BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]

[redacted]

RE: CEAP IR 51 - Sazul Nahuyutsa Solar Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Sazul Nahuyutsa Solar 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 $16.3M.

Major Scope of Work Identified:

- Add one 60kV line position with associated substation equipment at BC Hydro Tachick (TAC) substation
- 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
- Permits

Key Assumptions:

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

Key Risks:

- 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,

[redacted]

Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_51_Sazul Nahuyutsa Solar_FeS_Report_final.pdf

[redacted]

Sazul Nahuyutsa Solar Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 51

Prepared for: [redacted]

[redacted]

Report Metadata

Header:	Sazul Nahuyutsa Solar Project
Subheader:	Interconnection Feasibility Study
Title:	Sazul Nahuyutsa Solar Project
Subtitle:	2024 CEAP IR # 51
Report Number:	900-APR-00012
Revision:	0
Confidentiality:	Public
Date:	2024 Jul 30
Volume:	1 of 1
Prepared for:	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
Related Facilities:	Tachick substation (TAC)
Additional Metadata:	Transmission Planning 2024-063 Filing Subcode 1350

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

[redacted]

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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its Sazul Nahuyutsa Solar Project (2024 CEAP IR # 51) to the BC Hydro (BCH) system. Sazul Nahuyutsa Solar Project has ten (10) [redacted] 3.52MW solar inverters with total installed capacity of 35.2 MW. The proposed Point of Interconnection (POI) is at the 66kV bus of existing BC Hydro's Tachick substation (TAC). The IC's project will connect to the POI via a 12.35 km customer built 66 kV interconnection line (60LP51). The IC's proposed commercial operation date (COD) is October 01, 2028.

To interconnect the Sazul Nahuyutsa Solar 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 66 kV line position at TAC is required to interconnect the IC's generating project to the BC Hydro system.
2. The study does not find any other performance violations under system normal conditions, such as thermal overload, voltage performance violation or voltage stability concern, caused by connection of Sazul Nahuyutsa Solar Plant.
3. The study identifies the thermal overload performance violations on the 230/66kV T2&T5 TAC transformers when TAC T3 transformer is in a planned outage due to the interconnection of Sazul Nahuyutsa project. A generation shedding transfer trip or curtailment scheme to Sazul Nahuyutsa substation (P51) is required to mitigate the potential thermal overloads on the 230/66kV TAC transformers.
4. An Anti-islanding Transfer Trip to P51 is required to isolate the solar plant when it is islanded with local loads during various operation conditions or under system contingencies (such as loss of 2L353 or loss of TAC T3 transformer, or TAC 66 kV breaker internal faults resulting in Sazul Nahuyutsa Solar plant islanded with local loads…). In addition, the IC is required to install anti-islanding protection within their facility to disconnect the IC's solar plant from the grid when an inadvertent island with the local load forms.

[redacted]

5. BC Hydro will provide line protections for the 66kV 60LP51 transmission line (BCH end only) that will integrate Sazul Nahuyutsa Solar Plant to BC Hydro system at TAC. As part of the new 60LP51 line protection, telecommunication facilities will be required between TAC and P51. Additionally, BCH will upgrade existing 2L353 line protection between GLN and TAC substations. 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.

[redacted]

Contents

Appendices

 [redacted]

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
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
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
TIR	BC Hydro “60 KV to 500 kV Technical Interconnection Requirements for Power Generators”
WECC	Western Electricity Coordinating Council
WTG	Wind Turbine Generator
EDM	Edmonds Office
FVO	Fraser Valley Office
GLN	Glenannan Substation
TAC	Tachick Substation
SKT	Sinkut Microwave Repeater
SIO	South Interior Office
P51	Sazul Nahuyutsa Solar plant (unofficial site code)
60LP51	66kV transmission line from TAC to P51

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name	Sazul Nahuyutsa Solar Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	Tachick substation 66kV bus	
IC's Proposed COD	01 October 2028	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection (MW)	34.5 MW (Summer)	34.5 MW (Winter)
Number of Generator Units	10	
Plant Fuel	Solar	

[redacted] the interconnection customer (IC), requests to interconnect its Sazul Nahuyutsa Solar Project (2024 CEAP IR # 51) to the BC Hydro system. Sazul Nahuyutsa Solar Project has ten (10) [redacted] 3.52MW solar inverters with total installed capacity of 35.2 MW. The IC's proposed Point of Interconnection (POI) is at the 66kV bus of BC Hydro's Tachick substation (TAC). The IC's project will connect to the POI via a 12.35 km customer built 66 kV interconnection line (60LP51). The IC's proposed commercial operation date (COD) is October 01, 2028.

Figure 1-1 shows the Glenannan-Tachick transmission system diagram. Glenannan substation (GLN) is a major substation in North Coast and presently supplies one 230 kV transmission line — 2L353 to TAC. TAC has three 230/66 kV transformers (TAC T3, T2 & T5), and TAC T3 is in-service under normal conditions. When TAC T3 is out of service, the area load and generation are supplied from TAC T2 and TAC T5 (operating in parallel).

[redacted]

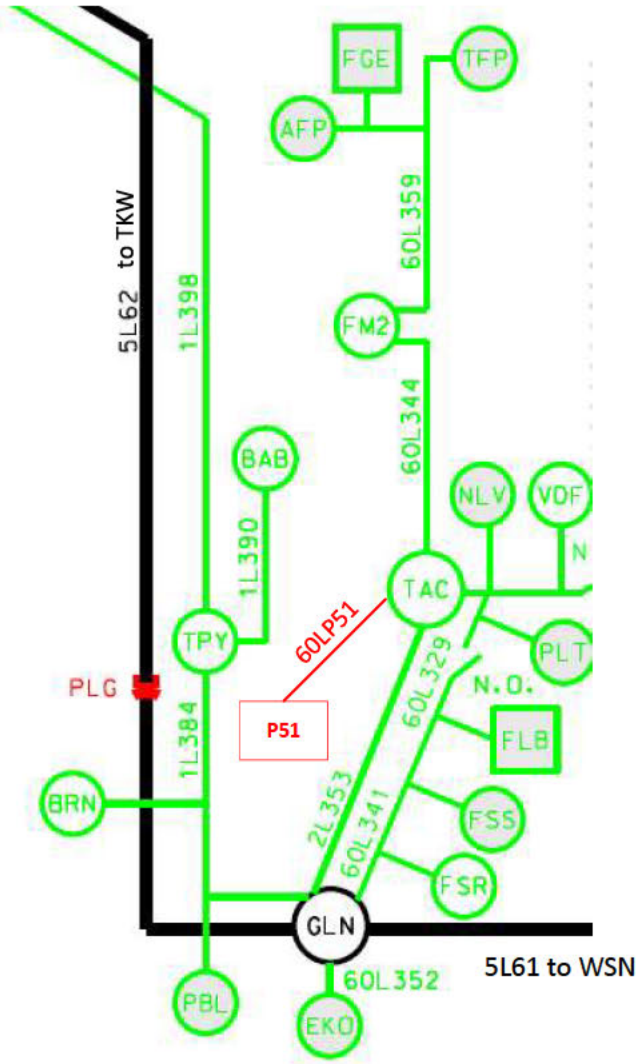


Figure 1-1: Glenannan-Tachick 230/66kV Regional Transmission System Diagram with the Proposed Solar Project Interconnection

In the Glenannan-Tachick region, there are two generation plants:

- Fort St. James Green Energy Generating Station (FGE) has a total capacity of 40 MW and is connected to TAC via the line 60L344.
- Fraser Lake Biomass Generating Station (FLB) has a total capacity of 7.2 MW and is connected to GLN Substation via 60L329.

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 the estimated cost of required Network Upgrades and the estimated time to construct will be provided.

Per OATT, the Feasibility Study is performed individually for each of the participating projects in the CEAP 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.

[redacted]

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.

[redacted]

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.

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new 66 kV line position at TAC is required to interconnect the IC's generating project to the BC Hydro system. The IC's project will connect to the POI via a 12.35 km customer built 66 kV interconnection line, 60LP51.

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 2029 heavy winter (29HW) 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, P2) for various load conditions.

Under light load conditions, regional generations and Sazul Nahuyutsa Solar plant are set to their MPO, thermal overload on the 230/66kV TAC transformers T2&T5 are identified when TAC T3 transformer is in a planned outage. A generation shedding transfer trip or curtailment scheme to Sazul Nahuyutsa substation is required to mitigate the potential thermal overloads on the 230/66kV TAC transformers.

For all the studied load conditions (29LS, 29HS, 29HW), there is no other branch or transformer overload identified under system normal condition and single contingencies.

Table 5-1: Summary of Branch Loading Analysis Results

Case	IC's Plant Output	Contingency		Branch Loading	
				TAC T3	TAC T2/T5
		Cat.	Description	230/66kV transformer	230/66kV transformer
Winter Rating				89 MVA	39.5 MVA
29HW	Max	P0	System Normal	39%	N/A
	Max	P1	TAC T3	N/A	55%
Summer Rating				75 MVA	33 MVA
29HS	Max	P0	System Normal	22%	N/A
	Max	P1	TAC T3	N/A	73%
29LS	Max	P0	System Normal	88%	N/A
	Max	P1	TAC T3	N/A	105%

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, 29HW). Table 5-2 shows a summary 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	TAC 66kV	TAC 230kV	GLN 230kV
29HW	Max	P0	System normal	1.04	1.01	1.02
29HS	Max	P0	System normal	1.04	1.01	1.02
	0 MW	P0	System normal	1.05	1.02	1.02
29LS	Max	P0	System normal	1.05	1.01	1.03
	0 MW	P0	System normal	1.05	1.02	1.03

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 over the full MW operating range, which is subjected to further verification in the next stage of interconnection study.

5.1.4 Anti-Islanding Requirements

During various operation conditions or under system contingencies (such as loss of 2L353 or loss of TAC T3 transformer, or TAC 66 kV breaker internal faults resulting in Sazul Nahuyutsa Solar plant islanded with local loads…), the IC's project will be inadvertently islanded with the existing generators and BC Hydro loads, which is not allowed. An Anti-islanding Transfer Trip scheme to P51 is required to isolate the solar plant. In addition, the IC is required to install anti-islanding protection within its facility to disconnect the IC's solar plant from the grid when an inadvertent island with the local load forms.

5.2 Fault Analysis

The short circuit analysis in the FS 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 66 kV line position at TAC is required to interconnect the IC's generating project to the BC Hydro system. The IC's project will connect to the POI via a 12.35 km customer built 66 kV interconnection line, 60LP51.

Following is the station work required at TAC substation:

- Add one 66kV line position with the associated substation equipment.
- Terminate Sazul Nahuyutsa Solar 60LP51 66 kV transmission line.
- Other associated station work.

Refer to Appendix B - One-Line Sketch at TAC for details.

5.4 Protection & Control Requirements

BC Hydro will provide line protections for the 66kV 60LP51 transmission line (BC Hydro end only) that will integrate Sazul Nahuyutsa Solar Plant to BC Hydro system at TAC. As part of the new 60LP51 line protection, telecommunication facilities will be required between TAC and Sazul Nahuyutsa Plant (tentatively designated as P51). Additionally, BCH will upgrade existing 2L353 line protection between GLN and TAC substations.

[redacted]

The IC is to provide the following for the interconnection of Sazul Nahuyutsa Solar plant.

- 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 P51 to provide protection coverage for 60LP51 line. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 60LP51 between TAC and P51 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.
- Provide islanding protection as stated in Section 5.1.

The generation shedding transfer trip/curtailment scheme or the Anti-islanding Transfer Trip scheme to Sazul Nahuyutsa substation stated in Section 5.1 are mainly to address the overloading concerns under contingencies or the islanding concerns, 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 64 kbps synchronous circuits between TAC and P51 for "P51-TAC 60LP51 PY DIGITAL TELEPROT" and "P51-TAC 60LP51 SY

[redacted]

DIGITAL TELEPROT". Physical interface shall be C37.94 optical over multimode fibre using ST connectors.

- WECC Level 3 64 kbps synchronous circuits between GLN and TAC for "GLN-TAC 2L353 PY DIGITAL TELEPROT" and "GLN-TAC 2L353 SY DIGITAL TELEPROT". Physical interface shall be C37.94 optical over multimode fibre using ST connectors.

Telecontrol Requirements for Telecom

- P51 SCADA circuit off FVO and SIO.
- TAC REMACC circuit off EDM.

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.

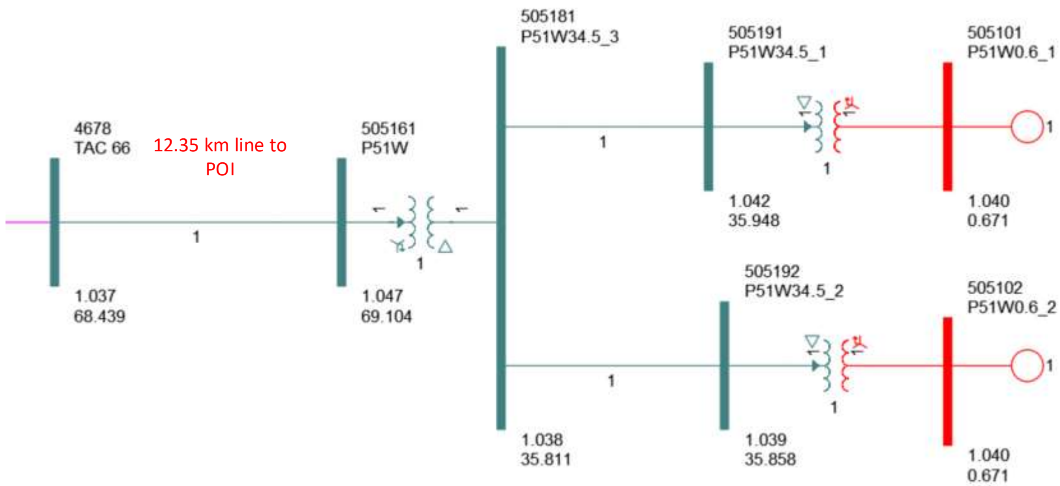
7 Conclusions

To interconnect the Sazul Nahuyutsa Solar 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 66 kV line position at TAC is required to interconnect the IC's generating project to the BC Hydro system.
2. The study does not find any other performance violations under system normal conditions, such as thermal overload, voltage performance violation or voltage stability concern, caused by connection of Sazul Nahuyutsa Solar Plant.
3. The study identifies the thermal overloads on the 230/66kV TAC transformers when TAC T3 transformer is in a planned outage due to the interconnection of Sazul Nahuyutsa project. A generation shedding transfer trip or curtailment scheme to Sazul Nahuyutsa substation (P51) is required to mitigate the potential thermal overloads on the 230/66kV TAC transformers.
4. An Anti-islanding Transfer Trip to P51 is required to isolate the solar plant when it is islanded with local loads during various operation conditions or under system contingencies (such as loss of 2L353 or loss of TAC T3 transformer, or TAC 66 kV breaker internal faults resulting in Sazul Nahuyutsa Solar plant islanded with local loads). In addition, the IC is required to install anti-islanding protection within their facility to disconnect the IC's solar plant from the grid when an inadvertent island with the local load forms.
5. BC Hydro will provide line protections for the 66kV 60LP51 transmission line (BCH end only) that will integrate Sazul Nahuyutsa Solar Plant to BC Hydro system at TAC. As part of the new 60LP51 line protection, telecommunication facilities will be required between TAC and P51. Additionally, BCH will upgrade existing 2L353 line protection between GLN and TAC substations. 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: Sazul Nahuyutsa Solar Project Single Line Diagram for Power Flow Study.



As seen in the diagram, Sazul Nahuyutsa Solar Project has one main power transformer with two feeders connecting ten (10) solar inverters.

Appendix B
One-Line Sketch for TAC

Figure B-1 shows the Stations Planning One-Line Sketch for TAC.

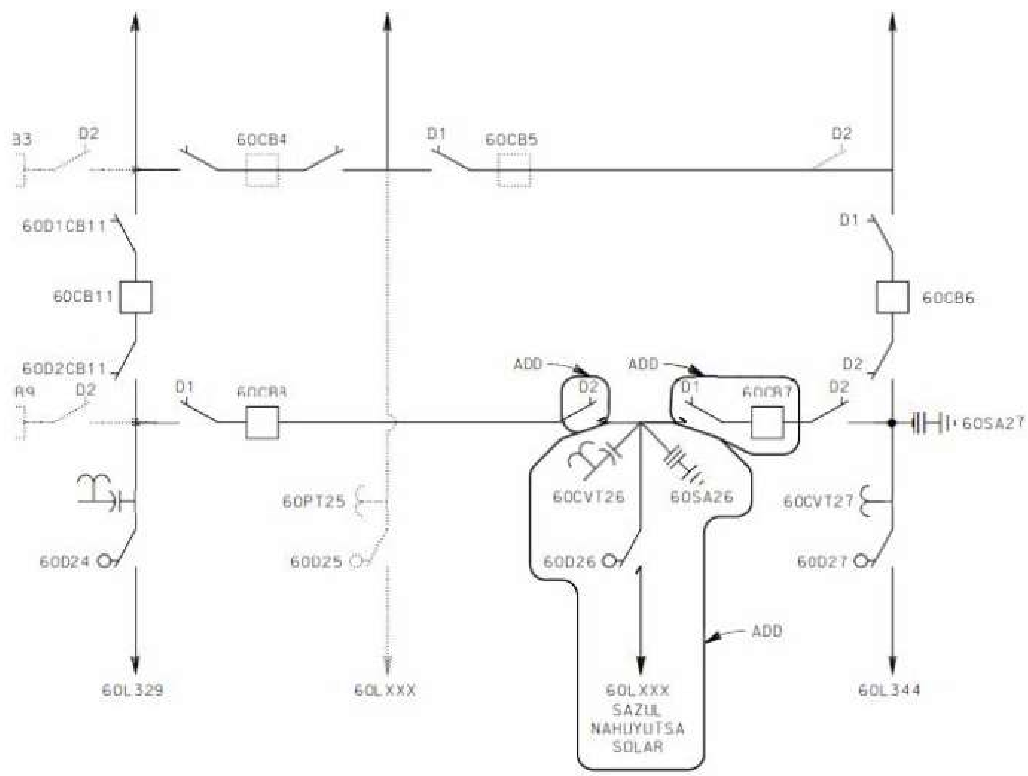


Figure B-1: Stations Planning One-Line Sketch for TAC.