BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]:

RE: CEAP IR 91 - Amor de Cosmos Wind Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Amor de Cosmos 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 $11.2 M.

Major Scope of Work Identified:

- Supply and install one 132 kV line position with the associated substation equipment at BC Hydro Ladore Falls Generating Station (LDR)
- Expand the existing control building to accommodate the new P&C panels and other equipment at LDR
- Supply and install protection relays and other required protection / telecom equipment

Exclusions:

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

Key Assumptions:

- Construction will be done by contractor
- 2 years of construction is considered
- Early Engineering and Procurement
- No station site expansion is required
- 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 materials and major equipment be affected by market conditions and escalation
- Expansion of station site may be required leading to increased costs and/or longer project schedule

Please note that the Revenue Metering requirements and associated costs required to interconnect your project have not been determined at this stage and, therefore, not included in the above estimate. Revenue Metering costs that are attributable to the Interconnection Customer are to be paid in cash. For more details on Revenue Metering requirements and responsibilities, please refer to:

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-complex-revenue-metering.pdf.

Schedule

Based on the Interconnection Feasibility study, the non-binding good faith estimated in-service date for your project's Network Upgrades is Quarter 3 2029 (calendar year). To achieve this timeline, we may need to expedite certain activities, including engineering design and procurement of long-lead equipment.

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

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

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

Next Steps

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

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

Sincerely,

Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_91_Amor de Cosmos Wind_FeS_Report_final.pdf

[redacted]

Amor de Cosmos Wind Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 91

Prepared for: [redacted]

[redacted]

[redacted]

Report Metadata

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Subheader:	Interconnection Feasibility Study
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[redacted]

Revisions

Revision	Date	Description
0	2024 Jul	Initial release

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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its Amor de Cosmos Wind Project (2024 CEAP IR # 91) to the BC Hydro (BCH) system. Amor de Cosmos Wind Project has twenty-nine (29) [redacted] Type-3 wind turbine generators, adding a total capacity of 154.0 MW into the BC Hydro system. The Point of Interconnection (POI) is at the 132 kV bus of BC Hydro 132 kV Ladore Falls generating station (LDR) via a customer built 132 kV line approximately 53 km in length. The IC's proposed commercial operation date (COD) is August 1, 2029.

To interconnect the Amor de Cosmos 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 132 kV line position at LDR substation is required to interconnect the IC's generating project to the BC Hydro system.

2. The connection of Amor de Cosmos Wind Project caused a potential thermal overloads on 1L117, 1L118, 1L119, 1L101, 1L102, and 1L106 under various single contingency conditions. A new remedial action scheme (RAS) is required to monitor flows on the identified overloaded elements and curtail or trip the selected generations including the IC's generation facility to mitigate identified overloads. Further details of the RAS scheme will be studied and determined in subsequent studies.

3. For internal breaker fault of DMR 1CB15, the addition of Amor de Cosmos Wind Project causes potential thermal overloads and voltage issues. A new RAS is required for tripping the generations in North Vancouver Island system for this event. Further details of the RAS scheme will be studied and determined in subsequent studies.

4. The existing North Vancouver Island Remedial Action Scheme (NVI RAS) is required to be updated or be integrated, if necessary, with the requested new RAS to mitigate the potential overloads.

5. Amor de Cosmos Wind is not arranged for islanded operation. The IC is required to install anti-islanding protection within their facility to disconnect the wind farm from the grid when an inadvertent islanding 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 Amor de Cosmos Wind farm as submitted does not meet the reactive capability requirement which will need to be addressed.

7. BC Hydro will provide line protection (BC Hydro end only) for the new line between BC Hydro LDR substation and IC's Amor de Cosmos Wind (P91) substation. 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.

Contents

Appendices

Acronyms

The following are acronyms used in this report.

BCH	BC Hydro
LDR	BC Hydro Ladore Falls Generating 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	Amor de Cosmos Wind Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	Ladore Falls (LDR) Generating Station 132 kV bus	
IC's Proposed COD	1st August 2029	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection [1] (MW)	150 MW (Summer)	150 MW (Winter)
Number of Generator Units	22 x 7.0 MW	
Plant Fuel	Wind	
Note 1: The maximum achievable power injection at the POI is approx. 147.3 MW after accounting for MW losses and service load which is lower than the IC proposed 150 MW.		

[redacted] the interconnection customer (IC), requests to interconnect its Amor de Cosmos Wind Project (2024 CEAP IR # 91) to the BC Hydro (BCH) system. Amor de Cosmos Wind Project has twenty two (22) [redacted] Type-3 wind turbine generators, adding a total capacity of 154.0 MW into the BC Hydro system. The proposed Point of Interconnection (POI) is on the BC Hydro's 132 kV bus of BC Hydro 132 kV Ladore Falls generating station (LDR) via a customer built 132 kV line, approximately 53 km in length. The IC's proposed commercial operation date (COD) is Aug. 1, 2029.

Figure 1-1 shows the North Vancouver Island regional 132/230 kV transmission system diagram. There is an existing remedial action scheme (RAS), named North Vancouver Island Remedial Action Scheme (NVI RAS), implemented to address the thermal overloads on 1L120 (GLD-SCA) and other 132 kV lines under the contingency of loss of 2L154 (GLD-DMR) during high CSS and KKS generation conditions. This RAS will curtail the CSS and KKS generation to a predetermined limit, and sequentially trip 1L157 at Gold River substation (GLD).

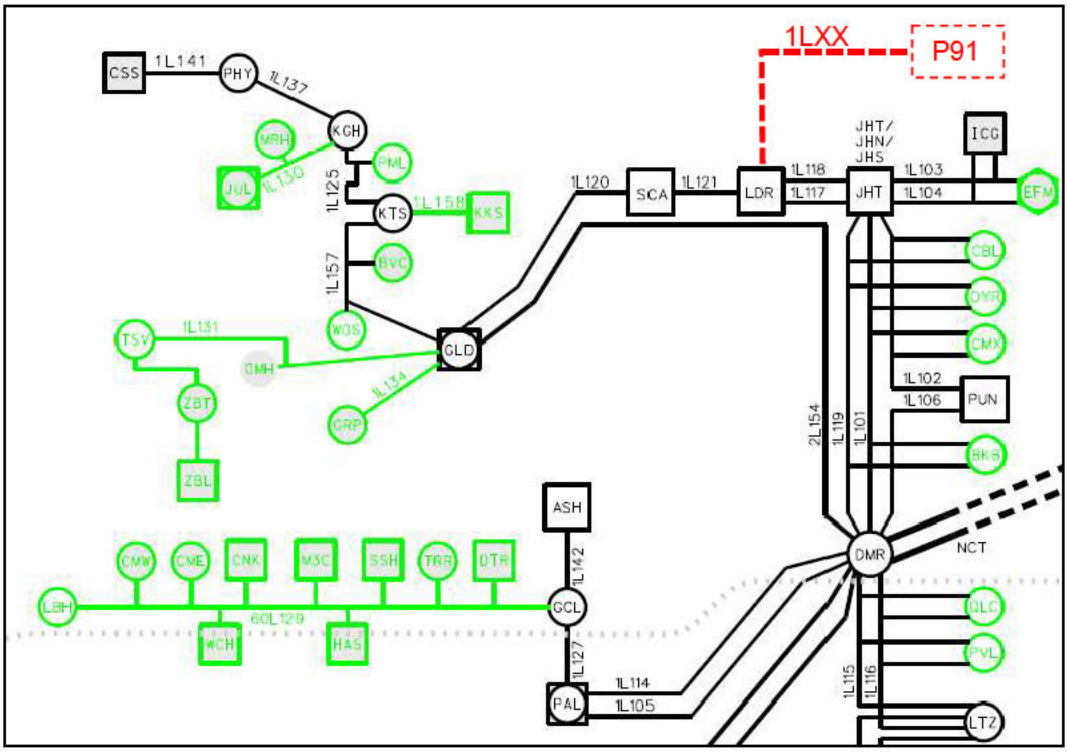

Figure 1-1: North Vancouver Island Transmission System Diagram in 2024 with the Proposed Amor de Cosmos Wind Project Interconnection

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) The existing NVI RAS is feasible to be updated.
3) New RAS scheme can be accommodated to meet the requirements.

5 System Studies and Results

The proposed customer-built 132 kV interconnection line from BC Hydro's LDR substation to the IC's generation station (P91) will be designated as 1LXX. It will become an 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 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 studied to capture any possibility of performance violations under high load conditions.

5.1.1 Branch Loading Analysis

For the studied load conditions (29hw, 30ls, 30hs), no branch or transformer overload is identified under system normal condition (P0).

The connection of Amor de Cosmos Wind Project will cause additional thermal overloads on 1L101 , 1L102 , 1L106 , 1L117 , 1L118 , and 1L119 , under various single contingency conditions. A new RAS is required to monitor flows on the identified overloaded elements and curtail or trip selected local generations in NVI area, including the IC's wind generation at P91. The list of generation units to be included in the updated RAS contains the existing CSS, KKS, JHT, LDR, SCA units and the new Amor de Cosmos Wind project. Further details of the RAS scheme will be studied and determined in subsequent studies.

There is an existing NVI RAS in the area to mitigate the potential overloads on 1L120 or 1L121 caused by loss of 2L154. The existing NVI RAS needs to be updated and be integrated, if necessary, with the requested new RAS.

Table 5-1 below shows the worst case overloading on existing lines with IC at maximum output.

Table 5-1: Summary of Branch Overoading

Case	Contingency		Overloaded branch	Overlaod %
	Category	Description		
29HW	P1	1L117	1L118 (LDR-JHT)	119.4
	P1	1L118	1L117 (LDR-JHT)	134.3
	P1	1L119	1L102 (JHT-CBL)	116.4
	P2	1L102 (JHT-CBL)	1L119 (JHT-CBL)	121.7
30LS	P1	1L117	1L118 (LDR-JHT)	115.0
	P1	1L118	1L117 (LDR-JHT)	128.4
	P1	1L119	1L106 (DMR-PUN)	105.6
	P1	1L102	1L101 (JHT-OYR)	116.2
	P2	1L119 (JHT-CBL)	1L102 (JHT-CBL)	124.9
	P2	DMR 1CB1, 1CB2, 1CB7 or 1CB8	1L119 (BKB-OYR)	162.2
30HS	P1	1L102	1L101 (JHT-OYR)	113.5
	P1	1L118	1L117	129.9
	P1	1L117	1L118	116.4
	P2	1L119 (JHT-CBL)	1L102 (JHT-CBL)	127.7
	P2	DMR 1CB1, 1CB2, 1CB7 or 1CB8	1L119 (JHT-CBL)	150.4

5.1.2 Steady-State Voltage Analysis

For all the studied load conditions (29hw, 30ls, 30hs), the voltage performance under system normal condition (P0) and single contingency (P1) is acceptable.

For internal breaker fault event (P2) of DMR 1CB15, all the connected 132 kV lines at DMR, including 1L119, 1L101 and 1L106, will be tripped and sequentially result in the 2L154 as the only connected path to transfer NVI generations to DMR. The addition of Amor de Cosmos Wind will exacerbate this existing overloads and

potential voltage issues in NVI. A new RAS is required for tripping the generations in NVI system for this event. The list of generation units to be included in the new RAS contains the existing CSS, KKS, JHT, LDR, SCA units and the new Amor de Cosmos Wind project. Further details of the RAS 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 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 required to be addressed.

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

The following is the scope of work at LDR substation:

- Add one 132 kV line position with the associated substation equipment. Refer to the attached planning one-line sketch in Appendix B for details.
- Expand the existing control building, if required, to accommodate the new P&C panels and other equipment.
- Terminate the 132 kV line from Amor de Cosmos Wind Project.
- Other associated station work.

5.4 Protection & Control Requirements

For successful integration of the new IC, new line protection relays will be installed at BC Hydro's Ladore Falls (LDR) and IC's Amor de Cosmos Wind (P91) substations to protect 1LXX using line current differential scheme (87L). As part of the line protection addition, telecommunication facilities will be required between the two substations.

The IC is to provide the following for the interconnection of Amor de Cosmos 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 Amor de Cosmos Wind (P91) to provide protection coverage for 1LXX. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 1LXX during a transmission line fault. Non-core protection such as local breaker failure, auto-reclosing, backup protection, NERC PRC related settings 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 stated in Section 5.1.

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

- WECC Level 3 PY & SY, LDR – P91, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- One P91 SCADA circuit to FVO and SIO.

Other Requirements for Telecom

- PY & SY T1s over separate OC3s, LDR – P91
- MPLS links and LSPs for new LDR MPLS nodes

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 Amor de Cosmos 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 132 kV line position at LDR substation is required to interconnect the IC's generating project to the BC Hydro system.

2. The connection of Amor de Cosmos Wind Project will cause potential thermal overloads on 1L117, 1L118, 1L119, 1L101, 1L102, and 1L106 under various single contingency conditions. A new RAS is required to monitor flows on the identified overloaded elements and curtail or trip selected generations, including the IC's generation facility to mitigate identified overloads. Further details of the RAS scheme will be studied and determined in subsequent studies.

3. For internal breaker fault of DMR 1CB15 breaker, the addition of Amor de Cosmos Wind Project will exacerbate teh existing potential thermal overloads and voltage issues. A new RAS is required for tripping the generation in NVI system for this event. Further details of the RAS scheme will be studied and determined in subsequent studies.

4. The existing NVI RAS is required to be updated or be integrated with the requested new RAS to mitigate the potential overloads.

5. The Amor de Cosmos Wind is not arranged for islanded operation. The IC is required to install anti-islanding protection within their facility to disconnect the wind farm from the grid when an inadvertent islanding 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 Amor de Cosmos Wind farm as submitted does not meet the reactive capability requirement which will need to be addressed.

7. BC Hydro will provide line protection (BC Hydro end only) for new line between BC Hydro LDR substation and the IC's Amor de Cosmos Wind (P91) substation. 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 Amor de Cosmos Wind Project single line diagram used for power flow study.

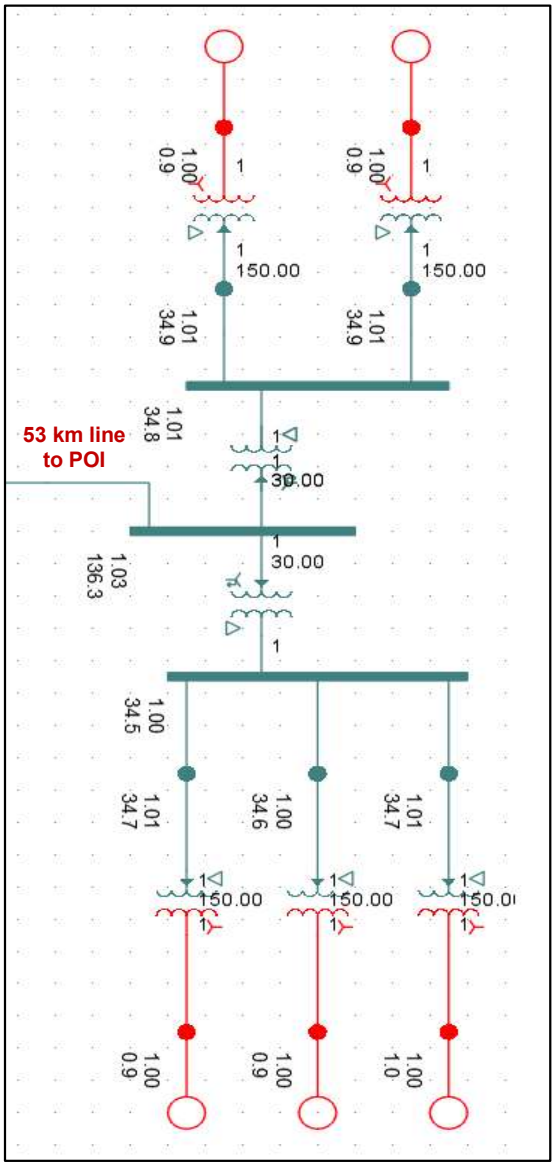

Figure A-1: Amor de Cosmos Wind Project Single Line Diagram for Power Flow Study.

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

- Part 1 has three (3) feeders connecting 13 wind farms to the collector station.
- Part 2 has two (2) feeders connecting 9 wind farms to the collector station.

Appendix B
One-Line Sketch for Addition of a 132 kV Line Position at LDR Substation

Figure B-1 shows the Stations Planning One-Line Sketch of the existing LDR substation with the connection of IC's project.

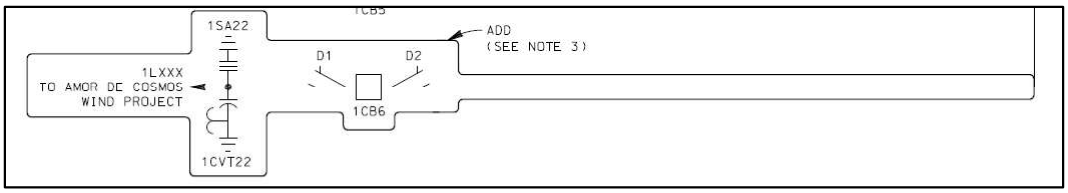

Figure B-1: Stations Planning One-Line Sketch of the existing LDR substation with the connection of IC's project.