and the alternative spending levels;
- Clarification on highest performing DSM measures and other DSM measure details;
- Clarification on the avoided costs used to conduct the DSM cost tests;
- Modified Total Resource Cost Test (MTRC) implications;
- Avoided cost of renewable/low carbon gas; and
- Support for DSM savings to be applied across all fuel types, emphasizing the benefits of saving an additional unit of energy (renewable or conventional).

Overview of RPAG feedback

Provided overview of FEI supply and system capacity planning in the diversified energy future, including:

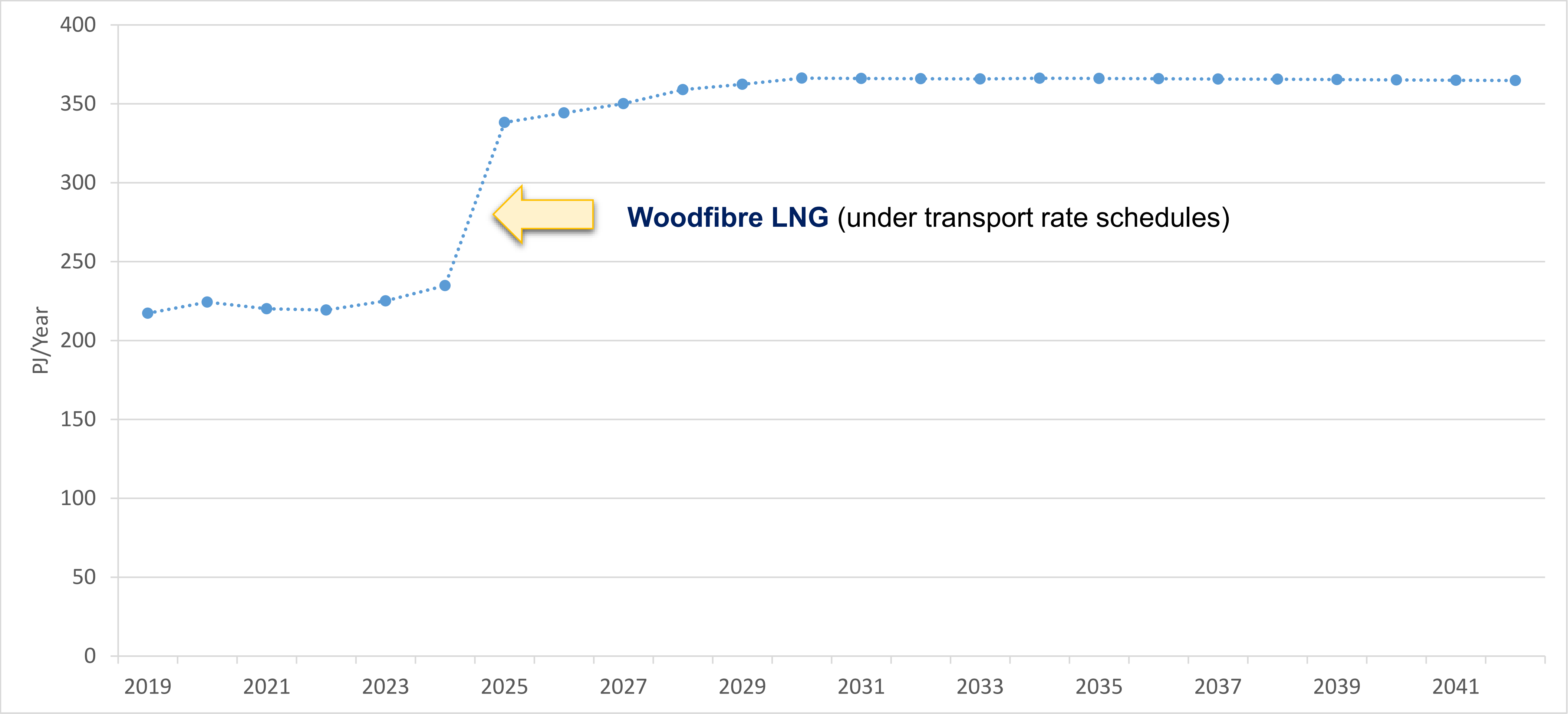
- Annual demand and daily peak demand by sector;
- The role of LNG storage as part of resiliency planning;
- How to account for flow-through projects such as Woodfibre and LNG in GHG emission calculations;
- In terms of current RNG projects, 13 are in BC and 14 are outside of BC;
- The work under way to transition toward hydrogen; and
- Update on the Regional Gas Supply Diversity Project – the importance of resiliency, hydrogen potential and working with Indigenous communities on this project.

Support for FEI and BC Hydro to work together in resource planning to ensure the alignment of demand, supply and cost scenarios in meeting BC's energy needs into the future.

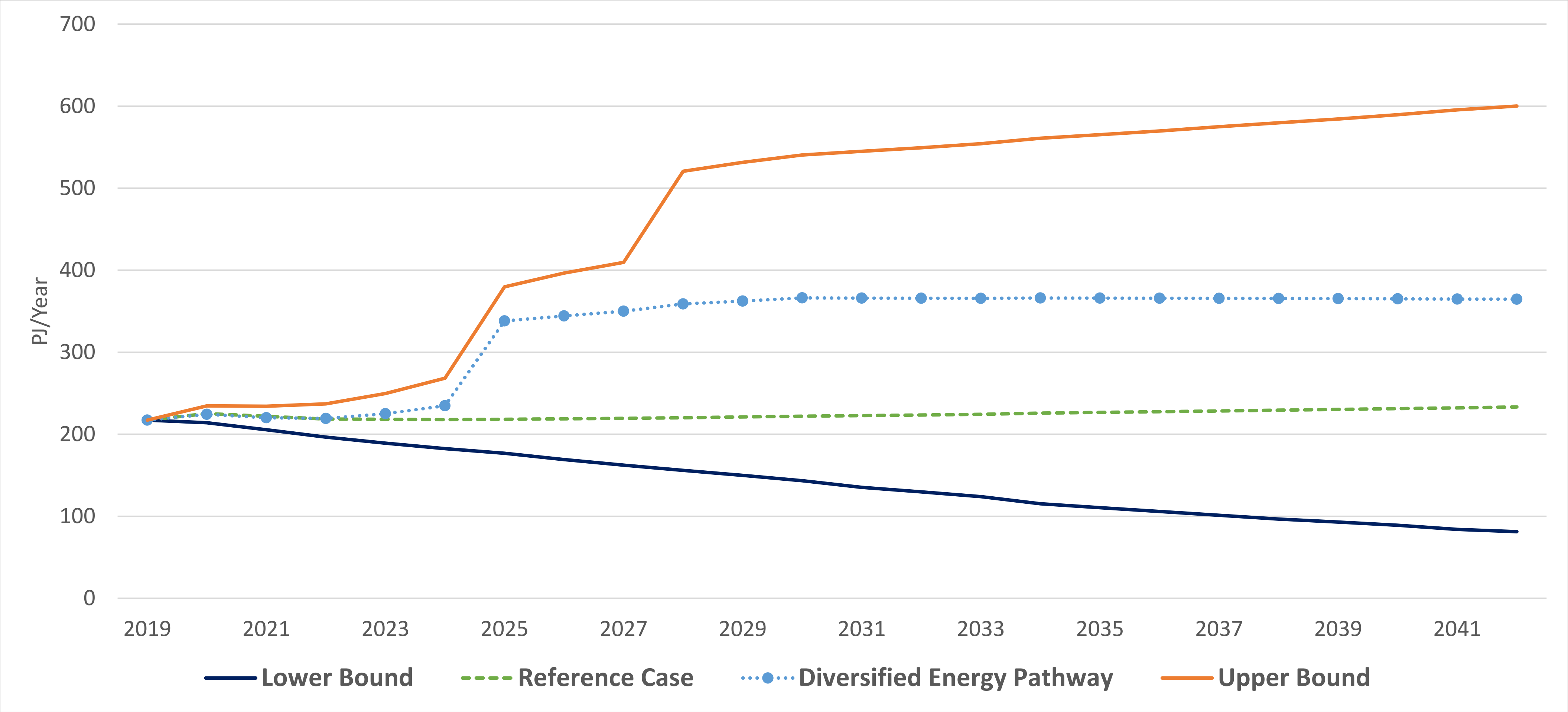
- Collaboration will be critical in identifying the right fuel for the right use at the right time.

Overview of the Diversified Energy Scenario - FEI's planning scenario

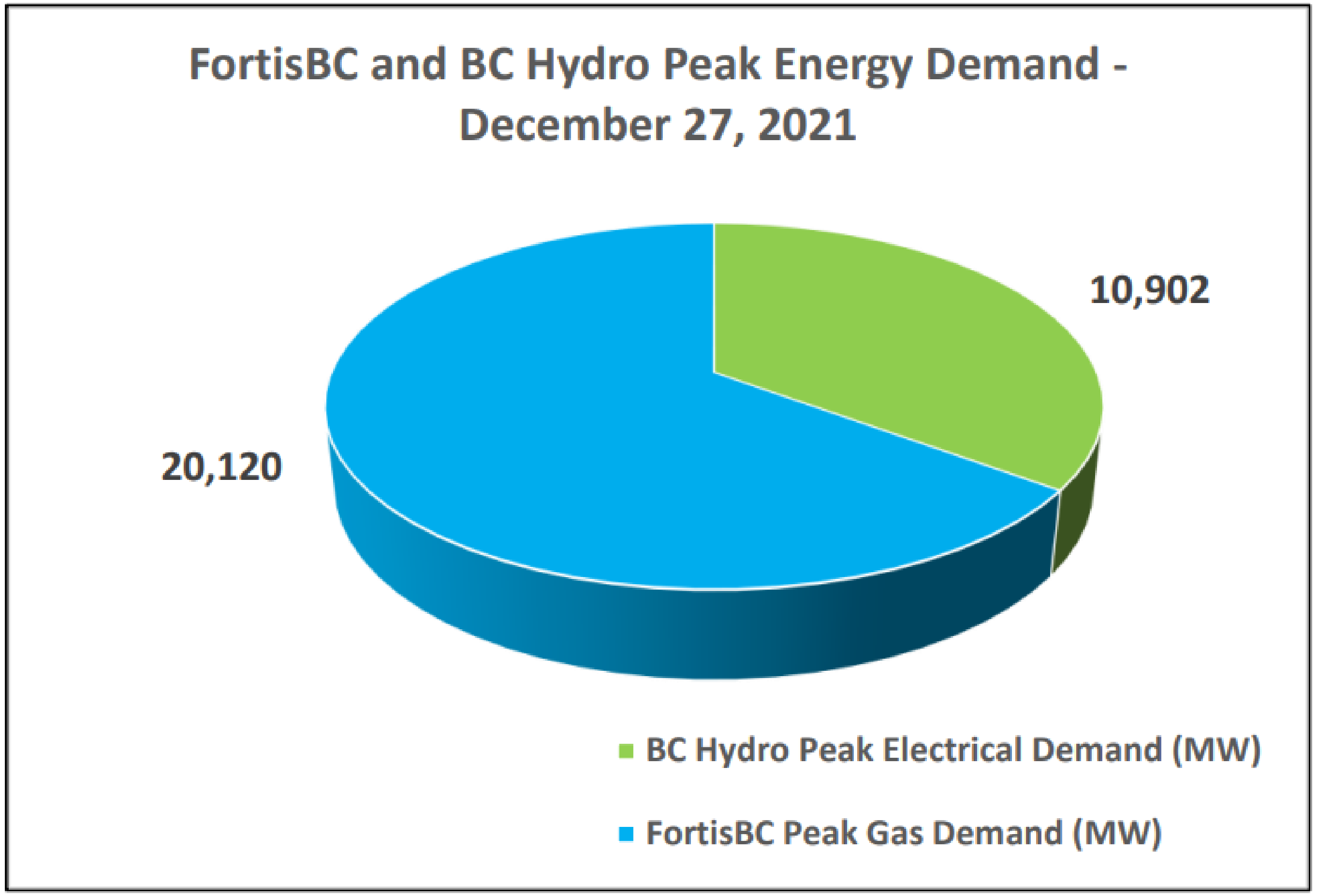
Annual Demand – Diversified Energy Pathway



Annual Demand – Diversified Energy Pathway compared to other scenarios

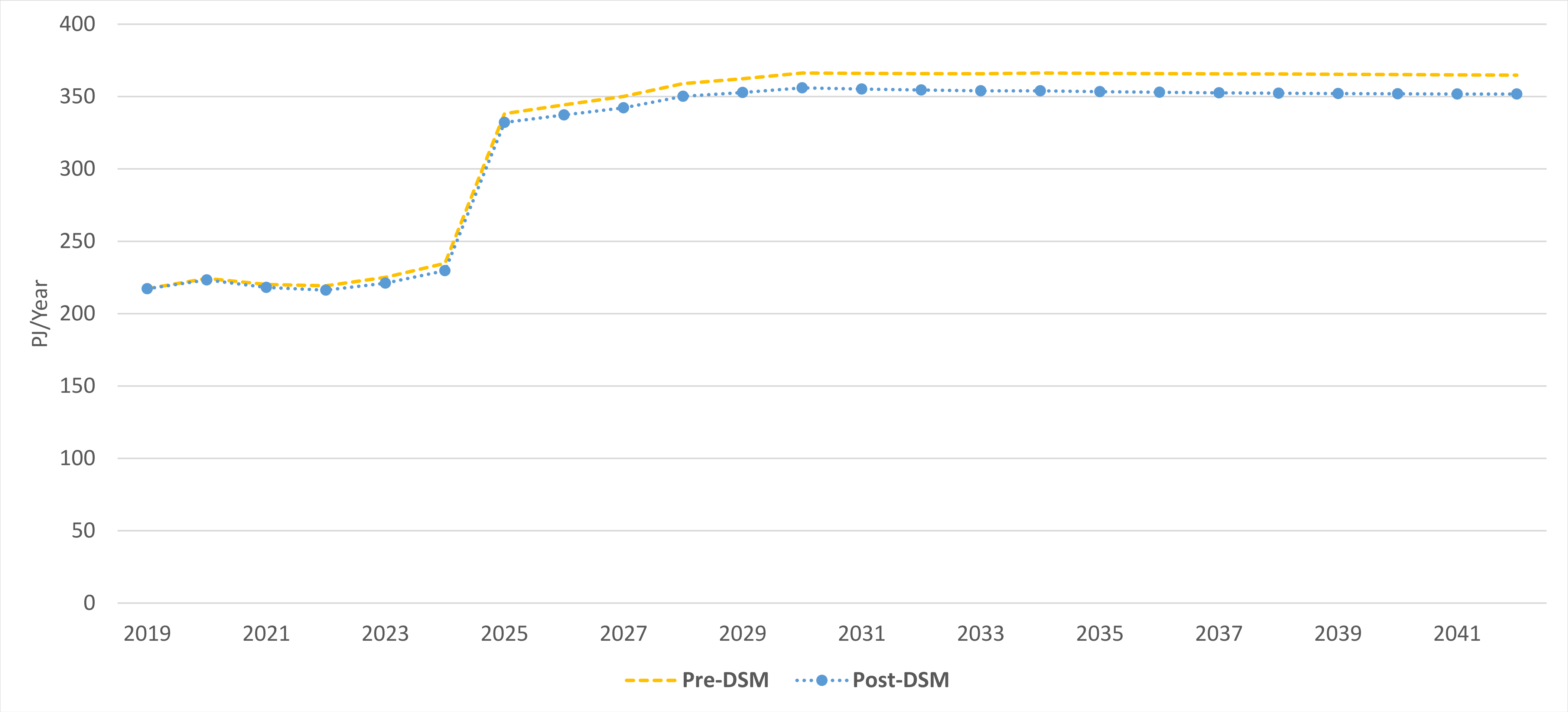


Peak Hour Energy Demand in Cold Snap – December 27, 2021

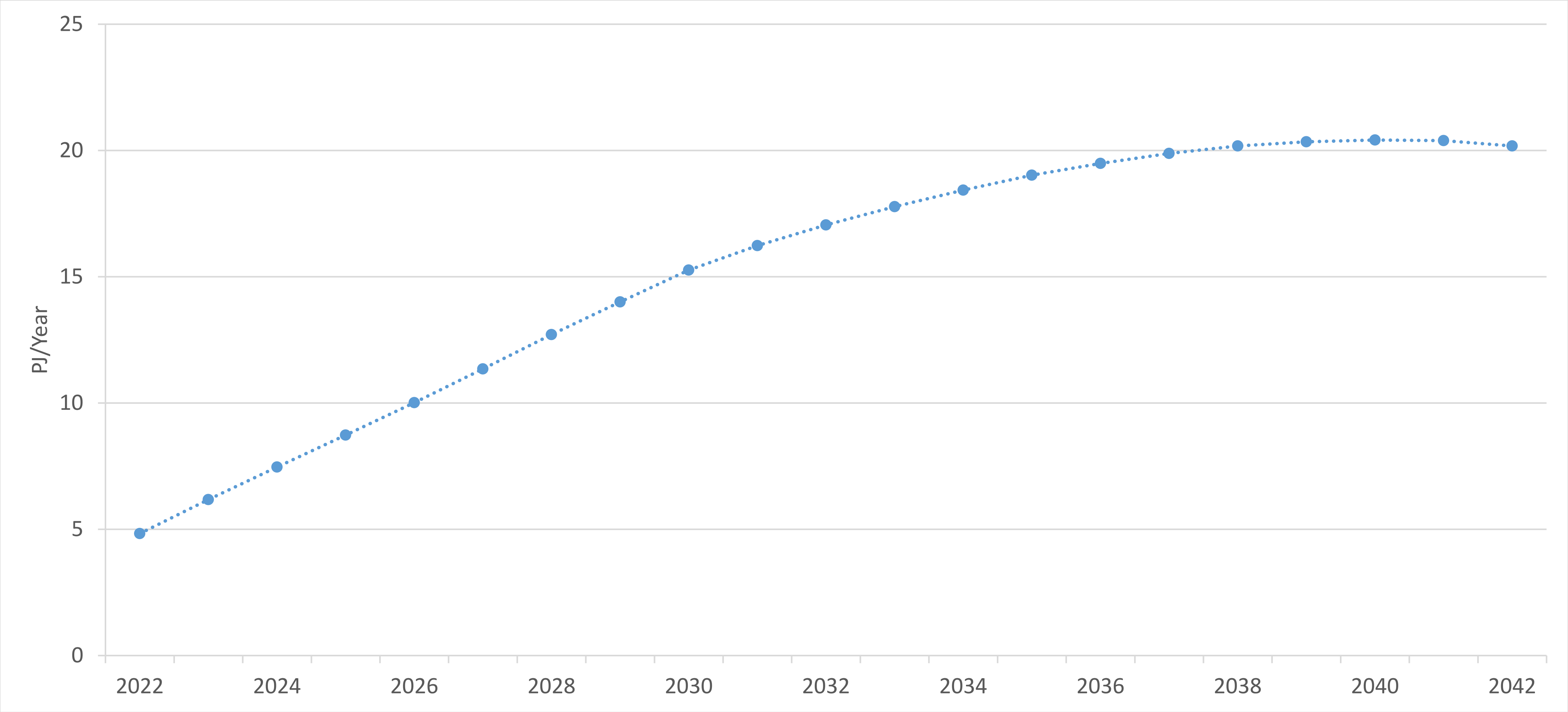


Peak gas demand in equivalent MW using standard unit conversion of 1 MW = 3.6 GJ/hr

Demand Side Management Impact



Demand Side Management Annual Savings – Built Environment



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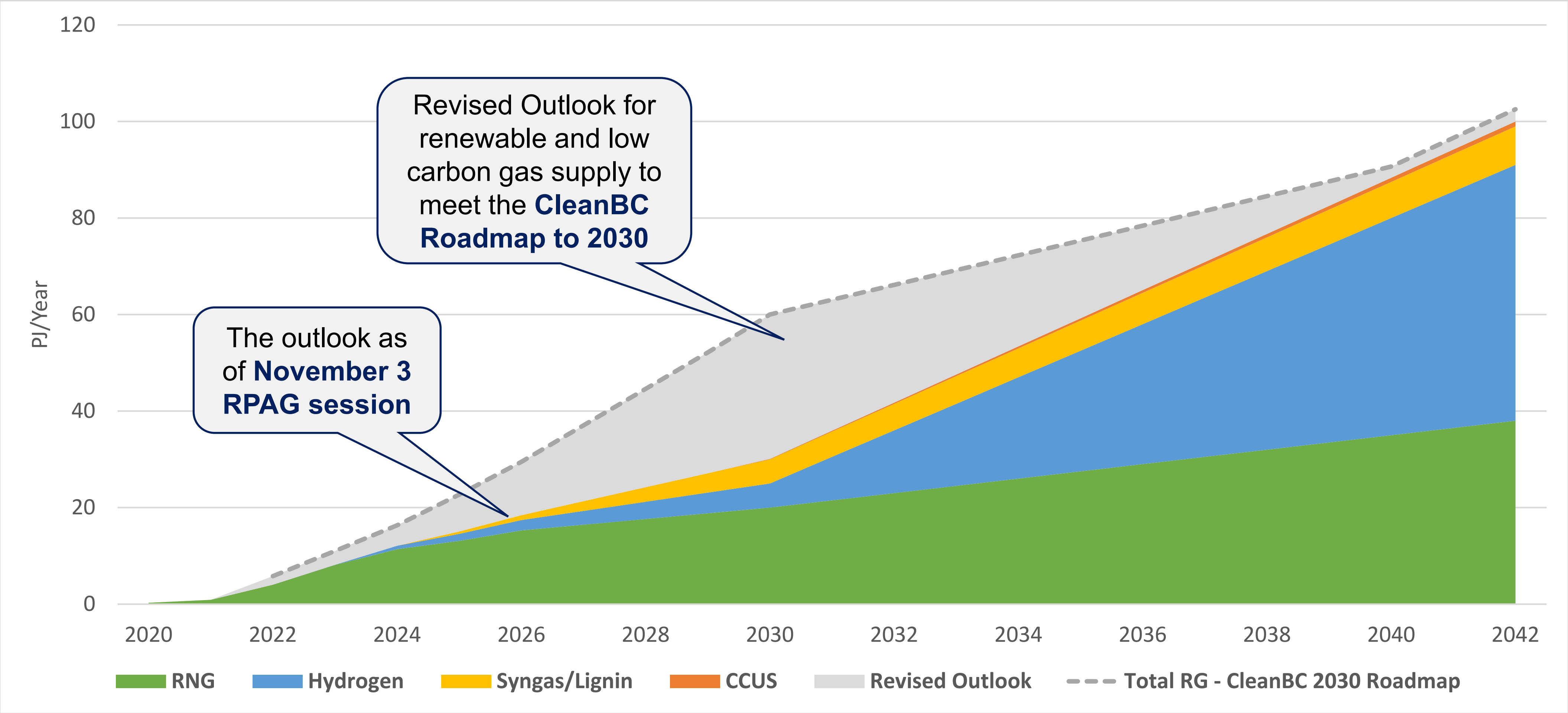
Renewable and Low Carbon Gas Supply Outlook



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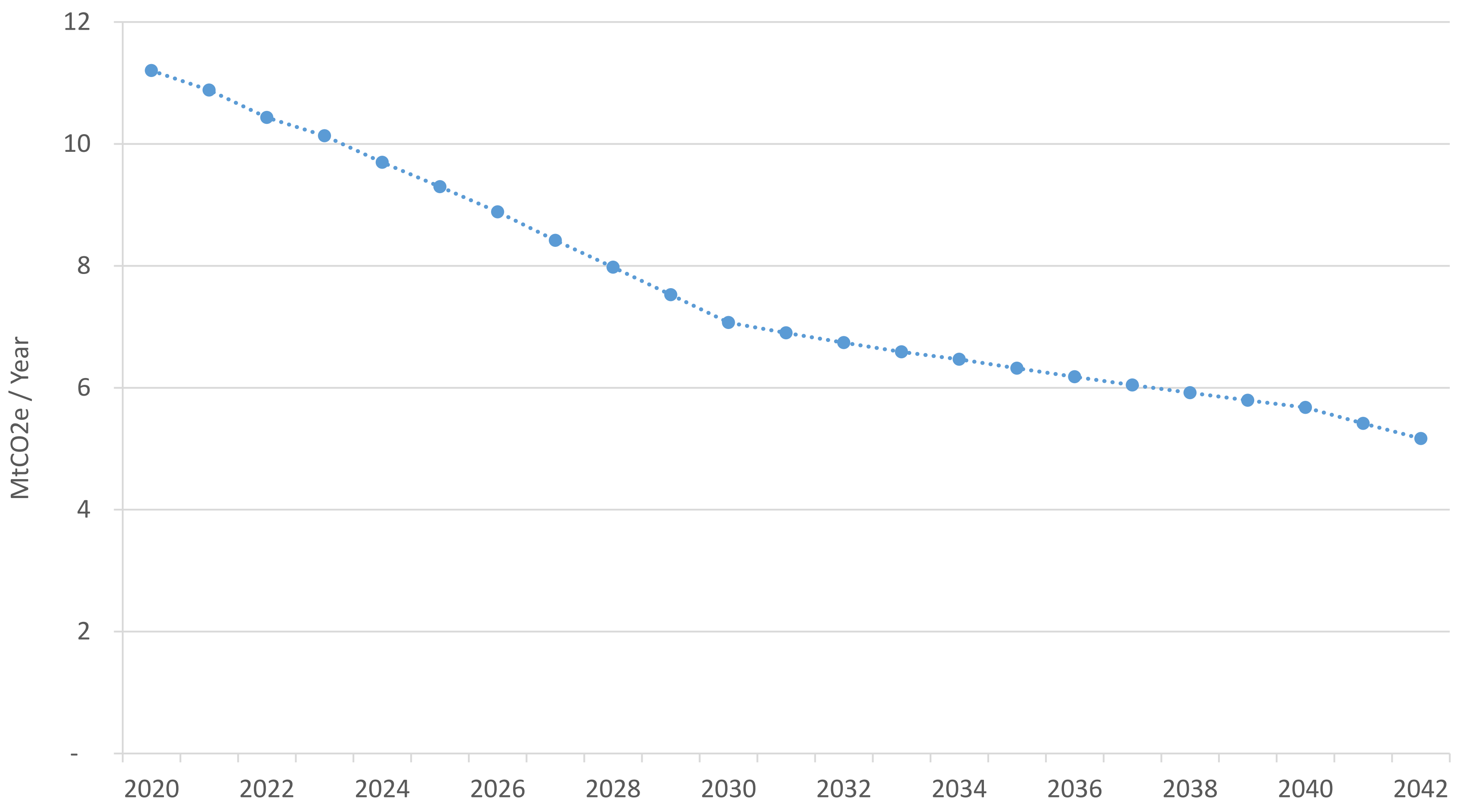
GHG Emissions – Built Environment

Draft



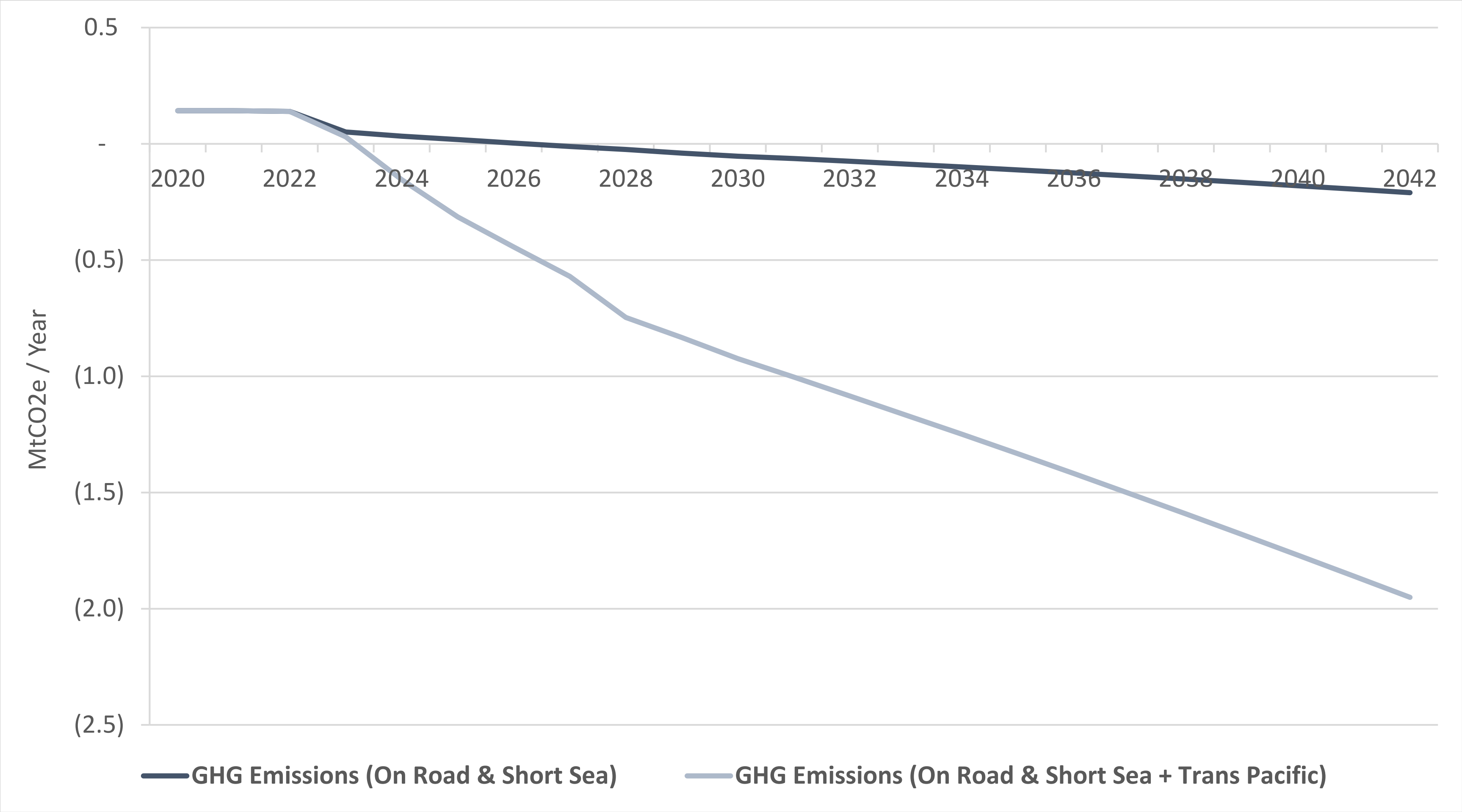
FEI's GHG Emissions reduction from 2007 levels	46%
CleanBC Roadmap to 2030	47%

BC GHG Inventory, 2019

Transport	41%
Oil and Gas, Refining, Mining	20%
Downstream Industry	15%
Agriculture and Waste	10%
Residential	6%
Commercial	4%
Other	4%

GHG Emission Reductions in the Transportation Sector Through the Displacement of Higher Carbon Fuels

Draft



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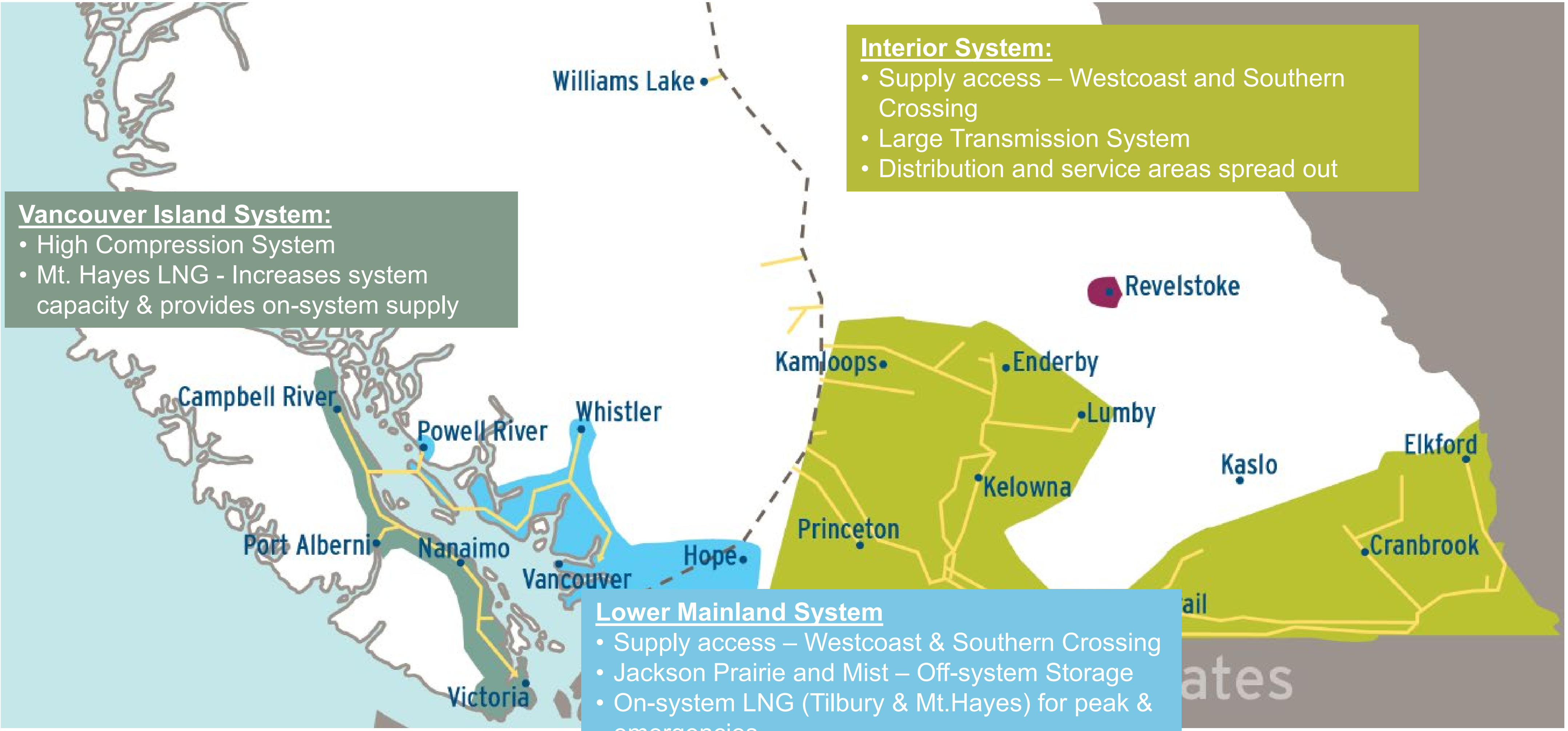
System Infrastructure



Interior System:
- Supply access – Westcoast and Southern Crossing
- Large Transmission System
- Distribution and service areas spread out

Vancouver Island System:
- High Compression System
- Mt. Hayes LNG - Increases system capacity & provides on-system supply

Lower Mainland System
- Supply access – Westcoast & Southern Crossing
- Jackson Prairie and Mist – Off-system Storage
- On-system LNG (Tilbury & Mt.Hayes) for peak & emergencies

Regional Gas Market Resources

Supply Hubs:
- Station 2
- AECO/NIT

Market Hubs:
- Kingsgate
- Sumas

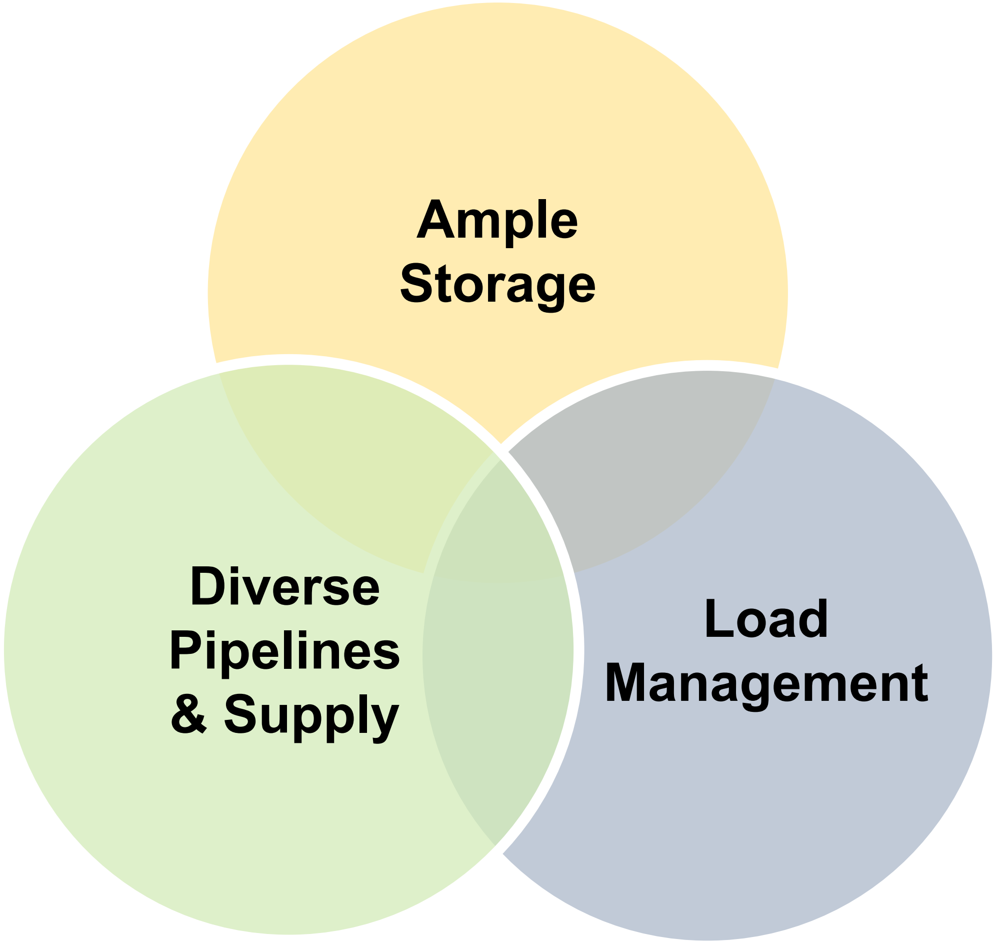
Seasonal Storage:
- Aitken Creek
- Rockpoint

Market Area Storage:
- Jackson Prairie
- Mist

LNG – Peaking Supply:
- Tilbury
- Mt. Hayes

Resiliency

- **Over-reliance on Westcoast T-South** system that serves Lower Mainland, and rest of province to some extent
- 2018 **Enbridge pipeline rupture** highlighted the need for resiliency to serve BC customers
- 2021 **extreme weather** events further underscores the need
- Six to eight years of planning, approvals, and implementation highlights the need to **start the process**
- Opportunity for regional supply risks being served by **future community energy systems** in long term planning



Key Factors Impacting FEI's Supply Portfolio

Renewable Supply

- Incorporating Renewable Supply into the Portfolio
- Characteristics of On-System vs Off-System Supply

Regional Market Conditions

- Limited Resources in Region (constrained in winter)
- New demand ahead of additional pipeline infrastructure

Supply System Failure

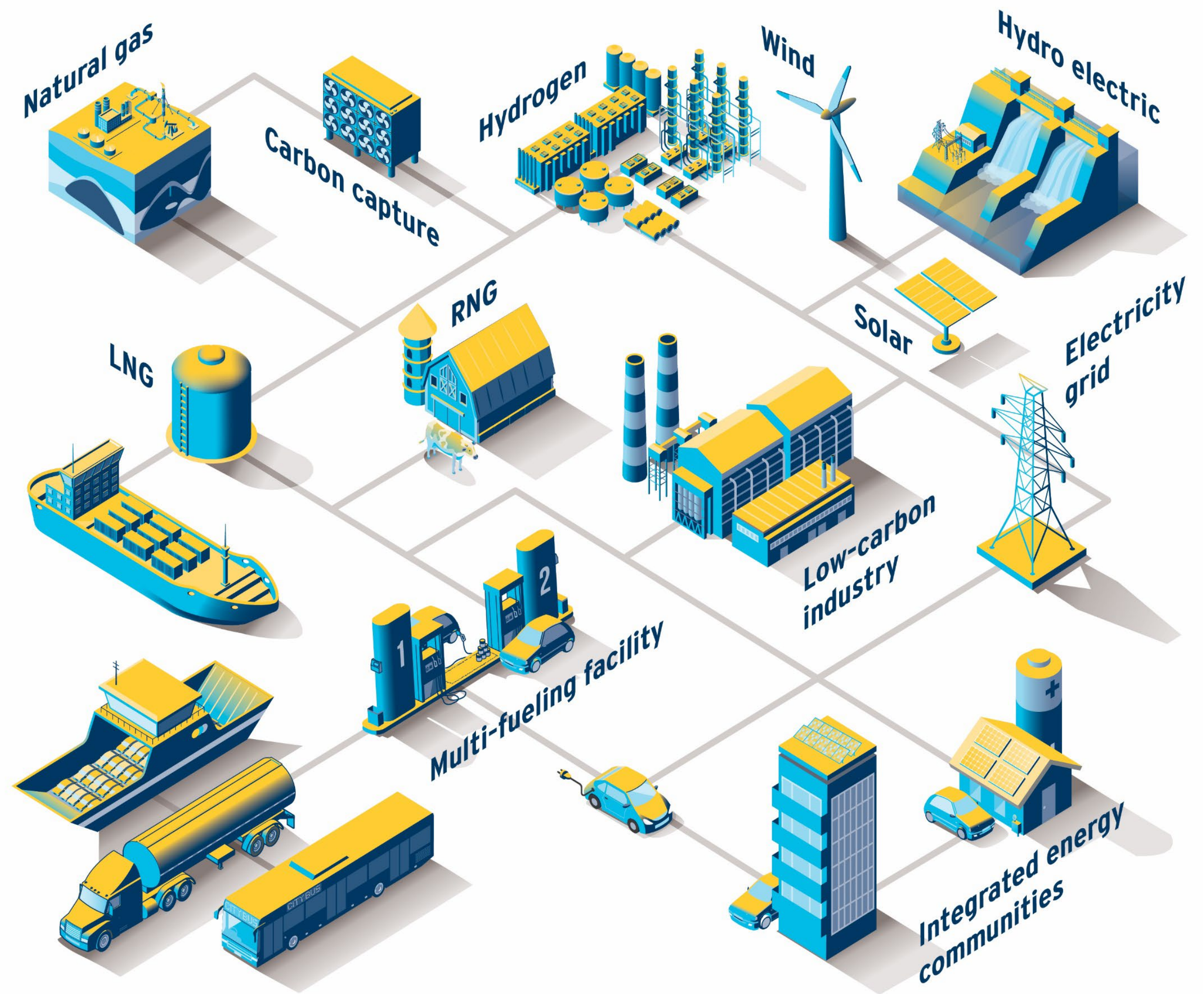
- Hold contingency resources
- Portfolio Approach to Resiliency

New/Potential Regional Infrastructure

- Evaluate pipeline and storage alternatives

20-Year Vision

- Customer energy needs and services
- Energy efficiency
- Renewable / Low Carbon Gas Supply
- Infrastructure
- Rate impacts and affordability
- Carbon emission reductions
- Sustainability
- Partnerships



Questions and Discussion

Break

Further Discussion on the Regional Gas Supply Diversity Project and its role in a diversified energy future

Regional Gas Supply Diversity (RGSD)

FEI's Southern Crossing Pipeline Extension to the Lower Mainland

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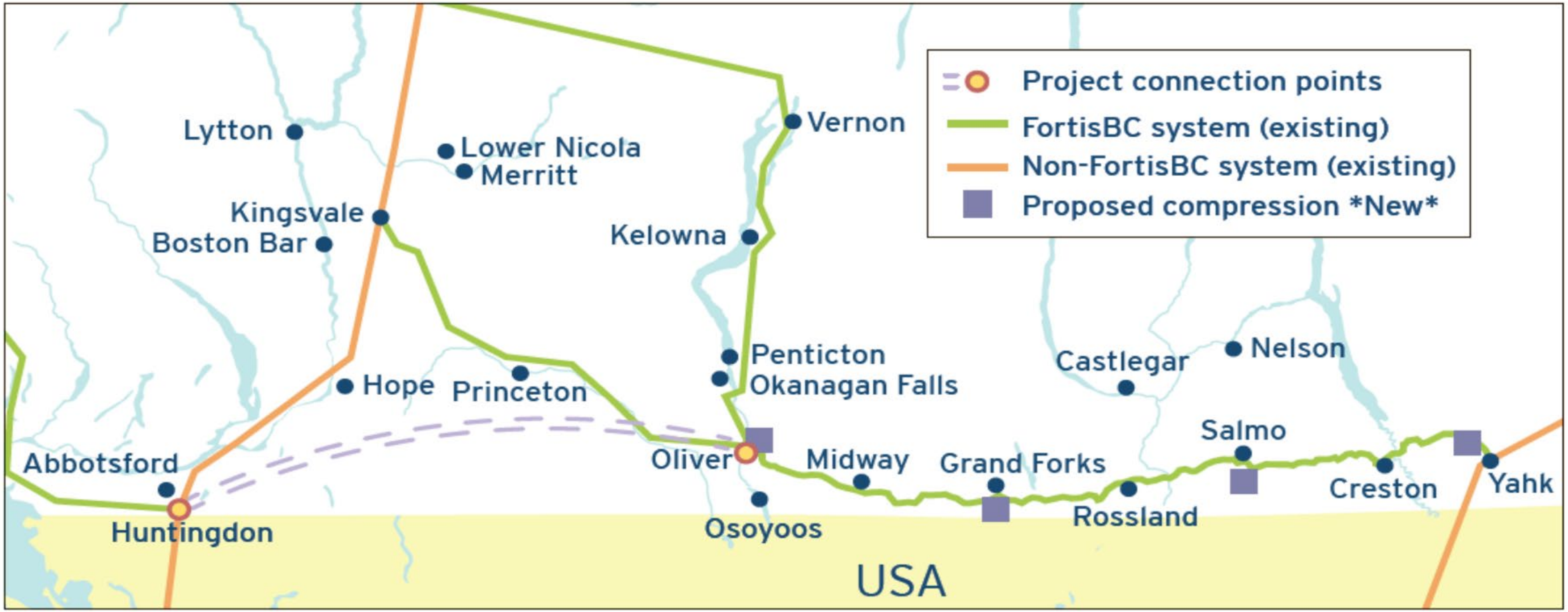
Regional Gas Supply Diversity (RGSD) Project Concept

- Extension of **FEI's Southern Crossing Pipeline** at Oliver to the Lower Mainland



FEI 2030 Customer Bill Impact - RGSD vs T-South Expansion

	RGSD (approx. 243 KM Extension) *Preliminary Results*	**T-South Expansion** (900 Km with required looping) (FEI do nothing) - not Hydrogen ready ($0.85/GJ Toll - $1.00/GJ) Impact to FEI 700 TJ/d of capacity
CAPEX	$4B (includes AFUDC)	
Cost of Service (COS) 5 year avg	$0.3B/year	
Gas Supply Benefits (revenues)	$0.1B/year	
Net COS 5 year avg	$0.2B/year	$0.15B/year
Approx. 2030 FEI Customer Bill Impact	Approx. 5.0%	Approx. 4%

Evaluation Criteria (non-quantified)

	Resiliency	Clean Growth Pathway	Energy Supply	Indigenous Opportunities
RGSD	▲	▲	▲	▲
T-South Expansion	▼	▼	▲	▼

Superior Alternative	▲	Acceptable Alternative	▬	Inferior Alternative	▼

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Regional Energy Infrastructure Need and Vision

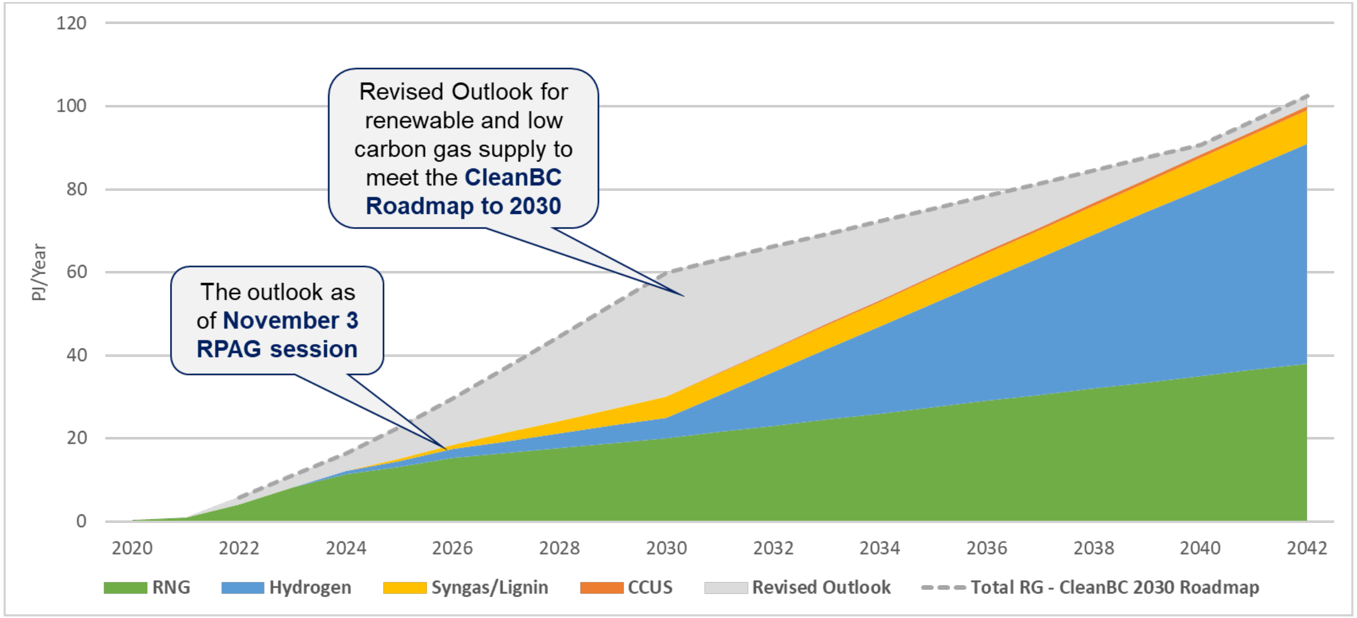
Need:

- **Resilient Communities** – provides a second energy source and benefits to on-route communities
- **Clean Energy Transformation** – accelerate the delivery of renewable and low-carbon energy to customers
- **Energy Supply** – supply source to alleviate capacity constraints in the region

Vision:

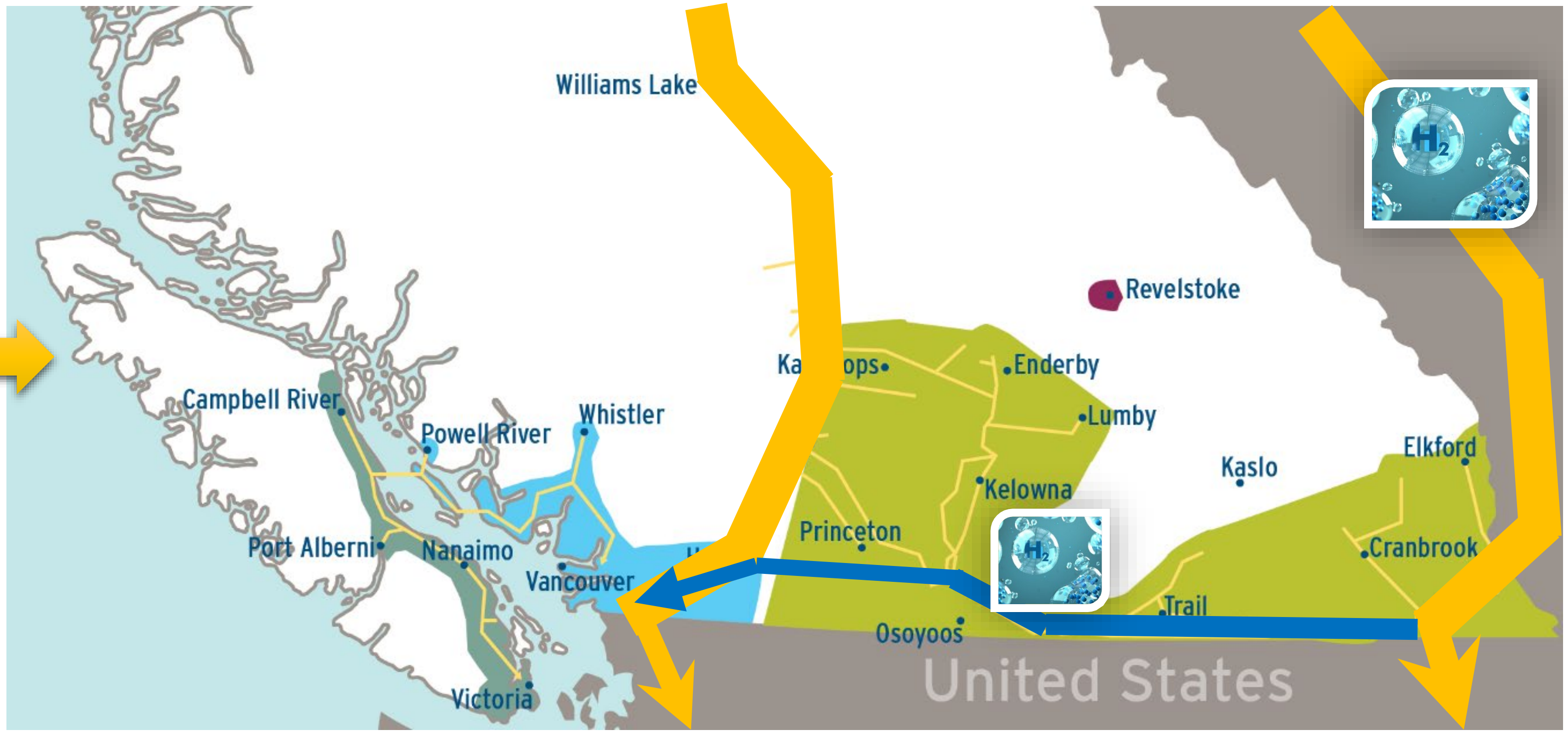
- **Regional Clean Energy Solution** – capacity to deliver clean energy to meet expected demand
- **Indigenous Opportunities** – create inclusion and long-lasting partnerships with Indigenous communities

Net Zero by 2050 Challenge



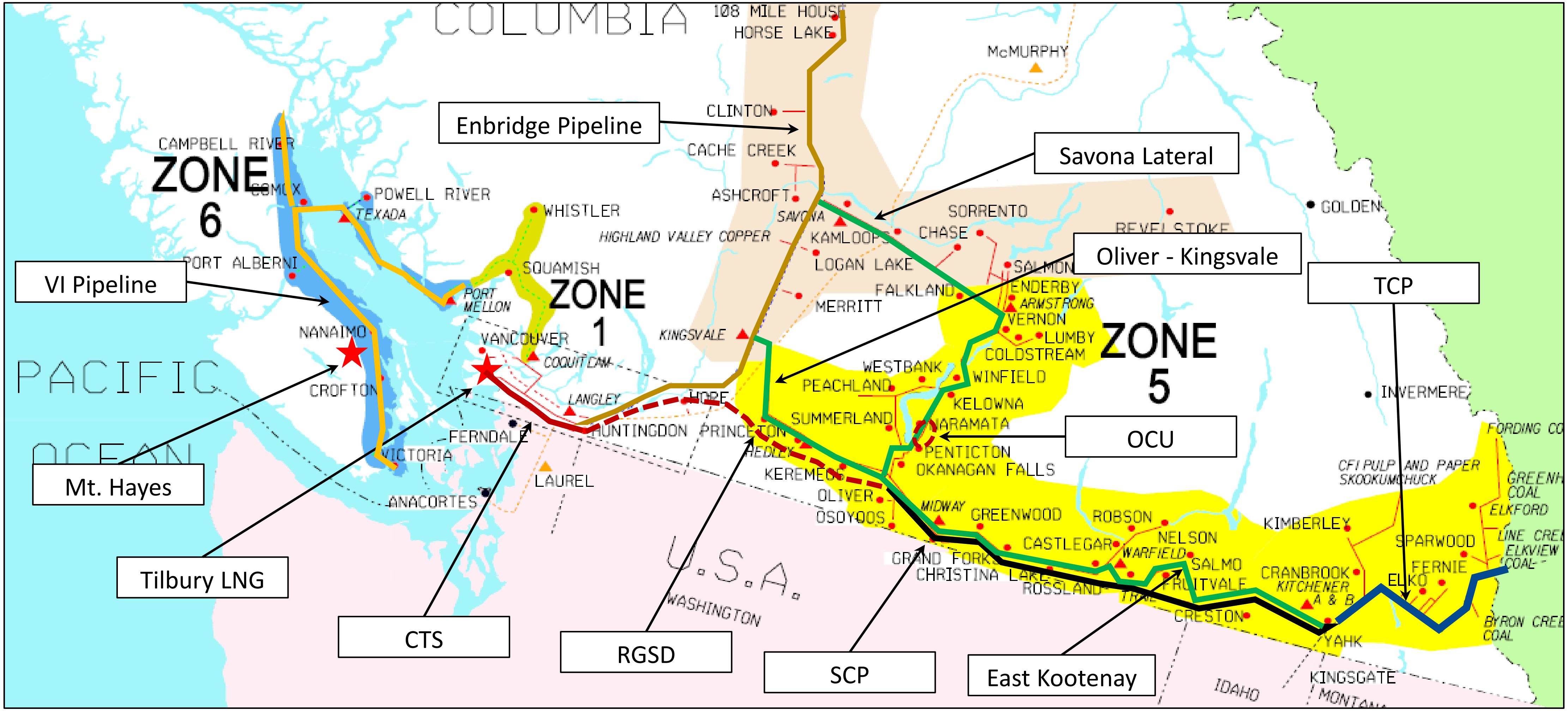
- Transformational change to meet BC's Climate Objectives will require significant increase in hydrogen & renewable natural gas supply
  - **See FortisBC Clean Growth Pathway & BC Hydrogen Strategy**
- New hydrogen-ready pipe system
  - Strategically located to increase access to hydrogen & renewable natural gas
  - Functions as an accelerator for feed-in projects including solar & wind

Resilient Supply and Clean Energy Transformation Concept



- Increase capacity of East to West supply & connect to Vancouver area; designed to carry **Hydrogen**
  - Enables supply of Hydrogen from Alberta & capture of on-route Hydrogen & bio-methane
  - Provides significant secondary supply source to Vancouver & Southern Interior to assure supply reliability

Transmission Network - RGSD Strengthens Entire System



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Milestone Development Work

Prior to 2021	2021	2022/23	2027/28	2028	2029
Introduced pipeline solution in LTGRPs, ACPs and Compliance Report	Completed studies on key development components and preliminary business plan	Indigenous Engagement Project Development File CPCN	Approvals ▪ CPCN ▪ EA ▪ BCOGC	Construction	In service

Ongoing Stakeholder and Indigenous dialogue

Questions and Discussion

Developing the LTGRP Action Plan

LTGRP Draft Action Items

Accelerate the development and acquisition of renewable and low carbon gas supplies to meet customer energy needs and contribute to Provincial Emission Reduction Targets

- RNG, H2, Syngas, Lignin, CCS – BC based and in other jurisdictions
- Implement H2 blending and H2 hubs, and plan for transitioning to H2 compatible infrastructure
- Support development of renewable and low carbon gas supply industry and market in BC and other jurisdictions
- Grow expertise and capacity within FEI

Seize market opportunities to provide gas service that decreases global GHG emissions

- Marine fueling, LNG exports, heavy duty transportation and equipment

Implement FEI system resiliency plan

- TLSE, AMI, RGSD, Distributed Energy Resources (H2 Hubs, district energy, CHP, etc., integrated solutions)

LTGRP Draft Action Items (continued)

File FEI's Next Multi-year DSM Expenditure Plan for approval (2023 and beyond)

- Transition and evolve (Deep energy retrofits, +100% efficiency equipment, behavior)

Develop regional gas infrastructure projects that improve supply optionality, reliability and resiliency for FEI while solving regional capacity constraints

- Regional Gas Supply Diversity Project

Continue to work with government on policy framework

- Support innovation and renewable / low carbon gas supply and other integrated energy solutions

Continue to explore innovative ways to provide integrated energy solutions, including extending gas service to Indigenous and other communities.

Develop clean energy partnerships with Indigenous communities and others

LTGRP Draft Action Items (continued)

Continue to improve resource planning engagement activities

- Continue to seek broader participation and input from Indigenous communities
- Explore and employ new technologies to expand and improve collaboration and discussion

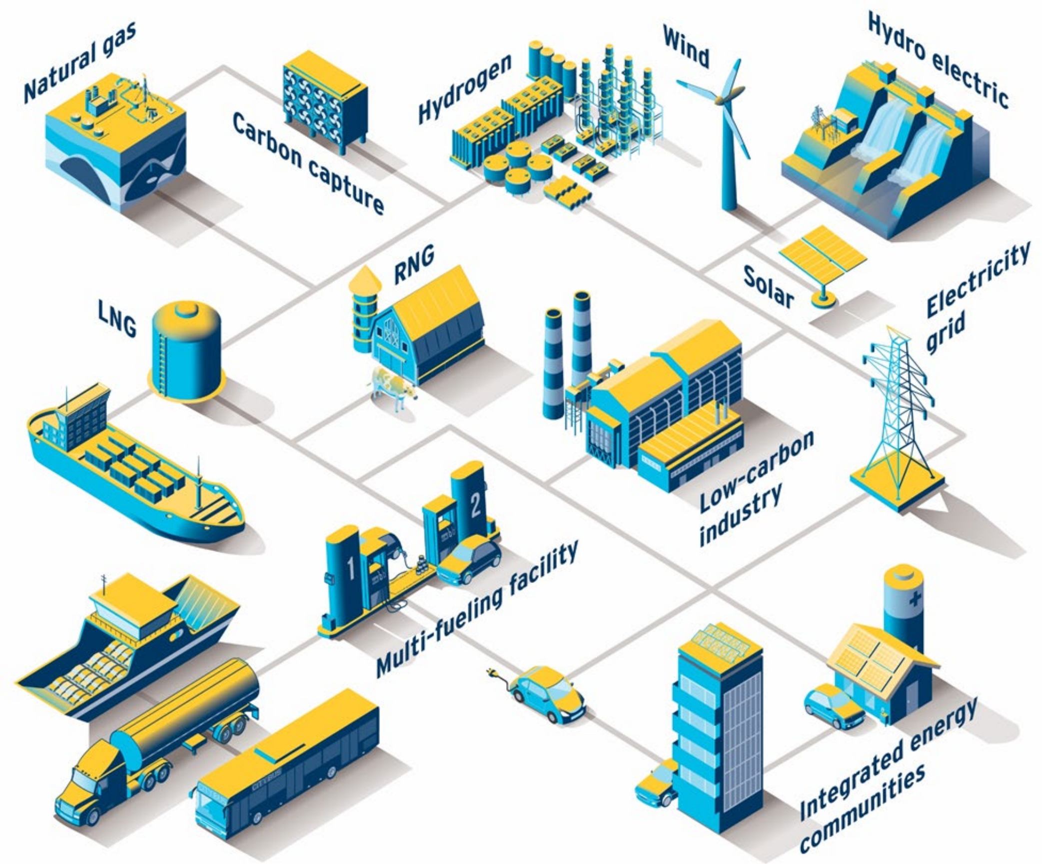
Expand and advance exploration and research on innovative energy solutions

- Clean Growth Innovation Fund, innovative DSM technologies

Continue FEI's efforts to collaborate with other utilities and energy solution providers on growing a diverse, reliable, resilient and affordable energy system throughout BC

- Future scenarios, demand forecasting, innovative solutions, regulatory mechanisms

Questions and Discussion



Wrap-up & Next Steps

Thank you for attending today's session, we appreciate your time and input.

The session presentation and notes will be posted online in the next few weeks.

If you have any further feedback or questions, please reach out to the Resource Planning team at **irp@fortisbc.com.**

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Thank you

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Attachment 2.4

REFER TO LIVE SPREADSHEET MODEL

Provided in electronic format only

(accessible by opening the Attachments Tab in Adobe)