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Burnaby, BC
V3N 4X8

July 30, 2024

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RE: CEAP IR 82 - Ts̓eba'e Ihts̓i Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Ts̓eba'e Ihts̓i 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 \$107.9M.

Major Scope of Work Identified:

- Expand BC Hydro Tatogga (TAT) substation and extend existing 287kV bus structure
- Construct one 287kV line position with associated substation equipment at TAT
- Upgrade rating of capacitor bank at BC Hydro Bob Quinn (BQN) substation
- Supply and install protection relays and other required protection equipment
- Supply and install required telecommunications equipment

Exclusions:

- GST
- Right-of-way
- Permits

Key Assumptions:

- Construction will be done by contractor
- 3 years of construction
- Site can be expanded at TAT
- Control building at existing stations will not require expansion
- Early Engineering and Procurement
- No piles or ground improvements will be required
- No contaminated soil will be encountered during construction
- A Certificate of Public Convenience and Necessity (CPCN) requirement will not impact the schedule

Key Risks:

- Additional right-of-way or acquisition of property may be required
- Transmission routing may be different than assumed, including number of disconnect switches and structure types may change
- No defined supply chain strategy, construction costs may increase depending on delivery method
- Costs 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
- A CPCN requirement may delay the project schedule and increase costs

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_82_Ts̓eba'e Ihts'ī_FeS_Report_final.pdf



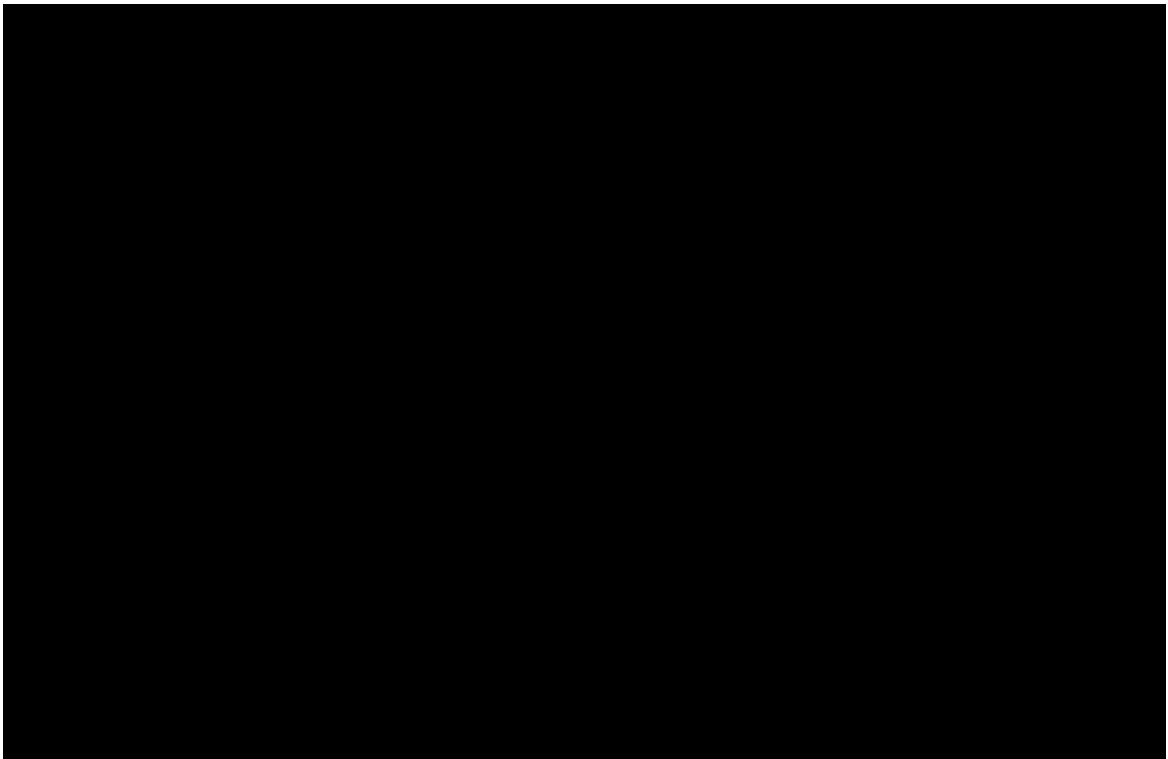
Tṣēba'e Ihts'ī Wind Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 82

Prepared for:





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Executive Summary

█ the interconnection customer (IC), requests to interconnect its Tṣēba'e Ihts'ī Wind Project (2024 CEAP IR # 82) to the BC Hydro (BCH) system. Tṣēba'e Ihts'ī Wind Project has thirty-four (34) █ █ Type-3 wind turbine generators, adding a total capacity of 200 MW into the BC Hydro system. The proposed Point of Interconnection (POI) is at the 287 kV bus of BC Hydro 287 kV Tatogga Substation (TAT) via a customer built 287 kV line approximately 26 km in length. The IC's proposed commercial operation date (COD) is October 1, 2031.

To interconnect the Tṣēba'e Ihts'ī 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 287 kV line position at TAT substation is required to interconnect the IC's generating project to the BC Hydro system.
2. The connection of Tṣēba'e Ihts'ī Wind Project caused a potential thermal overload on line 2L102 (SKA – BQN) under system normal condition. Thermal upgrade of line 2L102 facility rating to a minimum of 980 Amps is required by upgrading existing BQN series capacitors. In addition, spares strategy of the upgraded BQN series capacitors shall ensure the potential unavailability of series capacitor less than one year.
3. The study identified potential voltage instability issues when system is operated with BQN series capacitor in bypass mode. A new RAS scheme is required to shed proposed wind generation for this scenario. Details of the new RAS will be further investigated in subsequent studies.
4. If 5L61, or 5L62 or 5L63 are forced out of service, North Coast system including Tṣēba'e Ihts'ī Wind will form an island. It is required that Tṣēba'e Ihts'ī Wind generation participates in the existing North Coast Generation Shedding Application/Scheme. As part of bulk system re-enforcements between WSN, GLN, TKM and SKA existing Generation Shedding Application needs to be modified accordingly which will include Tṣēba'e Ihts'ī Wind generation. Details of the Application will be further investigated in subsequent studies.



5. Tṣēba'e Ihts'ī Wind will form an island with BC Hydro generating plants and loads under system contingencies such as loss of 2L102, 2L374 or TAT breaker internal fault. A new Anti-islanding Transfer Scheme is required to trip 2L374 and Tṣēba'e Ihts'ī Wind generation at their entrance circuit breaker.
6. 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 Tṣēba'e Ihts'ī Wind farm as submitted does not meet the reactive capability requirement which will need to be addressed.
7. BC Hydro will provide line protection for new line between BC Hydro TAT substation and IC's Tṣēba'e Ihts'ī Wind (P82) substation (BC Hydro end only). As part of the line protection for the new line, telecommunication facilities will be required between the two terminals 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.

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 Addition of a 287 kV Line Position at TAT Substation



Acronyms

The following are acronyms used in this report.

BCH	BC Hydro
TAT	BC Hydro Tatogga Substation
CEAP	Competitive Electricity Acquisition Process
COD	Commercial Operation Date
DTT	Direct Transfer Trip
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
FVO	Fraser Valley Office
IBR	Inverter-Based Resources
IC	Interconnection Customer
LAPS	Local Area Protection Schemes
MPO	Maximum Power Output
NERC	North American Electric Reliability Corporation
NRIS	Network Resource Interconnection Service
OATT	Open Access Transmission Tariff
POI	Point of Interconnection
RAS	Remedial Action Scheme
SIO	South Interior Office
TIR	BC Hydro “60 KV to 500 kV Technical Interconnection Requirements for Power Generators”
WECC	Western Electricity Coordinating Council

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name	Ts̓ēba'e Ihts'ī Wind Project	
Name of Interconnection Customer (IC)	[REDACTED]	
Point of Interconnection (POI)	Tatogga Substation (TAT) 287 kV bus	
IC's Proposed COD	1st October 2031	
Type of Interconnection Service	NRIS <input checked="" type="checkbox"/>	ERIS <input type="checkbox"/>
Maximum Power Injection ¹ (MW)	200 MW (Summer)	200 MW (Winter)
Number of Generator Units	34 x 5.9 MW	
Plant Fuel	Wind	
Note 1: The maximum achievable power injection at the POI is approx. 191.3 MW after accounting for MW losses and service load which is higher than the IC proposed 190 MW.		

[REDACTED] the interconnection customer (IC), requests to interconnect its Ts̓ēba'e Ihts'ī Wind Project (2024 CEAP IR # 82) to the BC Hydro (BCH) system. Ts̓ēba'e Ihts'ī Wind Project has thirty-four (34) [REDACTED] [REDACTED] Type-3 wind turbine generators, adding a total capacity of 200.0 MW into the BC Hydro system. The Point of Interconnection (POI) is at the 287 kV bus of BC Hydro 287 kV Tatogga Substation (TAT) via a customer built 287 kV line approximately 26 km in length. The IC's proposed commercial operation date (COD) is October 1, 2031.

Figure 1 below shows North Coast Regional Transmission System supplied from Skeena Substation (SKA). Bob Quinn Substation (BQN) is a 287 kV, three terminal substation connecting: 2L102, a series compensated transmission line extending 341 km from Skeena Substation (SKA); 2L379, a three terminal line which serves as the interconnection between BQN and Coast Mountain Hydro Limited Partnership's Forrest Kerr (FKR) and Volcanic Creek (VOL) generating stations; and 2L374, a 96 km BC Hydro owned and operated transmission line which serves as the connection to the BC Hydro Tatogga Substation (TAT). The line 2L374 extending another 15 km to the TVC customer's New Crest Red Chris Mining Ltd. Substation (RDC) is owned and operated by RDC. Forest Kerr generating plant

has 9 units with total MPO of 195 MW, McLymont Creek generating plant has 3 units with total MPO of 66 MW and Volcano Creek generating plant has 2 units with total MPO of 17.8 MW. All three generating stations connect to BQN substation via 2L379.

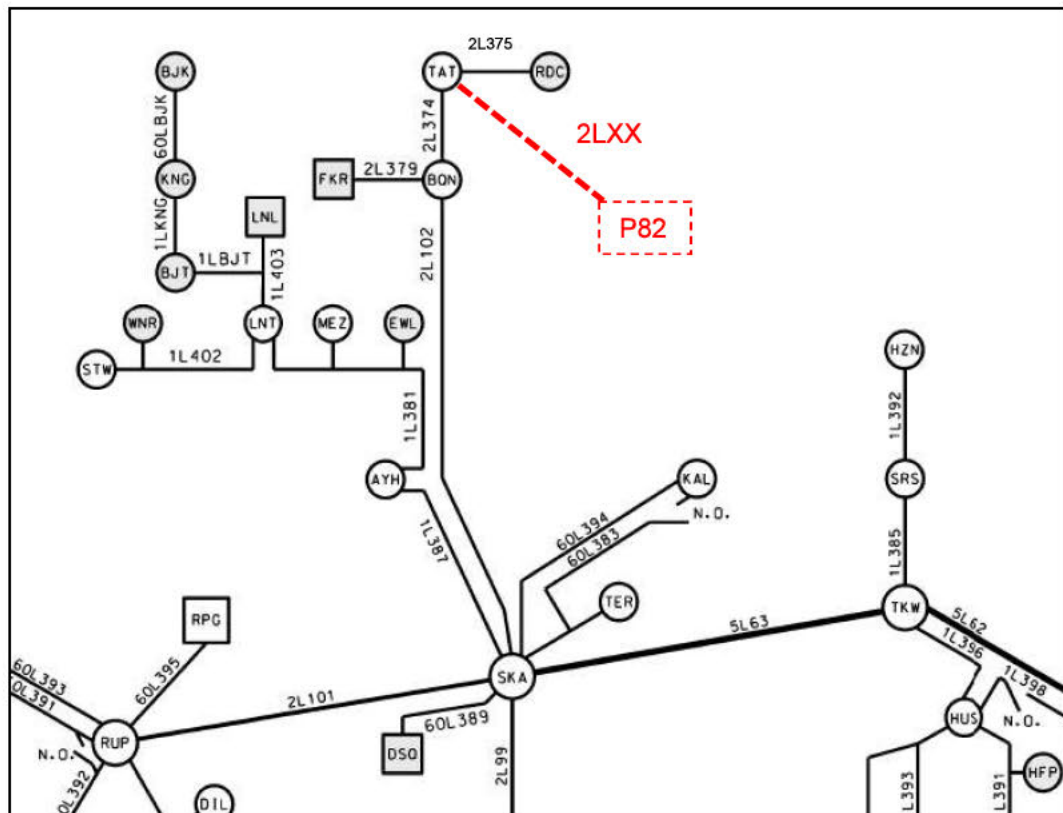


Figure 1: North Coast Regional Transmission System Diagram in 2024 with the Proposed Wind Project Interconnection

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 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.

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) Planned new TCT substation will be in-service in Oct 2026 .
 - Build a new 287 kV TCT substation to loop in 2L102
 - Re-locate SKA 2RX2 35 MVar reactor to TCT
 - Swap BQN 2RX22 and 2RX231 reactors by relocating 2RX22 15 MVar in 2RX231 position and 2RX231 35 MVar in 2RX22 position.
 - Install 1x30 MVar STATCOM at the new TCT substation (ISD: 2026). Analysis is performed if this project and system re-enforcement is delayed beyond the ISD of wind proponent.
- 3) The existing North Coast Generation Shedding Application/Scheme is feasible to be updated.

5 System Studies and Results

The new line 2LXX (from BC Hydro's TAT substation to the IC's generation station) will become IC's BES and the IC will be responsible for the compliance with applicable MRS requirements. In addition, TAT substation and line 2L374 from BQN to TAT will become part of BC Hydro BES facility. The line from TAT to RDC designated as 2L375 will be 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 2032 light summer (32LS) 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 2032 heavy summer (32HS) and 2031 heavy winter (31HW) cases are also studied to capture any possibility of performance violations under high load conditions.

5.1.1 Branch Loading Analysis

For the studied load conditions (31hw, 32ls, 32hs), thermal overload violation have been identified under system normal condition (P0).

The study identified potential thermal overload on line 2L102 (SKA – BQN) under system normal condition caused by the Ts̓ēba'e Ihts'ī Wind project. Potential overload is identified under light load and high generation scenario. Based on the Operating Order 5T-10 facility rating of 2L102 is limited by BQN series capacitor. Thermal upgrade of line 2L102 facility rating to a minimum of 980 Amps is required by upgrading or replacing existing BQN series capacitors. In addition, the spare strategy of upgraded BQN series capacitors shall ensure the potential unavailability of series capacitor less than one year.

Table 2: Series Capacitor Stations Upgrade Requirements

Series Capacitor Stations Upgrade Requirements				
Circuit	Positive Sequence Series Capacitor Reactance	Line Compensation	Series Capacitor Minimum Current Rating	Location
	(ohm)	(%)	(Amp)	
2L102	43.9	35%	980	BQN

Table 2: Summary of branch overloading

Case	Contingency		Overloaded branch	Overload %
	Category	Description		
31HW	P0	System Normal	2L102 (SKA-BQN)	125.8
32HS	P0	System Normal	2L102 (SKA-BQN)	128.3
32LS	P0	System Normal	2L102 (SKA-BQN)	150.0

No additional thermal violations under single contingency (P1 and P2) have been identified caused by the proposed IC.

5.1.2 Steady-State Voltage Analysis

For the studied load conditions (31hw, 32ls, 32hs), no voltage performance issues under system normal condition (P0) have been identified.

The study identified potential voltage instability when system is operated with BQN series capacitor in bypass mode under light load and high generation situation. A new RAS scheme is required to shed proposed wind generation at TAT for this scenario. Details of the new RAS will be further investigated in subsequent studies.

No additional voltage performance violation under single contingency (P1 and P2) have been identified.

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 not be capable of meeting the BC Hydro's reactive capability requirement at the plant's maximum MW output, which is subjected to further verification in the next stage of interconnection study.

5.1.4 Anti-Islanding Requirements

Tsēba'e Ihts'i Wind will form an island with BC Hydro generating plants and loads under system contingencies such as loss of 2L102, 2L374 or TAT breaker internal fault. An Anti-islanding Transfer Trip scheme is required to trip 2L374 and the Tsēba'e Ihts'i Wind generation at their entrance circuit breaker.

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 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 following is the scope of station work:

Tatogga Substation

- Expand the substation and extend the existing 287 kV bus structure.
- Add one 287kV line position with the associated substation equipment. Refer to the attached one-line diagram in Appendix B for details.
- Terminate the Tsebae Ihtsi customer line.
- Other associated station work.

Bob Quinn Substation

- Upgrade the existing capacitor bank 2CX1 to the ultimate stage. The bank existing current rating is 650 A and is required to be upgraded to 980 A. The compensation level of 35% and the reactance of bank of 43.9 ohms will remain the same.

- Bank was built to be upgraded to the ultimate stage without the replacement of the existing equipment. The upgrading will require only the addition of capacitor cans and MOV units up to the ultimate stage. The feasibility of the bank upgrade will be confirmed in the next stage by Engineering.
- No online diagram is provided at this stage.

5.4 Protection & Control Requirements

For successful integration of the new IC, the line protection relays at BC Hydro's TAT for 2LXX will be added. As part of the line protection addition, telecommunication facilities will be required for TAT and Ts̓ēba'e Ihts'īl.

BC Hydro will reconfigure the existing three terminal line between BQN, TAT, and RDC to become two independent two terminal lines with the addition of Ts̓ēba'e Ihts'ī Wind Project. A new protection system at TAT will be required to accommodate this change.

BC Hydro will make modifications to the BQN series capacitory 2CX1 to increase its continuous current rating. Protection settings changes are required for to accommodate the capacitor upgrade.

The IC is to provide the following for the interconnection of Ts̓ēba'e Ihts'ī 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 Ts̓ēba'e Ihts'īl to provide protection coverage for 2LXX. BC Hydro P&C Planning will provide settings for these relays.
- The IPP 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.

- Proponent should be aware there may be system operating events that cause TAT substation to be sourced with only two-phase voltage or unbalanced three-phase voltage during system events in the SKA to BQN area during a single-pole reclose intervals.

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, TAT – P82, with C37.94 interfaces.
- WECC Level 3 PY & SY, BQN – TAT, with C37.94 interfaces.
- WECC Level 3 PY & SY, TAT – RDC, with C37.94 interfaces.
- Remove existing digital teleprotection circuits, PY and SY, associated with BQN–TAT, BQN–RDC, TAT–RDC for 2L374.

Telecontrol Requirements for Telecom

- One P82 SCADA circuit 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 Ts̓ēba'e Ihts'ī 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 287 kV line position at TAT substation is required to interconnect the IC's generating project to the BC Hydro system.
2. The connection of Ts̓ēba'e Ihts'ī Wind Project caused a potential thermal overload on the line 2L102 (SKA – BQN) under system normal condition. Thermal upgrade of line 2L102 facility rating to a minimum of 980 Amps is required by upgrading existing BQN series capacitors. In addition, the spare strategy of the upgraded series capacitors shall ensure the potential unavailability of series capacitor less than one year.
3. The study identified potential voltage instability issue when system is operated with BQN series capacitor in bypass mode. A new RAS scheme is required to shed proposed wind generation at TAT for this scenario. Details of the new RAS will be further investigated in subsequent studies.
4. If 5L61, or 5L62 or 5L63 are forced out of service, North Coast system including Ts̓ēba'e Ihts'ī Wind will form an island. It is required that Ts̓ēba'e Ihts'ī Wind generation participates in the existing North Coast Generation Shedding Application/Scheme. As part of bulk system re-enforcements between WSN, GLN, TKM and SKA existing Application needs to be modified accordingly which will include Ts̓ēba'e Ihts'ī Wind generation. Details of the Application will be further investigated in subsequent studies.
5. Ts̓ēba'e Ihts'ī Wind will form an island with BC Hydro generating plants and loads under system contingencies such as loss of 2L102, 2L374 or TAT breaker internal fault. A new Anti-islanding Transfer Trip scheme is required to trip 2L374 and Ts̓ēba'e Ihts'ī Wind generation at their entrance circuit breaker.
6. 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 Ts̓ēba'e Ihts'ī Wind farm as submitted does not meet the reactive capability requirement which will need to be addressed.

7. BC Hydro will provide line protection for new line between BC Hydro TAT substation and IC's Tšēba'e Ihts'i Wind (P82) substation (BC Hydro end only). As part of the line protection for the new line, telecommunication facilities will be required between the two terminals 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 Tᓃēba'e Ihts'ī Wind Project single line diagram used for power flow study.

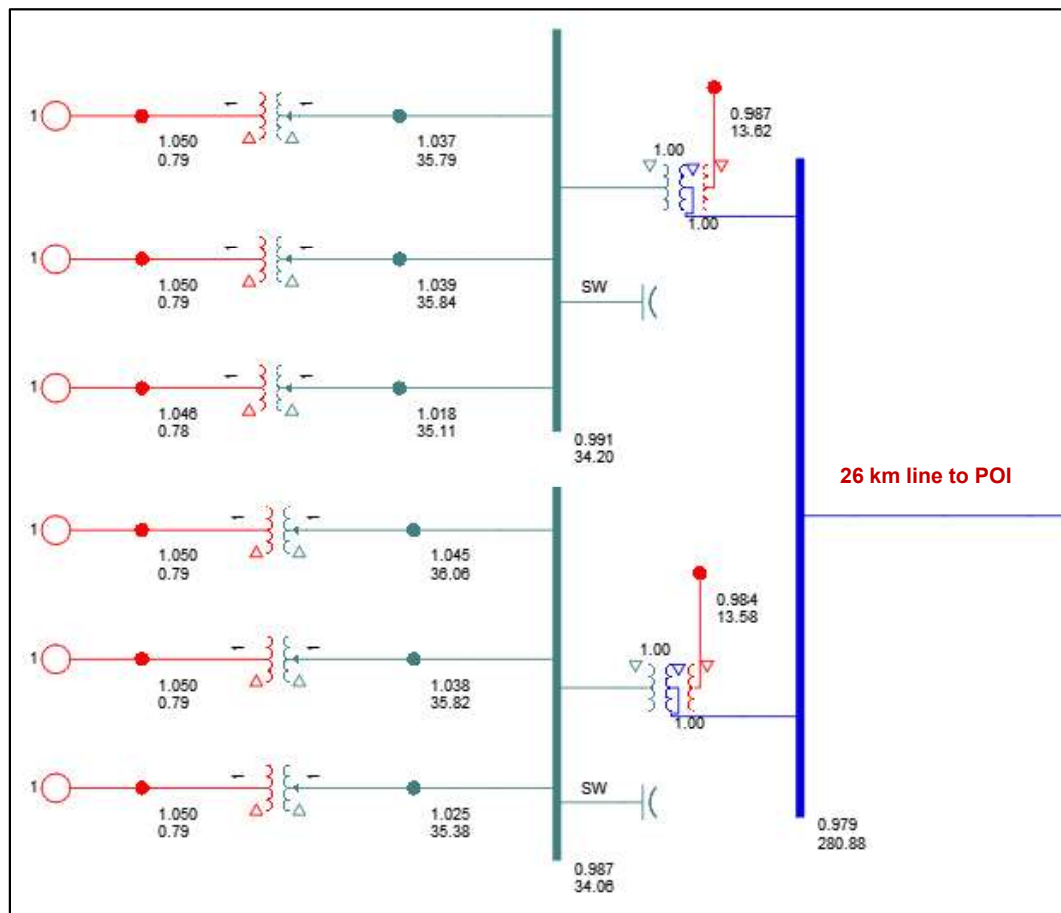


Figure A-1: Tᓃēba'e Ihts'ī Wind Project Single Line Diagram for Power Flow Study.

As seen in the diagram, Tᓃēba'e Ihts'ī Wind Project has two main power transformers dividing the plant into two parts.

- Part 1 has five (3) feeders connecting 17 wind farms to the collector station.

- Part 2 has three (3) feeders connecting 17 wind farms to the collector station.

