BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]

[redacted]

RE: CEAP IR 103 - Site C Solar Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Site C 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 $20.7 M.

Major Scope of Work Identified:

- Extend the existing 138 kV bus structure at BC Hydro's Southbank (SBK) substation
- Supply and install one 138kV line position with the associated substation equipment at SBK
- Expand the existing control building to accommodate the new P&C panels and other equipment at SBK
- Supply and install protection relays and other required protection / telecom equipment

Exclusions:

- GST
- Right-of-Way or Property costs
- Permits

Key Assumptions:

- Construction will be done by contractor
- 2 years of construction
- Early Engineering and Procurement
- No site expansion will be required at SBK to construct the new line position
- Control building at SBK can be expanded to accommodate new equipment
- No piles or ground improvements will be required
- No contaminated soil will be encountered during construction

Key Risks:

- Microwave tower on the southwest side the SBK control building may require relocation
- Transmission routing may be different than assumed, structure types and required major equipment 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 materials and major equipment be affected by market conditions and escalation
- Expansion of station site may be required leading to increased costs and/or longer project schedule

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_103_Site C Solar_FeS_Report_final.pdf

[redacted]

Site C Solar Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 103

Prepared for: [redacted]

[redacted]

[redacted]

Report Metadata

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[redacted]

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[redacted]

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its Site C Solar Project (2024 CEAP IR # 103) to the BC Hydro (BCH) system. Site C Solar Project has fifty (50) [redacted] solar and battery inverters, adding a total capacity of 200 MW into the BC Hydro system. The proposed Point of Interconnection (POI) is at BC Hydro's South Bank Substation (SBK). The IC's project will connect to the POI via a 16 km 138 kV interconnection line. The IC's proposed commercial operation date (COD) is Oct 1, 2028.

To interconnect the Site C 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 138 kV line position at SBK is required to interconnect the IC's generating project to the BC Hydro system.
2. The connection of Site C Solar Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal conditions, as well as under single contingencies conditions.
3. 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 loads forms.
4. According to BC Hydro's TIR, the IC's project must have sufficient reactive power capability over full MW operating range including at the zero MW output level. The Site C Solar project as submitted does not meet the reactive capability requirements, which will need to be addressed.
5. BC Hydro will provide line protection relays and associated telecommunication facilities at BC Hydro's South Bank (SBK) substation for the new line that extends from SBK to the IC's entrance 138kV bus. 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
CEAP	Competitive Electricity Acquisition Process
COD	Commercial Operation Date
DTT	Direct Transfer Trip
ERIS	Energy Resource Interconnection Service
ET3	Cutbank Ridge Partnership's (CRP) Tower 03-07 Substation
FeS	Feasibility Study
FVO	Fraser Valley Office
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
P103	BCH's Unified Study Project Code: # 103 for Site C Solar Project
PLD	Parkland Substation
POI	Point of Interconnection
RAS	Remedial Action Scheme
SBK	South Bank Substation
SIO	South Interior Office
TIR	BC Hydro "60 KV to 500 kV Technical Interconnection Requirements for Power Generators"
WECC	Western Electricity Coordinating Council
WTG	Wind Turbine Generator
1LXX	SBK – P103 line: 138 kV transmission line between SBK to Site C Solar Plant

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name	Site C Solar Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	SBK Substation	
IC's Proposed COD	1st October 2028	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection [1] (MW)	195 MW (Summer)	195 MW (Winter)
Number of Generator Units	50 x 4 MW	
Plant Fuel	Solar	

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Figure 1-1 shows the Peace region 138/230/500 kV transmission system diagram including the existing, the projects before Site C Solar Project, and Site C Solar Project. Since 1L377 is normally open between ET3 and PLD, the Peace Regional System has been separated into two portions: north portion with only 138 kV transmission system connected at GMS and SBK, and south portion with 230 kV / 138 kV transmission system connected at SBK and GMS. Site C Solar Project is connected at SBK 138 kV bus, which is on North portion of the Peace Regional System.

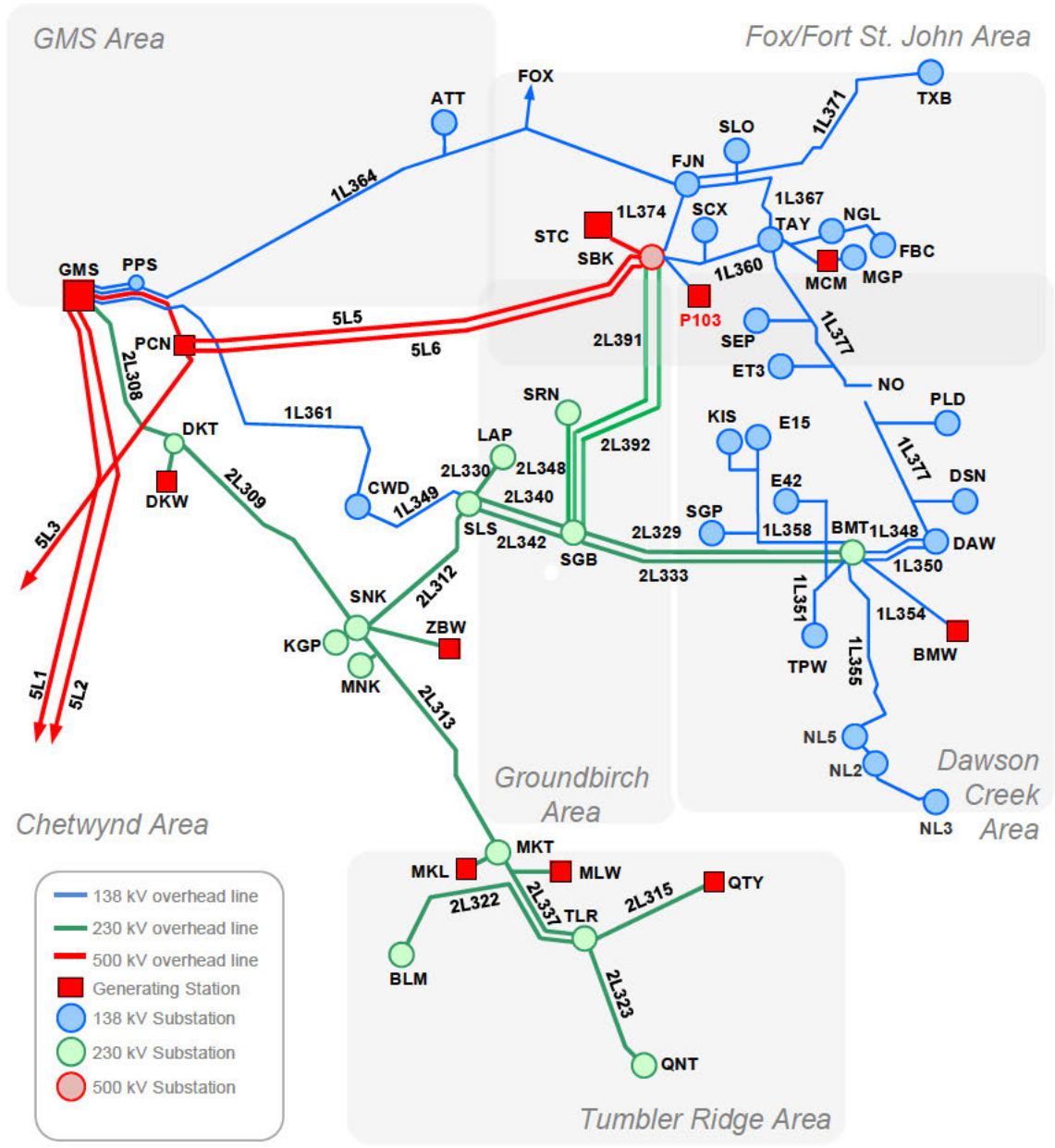

Figure 1-1: Peace Region 138/230/500 kV Transmission System Diagram

The Peace region 138/230/500 kV system has pre-existing branch overload and voltage stability concerns under single or multiple contingencies. The Peace Region Load Shedding and Generation Shedding RAS are relied on to address these overload and voltage stability concerns.

In the Peace region, Site C generating project is the major capital project under construction, which will add six hydroelectric generators with a total installed capacity of 1100 MW. The transmission component of this project, which includes two parallel 500 kV lines (5L5 and 5L6) to Peace Canyon substation (PCN), has entered in service in 2023. Based on the schedule available at the time of study, the Site C project will be completed by the end of 2025.

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) 1L377 is permanently open between ET3 and PLD. The normal open point is 1D6L377.
3) The Site C Generating Plant will be completed by the end of 2025.
4) The BMT T4 will be in service by Q1 2027.
5) The Fort St. John Area Transmission Reinforcement Project, which will build a 15 km new 138 kV transmission line from SBK to TAY, parallel with the existing 1L360, will be in service by April 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.

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

The study finds no transformer or transmission line overload under system normal conditions for all three load conditions studied.

In the light summer condition (29LS), the study finds pre-existing branch overloads on 2L308 or 2L312 under single contingencies which is currently addressed by Peace Region generation shedding RAS. The connection of this IC's project will not contribute to these pre-existing overloads. No performance violations have been identified for other P1 and P2 contingencies.

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).

Site C Solar Project does not contribute to the low voltage performance concerns identified under heavy load conditions (29HS, 28HW). The existing Peace Region load shedding RAS will continue to be relied upon to mitigate these low voltage concerns.

The connection of Site C Solar Project at SBK 138 kV bus will provide both power and voltage support to North portion of Peace Regional System, which will relieve the pre-existing voltage performance concerns in this area when Site C Solar generators are online.

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 does not meet 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.

5.1.4 Anti-Islanding Requirements

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 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 the Site C Solar will be 138kV switchyard of the existing substation South Bank (SBK). The following is the scope of station work:

- Extend the existing 138 kV bus structure.
- Add one 138kV line position with the associated substation equipment. Refer to Appendix B – One-line Sketch of Upgrades at SBK Substation for details.

- Expand the existing control building, if required, to accommodate the new P&C panels and other equipment.
- Terminate the Site C Solar.
- Other associated station work.

Further station design will be done in the next System Impact Study stage, if the IC proceeds further.

5.4 Protection & Control Requirements

For successful integration of the new IC, new line protection relays at BC Hydro's South Bank (SBK) substation will be added for coverage of the new transmission line that extends from SBK to the IC's entrance 138kV bus. As part of the line protection replacement, telecommunication facilities will be required for each of the two substations.

The IC is to provide the following for the interconnection of Site C Solar:

- 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) relays at the entrance of Site C Solar to provide protection coverage for new line SBK – P103. BC Hydro P&C Planning will provide 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.

5.5 Telecommunications Requirements

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

Teleprotection Requirements for Telecom

- Provide WECC Level 3 64 kbps synchronous circuits between South Bank (SBK) Substation and P103 for "SBK – P103 1LXX PY DIGITAL TELEPROT" and "SBK – P103 1LXX SY DIGITAL TELEPROT" with C37.94 interfaces.

Telecontrol Requirements for Telecom

- Provide P103 SCADA circuit off FVO & SIO.

Other Requirements for Telecom

- Provide PY & SY aggregate T1's over separate OC3's between P103-SBK.

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 Site C 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 138 kV line position at SBK is required to interconnect the IC's generating project to the BC Hydro system.
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Appendix A
Plant Single Line Diagram Used for Power Flow Study

Figure A-1 shows Site C Solar Project single line diagram used for power flow study.

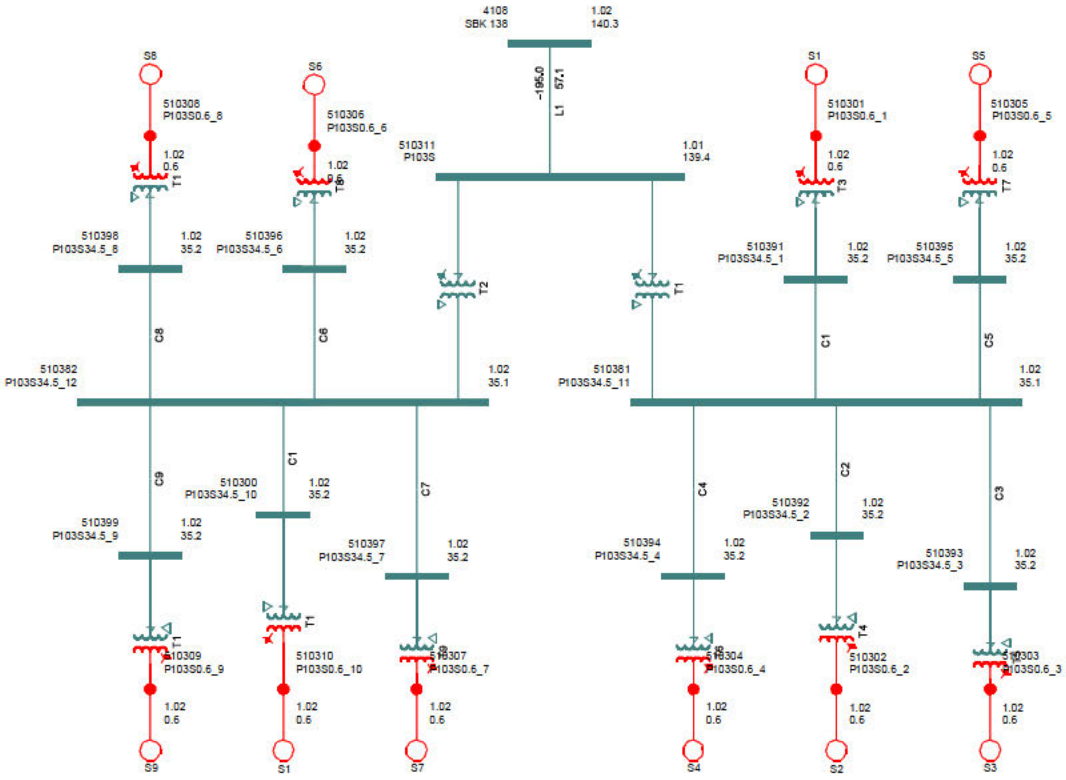

Figure A-1: Site C Solar Project Single Line Diagram for Power Flow Study

As seen in the diagram, Site C Solar Project has two main power transformers dividing the plant into two parts.

- Part 1 has five (5) feeders connecting 25 solar inverters to the collector station, and
- Part 2 has five (5) feeders connecting 25 solar inverters to the collector station.

Appendix B
One-Line Sketch of Upgrades at SBK Substation

Figure B-1 shows the required upgrades at SBK Substation

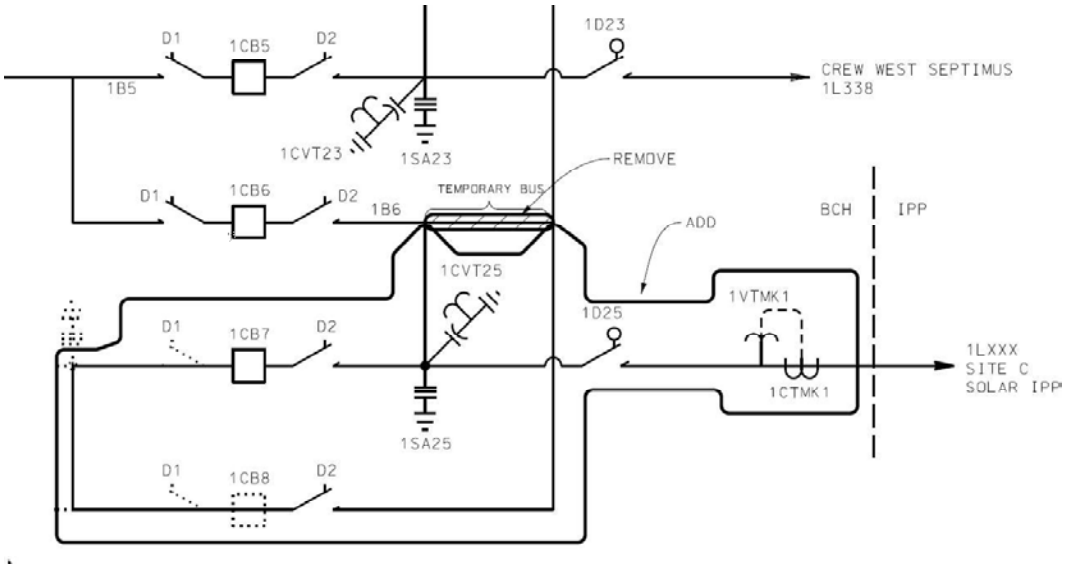

Figure B-1: One-line Sketch of Upgrades at SBK Substation