BC Hydro
Power smart

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

July 30, 2024

[redacted]

RE: CEAP IR 10 - [redacted] - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed [redacted] 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 $14.7M.

Major Scope of Work Identified:

- Supply and install a new 230kV tap between Str 14-02 and 14-03 on the existing transmission line 2L86
- Supply and install one disconnect switch structure
- Supply and install protection relays and other required protection equipment
- Supply and install microwave towers, waveguides, antennas, and other required telecommunications equipment

Exclusions:

- GST
- Right of Way
- Property
- Permits

Key Assumptions:

- Construction by contractor
- 2 years of construction
- No expansion of existing stations or control buildings to accommodate new equipment
- Early Engineering and Procurement
- No piles will be required for construction
- No contaminated soil will be encountered during construction

Key Risks:

- Additional right of way or acquisition of more property may be required
- Line outage may be required for the tap connection leading to cost and/or schedule impacts
- Transmission routing may be different than assumed, including number of disconnect switches and structure types may change
- No defined supply chain strategy, construction costs may increase depending on delivery method
- Cost of construction may increase based on geotechnical condition of the actual project site
- Project schedule may be longer than expected, leading to increased costs
- Costs may be affected by market conditions and escalation

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 2029 (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,

Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_10_[redacted]FeS_Report_final.pdf

[redacted]

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 10

Prepared for: [redacted]

[redacted]

300-APR-0004
2024 Jul 30

Report Metadata

Header:	[redacted]
Subheader:	Interconnection Feasibility Study
Title:	[redacted]
Subtitle:	2024 CEAP IR # 10
Report Number:	300-APR-0004
Revision:	0
Confidentiality:	Public
Date:	2024 Jul 30
Volume:	1 of 1

[redacted]

Related Facilities:	2L86
Additional Metadata:	Transmission Planning 2024-036 Filing Subcode 1350

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

Disclaimer of Warranty, Limitation of Liability

This report was prepared solely for internal purposes. All parties other than BC Hydro are third parties.

BC Hydro does not represent, guarantee or warrant to any third party, either expressly or by implication:

any information, product or process disclosed, described or recommended in this report.

BC Hydro does not accept any liability of any kind arising in any way out of the use by a third party of any information, product or process disclosed, described or recommended in this report, nor does BC Hydro accept any liability arising out of reliance by a third party upon any information, statements or recommendations contained in this report. Should third parties use or rely on any information, product or process disclosed, described or recommended in this report, they do so entirely at their own risk.

This report was prepared by the British Columbia Hydro And Power Authority ("BCH") or, as the case may be, on behalf of BCH by persons or entities including, without limitation, persons or entities who are or were employees, agents, consultants, contractors, subcontractors, professional advisers or representatives of, or to, BCH (individually and collectively, "BCH Personnel").

This report is to be read in the context of the methodology, procedures and techniques used, BCH's or BCH's Personnel's assumptions, and the circumstances and constraints under which BCH's mandate to prepare this report was performed. This report is written solely for the purpose expressly stated in this report, and for the sole and exclusive benefit of the person or entity who directly engaged BCH to prepare this report. Accordingly, this report is suitable only for such purpose, and is subject to any changes arising after the date of this report. This report is meant to be read as a whole, and accordingly no section or part of it should be read or relied upon out of context.

Unless otherwise expressly agreed by BCH:

(a) any assumption, data or information (whether embodied in tangible or electronic form) supplied by, or gathered from, any source (including, without limitation, any consultant, contractor or subcontractor, testing laboratory and equipment suppliers, etc.) upon which BCH's opinion or conclusion as set out in this report is based (individually and collectively, "Information") has not been verified by BCH or BCH's Personnel; BCH makes no representation as to its accuracy or completeness and disclaims all liability with respect to the Information;

(b) except as expressly set out in this report, all terms, conditions, warranties, representations and statements (whether express, implied, written, oral, collateral, statutory or otherwise) are excluded to the maximum extent permitted by law and, to the extent they cannot be excluded, BCH disclaims all liability in relation to them to the maximum extent permitted by law;

(c) BCH does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this report, or any information contained in this report, for use or consideration by any person or entity. In addition, BCH does not accept any liability arising out of reliance by a person or entity on this report, or any information contained in this report, or for any errors or omissions in this report. Any use, reliance or publication by any person or entity of this report or any part of it is at their own risk; and

(d) In no event will BCH or BCH's Personnel be liable to any recipient of this report for any damage, loss, cost, expense, injury or other liability that arises out of or in connection with this report including, without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

Copyright Notice

Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its [redacted] (2024 CEAP IR # 10) to the BC Hydro (BCH) system. [redacted] has twenty-six (26) [redacted] solar PV inverters, and nineteen (19) [redacted] BESS inverters. The total capacity of the solar PV and BESS inverters is 167.4 MW, and the proposed maximum power injection into the BC Hydro system is 80 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 230 kV line 2L86, approx. 22.5 km from Kelly Lake substation (KLY). The IC's project will connect to the POI via a 0.613 km 230 kV interconnection line. The IC's proposed commercial operation date (COD) was July 31, 2026.

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

1. The Tap connection on the BCH's existing circuit 2L86 is acceptable for interconnecting the IC's generating project to the BCH system. At the POI, BCH will design and build the tap that will include a tap structure and a switch structure on the tap side. A 253 kV rated disconnect switch will be installed to isolate the IC's facilities from the BCH system.

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

3. [redacted] is not arranged for islanded operation. The IC is required to install anti-islanding protection within its facility to disconnect the IC's solar farm from the grid when an inadvertent island with the local load forms.

4. BC Hydro will replace the line protection relays at KLY and HMH for 2L86 as well as HMH and SCK for 2L352. As part of the line protection replacements, telecommunication facilities will be required for each of the four substations of KLY, HMH, SCK and P10. The IC shall provide required relays, telecom facility and associated equipment at its facilities 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
BESS	Battery Energy Storage System
CEAP	Competitive Electricity Acquisition Process
COD	Commercial Operation Date
DTT	Direct Transfer Trip
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
FVO	Fraser Valley Office
IBR	Inverter-Based Resources
IC	Interconnection Customer
LAPS	Local Area Protection Schemes
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
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

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

Table 1-1 Summary of Project Information

Project Name	[redacted]	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	on 2L86 at 22.5 km from KLY	
IC's Proposed COD	31st July 2026	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection (MW)	80 MW (Summer)	80 MW (Winter)
Number of Generator Units	26 x 3.24 MW Solar PV inverters 19 x 4.375 MW BESS inverters	
Plant Fuel	Solar	

[redacted] the interconnection customer (IC), requests to interconnect its [redacted] (2024 CEAP IR # 10) to the BC Hydro system. [redacted] has twenty-six (26) SG3600UD solar PV inverters, and nineteen (19) [redacted] BESS inverters. The total capacity of the solar PV and BESS inverters is 167.4 MW, and the proposed maximum power injection into the BC Hydro system is 80 MW. The IC's proposed Point of Interconnection (POI) is on BC Hydro's 230 kV line 2L86, approx. 22.5 km from Kelly Lake substation (KLY). The IC's project will connect to the POI via a 0.613 km 230 kV interconnection line. The proposed commercial operation date (COD) is July 31, 2026.

Figure 1-1 shows Kelly area transmission system diagram. KLY is a major substation in this area with two 500/230 kV transformers (KLY T1 & KLY T4). KLY supplies local area loads through two 230 kV transmission lines 2L86 and 2L94. KLY is connected to Bridge River system via 2L90 and South Interior west via 2L92 and 2L93. Generation in Northern Interior is transmitted via three 500 kV transmission lines 5L11, 5L12 and 5L13 to KLY, and from KLY to BC provincial loads center in Lower Mainland and Vancouver Island via 5L41 and 5L42. With connection of the IC's project, less supply is required from KLY 500 kV for the local area loads.

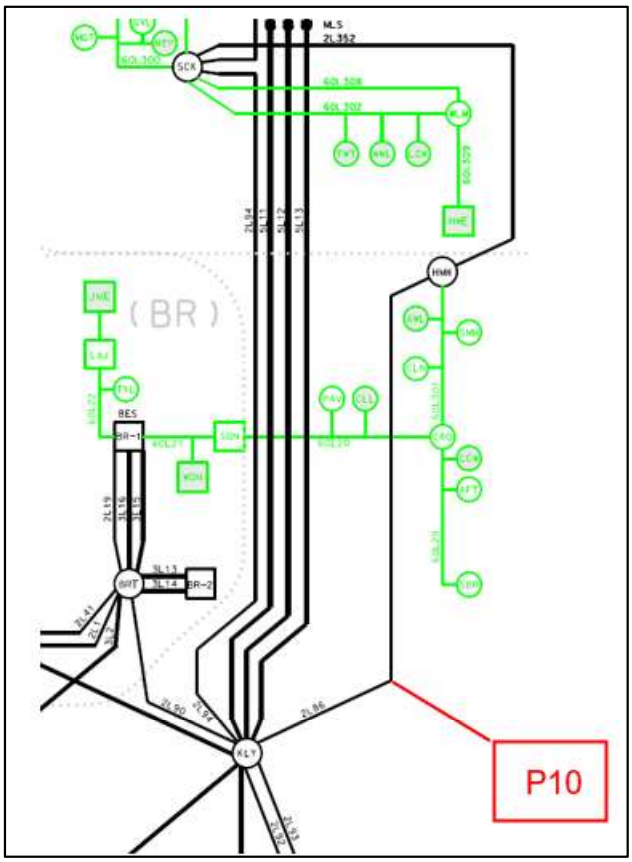

Figure 1-1: Kelly Lake Area Transmission System Diagram

There are several high-queued load interconnections and their associated network upgrades in the study area. The relevant network upgrade being planned in the study region is as follows.

- Bridge River Transmission Reinforcement Project (BRTP): this project will upgrade 2L90 line rating.

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) Bridge River Transmission Reinforcement Project (BRTP) is assumed to be in-service in summer 2029.

5 System Studies and Results

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.

In according to the Power Call schedule, 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 branch loading analysis under system normal and single contingencies (P1) for various load conditions.

The study finds no transformer or line overload under system normal conditions and selected single contingency conditions for all three load conditions studied.

Table 5-1: Summary of Branch Loading Analysis Results

Case	IC's Plant Output	Contingency		Branch Loading			
				KLY T4	2L90	2L92	2L86
		Cat.	Description				P10 POI - HMH
Winter Rating				356 MVA	440 MVA	390 MVA	319 MVA
28HW	Max	P0	System Normal	34 %	27 %	8 %	16%
	Max	P1	Loss of [redacted]	40 %	25 %	7 %	14%
	Max	P1	KLY T1	48 %	24 %	7 %	15%
	Max	P1	2L90	26 %	-	10%	18%
	Max	P1	2L93	34 %	28 %	12 %	16%
Summer Rating				356 MVA	403 MVA	230 MVA	319 MVA
29HS	Max	P0	System Normal	34 %	8 %	8 %	17%
	Max	P1	Loss of [redacted]	37 %	7 %	7 %	15%
	Max	P1	KLY T1	42 %	7 %	8 %	17%
	Max	P1	2L90	32 %	-	9 %	18%
	Max	P1	2L93	35 %	8 %	11 %	18%
29LS	Max	P0	System Normal	35 %	30 %	14 %	24%
	Max	P1	Loss of [redacted]	39 %	27 %	16 %	21%

	Max	P1	KLY T1	46 %	28 %	16 %	23%
	Max	P1	2L90	31 %	-	12 %	25%
	Max	P1	2L93	36 %	30 %	23 %	24%

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	KLY 500	KLY 230	HMH 230
28HW	Max	P0	System Normal	1.05	1.05	1.05
	Max	P1	Loss of [redacted]	1.05	1.05	1.05
	Max	P1	KLY T1	1.05	1.05	1.05
	Max	P1	2L90	1.05	1.05	1.05
	Max	P1	2L93	1.05	1.05	1.05
29HS	Max	P0	System normal	1.05	1.05	1.05
	Max	P1	Loss of [redacted]	1.05	1.05	1.05
	Max	P1	KLY T1	1.05	1.05	1.06
	Max	P1	2L90	1.05	1.05	1.06
	Max	P1	2L93	1.05	1.05	1.06
29LS	Max	P0	System normal	1.05	1.05	1.05
	Max	P1	Loss of [redacted]	1.05	1.05	1.05
	Max	P1	KLY T1	1.05	1.05	1.06
	Max	P1	2L90	1.05	1.05	1.06
	Max	P1	2L93	1.05	1.05	1.06

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 [redacted] Solar inverter has +/- 2.16 Mvar reactive capability at zero MW output and [redacted] BESS inverter has +/- 5.0 Mvar reactive capability at zero MW output, which means the solar farm can meet the reactive power requirement at 0 MW. This will need to be re-confirmed if the IC's project proceeds further.

5.1.4 Anti-Islanding Requirements

The IC is required to install anti-islanding protection within its facility to disconnect the IC's wind farm 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

The POI of [redacted] is a tap connection on BC Hydro's 230 kV transmission line 2L86 (HMH-KLY).

No station work is required.

5.4 Transmission Line Requirements

At the POI, BCH will design and build the tap that will include a tap structure and a switch structure on the tap side. A 253 kV rated disconnect switch will be installed to isolate the IC's facilities from the BCH system. Additional Right-of-Way (ROW) may be required to accommodate the tap. Line outage may be required for the tap connection.

5.5 Protection & Control Requirements

BC Hydro will replace the line protection relays at KLY and HMH for 2L86 as well as HMH and SCK for 2L352. As part of the line protection replacements,

telecommunication facilities will be required for each of the four substations of KLY, HMH, SCK and P10.

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

- 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 P10 to provide protection coverage for 2L86. BC Hydro P&C Planning will provide core protection settings for these relays.
- 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 line protection relays and PPIS equipment by BCH servers.
- Provide anti-islanding protection as stated in Section 5.1.

5.6 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, KLY – HMH, with C37.94 interfaces.
- WECC Level 3 PY & SY, KLY – P10, with C37.94 interfaces.
- WECC Level 3 PY & SY, HMH – P10, with C37.94 interfaces.
- WECC Level 3 PY & SY, SCK – HMH, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- One P10 SCADA circuit off FVO & SIO.

Other Requirements for Telecom

- None identified.

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

1. The Tap connection on the BCH's existing circuit 2L86 is acceptable for interconnecting the IC's generating project to the BCH system. At the POI, BCH will design and build the tap that will include a tap structure and a switch structure on the tap side. A 253 kV rated disconnect switch will be installed to isolate the IC's facilities from the BCH system.

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

3. [redacted] is not arranged for islanded operation. The IC is required to install anti-islanding protection within its facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local load forms.

4. BC Hydro will replace the line protection relays at KLY and HMH for 2L86 as well as HMH and SCK for 2L352. As part of the line protection replacements, telecommunication facilities will be required for each of the four substations of KLY, HMH, SCK and P10. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the new protection schemes.

Appendix A
Plant Single Line Diagram Used for Power Flow Study

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

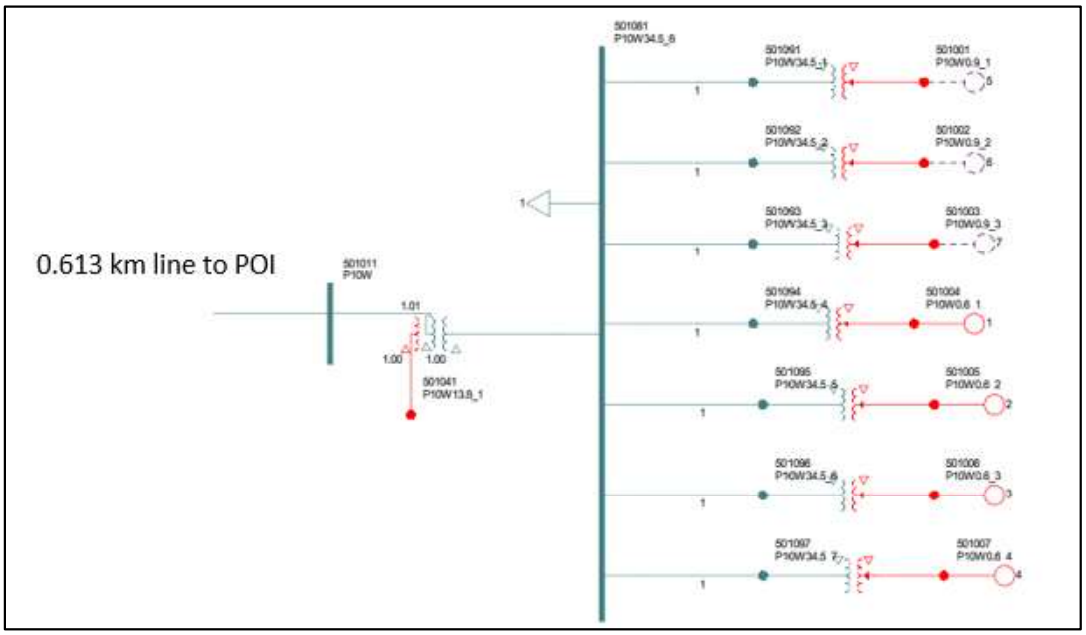

Figure A-1: [redacted] Single Line Diagram for Power Flow Study.

As seen in the diagram, [redacted] has one main power transformer.

- There are three (3) feeders connecting 19 BESS inverters to the collector station.
- There are four (4) feeders connecting 26 solar PV inverters to the collector station.