BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]

[redacted]

RE: CEAP IR 76 - Nithi Mountain Wind Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Nithi Mountain Wind 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 $12.6M.

Major Scope of Work Identified:

- Add one 230kV line position with associated substation equipment at BC Hydro Glenannan (GLN) substation
- Supply and install protection relays and other required protection equipment
- Supply and install required telecommunications equipment

Exclusions:

- GST
- Permits

Key Assumptions:

- Construction by contractor
- 2 years of construction
- No expansion of existing stations or control building to accommodate new equipment
- Early Engineering and Procurement
- No piles or ground improvements will be required
- 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 2030 (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_76_Nithi Mountain Wind_FeS_Report_final.pdf

[redacted]

Nithi Mountain Wind Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 76

[redacted]

[redacted]

[redacted]

Report Metadata

Header:	Nithi Mountain Wind Project
Subheader:	Interconnection Feasibility Study
Title:	Nithi Mountain Wind Project
Subtitle:	2024 CEAP IR # 76
Report Number:	900-APR-00016
Revision:	0
Confidentiality:	Public
Date:	2024 Jul 30
Volume:	1 of 1

[redacted]

Related Facilities:	GLN (230 kV)
Additional Metadata:	Transmission Planning 2024-086 Filing Subcode 1350

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

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Executive Summary

[redacted], the interconnection customer (IC), requests to interconnect its Nithi Mountain Wind Project (2024 CEAP IR # 76) to the BC Hydro system. Nithi Mountain Wind Project has 36 [redacted] Type-3 wind turbine generators, adding a total capacity of 205.2 MW into the BC Hydro system. The Point of Interconnection (POI) is at the 230 kV bus of BC Hydro's Glenannan substation (GLN). The IC's proposed commercial operation date (COD) is Oct 1, 2028.

To interconnect the Nithi Mountain Wind 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 230 kV line position at GLN is required to interconnect the IC's generating project to the BC Hydro system.

2. The connection of Nithi Mountain Wind Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and contingency conditions.

3. An Anti-islanding transfer trip scheme is required to isolate Nithi Mountain Wind project at the IC's entrance circuit breaker to avoid potential islanding operations with BC Hydro loads under various system contingencies.

   In addition to above and line protection, the IC is also required to install anti-islanding protection within their facility to disconnect the wind farm from the grid when an inadvertent island with the local loads forms as a backup of the anti-islanding transfer trip protection.

4. Nithi Mountain Wind is required to participate in the existing North Coast Generation Shedding Application/Scheme.

5. 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 wind farm as submitted does not meet the reactive capability requirement at zero MW output level which is required to be addressed.

6. BC Hydro will provide differential line protections (BC Hydro end only) for the new line 2LXXX between BC Hydro GLN substation and IC's Nithi Mountain Wind substation (P76). As part of the line protection addition, telecommunication facilities will be required for both 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.

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
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
P76	Project – Nithi Mountain Wind
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
WTG	Wind Turbine Generator

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name	Nithi Mountain Wind Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	230 kV bus of Glenannan Substation	
IC's Proposed COD	1st October 2028	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection [1] (MW)	200.0 MW (Summer)	200.0 MW (Winter)
Number of Generator Units	36 x 5.7 MW	
Plant Fuel	Wind	

[redacted], the interconnection customer (IC), requests to interconnect its Nithi Mountain Wind Project (2024 CEAP IR # 76) to the BC Hydro system. Nithi Mountain Wind Project has 36 [redacted] Type-3 wind turbine generators, adding a total capacity of 205.2 MW into the BC Hydro system. The Point of Interconnection (POI) is at the 230 kV bus of BC Hydro's Glenannan substation (GLN). The IC's proposed commercial operation date (COD) is Oct 1st, 2028.

Figure 1-1 shows the North Coast Regional transmission system diagram.

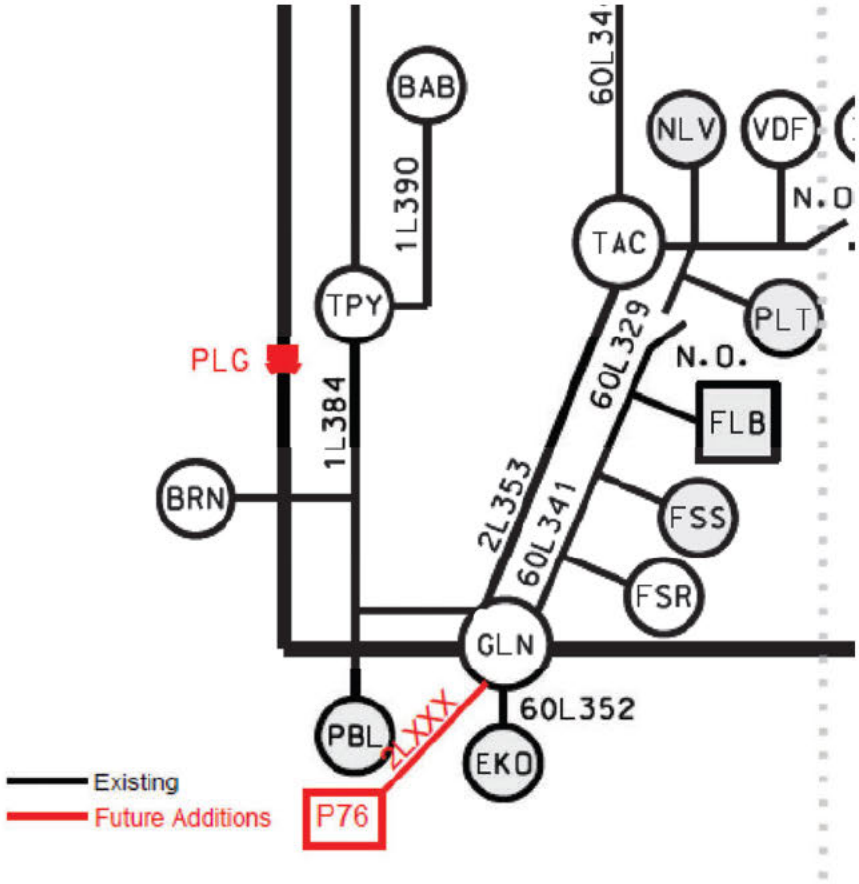

Figure 1-1: North Coast Regional Transmission System Diagram with the Proposed Nithi Mountain Wind Interconnection

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 with 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.

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) Other higher queue projects are included.

5 System Studies and Results

The proposed customer-built 230 kV interconnection line from BC Hydro's GLN substation to the IC's generation station (P76) will be designated as 2LXXX. It will become IC's Bulk Electric System (BES) element and the IC will be responsible for the compliance with applicable MRS requirements. 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), 2031 heavy winter (31HW), 2032 light summer (32LS), and 2032 heavy summer (32HS) system load conditions, taking into considerations of factors such as load conditions, seasonal variation in ambient temperatures, and generation patterns that stress the transmission system to capture any performance violations.

Based on the total installed capacity of 205.2 MW it is observed that approximately 197.1 MW injection is achievable at the POI.

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.

For all the studied load conditions there is no branch or transformer overload identified under system normal condition (P0) and single contingency conditions (P1 and P2).

Table 5-1: Summary of Branch Loading Analysis Results

Case	IC's Plant Output	Contingency		Branch Loading	
				5L12	5L13
		Cat.	Description	WSN-KLY	WSN-KLY
Winter Rating				1950 A	1950 A
31HW	Max	P0	System Normal	44.1 %	45.0 %
	Max	P2	WSN 5CB13	65.7 %	66.0 %

Summer Rating				1950 A	1950 A
29LS	Max	P0	System Normal	8.4 %	8.6 %
	Max	P2	WSN 5CB13	12.5 %	12.8 %
32LS	Max	P0	System Normal	7.5 %	7.6 %
	Max	P2	WSN 5CB13	11.2 %	11.4 %
32HS	Max	P0	System Normal	38.4 %	39.1 %
	Max	P2	WSN 5CB13	57.0 %	58.2 %

5.1.2 Steady-State Voltage Analysis

For all the studied load conditions there is no voltage performance concerns identified under system normal condition (P0) and single continency conditions (P1 and P2).

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

Case	IC's Plant Output	Contingency		Bus Voltage (P.U.)
		Cat.	Description	GLN 230
31HW	Max	P0	System normal	1.02
	0	P0	System normal	1.02
	Max	P1	GLN T1	1.01
29LS	Max	P0	System normal	1.02
	0 MW	P0	System normal	1.02
	0 MW	P1	GLN T1	1.02
32LS	Max	P0	System normal	1.03
	0 MW	P0	System normal	1.03
	0 MW	P1	GLN T1	1.03
32HS	Max	P0	System normal	1.02
	0 MW	P0	System normal	1.02
	Max	P1	GLN T1	1.01

5.1.3 Reactive Power Capability Evaluation

The BCH TIR requires IBR generators have the dynamic reactive power capability at a minimum of +/- 33% of its Maximum Power Output (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 for this project, the study finds that the proposed generating project can meet the BC Hydro's reactive capability requirement at full MW output.

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. The proposed wind farm does not meet this requirement at near zero MW output, which is required to be addressed.

5.1.4 Anti-Islanding Requirements

An Anti-islanding transfer trip scheme is required to isolate Nithi Mountain Wind project at the customer's entrance circuit breaker to avoid potential islanding operations with BC Hydro loads under following system contingencies:

- Loss of both GLN T1 and GLN T2, or
- Loss of both 5L61 and 5L62, or
- GLN 230 kV breaker 2CB7 internal fault

The IC is also required to install anti-islanding protection within their facility to disconnect the wind farm from the grid when an inadvertent island with the local loads forms as a backup of the anti-islanding transfer trip protection.

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

To interconnect this customer, the following is the station work required at GLN substation:

- Expand the substation and extend the existing 230 kV bus structure.
- Add one 230kV line position with the associated substation equipment. Refer to the attached one-line diagram for details.
- Terminate the Nithi Mountain Wind customer line.
- Other associated station work.

5.4 Protection & Control Requirements

For successful integration of the Nithi Mountain Wind Project, new differential line protection shall be added at BCH GLN and at the Nithi Mountain Wind Project (P76) for new transmission line 2LXXX. As part of the line protection addition,

telecommunication facilities will be required for both substations. BC Hydro requires Nithi Mountain Wind Project participate in the existing North Coast RAS.

The IC, [redacted] to provide the following for the interconnection of Nithi Mountain Wind 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) relays at the entrance of P76 to provide protection coverage for 2LXXX. BC Hydro P&C Planning will provide core settings for these relays. 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 line protection relays and PPIS equipment by BCH servers.
- Provide anti-islanding protection as per Section 5.1.4.

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, GLN – P76, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- Provide P76 SCADA circuits to FVO and 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 Nithi Mountain Wind 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 230 kV line position at GLN is required to interconnect the IC's generating project to the BC Hydro system.
2. The connection of Nithi Mountain Wind Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and contingency conditions.
3. A Anti-islanding transfer trip scheme is required to isolate Nithi Mountain Wind project at the customer's entrance circuit breaker to avoid potential islanding operations with BC Hydro loads under various system contingencies.

   The IC is also required to install anti-islanding protection within their facility to disconnect the wind farm from the grid when an inadvertent island with the local loads forms as a backup of the anti-islanding transfer trip protection.
4. Nithi Mountain Wind is required to participate in the existing North Coast Generation Shedding Application. If major North Coast cut-plane line 5L61 is forced out of service, North Coast system including Nithi Mountain Wind will form an island. The updated North Coast Generation Shedding Application would shed the existing generations in North Coast region, depending on the unbalanced load-generation conditions. When activated, it is assumed that the Application will trip Nithi Mountain Wind by opening its entrance circuit breaker.
5. 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 wind farm as submitted does not meet the reactive capability requirement at zero MW output level which is required to be addressed.

6. BC Hydro will provide differential line protections (BC Hydro end only) for the new line 2LXXX between BC Hydro GLN substation and IC's Nithi Mountain Wind substation (P76). As part of the line protection addition, telecommunication facilities will be required for both substations. BC Hydro requires Nithi Mountain Wind Project participate in the existing North Coast RAS. 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 Nithi Mountain Wind Project single line diagram used for power flow study.

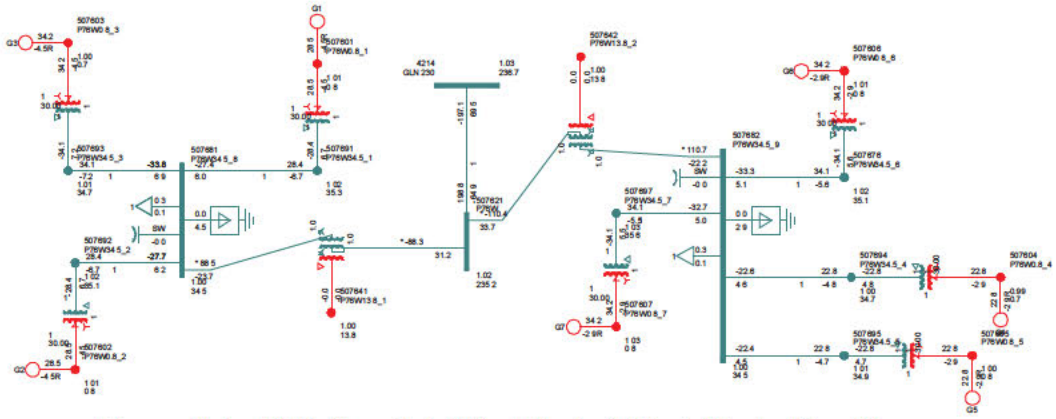

Figure A-1: Nithi Mountain Wind Project Plant Single Line Diagram

As seen in the diagram, Nithi Mountain Wind Project has two main power transformers dividing the plant into two parts.

- Part 1 has three (3) feeders connecting.
- Part 2 has four (4) feeders.

Appendix B
One-Line Sketch at Glenannan Substation

Figure B-1 shows the Stations Planning One-Line Sketch at GLN 230 kV substation.

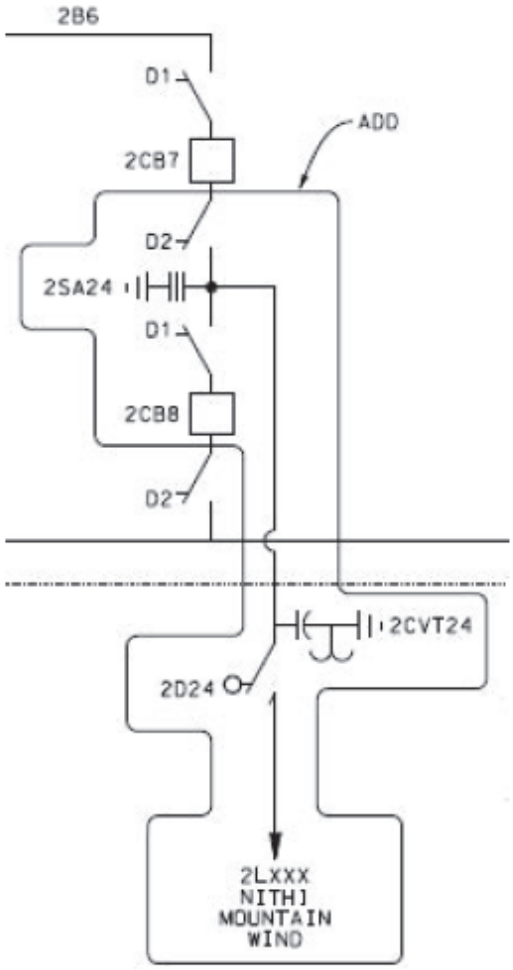

Figure B-1: GLN 230 kV Substation Planning One-Line Sketch