BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]

RE: CEAP IR 90 - Hardwicke Wind Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Hardwicke 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 $95.8M.

Major Scope of Work Identified:

- Acquire adequate property for a new substation close to the existing transmission line 2L154
- Construct a new outdoor 230 kV, 3- circuit breaker ring bus AIS switching substation
- Construct a new control building and other required substation facilities and infrastructures
- Supply and install protection relays and other required protection equipment
- Supply and install microwave towers, waveguides, antennas, and other required telecommunications equipment

Exclusions:

- GST
- Right-of-way
- Permits

Key Assumptions:

- Construction by contractor
- 3 years of construction
- No expansion of existing stations or control buildings to accommodate new equipment
- No structural or foundation upgrade will be required for telecommunication tower modification at BC Hydro Strathcona Microwave Repeater (STN)
- Early Engineering and Procurement
- No ground improvements will be required
- No piles will be required for construction
- No contaminated soil will be encountered during construction

Key Risks:

- Additional right of way or acquisition of more property may be required
- Existing microwave towers may need to be upgraded at various sites to accommodate new equipment leading to increased costs
- 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
- 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 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_90_Hardwicke Wind_FeS_Report_final.pdf

[redacted]

Hardwicke Wind Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 90

Prepared for: [redacted]

[redacted]

[redacted]

Report Metadata

Header:	Hardwicke Wind Project
Subheader:	Interconnection Feasibility Study
Title:	Hardwicke Wind Project
Subtitle:	2024 CEAP IR # 90
Report Number:	550-APR-00010
Revision:	0
Confidentiality:	Public
Date:	2024 Jul 30
Volume:	1 of 1

[redacted]

Related Facilities:	2L154
Additional Metadata:	Transmission Planning 2024-094 Filing Subcode 1350

[redacted]

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

Disclaimer of Warranty, Limitation of Liability

This report was prepared solely for internal purposes. All parties other than BC Hydro are third parties.

BC Hydro does not represent, guarantee or warrant to any third party, either expressly or by implication:

any information, product or process disclosed, described or recommended in this report.

BC Hydro does not accept any liability of any kind arising in any way out of the use by a third party of any information, product or process disclosed, described or recommended in this report, nor does BC Hydro accept any liability arising out of reliance by a third party upon any information, statements or recommendations contained in this report. Should third parties use or rely on any information, product or process disclosed, described or recommended in this report, they do so entirely at their own risk.

This report was prepared by the British Columbia Hydro And Power Authority ("BCH") or, as the case may be, on behalf of BCH by persons or entities including, without limitation, persons or entities who are or were employees, agents, consultants, contractors, subcontractors, professional advisers or representatives of, or to, BCH (individually and collectively, "BCH Personnel").

This report is to be read in the context of the methodology, procedures and techniques used, BCH's or BCH's Personnel's assumptions, and the circumstances and constraints under which BCH's mandate to prepare this report was performed. This report is written solely for the purpose expressly stated in this report, and for the sole and exclusive benefit of the person or entity who directly engaged BCH to prepare this report. Accordingly, this report is suitable only for such purpose, and is subject to any changes arising after the date of this report. This report is meant to be read as a whole, and accordingly no section or part of it should be read or relied upon out of context.

Unless otherwise expressly agreed by BCH:

(a) any assumption, data or information (whether embodied in tangible or electronic form) supplied by, or gathered from, any source (including, without limitation, any consultant, contractor or subcontractor, testing laboratory and equipment suppliers, etc.) upon which BCH's opinion or conclusion as set out in this report is based (individually and collectively, "Information") has not been verified by BCH or BCH's Personnel; BCH makes no representation as to its accuracy or completeness and disclaims all liability with respect to the Information;

(b) except as expressly set out in this report, all terms, conditions, warranties, representations and statements (whether express, implied, written, oral, collateral, statutory or otherwise) are excluded to the maximum extent permitted by law and, to the extent they cannot be excluded, BCH disclaims all liability in relation to them to the maximum extent permitted by law;

(c) BCH does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this report, or any information contained in this report, for use or consideration by any person or entity. In addition, BCH does not accept any liability arising out of reliance by a person or entity on this report, or any information contained in this report, or for any errors or omissions in this report. Any use, reliance or publication by any person or entity of this report or any part of it is at their own risk; and

(d) In no event will BCH or BCH's Personnel be liable to any recipient of this report for any damage, loss, cost, expense, injury or other liability that arises out of or in connection with this report including, without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

Copyright Notice

Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its Hardwicke Wind Project (2024 CEAP IR # 90) to the BC Hydro (BCH) system. Hardwicke Wind Project has twenty-nine (29) wind operation turbines generators [redacted], adding a total capacity of 194 MW into the BC Hydro system. The proposed Point of Interconnection (POI) is at a new switching station on BC Hydro's 230 kV line 2L154, approximatly 45 km from Gold River substation (GLD). The IC's project will connect to the POI via a 53 km customer built 230 kV interconnection line. The IC's proposed commercial operation date (COD) is Aug 1, 2029.

To interconnect the Hardwicke 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 switching station (referred to as "P90T") on 2L154 is required as the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P90T, 2L154 will be segregated into two new lines, temporarily referred to as: 2L154_A (GLD-P90T) and 2L154_B (P90T-DMR). The customer-built 230 kV line from switching station P90T to their site substation P90 will be designated as 2L154_C. The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

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

3. The connection of Hardwicke Wind Project will exacerbate the pre-existing thermal overload on multiple BC Hydro facilities under various single contingencies. These overloads are presently addressed by the North Vancouver Island Remedial Action Scheme (NVI RAS). The NVI RAS needs to be updated and the new wind generators at Hardwicke Wind Project are required to be included in the updated NVI RAS.

4. The study identified potential voltage instability in North Vancouver Island regional under Circuit Breaker fault (DMR 1CB15) or Loss of Transmission Line (2L154_B) single contingency caused by the connection of Hardwicke

Wind Project. A new RAS is required for tripping the Hardwicke Wind generation at the new switching station for these events.

5. In addition to entrance protection and 2L154_C 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.

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 Hardwicke Wind Project as submitted does not meet the reactive capability requirement at full MW output level, which will need to be addressed.

7. The new lines 2L154_A and 2L154_B will remain as part of BC Hydro BES and need to be compliant with applicable NERC MRS requirements. The new line 2L154_C (P90T-P90) will become a IC's BES line the IC will be responsible for the complance with applicable MRS requirements.

8. BC Hydro will provide line protections for 2L154_A, 2L154_B and 2L154_C (BCH 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.

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
DMR	Dunsmuir Substation
DTT	Direct Transfer Trip
EDM	Edmonds Office
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
FVO	Fraser Valley Office
GLD	Gold River Substation
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
NVI	North Vancouver Island
OATT	Open Access Transmission Tariff
POI	Point of Interconnection
RAS	Remedial Action Scheme
SIC	South Interior Control
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	Hardwicke Wind Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	At a new switching station on 2L154, 45 km from Gold River substation	
IC's Proposed COD	1st August 2029	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection (MW)	194 MW (Summer)	194 MW (Winter)
Number of Generator Units	29 x 6.8/7.0 MW	
Plant Fuel	Wind	

[redacted] the interconnection customer (IC), requests to interconnect its Hardwicke Wind Project (2024 CEAP IR # 90) to the BC Hydro system. Hardwicke Wind Project has twenty-nine (29) wind operation turbines generators [redacted] adding a total capacity of 194 MW into the BC Hydro system. The IC's proposed Point of Interconnection (POI) is at a new switching station on the BC Hydro's 230 kV line 2L154, approx. 45 km from Gold River substation (GLD). The IC's project will connect to the POI via a 53 km 230 kV interconnection line. The proposed commercial operation date (COD) is Aug 1, 2029.

Figure 1-1 shows the North Vancouver Island (NVI) region 132/230 kV transmission system diagram. NVI is a generation-rich sub-area where most of the generation in Vancouver Island is located. Within the NVI 132/230 kV system, there are pre-existing branch overload concerns under contingencies.

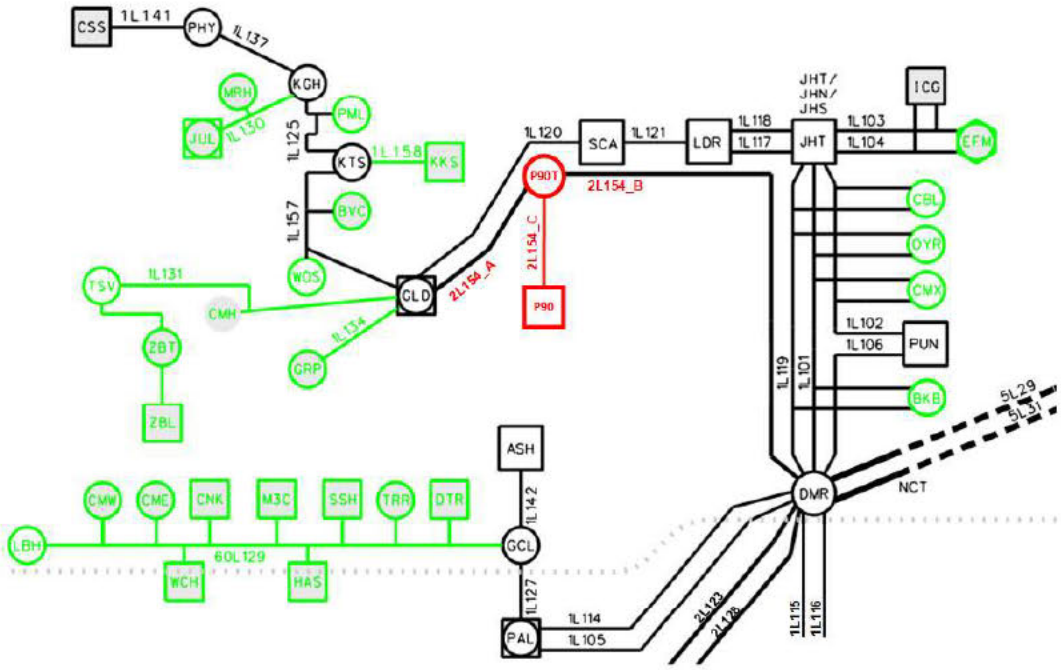

Figure 1-1: North Vancouver Island region 132/230 kV Transmission System Diagram with Proposed Hardwicke Wind Project Interconnection

The North Vancouver Island Remedial Action Scheme (NVI RAS) has been implemented to mitigate these issues, where the NVI RAS specifically addresses thermal overloads on the 1L120 (GLD-SCA) line and other 132 kV lines in the event of a loss of the 2L154 (GLD-DMR) line during periods of high CSS and KKS generation. As part of its operation, the RAS will reduce the generation output of CCS and KKS.

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) The current 2L154 line rating is constrained by the GLD transformer rating, rather than any terminal equipment from DMR. The rating of 2L154_B is assumed 1009 A (summer) and 1304 A (winter) after segregation on 2L154.

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new switching station (referred to as "P90T") on 2L154 is proposed as the POI to interconnect the IC's generating project with the BCH system. There are multiple terminals and multiple sources on the existing line 2L154. 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 P90T, the existing line 2L154 will be segregated into two new lines, temporarily referred to as: 2L154_A (GLD-P90T) and 2L154_B (P90T-DMR). The proposed customer-built 230 kV line (P90T-P90) will be designated as 2L154_C. The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

The existing line 2L154 is included in the Bulk Electric System (BES) list. The new lines 2L154_A and 2L154_B will remain as part of BC Hydro BES and compliant with applicable MRS requirements. The new line 2L154_C will become a IC's BES line and the IC will be responsible for the compliance with applicable MRS requirements.

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 2029 heavy summer (29hs), 2030 heavy summer (30hs) and 2031 heavy winter (31hw) cases are also checked at a high level to capture any possibility of performance violations under high load conditions.

5.1.1 Branch Loading Analysis

Table 5-1 shows a summary of branch loading analysis under system normal and single contingencies (P1, P2) for various load conditions.

The study finds no transformer or line overload under system normal conditions for all three load conditions studied. For single contingencies, the connection of Hardwicke Wind Project could cause multiple line or transformer overload in the summer load conditions (29hs, 30hs, 30ls).

Under the heavy and light summer condition (29hs, 30hs, 30ls), the connection of Hardwicke Wind Project will exacerbate the pre-existing thermal overload on the BC Hydro facilities 1L120 (GLD-SCA), 1L121 (SCA-LDR), 1L119 (JHT-DMR), 1L101 (JHT-DMR), 1L102 (JHT-DMR), and 2L154 (GLD-DMR), and GLD 230/132 kV transformers under various single contingencies. These overloads are presently addressed by the North Vancouver Island Remedial Action Scheme (NVI RAS). The NVI RAS needs to be updated and the new wind generators at Hardwicke Wind Project are required to be included in the updated NVI RAS. The Hardwicke Wind generation is required to be tripped at the IC's substation P90 under various system contingencies. The updated NVI RAS would require additional circuits to be monitored, including the direction of MW flow. The units to be tripped/run backed will be determined based on the overloaded circuits and flow directions. The list of generation units to be included in the updated RAS contains the existing CSS, KKS, JHT, LDR, SCA, and Hardwicke Wind.

Table 5-1: Summary of Branch Loading Analysis Results

Case	North Vancouver Island Regional Generation/ Load	IPP's Generator Output	Contingency Identified		Branch Loading		
					2L154_A	2L154_B	1L121
			Cate-gory	Description	GLD-P90T	P90T-DMR	SCA-LDR
30LS	528.3 MW / 170 MW	197.4 MW	P0	System Normal	277.4 Amps 32.9 %	749.9 Amps 74.3 %	501.5 Amps 78.5 %
	528.3 MW / 170 MW	197.4 MW	P1	1L121 OOS	648.4 Amps 76.8 %	1108.7 Amps 109.9 %	OOS
	528.3 MW / 170 MW	197.4 MW	P1	2L154_B OOS	541.1 Amps 64.1 %	OOS	1663.7 Amps 260.5 %

5.1.2 Steady-State Voltage Analysis

With the connection of the IC's project, the voltage performance under system normal condition is acceptable for all load conditions (29hs, 30ls, 30hs, 29hw).

For internal breaker fault event (P2) of DMR 1CB15 breaker, all the 132 kV breakers connected to DMR bus 1B1 and 1B3 opens causing isolation of lines 1L119, 1L101 and 1L106 connecting to North Vancouver Island system resulting 2L154 as the only connected path to deliver NVI generation to DMR. The connection of Hardwicke Wind Project causes potential voltage instability issues at North Vancouver Island. Additionally, the connection of Hardwicke Wind Project causes potential voltage instability during loss of 2L154_B. A new RAS is required for tripping the new Hardwicke Wind generation at the switching station P90T for these events. Further details of the RAS scheme will be studied and determined in subsequent studies.

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 for this project, the study finds that the proposed generating project does not fully meet the BC Hydro's reactive capability requirement at the plant's maximum MW output. Additional 230 kV reactive power equipment is required to be installed at the customer's substation to meet the TIR requirements.

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 Solar Plant would be capable of meeting the BC Hydro's reactive capability requirement at the plant's zero MW output, which needs to be re-confirmed if the IC's project proceeds further.

5.1.4 Anti-Islanding Requirements

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

A new outdoor 230 kV, 3-circuit breaker ring bus Air Insulated Switchgear (AIS) switching substation (P90T temporarily) will be built at the proposed POI, close to the existing 230 kV transmission line 2L154. The existing transmission line 2L154 will be cut and looped in to, and 230 kV line of Hardwicke Wind Project (2L154_C) will be terminated at the new substation.

The station upgrade scope at the new switching station P90T is as follows.

- Acquire adequate property for a new substation close to the existing transmission line 2L154.
- Construct a new outdoor 230 kV, three-circuit breaker ring bus AIS switching substation. Refer to the one-line sketch in Appendix B for details.

5.4 Protection & Control Requirements

BC Hydro will provide line protections for 2L154_A (GLD-P90T), 2L154_B (P90T-DMR) and 2L154_C (P90T-P90, 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 Hardwicke 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) at the entrance of P90 to provide protection coverage for 2L154_C. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 2L154_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.
- The IC will be required to receive generation shedding or generation run back initiation signal via the 2L154_C line protection telecom channel.

The runback schemes or RAS requirements stated in Section 5.1 are mainly to address the overloading concerns under contingencies, which are preliminary. These RAS requirements may utilize the communication channels required for protection purposes included in the cost estimate. If the proposed project proceeds through the CEAP process, subsequent System Impact Studies may identify additional RAS requirements for this interconnection. These RAS functional requirements will include initiating events, control actions, and latency times. Depending on these supplementary requirements, additional telecommunication facilities may be needed to facilitate signal transmission between the BC Hydro substations and customer facilities.

5.5 Telecommunications Requirements

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

Teleprotection Requirements for Telecom

- Provide WECC Level 3 64 kbps synchronous circuits between GLD and P90T for “GLD – P90T 2L154 PY DIGITAL TELEPROT” and “GLD – P90T 2L154 SY DIGITAL TELEPROT”. Physical interface shall be C37.94 optical over multimode fibre using ST connectors.
- Provide WECC Level 3 64 kbps synchronous circuits between DMR and P90T for “DMR – P90T 2L154_B PY DIGITAL TELEPROT” and “DMR – P90T 2L154_B SY DIGITAL TELEPROT”. Physical interface shall be C37.94 optical over multimode fibre using ST connectors.
- Provide WECC Level 3 64 kbps synchronous circuits between P90T and P90 for “P90T – P90 2L154_C PY DIGITAL TELEPROT” and “P90T – P90 2L154_C SY DIGITAL TELEPROT”. Physical interface shall be C37.94 optical over multimode fibre using ST connectors.

Telecontrol Requirements for Telecom

- One P18 SCADA circuit off FVO & SIO.
- Two P18T SCADA circuits off FVO & SIO.
- One P18T 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 Hardwicke 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 switching station (referred to as "P90T") on 2L154 is required as the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P90T, 2L154 will be segregated into two new lines, temporarily referred to as: 2L154_A (GLD-P90T) and 2L154_B (P90T-DMR). The customer-built 230 kV line from switching station P90T to their site substation P90 will be designated as 2L154_C. The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

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

3. The connection of Hardwicke Wind Project will exacerbate the pre-existing thermal overload on multiple BC Hydro facilities under various single contingencies. These overloads are presently addressed by the North Vancouver Island Remedial Action Scheme (NVI RAS). The NVI RAS needs to be updated and the new wind generators at Hardwicke Wind Project are required to be included in the updated NVI RAS.

4. The study identified potential voltage instability in North Vancouver Island regional under Circuit Breaker fault (DMR 1CB15) or Loss of Transmission Line (2L154_B) single contingency caused by the connection of Hardwicke Wind Project. A new RAS is required for tripping the Hardwicke Wind generation at the new switching station for these events.

5. In addition to entrance protection and 2L154_C 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.

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 Hardwicke Wind Project as submitted does not meet the

reactive capability requirement at full MW output level, which will need to be addressed.

7. The new lines 2L154_A and 2L154_B will remain as part of BC Hydro BES and need to be compliant with applicable NERC MRS requirements. The new line 2L154_C (P90T-P90) will become a IC's BES line and the IC will be responsible for the complance with applicable MRS requirements.

8. BC Hydro will provide line protections for 2L154_A, 2L154_B and 2L154_C (BCH 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 Hardwicke Wind Project single line diagram used for power flow study.

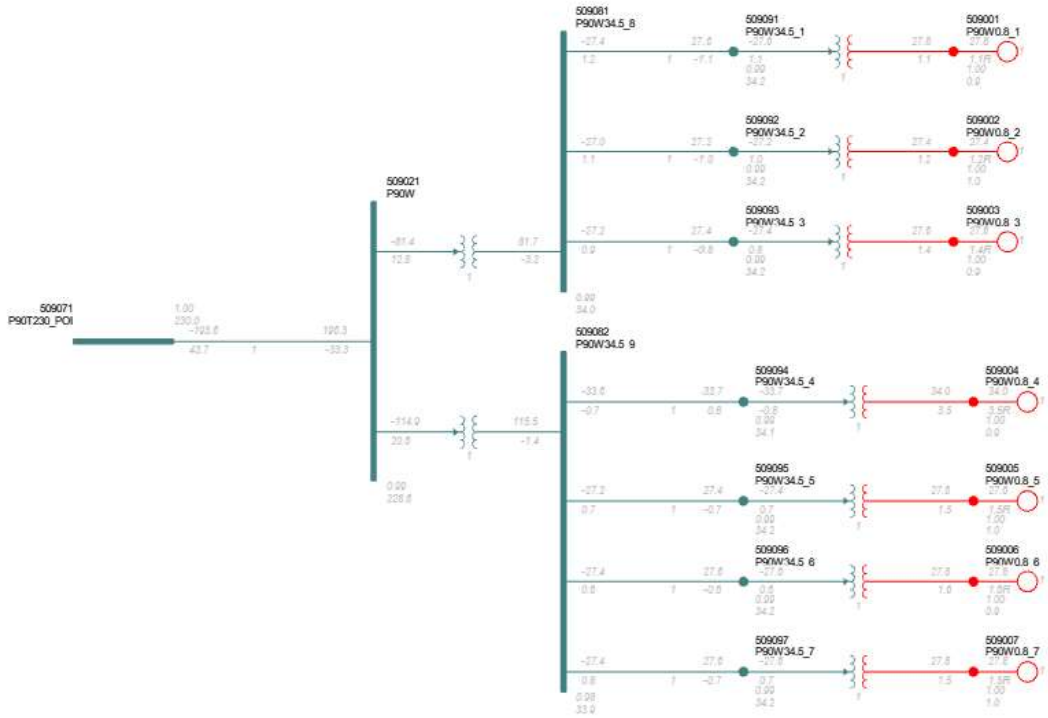

Figure A-1: Hardwicke Wind Project Single Line Diagram for Power Flow Study.

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

- Part 1 has three (3) feeders connecting 12 wind turbines to the collector station.
- Part 2 has four (4) feeders connecting 17 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 P90T.

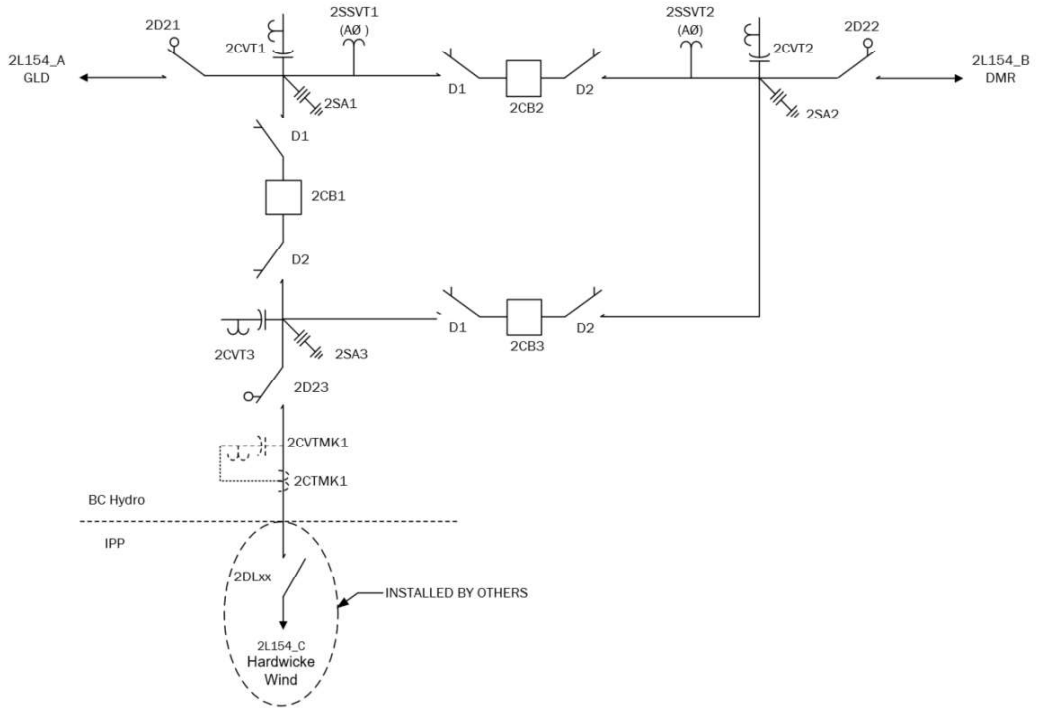

Figure B-1: Stations Planning One-Line Sketch for the New Switching Station P90T.