

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

July 30, 2024



RE: CEAP IR 84 -

- Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed 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 \$83.1M.

Major Scope of Work Identified:

- Acquire adequate property for a new substation close to the existing transmission line 1L244
- Construct a new outdoor 138kV, 3- circuit breaker ring bus switching substation
- Supply and install microwave towers, waveguides, antennas, and other required telecommunications equipment
- Supply and install protection relays and other required protection equipment

Exclusions:

- GST
- Right-of-ways
- Permits

Key Assumptions:

- Construction will be done by contractor
- 3 years of construction
- No expansion of existing station or control building to accommodate new equipment
- Early Engineering and Procurement
- No structural or foundation upgrade is required for the microwave tower at BC Hydro Nicola substation (NIC)
- No piles or ground improvements will be required
- No contaminated soil will be encountered during construction

Key Risks:

- Additional right of way or acquisition of more property may be required
- Transmission routing may be different than assumed, including number of disconnect switches and structure types may change
- Existing microwave towers may need to be upgraded at various sites to accommodate new equipment leading to increased costs
- 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 stie
- 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 2031 (calendar year). To achieve this timeline, we may need to expedite certain activities, including engineering design and procurement of long-lead equipment.

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

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

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

Next Steps

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

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



Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_84_ FeS_Report_final.pdf

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR #84

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Interconnection Feasibility Study

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Executive Summary

the interconnection customer (IC), requests to interconnect its (2024 CEAP IR # 84) to the BC Hydro (BCH) system. has sixteen (16) type-3 wind turbine generators with total installed capacity of 94.4 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 138 kV line 1L244, approx. 27 km from Nicola substation (NIC). The IC's project will connect to the POI via a 0.1 km 138 kV interconnection line. The IC's proposed commercial operation date (COD) is Sept. 30, 2029.

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

- A new 138 kV switching station (referred to as "P84T") on 1L244 is required at the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P84T, 1L244 will be segregated into three new lines, temporarily referred to as: 1L244_A (NIC-P84T), 1L244_B (P84T-WBK) and 1L244_C (P84T-P84).
- 2. The connection of does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and single contingency conditions.
- 3. A direct transfer trip (DTT) from NIC to P84T is required to isolate the wind farm for protective and unintentional tripping of 1L244_A. In addition to entrance protection and 1L244_C line protection, the IC is required to install anti-islanding protection within their facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local loads forms.
- 4. The new line 1L244_A will become part of BC Hydro BES and need to be compliant with applicable NERC MRS requirements. The new line 1L244_B (P84T-WBK) will remain as a non-BES line.
- 5. BC Hydro will provide line protections for 1L244_A, 1L244_B and 1L244_C (BC Hydro end only) protections. As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC shall

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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.

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Appendices

Appendix A	Plant Single Line Diagram Used for Power Flow Study
Appendix B	One-Line Sketch for New Switching Station

Acronyms

The following are acronyms used in this report.

BCH BC Hydro

CEAP Competitive Electricity Acquisition Process

COD Commercial Operation Date

DTT Direct Transfer Trip

EDM Edmonds Office

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

WTG Wind Turbine Generator

EDM Edmonds Office

FVO Fraser Valley Office

SIO South Interior Office

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name		8			
Name of Interconnection Customer (IC)					
Point of Interconnection (POI)	on 1L244 at 27 km from NIC				
IC's Proposed COD	September 30 th , 2029				
Type of Interconnection Service	NRIS 🖂	ERIS			
Maximum Power Injection (MW)	92 MW (Summer)	92 MW (Winter)			
Number of Generator Units	16 x 5.9 MW WTGs				
Plant Fuel	Wind				

the interconnection customer (IC), requests to interconnect its (2024 CEAP IR # 84) to the BC Hydro system. has sixteen type-3 wind turbine generators with total installed capacity of 94.4 MW. The IC's proposed Point of Interconnection (POI) is on BC Hydro's 138 kV line 1L244, approx. 27 km from Nicola substation (NIC). The IC's project will connect to the POI via a 0.1 km 138 kV interconnection line. The proposed commercial operation date (COD) is September 30th, 2029.

transformers (NIC T2 & T3) and two 230/138 kV transformers (NIC T5 & T6). NIC presently supplies three 138 kV transmission lines - 1L251 to the

Copper Mountain substation (CUM) and Similco substation (SCO), 1L243 to BC Hydro's Highland substation (HLD) and 1L244 to BC Hydro's Westbank substation (WBK).

Figure 1-1 shows the Nicola-Highland region transmission system diagram. Nicola substation (NIC) is a major substation in this area with two existing 500/230 kV

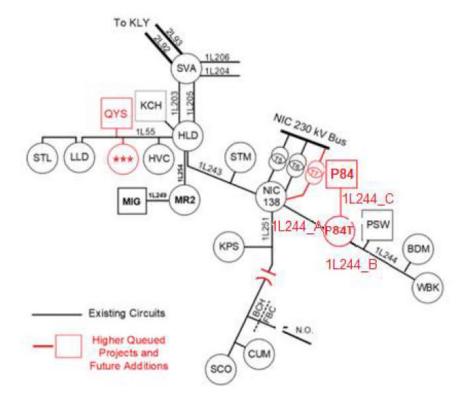


Figure 1-1: Nicola-Highland region 138/230 kV Transmission System Diagram

The existing line 1L244 is a radial circuit that mainly supplies WBK. There are two existing customers' facilities tap-connected on the line – Pennask-Shinish Wind Farm (PSW) and Brenda Mines Substation (BDM). PSW is an IPP wind farm with total capacity of 30 MW.

In addition to PSW, there are three other customers' owned power plants in the study region.

- Kwoiek Creek Generating Station (KCH) has a total capacity of 60 MW and is connected to HLD via the line 1L57.
- Merritt Green Energy Project Generating Station (MIG) has a total capacity of 40 MW and is connected to Merritt 2 Substation (MR2) via 1L249.
- quA-ymn Solar farm (QYS) is a 15 MW IPP generating project currently under construction. It will connect to BC Hydro system via a tap on 1L55.

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

- Nicola Substation Transformation Capacity Reinforcement: this project will add a new 230 kV/138 kV transformer at NIC (i.e. NIC T7) to mitigate the possible transformer overload associated with the industrial load increase in Highland region.
- 1L243 reconductoring: this line rating upgrade is required to accommodate an industrial load increase in Highland region.
- 1L251 series capacitor project: Line 1L251 will be series compensated to accommodate an industrial load increase on 1L251.

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 Table 1 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.

- 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) West Kelowna Transmission Project (WKTP) is not included in the Feasibility Study model, as the project scope is undetermined at the time of performing this study.
- 3) For the purpose of performing this study, Nicola Substation Transformation Capacity Reinforcement project (i.e. addition of NIC T7) and 1L243 reconductoring is assumed completed by the time the IC's generating project enters service.
- 4) 1L243 after reconductoring is assumed to have a conductor rating of 1145 A (summer) and 1388 A (winter).

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new switching station (referred to as "P84T") at the proposed POI on 1L244 is required to interconnect the IC's generating project to the BCH system. There are multiple terminals and multiple sources on the existing line 1L244. The addition of the new switching station would help to maintain reliability and adequate protection performance to serve the existing customers and the new addition.

With the new switching station P84T, the existing line 1L244 will be segregated into three new lines, temporarily referred to as: 1L244_A (NIC-P84T), 1L244_B (P84T-WBK) and 1L244_C (P84T-P84).

The existing line 1L244 does not meet BES criteria and is excluded from the Bulk Electric System (BES) list. The new line 1L244_A will become part of BC Hydro BES and need to be compliant with applicable MRS requirements. The new line 1L244_B will remain as a non-BES line.

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 2030 light summer (30LS) 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 2030 heavy summer (30HS) 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) for various load conditions.

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

Table 5-1: Summary of Branch Loading Analysis Results

Case	IC's	Contingency		Branch Loading				
	Plant			1L244_A	1L244_B	NIC T5	1L243	
	Output	Cat.	Description	NIC-P84T	P84T-PSW tap		NIC-HLD	
	Wint	er Rati	ng	220 MVA	220 MVA	180 MVA	331.8 MVA	
29HW	Max	PO	System Normal	22%	24%	9%	16%	
	Max	P1	NIC T6, NIC T2 1	22%	23%	13%	14%	
	Sumn	ner Rat	ting	169.7 MVA	169.7 MVA	180 MVA	273.7 MVA	
30HS	Max	PO	System Normal	35%	45%	12%	21%	
	OFF ²	PO	System Normal	44%	43%	20%	36%	
	Max	P1	NIC T6, NIC T2	32%	44%	15%	18%	
30LS	Max	PO	System Normal	51%	8%	5%	19%	
	Max	P1	NIC T6, NIC T2	50%	7%	6%	18%	
	Max	P1	1L244B (P84T- PSW_Tap)	51%	323	4%	19%	
	Max	P1	1L251	51%	8%	5%	19%	
	Max	P1	1L243	51%	8%	3%	975	
	Max	P1	1L55	51%	8%	2%	6%	
	Max	P1	2L265	51%	9%	6%	24%	
	Max	P1	2L265	51%	9%	6%	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 (30LS, 30HS, 29HW). 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	NIC 138	WBK 138	HLD 138	P84T
29HW	Max	PO	System normal	1.03	0.99	1.01	1.02
	0 MW ²	P1	NIC T6, NIC T2 1	1.03	0.99	1.01	1.02
	0 MW ²	P2.3	NIC 5CB11 ⁴	1.02	0.99	1.01	1.02
30HS	Max	PO	System normal	1.02	0.96	1.01	1.02
	0 MW ²	PO	System normal	1.02	0.93	1.01	1.02
	OFF ³	PO	System normal	1.02	0.92	1.01	1.02
	0 MW ²	P1	NIC T6, NIC T2	1.02	0.93	1.01	1.02
	0 MW ²	P2.3	NIC 5CB11 ⁴	1.02	0.93	1.01	1.02
	OFF ³	P2.3	NIC 5CB11 ⁴	1.01	0.92	1.00	1.01
30LS	Max	PO	System normal	1.02	1.00	1.01	1.02
	Max	P1	NIC T6, NIC T2	1.02	1.00	1.01	1.02
	Max	P1	1L251	1.02	1.00	1.01	1.02
	Max	P1	1L243	1.02	1.00	1.01	1.02
	Max	P1	1L55	1.03	1.00	1.03	1.02
	Max	P1	2L265	1.03	1.00	1.01	1.02

Note 1: NIC T2 is in the same protection zone as NIC T6.

Note 2: Representative of a windless condition with zero MW generation from both PSW and P57.

ote 3: (P84) is assumed isolated from the grid.

Note 4: NIC 5CB11 fault results in tripping of 5L87 and NIC T2.

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 to 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.

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 WTG has +/- 3.0 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

If 1L244_A between NIC and P84T is open at either end, the IC's project may be inadvertently islanded with the existing generators and BC Hydro loads, which is not allowed. A direct transfer trip (DTT) from NIC to P84T is required to isolate the wind farm for protective and unintentional tripping of 1L244_A.

In addition, 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 Feasibility Study (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.

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5.3 Stations Requirements

A new outdoor 138 kV, 3-circuit breaker ring bus switching substation (P84T temporarily) will be built at the proposed POI, close to the existing 138 kV transmission line 1L244. The existing transmission line 1L244 will be cut and looped in to, and 138 kV line of Boulder & (1L244_C) will be terminated at the new substation.

The station scope of constructing the new switching station P84T is as follows.

- Acquire adequate property for a new substation close to the existing transmission line 1L244.
- Construct a new outdoor 138 kV, three-circuit breaker ring bus switching substation. Refer to the one-line sketch in Appendix B for details.

Notes:

- The designation of the new substation and the new line connecting to the customer and the two new lines derived from 1L244 will be assigned in next stage.
- The Installation location of the metering kits will be decided in later stage.

5.4 Protection & Control Requirements

BC Hydro will provide line protections for 1L244_A (NIC-P84T), 1L244_B (P84T-WBK) and 1L244_C (P84T-P84) (BC Hydro end only) protections. As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

The IC is to provide the following for the interconnection of

- 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 P84 to provide protection coverage for 1L244_C.
 BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 1L244_C during a transmission line fault.
 Non-core protection such as local breaker failure, auto-reclosing, backup

- protection for station elements will not be provided by BC Hydro P&C Planning.
- The IC is responsible for NERC PRC-related tasks, settings to compliance standards within their facilities.
- The IC is responsible for providing a communications link for remote interrogation of the PPIS equipment by BCH servers.
- 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

- WECC Level 3 PY & SY, NIC P84T, with C37.94 interfaces.
- WECC Level 3 PY & SY, NIC P84T, with C37.94 interfaces.
- WECC Level 3 PY & SY, P84T P84, with C37.94 interfaces.
- WECC Level 3 PY & SY, P84T PSW, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- One P84 SCADA circuit off FVO & SIO.
- Two P84T SCADA circuits off FVO & SIO.
- One P84T REMACC circuit off EDM.

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

- A new 138 kV switching station (referred to as "P84T") on 1L244 is required at the proposed POI for interconnecting the IC's generating project to the BCH system.
- 2. The connection of does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and single contingency conditions.
- 3. A direct transfer trip (DTT) from NIC to P84T is required to isolate the wind farm for protective and unintentional tripping of 1L244_A. In addition to entrance protection and 1L244_C line protection, the IC is required to install anti-islanding protection within their facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local loads forms.
- 4. The new line 1L244_A will become part of BC Hydro BES and need to be compliant with applicable NERC MRS requirements. The new line 1L244_B (P84T-WBK) will remain as a non-BES line.
- 5. BC Hydro will provide line protections for 1L244_A, 1L244_B and 1L244_C (BC Hydro end only) protections. As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC 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 single line diagram used for power flow study.

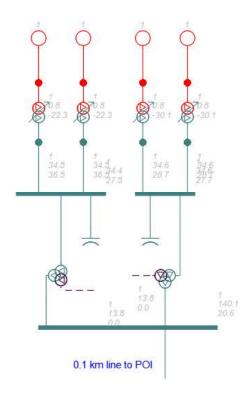


Figure A-1: Single Line Diagram for Power Flow Study.

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

- Part 1 has two (2) feeders connecting 8 wind turbines to the collector station.
- Part 2 has two (2) feeders connecting 8 wind turbines to the collector station.



Appendix B

One-Line Sketch for New Switching Station

Figure B-1 shows the Stations Planning One-Line Sketch for the New Switching Station P84T.

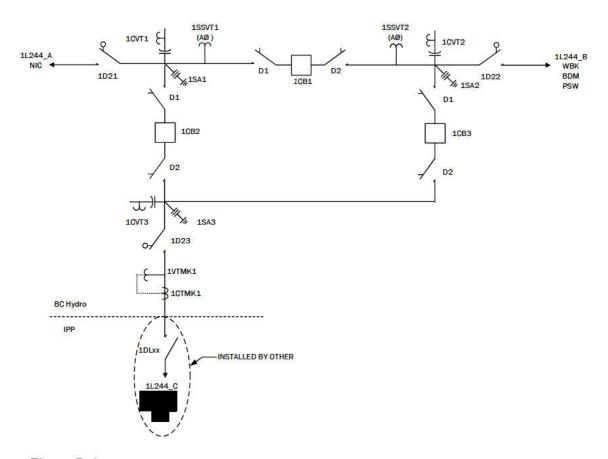


Figure B-1: Stations Planning One-Line Sketch for the New Switching Station P84T.