BC Hydro
Power smart

6911 Southpoint Drive (B03)
Burnaby, BC
V3N 4X8

July 30, 2024

[redacted]

[redacted]

[redacted]

RE: CEAP IR 25 - [redacted] Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed [redacted] Project submitted under Attachment M-2: Transmission Service and Interconnection Service Procedures for Competitive Electricity Acquisition Process (CEAP) of the Open Access Transmission Tariff (OATT). This letter provides a non-binding good faith estimate of the cost and time to construct the facilities required to interconnect your project to BC Hydro's Transmission System, being the Network Upgrades, based on the findings of the Interconnection Feasibility study.

Open Access Transmission Tariff

The OATT defines Network Upgrades as additions, modifications, and upgrades to BC Hydro's Transmission System required at or beyond the Point of Interconnection to accommodate the interconnection of the Generating Facility to the BC Hydro's Transmission System. Pursuant to the OATT, BC Hydro will design, procure, construct, install, and own the Network Upgrades. While BC Hydro will pay the costs for the Network Upgrades, the Interconnection Customer provides security for such costs.

Cost Estimate

Based on the Interconnection Feasibility study, the non-binding good faith estimated cost (typical accuracy range of +150%/-50%) for Network Upgrades required to interconnect your project is $66.6 M.

Major Scope of Work Identified:

- Acquire property for the new switching substation near transmission line 60L283
- Construct a new 69kV, 3-circuit breaker ring bus switching substation, control building and other required substation facilities and infrastructures
- Supply and install microwave towers and associated infrastructures
- Supply and install two frequency-diversity microwave terminals
- Addition and upgrade of Protection, Control and Telecom

Exclusions:

- GST
- Permits
- Right of Way
- Property costs

Key Assumptions:

- Construction work will be done by contractor
- 3 years of construction is considered
- Early Engineering and Procurement
- Existing control building will accommodate new P&C equipment
- No ground improvements will be required
- No contaminated soil will be encountered during construction

Key Risks:

- Cost of property acquisition cost may be higher
- Construction cost of new switching station and microwave towers can be higher than estimated
- Cost of materials and major equipment such as circuit breaker and disconnect switch may be affected by market conditions and escalation.
- No defined supply chain strategy, construction costs may increase depending on delivery method
- Project schedule may be longer than expected, leading to increased costs.

Please note that the Revenue Metering requirements and associated costs required to interconnect your project have not been determined at this stage and, therefore, not included in the above estimate. Revenue Metering costs that are attributable to the Interconnection Customer are to be paid in cash. For more details on Revenue Metering requirements and responsibilities, please refer to:

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-complex-revenue-metering.pdf.

Schedule

Based on the Interconnection Feasibility study, the non-binding good faith estimated in-service date for your project's Network Upgrades is Quarter 3 2031 (calendar year). To achieve this timeline, we may need to expedite certain activities, including engineering design and procurement of long-lead equipment.

Timely actions required from you to minimize risks to the schedule:

- Submission of additional technical data required for the System Impact Study and Facilities Study
- Submission of any required information or document such as demonstration of Site Control
- Execution of Combined Study Agreement and Standard Generator Interconnection Agreement
- Financial commitments and securities

Please note that changes to your interconnection request, delays in data submission, or financial commitments may also impact the target in-service date.

Next Steps

In September 2024, we will issue a final invoice for the Feasibility Study costs. This invoice will reflect the total amount due, taking into account the $15,000 Feasibility Study deposit you have already paid and any remaining amount on the non-refundable $15,000 Interconnection request deposit that we did not spend in reviewing and validating your interconnection request.

If you have any questions, please contact the BC Hydro CEAP Team at ceap2024@bchydro.com.

Sincerely,

[redacted]

Senior Manager, Transmission Interconnections
BC Hydro

Encl.: CEAP2024_IR_25_[redacted]_FeS_Report_final.pdf

[redacted]

[redacted] Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 25

Prepared for: [redacted]

[redacted]

300-APR-00004
2024 Jul 30

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[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
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Revision	Date	Description
0	2024 Jul	Initial release

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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its [redacted] Project (2024 CEAP IR # 25) to the BC Hydro (BCH) system. [redacted] Project has twenty-five (25) [redacted] solar inverters with total installed capacity of 76.25 MW. The IC's proposed Point of Interconnection (POI) is on BC Hydro's 60 kV line 60L283, approx. 9 km from Marysville substation (MVL). The IC's project will connect to the POI via a 0.09 km 60 kV interconnection line. The proposed Commercial Operation Date (COD) is September 30, 2028.

To interconnect the [redacted] Project and its facilities to the BCH Transmission System at the proposed POI, this Feasibility Study has identified the following conclusions and requirements:

1. A new 60 kV switching station (referred to as "P25T") on 60L283 is required at the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P25T, 60L283 will be segregated into two segments, and three new lines are temporarily referred to as: 60L283_A (CBK-P25T), 60L283_B (P25T-MVL) and 60L283_C (P25T-P25).

2. The connection of [redacted] Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal conditions.

3. The connection of [redacted] Project will cause line overloads on 60L283_A (P25T - CBK), 60L283_B (P25T - MVL) and 60L298 (MVL - JOE) under single contingencies. When an overload on 60L283_A, 60L283_B and 60L298 occurs, a signal upon detection will be initiated to shed or run back generation at the IC's facility, which will bring the line loadings down within the ratings.

4. The [redacted] project is not arranged for islanded operation. In addition to entrance protection and line protection of 60L283_C, the IC is required to install anti-islanding protection within their facility to disconnect the [redacted] site from the grid when an inadvertent island with the local load forms.

5. BC Hydro will provide line protections for 60L283_A, 60L283_B and 60L283_C (BC Hydro end only). As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

The above conclusions are made based on the IC's input data and study assumptions listed in Section 4, which represent the best available information on May 22, 2024.

A non-binding good faith estimated cost and time to construct the Network Upgrades required to interconnect the proposed project will be provided in a separate letter to the IC.

Contents

Appendices

Acronyms

The following are acronyms used in this report.

BCH	BC Hydro
CEAP	Competitive Electricity Acquisition Process
COD	Commercial Operation Date
DTT	Direct Transfer Trip
EDM	Edmonds OfficeERIS Energy Resource Interconnection Service
FeS	Feasibility Study
FVO	Fraser Valley Office
HAM	Hamilton Microwave Repeater
IBR	Inverter-Based Resources
IC	Interconnection Customer
MPO	Maximum Power Output
NERC	North American Electric Reliability Corporation
NRIS	Network Resource Interconnection Service
OATT	Open Access Transmission Tariff
POI	Point of Interconnection
RAS	Remedial Action Scheme
SIC	South Interior Control
SIO	South Interior Office
TIR	BC Hydro “60 KV to 500 kV Technical Interconnection Requirements for Power Generators”
WECC	Western Electricity Coordinating Council

1 Introduction

[redacted] the interconnection customer (IC), requests to interconnect its [redacted] Project (2024 CEAP IR # 25) to the BC Hydro (BCH) system. [redacted] Project has twenty-five (25) [redacted] solar inverters with total installed capacity of 76.25 MW.

Table 1-1 below summarizes the project reviewed in this Feasibility Study.

Table 1-1 Summary of Project Information

Project Name	[redacted] Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	on 60L283 at 9 km from MVL	
IC's Proposed COD	30th September 2028	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection (MW)	75 MW (Summer)	75 MW (Winter)
Number of Generator Units	25 x 3.05 MW	
Plant Fuel	Solar	
Note 1: The maximum achievable power injection at the POI is approx. 74.46 MW after accounting for MW losses and service load which is lower than the IC proposed 75 MW.		

Figure 1-1 shows the South Interior East (SIE) region 500/230/60 kV transmission system topology diagram when the proposed [redacted] Project (#25) will be in-service. Cranbrook substation (CBK) is a major substation in the Cranbrook area. The substation provides a 500 kV connection to Alberta, supplies the Invermere substation (INV) via the 230 kV transmission line 2L258, and connects to Natal substation (NTL) via 2L113 and Nelway substation (NLY) via 2L294. Additionally, CBK also facilitates 60 kV connections to local substations and generating stations.

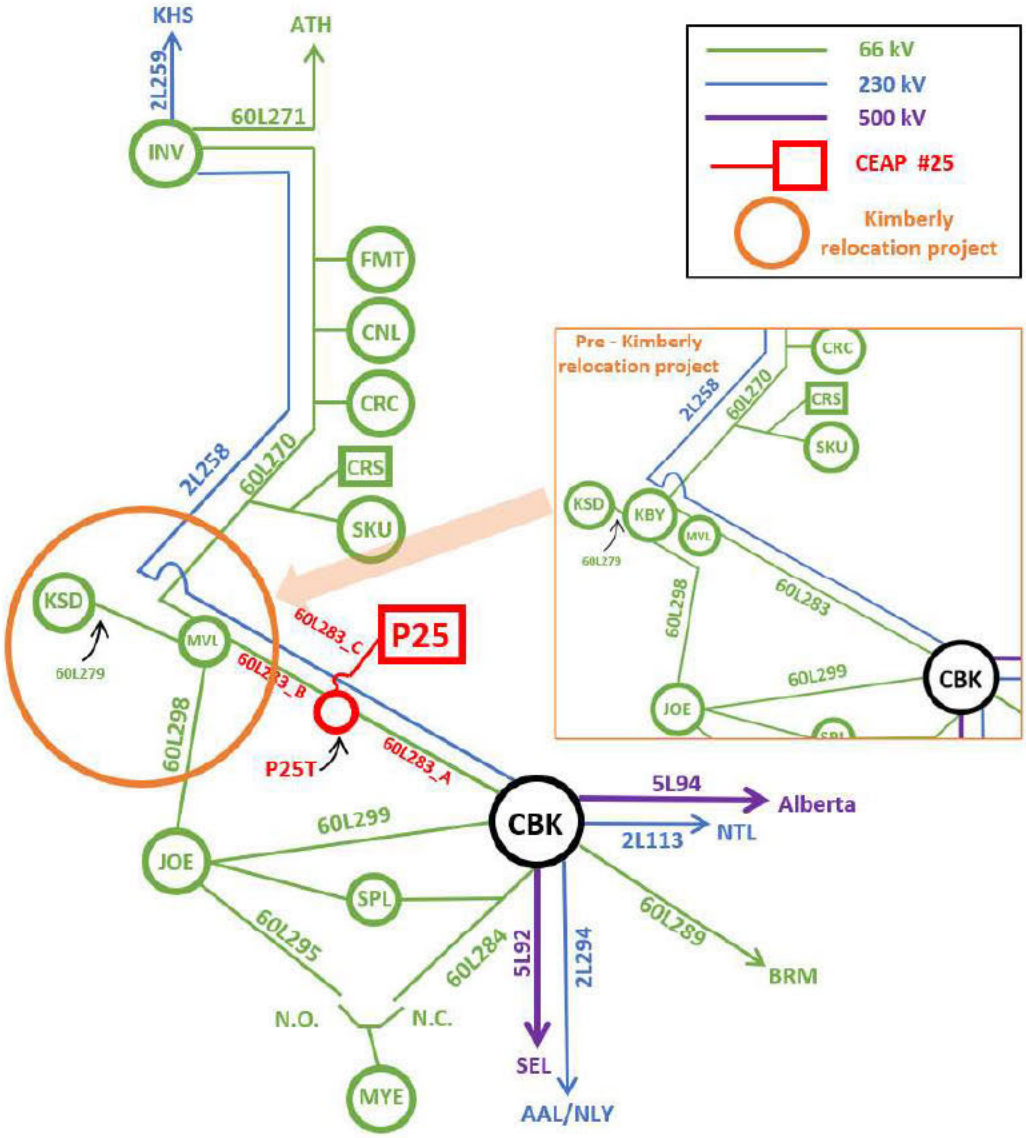

Figure 1-1: SIE region 500/230/60 kV Transmission System Topology Diagram

Prior to the [redacted] project, the existing 60 kV Kimberly (KBY) substation will be decommissioned as planned. After decommissioning KBY, the existing 60 kV circuits 60L270, 60L283 and 60L298 currently terminated at KBY will be re-terminated at the to-be-rebuilt Marysville substation (MVL), and the load at KSD will be served from the MVL via a renamed line 60L279 (MVL-KSD). An existing small solar farm Sun Mine (close to 1 MW) is currently connected to KSD.

2 Purpose and Scopes of Study

This Feasibility Study is a preliminary evaluation of the system impact of interconnecting the proposed project to the BC Hydro system based on power flow and short circuit analysis in accordance with BCH's Open Access Transmission Tariff (OATT). A non-binding good faith estimated cost of required Network Upgrades and estimated time to construct will be provided.

Per OATT, the feasibility study is performed individually for each of the participating projects in the CEAP process and focuses specifically on the BC Hydro regional transmission system where the proposed generating project is proposed to be constructed. An assessment of the incremental effect on the 500kV bulk transmission system is beyond this study scope.

This is a "limited scope" study which is restricted to power flow studies of P0, P1 and P2 planning events as defined in TPL-001-4 and short circuit analysis. The study does not address other technical aspects such as transient stability and switching transients and impact of multiple contingencies. These subjects would be addressed in subsequent System Impact Study if the project is a Successful Participant of the CEAP.

In case impact to the adjacent external systems to BC Hydro is observed, such impact would be addressed in subsequent detailed and coordinated studies with the relevant adjacent entities if the proposed interconnection proceeds further.

3 Standard and Criteria

The Feasibility Study is performed in compliance with the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) reliability standards, and the BCH interconnection requirements in the TIR, and upon the ratings of the existing BCH transmission facilities described in Operating Orders, specifically:

- NERC standards: TPL-001-4 and FAC-002-3 relevant to the scope of this Feasibility Study.
- WECC criteria TPL-001-WECC-CRT-4 Transmission System Planning Performance, July 1, 2023.
- BC Hydro's 60 kV to 500 kV Technical Interconnection Requirements for Power Generators.
- BC Hydro Operating Order 5T-10, Ratings for All Transmission Circuits 60 kV or Higher, April 16, 2024.
- BC Hydro Operating Order 5T-14, Ratings for All Transmission and Distribution Transformer, November 8, 2022.
- BC Hydro System Operating Order 7T-22 System Voltage Control, September 19, 2023.

4 Assumptions and Conditions

This Feasibility Study is performed based on the IC's submitted data and information available to BC Hydro on May 22, 2024 for the study purpose. Appendix A shows the plant single line diagram for the IC's project used in the study model. Certain assumptions were, as set out below, made to the extent required.

The power flow study cases used in this Feasibility Study are established based upon the BC Hydro's base resource plan and load forecasts available at the time of performing the study, which includes existing and future generations, transmission facilities, and loads in addition to the subject interconnection project in this study. Applicable seasonal conditions and the appropriate study years for the study planning horizon are also incorporated.

Additional assumptions are listed as follows:

1) The regional generation are dispatched to the patterns that stress the transmission system in the study area. In these patterns, the regional generations are typically set to their Maximum Power Outputs (MPO) unless otherwise specified.

2) Kimberly relocation project is assumed to be completed by the time the [redacted] Project is in-service.

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new switching station (referred to as "P25T") at the proposed POI on 60L283 is required to interconnect the IC's generating project to the BCH system. The addition of the new switching station would help to maintain reliability and adequate protection performance to serve the existing customers and the new addition.

With the new switching station P25T, the existing line 60L283 will be segregated into two segments, and three new lines are temporarily referred to as: 60L283_A (CBK-P25T), 60L283_B (P25T-MVL) and 60L283_C (P25T-P25). The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

5.1 Power Flow Study Results

Power flow studies were performed to evaluate whether the IC's generating project would cause any unacceptable system performance (e.g. equipment overloads, steady-state voltage violation and voltage instability) and to determine the reinforcement requirement based on steady state performance analysis.

The study focuses on the 2029 light summer (29LS) system load condition which is typically a stressed condition for a generation interconnection project, taking into considerations of factors such as load conditions, seasons and generation patterns. The 2029 heavy summer (29HS) and 2028 heavy winter (28HW) cases are also checked at a high level to capture any possibility of performance violations under high load conditions.

5.1.1 Branch Loading Analysis

Table 5-1 shows a summary of key branch loading analysis under system normal and single contingencies (Category P1 and P2) for various load conditions.

The study finds no transformer or line overload under system normal conditions for all three load conditions studied. For various single contingencies, the connection of the [redacted] Project could result in line overloads on 60L283_A (P25T - CBK), 60L283_B (P25T - MVL) and 60L298 (MVL - JOE) in the summer load conditions (29HS & 29LS). The details can be found in Table 5-1. Under system normal conditions, the line loadings on these three transmission

lines may reach up to 96% of their normal ratings. Additionally, following the 60L283_B contingency, the most severe overload occurs in the 60L283_A line section from P25T to CBK, with a potential loading of up to 163.6% of its normal rating.

To mitigate post-contingency overloading concerns, generation re-dispatching and/or generation shedding can be utilized at the project site, depending on the severity of the post-contingency overload. The details of the gen-shedding requirements will be determined in next study stage.

Table 5-1 Summary of Key Branch Loading Analysis Results

Case	IC's Plant Output	Contingency Identified		Branch Loading		
				60L283_A	60L283_B	60L298
		Cat.	Description	P25T-CBK	P25T-MVL	MVL-JOE
Winter Rating				94 MVA	94 MVA	68.6 MVA
28HW	Max	P0	System Normal	45 %	44.8 %	45.8 %
		P1	60L298	71.4 %	15.7 %	N/A
Summer Rating				49.7 MVA	49.7 MVA	49.7 MVA
29HS	Max	P0	System Normal	96.0 %	72.6 %	72.2 %
		P1	60L283_A (CBK– P25 POI)	N/A	160.1 %	148.2 %
		P1	60L283_B (MVL– P25 POI)	163.6 %	N/A	11.8 %
		P1	60L298	153.3 %	11.4 %	N/A
		P1	60L299	102.2 %	65.7 %	64 %
		P1	60L295	103.7 %	64.2 %	62.4 %
		P2.1	60L283_A CBK Breaker	N/A	160 %	148.1 %
		P2.1	60L283_A P25 POI Breaker	N/A	160.0 %	148.2 %
		P2.1	60L283_B MVL Breaker	163.4 %	N/A	11.8 %
		P2.1	60L283_B P25 POI Breaker	163.4 %	N/A	11.5%
		P2.1	60L298 MVL Breaker	153.3 %	11.4 %	N/A
		P2.1	60L298 JOE Breaker	153.3 %	11.7 %	N/A
29LS	Max	P0	System Normal	96.4 %	64.3 %	71.2 %
		P1	60L283_A (CBK– P25 POI)	N/A	155.2 %	150.4 %
		P1	60L283_B (MVL– P25 POI)	157.8 %	N/A	8.8 %
		P1	60L298	154.4 %	4.1	N/A
		P1	60L299	105.3 %	55.8 %	60.8 %
		P1	60L295	104.8 %	55.4 %	60.5 %
		P2.1	60L283_A CBK Breaker	N/A	155.2 %	150.4 %
		P2.1	60L283_A P25 POI Breaker	N/A	155.3 %	150.4 %
		P2.1	60L283_B MVL Breaker	157.5 %	N/A	16.3 %
		P2.1	60L283_B P25 POI Breaker	157.5 %	N/A	16.3 %
		P2.1	60L298 MVL Breaker	154.3 %	4.1 %	N/A
		P2.1	60L298 JOE Breaker	154.3 %	4.36 %	N/A

Single contingencies in the 230 kV system are also studied. The 60 kV transmission system near [redacted] project would have branch overload and voltage instability concerns after a single contingency on 2L258, which is similar to the outcome in the pre-exsiting system. This issue can be addressed by

existing local protections, which will open 2L259 and 60L271 lines at INV after a 2L258 contingency and trip off the loads in the northern part of INV.

5.1.2 Steady-State Voltage Analysis

With the connection of the IC's project, the voltage performance under system normal condition and single contingencies is acceptable for all the three load conditions (29LS, 29HS, 28HW). Table 5-2 shows a summery of steady-state voltage performance under various system conditions and contingencies.

Table 5-2 Summary of Steady-State Voltage Study Results

Case	IC's Plant Output	Contingency		Bus Voltage (PU)		
		Cat.	Description	P25S 66	CBK 66	MVL 66
28HW	Max	P0	System Normal	0.997 PU	1.012PU	1.002 PU
		P1	60L298	0.992 PU	1.009 PU	0.994 PU
29HS	Max	P0	System Normal	1.002 PU	1.018 PU	1.006 PU
		P1	60L298	0.996 PU	1.014 PU	0.997 PU
29LS	Max	P0	System Normal	1.017 PU	1.044 PU	1.021 PU
		P1	60L298	1.013 PU	1.046 PU	1.013 PU

5.1.3 Reactive Power Capability Evaluation

The BC Hydro TIR requires IBR power plant to have the dynamic reactive power capability at a minimum of +/- 33% of its MPO at the high voltage side of the IC's switchyard over the full MW operating range.

Based on the PSS/E power flow data submitted by the IC, the proposed generating project would be capable of meeting the BC Hydro's reactive capability requirement at the plant's maximum MW output, which is subjected to further verification in the next stage of interconnection study.

Furthermore, the BCH TIR requires the IC's project to provide sufficient reactive power capability over full MW operating range including at zero MW output level. According to the IC-provided reactive capability curve, the proposed solar inverter each has +/- 2.16 Mvar reactive capability at zero MW output, which means that the solar farm is capable of meeting the reactive power requirement at zero MW. This will need to be re-confirmed if the IC's project proceeds further.

5.1.4 Anti-Islanding Requirements

The [redacted] project is not arranged for islanded operation. The IC is required to install anti-islanding protection within their facility to disconnect the [redacted] Project from the grid when an inadvertent island with the local load forms.

5.2 Fault Analysis

The short circuit analysis in the FeS is based upon the latest BC Hydro system model, which includes the generating facility information and associated impedance data provided by the IC. A more detailed study will be performed at the system impact study stage if needed.

5.3 Stations Requirements

A new outdoor 60 kV, 3-circuit breaker ring bus Air Insulated Switchgear (AIS) switching substation (P25T temporarily) will be built at the proposed POI, close to the existing 60 kV transmission line 60L283. The existing transmission line 60L283 will be cut and looped in / out, and 60 kV line from [redacted] Project (60L283_C) will be terminated at the new substation.

The station scope at the new switching station P25T is as follows.

- Acquire adequate property for a new substation close to the existing transmission line 60L283.
- Construct a new outdoor 60 kV, three-circuit breaker ring bus AIS switching substation. Refer to the one-line sketch in Appendix B for details.
- Construct a new control building and other required substation facilities and infrastructures.
- Cut the existing 60L283 and loop in / out the substation.
- Terminate the 60 kV line from [redacted] at the station.

5.4 Protection & Control Requirements

BC Hydro will provide line protections for 60L283_A, 60L283_B and 60L283_C. As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

The IC is to provide the following for the interconnection of [redacted] project.

- Entrance protection that complies with the latest version of the "60 kV to 500 kV BC Hydro Technical Interconnection Requirements for Power Generators."
- Provide two SEL-411L-1 relays (firmware and options specified by BC Hydro) at the entrance of P25 to provide protection coverage for 60L283_C. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 60L283_C during a transmission line fault. Non-core protection such as local breaker failure, auto-reclosing, backup protection for station elements will not be provided by BC Hydro P&C Planning.
- The IC is responsible for NERC PRC-related tasks, settings to compliance standards within their facilities.
- The IC is responsible for providing a communications link for remote interrogation of the PPIS equipment by BCH servers.
- The IC is required to provide anti-islanding protection as stated in Section 5.1.

The runback schemes or RAS requirements stated in Section 5.1 are mainly to address the overloading concerns under contingencies, which are preliminary. These RAS requirements may utilize the communication channels required for protection purposes included in the cost estimate. If the proposed project proceeds through the CEAP process, subsequent System Impact Studies may identify additional RAS requirements for this interconnection. These RAS functional requirements will include initiating events, control actions, and latency times. Depending on these supplementary requirements, additional telecommunication facilities may be needed to facilitate signal transmission between the BC Hydro substations and customer facilities.

5.5 Telecommunications Requirements

BC Hydro performed a high-level feasibility assessment of a telecom solution to meet the following requirements.

Teleprotection Requirements for Telecom

- WECC Level 3 PY & SY, CBK – P25T, with C37.94 interfaces.
- WECC Level 3 PY & SY, MVL – P25T, with C37.94 interfaces.
- WECC Level 3 PY & SY, P25T – P25, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- Two P25T SCADA circuit off FVO & SIO.
- Two P25 SCADA circuit off FVO & SIO.
- One Provide P25T REMACC circuit off EDM.

Other Requirements for Telecom

- PY & SY T1s between P25T-MRR
- TMS circuit for P25T (end point TBD)

Certain assumptions were made for determining a potential telecom solution. Details of the telecom solution (e.g. assumptions made, alternatives investigated and work required for BCH and the IC) would be provided at the next study stage.

6 Cost Estimate and Schedule

The non-binding good faith estimated cost and time to construct the Network Upgrades required to interconnect the proposed project will be provided in a separate letter to the IC.

7 Conclusions

To interconnect the [redacted] Project and its facilities to the BCH Transmission System at the POI, this Feasibility Study has identified the following conclusions and requirements:

1. A new 60 kV switching station (referred to as "P25T") on 60L283 is required at the proposed POI for interconnecting the IC's generating project to the BCH system.

2. The connection of [redacted] Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal conditions.

3. The connection of [redacted] Project will cause line overloads on 60L283_A (P25T - CBK), 60L283_B (P25T - MVL) and 60L298 (MVL - JOE) under single contingencies. If an overload on 60L283_A, 60L283_B and 60L298 is detected, a signal will be initiated to shed or run back generation at the IC's facility.

4. The [redacted] project is not arranged for islanded operation. In addition to the entrance protection and line protection of 60L283_C, the IC is required to install anti-islanding protection within their facility to disconnect the [redacted] site from the grid when an inadvertent island with the local load forms.

5. BC Hydro will provide line protections for 60L283_A, 60L283_B and 60L283_C (BC Hydro end only). As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

Appendix A
Plant Single Line Diagram Used for Power Flow Study

Figure A-1 shows [redacted] Project single line diagram used for power flow study.

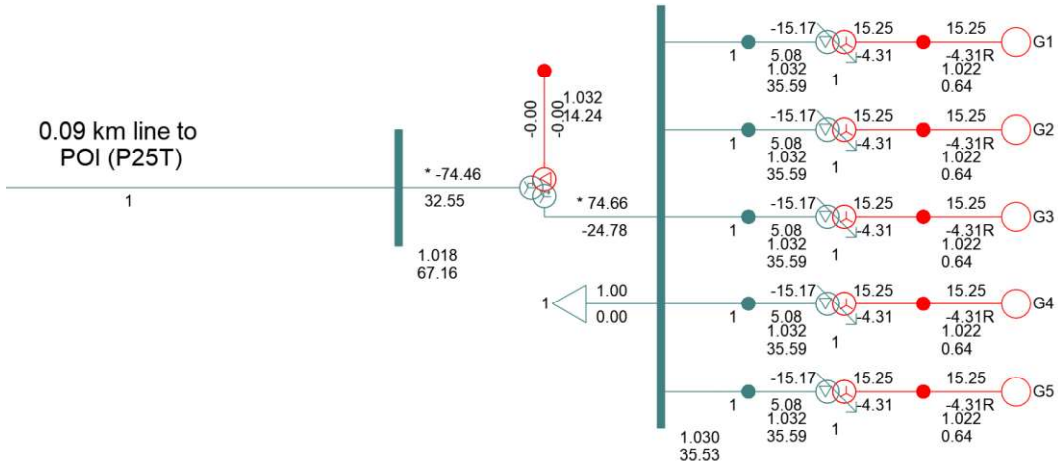

Figure A-1: [redacted] Project Single Line Diagram for Power Flow Study.

As seen in the diagram, [redacted] Project has one main power transformer and five (5) feeders connecting twenty-five (25) solar inverters to the collector station.

Appendix B
One-Line Sketch for New Switching Station

Figure B-1 shows the Stations Planning One-Line Sketch for the New Switching Station P25T.

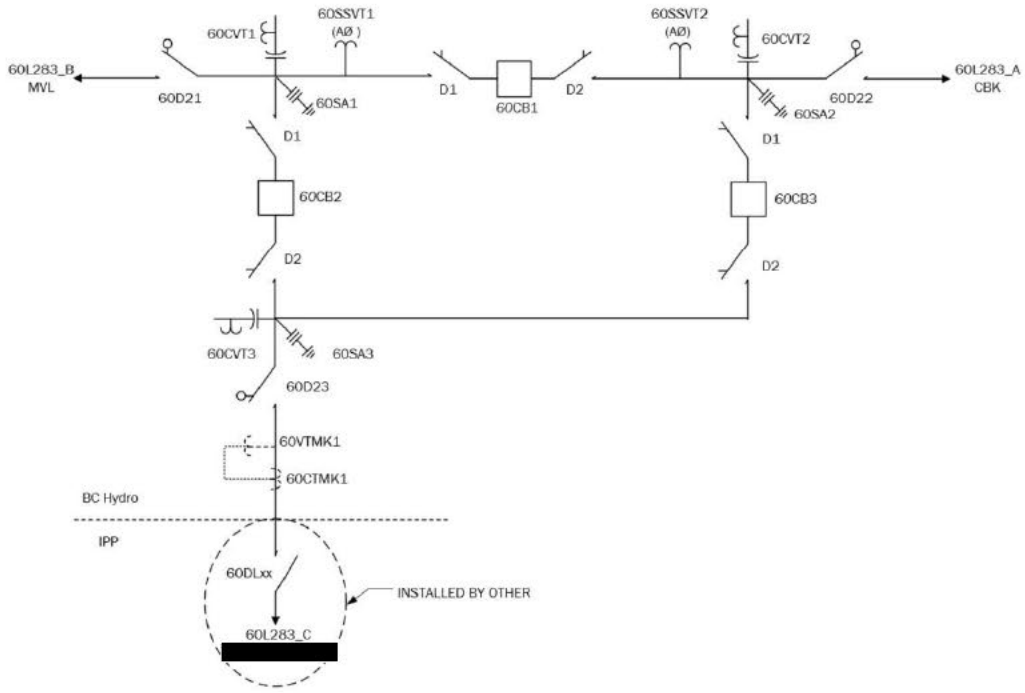

Figure B-1: Stations Planning One-Line Sketch for the New Switching Station P25T.