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February 18, 2021

Commercial Energy Consumers Association of British Columbia
c/o Owen Bird Law Corporation
P.O. Box 49130
Three Bentall Centre
2900 – 595 Burrard Street
Vancouver, BC
V7X 1J5

Attention: Mr. Christopher P. Weafer

Dear Mr. Weafer:

Re: FortisBC Energy Inc. (FEI)

Project No. 1599129

Application for a Certificate of Public Convenience and Necessity (CPCN) for the Pattullo Gas Line Replacement Project (the Application)

Response to the Commercial Energy Consumers Association of British Columbia (CEC) Information Request (IR) No. 2

On August 31 2020, FEI filed the Application referenced above. In accordance with the British Columbia Utilities Commission Order G-350-20 setting out a further Regulatory Timetable for the review of the Application, FEI respectfully submits the attached response to CEC IR No. 2.

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

16. Reference: Exhibit B-6, BCUC 1.4.1.1 and 1.4.6

> For context, FEI calculates UPC_{peak} values in sixty-six different local regions, each composed of one or more municipal districts. To smooth typical annual variances in the data, regional average UPC_{peak} values for each rate schedule are averaged with the results of the preceding two years' annual load gather assessment values producing a three year "rolling average" UPC_{peak} for each rate class within the region. These three-year rolling average UPC_{peak} values are combined with current accounts and account addition forecasts to produce peak-hour load forecasts over a forecast period.
>
> FEI prepares new forecasts annually, based on the newest consumption information, and does not modify the UPC_{peak} values over the forecast period to account for any changes in customer consumption patterns.

16.1 Please explain what FEI uses this UPC_{peak} for, with respect any longer-term planning decisions for the future, which may need to be made in the nearer term.

Response:

FEI uses UPC_{peak}, calculated based on the most recent consumption versus temperature relationship measured for existing customers, to determine the peak demand of each customer. The peak demand for each customer is loaded into a hydraulic model of the local distribution system at each customer location. From this hydraulic model, FEI can determine what the total peak demand of the distribution system is, what the gas flow through the regulating stations that feed the distribution systems are, what the expected gas flow and pressure losses in the pipe elements caused by the peak demand flows are, and therefore what the expected pressure is at any point within the system. The UPC_{peak} for each customer is unique to that customer and calculated from their consumption history. Such a hydraulic model is representative of the current system and existing customers and can be used to plan and understand how the system may currently respond to changes in configuration, such as those described in the PGR Project.

For longer term or nearer term planning, to understand how a system will respond in the future to new customers and proposed changes in configuration, FEI must use an average UPC. FEI uses an average UPC_{peak} that is unique to the local region and rate schedule of existing customers and calculated as described in the referenced section above. Residential customers in New Westminster, for example will have a UPC_{peak} that is different from residential customers in other regions. This regional UPC_{peak} is used when multiplied by forecast numbers of new accounts each year to estimate the additional peak demand caused by new customers each year. Additionally this future peak demand is added to the hydraulic model of the distribution system in locations where future customers are anticipated to connect. The result is a number of hydraulic models for the distribution system that represent future years. These models can be used to assess the future impacts of load growth and system configuration changes, and to explore the required future timing and ultimate effectiveness of various alternatives to address the impacts of future load growth or configuration changes on the system. FEI uses such models to identify and scope system reinforcement needs and understand potential outcomes near the end of a 20 year forecast period, but will typically make decisions on firm commitments around projects based on models created within 2 to 4 years of the anticipated need.

16.2 Does FEI's peak demand forecasting consider the potential impact of climate change over the next 20 years?

16.2.1 If yes, please explain how.

16.2.2 If no, please explain why not.

Response:

FEI's peak demand forecast does not directly consider the potential impact of climate change over the next 20 years. While FEI is not aware of a reliable method to forecast future changes in extreme weather (especially in the cold temperatures which set FEI's peak demand) over a relatively short interval of 20 years, FEI recognizes that climate change may result in increased weather variability. Such variability is not expected to adversely impact peak demand or the need for the PGR Project.

FEI applies trends in recent weather history that may reflect climate change impacts by periodically re-adjusting the system design temperature or Design Degree Day (DDD) used to estimate peak demand. FEI last updated the DDD for each of the 22 weather zones in its operating territory in 2017. These updates examine the weather history in each weather zone over the preceding 60 years. The last update resulted in a warming in the design temperature or DDD in most weather zones. For example, in the case of the Metro Vancouver region, the DDD changed from a 31.0 DD to a 30.2 DD. This represented a warming of 0.8 °C in the design temperature. This results in a slightly lower peak demand estimate for customers in the region, but has no impact on the need for the PGR Project.

16.3 Does FEI have evidence to suggest that its peak demand has or could change significantly with climate change? Please explain

Response:

Please refer to the response to CEC IR2 16.2.

17. Reference: Exhibit B-9, CEC 1.4.1 and B-6, BCUC 1.3.1 and 1.4.6

Please refer to the response to BCUC IR1 3.1 for a discussion of the capacity of the Pattullo Gas Line.

For illustrative purposes, the table provides a comparison to the estimated peak day flow in the Pattullo Gas Line expected in 2020.

Winter	Coldest Day	Mean daily Temperature (°C)	Peak hourly Pattullo Gas Line Demand (m^3/hr.)	Estimated 2020 Peak Day Demand (m^3/hr.)
2007-08	1-Dec-07	-1.2	54,050	86,060
2008-09	20-Dec-08	-10.3	63,340	
2009-10	19-Dec-09	-2.8	58,080	
2010-11	23-Nov-10	-6.4	42,190	
2011-12	18-Jan-12	-5.7	69,910	
2012-13	13-Jan-13	-2.8	52,830	
2013-14	7-Dec-13	-5.9	58,540	
2014-15	30-Nov-14	-4.5	56,190	
2015-16	2-Jan-16	-2	45,920	
2017-18	21-Feb-18	-3.4	53,800	
2018-19	10-Feb-19	-5.2	54,510	
2019-20	14-Jan-20	-7.1	60,900	

3.1 Please provide the system capacity of the Pattullo Gas Line.

Response:

As illustrated in Figure 3-1 of the Application, the Pattullo Gas Line is one of four feeds into the Metro Vancouver 700 kPa trunk distribution system. When considered in isolation, the Pattullo Gas Line cannot be measured in terms of "system capacity" as there are multiple simultaneous gas supplies to this trunk distribution system. This is because the capacity (or support capability) provided by each feed is dependent on how the load within the trunk distribution system is distributed and how the supplies interact together to support the system.

To illustrate the comparative capacities of the trunk distribution system with or without the Pattullo Gas Line, FEI completed an analysis which proportionally and incrementally increased the load on all the stations in this system until the pressure dropped below levels necessary for at least one of the stations to deliver sufficient gas to downstream customers. This system condition represents the threshold beyond which customer outages would start to occur.

The results of this analysis indicate that with the Pattullo Gas Line in place, the ultimate capacity of the trunk distribution system is approximately 250,800 m^3/hr. This measure is the theoretical peak load that could be supplied to the stations distributed along its length. The current 2020/21 forecast peak demand of the trunk distribution system is approximately 168,800 m^3/hr.

Year	Peak Demand ($10^3m^3/hr$)	Capacity of the Trunk Distribution System with the Pattullo Gas Line ($10^3m^3/hr$)	Capacity of the Trunk Distribution System without the Pattullo Gas Line ($10^3m^3/hr$)	Customers at risk of outage
2023	174.0	250.8	160	Up to 10,700
2024	175.7	250.8	160	
2025	177.4	250.8	160	
2026	179.2	250.8	160	
2027	181.0	250.8	160	
2028	182.9	250.8	160	10,700 to 18,000
2029	184.7	250.8	160	
2030	186.5	250.8	160	
2031	188.2	250.8	160	
2032	190.0	250.8	160	18,000 to 25,500
2033	191.8	250.8	160	
2034	193.5	250.8	160	25,500 to 32,500
2035	195.2	250.8	160	
2036	196.9	250.8	160	
2037	198.5	250.8	160	
2038	200.1	250.8	160	
2039	201.7	250.8	160	
2040	203.3	250.8	160	
2041	204.8	250.8	160	
2042	206.4	250.8	160	
2043	208.0	250.8	160	

[1]

17.1 In BCUC 1.3.1 FEI indicates that the forecast peak demand for the trunk distribution system is approximately 168,800 m3/hr for 20/21, while in CEC 1.4.1 FEI states that the estimated Peak day demand for the Pattullo gas line is 86,060 m3/hr. Is it fair to say that the Pattullo gas line accounts for about half the trunk distribution peak day demand? Please explain why or why not.

Response:

Confirmed. Under peak conditions, the Pattullo Gas Line supplies just over half of the natural gas in the trunk distribution system as this supply is closest to district stations serving large demands in New Westminster, southeast Burnaby, and southwest Coquitlam.

18. Reference: Exhibit B-9, CEC 1.2.2 and Exhibit B-1-1 page 54 and 55

2.1 Please describe how the Class 4 level of estimate differs from the Class 3.

Response:

The following response also addresses CEC IR1 3.2.

There are a number of characteristics used in assigning an AACE estimate class to a project estimate. The primary characteristic is the maturity level of project definition deliverables which

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical +/- range relative to index of 1 (i.e. Class 1 estimate) [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Screening or feasibility	Stochastic (factors and/or models) or judgment	4 to 20	1
Class 4	1% to 15%	Concept study or feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget authorization or control	Mixed but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 75%	Control or bid/tender	Primarily deterministic	1 to 3	5 to 20
Class 1	65% to 100%	Check estimate or bid/tender	Deterministic	1	10 to 100

Notes:
[a] If the range index value of "1" represents +10/-5%, then an index value of 10 represents +100/-50% (at an 80% confidence interval).
[b] If the cost index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%.

Table 1 – Generic Cost Estimate Classification Matrix

4.4.4.4.2 FINANCIAL EVALUATION OF ALTERNATIVES 6A AND 6D

Alternative 6A (Gaglardi Route) and Alternative 6D (Sperling Route) were developed to an AACE Class 4 cost estimate. The refined cost estimate took into consideration the development activities of each route from the technical progression as well as feedback from engagement and consultation with stakeholders, landowners and the community.

Table 4-9: Financial Evaluation Summary

	Alternative 6A: Gagiardi Route (Class 4)	Alternative 6D: Sperling Route (Class 4)
Total Capital Costs, AACE Class 4, 2020 ($ millions)	173.313	175.354
PV of Incremental Revenue Requirement[22] over 68 years ($ millions)	176.881	178.560
Levelized Delivery Rate Impact over 68 years (in %)	1.13%	1.14%
Levelized Delivery Rate Impact over 68 years (in $/GJ)	0.0510	0.0515
Average Residential UPC (in GJ/yr)	90.00	90.00
Average Residential Bill Impact per year over 68 years (in $)	4.59	4.64
Financial Evaluation Score	3	3

18.1 FEI's AACE Class 4 capital cost estimate is nearly $200 million with a 1% to 15% project maturity. Please provide a $ based accuracy range for the Total capital costs.

18.1.1 If FEI is not able to do so, please explain why not.

Response:

Please refer to the response to BCUC IR2 32.1. The PGR Project P50 capital cost estimate (with contingency) is approximately $154 million in 2020$. As described in the response to BCUC IR2 32.1, the expected accuracy range is approximately -20 to +27 percent. This corresponds to an expected cost estimate range of $123.2 to $195.2 million.

19. Reference: Exhibit B-1-1 page 53

Table 4-8: Non-Financial Evaluation Summary of Alternatives 6A and 6D

Criterion	Alternative 6A: Gaglardi Route (Class 4)	Alternative 6D: Sperling Route (Class 4)
Schedule Impacts **(Weighting – 60%)**	2 • Permitting required from two municipalities, with strong opposition • Requires negotiations with a few private landowners for RoW and temporary access • Low level of congestion of third party utilities in route corridor • Potential coordination conflict with the Trans Mountain Expansion Project	3 • Project does not cross private land; no private land SRW negotiations are required. Land discussions with various permitting agencies required. • Permitting required from one municipality, that is supportive • Highest level of construction productivity • Overall least congested alternative, fewest number of utility crossings
Community, Indigenous and Stakeholder Impacts **(Weighting – 25%)**	2 • Significant traffic impacts, including cumulative impacts from other previous (LMIPSU) and planned (non-FEI) projects in proximity to the Gaglardi Route • Multiple schools, churches and care facilities potentially impacted • Less than 10 businesses potentially impacted • Minimal impact to private lands	3 • Less than 10 businesses potentially impacted • Minimal impact to private lands • Impacts to access to community and recreation centres • Localized traffic impacts only
Environmental and Archaeological Impacts	3 • Critical habitat for several at-risk species; however mitigation available through project design	2 • Critical habitat for several at-risk species; however mitigation available through project design

Criterion	Alternative 6A: Gaglardi Route (Class 4)	Alternative 6D: Sperling Route (Class 4)
(Weighting – 15%)	• Several fish-bearing watercourses, including the Brunette River • Known archaeological site; however mitigation available through project design	• Several fish-bearing watercourses, including Still Creek • Water management concerns (dewatering and disposal) • Crosses, or is located within close proximity to, wetlands and riparian areas • Potential for encountering contaminated soil, or water • No known archaeological or heritage sites
Weighted Total[1]	**2.15**	**2.85**

Note:
[1] Weighted total is calculated for each alternative by multiplying the score for each criterion with its associated weighting and then summing the scores. The maximum possible weighted total is 3.

19.1 Are the Environmental and Archaeological impacts able to be fully mitigated in Alternative D, or will there potentially be unresolved issues? Please explain.

Response:

FEI expects that all environmental and archaeological impacts associated with Alternative 6D will be mitigated through standard environmental and archaeological permitting processes and the implementation of best management practices during construction. No unresolved issues are anticipated.

20. Reference: Exhibit B-1-1 page 54 and Exhibit B-9, CEC 1.2.1 and 1.2.1

4.4.4.4.2 FINANCIAL EVALUATION OF ALTERNATIVES 6A AND 6D

Alternative 6A (Gaglardi Route) and Alternative 6D (Sperling Route) were developed to an AACE Class 4 cost estimate. The refined cost estimate took into consideration the development activities of each route from the technical progression as well as feedback from engagement and consultation with stakeholders, landowners and the community.

	ESTIMATE CLASSIFICATION				
	CLASS 5	CLASS 4	CLASS 3	CLASS 2	CLASS 1
MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES	0% to 2%	1% to 15%	10% to 40%	30% to 75%	65% to 100%
General Project Data:					
Project Scope Description	Preliminary	Preliminary	Defined	Defined	Defined
Commodity Characteristics and Capacity	Preliminary	Preliminary	Defined	Defined	Defined
Station, Terminal and Tie-in Locations	Preliminary	Preliminary	Defined	Defined	Defined
Right-of Way (ROW) Strategy	Not Required	Preliminary	Defined	Defined	Defined
Soils, Hydrology, Subsea	Not Required	Preliminary	Defined	Defined	Defined
Integrated Project Plan	Not Required	Preliminary	Defined	Defined	Defined
Stakeholder Management Plan	Not Required	Preliminary	Defined	Defined	Defined
Stakeholder Consultation/Requirements	Not Required	Preliminary	Defined	Defined	Defined
Project Master Schedule	Not Required	Preliminary	Defined	Defined	Defined
Escalation Strategy	Not Required	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	Not Required	Preliminary	Defined	Defined	Defined
Project Code of Accounts	Not Required	Preliminary	Defined	Defined	Defined
Procurement/Contracting Strategy	Not Required	Preliminary	Defined	Defined	Defined
Engineering and ROW Deliverables:					
Hydraulic Design	S	P	C	C	C
Route Mapping/Survey/Topography/Alignment Sheets	S/P	P/C	C	C	C
Land/ROW Title Negotiation	NR	S/P	P/C	C	C
Piping/Mechanical Discipline Drawings (including valving and pigging)	S	P	P	C	C
Instrumentation/Control and Monitoring/SCADA System Discipline Drawings	NR	S/P	P	C	C
Civil/Site Preperation/Structural Discipline Drawings	NR	S/P	P	C	C
Crossings and Borings Designs and Drawings	NR	S/P	P	C	C
Station/Terminal Interface Design	NR	S/P	P	C	C
Specifications and Datasheets	NR	S	P	C	C

Table 3 – Estimate Input Checklist and Maturity Matrix (Primary Classification Determinate)

Engineering and ROW Deliverables:

- **Not Required (NR):** Deliverable may not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- **Started (S):** Work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.
- **Preliminary (P):** Work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.
- **Complete (C):** The deliverable has been reviewed and approved as appropriate.

To improve the certainty of the cost estimate and schedule without incurring the delay associated with preparing a full class 3 estimate, FEI is completing additional activities to improve the maturity level of project definition deliverables beyond that of a typical AACE Class 4 cost estimate. These additional items include:

- General Project Data
  - Station, Terminal and Tie-in locations
  - Right-of-Way (ROW) Strategy
  - Stakeholder Consultation /Requirements
  - Procurement/Contracting Strategy
- Engineering and ROW Deliverables
  - Hydraulic Design
  - Crossings and Boring Design and Drawings
  - Specifications and Datasheets

20.1 FEI indicated in its original application that it would conduct additional analysis to improve the Class 4 cost estimate in certain areas. Did FEI conduct the additional analysis identified in the application? Please explain.

20.1.1 If no, please explain why not.

Response:

FEI confirms that planning and design activities were completed to improve the maturity level of project definition deliverables beyond the requirements of a typical AACE Class 4 cost estimate. Examples include:

- FEI finalized the locations of suitable take-off and tie-in, meeting the routing objectives for the new gas line. Current FEI infrastructure and a defined hydraulic design supported the take-off location at kilometre point 11.5 along the existing LMIPSU NPS 30 (762mm) gas line, and tie-in location at 16th Street and 4th Avenue in Burnaby to interconnect with the existing trunk distribution system. FEI has completed preliminary design and construction plans for the take-off and tie-in locations. Details of these installations are provided in Appendix C-2 of the Amended Application.
- As discussed in Section 5.6.1 of the Amended Application, FEI has defined the project delivery method beyond what is expected for an AACE Class 4 cost estimate. As per the Schedule provided in Appendix F of the Amended Application, FEI developed an early procurement strategy to allow procurement of long lead materials to begin in early 2021.
- FEI completed substantial preliminary design of major crossings during the Class 4 estimating stage. This included completing early geotechnical data, selecting the crossing methodology, and developing the crossing and boring design and drawings to a review stage. FEI believes these deliverables are completed to a preliminary level and significantly influenced the quantitative risk analysis. The crossing details are available in Appendix C-1 of the Amended Application.

- FEI developed the materials specifications and datasheets to a preliminary level, with cross-functional reviews completed by Engineering and Procurement subject matter experts. The material specifications and equipment datasheets are provided in Appendix C-1 of the Amended Application. These support the procurement strategy previously discussed.

As described in response to BCUC IR2 32.1, the output of the quantitative risk analysis concluded the estimate has an expected accuracy range of -20% to +27%. As noted on page 4 of AACE RP 97R-18 *Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Pipeline Transportation Infrastructure Industries*, "Depending on the technical and project deliverables (and other variables) and risks associated with each estimate, the accuracy range for any particular estimate is expected to fall within the ranges identified." Consequently, the expected accuracy range calculated for the PGR Project is indicative of an estimate having a classification somewhere between the typical expected accuracy range for any particular estimate for Class 3 (Low: -10% to -20%, High: +10% to +30%) and Class 4 (Low: -15% to -30%, High: +20% to +50%).

20.2 For those areas that FEI was completing additional activities beyond that of a typical AACE Class 4 estimate, did FEI take the analysis up to the Class 3 level, or just make certain improvements? Please explain. I.e. if the Station, Terminal and Tie-in locations would move from 'Preliminary' to 'Defined'.

Response:

Please refer to the response to CEC IR2 20.1.

20.3 Will FEI need to develop a Class 3 estimate before it contracts out work, or will it be able to begin contracting based on a Class 4 estimate? Please explain.

Response:

FEI intends to develop a Class 3 estimate before it contracts out work. FEI's practice is to develop progressively more defined cost estimates from Class 3 to Class 2 to Class 1 in conjunction with the progression of engineering from 30 to 60 to 90 percent design completion. Contracting the work could happen at any point along the progression of estimate classes depending on negotiation and agreement between the parties.

21. Reference: Exhibit B-1-1 page 55 and Exhibit B-9, CEC 1.15.1

Table 4-9: Financial Evaluation Summary

	Alternative 6A: Gaglardi Route (Class 4)	Alternative 6D: Sperling Route (Class 4)
Total Capital Costs, AACE Class 4, 2020 ($ millions)	173.313	175.354
PV of Incremental Revenue Requirement[22] over 68 years ($ millions)	176.881	178.560
Levelized Delivery Rate Impact over 68 years (in %)	1.13%	1.14%
Levelized Delivery Rate Impact over 68 years (in $/GJ)	0.0510	0.0515
Average Residential UPC (in GJ/yr)	90.00	90.00
Average Residential Bill Impact per year over 68 years (in $)	4.59	4.64
Financial Evaluation Score	3	3

Average Bill Impact ($)	Avg. Use per Customer (UPC) in GJ	Alternative 6A: Broadway and Gaglardi Way Corridor	Alternative 6B: Cape Horn Gate Corridor	Alternative 6C: Fraser Gate Corridor
Levelized Delivery Rate Impact Over 73 years ($/GJ)		$ 0.036	$ 0.054	$ 0.048
Residential				
Rate Schedule 1	90	$ 3.2	$ 4.8	$ 4.4
Commercial				
Rate Schedule 2	340	$ 12.1	$ 18.2	$ 16.5
Rate Schedule 3	3,770	133.8	202.1	182.5
Industrial				
Rate Schedule 4	9,050	$ 321.3	$ 485.1	$ 438.0
Rate Schedule 5	16,240	576.5	870.5	786.0
Rate Schedule 6	2,060	73.1	110.4	99.7
Rate Schedule 7	177,950	6,317.2	9,538.1	8,612.8

21.1 Please provide a table similar to that found in CEC 1.15.1 for Alternative 6A and 6D.

Response:

Please see the table below for the average bill impact per year (in dollars and in percentage) for FEI's customers in Rate Schedules 1 through 7 based on the levelized delivery rate impact in $ per GJ over 68 years (as shown in Table 4-9 of the Amended Application). FEI has excluded transportation customers as the utility does not have insight into their total bill including their commodity charges.

Average Bill Impact ($)	Avg. Use per Customer (UPC) in GJ	Alternative 6A: Gaglardi Route (Class 4)		Alternative 6D: Sperling Route (Class 4)	
Levelized Delivery Rate Impact Over 68 years ($/GJ)		$ 0.0510	1.13%	$ 0.0515	1.14%
Residential					
Rate Schedule 1	90	$ 4.6	0.76%	$ 4.6	0.77%
Commercial					
Rate Schedule 2	340	$ 17.3	1.05%	$ 17.5	1.06%
Rate Schedule 3	3,770	192.3	1.35%	194.2	1.37%
Industrial					
Rate Schedule 4	9,050	$ 461.6	2.22%	$ 466.1	2.24%
Rate Schedule 5	16,240	828.2	1.82%	836.4	1.84%
Rate Schedule 6	2,060	105.1	1.51%	106.1	1.53%
Rate Schedule 7	177,950	9,075.5	3.25%	9,164.4	3.29%

21.2 Please include % impacts for each rate class.

Response:

Please refer to the response to CEC IR2 21.1.

22. Reference: Exhibit B-1-1 page 60 and 61

5.3.2.1 Assessment of Feasible Route Options

Following the identification of feasible route options, evaluation criteria were established to select a preferred route. FEI evaluated each route option using both quantitative and qualitative criteria.

5.3.2.2 Evaluation Criteria

The three broad categories of principles and considerations that were taken into account during the route options evaluation are listed and defined in Table 5-1 below.

Table 5-1: Gas Line Route Evaluation Criteria Definitions

Category 1: Community and Stakeholder Considerations	
Health and Safety	Considers the risks to the community, stakeholders, employees, and contractors during construction and during the life of the gas line.
Traffic Impacts	Considers the direct and indirect effects of the Project on traffic and commercial/residential access during construction of the gas line.
Socio-Economic	Considers the effect of the Project on the cultural values, economic well-being, and daily life for local stakeholders and citizens during construction and during the life of the gas line.
Category 2: Environmental Considerations	
Ecology	Considers the impact during construction and during the life of the gas line to the environment including environmentally sensitive areas along the project corridor.
Cultural Heritage	Considers the impact during construction and during the life of the gas line to known archaeology and culturally sensitive areas at the project site.
Human Environment	Considers the impact of the Project to the human environment including noise, local emissions, aesthetics, nuisance factor and the short and long-term effects that may be observed by residents and visitors in the project area.
Category 3: Technical Considerations	
Construction	Considers the existing above and belowground constraints in terms of gas line construction activities, pipe-laying productivity, requirements for non-standard higher risk construction techniques, and construction footprint.
Operation	Considers long-term impacts including those to employees and contractors to maintain the gas line integrity and complete maintenance and repairs. Also considers impacts to adjacent development and third party land ownership and use.
Adjacent Infrastructure	Considers the potential impacts on adjacent (existing and planned) facilities and buried/above ground utility infrastructure and risk to longevity and safe operation of the gas line and facilities from adjacent infrastructure.
Project Execution Certainty	Considers the impact of compounding risks associated with the criteria in Categories 1, 2 and 3.

Table 5-3: Route Evaluation Scoring

Score	Impact Evaluation
5	Very low (negligible) impact, best choice
4	Low impact, better choice
3	Moderate impact, good choice
2	High negative impact, poor choice
1	Very high negative (unacceptable) impact, not feasible

FEI implicitly considered cost within the Community and Stakeholder, Environmental and Technical evaluation criteria. In general, routing that minimizes impacts to all criteria without adding extensive length would result in the lowest cost.

Table 5-2: Gas Line Route Evaluation Weighting[23]

Criterion	Weighting	Evaluation
Community and Stakeholder Considerations Weighting		
Health and Safety	10	Assessment of the construction zone environment, nature of the planned construction activities and proximity to vulnerable entities.
Traffic Impacts	12.5	Roadway usage impacts, number of intersections impacted, number of commercial accesses impacted, etc.
Socio-Economic	7.5	Properties and businesses directly impacted during construction and nature of impacts, community infrastructure impacted (e.g. schools, hospitals, recreation centers, etc.)
Sub-total:	***30***	
Environmental Considerations Weighting		
Ecology	5	Natural and environmentally sensitive areas impacted.
Cultural heritage	5	Culturally sensitive areas impacted.
Human Environment	12.5	Nature and proximity of visual, noise and vibration impacts, residential accesses impeded, etc.
Sub-total:	***22.5***	
Technical Considerations Weighting		
Construction	15	Type of construction required, pipe installation productivity, length of gas line, and overall construction footprint, etc.
Operation	10	Areas of potential operational difficulty identified.
Adjacent infrastructure	10	Type of adjacent infrastructure, proximity and spacing, planned infrastructure, ability to manage sufficient clearances, etc.
Project Execution Certainty	12.5	An evaluation of impacts such items as regulatory permitting, timeline/schedule, budget certainty, scope certainty, environmental and archaeological impacts, geotechnical conditions and various constructability considerations (including resources).
Sub-total:	***47.5***	
Total	**100**	

22.1 FEI states that it 'implicitly considered costs' in each of the categories. Why did FEI not consider least cost as a route evaluation criterion on its own, or at least identify least cost as an evaluation criterion within the groupings?

Response:

FEI did not consider least cost as a route evaluation criterion on its own as the impacts on cost are inherent to any challenges associated with a specific criterion. Through the scoring process, any negative impact would naturally increase the Project's cost or delay its schedule, or both.

As the routing process included multiple route variations, using this implicit cost methodology is the most effective way to ensure cost-effective routing. A route selection that minimizes impacts to all criteria without adding extensive length or scope would result in selection of the lowest cost solution.

22.2 Is FEI able to definitively say that the selected route was the least cost route or, at a minimum, the most cost-effective route?

22.2.1 If yes, please provide a percentage and dollar estimate of how much lower the cost would be.

22.2.2 If no, please explain why not.

Response:

FEI can definitively state that it has selected the most cost-effective route considering the evaluation criteria in Table 5-1 of the Amended Application. The preferred route poses the least risk to the community and stakeholders, the environment, cultural heritage, construction, operations, adjacent infrastructure and project execution certainty. FEI implicitly considered both cost and schedule risk when completing the route evaluation. While FEI did not complete cost estimates for every possible route alignment and therefore cannot definitively say the preferred route is the least cost, the preferred route minimizes impacts to all criteria without adding extensive length, which means that it is likely the least cost route.

23. Reference: Exhibit B-1-1 page 68

> ***5.4.2.5 In-line Inspection***
>
> ILI is a process that utilizes the pipeline gas flow and pressure to propel an inspection tool within the gas line. There are a number of types of ILI tools that can be used to detect and size a variety of gas line anomalies, including corrosion, mechanical damage, and cracking.
>
> Due to the longevity of steel gas lines, it is appropriate to design the new gas line with provisions for ILI capability. This will enable the cost effective and targeted mitigation of specific gas line hazards (i.e. corrosion) over the service life of the new asset. For further details, see the Preliminary Pipeline Design Basis Memorandum, P-00758-PIP-DBM-0003, in the Appendix C-1.
>
> To facilitate ILI, the PGR Project gas line design must incorporate certain features and mechanical components such as avoiding use of tight radius pipe bends, wall thickness transitions, and ensuring that all fittings and appurtenances (e.g. valves, tees) allow for consistent and reliable passage of ILI tools to maximize data collection.

23.1 Please confirm or otherwise explain that the In-line inspection capability preparation is technologically consistent with the in-line inspection capability that FEI is installing in other areas of its pipeline.

Response:

Confirmed. The in-line inspection capability being provided on the PGR Project is consistent with FEI's practices for new construction of similar pipelines and facilities in anticipation of integrity and asset management activities.

24. Reference: Exhibit B-1-1 page 72

> **5.4.5 Decommissioning and Abandonment**
>
> A section of approximately 2.0 km of the existing Pattullo Gas Line Crossing will be abandoned between the Pattullo Gate Station in the City of Surrey to the intersection of McBride Boulevard and Royal Avenue in the City of New Westminster. The section of gas line located on the existing Pattullo Bridge will be abandoned and removed during bridge demolition. Sections located on either end of the bridge will be abandoned in place, grout filled and capped every 200m. The abandonment process will follow applicable FEI specifications.

24.1 Does FEI have approval from, or a satisfactory agreement with, the City of Surrey to abandon its pipeline in place?

24.1.1 If no, please explain why not.

24.1.2 If no, what consultation has FEI undertaken with the City of Surrey related to the abandonment of the pipeline?

Response:

FEI and the City of Surrey entered into an operating agreement dated May 31, 2019 (Operating Agreement), which, among other things, sets out the agreed terms and conditions under which FEI may abandon its gas lines in place. This includes the abandonment of the portion of the Pattullo Gas Line Crossing located within the City of Surrey.

Under the Operating Agreement, FEI and the City of Surrey have agreed that where FEI intends to permanently cease the use of a gas line located on, along, across, over or under Public Places (as defined under the Operating Agreement):

(i) FEI is required to promptly notify the City of Surrey;

(ii) FEI may, in its discretion, remove or leave a gas line in place; and

(iii) FEI shall fill any gas lines left in place, which has a nominal diameter greater than 323 mm (12 inches) with sand, controlled density fill or similar material to prevent their collapse.

FEI met with the City of Surrey in June 2020 to review the Project and will continue to meet with the City of Surrey as project planning proceeds.

Please also refer to the response to BCUC IR2 36.1.1.

25. Reference: Exhibit B-1-1, page 74

Table 5-10: Project Schedule and Milestones

Activity		Milestone Date
Consultant / Contractor Selection		
	Procure Detailed Engineering Services	Dec 2020
	Procure Contractor Services	Nov 2020
Detailed Design and Constructability Reviews		
	30% Design Package	Feb 2021
	60% Design Package	March 2021
	90% Design Package	May 2021
	Issued for Construction Package	July 2021
Obtain Permit Approvals		
	BCOGC Permits – Early Works	Sept 2021
	BCOGC Permits – Mainline and Facilities	Jan 2022
	Federal Permits (Department of Fisheries and Oceans, Species at Risk Act)	Jan 2022
	Ministry of Transportation and Infrastructure Permits	Jan 2022
	Municipal Permits	Jan 2022
	Third Party Utility Permits	Jan 2022
	Environmental and Archaeological Permits	Jan 2022
Procurement		
	Procure Line Pipe	Mar 2021
Construction Contract Award		
	30% Design – Cost Estimate Submission	March 2021
	60% Design – Cost Estimate Submission	April 2021
	90% Design – Cost Estimate Submission	June 2021
	Award Mainline Construction Contract	Sept 2021
Mobilization to Site		
	Mobilization for Early Works	Oct 2021
Mainline and Facilities Construction		
	Mainline and Facilities Construction	Apr 2022 - Sept 2022
	Mechanical Completion	Oct 2022
	Commissioning	Oct 2022 – Dec 2022
	Restoration and Demobilization	Sep 2022 - Dec 2022
Decommissioning and Abandonment		
	Decommissioning of Pattullo Gas Line	Jan 2023 - Mar 2023
	Abandonment of Pattullo Gas Line	Jan 2023 - Mar 2023
	Infrastructure Modifications	Apr 2023 – July 2023
	Project Close Out	Oct 2022 – July 2023

25.1 Has FEI completed the Milestones related to the Consultant/Contractor selection?

25.1.1 If no, please explain why not and identify when FEI expects that to occur.

25.1.2 If no, to what extent will that delay the remaining milestones?

Response:

FEI has completed the activities related to procuring contractor services and achieved the December 2020 Procure Contractor Services milestone with no impact on the remaining milestones.

The Procure Detailed Engineering Services milestone scheduled for December 2020 is not on the Project's current critical path and thus will not delay any of the remaining milestones, so was rescheduled to February 2021.

26. Reference: Exhibit B-1-1 page 75 and 76

> **5.6.1 Project Delivery Method/Contract Pricing**
>
> FEI will use a Construction Manager at Risk (CMAR) project delivery method to deliver the Project. This delivery method is a form of early contractor involvement where a contractor is engaged under a services contract that takes an integrated team approach to the planning, design and construction of the project. The integrated team will consist of FEI, the engineering design firm and a contractor working collaboratively to deliver the Project for the lowest cost and completion prior to the schedule constraint. The aim of this project delivery method is to engage the construction expertise early in the design process to provide constructability input and manage project execution risk. As part of the competitive contractor selection process, FEI and the contractor have agreed on key commercial terms for overhead and profit margin.
>
> To help ensure that the Project is delivered at the lowest reasonable cost, a transparent and progressive "open book" cost estimating process will be used as the design advances from 30 percent design milestone through the 60 to 90 percent design completion milestones. At each
>
> milestone, the contractor will be required to provide a risk adjusted cost estimate. Risk will be allocated collaboratively between FEI and the contractor using the principles that a party shall bear a risk that it can control and is best able to manage. At the 90 percent design milestone, the contractor and FEI will seek to agree on a lump sum fixed price, which includes an amount in the estimate for the risks allocated to the contractor, to complete the Project. The lump sum fixed price effectively means that the contractor holds all of the Project's construction and execution risks assigned to the contractor during the risk allocation process.

26.1 Please provide a more detailed overview of the Construction Manager at Risk ("CMAR") methodology.

Response:

CMAR is a collaborative project delivery method in which the owner contracts with two separate firms: an engineering firm to design the project (Design Firm), and a separate CMAR firm that will act as construction manager and general contractor. The CMAR method is commonly used to deliver a project:

(i) where there is a need for schedule acceleration that requires fast-tracking of some activities to meet a mandated constraint by incorporating the contractor's input early in the design process;

(ii) when a project has significant technical complexity, constructability issues and requires a high level of risk management that a contractor is best able to address early with a design engineer; and

(iii) when there is a need for price certainty early in the design process based on the project's risk profile.

The attributes of the PGR Project, including complex geological conditions, major crossings, working in a dense urban environment, and numerous stakeholder interfaces, support the selection of CMAR as the appropriate delivery method. Additional information regarding the

advantage and disadvantages of the CMAR delivery method is provided in the response to CEC IR2 26.3.

Along with selecting the contractor early in the process, the CMAR delivery method has two notable attributes:

1. The contractor is required to provide a construction price estimate at an early stage of the design development (30 percent design in case of the PGR Project) that provides a higher level of cost control and cost certainty to FEI. This early price is adjusted to form a fixed price construction contract as the design advances to completion and risks are allocated to the party best able to manage and control.

2. There is a provision in the process for FEI to take pre-determined "off ramps" and terminate the CMAR for convenience prior to finalizing a contract price. If the off-ramp is taken, FEI can either utilize another CMAR firm or bid the job to the market using the traditional design-bid-build model to still meet the project's objectives.

CMAR project delivery is done in two phases, as follows:

Phase I Services – Preconstruction:

The scope of work for Phase I services includes a constructability review of the ongoing design, and development of progressive open book cost estimates (described later), as the design advances from 30 percent preliminary design through to 60 to 90 percent completion, The CMAR firm and FEI would then seek to agree on a price to construct the project. The initial cost estimate by the CMAR firm will be at the 30 percent milestone and will establish the baseline cost for the construction portion of the Project. A third party will be retained to provide an independent cost estimate, using the same basis as the CMAR firm, to assist in validating the costs presented by the CMAR firm through Phase I up to and including review of any possible Early Works package and the final proposed contract price.

Phase I will also be the mechanism to ensure the CMAR firm provides input into required permits, the projected construction schedule, and determination of the need for any Early Works package. An Early Works package could include competitive procurement of long lead materials and equipment, site preparations, third-party utility relocations if and where needed, and mobilization of the CMAR firm prior to completion of Phase I.

Phase II Services – Construction:

Phase II services will include construction of the Project with the CMAR acting as General Contractor, procurement of any additional specialty subcontracts and vendor packages, support for commissioning and startup of the project, and turnover to FEI for long-term operation and maintenance.

Principles of Open-Book Pricing[1]

The open-book process is used for developing cost and price during Phase 1 and also to establish the final contract price for the CMAR project delivery method. The cost of work and price are described as follows:

- **Cost of work:** The construction cost estimate is based on the actual cost of work to perform the work based on the contractor providing, in a transparent manner, all the documentable cost elements, without any overhead or profit, that make up the estimate, such as labour rates, expenses, materials, equipment, and production rates for the self-performed work (if any), combined with subcontractor quotes. The cost of work will also include any agreed upon contingency.
- **Price:** Once a cost estimate is finalized, the agreed upon overhead and profit percentages, established through the competitive RFP process, as described in the responses to CEC IR2 26.5 and 27.1, are converted to a dollar amount and added to the construction cost estimate to create a fixed price.

The cost is developed by the CMAR firm based on several foundational principles for open book pricing as follows:

- **Transparency and validation:** Costs are developed transparently, with no hidden amounts and nothing embedded or inflated in any cost element. Transparency means full, confidential disclosure of all the details by the CMAR contractor and includes third-party verification by the independent cost estimator, the owner's engineer, the owner's advisor and FEI's project team. The estimating process is truly an open book, with all cost information available for review by FEI and its supporting subject matter experts.
- **Accuracy and completeness:** The development of costs and price must include all cost elements for all of the construction scope and must be complete at each cost estimate submission by the CMAR contractor, with no exclusions.
- **Realism and fairness:** Cost and pricing must be both realistic and fair to both parties at all times.
- **Risk and opportunity assessment:** Anything that is an undefined risk or opportunity will be quantitatively assessed and a dollar amount added as a project contingency amount to the CMAR firm's cost estimate, exclusive of overhead and profit.

To derive a contract price, the books are "closed" and FEI then uses the fixed-price methodology where the contractor guarantees to FEI a fixed dollar amount (price) based on the agreed-upon scope, schedule, risk allocation and contract terms and conditions to deliver the project.

[1] Source reference: Principles and Best Practices for Collaborative Delivery, Water and Wastewater Design-Build Handbook, pp. 2-9.

Value added by utilizing CMAR

Since the CMAR project delivery method is a form of early contractor involvement and the contractor is integrated early into the project team while the design advances, there are many opportunities for the contractor to add value to the Project and participate in value engineering analysis to reduce cost, improve schedule and reduce risks, particularly at the 30 percent design milestone. To date the CMAR firm has provided the following value added inputs to the design:

- Input was provided that led to the development of an alternative trench solution for an area of challenging geotechnical conditions which is expected to reduce costs and improve schedule;
- Input was provided into the gas line alignment and necessary temporary workspace requirements for construction to facilitate consultation with key stakeholders to reduce risks associated with obtaining permits;
- Input was provided into the traffic management strategy to reduce risks associated with construction execution;
- Input was provided into the selection of the preferred crossing methods for each of the major crossings as further described in FEI's response to BCUC IR2 27.2 to reduce risks associated with construction execution; and
- Input was provided into the development of construction related project execution plans to reduce risks associated with construction execution.

26.2 Please identify any alternative delivery methodologies that FEI considered and explain why FEI selected the CMAR methodology.

Response:

FEI considered several alternative delivery methodologies for the Project including: Design-Bid-Build (DBB), Design-Build (DB), Construction Manager At Risk (CMAR), Construction Manager – Agency (CM-A), Integrated Project Delivery (IPD), and Progressive Design Build (PDB).

FEI selected the project delivery methodology by utilizing the in-house Project Delivery Method Selection Framework developed in collaboration with Ernst and Young Canada (EY). This framework provides a detailed and structured approach for selecting project delivery methods for FEI's capital projects.

FEI engaged EY to evaluate which delivery method was most appropriate for the PGR Project considering the evaluation criteria described in the framework. EY concluded that CMAR is the preferred project delivery method. With the selection made, FEI engaged EY to conduct a market sounding to understand contractor's capabilities using CMAR in BC and Canada. EY concluded that the construction market was familiar with using this delivery method. To assist

FEI in implementing the CMAR method, Integrated Delivery Solutions, was retained to provide owner advisory services for the duration of Phase 1. The principal of Integrated Delivery Solutions, Mark Alpert, PE, is recognized as an industry expert on the application of the CMAR method and is a Fellow of the Design Build Institute, USA.

The rationale and reasons for selecting the CMAR method are explained in the response to CEC IR2 26.1.

26.3 Please provide a Pro/Con list of the CMAR methodology.

Response:

The table below lists the typical advantages and disadvantages of the CMAR methodology. Please refer to the response to CEC IR2 26.1 for the description of Phases 1 and 2.

Advantages	Disadvantages
▪ Potential to fast track early components of construction prior to completion of design. ▪ Used to address complex design issues through three-party collaboration by FEI, the design firm and contractor. ▪ Price certainty is established with a low level of design maturity. ▪ CMAR firm is responsible for the Project cost and schedule during construction in Phase 2. ▪ Selection based on the CMAR's qualifications which is particularly beneficial for technically complex projects such as the PGR Project. ▪ Constructability input is provided earlier in design, mitigating risks of scope changes during Phase 2. ▪ Risk allocation is done collaboratively.	▪ FEI retains design liability. ▪ Cost of construction is not known at the time of initial Phase 1 contract signing. ▪ FEI is subject to greater risk of scope changes during Phase 1 as the design progresses. ▪ FEI may need to facilitate collaboration between the Design Firm and the CMAR firm.

26.4 Has FEI used a CMAR project delivery method in the past, or is this a new methodology for the company? Please explain.

26.4.1 If FEI has used this methodology in the past, please cite some examples and identify any issues that have arisen in the past.

26.4.1.1 Please explain how FEI will address the issues it has experienced in the past with this method of project delivery.

26.4.2 If FEI has not used the project delivery methodology in the past, please explain why not.

Response:

FEI has not used a CMAR project delivery method in the past. The CMAR project delivery method, however, has many characteristics that are similar to the Progressive Design Build (PDB) method, which is often used for projects that have complex design and major constructability issues to address during the early phases. During the early phases of the PGR Project, when Alternative 2B (the DP HDD alternative) was being considered, FEI utilized the PDB method and FortisBC Inc. is utilizing a variant of the PDB method to deliver the Corra Linn Dam Spillway Gates Project.

CMAR is one of many project delivery methods that are considered when executing multi-year projects. FEI selects a project delivery method based on how well it meets each project's specific objectives and constraints.

26.5 Please provide a list of the key commercial terms that are agreed upon.

Response:

FEI is filing a portion of this response on a confidential basis pursuant to Section 18 of the BCUC's Rules of Practice and Procedure regarding confidential documents adopted by Order G-15-19. The commercial terms agreed upon by FEI and its contractor were the subject of a competitive bid process, are commercially sensitive and are confidential. Release of this information to the public would prejudice FEI and its contractor's negotiating position in the future.

Should participants in this proceeding require access to some or all of the information filed confidentially, FEI has provided a proposed Undertaking of Confidentiality in Appendix B-3 to the Amended Application, to be executed before confidential information may be released to registered parties under the terms of the undertaking. FEI has no objection to providing confidential information to its customary and routine intervener groups representing customer interests. Should any other party seek access to this confidential information, FEI requests that the BCUC provide an opportunity for the company to file comments on the request.

The key commercial terms that are agreed upon are as follows:

1. Profit margin of [redacted] percent of the direct cost of the Project.
2. Corporate overhead of [redacted] percent of the direct cost of the Project (including any mark-up on subcontractors, consultants, vendors, and suppliers).
3. Labour rates and plant and equipment rates (excluding any overhead and profit).

26.6 Is the project design at 30% already?

26.6.1 If not, when will FEI reach the 30% design milestone?

26.6.2 If no, how will the cost estimating process be done before the 30% design milestone, and how will the lowest reasonable cost be assured?

Response:

No, the Project design is not yet at 30 percent. FEI expects to reach the 30 percent design milestone on February 26, 2021, as referenced in Table 5-10 of the Amended Application.

In alignment with AACE's cost estimating process, the Class 4 deliverables including the cost estimate were completed in Q4 2020 and included in the Amended Application. The next step will be completion of the Class 3 deliverables to achieve the 30 percent design milestone and the associated cost estimate will be completed thereafter by May 26, 2021.

To assure the lowest reasonable cost, the CMAR project delivery model will utilize an "open book" cost estimating process described in response to CEC IR2 26.1.

26.7 How will the parties resolve disputes with regard to bearing risks? Please explain.

Response:

The general risk management principle is that risk is allocated to the party best able to manage and control a particular risk. FEI and the contractor will first seek to allocate risks based on this principle. In cases where the parties cannot agree on who can best manage the risk, FEI has engaged an owner's advisor in the CMAR process to facilitate the discussion. It is unlikely that a dispute will arise given the intended collaboration during Phase 1 between the CMAR firm and the Design Firm as this phase is intended to improve the design and allow the project to be constructed in a more timely and cost effective manner than it would have been otherwise. In some cases the contractor may request a higher contingency to cover risks that it feels it cannot cover or control. In this case the two parties negotiate accordingly to arrive at a mutually agreeable solution. In the event the parties are still not able to resolve disputes, or agree on the risk allocation, or a contract price and a Phase 2 construction contract is not negotiated to FEI's satisfaction, FEI has the option to utilize the off-ramp and terminate the CMAR firm and bid the construction work competitively to the market.

1

27. Reference: Exhibit B-1-1 page 76

> To establish price competitiveness, the contractor will be required at the onset to provide a document that thoroughly defines all pricing assumptions, shows all cost elements that will be used to estimate all aspects of the work, and provide the steps to show how the estimated total project costs will be derived. FEI will conduct independent cost estimation and estimate validation to determine market competitiveness. FEI will also engage the services of an Owner's engineer to review the contractor's submittals and complete a check estimate review. In addition, a comprehensive cost reconciliation process will be conducted to address any significant differences between the independent estimate and the contractor's. Should FEI and the contractor be unable to reach an agreement on price, schedule or risk allocation, anywhere from 60 percent design onwards, FEI can take an "off ramp" and terminate the services contract for convenience, prepare a tender package and tender the construction.

27.1 How did FEI select its contractor? Please explain and identify how many companies were considered in the process.

Response:

FEI undertook a multi-phase procurement process where the first phase included issuance of an Expression of Interest (EOI) to the market to a total of twelve pipeline, utility, and general contractors with experience in both Western Canada and the Lower Mainland. The EOIs were evaluated and a short list of five potential contractors that met all of the requirements, and who were interested and available were selected. These five shortlisted contractors subsequently received a Request for Proposal (RFP) seeking information on a best-value basis. The proponents were required to demonstrate the qualifications of both the organization and personnel in executing similar projects and describe a methodology as to how they intend to execute the project to meet the Project's objectives. In addition, the proponents were required to provide and agree upon key commercial terms for overhead, profit, labor, and equipment rates. The proposals were then quantitatively evaluated on a best-value basis and a contractor selected based on experience, capabilities, proposed project team resources, and commercial considerations.

27.2 How did FEI select its Owner's engineer? Please explain and identify how many companies were considered in the process.

Response:

FEI prepared a Scope of Work package outlining the objectives, services, key project roles, and qualifications required. This was distributed to three pre-qualified pipeline engineering consultants with which FEI has long-term master services agreements and are currently working on other FEI major projects. The proponents provided a proposal outlining their organizational qualifications, proposed project team, rates, availability, and schedule to perform the function as Owner's Engineer. FEI reviewed the three proposals received, evaluated the proposals on a best value basis, and selected Universal Pegasus as the preferred proponent.

28. Reference: Exhibit B-1-1, page 79

> Throughout the Project, FEI will track the following socio-economic indicators: Project investment in local Indigenous communities, in local municipalities, and in the region.
>
> Based on FEI's experience assessing and delivering previous projects of this scope, the Project is not expected to have any long-term negative effects on the socio-economic conditions in the area and will have some positive effects for the Indigenous and local supply chain.

28.1 Is FEI undertaking any specific activities to promote project investment in local indigenous communities or in the area? Please explain.

Response:

FEI will endeavor to identify opportunities, whether managed by FEI or its contractors, for local and Indigenous contractor participation in the Project and to proactively engage with local communities about their potential involvement.

FEI plans to engage with local businesses and business organizations, so that they are aware of the Project-related opportunities. This will include a business-to-business networking session, where FEI introduces potential prime contractors to interested local businesses, and facilitates relationship building. FEI will engage with Indigenous communities and/or their economic development departments to determine their respective interest and capacity to participate in economic opportunities associated with the Project.

28.2 Will FEI be reporting on the socio-economic indicators at a later date? Please explain.

28.2.1 If no, why not.

28.2.2 If yes, when and how will this occur?

Response:

FEI will be tracking and reporting on the socio-economic indicators on a bi-annual or quarterly basis as part of FEI's public communications regarding the Project. These indicators will be incorporated into FEI's communications including project newsletters, webpage updates, and media announcements.

29. Reference: Exhibit B-1-1 page 84

> **5.10.3 Cost Estimate Validation**
>
> Cost estimate quality assurance and validation were completed as follows:
>
> - Internal reviews that included peer reviews, document quality checks, and independent review of project documents;
> - Validation reviews involving both Mott MacDonald and FEI team members throughout the estimate development process to confirm that the estimate assumptions were valid;
> - An external independent review to verify and validate that the estimate, as well as schedule, met the AACE Class 4 criteria and requirements and that a well-documented, reasonable and defensible estimate was developed; and
> - Internal and external reviews related to constructability and productivity.

29.1 Which groups/positions were involved in the internal peer reviews, document quality check and independent review of project documents?

Response:

The following groups/positions were involved in the internal peer reviews, document quality check and independent review of project documents.

Group	Position
Project Management	Project Director
	Senior Project Manager
Engineering	Engineering Lead
	Senior Project Engineer
	Senior Pipeline Engineer
	Engineering Supervisor, Station Design
	Plant Designer
	Civil Project Engineer
	Electrical Project Engineer
	Traffic Engineer
	Materials and Welding Engineer
	Junior Engineer
Pipeline Integrity	Regional Engineer
	Senior Geotechnical Engineer
	Corrosion Control Manager
	Corrosion Control Analyst
	In-line Inspection Manager
Environmental	Environmental Programs Manager

Group	Position
Operations & Construction	Pipeline Operations Supervisor
	Transmission Operations Supervisor
	Construction Manager
Community Relations	Community Relations Manager
	Corporate Communications Advisor
	Indigenous Relations Manager
Permitting	Permit Compliance Manager
Property Services	Property Service Lead
Procurement	Procurement Manager

29.2 Please describe the types of activities included in a validation review.

Response:

The activities included in the estimate validation review were aligned with AACE RP 31R-03 *Reviewing, Validating, and Documenting the Estimate*.

The estimate validation review conducted was qualitative in nature and focused on ensuring that the estimate technically met the requirements defined by FEI as part of the consultant's scope. This qualitative validation review focused on:

- Was the estimate developed using contractually or procedurally-required practices, tools and data as defined in FEI's scope of work;
- Did the estimate cover the entire project scope;
- Was the estimate free from errors and omissions; and
- Was the estimate structured and presented in the expected format and did it use FEI's estimating structure.

The validation process included a benchmarking of the estimate against and comparative analysis of various cost metrics and cost targets, including similar completed projects from FEI's historical data, in particular the recently completed Lower Mainland Intermediate Pressure System Upgrade (LMIPSU) Project, as well as third-party published data from the public domain.

29.3 Please identify which company conducted the external independent review to verify and validate the estimate, and the defensibility of the estimate.

Response:

Validation Estimating LLC (principal is John Hollmann) conducted the external independent review to verify the estimate. Hollmann concluded that the estimates and schedule were developed within the range of uncertainty typical for AACE Class 4, and as such are defensible.

30. Reference: Exhibit B-1-1 page 84 and 85 and 86

5.10.4 Risk Analysis and Contingency Determination

FEI engaged Yohannes Project Consulting Inc. (YPCI), a company specializing in project risk management, to conduct a qualitative risk analysis to identify and assess all of the risks associated with the Project. YPCI conducted multiple workshops with the Project team to develop a risk register for the Project to identify risks that could likely occur. As the engineering advances on the Project, the probability or the consequence of several identified risks were either mitigated entirely or reduced. All of the risks associated with the Project are contained within the Pattullo Gas Line Replacement (PGR) Sperling Avenue Route – Qualitative Risk Assessment Report Class 4, which is attached as Confidential Appendix E-1.

FEI also retained Validation Estimating LLC, USA (Validation Estimating), a company that provides services in estimate validation, risk analysis, contingency and estimation. Validation Estimating completed the contingency estimation using a quantitative analysis by applying an integrated parametric and expected value methodology that is aligned with AACE International Recommended Practice 42R-08: *Risk Analysis and Contingency Determination Using Parametric Estimating* and 65R-11: *Integrated Cost and Schedule Risk Analysis and Contingency Determination Using Expected Value*. This analysis is described in the report titled "Pattullo Gas Line Replacement (PGR) Project Sperling Avenue Options Capital Cost and Schedule Risk Analysis and Contingency Estimate", attached as Confidential Appendix E-2.

The risk likelihood and consequence matrix scale used for the Project are based on the 5 by 5 risk assessment matrix recommended in AACE 62R-11, as illustrated in Figure 5-4 below.

Figure 5-4: Risk Assessment Matrix

	Risk Impact Category (Cost, Schedule, Performance/Quality/Scope)				
	IMPACT				
Likelihood (Probability)	Very Low	Low	Medium	High	Very High
Very High (>50%)	Moderate	Moderate	Major	Major	Major
High (5 - 50%)	Minor	Moderate	Major	Major	Major
Medium (1-5%)	Minor	Moderate	Moderate	Major	Major
Low (0.1-1.0%)	Minor	Minor	Moderate	Moderate	Moderate
Very Low <0.1%	Minor	Minor	Minor	Minor	Moderate

5.10.4.2 Risk Register, Qualitative Assessment and Action Plan

The risk identification process identified a number of risks, which YPCI tabulated in the risk register included in Appendix A to YPCI's Risk Report (Confidential Appendix E-1). YPCI also recorded the risk response actions to deal with the identified risks in the risk register. The Project Team completed a qualitative assessment to prioritize or rank the risks so that the Project team could focus on risk response actions and mitigation for the high priority risks. As part of this qualitative process, the Project team assigned a likelihood and consequence rating to each identified risk using the risk assessment matrix noted above.

5.11 CONCLUSION

In this section, FEI described the PGR Project in detail, including information on the Project components, route selection process, basis of design and engineering, project schedule and resource requirements, project impacts, and permitting and approval requirements. FEI has provided the basis of project cost estimate and has appropriately completed cost validation and

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project risk assessment. FEI's has identified risk mitigation activities to mitigate the overall cost and schedule risk of the Project.

30.1 Please confirm that FEI adhered to standard risk analyses which were conducted by external parties.

30.1.1 If not, please identify all areas in which FEI did not conform to standard risk analysis practices, or identify those that were not conducted by external parties.

30.1.1.1 If not, please explain why not for each area identified.

30.1.2 If yes, have such practices been previously approved by the BCUC for projects over $100 million? Please explain.

Response:

FEI confirms it adhered to standard risk analyses which were conducted by external parties. FEI has adhered to AACE estimating and risk analysis practices for all projects over $100 million since the issuance of the 2010 CPCN Guidelines and the updated 2015 CPCN Guidelines. These guidelines state that cost estimates for CPCN applications should have a Class 3 degree of accuracy as defined in AACE RP 10S-90 *Cost Engineering Terminology*, and include a risk analysis identifying all significant risks to successful completion of the Project. These practices have been applied to the previously approved Lower Mainland Intermediate Pressure System Upgrade (LMIPSU) and Inland Gas Upgrades (IGU) projects (the only projects in excess of $100 million since the referenced CPCN guidelines were in effect).

31. Reference: Exhibit B-1-1 page 90 and 91

> The PGR Project estimated capital cost, provided in the table above, is based on the following:
>
> - The base cost estimate of $124.333 million in 2020 dollars developed by FEI and Mott MacDonald as described in Section 5.10.1 of the Application, and $5.612 million of actual Project development costs incurred between February and November 2020;
>
> - A contingency estimate of $30.100 million in 2020 dollars (approximately 24 percent) of the base cost estimate ($124.333 million in 2020 dollars) provides a total Project capital budget at a P50 confidence level as discussed in Section 5.10.4.4 of the Application;
> - A P50 escalation value of $7.733 million during the construction period from 2021 to 2023 as discussed in Section 5.10.4.5 of the Application applied to both the base capital cost and contingency. The escalation is used to convert the Project capital cost from 2020 dollars to as-spent dollars;
> - Deferred costs of $2.857 million (as-spent) for the Application and Preliminary Stage Development Costs discussed in Section 6.4.3 below; and
> - AFUDC, estimated based on FEI's 2021 approved AFUDC rate of 5.47 percent, which is equal to FEI's after-tax weighted average cost of capital.[27]

31.1 Please confirm that ratepayers will be responsible for the actual costs of the project, not the estimated costs.

31.2 Assuming approval of the CPCN, what options do ratepayers have in the event that certain costs were not judged to be prudent in hindsight? Please explain.

31.3 When might an assessment of prudence be undertaken and what information would be available to the Commission at that time?

Response:

FEI confirms that if the BCUC approves FEI's Application for a CPCN for the Project, FEI would recover all prudently incurred actual costs from ratepayers, not the estimated costs. This is consistent with past regulatory treatment.

As explained in the response to BCUC IR1 15.11, FEI expects to provide periodic reporting to the BCUC following the decision approving a CPCN. Consistent with other recent FEI CPCN decisions, the utility expects that it will be required to file quarterly or semi-annual reports, and a final report six months after the Project is complete. These reports include a breakdown of the final Project costs, along with a comparison to the cost estimate provided in the Amended Application, and an explanation of all material cost variances. This process provides the BCUC with visibility into the actual Project costs, and allows the BCUC to determine if any further process is required.

32. Reference: Exhibit B-1-1 page 91 and Exhibit B-6, CEC 1.12.3

> 1. **Levelized Delivery Rate Impact**: Ability for an alternative to be completed with the lowest possible delivery rate impact over the approximate financial life of the asset (i.e., 73-year analysis period) for the PGR Project. Alternatives that minimize the levelized delivery rate impact to FEI's non-bypass customers score the highest. [Emphasis retained]
>
> 12.3 Please provide the useful life and depreciation rate(s) FEI proposes to use in its revenue requirements for the PGR Project.

Response:

Upon BCUC approval of the PGR Project and once construction has been completed, each individual asset of the PGR Project will enter rate base on January 1 the following year and begin depreciating at the approved depreciation rate for each asset. The current approved depreciation rates for FEI's assets in rate base are based on FEI's 2017 Depreciation Study, approved by BCUC Order G-165-20 as part of FEI's 2020-2024 Multi-Year Rate Plan (MRP) Application and included in the table below. Additionally, included in the aforementioned depreciation study was the average service life (ASL) for each of the assets which FEI has also included in the table below.

PRG Project Components	FEI Asset Account No.	FEI Asset Account Name	Approved Depreciation Rate (%)	Average Service Life ASL (yrs)
Intermediate Pressure (IP) Pipeline	475-00	Distribution Plant – Main	1.35 %	65
PRS Building Structure	472-00	Distribution Plant – Structures & Improvements	2.15 %	38
PRS Equipment	477-10	Distribution Plant – Measuring & Regulating Equipment	2.51 %	33
PRS Land in Fee Simple	470-00	Distribution Plant – Land in Fee Simple	0.00 %	n/a
IP Pipeline Statutory Right of Way (SRW)	471-01	Distribution Land Rights	0.00 %	n/a

The approved depreciation rate is not equivalent to the average service life estimated by the depreciation study of each asset as shown in the table above. Under group asset accounting, the asset depreciation rate also includes the accumulated gains/losses within the same asset group at the time of the depreciation study. The depreciation rates of each asset account are reviewed and updated periodically with new studies that are filed to BCUC for approval.

32.1 Why did FEI switch from a 73-year analysis period to a 68-year analysis period? Please explain.

Response:

Please refer to the response to BCUC IR2 24.1.

33. Reference: Exhibit B-1-1 page 92 and Exhibit B-6, CEC 1.15.2 Attachment, PDF page 159 of 179

The financial evaluation of the PGR Project includes the following assumptions:

- **Inflation:** Two percent annually for incremental O&M, property tax, and future capital replacement costs during the post-Project analysis period. This is comparable to the

historical 5-year average BC CPI from 2015 to 2019 which is also approximately two percent[28];

Class 3 (Define)

Required Documentation

❒Approved Planning Scope
- Operations signoff
- SCC sign-off (as required)

❒Approved Work Plan
- Work Plan to be signed as reviewed by Operations, Engineering and SCC (if required)
- Site access
- Crane requirements and access
- On site facilities
- Management and labour resources
- Security

❒Drawings and Lists
- Documentation will vary depending on project type, and engineering discipline.
- Document to be signed as approved by engineering discipline.

Minimum Drawing Requirement:
- Equipment layout. Site Plan
- Equipment lists, material quantities, long term delivery items identified
- Equipment sizing, Single Line Drawing

❒Preliminary Specifications
- Operations signoff
- Engineering signoff

❒Approved Schedule
- Completed using MS Project
- Signoff by PMO
- Signoff by Project Engineer
- Signoff by SCC
- Signoff by Operations

❒Class 3 Estimate
- Produced from Generation Estimate Sheet
- SAP Historical Cost Information, inflation review
- Written Vendor quotes based on preliminary specification
- Confirmation of Contracting Out status

❒Preliminary Budget Set

❒Business case completed

33.1 Please provide the annual inflation rate from the BC CPI from 2015 to 2020 inclusive.

Response:

Please see the table below for the annual inflation rate from the BC CPI from 2015 to 2020 inclusive. FEI notes that with the addition of 2020, the average inflation rate over the period is now 1.8 percent, similar to the 2 percent calculated for 2015 to 2019.

	2015	2016	2017	2018	2019	2020
Annual BC CPI Percent Change (%)	1.1%	1.8%	2.1%	2.7%	2.3%	0.8%

Reference: https://www2.gov.bc.ca/assets/gov/data/statistics/economy/cpi/cpi_annual_averages.pdf

33.2 Please provide any evidence that FEI has available as to expected changes in inflation rates in the next five years.

Response:

Please see the table below for a five year forecast (2021-2025) of inflation rates (BC CPI) from the Conference Board of Canada (CBOC) and three Canadian chartered banks. Note that most publicly available BC CPI forecasts from Canadian chartered banks are up to and including 2022 only.

FEI notes that the assumption of inflation at two percent annually, as discussed in Section 6.3 of the Amended Application, is for the post-project years beginning 2023 (the new assets are forecast to be in-service in 2022). This is comparable to the average BC CPI for 2022 as well as the forecast from CBOC for 2023 to 2025 as shown in the table below. FEI considers it appropriate to use inflation of two percent annually for the financial analysis completed for the PGR Project.

	2021F	2022F	2023F	2024F	2025F
Conference Board of Canada (CBOC)	1.8%	2.5%	2.1%	2.0%	2.0%
Royal Bank Canada	0.8%	1.8%	n/a	n/a	n/a
Scotiabank	1.5%	2.2%	n/a	n/a	n/a
BMO	1.6%	2.0%	n/a	n/a	n/a
Average	1.4%	2.1%	2.1%	2.0%	2.0%

References:

- CBOC – https://www.conferenceboard.ca/e-data/browsedirectories.aspx?did=21 (Available only with subscription)
- Royal Bank Canada – http://www.rbc.com/economics/economic-reports/pdf/provincial-forecasts/bc.pdf
- Scotiabank – https://www.scotiabank.com/ca/en/about/economics/economics-publications/post.other-publications.the-provinces.british-columbia--october-15--2020-.html
- BMO – https://economics.bmo.com/media/filer_public/a6/fd/a6fd81f1-71a6-4ecd-9fe7-5e315121a778/outlookprovincial.pdf

33.3 For Generation Project Cost Classification System, a Class 3 estimate appears to include an inflation review. Will FEI be conducting such a review? Please explain why or why not.

Response:

The Generation Project Classification System referenced is used by FortisBC Inc. (FBC) for electric generation projects when developing Class 3 estimates. As indicated in AACE RP 17R-97 *Cost Estimate Classification System*, "each industry will have a typical set of deliverables that are used to support the type of estimates used in that industry." As such, while the deliverables differ, the estimating methodology used by FEI is similar to that used by FBC for generation projects and aligns to the AACE recommended practices.

FEI confirms that an inflation review and analysis was conducted for the PGR Project. The inflation review cited above is done as part of any multi-year project that requires a CPCN application to develop the as-spent cost profile when performing the financial and rate impact analysis. For the PGR Project, FEI completed an escalation analysis which was submitted as part of the Amended Application, Appendix E-3, Validation Estimating Escalation Report. As per AACE RP 10S-90 *Cost Engineering Terminology definition*, escalation is "a provision in costs or prices for uncertain changes in technical, economic, and market conditions over time. Inflation (or deflation) is a component of escalation."

34. Reference: Exhibit B-1-1 page 95 and 96

6.5 RATE IMPACT

The PGR Project will have incremental delivery rate impacts from 2022 to 2025. The causes of the delivery rate impacts in each year are explained below:

- **2022 to 2024:** Delivery rates will be impacted in these years by the amortization of the PGR Application and Preliminary Stage Development Costs deferral account as discussed in Section 6.4.3 above;
- **2023 and 2024:** Delivery rates will be impacted in these years as the assets for the new IP pipeline and PRS in the City of Burnaby are scheduled to be placed in-service in 2022 and 2023,[34] which will be transferred to rate base on January 1 of 2023 and 2024, respectively (as discussed in Section 6.4.1 above); and
- **2024 and 2025:** Delivery rates will be impacted in these years as the decommission/abandonment costs for the Pattullo Gas Line are scheduled to occur in 2023 and 2024,[35] after which the costs will be transferred to FEI's Net Salvage deferral account on January 1st of 2024 and 2025, respectively (as discussed in Section 6.4.2 above). The estimated delivery rate impact in 2025 due to the decommissioning and abandonment costs is offset by the elimination of the amortization of the PGR Application and Preliminary Stage Development Costs deferral account, resulting in a delivery rate credit in 2025.

Table 6-6 below shows the annual delivery rate impact in percentage terms compared to FEI's 2021 approved non-bypass revenue requirement[36] and the incremental annual delivery rate impact in percentage terms (year-over-year) from 2022 to 2025.

Table 6-6: Summary of Delivery Rate Impact for the PGR Project

	2022	2023	2024	2025
Annual Delivery Margin, Incremental to 2021 Approved, Non-Bypass ($ millions)	0.288	5.715	13.890	13.773
% Increase to 2021 Approved Delivery Margin, Non-bypass	***0.03%***	***0.65%***	***1.58%***	***1.57%***
Incremental % Delivery Rate Impact (Year-over-Year)	***0.03%***	***0.62%***	***0.92%***	***(0.01%)***
Average Annual % Delivery Rate Impact (4 years, 2022 - 2025)	0.39%			
Average Annual Delivery Rate Impact (4 years, 2022 - 2025), $/GJ	0.018			
Cumulative % Delivery Rate Impact (4 years, 2022 - 2025)	1.57%			
Cumulative Delivery Rate Impact (4 years, 2022 - 2025), $/GJ	0.071			

The Project will result in an estimated delivery rate impact of 1.57 percent in 2025 when all construction, including the decommissioning and abandonment, is completed and all capital costs have entered FEI's rate base. The average annual delivery rate impact over the four years from 2022 to 2025 is estimated to be 0.39 percent annually or $0.018 per GJ annually. For a typical FEI residential customer consuming 90 GJ per year, this would equate to an average bill increase of approximately $1.62 per year over the four years, or cumulatively $6.39 over the four years.

34.1 Is the CEC's understanding correct that there will be no additional delivery rate increase impacts past 2025 and no changes other than potential decreases?

34.1.1 If no, please explain why not.

Response:

Confirmed. There will be no additional delivery rate impacts (increases or decreases) due to the capital cost of the PGR Project past 2025.

35. Reference: Exhibit B-1-1 page 97

> **7. ENVIRONMENT AND ARCHAEOLOGY**
>
> **7.1 *INTRODUCTION***
>
> FEI is committed to delivering safe, reliable energy in an environmentally responsible manner. Based on the preliminary environmental and archaeological assessments completed by its consultants, FEI expects that the Project will have minimal environmental and archaeological impacts. The environmental and archeological assessments considered the potential impacts of the Project as divided into the following two components:
>
> - the replacement gas line in the Sperling Avenue Corridor (Sperling Route); and
> - the decommissioning of the Pattullo Gas Line.

35.1 Is it correct to state that FEI has or will undertake all required environmental and archaeological activities throughout the project execution time frame?

Response:

Confirmed. FEI will undertake all required environmental and archaeological activities throughout the Project execution time frame.

35.2 Please identify any areas of environmental or archaeological concern where FEI has relied on internal assessments instead of third party professional assessments.

35.2.1 For any areas identified, please explain why FEI did not rely on third party assessments.

Response:

Consistent with past practice, FEI has retained and relied on third-party qualified professionals to identify and assess all areas of environmental and archeological concern.