Project design document form
(Version 11.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	Expansion San Pedro Wind Farm
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	4
Completion date of the PDD	27/07/2020
Project participants	RIO ALTO SA / ENERGIAS ABTAO SA
Host Party	CHILE
Applied methodologies and standardized baselines	Selected methodology: ACM0002 v.20.0 “Grid-connected electricity generation from renewable sources”
Sectoral scopes	Sectoral Scope I. Energy Industries (renewable / non-renewable sources)
Estimated amount of annual average GHG emission reductions	119,235

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The project activity of Expansion San Pedro Wind Farm (hereinafter referred to as SPII), consists in the construction of a wind farm, and the purpose is to generate renewable energy and supply electricity to the most important Chilean grid.

The wind farm is located at the *Chiloé* Island, Mountain Range of *San Pedro*, Commune of *Dalcahue*, in the (10th) Region (*Región de los Lagos*), Chile. Placed near 1,174 km. south of Santiago de Chile, consist of the installation of 13 wind turbines, with a total installed capacity of 65 MW. The project was designed to supply the electricity generated to the central Chilean grid: the Central Interconnected System (SIC), now supplies to the National Electric System (SEN[1]).

This project contributes, by using the available wind resource at the region, to the development of the renewable energies, expanding renewable installed capacity and producing electricity through environmentally respectful technologies, and will definitely contribute to the local and national sustainable development. Particularly, this project will contribute to the reduction of CO_2e emissions as it produces a substitution effect on the energy generated in fossil fuel based thermal plants at interconnected system.

With an expected production of 199.057 GWh/year[2], it will reduce emissions by 119,235 tonnes of CO_2e per year.

The project is being developed by Rio Alto, SA and Energias Abtao, SA (hereinafter the *Project Developers*), Special Purpose Vehicles (SPV), developed under the laws of Chile.

Societies structure is as follows: Trans Antartic Energía II[3] (73.88%), Jealsa Energía SL[4] (23,58%), and Inversiones Buutalcura SA[5] (2,54%) for the first one and 50:50 Trans Antartic Energía II and Inversiones Buutalcura SA for the second of the companies involved.

The production of non-conventional renewable energy (hereinafter ERNC, by its acronym in Spanish) is essential for the reduction of the intensive use of fossil fuels, for the reduction of GHG emissions in Chile, and for the diversification and sustainability of the energy sector.

The SPII activity contributes to sustainable development in Chile by:

- Use of renewable natural resources as energy source: wind resource utilization. The project will generate electricity with a technology that does not produce greenhouse gas emissions (GHG).
- Job creation at the region: the project is expected to create jobs during the construction phase (due to road construction, electrical infrastructures, wind turbines installation and the control building). It is expected to create around 80 direct jobs during the construction phase and 7 direct jobs during the operational phase[6].

---

[1] SEN – Sistema Energético Nacional (National Energetic System)

[2] Document: "*Evaluación de Recursos Eólicos. Parque Eólico San Pedro II (Chile)*" (Barlovento Recursos Naturales, S.L., January 2014)

[3] Trans Antartic Energía II belongs 100% to Grupo Jealsa, company that brings expertise in renewable energy projects.

[4] Jealsa Energía SL belongs 100% to Grupo Jealsa.

[5] Inversiones Buutalcura SA belongs 100% to Grupo Baztan.

[6] EID Environmental Impact Declaration *"Resolución exenta nº733 que Califica Ambientalmente el proyecto Ampliación Parque Eólico San Pedro", República de Chile, Comisión de Evaluación X Región de Los Lagos, Puerto Montt. December 2013.*

- Development of non-conventional renewable energies (ERNC): the project will contribute to the technology transfer process, increasing the amount of wind power facilities in Chile, still uncommon nowadays.
- Development of the local community (professional skills): the project will allow different people to develop specific operational skills in wind power plants, since the contracted company will train local staff in the operation and maintenance of the facility.
- Improvement of local economy: the project will contribute to increase incomes at local level due to the necessity of resources or services for the staff of the wind farm, both in phase of construction and operation, such as accommodation, meals, equipment operation and maintenance, etc. It will also influence this local improvement, by taxes such as work permits and payment of easements for the ground use by the evacuation power line.
- Development of the sustainable image of the area: the project activity can contribute to the development of tourism, especially those seeking for sustainable destinations, because it confirms and improves *Chiloé* island sustainable image.

Therefore, and as a summary, can be affirmed that the SPII contributes to increase the grid´s installed power in non-conventional renewable energies, thereby contributing to the mitigation of climate change. On the other hand, the project generates local and regional benefits, both in operation and construction phase. The consideration of the CDM since the start of the project, and income from CER sales, can help to reduce the economic obstacle of this kind of projects in Chile.

In another vein, SPII is a grid connected wind power project, which does not involve switching from fossil fuels and the grid's geography and system boundaries are conveniently explicit (see *Section B.3*). Furthermore, characteristics, data and information required, are available through the National Energy Commission (CNE, by its acronym in Spanish) and the "*Coordinador Eléctrico Nacional"* (entity managing SEN).

The Expansion San Pedro Wind Farm project activity, with its 65 MW of installed capacity and an expected production of 199,057 GWh/year, will directly reduce the greenhouse gases emissions from the electrical system, by displacing electric energy generated in fuel-based power plants that currently operate, and will continue operating, in the Chilean system.

Related to the implementation of the project activity, and as a basis for the demonstration of the consideration of the CDM since the beginning of the project, Project Schedule and main milestones of the project are going to be presented:

Date	**Project Implementation Milestones**
11/07/2012	Presentation of SPII Environmental Impact Declaration. [7]
22/08/2012	First Consolidated report of request for clarifications, corrections and/or additions to the Environmental Impact Declaration.[8]
24/07/2013	Second Consolidated report of request for clarifications, corrections and/or additions to the Environmental Impact Declaration.[9]
10/12/2013	Consolidated report of Environmental Impact Assessment.[10]
19/12/2013	SEIA (Environmental Assessment Impact Service), Xth Region of Los Lagos emits resolution of Environmental Qualification of SPII [11]

[7] Date of entry at the Chilean SEA Electronic system. Submitted by Matías Steinacker, of *Transantartic Energía*. Link

[8] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

[9] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

[10] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

[11] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link.

Related to the power evacuation line which is serving SPII to introduce generated energy into the system, the main milestones that can be observed below (separated due to the earlier processing of environmental permits for the power evacuation line, prior to the start of those relating to the project activity). Note that milestones titles and documentation (regarding power evacuation line) refer to the SPWFP (San Pedro Wind Farm Project); this is because the evacuation line was posed in parallel to that project, but it is also used by SPII, through the payment of a toll, as mentioned before.

Date	Project Implementation Milestones
06/05/2011	Presentation of power evacuation line of SPWFP Environmental Impact Declaration
08/07/2011	First Consolidated report of request for clarifications, corrections and/or additions to the Environmental Impact Declaration.[12]
25/11/2011	Consolidated report of Environmental Impact Assessment.[13]
01/12/2011	SEIA (Environmental Assessment Impact Service), Xth Region of Los Lagos emits resolution of Environmental Qualification of the power evacuation line [14]

Table A2: Power Evacuation Line Main Environmental Milestones.

Continuing with the project activity, focusing on a technical and implementation level, the following milestones have occurred, according to the following timetable:

Date	Project Implementation Milestones
12/12/2011	Constitution of exploitation society (RIO ALTO)
10/04/2014	Constitution of exploitation society (ENERGIAS ABTAO)
25/08/2014	Contract between RIO ALTO and ENERGIAS ABTAO and Gamesa Chile SpAnto develop the wind farm
18/05/2015	Date in which *Project Developers* activate EPC contract with GAMESA
19/05/2015	Start date of activity of SPII
02/03/2017	Date for finishing the installation of aerogenerator
08/04/2017	Commissioning of the project
08/04/2017	Connection of the project to the grid
01/01/2021	Starting Date of Crediting Period

Table A3: Project Schedule related milestones.

[12] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

[13] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

[14] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link

Here, is also a table with the CDM process main milestones.

Note that the validation offer with the DOE was signed on 21/09/2015, but the registration process was stopped at the time of paying the fee. The PP has decided to restart the process and wants to finish the registration of the project in CDM.

Date	CDM Milestones
11/07/2012	The project is considered to be included in CDM, as explicitly mentioned in the Environmental Impact Study, Section "*General Background of the Project*", Objectives[15].
10/10/2013	The *Project Developers*,through *Transantartic Energía S.A.,* hired[16] *Soil Recovery* (which belongs to *GRUPO SOIL*) to analyze project feasibility to be included into the CDM. Once demonstrated, preliminarily, its feasibility and additionality, subsequent stages, as the elaboration of the present PDD, have been also developed by *Soil Recovery*.
23/10/2013	The *Project Developers* (through RIO ALTO S.A.) sent the Prior Consideration of the CDM to the UNFCCC and Chilean DNA[17].
31/10/2013	UNFCCC confirms reception of the CDM Prior Consideration and enables publicly available information about the project[18].
27/02/2014	The Chilean Ministry Of Environment (Chilean DNA) confirms reception of the CDM Prior Consideration[19]
21/09/2015	DOE was chosen and validation offer is signed[20]

Table A4: CDM process main milestones.

A.2. Location of project activity

>>

Chile

A.2.1. Region/State/Province etc.

>>

Región de Los Lagos (Xth), *Provincia de Chiloé*
Region of *Los Lagos* (10th), *Chiloé* Province

A.2.2. City/Town/ Commune etc.

>>

Mountain Range of *San Pedro*, Commune of *Dalcahue*.

A.2.3. Physical/Geographical location

>>

The SPII will be, as mentioned above, located in the commune of *Dalcahue*, north-west of *Castro*, *Chiloé* province, Region of *Los Lagos* (10^{h}). Specifically, is located on the plateau of the mountain

[15] Environmental Impact Declaration. Link

[16] Copy of the acceptation of the proposal between TAE (*Transantartic Energía, S.A.* and *Soil Recovery, S.L.*)

[17] Copy of the e-mail in which RIO ALTO sends the CDM Prior Consideration Form to the UNFCCC and the Chilean DNA

[18] Copy of the e-mail in which UNFCCC confirms reception of the CDM Prior Consideration

[19] Stamped copy of the CDM Prior Considerarion Form

[20] Validation Offer signed with AENOR.

range of *San Pedro*, approximately at 700 m.a.s.l., and approximately 22.6 km from the Atlantic Ocean.

The coordinates of the project are 42°16'36.18"S; 73°53'23.10"O (Latitude: -42.276716; Longitude -73.88975), data corresponding to the substation location of SPII.

The coordinates of the polygon which covers wind turbines in decimal coordinate points are as follows:

Polygon points	Decimal Coordinates		z Height (m.a.s.l)
	Latitude	Longitude	
V1	42.2887	73.9450	735
V2	42.2880	73.9451	733
V3	42.2843	73.9359	739
V4	42.2824	73.9361	755
V5	42.2771	73.9001	717
V6	42.2754	73.9001	722
V7	42.2754	73.8978	728
V8	42.2744	73.8978	727
V9	42.2744	73.9001	726
V10	42.2737	73.9001	728
V11	42.2700	73.9062	752
V12	42.2602	73.8889	704
V13	42.2663	73.8883	696
V14	42.2630	73.8830	668
V15	42.2725	73.8854	706
V16	42.2704	73.8808	694
V17	42.2805	73.8897	685
V18	42.2768	73.8982	724
V19	42.2840	73.8938	676
V20	42.2830	73.9224	750

Table A5.1 Coordinates of Project Polygon – Project Area.[21].

The coordinates of the aerogenerators in decimal points, placed inside the polygon described below are:

Polygon points	Decimal Coordinates	
	Latitude	Longitude
AEG1	42.288261	73.944195
AEG2	42.286700	73.939976
AEG3	42.284730	73.936297
AEG4	42.283753	73.928066
AEG5	42.282501	73.923285
AEG6	42.281271	73.918867
AEG7	42.280595	73.911226
AEG8	42.279900	73.904482
AEG9	42.281342	73.899837
AEG10	42.271409	73.898081
AEG11	42.268750	73.895011
AEG12	42.265698	73.892312
AEG13	42.262331	73.889656

Table A5.2 Coordinates of Project AEGs[22].

Below, location can be observed by the following figures:

[21] Decimal Point from UTM Coordinates (zone 18-G).

[22] Decimal Point from UTM Coordinates (zone 18-G).

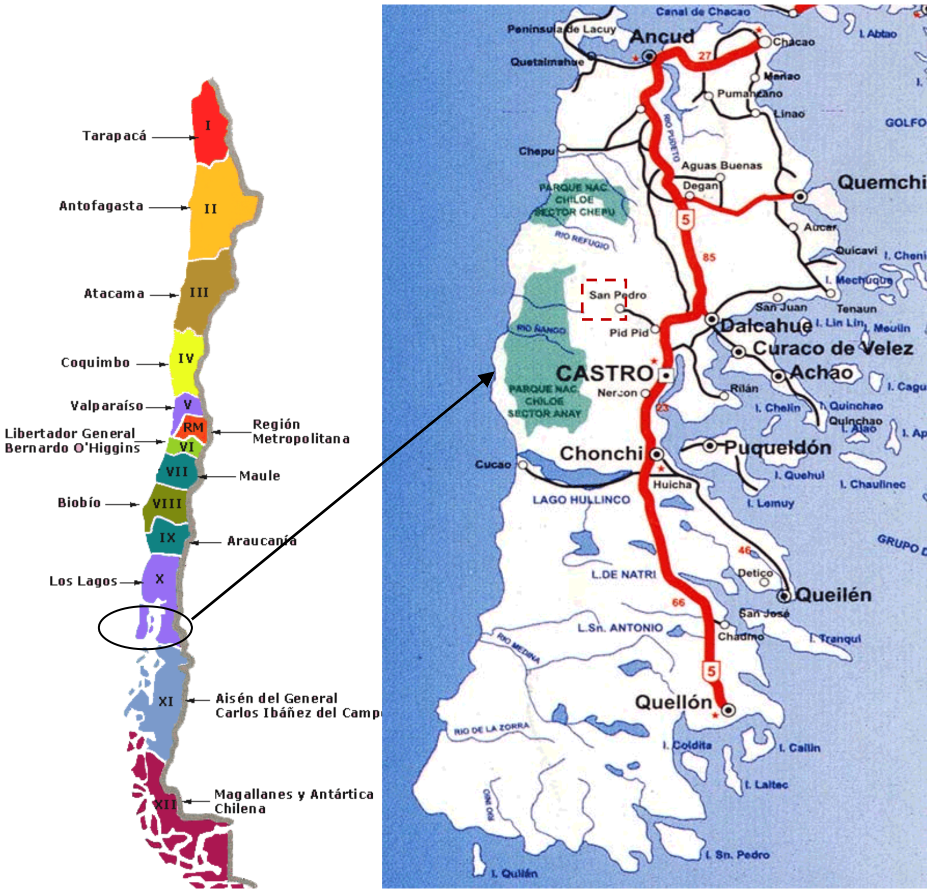

Figure A1. General Location. Chile

Figure A2. Specific Location. Aerogenerators

A.3. Technologies/measures

>>

The SPII is a large scale project of renewable energy, which consists in 13 positions where 13 *Gamesa G-128 5MW* wind turbines will be placed, according to previous undertaken studies.

These turbines have been selected for their high performance, their adaptation to the local wind conditions and their reliability.

The following table shows the main characteristics and variables of the project:

Item	Value	Magnitude
Total Power Capacity	65	MW
Turbine	IEC Clase IIA[23]	-
Rated Power per turbine	5.0	MW
Cut-in-cut-out wind	4.0-30.0	m/s
Design Nominal speed	11	m/s
Rotor diameter	128	m
Tower Height	95	m
Rated output Voltage	690	V
Equivalent annual operating hours	3,062	hours
Annual Production	199,057	MWh
Capacity Factor	34.96	%
Transmission Line Voltage	110 / 220	kV
Transmission Line Length	22.22	Km
Substation	30 / 110	kV/ kV

Table A6: Main characteristics of the project.

According to the technical characteristics of the AEG, could have a tower height of 81, 95, 120 or 140 meters. The elected model is which has 95 meters tower height.

The minimum expected operational lifetime for SPII is 21 years.

Since *Project Developers* business is the generation, but not electrical transmission, for its evacuation, the wind farm will connect to an evacuation power line that has been built specifically for this kind of purposes, and allows providing the evacuation service also to other wind farms.

Once constructed, final transmission line length is 22.22 km. That is a + 2.87% over the length established in transmission line EID. However, it was expected to have approximately +/- 10% over estimated final length of 21.6 km, once executed.

The evacuation power line was designed taking into account the potential energy generation capacity of the site, by defining two stages of operation; firstly energizing the line in 110 kV to evacuate about 100 MW and secondly, by achieving its greater capability, energizing it in 220 kV, making it able to evacuate up to 300 MW.

In this phase, the project must endure the cost of part of the line through the payment of a toll.

This situation could change in future new phases, when energizing the line up to 220 kV or with the addition of new energy infrastructures that could be evacuated by it.

The energy flow of the project can be summarized as follows:

[23] Standard *IEC 61400-1 Class IIA including A1* 3rd edition (2005), under Germanischer Lloyd (GL) Ed. 2010 regulations and Standard *IEC 61400-22 concerning the design.* Conformity Statement Number *DE-232701-A-0*.

Wind turbines have an internal transformer which will increase the output voltage from 0.69 kV up to 30 kV. Approximately 6.75 km internal connection path will be available between wind turbines and electrical substation, which correspond to a 30/110 kV transformer.

The underground canalization have cables for the evacuation of electrical energy, as well as optic fibers, which will be responsible for maintaining the communication between each wind turbine control system and the telecommand control system. Each wind turbine has an advanced monitored automated control to ensure the correct operation, anticipate or repair equipment failure and sometimes make interventions automatically. For these reasons, it provides a centralized control system with SCADA system for remote management via satellite link or another similar solution that allows knowing the status of the wind farm operation at any time.

Related to the measurement of electricity, summarizing what provided later (see *Section B.7.*), electricity generation of the SPII project activity will be determined by San Pedro substation metering equipment, which is the point of delivery of the electricity to the SEN.

Thereby, the delivery point (to the SEN) of the net electricity generated by the project will be the San Pedro Substation.

Metering equipment readings will be cross-checked with the invoice of sales and assessed by the SPII technical staff.

Related to the metering equipment into Substation, Main Meter or M_1 (as presented in *Figure B7.1*) acts as the main meter to measure energy output at the SPII.

The cross-check measurement for SPII M_1 will be done by Secondary Meter or M_2 (as presented in *Figure B7.1*).

In addition, another cross-check procedure can be done by the information coming out from SCADA control system or from each aero-generator. All of them will be attending to the grid-topology and potential electricity transmission losses.

The project has been designed in such a way that the information can be accessed in real time by all the relevant actors across the transaction of energy produced by the project activity (such SPII operators, *Project Developers*, or the grid operator CEN).

Related to the technical characteristics of the metering equipment placed inside SPII boundaries, are type bi-directional Class 0.2, and they meet the Technical Standards Safety and Quality of Service (NTSCS, or NTSyCS "*Norma Técnica de Seguridad y Calidad del Servicio*") which is the national relevant standard. The metering equipment carries out continuous and high precision measurements.

As specified above, for further considerations about monitoring tasks, see *Section B.7.*

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (host)	RIO ALTO SA (Project Participant, private entity)	No
Chile (host)	ENERGIAS ABTAO SA (Project Participant, private entity) [24]	No

A.5. Public funding of project activity

>>

There is no public funding from any Annex I Party for this project.

A.6. History of project activity

>>
The project participants of this project confirm that:
(a) The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);
(b) The proposed CDM project activity is not a project activity that has been deregistered.
On the other hand, the project participants declare:
(a) The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA;
(b) A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) does not exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

>>
According to the Methodological tool "*Assessment of debundling for small-scale project activities*" V04, debundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. Since a large scale methodology is used, this point is not applicable for this project.

[24] As previously specified, RIO ALTO SA is a Special Purpose Vehicle (SPV) developed under the laws of Chile, that has the following structure: Trans Antartic Energía II (73.88%), Jealsa Energía SL (23,58%) and Inversiones Buutalcura SA (2,54%). ENERGIAS ABTAO SA is, similarly to the previous case, a company 50:50 Trans Antartic Energia S.A and Inversiones Buutalcura SA. In addition Trans Antartic Energía II and Jealsa Energía SL belong 100% to Grupo Jealsa, and Inversiones Buutalcura SA belongs 100% to Grupo Baztan.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

>>
The following approved baseline and monitoring methodologies were applied to the project activity:

- Type Large Scale Consolidated Methodology (Reference ACM0002): "*Grid-connected electricity generation from renewable sources*" – for the power generation component using renewable energy and exports part of the same power to grid Version 20.0. approved in EB 105. Sectoral Scope: 01 (hereafter referred as "the Methodology").

  https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG
- Methodological tool "*Tool to calculate the emission factor for an electricity system*" Version 07.0 - for the calculation of emissions factor. Approved in the EB meeting 100.

  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
- Methodological tool "*Tool for the demonstration and assessment of additionality*" Version 07.0.0 – for the baseline scenario and to demonstrate additionality. Approved in EB 70. (hereafter referred as "the Tool").

  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf
- Methodological tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*" Version 03.0– for project emissions from electricity consumption. Approved in EB 96.

  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf
- Methodological tool "*Common Practice*" V 03.1 – for demonstrating additionality. Approved in EB 84.

  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf
- Methodological tool "*Investment analysis*" Version 10.0 – for the investment analysis of the additionality. Approved in EB 105.

  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v10.0.pdf

B.2. Applicability of methodologies and standardized baselines

>>

The consolidated baseline methodology ACM0002 is applicable due to the following reasons, including those referred to the established clauses of the methodology:

- General criteria for using of large scale methodology:

  Small scale project methodologies apply for an installed capacity less than 15 MW. SP II has an installed capacity equal to 65 MW so it is a project where large scale methodology is applicable.

- Criteria 1 "*This methodology is applicable to grid-connected renewable power generation project activities that (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing plant(s)/unit(s); or (d) involve a replacement of (an) existing plant(s)/unit(s)*"

  The SPII is a grid-connected renewable power generation project activity.

Meets Clause (a): the SPII activity consists in the installation of a wind power plant (Greenfield power plant) at a site where no renewable power plant was operated prior to the implementation of the project activity.

- Criteria 2 "*The methodology is applicable under the following conditions: The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit*".

  The project activity meets the criteria, as it is based on the installation of a power plant of the type: wind power.

- Criteria 3 "*In case of hydro power plants: one of the following conditions shall apply:*
  - *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or*
  - *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density calculated using equation (7), is greater than 4 W/m^2; or*
  - *The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m^2; or*
  - "*The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m^2, all of the following conditions shall apply":*
    - *The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m2;*
    - *Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;*
    - *Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: (…)"*

  The SPII is not an hydropower plant, so subsequent applicability conditions for hydropower plants, are not applicable to the project.

- Criteria 4 "*In the case of integrated hydro power projects, project proponent shall: (…)"*

- Criteria 5 "*The methodology is not applicable to*: *a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; b) Biomass fired power plants/units"*.

  The project activity does not involve switching from fossil fuels to renewable energy sources, and is not a biomass fired power plant, so the methodology is applicable.

- Criteria 6 "*In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance*"".

  The SPII is not a case of retrofit, rehabilitation, replacement or capacity addition, so this applicability condition does not concern the project.

- Criteria 7: "*In addition, the applicability conditions included in the tools referred to below apply*"

  Applicability conditions included in the tools that are to be used in this project, referred by the methodology, are discussed below.

The *"Tool to calculate the emission factor of an electricity system Version 07.0*" is applicable since the following applicability criteria are accomplished:

- Criteria 8 "*This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects)".*

  The tool may be applied because SPII supplies electricity to a grid.

- Criteria 9 "*In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in Annex I country*".

  The project electricity system is not located partially or totally in an *Annex I country*, so the tool is applicable.

- Criteria 10 "*Under this tool, the value applied to the CO_2 emission factor of biofuels is zero*".

  The project activity does not involve biofuels.

The "*Tool for the demonstration and assessment of additionality. Version 07.0.0*" is applicable since the following applicability criteria is accomplished:

- Criteria 11 "*Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory"*.

The project activity does include an approved methodology, ACM0002, that includes the additionally tool.

The "*Common practice. Version 03.1*" is applicable since the following applicability criteria are accomplished:

- Criteria 12 "*This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality. In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail"*.

This applies for SPII since methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" applies too.

The "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation. Version 03.0*" is applicable since the following applicability criteria are accomplished:

- Criteria 13 "*This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities"*.

This applies for SPII since electricity is supplied to the grid.

- Criteria 13 "*This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO2 emissions."*

This applies for SPII since electricity is supplied to the grid, not to the project activity.

The Methodological tool "*Investment analysis Version 10.0*". is applicable since the following applicability criteria are accomplished:

- Criteria 14 "*This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario."*

This applies for SPII since the methodological tool "*Tool for the demonstration and assessment of additionality*" applies to the project activity.

Finally, the following justifications are referred to the exclusion of tools that are mentioned in the methodology. If used, these tools have some applicability criteria that have to be accomplished. That means, applicability criteria of the excluded tools, are not applicable to the SPII since the tools are not used by the following reasons:

- Exclusion of: "*Combined tool to identify the baseline scenario and demonstrate additionality*" is not applied in the proposed project, since the project activity is not a retrofit or replacement of existing grid-connected renewable power plant/unit(s) at the project site. The use of some steps of this tool in the Methodology, is expected when such kind of project activities are involved.

- Exclusion of: "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*" is not applied in the proposed project, since no fossil fuel combustion is involved in the project activity.

- Exclusion of: *"Tool to determine the remaining lifetime of equipment"* is not applied, since there is no replacement, retrofit or upgrading of facilities and *Project Developers* have knowledge about equipment lifetime through manufacturer.

- Exclusion of: "*Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*" is not applied since there is no necessity to assess whether the current baseline is still valid for another crediting period, because the proposed project is in its initial phase, facing its first crediting period.

B.3. Project boundary, sources and greenhouse gases (GHGs)

>>

	Source	GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	The project will supply zero-emissions renewable energy to the grid.	CO_2	No	Excluded by simplification, as set out in ACM0002 Section 5.4
		CH_4	No	Excluded by simplification, as set out in ACM0002 Section 5.4
		N_2O	No	Excluded by simplification, as set out in ACM0002 Section 5.4

Table B1: Emissions sources included in, or excluded, from the project boundary

According to the ACM0002 *Section 5.1*, "*The spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to*". That means the project boundary must be considered as the entire electricity generation system in which SPII is going to introduce energy outputs, *i.e.* SEN system.

At the following figure, a simplified and schematic approach of the project boundary is presented:

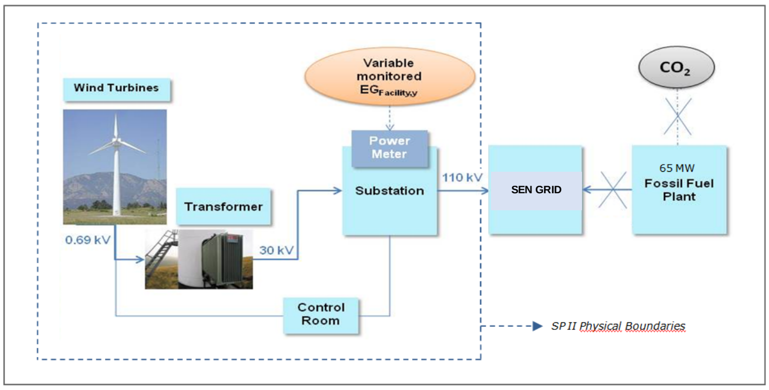

Figure B1. Schematic view of the project activity

B.4. Establishment and description of baseline scenario

>>

The project activity consists in the installation of a new grid-connected renewable power plant and it does not modify or retrofit an existing generation facility. Therefore, the baseline scenario is consistent with the Methodology:

Electricity delivered to the Chilean SEN grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (version 07.0).

As mentioned before, "the grid", or the relevant electrical system to the SPII boundary corresponds to the SEN, being one of the three systems in the country, that are not interconnected between each other. The SEN comprises Chilean regions from Arica and Parinacota (XV) to Los Lagos (X) and there are no electricity imports or exports of the SEN grid to other national grid.

Figure B2. Project System Boundary SEN. Source: Electricas CEN (April 2020) https://www.electricas.cl/educacion-en-energia/mapas-de-energia/

Although there is legislation of non-conventional renewable energy (NCRE) in Chile, and specifically to promote use of renewable energy since 2008 (see *Section B.5*), it has not contributed enough and the causes are essentially attributable to:

1) Promotion is not an active liquid that can be used as part of the funding.
2) The promotion does not relieve the projects of the need to use their energy or have some other mechanism of prices stabilization to obtain funding.
3) The volatility of energy price is a significant barrier when financially developing an ERNC project.
4) Although the promotion of specific ERNC laws, the slowness in processing environmental permits, the fact of the existing regulatory deficiencies with negative implications for new entry companies and the very limited access to finance due to the third point above, are making it difficult for the real promotion of renewable energies in Chile.

The mechanism has not a high enough value to make an attractive financing only based on this.

Further description of the system to improve understanding of the baseline scenario, and its relevant operation of grid-connected fossil fuel based power plants, is provided at *Section B.5, Step 4, Common Practice Analysis*.

B.5. Demonstration of additionality

>>

The table to use if the proposed project activity is a type of project activity which is deemed automatically additional, is not applicable, so it has been deleted of the content of this subsection. According to the *Tool*, to objectively demonstrate additionality of the project, several stages or "*Steps*" are proposed. As a summary of the procedure, the following steps should be performed:

- Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
- Step 1: Identification of alternatives to the project activity
- Step 2: Investment analysis
- Step 3: Barrier analysis
- Step 4: Common practice analysis

Note that some of these steps are not necessarily mandatory to develop the demonstration of additionality, since they will be optional depending on choices made in previous steps.

In this sense, for example, if analysis of investment option has been chosen, this means that, after completing Step 2, the analysis will continue directly to Step 4.

Before the beginning of the analysis, the following concepts have to be established:

- The applicable geographical area is the system, as explained when analyzing tool applicability criteria at *Section B.2*, since it is an independent electrical system, not connected with any other in Chile or in neighbor countries. The system is also the main electrical system of the country (see *Step 4* at this section).
- The SPII expects a renewable electrical generation that will reduce greenhouse gas emissions (hereinafter GHG) in Chile, specifically into the system. Such reduction occurs by displacement of fossil fuel based technologies (which currently operate in the system) by implementing renewable energy generation.

Note that the analysis takes into consideration the data that was applicable when the project started the registration process.

<u>Step 0: Demonstration whether the proposed project activity is the first-of-its-kind</u>

The Expansion San Pedro Wind Farm project activity does not correspond to a first-of-its-kind project, therefore, *Step 1* has to be completed.

<u>Step 1: Identification of alternatives to the project activity consistent with current laws and regulations</u>

Realistic alternatives have to be defined based on several sub-steps proposed in the *Tool*.

Note that, according to *paragraph 8* of the *Tool* (*Section 2.1*), projects applying ACM0002 Methodology (as is the case), only have to identify at least one credible alternative that could be more attractive than the project activity.

Sub-Step 1.a. Define alternatives to the project activity.

The project activity consists in the installation of a new grid-connected renewable power plant; wind farm; for clean energy generation that will be exported to SEN's grid for its consumption.

The alternative would be as follows:

- The proposed project activity is undertaken without being registered as a CDM project activity, *i.e.* a wind farm with an installed capacity of 65 MW with an annual estimated production of 199,057 MWh, developed without the CERs incentive.

Taking into account the following conditions, it is evident that the wind farm cannot be easily developed without CERs incentive, due to both technical and economic obstacles:

- Some significant barriers and disadvantages to the ERNC generation in Chile.

  These are, mainly, citizen opposition to the construction of new transmission infrastructures (limits the transmission capacity of the project and increases its risks), slowness in processing environmental permits, regulatory deficiencies with negative implications for new entry companies, very limited access to finance due to the high volatility of energy prices, difficulties in processing permits and handling them for network connections.

  Such barriers are reflected in the Report of the Advisory Commission of Electricity Development (CADE, by its acronym in Spanish) of Chile, published in November 2011[25].

- The inexistence of similar scale wind farms into the system carried out without CERs incentive (see *Step 4* at this section).

Sub-Step 1.b. Consistency with mandatory laws and regulations.

This section should assess, for the mentioned alternative (undertake the project activity not taking into account CERs incentive), its compliance with mandatory regulations and applicable laws.

In this sense, it is considered that, being SPII in line with laws and other mandatory regulations, it can be implemented without CERs incentive while remaining consistent with the regulatory framework.

The applicable regulatory framework currently affecting SPII is as follows:

- Law 19,300, March 9, 1994, that *"Approves Law about general environmental rules"*.

  (Ley 19.300, de 9 de Marzo de 1994, que "*Aprueba Ley sobre bases generales del medioambiente"*).

- Decree No.327, September 10, 1998, that "*Sets the Regulations of the General Law of Electrical Services*".
  (Decreto nº 327, de 10 de Septiembre de 1998, que "*Fija el Reglamento de la Ley General de Servicios Eléctricos"*).

- Law 19,940, March 13, 2004, that *"Regulate Electric Power transport systems, establishes a new tariff system for medium power systems and introduces the adjustments that instructs the General Law of Electrical Services"*.
  (Ley 19.940, de 13 de Marzo de 2004, que "*Regula Sistemas de transporte de Energía Eléctrica, establece un nuevo régimen de tarifas para sistemas eléctricos medianos e introduce las adecuaciones que indica a la Ley General de Servicios Eléctricos"*).

- Decree No.99, May 12, 2005, that "*Sets distribution tolls applicable to transportation service that public distribution service dealerships provide, as it states*".
  (Decreto nº 99, de 12 de Mayo de 2005, *"Que fija peajes de distribución aplicables al servicio de transporte que presten los concesionarios de servicio público de distribución que señala"*).

- Law 20,018, May 19, 2005, that "*Modifies Electrical Sector Regulatory Framework".*
  (Ley 20.018, de 19 de Mayo de 2005, que *"Modifica el Marco Normativo del Sector Eléctrico"*).

[25] Advisory Commission of Electricity Development (CADE)

- Decree No.188, July 23, 2005, that "*Modifies, as it states, Decree nº 99, 2005, which sets distribution tolls applicable to transportation service that public distribution service dealerships provide, as it states".*
(Decreto nº 188, de 23 de Julio de 2005, *"Que modifica, en lo que indica, el Decreto nº 99, de 2005, que fija peajes de distribución aplicables al servicio de transporte que presten los concesionarios de servicio público de distribución que señala"*).

- Decree No.244, January 17, 2006, that "*Approves regulation to unconventional generation means and small generation means, as established in the General Law of Electrical Services"*.
(Decreto nº 244, de 17 de Enero de 2006, que "*Aprueba el Reglamento para medios de generación no convencionales y pequeños medios de generación establecidos en la Ley General de Servicios Eléctricos"*).

- Supreme Decree No.62, June 16, 2006, *"Approves regulation for power transfer between generation companies as established in the General Law of Electrical Services"*.
(Decreto Supremo N°62, de 16 de Junio de 2006, "*Aprueba reglamento de transferencias de potencia entre empresas generadoras establecidas en la Ley General de Servicios Eléctricos*").

- Decree-Law No.4/20,018, February 5, 2007, that "*Sets consolidated text, coordinated and systematized text of Decree-Law n º 1, about mining, 1982, General Law of Electrical Services, regarding Electric Power"*.
(Decreto con Fuerza de Ley nº 4/20.018, de 5 de febrero de 2007, que "*Fija texto refundido, coordinado y sistematizado del Decreto con Fuerza de Ley nº 1, de minería, de 1982, Ley General de Servicios Eléctricos, en materia de Energía Eléctrica"*).

- Supreme Decree No.44, May 2, 2007, that "*Modifies Decree nº 62, 2006, which approves regulation for power transfer between generation companies as established in the General Law of Electrical Services"*.
(Decreto Supremo N° 44, de 2 de Marzo de 2007, que "*Modifica Decreto Nº 62, de 2006, que Aprueba el Reglamento de Transferencias de Potencia entre Empresas Generadoras establecidas en la Ley General de Servicios Eléctricos"*).

- Exempt Resolution No.24, May 25, 2007, that *"Delivers Connection and Operation Technical Standard of small generation means distributed in medium voltage".*
(Resolución nº 24 Exenta, de 25 de Mayo de 2007, *"Dicta Norma Técnica de Conexión y Operación de Pequeños Medios de Generación Distribuidos en Media Tensión*").

- Law 20,220, September 14, 2007, that "*Refine the existing legal framework in order to protect the security of supply to regulated customers and sufficiency of electrical systems"*.
Ley 20.220, de 14 de Septiembre de 2007, que "*Perfecciona el marco legal vigente con el objeto de resguardar la seguridad del suministro a los clientes regulados y la suficiencia de los sistemas eléctricos"*.

- Decree No.26, February 26, 2008, that "*Enacts measures to avoid, reduce, and manage generation deficit in the Central Interconnected System, pursuant to the Article 163º of the General Law of Electrical Services"*.
(Decreto nº 26, de 26 de Febrero de 2008, que "*Decreta medidas para evitar, reducir, y administrar déficit de generación en el Sistema Interconectado Central, en ejecución del Artículo 163º de la Ley General de Servicios Eléctricos"*).

- Law 20,257, April 1, 2008, that *"Introduces modifications to the General Law of Electrical Services regarding to the electrical energy generation by non conventional renewable energy sources"*.
(Ley 20.257, de 1 de Abril de 2008, que "*Introduce modificaciones a la Ley General de Servicios Eléctricos respecto de la generación de energía eléctrica con fuentes de Energías Renovables No Convencionales"*).

- Exempt Resolution No.329, June 14, 2013, that *"Modifies and approves the consolidated text of the Connection and Operation Technical Standard of small generation means distributed in medium voltage "*.
(Resolución nº 329 Exenta, de 14 de Junio de 2013, que *"Modifica y aprueba el texto refundido de Norma Técnica de Conexión y Operación de Pequeños Medios de Generación Distribuidos en Media Tensión*").

- Decree No.40, August 12, 2013, that *"Approves Environmental Impact Assessment system regulation"*.
(Decreto 40, de 12 de Agosto de 2013, que "*Aprueba Reglamento del Sistema de Evaluación de Impacto Ambiental"*).

- Law 20,698, October 22, 2013, that *"Promotes the expansion of the electrical matrix, by non conventional renewable sources"*.
(Ley 20.698, de 22 de Octubre de 2013, que "*Propicia la ampliación de la matriz energética, mediante fuentes renovables no convencionales"*).

- Technical Standard for Safety and Quality of Service (NTSCS, by its acronym in Spanish), May 2005, and its respective modifications (*R.M. Exta. No.40, May 16, 2005; R.M. Exta. No.85, October 7, 2009; R.M. Exta. No.68, March 10, 2010*).
(Norma Técnica de Seguridad y Calidad de Servicio (NTSCS), de Mayo de 2005, y sus respectivas modificaciones: *R.M. Exta. nº 40 de 16 de Mayo de 2005*; *R.M. Exta. nº 85 de 7 de Octubre de 2009; R.M. Exta. nº 68 de 10 de Marzo de 2010*).

- Decree 29, March 3, 2014, that "*Approves bidding regulations for the provision of annual blocks of energy from non-conventional renewable energy generation means*". (Decreto 29, de 3 de marzo de 2014, que "*Aprueba reglamento de licitaciones para la provisión de bloques anuales de energía provenientes de medios de generación de energía renovable no convencional*").

- Decree 31, March 16, 2017, that "Approves regulations for the determination and payment of compensation for unavailability of electricity supply". (Decreto 31, de 16 de marzo de 2017, que Aprueba reglamento para la determinación y pago de las compensaciones por indisponibilidad de suministro eléctrico).

The first alternative consists on the proposed project activity undertaken without the CDM. From the Chilean regulation point of view, this is the same as the proposed project in its present CDM state, which has already proven compliance with all national regulations.

<u>Step 2. Investment Analysis.</u>

The purpose of this step is to show that the proposed project activity is economically and financially less attractive than at least one other alternative, previously identified in Step 1, without the revenues incoming from the sale of certified emission reductions (CER).

In this Step, it is intended to determine whether the project activity is not:

- The most economically or financially attractive; or

- Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

To develop such analysis, it is necessary to use, complementarily to the Methodological tool "*Investment analysis*" Version 10.0 and the "*Tool for the demonstration and assessment of additionality*" Version 07.0.0. The last tool refers to the "*Guidelines on the assessment of investment analysis v.10"* (hereinafter, the *Guideline*).

Following, some mandatory steps are presented to develop the investment analysis.

Sub-Step 2.a. Determine appropriate analysis method.

These are the three methods proposed by the Tool, from which the most appropriate must be chosen:

- *Option I: Simple Cost Analysis*
- *Option II: Investment Comparison Analysis*
- *Option III: Benchmark Analysis*

Option I is determined by the condition that the project does not generate benefits (financial or economic) apart of those related to the CER sales. As the project generates economic benefits by selling electricity, this option is not applicable.

Between *Option II* and *Option III*, the *Guideline* is used in order to decide which of the two proposed options is appropriate for the project. According to the *Guideline*, if the baseline (the system and the elements that compose it) on which the project will settle leaves no other alternative to supply the same product or service, *Option II* shall be used. Since the baseline scenario provides the ability to obtain renewable energy by other sources, additionally of wind provenance, the *Option III "Benchmark Analysis"* is chosen as the most appropriate option to develop the investment analysis.

Sub-Step 2.b. Apply benchmark analysis.

Project IRR, or *Internal Rate of Return*, has been identified as the most suitable economical/financial indicator to the case, since the project will be considered as financially attractive when this IRR is better than the *Benchmark IRR*.

The type of Project IRR selected to be used is going to be the *post-tax* IRR, since it includes all input and output cash flows.

Following the *Tool*, the selected parameter derives from: "*Government/official approved benchmark where such benchmarks are used for investment decisions*".

The Project IRR post-tax derives from Decree-Law No.4/20,018, February 5, 2007, that "*Sets consolidated text, coordinated and systematized text of Decree-Law n º 1, about mining, 1982, General Law of Electrical Services, regarding Electric Power"* (Decreto con Fuerza de Ley nº 4/20.018, de 5 de febrero de 2007, que "*Fija texto refundido, coordinado y sistematizado del Decreto con Fuerza de Ley nº 1, de minería, de 1982, Ley General de Servicios Eléctricos, en materia de Energía Eléctrica"*, in Spanish).

In its *Article 174*, establishes that, for valuation of activities in transmission and generation of electricity the discount rate shall be 10% in real terms. This should be seen as an opportunity cost, and it is defined for common activities of transmission and power generation with traditional technologies. However, it represents a general benchmark for the sector, although it is only a lower limit for NCRE as wind.

While the *Guideline* allows considering higher values, due to the reasons exposed above and, in a conservative way, the selected *Benchmark IRR* for the investment analysis will be: 10%.

Sub-Step 2.c. Calculation and comparison of financial indicators.

The project's cash flow analysis, developed by the *Project Developers*, is based on confidential information and its details have only been made available to the DOE and the UNFCCC, when required.

The cash flow is based upon the following assumptions:

- As instructed in the *Guideline*, input values are valid and applicable, considering the latest information available at the time of the investment decision[26].

- SPII will provide an annual generation of 199,057 MWh, obtained using a 34.96% plant load factor[27].

- Project life has been set at 21 years. Certified equipment lifetime is 20 years[28]; however, 21 years is assumed due to favorable weather conditions in Chile and is also considered as a valid and consistent hypothesis by the turbine manufacturer. This is conservative, since using a smaller number of years would reduce the IRR[29].

- According to the *Clean Development Mechanism Standard (CDM-EB65-A05-STAN)*, national and/or sectoral policies and circumstances shall be taken into account when establishing the baseline scenario, in some cases described in its *Section 7.2.5.*

  Particularly, only policies or regulations that have been implemented before the adoption of the Kyoto Protocol by the Conference of the Parties (COP, 11 December 1997), or before the adoption by the COP of the Decision 17/CP.7 (11 November, 2001), depending on the policy type, have to be taken into account when establishing a baseline scenario.

  In the specific case of Chile, the relevant Chilean law is Law 20,257, April 1, 2008, that *"Introduces modifications to the General Law of Electrical Services regarding to the electrical energy generation by non conventional renewable energy sources"*.

  It is intended to encourage the development of Non Conventional Renewable Energies (NCRE). In the context of the proposed project activity: each electricity company that conducts energy withdrawals from electricity systems that have an installed capacity exceeding 200 megawatts to commercialize with distributors or end-customers, whether or not subject to price regulation, is subject to an obligation, enforced by the respective CEN Tolls Directorate, that requires that 10% of its annual energy withdrawal has been injected into any such system by means of NCRE generation owned by the company or contracted to a third party[30].

  As per that established in CDM Standard, these policies have been excluded in SPII related calculations.

The project investment analysis, on a 21-year Project basis, provides these results:

[26] This is also applicable to the rest of the assumptions involved in the analysis.

[27] Based on information presented in document: *"Evaluación de Recursos Eólicos Parque Eólico San Pedro 2 (Chile). Enero 2014. Barlovento"*

[28] As stated in Certificate: Standard *IEC 61400-1 Class IIA including A1* 3rd edition (2005), under Germanischer Lloyd (GL) Ed. 2010 regulations and Standard *IEC 61400-22 concerning the design.* Conformity Statement Number *DE-232701-A-0.*

[29] This statement is valid because net cash flows from year 20 onwards are strictly positive (this can be verified in the financial model provided to the DOE)

[30] Ley 20.257

Investment Analysis Assumptions	Input Value	Unit	Evidence
Electricity Generation	199,057	MWh/yr	As evidenced by Wind Study ("Evaluación de Recursos Eólicos Parque Eólico San Pedro 2 (Chile). Enero 2014. Barlovento")
Average Sales Price	80.0	US$/MWh	Value is such that maximizes the expected return on the project and is established based on reports such as: Average Cost of the Energy of Long Term in the SIC, realized by Systep in April, 2010; "*Fijación de precios de nudo, Abril de 2012, Sistema Interconectado Central (SIC). Informe Técnico Definitivo*"; or "*Corpbanca - Santander - Grupo Jealsa - Trans Antartic Proyección de mercado para parque eólico San Pedro II - Resultados Sensibilidad WTI*" among others.
Annual Income	15,924,560	US$/year	Business Case / Financial information
Total Investment	111,901,500	US$	As described in financial information supplied to the DOE and UNFCCC. Furthermore, as established in GAMESA's offer to the *Project Developers*, plus other development expenses, the total investment is already assessed and the results, as shown beside.
Average Annual Operational Costs [31]	28	US$/MWh	8.33 U$/MWh for operation and maintenance by GAMESA, and 20 US$ /MWh from the company own experience for other costs such as local taxes, insurances or administrative costs.
Load factor	34.96	%	Load factor was based on P-50 estimate. [32] (199,057/8760/65 MW) = 34.96%
Project duration	21	years	
Income taxes	25	%	As defined by the national tax requirements [33]
IRR without CERs sales	5.73	%	Business Case
IRR with CERs sales	5.84	%	Business Case

Table B2: Financial Characteristics of the Project Activity

The Project IRR post-tax of the project activity without the CER income (5.73 %) is below the selected benchmark (10.0%).

This indicates that the project activity by itself is not economic or financially attractive. Moreover, if the project activity obtains the condition of "registered" and therefore CDM incentives, the project IRR with CER obtains a positive increasing impact (5.84%), which is still below the benchmark value (10.0 %).

Therefore, the economical benefits that the *Project Developers* obtains from the registry of the activity project as CDM, involve a substantial incentive for the project implementation and would give feasibility to it. This would also contribute to sustainable development in a real way in Chile.

Results of the performed analysis can be summarized as follows:

IRR (%)	
Without CERs sales	5.73
With CERs sales	5.84

[31] Average Annual Operational Costs includes: O&M costs, insurances, administration, taxes, contingences, tolls, etc.

[32] From Wind Study *("Evaluación de Recursos Eólicos Parque Eólico San Pedro 2 (Chile). Enero 2014. Barlovento").*

[33] As defined in Law 20768, September 29, 2014, *"Tax Reform to amend the system of taxation of incomes and introduce different settings in the tax system"*.

Benchmark IRR	10.0

Table B3: Table Summary of Financial Analysis of Project activity

The CER income was considered for 21 years of project duration because a CDM renewable credit period of 7 years was selected.

Sub-Step 2.d. Sensitivity analysis

For the proposed project, the following financial parameters are taken as uncertain factors for sensitive analysis of financial attractiveness:

- Project Investment. (Static total investment)
- Operational and Maintenance Costs (O&M Cost)
- Annual supplied electricity (Generation)
- Energy Sale Price / Revenues (Spot price)

When the above financial indicators fluctuate within a ±10% range, the IRR of the proposed project (without CDM incomes) varies to different extents as shown in *Table B4* and *Figure B3*:

Parameter	-10%	-5%	0	+5%	+10%
Static total investment	6,83%	6,26%	5,73%	5,24%	4,78%
O&M Cost	6,27%	6,00%	5,73%	5,45%	5,17%
Annual supplied electricity	4,68%	5,21%	5,73%	6,23%	6,72%
Energy Sale Price / Revenues	4,10%	4,93%	5,73%	6,50%	7,25%

Table B4: Sensitivity Analysis

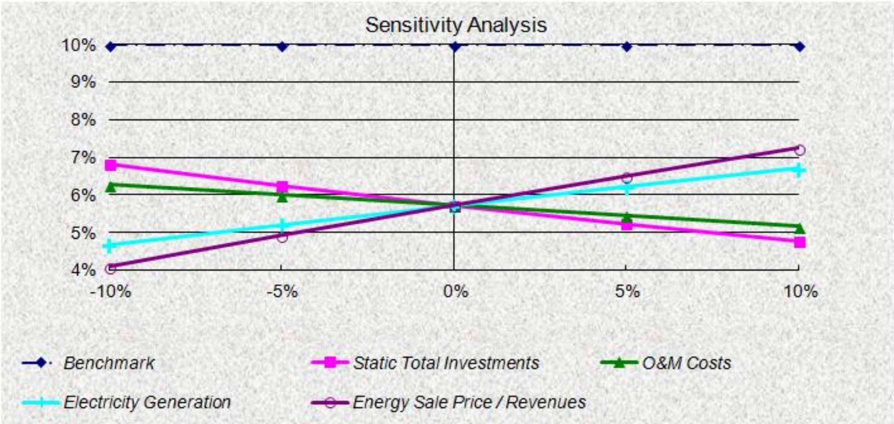

Figure B3: Sensitivity Analysis.

Investment: Project investments costs represent the most significant project expenses and include the costs of wind turbines and their respective control systems and also the costs of installation and commissioning (approximately 65% of the investment). Also represent the costs of concepts such as: civil and electrical works (the rest 35%).

A major variation of -27.9% in total costs of investment, could reach the benchmark as determined in the sensitivity analysis.

However, the investments required for project implementation were agreed by the parties in a contractual arrangement and are essentially based on turbines market prices.

The only concepts that today are not completely closed, and whose prices could vary (although are unlikely to change), do not represent even the 3% of the total investment, so variations in those concepts are completely unlikely to have an -27.9% influence at total investment costs.

This mayor variation, in conclusion, is not going to be observed in the project activity, so it could be considered not possible to reach benchmark with investment costs variations, due to the reasons presented.

O&M Cost: These costs have less influence in the project profitability than the necessary investments. In order to considerably improve project IRR, the reduction of O&M Cost would have to be substantial (a drop of 71.0% to reach 10.00% IRR). Moreover, this variation is not considered reasonable as it represents a strong modification in estimated operating costs, based in the received technology proposal, which is valid and applicable to calculate O&M costs today.

In conclusion, variations in O&M costs that could represent ±10% of the considered values are unlikely to occur, and considering 71.0% costs drop is not possible, so it can be concluded that O&M sensitivity is minimum or negligible.

Annual supplied electricity: project expected electricity supply, is based in, at least, 46 months of in-situ wind measures, meteorological statistical data and site conditions, plus wind resource quantification at project site[34].

The wind resource available at project site can be considered quite stable based on meteorological data and wind studies results. Those studies, including others that are based on the same area but for another wind farm, and that have been executed at different dates, all show a minimum variation in wind conditions. In addition, they consider long-term wind variations to get results so, wide range variations are not expected at project site.

The values considered to calculate project IRR, in terms of electricity generation, are based in the most conservative calculations of possible wind resource present at the site. As known, to calculate long term electricity generation in a wind farm, two values are used: P90 and P50 which represent the probable generation value and the favourable one, respectively.

Sensitivity analysis, show that with a +10% positive variation in electricity generation during the entire project expected life, benchmark is not going to be reached (limit in +38.5% to reach 10% benchmark value).

However, in this case, the favorable generation value (P50) is used in IRR calculations to account electricity generation, which means that the generation value is going to be, generally, smaller than the considered one.

This means that, considered model is conservative enough to assure that in real terms, probability of occurrence of a benchmark overpassing due to a +38.5% positive variation in electricity generation is not possible to occur, based on the reasons given above.

Energy Sale Price / Revenues: Project revenues can be impacted by variations in the amount of energy produced by SPII or in the price of energy obtained from sales in the Chilean Spot Market.

As explained above, the estimated production is based in almost four years of in-situ wind measurement, and therefore the estimation is consistent enough. The main variations can come from the energy selling price, pretending also act in the spot market. Amount of energy produced has been previously analyzed above.

[34] From Wind Study *("Evaluación de Recursos Eólicos Parque Eólico San Pedro 2 (Chile). Enero 2014. Barlovento")*

Sensitivity analysis shows that with a major variation of +25.1% in energy sale price, benchmark reaches 10%.

The considered energy sale price (80 USD/MWh) maximizes project expected profitability, and has been established based on most optimistic energy sales prospects about higher prices on energy in the future.

On a more realistic scenario, such an increase of energy prices has to be considered unlikely to occur, according to available information about market trends.

This value has been previously considered as project profitability maximized value by the grid agents for another wind farm in the area and also is common to see it considered in other registered projects in Chile nowadays.

Based on official information[35], energy costs are higher than desirable in Chile, especially when taking into account surrounding countries. The Committee considers necessary to establish a series of measures to reduce this costs, plus others, to bring sustainability to the electrical system. These measures probably would impact on the analyzed parameter sensitivity, making it unlikely to increase to the necessary level to reach benchmark.

Information from the National Energy Commission of Chile (CNE)[36] expect a general lowering of selling prices of energy around 6%, and a nominal variation of 1% in medium price of the grid can just be observed for the immediate months prior to the report publication.

Those values, therefore, are the official ones, and have to be noted that there are no official forecasts referring larger periods, so those used here, are the reference to compare used sale prices, with actual or expected ones.

Considering all of these data, is consistent enough to establish that the energy sale prices model used to calculate project IRR, assures a maximum profitability, and that a positive variation of +25.1% that affects project revenues during the entire life of the project, is unlikely to occur, which means that the project is not going to be financially attractive in any case without CERs.

<u>Step 4. Common practice analysis.</u>

Note that, as commented above, only the analysis of investment option has been chosen, so the additionality analysis can continue by following directly Step 4.

Before continuing with the Sub Step 4.a., a description of the applicable geographical area is presented below. The selected applicable geographical area is the SIC System.
Even if the *Tool* establishes that the *"applicable geographical area should be the entire host country"*, but also establishes that: *If the project participants opt to limit the applicable geographical area to a specific geographical area (such as province, region, etc.) within the host country, then they shall provide justification on the essential distinction between the identified specific geographical area and the rest of the host country".*

The justification of the election of the SIC System as the applicable geographical area is, basically, that the SIC was the grid applicable to the project when it was registered, and that the SIC is not interconnected with the others two electrical systems in Chile. Explanation of this could be observed below.

---

[35] *"Informe de la Comisión Asesora para el Desarrollo Eléctrico, Noviembre de 2011"* see Link

[36] *"Fijación de precios de nudo, Abril de 2012, Sistema Interconectado Central (SIC). Informe Técnico Definitivo"* see Link

SIC system is part of a set of four energy systems in Chile. No one is connected together. Their characteristics when the project was registered, according to the National Energy Commission of Chile are:

SING *(Sistema Interconectado del Norte Grande) - Regiones XV, I y II* (Regions XV, I and II)

Has an installed capacity of 4,600.1 MW (25.10% of total electrical installed capacity of the country).

Figure B4. Chilean Electric Systems

Generation infrastructures are predominantly thermoelectric, consisting in a 99.72% coal-fired power plants, fuel, diesel and natural gas combined cycles. There are only two hydroelectric units, representing only 0.28% of the total installed capacity.

SIC *(Sistema Interconectado Central) - Regiones III - X* (Regions III to X)

It is the largest in the country and serves energy to more than 90% of the population of Chile.

SIC installed capacity reaches 13,585.4 MW (74.12% of the total installed capacity in Chile) and a supply coverage that reaches about 92.22% of the population.

Generation infrastructures are composed by a 43.57% reservoir and pass hydroelectric plants; 54.99% coal, fuel, diesel and natural gas combined cycle power plants; and 1.44% wind farms.

SEA *(Sistema Eléctrico de Aysén) - Región XI*. (Region XI)

Its installed capacity reaches 41 MW (0.22% of the total installed capacity in Chile). Formed by thermoelectric power plants in a 52.2%, 42.93% hydroelectric and 4.88% wind farms.

SAM *(Sistema de Magallanes) - Región XII* (Region XII)

Has an installed capacity of 101.6 MW (100% thermoelectric power plants). It is constituted by three electric subsystems: *Punta Arenas, Puerto Natales* and *Puerto Porvenir.*

Only analyzing presented data about the electrical systems, can be observed that the use of the wind resource is not a common practice, assuming that correspond to a 1.08% of total installed capacity, and a 1.44% of total SIC generation capacity.

Focusing into the SIC system, can be clearly observed that there is a trend toward proliferation of thermoelectric power plants, with a low share of wind farms facilities, which support the hypothesis that it is not a common practice into the SIC system.

During 2012, last year with available official data when the registration process began, SIC system registered the following increases in its installed capacity:

Generation facility type	New installed capacity *(MW)*	Source
Hydroelectric	79,2	*"2003-2012 Estadísticas de Operación CDEC-SIC". Data from 31 December 2012*
Thermoelectric	789,9	
Eolic	0,0	

Table B5: New SIC installed capacity

Including additional information corresponding to the PMGD (*Distributed Small Generation Facilities or Pequeños Medios de Generación Distribuida*, in Spanish), summarizing, during 2012, 870.2 MW were added to the SIC system of which only 119.9 MW correspond with NCRE and no one to wind farms.

Furthermore, in terms of forecasts of generation plants that are planned to open in late 2012, the following table sets the expected installed capacity:

Generation facility type	**Expected installed capacity** *(MW)*	**Source**
Hydroelectric	20,4	*"2003-2012 Estadísticas de Operación CEN-SIC". Data from 31 December 2012*
Thermoelectric	318,5	
Eolic	0	

Table B6: SIC expected installed capacity

In the following table (and figure) can be observed, in line with that commented above, that the increase in the installed capacity that has been occurred in Chile in the last ten years, is based, principally, in the implementation of thermoelectric power plants.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total [MW]	**6.996,2**	**7.867,4**	**8.259,8**	**8.273,6**	**9.450,3**	**9.910,7**	**11.404,1**	**12.147,1**	**12.715,2**	**13.585,4**
Térmico	2.940,9	3.172,1	3.565,0	3.575,0	4.221,4	4.596,3	5.999,4	6.625,7	6.679,5	7.470,6
	42,0%	40,3%	43,2%	43,2%	44,7%	46,4%	52,6%	54,5%	52,5%	55,0%
Hidráulico	4.055,3	4.695,3	4.694,8	4.698,6	5.210,7	5.296,2	5.322,9	5.355,6	5.839,9	5.919,0
	58,0%	59,7%	56,8%	56,8%	55,1%	53,4%	46,7%	44,1%	45,9%	43,6%
Eólico	0,0	0,0	0,0	0,0	18,2	18,2	81,8	165,8	195,8	195,8
	0,0%	0,0%	0,0%	0,0%	0,4%	0,2%	0,7%	1,4%	1,5%	1,4%

Table B7: SIC new installed capacity 2003 – 2012

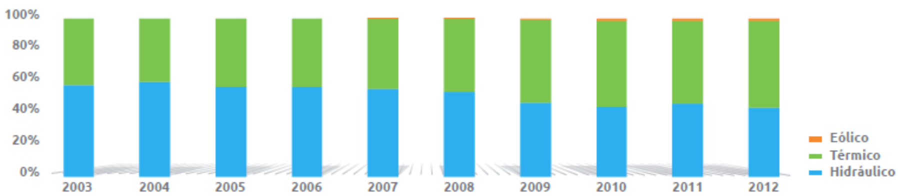

Figure B5. Chilean SIC new installed capacity 2003-2012

From the figure, that shows the increase in installed capacity between 2003 and 2012 (94%), can be observed that most of it corresponds to the installation of power plants (254% more power in 2012 than in base year, 2003).

In the following figure it can also be observed how the wind based represents a small contribution to electricity generation, with no relative growth rate indicating a possible trend of common practice.

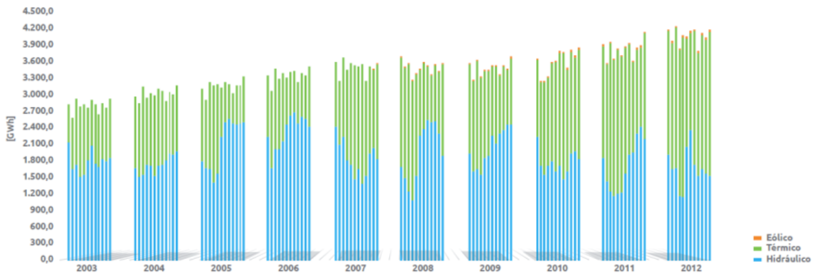

Figure B6. SIC generation from 2003 to 2012

Electric generation in Chile is growing continuously in order to satisfy demand, being growth from 33,708.1 GWh of gross generation in 2003 to 48,972.9 GWh in 2012, what indicates an increase in generation of a 45.3%. As has been shown, to satisfy the exigencies in electric demand, installed

capacity has been increased in a 94%. Note that the increase in installed capacity is higher than the increase in demand.

Distribución por Tipo de Aportes (%)				
AÑOS	Hidráulica	Térmica	Eólica	Solar
2003	63,80	36,20	0,00	0,00
2004	57,50	42,50	0,00	0,00
2005	66,98	33,02	0,00	0,00
2006	69,57	30,43	0,00	0,00
2007	52,86	47,13	0,01	0,00
2008	56,26	43,66	0,07	0,00
2009	58,65	41,19	0,16	0,00
2010	49,30	49,95	0,75	0,00
2011	44,56	54,73	0,71	0,00
2012	41,02	58,18	0,79	0,01

Table B8: SIC distribution between 2003 and 2012

In line with what has just been commented above, note that the hydroelectric contribution to the total installed capacity has decreased in the period 2003-2012 (although they have increased the installed capacity), mainly due to the occurrence of drought periods, which has been basically supplied with thermal generation, whose capacity is 60% coal-fired and oil, leading to a high rate of generation of greenhouse gases.

Moreover, note that, even without discounting those wind power CDM projects mentioned previously, the wind farms energy generation is less than 1% of total generation in the year with higher wind based energy supply, while hydraulic and thermal generation correspond with a 41.02% and 58.18 % in the same year, respectively.

Can be concluded that, as noted, electricity demand has doubled every 10 years, and it can be said also that, while efforts have been dedicated to increase hydroelectric generation installed capacity o the percentage contribution of thermal generation has been sensitive increased gradually.

Around the year 2012, when the ratio of hydroelectric generation reaches its lowest point in the last 10 years, the contribution of thermal energy source reaches its maximum for that period.

The SPII project might help to invert this trend, since it would allow substituting the generation by fossil fuels power plants.

Sub Step 4.a.The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above.

The project activity applies the following measure: Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy).

In consequence, the Methodological Tool on Common Practice v.03.1 shall be applied.

__Common Practice Step 1. Applicable capacity.__

Below, table 1 shows the calculations of the applicable capacity of the proposed project.

Table 1: Applicable capacity of the project			
Project	**Design Capacity** *(MW)*	**Applicable Capacity** *(MW)*	
		+50%	**-50%**
Exp. San Pedro Windfarm	65.00	97.50	32.50

Common Practice Step 2. Similar projects.

Below, table 2 shows the identification of similar projects that fulfill the conditions of the Methodological Tool on Common Practice.

Table 2: List of Similar Projects			
Project	**Design Capacity** *(MW)*	**Commercial Op. Date** *(before 19/11/15)*	
Canela 1	18.20	27/12/2007	***Not Similar*** *(1)*
Cristoro	3.54	14/02/2009	***Not Similar*** *(1)*
Parque Eólico Monte Redondo	48.00	07/12/2009	
Totoral	46.00	08/12/2009	
Canela 2	60.00	11/12/2009	
Central Wind Punta Colorada	20.00	04/09/2011	***Not Similar*** *(1)*
Ucuquer	7.20	03/01/2013	***Not Similar*** *(1)*
Parque Talinay Oriente	90.00	05/03/2013	

Source of similar projects: "Catastro Medios de Generación ERNC. CDEC-SIC, Chile"

Note 1: projects Design Capacity is not between Applicable Capacity of the Project

Common Practice Step 3. N_{all}.

Below, an update of table 2 shows the identification of similar projects and those which fulfill the conditions expressed in the description of Step 3.

Table 2: List of Similar Projects			
Project	**Design Capacity** *(MW)*	**Commercial Op. Date** *(before 19/11/15)*	
Canela 1	18.20	27/12/2007	***Not Similar*** *(1)*
Cristoro	3.54	14/02/2009	***Not Similar*** *(1)*
Parque Eólico Monte Redondo	48.00	07/12/2009	***CDM Registered*** *(2)*
Totoral	46.00	08/12/2009	***CDM Registered*** *(2)*
Canela 2	60.00	11/12/2009	***CDM Registered*** *(2)*
Central Wind Punta Colorada	20.00	04/09/2011	***Not Similar*** *(1)*
Ucuquer	7.20	03/01/2013	***Not Similar*** *(1)*
Parque Talinay Oriente	90.00	05/03/2013	***CDM Registered*** *(2)*

Source of similar projects: "Catastro Medios de Generación ERNC. CDEC-SIC, Chile"

Note 1: projects Design Capacity is not between Applicable Capacity of the Project

Note 2: information available at CDM UNFCCC webpage

As a result of the application of Step 3, the parameter N_{all} results on a value equal to zero.

Common Practice Step 4. N_{diff}.

As the measure applied to the project is the one expressed at the beginning of the Sub Step 4.a. (Switch of technology), the clause c) of the Step 2. is also applicable (the selection of the similar projects take into account those ones that use the same energy source as the proposed project

activity), and, finally, the Step 3. results on an unavailability of remaining similar projects, no project using different technologies within the similar projects identified in Step 3. can be chosen.

As a result of the application of Step 4, the parameter N_{diff} results on a value equal to zero.

Common Practice Step 5. Factor F.

Below, table 3 shows the results of the applicable calculations done from Steps 1 to 4 and the calculation of Factor F (which is equal to 1 – (N_{all} / N_{diff})).

Table 3: N_{all} / N_{diff}			
N_{all}	**N_{diff}**	**F**	**N_{all} - N_{diff}**
0.00	0.00	*undefined*	0.00

Common Practice Conclusions.

Below, table 4 shows the results of the stepwise approach to determine de additionality of the project using the Common Practice tool.

Table 4: Conclusions	
F > 0.2	**NO**
Nall - Ndiff > 3	**NO**
¿Common Practice?	**NO**

So, as a result of the application of the Methodological Tool on Common Practice v.03.1, it can be established that the proposed project is not a Common Practice.

Outcome of the Step 4.

The SPII project would allow substituting the generation by fossil fuels power plants, so it is considered as an output from this analysis, like a non common practice project.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

>>
As it has been mentioned previously, the project activity has been analyzed using the "Methodology ACM0002 v.20.0" (referred as "*the Methodology*") and the "Tool to calculate the emission factor for an electricity system v.07" (referred as "*the Tool*").

To calculate emission reductions, the next methodological process has been followed:

According to the methodology, emission reductions are calculated under the following equation:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
PE_y	=	Project emissions in year *y* (t CO_2e/yr)

Equation B1

As project emissions are not identified by the methodology, in case of a wind farm, the simplified *Equation B1* remains as shown in *Equation B2*:

$$ER_y = BE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)

Equation B2

Then, it is necessary to identify Baseline Emissions (BE_y).

The baseline scenario represents the electricity that would have otherwise been generated by the operation of the grid-connected power plants and by the addition of new generation sources.

The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (t CO_2/MWh)

Equation B3

To calculate $EG_{PJ,y}$ it is necessary to distinguish between the type of project activity. As SPII is a Greenfield Plant (see *Section B2*) the following equation applies:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Equation B4

Therefore, as the quantity of net electricity generation supplied by the project plant to the grid in year *y* is 199,057 MWh/yr:

$EG_{PJ,y}$ = 199,057

Related to the leakage, according to the Methodology, "*No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected."*.

To calculate de Emission Factor for the electricity system, which will yield the total equivalent CO_2 emission reduction for the whole crediting period, the "*Tool to calculate the emission factor of an electricity system*" Version 07.0 (EB 100) is going to be used.

At last, with the emission factor ($EF_{Grid,CM,y}$) it is going to be possible to calculate the Baseline Scenario Emissions (BE_y).

The steps for calculate the emission factor, are the following ones:

Step 1. Identify the relevant electricity systems;
Step 2. Choose whether to include off-grid power plants in the project electricity system (optional);
Step 3. Select a method to determine the operating margin (OM);
Step 4. Calculate the operating margin emission factor according to the selected method;
Step 5. Calculate the build margin (BM) emission factor;
Step 6. Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity systems

For determining the electricity emission factors, the project participants shall identify the relevant project electricity system. Project participants may delineate the project electricity system using any of the following options:
(a) Option 1. A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;
(b) Option 2. A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);
(c) Option 3. A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

In the case of the SPII, the project will supply electricity to the Chilean SEN[37] (*Sistema Energético Nacional* – National Electric System); therefore, system is defined by the Option 2 "*the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity",* the CEN. According to the to the information provided by the dispatch centre (CEN), no electricity imports have been produced. Even if there were no imports, for the purpose of determining the OM, the assumed emission factor for net electricity imports will be 0 tCO2/MWh. Moreover, electricity exports to other grids are not subtracted from electricity generation data in baseline calculation.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional).

Option I is chosen to calculate the operating margin and build margin emission factor because there is no off-grid power plant to be included in the project electricity system.

[37] SEN Sistema Energético Nacional.

Step 3. Select a method to determine the operating margin (OM)

The Tool establishes that the calculation of the operating margin emission factor $EF_{grid,OM,y}$ is based on one of the following methods:

(a) Simple OM; or
(b) Simple Adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The method used to calculate $EF_{grid,OM,y}$ is going to be the Simple OM (Option a) method.

As per criteria established in the "*Tool to calculate the emission factor of an electricity system*", the simple OM method can only be used if any one of the following requirements is satisfied:

(a) Low-cost/must-run resources constitute less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, and the average of the five most recent years shall be determined by using one of the approaches described below; or 2) based on long-term averages for hydroelectricity production (minimum time frame of 15 years).
(b) The average amount of load (MW) supplied by low-cost/must-run resources in a grid in the most recent three year is less than the average of the lowest annual system loads (LASL) in the grid of the same three years.

To use this method, the (a) requirement is analyzed. Low-cost/must-run resources must constitute less than 50% of total grid generation in an average of the five most recent years.

Average of five most recent years calculation method is as shown in the next equation (selected from the *Tool*):

$$\text{Share}_{LCMR} = \text{average}\left[\frac{EG_{LCMR_{y-4}}}{total_{y-4}}, \ldots, \frac{EG_{LCMR_y}}{total_y}\right]$$

Where:

Share_{LCMR}	=	Share of the low cost/must run resources (%)
EG_{LCMR_y}	=	Electricity generation supplied to the project electricity system by the low cost/must run resources in year y (MWh)
$total_y$	=	Total electricity generation supplied to the project electricity system in year y (MWh)
Y	=	The most recent year for which data is available

Equation B5

As stated before, the SEN is the applicable system for this project. When the registration process began in 2015, the SIC was not interconnected to the SING, so the SEN did not exist at that time. To make sure that the SIC also fulfilled to the conditions to apply for the Simple OM Method, an analysis for both systems is available in the Table B9.

As shown in the next table, the analysis of the real operation in the five most recent years with available official data[38] result in a contribution lower than 50% of low-cost/must-run resources grid generation (in average) for both systems.

[38] Annual Real Operation from CEN webpage

Year	2015	2016	2017	2018	2019	Average
Low cost/must run SEN	38.99%	34.10%	38.47%	45.52%	43.99%	40.2%

Table B9: SEN generation distribution the last five years

As can be observed above, the average percentages of low-cost/must-run of both systems fulfill one of the conditions to apply the Simple OM Method.

Regarding the different options to use the data vintages, the *ex ante* option was used for data record. Ex ante option has been chosen because it is expected that the OM will not have a wide range of variation during the first crediting period.

In order to calculate the emission factor, a weighted average for the generation values over a 3 year period were used based on the most recent data available (2017, 2018 and 2019) at the time of submission of the CDM-PDD to the DOE for validation.

Step 4. Calculate the operating margin emission factor according to the selected method.

To calculate the OM emission factor, there are two options from which Option A has been chosen, as there is information about specific generation per plant unit. Thus, the necessary data to conduct the OM emission factor calculations is available.

The following equation applies:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Equation B6

Where:

$EF_{grid,OM\ simple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

m = All grid power units serving the grid in year *y* except low-cost/must-run power units

y = The relevant year as per the data vintage chosen

The parameter $EG_{m,y}$ is determined as per the provision in the monitoring tables.

The following equations are used to calculate $EF_{EL,m,y}$ according to Option A1 of the simple OM method.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Equation B7

Where:

$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type *i* consumed by power unit *m* in the year *y* (Mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type *i* in the year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in the year *y* (tCO_2/GJ)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power plant *m* in the year y (MWh). For grid power plants, it was determined as per the provisions in the monitoring tables.
m	= All power units serving the grid in year *y* except low-cost/must-run power units
i	= All fossil fuel types combusted in power unit *m* in year *y*
y	= The relevant year.

To determine the fuel types being consumed in the system and their amount ($FC_{i,y}$), official sources of information as the Chilean National Energy Commission [39](*CNE, Comisión Nacional de Energía*) has been used. The Chilean National Energy Commission indirectly depends on the Chilean Energy Ministry.

In order to obtain parameters as $NCV_{i,y}$ and $EF_{CO2,i,y}$, these have been obtained from the official Chilean Energy Balance [40]or using conversion factors as established into the IPCC methodologies [41].

The net electricity generated and delivered to the grid by all power plants in SEN, has been calculated using the same raw data employed to determine the contribution of the low-cost/must-run power plants to the system[42] (see *Table B9*). Note that, as established into *Equation B5*, the parameter EG_y does not include generation provided by low-cost/must-run power plants/units.

As have been mentioned in *Step 3*, the *ex ante* option has been chosen to use the data vintage. Since this option has been chosen, the emission factor has been calculated through a weighted average for the generation values over the 3 year period were data is available. These years are 2017, 2018 and 2019.
Results of the calculation of the OM emission factor can be observed in Appendix 4 (Table A4.1 – year 2019; Table A4.2 – year 2018; Table A4.3 – year 2017; Table A4.4 – Results of Simple OM).

---

[39] See *"Consumos de combustible SEN"*

[40] 2018 Chilean Energy Balance. http://energiaabierta.cl/visualizaciones/balance-de-energia/

[41] Approachs to convert energy units and to calculate emissions that have been proposed by the IPCC in "*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1*" http://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/vol2.html

[42] Annual Real Operation from CEN webpage

Once the emission factor has been calculated by the Simple OM method ($EF_{grid,OMsimple,y}$), the next step is to calculate the Build Margin.

Step 5. Calculate the build margin (BM) emission factor.

In terms of vintage of data, the Option 1 has been chosen to calculate the BM emission factor (*ex ante* option).

This option sets that for the first crediting period, the build margin emission factor has to be based on the most recent information available on units already built for a sample group named *m* at the time of CDM-PDD submission to the DOE for validation (it is expected that the BM will not have a substantial range of variation during the first crediting period).

According to the specifications of the methodology, the data record chosen is 2019.

For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE and, for the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Note that this option does not require monitoring of the build margin emission factor during the crediting period.

The sample group of power units *m* used to calculate the build margin is determined as per the following procedure, consistent with the data vintage selected above:

(a) *Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);*

To determine this set of five power units, and exclude those registered as CDM, a list of those plants that latest enter in operation in the system during the last year with available information (Oct. 2019-Dic.2019) a list of those plants becomes latest to enter operation in the system during the last year with available data has been done. It can be observed in Appendix 4 - Table A4.5.

According to the Appendix 4 - Table A4.6: $AEG_{SET\text{-}5\text{-}units}$ = 8,213 MWh

(b) *Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh);*

According to the Appendix 4 - Table A4.7: $AEG_{SET\geq 20\%}$ = 13,935,190 MWh

(c) *From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}).*

$AEG_{SET\geq 20\%}$ has been selected to calculate BM because it comprises the larger annual electricity generation (when comparing it to $AEG_{SET\text{-}5\text{-}units}$).

The sample group of power units *m* used to calculate the build margin consists on the set of new power plants or power capacity additions in the electricity system that have been built most recently and that comprise ≥20% of the system generation (in MWh and without taking into account

CDM Registered projects); in particular, the set of plants includes 20.12% of the annual electricity generation in 2019.

The identified grid-connected power units of the system that have been built most recently and that shape the build margin (BM) emission factor are listed in the Appendix 4 - Table A4.8.

The power units, up to date of BM calculation year, registered as CDM project activities, which have been excluded from the set, are 54 in total.

According to the "*Tool to calculate the emission factor of an electricity system*", the build margin emission factor (BM) is calculated by the following equation:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (t CO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (t CO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

Equation B7

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in Step 4 section 6.4.1 for the simple OM, using options A.1. or A.2.. (if appropriate) for year 2019, and including in the *m* set of power plants those included in the BM calculation. Results and option used for each power plant in the *m* set can be observed in the Appendix 4 - Table A4.9. Results for the final $EF_{EL,m,y}$ can be observed in the Appendix 4 - Table A4.10.

Step 6. Calculate the combined margin emissions factor.

The combined margin emission factor (CM) is based on one of the following:

(a) Weighted Average CM; or
(b) Simplified CM

The (a) option (Weighted average CM) should be used as the preferred option, and those conditions required to use (b) option do not occur, so (a) option is the chosen method to calculate de CM.

Using the weighted average CM, the emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (t CO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year *y* (t CO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (per cent)
w_{BM}	=	Weighting of build margin emissions factor (per cent)

Equation B8

As the project is a wind power generation project activity, the default values for w_{OM} and w_{BM} are:

- w_{OM} = 0.75

- w_{BM} = 0.25

These values are applicable for the first and subsequent crediting periods.

Results of the calculation of $EF_{Grid,CM,iy}$ can be observed in Appendix 4 – Table A4.11

B.6.2. Data and parameters fixed ex ante

>>

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
Source of data	CNE
Value(s) applied	Values in Appendix 4 - Table A4.12
Choice of data or Measurement methods and procedures	Values have been adopted from the national official data from the CNE for period 2015-2019 which represent the most recent and reliable information available
Purpose of data	Calculation of the participation of the "Low cost/must run" power plants in the last five years (2015-2019). Calculation of Operating Margin and Build Margin
Additional comment	No additional comments.

Table B9: Parameter $EG_{m,y}$ fixed ex ante

Data / Parameter	$FC_{i,y}$
Unit	Mass or volume units (See Appendix 4 - Table A4.1 - Table A4.2 - Table A4.3)
Description	Amount of fuel type *i* consumed by the project electricity system in year *y*
Source of data	Chilean National Energy Commission (CNE, Chile)
Value(s) applied	Values in Appendix 4 - Table A4.1 - Table A4.2 - Table A4.3
Choice of data or Measurement methods and procedures	Values have been adopted from the National Energy Commission of Chile, a governmental institution, from recent publications (2014)
Purpose of data	To determine Fuel Consumption in the system, to calculate $EF_{grid,OMsimple,y}$ for years 2017, 2018 and 2019
Additional comment	As can be observed in Appendix 4 - Table A4.9, there are some power plants without data about fuel type or fuel consumption quantity

Table B10: Parameter $FC_{i,y}$ fixed ex ante

Data / Parameter	*$NCV_{i,y}$*
Unit	GJ/Mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	Chilean National Energy Balance 2018 ("*Balance Nacional de Energía 2018. Comisión Nacional de Energía, División de Prospectiva y Política Energética del Ministerio de Energía. Ministerio de Energía de Chile, 2019*")
Value(s) applied	Values in Appendix 4 - Table A4.13
Choice of data or Measurement methods and procedures	Values have been adopted as they refer to national official data (CNE and the IPCC 2006 method to convert from GCV to NCV). The CNE Energy Balance Report includes Gross Calorific Values (GCV) for the different types of fuel. These values were corrected to Net Calorific Values (NCV) based on the IPCC 2006 assumptions. Net Calorific Value has been calculated as established by IPCC, following the next criteria: "*The difference between NCV and GCV is the latent heat of vaporisation of the water produced during combustion of the fuel. As a consequence for coal and oil, the NCV is about 5 percent less than the GCV For most forms of natural and manufactured gas, the NCV is about 10 percent less*". That means, from National or official values for GCV, NCV has been obtained applying a correction factor of 0.95 for solid or liquid fuels and a correction factor of 0.90 for gas type fuels. That approach have been proposed by the IPCC in "*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1*"
Purpose of data	To calculate emission factors for the different type of fuels used to generate electricity in the system
Additional comment	No additional comments

Table B11: Parameter $NCV_{i,y}$ fixed ex ante

Data / Parameter	*$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$*
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Values in Appendix 4 - Table A4.13
Choice of data or Measurement methods and procedures	Unit-converted from values showed in: *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1, Table 1.4* (lower limit of the 95% confidence intervals)
Purpose of data	To calculate emission factors for the different type of fuels used to generate electricity in the system
Additional comment	No additional comments

Table B12: Parameters $EF_{CO2,I,y}$ and $EF_{CO2,m,i,y}$ fixed ex ante

Data / Parameter	$\eta_{m,y}$
Unit	- *(ratio)*
Description	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data	"Tool to calculate the emission factor for an electricity system" Version 07.0 Appendix 1
Value(s) applied	Values applied in results shown in Appendix 4 - Table A4.14
Choice of data or Measurement methods and procedures	Default values for the "Tool to calculate the emission factor for an electricity system" Version 07.0. Appendix 1. Default values for efficiency factors for power plants
Purpose of data	When for a power unit *m* only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit
Additional comment	No additional comments

Table B13: Parameter $\eta_{m,y}$ fixed ex ante

Data / Parameter	$EF_{grid, CM, y}$
Unit	tCO_2 / MWh
Description	Combined margin CO_2 emission factor of the grid connected power generation in year *y*
Source of data	Calculations based on parameters described above and that described in *Section B.6.1.*
Value(s) applied	0.5990
Choice of data or Measurement methods and procedures	Calculated using the "*Tool to calculate the emission factor for an electricity system*" version 07.0.
Purpose of data	Determine the system emission factor
Additional comment	No additional comments

Table B14: Parameter $EF_{grid, CM, y}$ fixed ex ante

B.6.3. Ex ante calculation of emission reductions

>>

As specified above in *Section B.6.1.*, *Equation B1*, the emission reductions of the project are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

BE_y = Baseline emissions in year *y* (t CO_2/yr)

PE_y = Project emissions in year *y* (t CO_2e/yr)

Equation B8

As project emissions are not identified by the methodology, in case of a wind farm, the simplified *Equation B8* remains as shown in *Equation B9*:

$$ER_y = BE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)

Equation B9

As specified previously, the baseline scenario represents the electricity that would have otherwise been generated by the operation of the grid-connected power plants and by the addition of new generation sources.

The equation to calculate baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Equation B10

$EG_{PJ,y}$ and $EF_{grid,CM,y}$ have been calculated in *Section B.6.1*. Results of these calculations are the following ones:

- $EG_{PJ,y}$ = 199,057 MWh/yr
- $EF_{grid,CM,y}$ = 0.5990 tCO_2 / MWh [43]

Taking these results into account, the parameter $\boldsymbol{BE_y}$ is equal to **119,235 tCO_2/yr**.

Project emissions

According to the Methodology, the GHG emission of the proposal project within the project boundary is zero, i.e.:

$PE_y = 0$

Leakage

According to the Methodology, the leakage of the proposed project is not considered.

Project emissions reductions

Applying *Equation B8*, then $\boldsymbol{ER_y}$ = 119,235 – 0 = **119,235 tCO_2/yr**

The proposed project activity is expected to achieve the quantity of 834,645 tCO_2e of net emission reductions during the first 7-year crediting period.

[43] Rounded down to four decimals in a conservative manner

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 2021	119,235	0	0	119,235
Year 2022	119,235	0	0	119,235
Year 2023	119,235	0	0	119,235
Year 2024	119,235	0	0	119,235
Year 2025	119,235	0	0	119,235
Year 2026	119,235	0	0	119,235
Year 2027	119,235	0	0	119,235
Total	834,645	0	0	834,645
Total number of crediting years	7			
Annual average over the crediting period	119,235	0	0	119,235

Table B15: Summary of ex ante estimates of emission reductions

Note that the annual average over the crediting period is rounded to a lower value without decimals, in a conservative manner, when dividing the total amount of emission reductions over the crediting period by the total number of crediting years.

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
Source of data	Electricity meter of the project installed in the interconnection point (San Pedro Substation)
Value(s) applied	199,057
Measurement methods and procedures	Net electricity supplied by the project activity to the grid. The metering equipment complies with laws and regulations and will be properly calibrated by independent provider. Calculated from energy exported by the project to the grid and energy imported by the project from the grid, directly obtained from the metering equipment. Double check by receipt of sales.
Monitoring frequency	Continuously measurement and monthly recording

QA/QC procedures	Readings of electricity meters, located at substation, will be continuously measured and monthly recorded by SPII technical staff. Data recorded will be archived for 2 years following the end of the last crediting period, by means of electronic and paper backup. The metering equipment consists of two meters (1 main, 1 backup, both 0.2s accuracy) located on the onsite substation, To guarantee QA/QC, it will be double checked by receipts of electricity sales. Related to the metering equipment into Substation, Main Meter or M_1 (as presented in *Figure B7.1*) acts as the main meter to measure energy produced by the project activity. The cross-check measurement for SPII M_1 will be done by Secondary Meter or M_2 (as presented in *Figure B.7*). In addition, another cross-check procedure can be done by the information coming out from SCADA control system or from each aero-generator. All of them will be attending to the grid-topology and potential electricity transmission losses. Meters inside SPII have to be certified at the moment of placement. Meters are going to be calibrated with a 3 years frequency in a conservative manner, under conditions presented by national relevant standard rules (see *Section B.7.3*). Metering equipment inside SPII will also be subjected to regular maintenance and testing in accordance with the stipulation of the document "*Norma Técnica de Seguridad y Calidad del Servicio, anexo técnico Sistema de Medidas para transferencias económicas"* (National Standard, supervised by the National Electrical Coordinator of Chile).
Purpose of data	Calculation of baseline emissions
Additional comment	No additional comments

Table B16: Monitored Parameter $EG_{facility,y}$

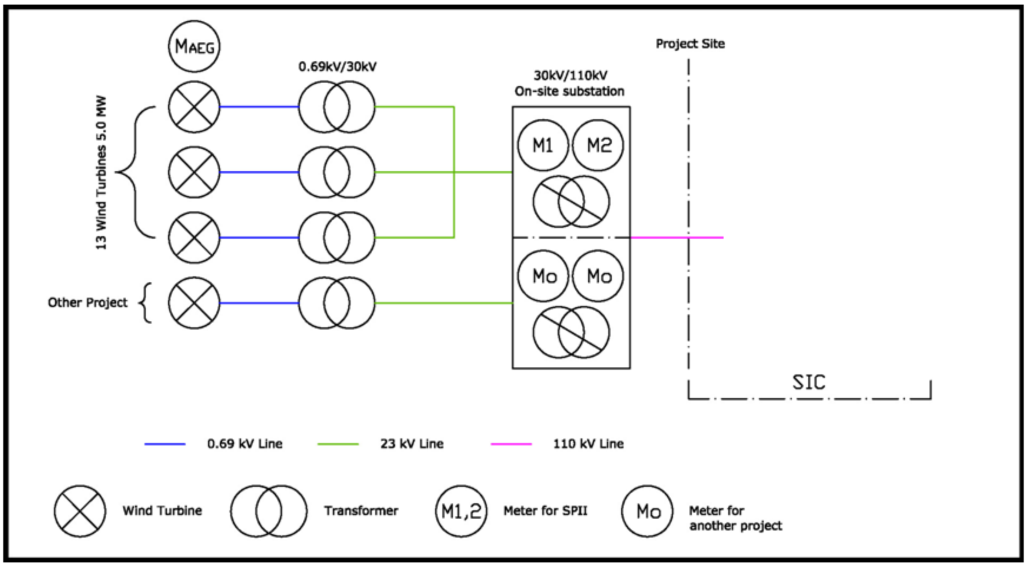

Figure B7.1. Measurement equipment placement

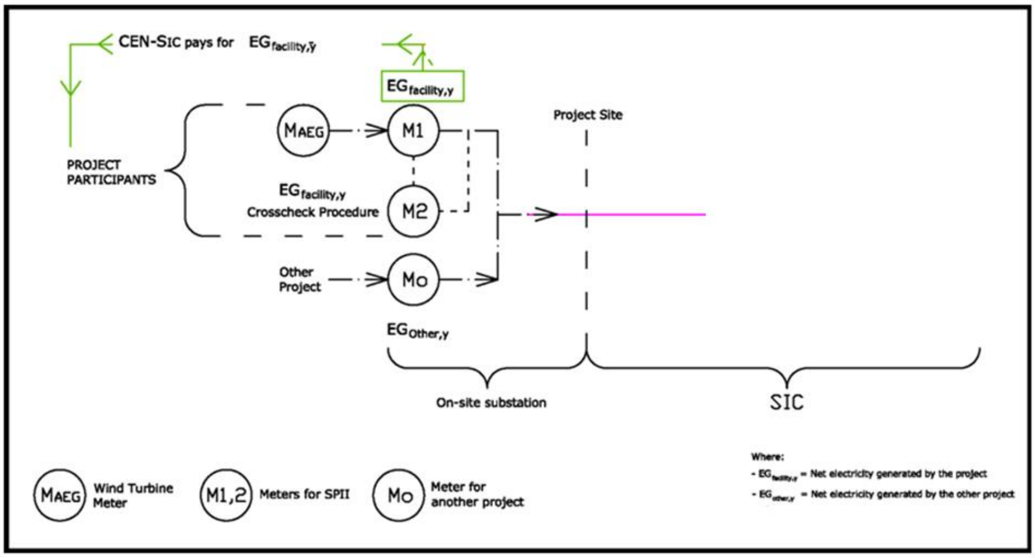

Figure B7.2. $EG_{facility,y}$ determination and payment flowchart

B.7.2. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

>>

Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emissions reduction for the proposed project are monitored and reported.

The monitoring plan to be applied is based on the net electricity determination, which is delivered to the system.

The CEN is an organism created with the purpose of coordinating the operation of the electricity generation facilities located on the transmission system, among others functions. The CEN is the responsible for verifying and quantifying (to pay for) the net electricity imported to the system from the generation units.

So, in terms of quantification of the net electricity generated by SPII and injected to the system, measurements accepted, corrected with transmission losses and endorsed by CEN are the most reliable and official, and this results on the invoices for which SPII will be paid for.

Monitoring organization and responsibilities.

Prior to the start of the crediting period, the organization of the monitoring team has been established. The project activity contemplates the designation of a proper staff to perform all the CDM monitoring tasks and *Project Developers* will be implicated someway in all the activities

involved in the monitoring procedures, including the training process of the new staff, making sure trained staff perform the monitoring duties, coordinating all functions with the project operator and the overall control of the monitoring procedures.

Within the company, clear roles and responsibilities will be planned for all staff involved in the CDM project and all the institutions included like SAESA, CEN and GAMESA, and a CDM focal point will be nominated.

For proper monitoring, staff has to be designated, so as the tasks to be carried out. The Organization for the monitoring plan can be observed in the following diagram:

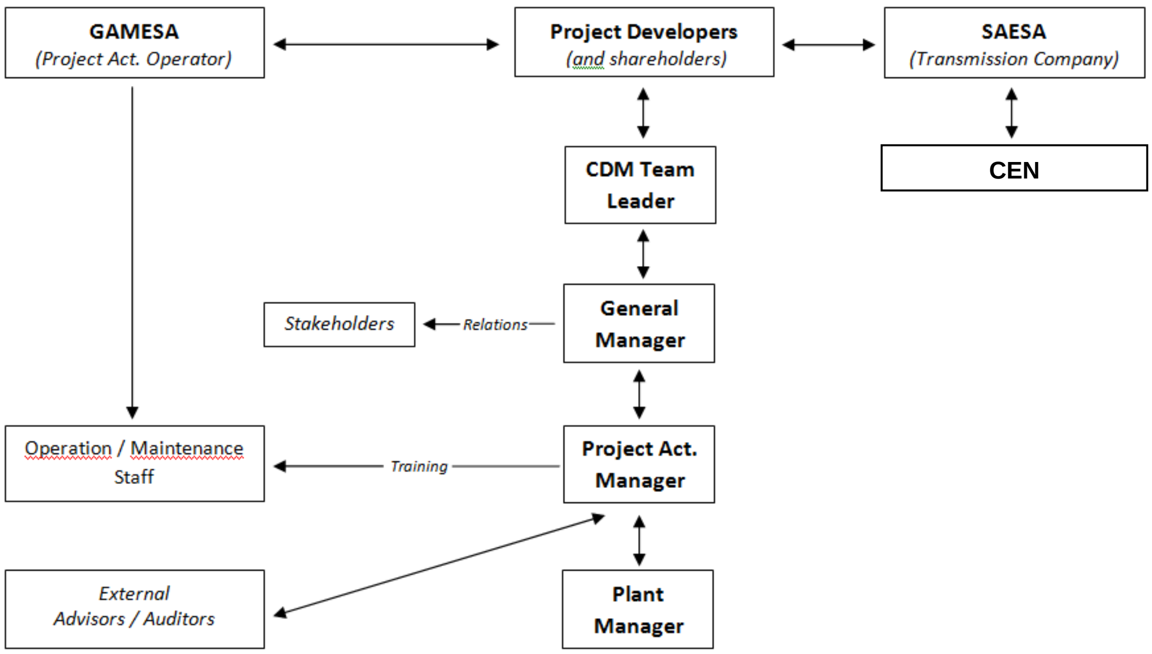

Figure B8. Organization of the monitoring plan

Previous to perform monitoring tasks, the staff will receive the adequate training for collection and recording of the corresponding data. CDM monitoring staff need to know and comprehend about the adequate sites and systems incorporated for data collection and record keeping, the correct steps to collect the data and to check it, before its final records, follow quality control and quality assurance arrangements, be in knowledge of the internal audits schedule and the equipment maintenance procedures, and how to proceed in cases of equipment failure and/or equipment replacement.

Responsibilities on the monitoring tasks:

- SPII equipment maintenance and calibration: the project activity manager, who belongs to the *Project Developers* (or one of its shareholders) human team, will be responsible for coordinate and be in knowledge of the maintenance and calibration of the equipment.

  Main characteristics (type, model and calibration documentation) of the monitoring equipment will be retained in the quality control system. The metering equipment will be maintained through time in accordance with the manufacturer specifications and other applicable standards or normative.

  Related to the calibration process and frequency, note that the metering equipment placed inside air generators (M_{AEG} in *Figure B7.1*) or also those meters placed at San Pedro

Substation (M_1 and M_2, inside Project Site, see *Figure B7.1*), must be calibrated by producer before installation accomplishing national standard rules: *NTSyCS "Norma Técnica de Seguridad y Calidad del Servicio, Comisión Nacional de Energía"* and "*NSEG 3 E.n71, Normas Técnicas sobre Medidores, Ministerio de Economía (Technical Standards for Measurment devices, Economy Ministry)*".

Once placed at their respective sites inside de wind farm limits, they do not need further calibration processes. Although this matter, also considering that there is no calibration frequency established by national normative or relevant standards in SEN, SPII is going to establish in a conservative way, a calibration frequency of 3 years, which is going to be realised *in situ* by certified entities. Any future modification in Chilean regulation will be applied.

- Metering equipment inside SPII will also be subjected to regular maintenance and testing in accordance with the stipulation of the document "*Norma Técnica de Seguridad y Calidad del Servicio, anexo técnico Sistema de Medidas para transferencias económicas"* (National Standard, supervised by the National Electrical Coordinator of Chile).

- Data records: data will be continuously measured and monthly recorded by SPII technical staff.

  Invoices shall be collected on a monthly basis, and all data recorded will be archived for 2 years following the end of the last crediting period, by means of electronic and paper backup.

  Project activity manager, who will be someone belonging to the *Project Developers* (or one of its shareholders) human team, will be responsible for the elaboration of annual data reports and its record in archives and to oversee and assure the quality of the data collection.

  The consolidated data will be sent to the CDM Team Leader who will be responsible for calculating the emission reductions from the project activity.

General Manager, who will be someone belonging to the *Project Developers* (or one of its shareholders) human team, will be responsible of overseeing and assuring the quality of the whole monitoring process and must be in knowledge of any procedure taken in context. Moreover, will be the one who carries out stakeholders and third part relations related to the project, excluding responsibilities for technical matters, which are going to be developed by the Project Manager.

Monitoring equipment and installation.

As shown in *Figure B7.1*, the electricity produced by SPII is transmitted to San Pedro Substation, which is located inside the project area. This substation receives the electricity from SPII and another wind farm, but the measurement of the quantity of electricity generated by SPII is collected individually by mean of its own metering equipment.

SPII Substation is connected to the system, as mentioned before.

The internal monitoring system comprises three ways to determine the electricity generated by SPII, all relevant for CDM purposes and located at different stages:

- M_{AEG} are meters placed on each aerogenerator.

- SCADA control system obtains, instantly, generation data from the whole M_{AEG} equipment.

- M_1 and M_2 meters (main meter and backup meter, to determine net electricity generation, located at the substation, measure the final energy generated and transmitted to *Chiloé* Substation. This metering equipment carries out continuous and high precision measurements.

The M_1 and M_2 meters are type bi-directional Class 0.2, and they meet the Technical Standards Safety and Quality of Service (NTSCS, or NTSyCS "*Norma Técnica de Seguridad y Calidad del Servicio*") which is the national relevant standard.

Also, in order to keep track on the electricity supplied, SPII revenues and receipts for sales are essential for CDM purposes, as they constitute the main electricity measurement to be considered in CDM, so act as another monitoring item (as they are going to be checked and recorded periodically).

Moreover, the project has been designed in such a way that the information can be accessed in real time by all the relevant actors across the transaction of energy produced by the project activity, either SPII organization or the grid operator CEN.

Quality Assurance and Quality Control (QA/QC) procedures.

Project developer, agrees with the common regulations of the grid operator, to ensure the QA procedure for measurement and the accuracy of the energy meters. The CEN will deliver to the project developer the necessary prescriptions for the measurement and information compilation. The project developer then, has to adjust to the given parameters and rules. The certification process ensures the correct operability of the measurement equipment and has to be done under regulation of the grid operator. Periodic checks could be conducted by the grid operator[44].

As mentioned above, the meter used for determining the energy supplied to the grid is a high accuracy measurement device.

In order to keep equipment running properly, although it is not necessary as mentioned before, they are going to be calibrated with a 3-year frequency by certified entities.

The accuracy of the measurement process and results will be assured by a coordinated work between CEN and SPII staff, which comprises SPII equipment readings. Thereby, any measurement discrepancies can be detected by every operator and assessed by them, altogether. Such actions allow the energy balances to be rigorously assessed and to the system operator to identify possible erroneous measurements and define appropriate corrective actions.

Once the information managed by the project developer and the grid operator are contrasted, and the invoices have been agreed, the values are registered by the project developer.

In case of failure of the metering equipment, different situations are considered:

- In case of failure of M_1, data measured by M_2 shall be used, always following quality assurance procedures in respect to contrast with receipt of sales.

- In case of failure of both SPII meters, data from cross check aerogenerator meters (MAEG) will be used if necessary. To safeguard the coherence of this information it will be needed, and is going to be taken into account the grid-topology and potential electricity transmission losses between the different measuring points.

[44] According to the Chilean regulation, the grid operator is entitled to conduct at any moment audits and verification of all the information provided by the project developer regarding the provision of electricity to the grid.

- Additionally, the amount of energy provided to the grid could be also cross-checked with the information the grid operator manage through secondary measuring devices that allow them to control the energy inputs to the grid.

In the case of failure of certificated equipment, it will be repaired or replaced by an accredited organization which has to do the required tests to verify the correct equipment functionality and certificate the new equipment as done with the first meters installed.

Maintenance records will be retained by the project staff.

Personnel training.

All people that participate in the CDM monitoring process will receive proper CDM training, in order to assure the correct application of the monitoring plan of the Project, to continuously check the correctly metering equipment operation, to collect data in at least hourly basis and to keep record of the amount of electricity supplied to the grid periodically.

Responsibilities for the technical staff training process fall upon the Project Activity Manager.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>

19/05/2015 (May 19, 2015) (see *Table A3*).

The initial date of the project activity is the date in which the project participant sign turnkey EPC contract.

C.2. Expected operational lifetime of project activity

>>

The project activity expected operational lifetime is 20 years and 00 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>

First crediting period.

C.3.2. Start date of crediting period

>>

01/01/2021 (January 01, 2021) or the day after registration, whichever is later.

C.3.3. Duration of crediting period

>>

7 years (January 2021 – December 2027), renewable twice.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

Article 8 of Law No. 19,300 sets forth that projects or activities included under Article 10 (article 3 of the Regulation) may only be implemented or modified following the assessment of their environmental impact.

Section c) of Article 10 of Law 19,300, and 3 of D.S. [Supreme Decree] 95-01/MINSEGPRES [Ministry of the Presidency], the Environmental Impact Assessment System Regulation (RSEIA), state that “Power Stations Generating Energy exceeding 3 MW”, must be the subject of an environmental impact assessment.

Regarding that this is a Wind Farm dedicated to generate energy to feed the system, whose 65 MW capacity exceeds that stated in the Law and the Regulation, the project is classified as a generating power station described under the law and this means that the construction, operation and abandonment thereof must be the subject of an environmental impact assessment system, prior to the execution thereof.

Although this Wind Farm project exclusively deals with electric power generation under the revised section c) (generation power stations), noteworthy is the fact the power transmission line and the connection thereof with the grid (transport) is subject to an independent environmental impact assessment, under the provisions of section b) of Article 10 and 3 of Law 19,300 and RSEIA, respectively, specifically relating to the "High Voltage Electrical Transmission Lines and Substations”, in compliance with paragraph two of Article 11 bis of Law 19,300, as amended by Law 20,417, according to which this project is a generation project.

On the basis of this information and conclusions, mitigation and reversion strategies for impact have been proposed and planned. Potential impacts identified have been classified into three groups: Potential impacts in the construction phase, potential impacts in the operation stage and potential impacts in the closure phase of the project.

The following paragraphs summarises the potential impact of the various stages of the project in addition to mitigation strategies:

Construction phase	
Potential environmental impact	Mitigation Measures
Fauna and Flora	- For the definition of the routes of the roads, intervention on forest and seedling areas is explicitly excluded. - For the installation of the equipment yard area (there are 4 planned) one of the currently performed by the construction of another wind farm in the area will be used. This minimizes the removal of vegetation for the execution of works. - Intervention on identified forest management areas is restricted. - On the intervention zones where vegetal cover exists, precaution will be taken when proceeding to its retirement and soil handling, independently of the rest of the excavation materials.

Inputs & Wastes	- The supply of construction materials will be provided by entities controlled by the MINECON, who establishes security requirements in the storage and handling of liquid petroleum fuels. - Wastes will be temporarily stored into containers, properly classified for their subsequent removal and disposal in authorized sites. - For household or similar wastes, they will be temporarily stored in covered and properly labeled containers, of capacity not less than 240 liters to be located in the tasks area. Their removal will take place every two weeks and will be conducted by an authorized company to transfer the waste to licensed landfills. - For construction wastes, temporary storage will be made in open top containers. For their withdrawal, the contractor for collection and transportation service will be noticed prior to filling the container.
Soil & Water	- Topsoil scarpment resulting materials, will be reused on the recovery tasks of disturbed soils, and the excavation exceeds for improvement of paths and roads, or led to a licensed disposal site. - Gravel extraction is not foreseen inside project influence area. - Machinery maintenance, except small operations, will not be executed into the project influence area. - In case of spillage, proceed to remove the contaminated soil in sealed drums and arrange to be subsequently transferred to authorized sites. - To develop SPII, it is considered to build a modular wastewater treatment plant duly authorized by the Health Authority. However, due to the proximity of the treatment plant of other wind farm in the project area, it is planned to use this plant to serve SPII. Later, a plant will be enabled in two different locations, serving different stages of the wind farm project. Also the restrooms that are allowed, upon approval of the DIA I Wind Farm San Pedro (Resolution No. 351), and which have system wastewater treatment, may be used in SPII. - For those working areas that are far away from the facilities mentioned above, chemical bathrooms will be installed, as established in the DSN 594/99 MINSAL, especially with regard to quantity and distance to the working areas.
Atmosphere & Emissions	- Internal unpaved roads will be moistened at least twice a day, whenever climate conditions advised this. - A Raschel mesh will be installed in the locations where work is developed outside the project area and nearby housing is facing the area or another covering will be placed that is equally efficient in retaining dust. - No materials will be cut in open spaces and a cutting area will be created with three of the four walls closed by a Raschel mesh or another covering with similar dust retention efficiency, the fourth wall will be open to allow materials to be taken in and out quickly. - Operatives will be provided environmental training, in particular relating to movement and transport of inert waste such as soil,

	rubble and other waste, and a worksite environmental manager will be appointed. - The most frequently used traffic areas for machinery and vehicles going into the enclosure will be compacted and stabilised, specifically in the entry and exit zones of working areas, which will be kept moist, and watered twice a day, whenever climate conditions advised this. - The worksite will be kept cleared and free of waste, and collection containers will be placed and properly identified and located. Cleaning tasks such as sweeping and lifting rubble into works will be carried out following the moistening of the area to avoid re-suspension of dust. - Soil and rubble shall be transported in trucks with hopper covered with a tight canvass, which is impermeable and fastened to the body; and all vehicles used shall be required to have up-to-date maintenance and check-ups. - Trucks used for various jobs will have been manufactured before or after 2007, and shall meet emission standards of EPA 98 or Euro III or higher. - The speed limit for vehicles on roads inside the enclosure will be 30 Km/h. - An Environmental Management Plan will be implemented to allow the verification of compliance with environmental regulations applicable to the project and the commitments undertaken in this section, with the purpose of anticipating any possible environmental contingencies which may occur during the development of the construction of the project.

Operation phase	
Potential environmental impact	Mitigation Measures
Fauna and Flora	- Micro-routing installation for specimens located in the intervened areas, which permits organism flux between the different fragments, and so, avoiding restrictions to dispersion and reproduction. - A fauna rescue and relocation plan will be established. Oriented to the low mobility organism (terrestrial vertebrates) with limited capacity to move between habitats.
Inputs & Wastes	- Wastes resulting from operation of wind turbines (lubricating oils), are defined as solid waste, so they are going to be confined in sealed containers. Shall be withdrawn by the authorized company in charge of maintenance of wind turbines. - Generated urban wastes, or assimilables, will be temporarily stored in covered and labeled containers for the collection thereof at least once per fifteen days by an authorized contractor.
Soil & Water	- To avoid modifying rainwater regime, channels and/or side ditches are going to be constructed into roads and paths, so water can

	move to the opposite site of the road in case of necessity. - During the operation stage, the particular wastewater system (previously authorized from the San Pedro EID I, consisting on a modular septic tank.
Atmosphere & Emissions	- No significant emissions are involved in operation phase.

Closure phase	
Potential environmental impact	Mitigation Measures
Soil & Water	- The area where the structure was, will be covered with a layer of soil from nearby soils where there are outstanding reliefs in order to restore landforms as close as possible to how it was originally.
Visual impact	- Concrete works will be covered to avoid visual impacts.

D.2. Environmental impact assessment

>>

Due to the application of the Law 19,300, March 9, 1994, that *"Approves Law about general environmental rules"*, SPII is subjected to the Environmental Impact Assessment procedure.

As can be observed at *Section A1.*, specifically in *Table A1*, EIA procedure for the SPII project is completed and the SEIA (Environmental Assessment Impact Service), of the *Xth* Region of *Los Lagos* has issued the resolution of Environmental Qualification of SPII [45].

The complete procedure for processing the Environmental Impact Assessment can be observed in the website of the SEIA, related specifically to the SPII Project[46].

As a summary of the resolution, there are not significant environmental impacts, as expressed in resolution "*Resolución Exenta Nº 733 Puerto Montt, 16 de Diciembre de 2013*" from the "*Comisión de Evaluación X Región de Los Lagos, República de Chile*" (Assessment Commission of the X Region of *Los Lagos*, Chile).

The location of the project, and the mitigation strategies taken, avoid the potential adverse environmental effects.

---

[45] Submitted by Environmental Impact Assessment Service, Xth Region of Los Lagos. Link.

[46] See the following link.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

To inform the community and the stakeholders about the project, a meeting was held, and took place on April 17th, 2015 at San Pedro public school, about 18 kilometers away from the wind farm[47].

The aim of this meeting was to inform stakeholders about the main characteristics of the project and to let them participate through comments, propositions, questions, etc.

The commune of Dalcahue and the Municipal Educational Corporation, helped and collaborated in the event organization, reporting to several stakeholders about the celebration of the meeting.

As a summary of the meeting, a presentation about the project was carried out by the Regional Manager of San Pedro Wind Farm Project. Beyond the project technical issues, environmental and social matters occupied a prominent place during the speech.

After the presentation, stakeholders were encouraged to make questions or to request information about the technical, social or environmental characteristics of the project.

Comments received and their consideration by project participant is summarized in the following sections.

First of all, a table which reflects all the stakeholders that were invited to assist to the meeting is presented below.

Name	Position	Assistance
Juan Alberto Perez	Dalcahue Commune Major	No
Luis Iglesias	Dalcahue Environmental Office	Yes
Luis Soto	Dalcahue Emergency Manager	Yes
Patricia Soto	Dalcahue Infrastructure Manager	No
Juan Carlos Soto	Dalcahue Health and Education Corporation Manager	No
Jorge Diaz Huichalao	Dalcahue Police Tenure Chief	No
Denise Ruiz	San Pedro Public School Director	No
Rodrigo Rojas	CONAF Inspector	No
Hernan Rivera	CONAF Regional Chief	No
Jasna Bahamonde	Roads Regional Chief	No
Gaspar Solis	San Pedro Neighborhood Council	Yes
Americo Arroez	San Pedro Neighborhood Council	Yes
Alicia Arroez	San Pedro Neighborhood Council	No
Marta Trujillo	San Pedro Neighborhood Council	No
Luis Perez	Community of San Pedro neighbor	Yes

[47] Evidences about the convening and holding of the meeting are provided to the validation team.

Name	Position	Assistance
Osvaldo Arroez	Community of San Pedro neighbor	Yes
Segundo Subiabre	Community of San Pedro neighbor	No
Nolberto Jara	Community of San Pedro neighbor	No
Sergio Trujillo	Community of San Pedro neighbor	Yes
Victor Trujillo	Community of San Pedro neighbor	No
Miriam Nacupillan	Community of San Pedro neighbor	Yes
Marta Nahuelquin	Community of San Pedro neighbor	Yes
Viviana Trujillo	Community of San Pedro neighbor	Yes
Joaquin Viveros	Community of San Pedro neighbor	No
Alex Viveros	Community of San Pedro neighbor	Yes
Alfredo Calfui	Community of San Pedro neighbor	Yes
Ivan Trujillo	Community of San Pedro neighbor	Yes
Manuel Aguila	Community of San Pedro neighbor	Yes
Ilse Jara	Community of San Pedro neighbor	No
Luis Soffia	Community of San Pedro neighbor	Yes
Omar Soffia	Community of San Pedro neighbor	Yes
Roxana Quinel	Community of San Pedro neighbor	Yes
Elsa Castro	Community of San Pedro neighbor	Yes
Ercilia Tabie	Community of San Pedro neighbor	Yes
Tania Calfui	Community of San Pedro neighbor	Yes
Macarena Jara	Community of San Pedro neighbor	Yes

E.2. Summary of comments received

>>

After the presentation, questions round took place. A few comments were made, because the community already knows about wind farms, the construction phases, etc., due to another wind farm (San Pedro Phase 1) implemented in the area. The comments and questions are summarized below:

Name	Question / Comment
Gaspar Solis *(San Pedro Neighborhood Council)*	Comments that he was once against the project, because some people misinformed him about the consequences of the wind farm. However, while visiting the San Pedro wind farm, he realizes that the information about the consequences of a wind farm he has was not true. He urged the company to work together with the community and to be considered in future actions.
Various neighbors	Several neighbors commented about problems related with the speed of trucks and vehicles on their way to the wind farm. This issue causes two serious problems for them: people's safety and dust emissions, which was a very significant problem because of the drought during this period.
Various neighbors	Several neighbors requested more efforts in order to solve the water supply problem they have due to the drought. They recognized that some actions were taken by the project participant when developing first phase of San Pedro wind farm, and that these actions have benefited the local community.
Gaspar Solis *(San Pedro Neighborhood Council)*	Finally, he asked the company representatives to meet what was said during the meeting, and to consider all of the local community concerns.

E.3. Consideration of comments received

>>

The event was recorded by the project participant. Questions and comments were answered straight away during the meeting. The results of the day were satisfactory; all stakeholders agreed with the project philosophy and are willing to collaborate.

For the local community neighbors, there was one question that it is considered relevant, and was raised and discussed during the meeting: the dust emissions due to the freight transport by road passing through, or near, communities.

Project participant explained the containment and mitigation measures that are going to be implemented to reduce or eliminate the dust emissions. Local stakeholders agreed with the measures and asked to take them into account and to implement them effectively.

Project participant also pledged to take into account all the community concerns that were raised during the meeting.

SECTION F. Approval and authorization

>>

The letter of approval (hereinafter LoA) from the host Party for the project activity is available at the time of completion of the PDD.

LoA has been sent to the validating DOE to assess its validity. Prior consideration (stamped by the Chilean DNA) has also been received at the time of submitting the PDD to the validation DOE.

Appendix 1. Contact information of project participants

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	RIO ALTO SA
Street/P.O. Box	Cerro el Plomonº5630, oficina 503, Las Condes, Santiago, Chile
Building	
City	Santiago
State/Region	
Postcode	
Country	Chile
Telephone	+34 616 654 940
Fax	
E-mail	rarroyo@jealsa.com
Website	
Contact person	Rosario Arroyo Brotons
Title	Energy Manager
Salutation	Sra.
Last name	Arroyo Brotons
Middle name	
First name	Rosario
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	ENERGÍAS ABTAO SA
Street/P.O. Box	Cerro el Plomonº5630, oficina 503, Las Condes, Santiago, Chile
Building	
City	Santiago
State/Region	
Postcode	
Country	Chile
Telephone	+34 616 654 940
Fax	
E-mail	rarroyo@jealsa.com
Website	
Contact person	Rosario Arroyo Brotons
Title	Energy Manager
Salutation	Sra.
Last name	Arroyo Brotons
Middle name	
First name	Rosario
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2. Affirmation regarding public funding

Not applicable.

Appendix 3. Applicability of methodologies and standardized baselines

Applicability of the selected methodology can be observed in Section B.2.

Appendix 4. Further background information on ex ante calculation of emission reductions

The information collected in this annex represents data used for the calculation of the operating margin and the build margin CO_2 emission factors, as well as the Emission factor of CO_2 from the combined margin of the electric system.

Table A4-1. Results of the Operating Margin Calculation for year 2019

	$NCV_{i,y}$ x $EF_{CO2,i,y}$		
Fuel Type	**EF** *(tCO_2/ton)*	**EF** *(tCO_2/MMBTU)*	**EF** *(tCO_2/m^3)*
Coal	2.43		
Natural Gas	-		0.00191
LPG	1.91		-
LNG	-	0.81098	
Petcoke	2.30		-
Diesel	3.14		-
Fuel-Oil	3.15-		-

$FC_{i,y}$ x $NCV_{i,y}$ x $EF_{CO2,i,y}$	
Fuel Type	**Emissions** *(tCO_2)*
Coal	23,856,742.06
Natural Gas	2,006,841.79
LPG	126.72
LNG	3,098,810.10
Petcoke	341.745,48
Diesel	208,817.05
Fuel-Oil	210,915.09
***TOTAL Emissions** (tCO2) =*	***29.515,181.25***

***EG_y*[48]**	
Year	**Total Generation** *(MWh)*
2019	***42,104,818***

$EF_{grid,Omsimple,y}$	
Year	**Emission Factor** *(tCO2/MWh)*
2019	***0.701***

[48] Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year 2019 (MWh).

Table A4-2. Results of the Operating Margin Calculation for year 2018

	$NCV_{i,y}$ x $EF_{CO2,i,y}$		
Fuel Type	**EF** *(tCO_2/ton)*	**EF** *(tCO_2/MMBTU)*	**EF** *(tCO_2/m^3)*
Coal	2.43		
Natural Gas	-		0.00191
LPG	1.91		-
LNG	-	0.81098	
Petcoke	2.30		-
Diesel	3.14		-
Fuel-Oil	3.15-		-

$FC_{i,y}$ x $NCV_{i,y}$ x $EF_{CO2,i,y}$	
Fuel Type	**Emissions** *(tCO_2)*
Coal	24,934,596.19
Natural Gas	81,161.35
LPG	1,221.28
LNG	4,186,314.67
Petcoke	381,192.65
Diesel	203,747.42
Fuel-Oil	9,576.09
Biogas	0.00
***TOTAL Emissions** (tCO2) =*	***29,797,809.65***

EG_y [49]	
Year	**Total Generation** *(MWh)*
2018	***41,018,147***

$EF_{grid,Omsimple,y}$	
Year	**Emission Factor** *(tCO_2/MWh)*
2018	***0.726***

Table A4-3. Results of the Operating Margin Calculation for year 2017

	$NCV_{i,y}$ x $EF_{CO2,i,y}$		
Fuel Type	**EF** *(tCO_2/ton)*	**EF** *(tCO_2/MMBTU)*	**EF** *(tCO_2/m^3)*
Coal	2.43		
Natural Gas	-		0.00191
LPG	1.91		-

[49] Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year 2018 (MWh).

LNG	-	0.81098	
Petcoke	2.30		-
Diesel	3.14		-
Fuel-Oil	3.15-		-

$FC_{i,y}$ x $NCV_{i,y}$ x $EF_{CO2,i,y}$	
Fuel Type	**Emissions** *(tCO_2)*
Coal	25,513,614.65
Natural Gas	804,794.09
LPG	4,139.77
LNG	63,821.44
Petcoke	379.654,16
Diesel	572,477.50
Fuel-Oil	47,291.79
Biogas	0.00
TOTAL Emissions *(tCO_2)* **=**	***27,385,788***

EG_y[50]	
Year	**Total Generation** *(MWh)*
2017	***42,048,156***

$EF_{grid,Omsimple,y}$	
Year	**Emission Factor** *(tCO_2/MWh)*
2017	***0.651***

[50] Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year 2017 (MWh).

Table A4-4. Results for the determination of $EF_{grid,OMsimple,y}$ [tCO_2/MWh]

Operating Margin Emission factor for the Chilean SEN		
Baseline	**$EF_{grid,OMsimple,y}$ [tCO_2/MWh]**	**Net Generation[51] [MWh]**
2017	0.6513	42,048,156
2018	0.7265	41,018,147
2019	0.7010	42,104,818
	$EF_{grid,OMsimple,2017-2019}$ **0.6926**	

Table A4-5. List of last power plants serving energy to the SEN system (Oct. 2019 - Dec. 2019)

Power Plants Oct-2019 / Dec-2019 (1)			
Power Plant	**Type**	**Start-up Date**	**CDM Status**
Ciruelillo	Thermoelectric	15/11/2019	-
Copiulemu	Natural gas	15/11/2019	-
Solar Luce	Solar	7/11/2019	-
Palacios	Hydropower: Run of the river	5/11/2019	-
TER Doña Javiera	Thermoelectric	28/10/2019	-
Solar Bellavista 1	Solar	24/10/2019	-
Solar San Isidro	Solar	12/10/2019	-
Solar Tricahue 2	Solar	1/10/2019	

Notes: *Note 1: to select power plants to include in this table, data are collected based on CNE (Chilean National Energy Commission) available information. They are, at first, selected by the year in which they start operating*

Table A4-6. Determination of $SET_{5\ units}$ and $AEG_{SET-5-units}$

Determination of $SET_{5\ units}$ and $AEG_{SET-5-units}$			
Power Plant	**Type**	**Start-up Date**	**Annual Electricity Generation** *(MWh)*
Ciruelillo	Thermoelectric	15/11/2019	0.0
Copiulemu	Natural gas	15/11/2019	0.0
Solar Luce	Solar	7/11/2019	1,441.5
Palacios	Hydropower: Run of the river	5/11/2019	6,771.8
TER Doña Javiera	Thermoelectric	28/10/2019	0.0
Annual Electricity Generation ($AEG_{SET-5-units}$) *(MWh)*			***8,213***

Table A4-7. Determination of AEG_{TOTAL} and 20% of AEG_{TOTAL}

AEG_{TOTAL} *(MWh)*

[51] Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh).

***Annual Electricity Generation (AEG$_{TOTAL}$)** (MWh)*	***69,243,201**[52]*

***20 % of AEG$_{TOTAL}$** (MWh)*	
***20 % of AEG$_{TOTAL}$** (MWh)*	***13,935,190***

Table A4-8. List of power plants that shape the BM Emission Factor

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEG$_{TOTAL}$	Accumulated
Ciruelillo	Diesel	15/11/2019	0.0	0.0	0.0000%	0.00%
Copiulemu	Natural gas	15/11/2019	0.0	0.0	0.0000%	0.00%
Solar Luce	Solar	7/11/2019	1,441.5	1,441.5	0.0021%	0.00%
Palacios	Hydropower: Run of the river	5/11/2019	6,771.8	6,771.8	0.0098%	0.01%
TER Doña Javiera	Diesel	28/10/2019	0.0	0.0	0.0000%	0.01%
Solar Bellavista 1	Solar	24/10/2019	4,315.6	4,315.6	0.0062%	0.02%
Solar San Isidro	Solar	12/10/2019	503.1	503.1	0.0007%	0.02%
Solar Tricahue 2	Solar	1/10/2019	7,175.2	7,175.2	0.0104%	0.03%
Eólica San Gabriel	Wind	27/09/2019	147,785.3	147,785.3	0.2134%	0.24%
Solar La Ligua	Solar	18/09/2019	861.5	861.5	0.0012%	0.24%
Solar Villa Seca	Solar	17/09/2019	1,118.6	1,118.6	0.0016%	0.25%
Solar RLA	Solar	14/09/2019	1,927.2	1,927.2	0.0028%	0.25%
Dos Valles	Hydropower: Run of the river	14/09/2019	8,955.2	8,955.2	0.0129%	0.26%
Dos Valles	Hydropower: Run of the river	14/09/2019	8,955.2	8,955.2	0.0129%	0.27%
Solar Las Lechuzas	Solar	6/09/2019	2,997.3	2,997.3	0.0043%	0.28%
Solar Placilla	Solar	6/09/2019	684.8	684.8	0.0010%	0.28%
Solar Huatacondo	Solar	5/09/2019	135,165.3	135,165.3	0.1952%	0.47%
Calfuco	Diesel	4/09/2019	0.0	0.0	0.0000%	0.47%
Solar Poblacion	Solar	30/08/2019	3,372.8	3,372.8	0.0049%	0.48%
Río Azul	Diesel	30/08/2019	0.0	0.0	0.0000%	0.48%
Eólica La Flor	Wind	30/08/2019	6,905.0	6,905.0	0.0100%	0.49%
Solar Doñihue	Solar	27/08/2019	5,796.6	5,796.6	0.0084%	0.50%
Solar Jose Soler Mallafre	Solar	23/08/2019	983.3	983.3	0.0014%	0.50%
Tucúquere	Solar	23/08/2019	2,806.1	2,806.1	0.0041%	0.50%
Eólica El Nogal	Wind	23/08/2019	7,773.3	7,773.3	0.0112%	0.51%
Solar Las Perdices	Solar	21/08/2019	2,595.1	2,595.1	0.0037%	0.52%
Solar Ariztia	Solar	20/08/2019	2,320.7	2,320.7	0.0034%	0.52%
Solar Jaururo	Solar	15/08/2019	1,208.1	1,208.1	0.0017%	0.52%
Solar Marchihue VII	Solar	14/08/2019	2,289.9	2,289.9	0.0033%	0.53%
Solar Vituco 2B	Solar	14/08/2019	2,658.2	2,658.2	0.0038%	0.53%
Solar Canesa I	Solar	13/08/2019	3,032.2	3,032.2	0.0044%	0.53%
Solar Santa Adriana	Solar	6/08/2019	1,514.2	1,514.2	0.0022%	0.54%
Solar Crucero	Solar	1/08/2019	3,311.9	3,311.9	0.0048%	0.54%
Central Cumbres	Hydropower: Run of the river	1/08/2019	61,930.7	61,930.7	0.0894%	0.63%

[52] Excluding power units registered as CDM project activities.

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEGTOTAL	Accumulated
Solar Talca	Solar	30/07/2019	7,947.3	7,947.3	0.0115%	0.64%
Solar Illapel 5X	Solar	20/07/2019	3,023.8	3,023.8	0.0044%	0.65%
Solar Chalinga	Solar	19/07/2019	3,007.3	3,007.3	0.0043%	0.65%
Solar Cruz	Solar	19/07/2019	3,634.9	3,634.9	0.0052%	0.66%
Solar Las Codornices	Solar	19/07/2019	3,287.7	3,287.7	0.0047%	0.66%
Solar Montt	Solar	19/07/2019	3,425.2	3,425.2	0.0049%	0.67%
Solar Ranguil	Solar	19/07/2019	2,126.9	2,126.9	0.0031%	0.67%
Solar Lo Sierra	Solar	12/07/2019	2,439.4	2,439.4	0.0035%	0.67%
Solar Casuto	Solar	29/06/2019	3,232.2	3,232.2	0.0047%	0.68%
Solar Norte Chico I	Solar	29/06/2019	1,976.1	1,976.1	0.0029%	0.68%
Diesel PRP Gami	Diesel	29/06/2019	0.0	0.0	0.0000%	0.68%
Diesel Los Sauces	Diesel	27/06/2019	0.0	0.0	0.0000%	0.68%
Diesel Picoltué	Diesel	27/06/2019	0.0	0.0	0.0000%	0.68%
Solar Lipangue	Solar	26/06/2019	2,706.5	2,706.5	0.0039%	0.68%
Solar La Lajuela	Solar	18/06/2019	9,764.7	9,764.7	0.0141%	0.70%
Solar Altos de Til Til	Solar	14/06/2019	2,146.3	2,146.3	0.0031%	0.70%
Solar Rovian	Solar	14/06/2019	9,001.6	9,001.6	0.0130%	0.71%
Diesel Almendrado	Diesel	11/06/2019	0.0	0.0	0.0000%	0.71%
Solar Santa Clara	Solar	5/06/2019	4,057.2	4,057.2	0.0059%	0.72%
Eólica Punta Sierra	Wind	5/06/2019	271,710.4	271,710.4	0.3924%	1.11%
CERRO PABELLON_Geotermica	Geothermal	31/05/2019	201,642.7	CDM Registered	0	1.11%
Solar El Laurel	Solar	29/05/2019	8,022.0	8,022.0	0.0116%	1.12%
Solar Pedreros	Solar	23/05/2019	3,887.2	3,887.2	0.0056%	1.13%
IEM	Coal	16/05/2019	737,056.9	737,056.9	1.0644%	2.19%
Solar Encon Solar	Solar	23/04/2019	10,501.3	10,501.3	0.0152%	2.21%
Solar Fotovolt Solar I	Solar	23/04/2019	940.2	940.2	0.0014%	2.21%
Solar GR Santa Rosa	Solar	12/04/2019	13,340.6	CDM registered	0	2.21%
Solar Pirque	Solar	11/04/2019	3,736.9	3,736.9	0.0054%	2.22%
Solar Marín	Solar	27/02/2019	6,146.0	6,146.0	0.0089%	2.23%
Minihidro Correntoso	Hydropower: Run of the river	22/02/2019	15,851.3	15,851.3	0.0229%	2.25%
Minihidro Palmar	Hydropower: Run of the river	22/02/2019	15,427.4	15,427.4	0.0223%	2.27%
Solar Cachiyuyo 2	Solar	15/02/2019	19,928.4	19,928.4	0.0288%	2.30%
Solar Calle Larga	Solar	15/02/2019	6,042.9	6,042.9	0.0087%	2.31%
Solar La Blanquina	Solar	15/02/2019	12,665.7	12,665.7	0.0183%	2.33%
Solar Malaquita 2	Solar	15/02/2019	20,271.3	20,271.3	0.0293%	2.36%
Zapallar	Diesel	15/02/2019	0.0	0.0	0.0000%	2.36%
Solar Valle Este 2	Solar	13/02/2019	18,754.6	18,754.6	0.0271%	2.38%
Solar Valle Oeste 2	Solar	13/02/2019	18,573.0	18,573.0	0.0268%	2.41%
Cogeneradora Aconcagua	Biomass	9/02/2019	1,163.6	1,163.6	0.0017%	2.41%
Eólica Aurora	Wind	1/02/2019	161,256.5	161,256.5	0.2329%	2.64%
Solar Alicahue	Solar	19/01/2019	5,233.7	5,233.7	0.0076%	2.65%
Solar El Queule	Solar	19/01/2019	1,638.8	1,638.8	0.0024%	2.65%

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEG$_{TOTAL}$	Accumulated
Punta Baja Solar	Solar	18/01/2019	3,950.2	3,950.2	0.0057%	2.66%
Solar Olivillo	Solar	27/12/2018	17,800.0	17,800.0	0.0257%	2.69%
Solar Piquero	Solar	6/12/2018	6,119.2	6,119.2	0.0088%	2.69%
Solar El Quemado	Solar	20/11/2018	6,219.2	6,219.2	0.0090%	2.70%
Solar Rodeo	Solar	17/11/2018	5,537.9	5,537.9	0.0080%	2.71%
Solar Las Palomas	Solar	31/10/2018	5,974.3	5,974.3	0.0086%	2.72%
Solar Catán	Solar	23/10/2018	5,456.3	5,456.3	0.0079%	2.73%
SOLAR EL ÁGUILA I	Solar	4/10/2018	3,928.8	3,928.8	0.0057%	2.73%
Solar El Pelícano	Solar	13/09/2018	290,274.3	290,274.3	0.4192%	3.15%
Solar El Chincol	Solar	7/09/2018	6,754.3	6,754.3	0.0098%	3.16%
Solar El Picurio	Solar	4/09/2018	6,361.2	6,361.2	0.0092%	3.17%
Solar Ocoa	Solar	1/09/2018	6,061.1	6,061.1	0.0088%	3.18%
Solar Villa Prat	Solar	22/08/2018	5,640.9	5,640.9	0.0081%	3.19%
Solar Santa Laura	Solar	17/08/2018	5,281.1	5,281.1	0.0076%	3.20%
Solar Los Patos	Solar	9/08/2018	5,482.6	5,482.6	0.0079%	3.20%
Solar Los Libertadores	Solar	8/08/2018	9,209.0	9,209.0	0.0133%	3.22%
Solar Talhuén	Solar	1/08/2018	8,192.5	8,192.5	0.0118%	3.23%
Solar La Acacia	Solar	28/07/2018	6,348.4	6,348.4	0.0092%	3.24%
CERRO DOMINADOR	Solar	4/07/2018	300,793.0	300,793.0	0.4344%	3.67%
Solar Peralillo	Solar	12/06/2018	6,549.0	6,549.0	0.0095%	3.68%
Eólica Cabo Leones	Wind	10/06/2018	353,877.1	CDM Registered	0	3.68%
Degañ	Diesel	5/06/2018	474.2	474.2	0.0007%	3.68%
HUAYCA1	Solar	4/06/2018	0.0	0.0	0.0000%	3.68%
HUAYCA2	Solar	4/06/2018	51,227.7	51,227.7	0.0740%	3.76%
Solar Amparo del Sol	Solar	1/06/2018	6,211.7	6,211.7	0.0090%	3.77%
Solar Mostazal	Solar	26/05/2018	20,660.3	20,660.3	0.0298%	3.80%
Solar Ovejería	Solar	25/05/2018	20,038.7	20,038.7	0.0289%	3.82%
Solar Luders	Solar	23/05/2018	6,968.9	6,968.9	0.0101%	3.83%
Eólica Sarco	Wind	1/05/2018	92,599.0	92,599.0	0.1337%	3.97%
FV BOLERO_Solar	Solar	6/04/2018	366,910.2	366,910.2	0.5299%	4.50%
Parque Sierra Gorda_Eólico	Wind	4/04/2018	356,459.2	356,459.2	0.5148%	5.01%
Solar El Sauce	Solar	27/03/2018	6,296.8	6,296.8	0.0091%	5.02%
Solar Chancon	Solar	21/03/2018	5,493.2	5,493.2	0.0079%	5.03%
Solar El Pitio	Solar	13/03/2018	6,300.5	6,300.5	0.0091%	5.04%
Hidro La Mina	Hydropower: Run of the river	21/02/2018	67,521.1	67,521.1	0.0975%	5.14%
Embalse Ancoa	Hydropower: Reservoir	16/02/2018	77,150.6	77,150.6	0.1114%	5.25%
Solar Santiago	Solar	31/01/2018	199,550.6	199,550.6	0.2882%	5.54%
El Campesino 1	Biomass	24/01/2018	1,172.1	1,172.1	0.0017%	5.54%
Solar Portezuelo	Solar	16/01/2018	5,657.2	5,657.2	0.0082%	5.55%
Solar Los Gorriones	Solar	5/01/2018	6,508.1	6,508.1	0.0094%	5.56%
Solar Cernicalo 1	Solar	21/12/2017	3,448.5	3,448.5	0.0050%	5.56%
Solar Cernicalo 2	Solar	21/12/2017	3,294.8	3,294.8	0.0048%	5.57%
Río Colorado	Hydropower: Run of the river	21/12/2017	49,267.1	49,267.1	0.0712%	5.64%

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEG TOTAL	Accumulated
Solar La Manga I	Solar	13/12/2017	4,431.9	4,431.9	0.0064%	5.64%
Solar Doña Carmen Solar	Solar	29/11/2017	61,894.7	61,894.7	0.0894%	5.73%
Solar Chimbarongo	Solar	21/11/2017	5,070.7	5,070.7	0.0073%	5.74%
Santuario Solar	Solar	17/11/2017	7,410.0	7,410.0	0.0107%	5.75%
Solar Valle de la Luna II	Solar	9/11/2017	6,134.6	6,134.6	0.0089%	5.76%
Solar La Quinta	Solar	8/11/2017	7,196.8	CDM Registered	0	5.76%
Solar San Francisco	Solar	8/11/2017	7,111.8	7,111.8	0.0103%	5.77%
Solar Antay	Solar	3/11/2017	24,822.4	24,822.4	0.0358%	5.81%
Solar El Pilpen	Solar	2/11/2017	7,160.6	7,160.6	0.0103%	5.82%
Solar El Roble	Solar	19/10/2017	18,232.5	18,232.5	0.0263%	5.84%
Lepanto	Biomass	18/10/2017	0.0	0.0	0.0000%	5.84%
Solar Panquehue II	Solar	18/10/2017	12,110.1	12,110.1	0.0175%	5.86%
Solar Don Eugenio	Solar	26/09/2017	6,122.7	6,122.7	0.0088%	5.87%
La Bifurcada	Hydropower: Run of the river	9/09/2017	1,205.6	1,205.6	0.0017%	5.87%
PUERTO SECO SOLAR	Solar	1/09/2017	30,032.4	30,032.4	0.0434%	5.91%
La Viña - Alto La Viña	Hydropower: Run of the river	28/08/2017	3,437.1	3,437.1	0.0050%	5.92%
Riñinahue	Hydropower: Run of the river	23/08/2017	6,934.4	6,934.4	0.0100%	5.93%
Solar Cabilsol	Solar	28/07/2017	5,497.5	5,497.5	0.0079%	5.94%
Solar Las Turcas	Solar	1/06/2017	4,254.2	4,254.2	0.0061%	5.94%
Eólica San Pedro II	Wind	19/05/2017	112,835.5	112,835.5	0.1630%	6.11%
PMGD CALAMA_Solar	Solar	12/05/2017	18,349.1	18,349.1	0.0265%	6.13%
PARQUE SOLAR FINIS TERRAE_Solar	Solar	18/04/2017	387,475.3	387,475.3	0.5596%	6.69%
Solar Marchigue 2	Solar	31/03/2017	14,401.3	14,401.3	0.0208%	6.71%
Solar Cordillerilla	Solar	27/03/2017	1,440.2	1,440.2	0.0021%	6.71%
Eólica San Juan	Wind	16/03/2017	589,780.0	589,780.0	0.8518%	7.57%
Solar Quilapilún	Solar	9/03/2017	214,690.0	214,690.0	0.3101%	7.88%
Solar El Romero	Solar	3/03/2017	461,397.7	461,397.7	0.6663%	8.54%
Solar Cuz Cuz	Solar	2/03/2017	5,521.4	5,521.4	0.0080%	8.55%
Solar Cardones	Solar	21/02/2017	417.7	417.7	0.0006%	8.55%
Eólica La Esperanza	Wind	13/02/2017	17,658.1	17,658.1	0.0255%	8.58%
Solar El Boco	Solar	30/01/2017	5,975.2	5,975.2	0.0086%	8.59%
URIBE_Solar	Solar	8/01/2017	154,322.3	154,322.3	0.2229%	8.81%
Solar La Esperanza II	Solar	30/12/2016	18,867.1	18,867.1	0.0272%	8.84%
Eólica Las Peñas	Wind	28/12/2016	30,690.3	30,690.3	0.0443%	8.88%
Kelar	Diesel	27/12/2016	443.1	CDM registered	0	8.88%
Kelar	LNG	27/12/2016	1,636,052.9	CDM registered	0	8.88%
Parque Eólico Lebu III	Wind	14/12/2016	6,651.0	6,651.0	0.0096%	8.89%
Solar Ñilhue	Solar	1/12/2016	1,810.7	1,810.7	0.0026%	8.89%
Solar San Pedro	Solar	1/12/2016	5,553.7	5,553.7	0.0080%	8.90%
Newen	Propane	27/11/2016	0.0	0.0	0.0000%	8.90%
Newen	Diesel	27/11/2016	0.0	0.0	0.0000%	8.90%
Newen	Natural gas	27/11/2016	369.1	369.1	0.0005%	8.90%

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEG$_{TOTAL}$	Accumulated
Tránquil	Hydropower: Run of the river	23/11/2016	0.0	0.0	0.0000%	8.90%
La Montaña 1	Hydropower: Run of the river	16/11/2016	1,403.4	1,403.4	0.0020%	8.90%
Carilafquén	Hydropower: Run of the river	28/10/2016	59,660.6	59,660.6	0.0862%	8.99%
Solar Hormiga Solar	Solar	27/10/2016	4,584.6	4,584.6	0.0066%	9.00%
Cumpeo	Hydropower: Run of the river	26/10/2016	25,961.2	25,961.2	0.0375%	9.03%
Solar Pampa Solar Norte	Solar	19/10/2016	206,218.5	206,218.5	0.2978%	9.33%
Solar Alturas de Ovalle	Solar	4/10/2016	11,011.4	11,011.4	0.0159%	9.35%
Eólica Renaico	Wind	12/09/2016	280,540.1	280,540.1	0.4052%	9.75%
Itata Hidro	Hydropower: Run of the river	9/09/2016	53,700.7	53,700.7	0.0776%	9.83%
Solar Conejo	Solar	8/09/2016	305,716.0	305,716.0	0.4415%	10.27%
hbs gnl	Natural gas	1/09/2016	0.0	0.0	0.0000%	10.27%
Eólica Los Buenos Aires	Wind	30/08/2016	82,570.5	82,570.5	0.1192%	10.39%
El Colorado	Hydropower: Run of the river	29/08/2016	6,477.1	6,477.1	0.0094%	10.40%
Solar Los Loros	Solar	17/08/2016	100,147.3	100,147.3	0.1446%	10.54%
Solar La Silla	Solar	12/08/2016	4,583.4	4,583.4	0.0066%	10.55%
Solar El Divisadero	Solar	10/08/2016	8,828.4	8,828.4	0.0127%	10.56%
Cochrane	Coal	9/07/2016	1,679,646.4	1,679,646.4	2.4257%	12.99%
Cochrane	Coal	9/07/2016	1,696,310.2	1,696,310.2	2.4498%	15.44%
El Agrio	Hydropower: Run of the river	7/07/2016	9,871.4	9,871.4	0.0143%	15.45%
Pulelfu	Hydropower: Run of the river	7/07/2016	53,544.6	53,544.6	0.0773%	15.53%
El Galpón	Hydropower: Run of the river	28/06/2016	5,806.0	5,806.0	0.0084%	15.54%
CMPC Tissue	LNG	16/06/2016	10,510.2	10,510.2	0.0152%	15.55%
Solar Chuchiñi	Solar	9/06/2016	4,933.4	4,933.4	0.0071%	15.56%
Solar Til Til	Solar	19/05/2016	3,543.0	3,543.0	0.0051%	15.57%
Chanleufu	Hydropower: Run of the river	19/05/2016	1,784.6	1,784.6	0.0026%	15.57%
Andes Generación	Diesel	17/05/2016	123.8	123.8	0.0002%	15.57%
Andes Generación	Fuel N°6	17/05/2016	16.2	16.2	0.0000%	15.57%
Solar Las Araucarias	Solar	12/05/2016	0.0	0.0	0.0000%	15.57%
Alto Renaico	Hydropower: Run of the river	9/05/2016	8,246.7	8,246.7	0.0119%	15.58%
PARQUE SOLAR PAMPA CAMARONES	Solar	4/05/2016	13,001.0	13,001.0	0.0188%	15.60%
Solar Carrera Pinto	Solar	3/05/2016	238,325.5	238,325.5	0.3442%	15.94%
CMPC Cordillera	LNG	25/04/2016	1,324.3	1,324.3	0.0019%	15.95%
Río Mulchén	Hydropower: Run of the river	1/04/2016	2,336.5	2,336.5	0.0034%	15.95%
Ujina	Fuel N°6	29/03/2016	0.0	0.0	0.0000%	15.95%
Ujina	Fuel N°6	29/03/2016	289.3	289.3	0.0004%	15.95%
Ujina	Fuel N°6	29/03/2016	38.5	38.5	0.0001%	15.95%
Ujina	Fuel N°6	29/03/2016	270.6	270.6	0.0004%	15.95%
Ujina	Fuel N°6	29/03/2016	297.4	297.4	0.0004%	15.95%
Ujina	Fuel N°6	29/03/2016	301.2	301.2	0.0004%	15.95%
Solar Bellavista	Solar	23/03/2016	3,759.8	3,759.8	0.0054%	15.96%
Solar Santa Julia	Solar	17/03/2016	7,301.8	7,301.8	0.0105%	15.97%
Molinera Villarrica	Hydropower: Run of the river	3/03/2016	1,358.3	1,358.3	0.0020%	15.97%

Power Plant	Type	Electricity Supply Date	2019 Electricity Generation *(MWh)*	Gen 2019 *(Excluding CDM) (MWh)*	Percentage of AEGTOTAL	Accumulated
El Paso	Hydropower: Run of the river	2/03/2016	88,664.5	88,664.5	0.1280%	16.10%
Solar La Chapeana	Solar	1/03/2016	4,887.3	4,887.3	0.0071%	16.10%
Solar Las Mollacas	Solar	1/03/2016	5,247.5	5,247.5	0.0076%	16.11%
Malalcahuello	Hydropower: Run of the river	1/03/2016	13,151.9	13,151.9	0.0190%	16.13%
Luz del Norte	Solar	24/02/2016	393,051.1	393,051.1	0.5676%	16.70%
Solar Lagunilla	Solar	5/02/2016	6,724.1	6,724.1	0.0097%	16.71%
SOLAR JAMA 2_Solar	Solar	21/01/2016	65,995.5	65,995.5	0.0953%	16.80%
El Molle	Biomass	18/12/2015	15,475.0	15,475.0	0.0223%	16.83%
Guacolda 5	Coal	15/12/2015	1,100,511.0	1,100,511.0	1.5893%	18.41%
PMGD PICA_Solar	Solar	10/12/2015	0.0	CDM registered	0	18.41%
Eólica Huajache	Wind	25/11/2015	14,210.1	14,210.1	0.0205%	18.44%
PAS1_Solar	Solar	4/11/2015	0.0	0.0	0.0000%	18.44%
El Mirador	Hydropower: Run of the river	2/11/2015	10,778.8	10,778.8	0.0156%	18.45%
Trailelfú	Hydropower: Run of the river	16/10/2015	7,841.5	7,841.5	0.0113%	18.46%
Solar El Pilar - Los Amarillos	Solar	15/10/2015	0.0	0.0	0.0000%	18.46%
Solar Sol	Solar	5/10/2015	6,409.0	6,409.0	0.0093%	18.47%
Los Hierros II	Hydropower: Run of the river	21/09/2015	19,203.2	19,203.2	0.0277%	18.50%
Solar Luna	Solar	16/09/2015	9,252.3	9,252.3	0.0134%	18.51%
Solar Lalackama 2	Solar	31/08/2015	46,758.9	46,758.9	0.0675%	18.58%
Munilque	Hydropower: Run of the river	13/08/2015	773.9	773.9	0.0011%	18.58%
Picoiquén	Hydropower: Run of the river	13/08/2015	83,501.7	CDM Registered	0	18.58%
LOS PUQUIOS	Solar	11/08/2015	1,159.3	1,159.3	0.0017%	18.58%
Lleuquereo	Hydropower: Run of the river	7/08/2015	7,518.1	7,518.1	0.0109%	18.59%
Los Guindos	Diesel	30/07/2015	0.0	0.0	0.0000%	18.59%
Raki	Wind	30/07/2015	18,372.4	18,372.4	0.0265%	18.62%
Bureo	Hydropower: Run of the river	13/07/2015	8,362.3	8,362.3	0.0121%	18.63%
Salvador RTS	Solar	7/07/2015	0.0	0.0	0.0000%	18.63%
Solar Lalackama	Solar	2/06/2015	154,951.6	154,951.6	0.2238%	18.86%
Solar Chañares	Solar	28/05/2015	92,814.7	92,814.7	0.1340%	18.99%
Laja 1	Hydropower: Run of the river	28/05/2015	79,123.4	CDM registered	0	18.99%
Talinay Poniente	Wind	26/05/2015	203,800.7	203,800.7	0.2943%	19.28%
Solar Javiera	Solar	19/05/2015	172,234.0	172,234.0	0.2487%	19.53%
SOLAR JAMA 1_Solar	Solar	14/04/2015	95,170.5	95,170.5	0.1374%	19.67%
Santa Fe	Biomass	10/04/2015	6,900.0	6,900.0	0.0100%	19.68%
Eólica Taltal	Wind	9/02/2015	307,674.0	307,674.0	0.4443%	20.12%

Table A4-9. Determination of $EF_{Grid,BM,y}$

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM) (MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
Ciruelillo	Diesel	15/11/2019	0.0	0.0
Copiulemu	Natural gas	15/11/2019	0.0	0.0
Solar Luce	Solar	7/11/2019	1,441.5	0.0
Palacios	Hydropower: Run of the river	5/11/2019	6,771.8	0.0
TER Doña Javiera	Diesel	28/10/2019	0.0	0.0
Solar Bellavista 1	Solar	24/10/2019	4,315.6	0.0
Solar San Isidro	Solar	12/10/2019	503.1	0.0
Solar Tricahue 2	Solar	1/10/2019	7,175.2	0.0
Eólica San Gabriel	Wind	27/09/2019	147,785.3	0.0
Solar La Ligua	Solar	18/09/2019	861.5	0.0
Solar Villa Seca	Solar	17/09/2019	1,118.6	0.0
Solar RLA	Solar	14/09/2019	1,927.2	0.0
Dos Valles	Hydropower: Run of the river	14/09/2019	8,955.2	0.0
Dos Valles	Hydropower: Run of the river	14/09/2019	8,955.2	0.0
Solar Las Lechuzas	Solar	6/09/2019	2,997.3	0.0
Solar Placilla	Solar	6/09/2019	684.8	0.0
Solar Huatacondo	Solar	5/09/2019	135,165.3	0.0
Calfuco	Diesel	4/09/2019	0.0	0.0
Solar Poblacion	Solar	30/08/2019	3,372.8	0.0
Río Azul	Diesel	30/08/2019	0.0	0.0
Eólica La Flor	Wind	30/08/2019	6,905.0	0.0
Solar Doñihue	Solar	27/08/2019	5,796.6	0.0
Solar Jose Soler Mallafre	Solar	23/08/2019	983.3	0.0
Tucúquere	Solar	23/08/2019	2,806.1	0.0
Eólica El Nogal	Wind	23/08/2019	7,773.3	0.0
Solar Las Perdices	Solar	21/08/2019	2,595.1	0.0
Solar Ariztia	Solar	20/08/2019	2,320.7	0.0
Solar Jaururo	Solar	15/08/2019	1,208.1	0.0
Solar Marchihue VII	Solar	14/08/2019	2,289.9	0.0
Solar Vituco 2B	Solar	14/08/2019	2,658.2	0.0
Solar Canesa I	Solar	13/08/2019	3,032.2	0.0
Solar Santa Adriana	Solar	6/08/2019	1,514.2	0.0
Solar Crucero	Solar	1/08/2019	3,311.9	0.0
Central Cumbres	Hydropower: Run of the river	1/08/2019	61,930.7	0.0
Solar Talca	Solar	30/07/2019	7,947.3	0.0
Solar Illapel 5X	Solar	20/07/2019	3,023.8	0.0
Solar Chalinga	Solar	19/07/2019	3,007.3	0.0
Solar Cruz	Solar	19/07/2019	3,634.9	0.0
Solar Las Codornices	Solar	19/07/2019	3,287.7	0.0
Solar Montt	Solar	19/07/2019	3,425.2	0.0
Solar Ranguil	Solar	19/07/2019	2,126.9	0.0

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM)* *(MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
Solar Lo Sierra	Solar	12/07/2019	2,439.4	0.0
Solar Casuto	Solar	29/06/2019	3,232.2	0.0
Solar Norte Chico I	Solar	29/06/2019	1,976.1	0.0
Diesel PRP Gami	Diesel	29/06/2019	0.0	0.0
Diesel Los Sauces	Diesel	27/06/2019	0.0	0.0
Diesel Picoltué	Diesel	27/06/2019	0.0	0.0
Solar Lipangue	Solar	26/06/2019	2,706.5	0.0
Solar La Lajuela	Solar	18/06/2019	9,764.7	0.0
Solar Altos de Til Til	Solar	14/06/2019	2,146.3	0.0
Solar Rovian	Solar	14/06/2019	9,001.6	0.0
Diesel Almendrado	Diesel	11/06/2019	0.0	0.0
Solar Santa Clara	Solar	5/06/2019	4,057.2	0.0
Eólica Punta Sierra	Wind	5/06/2019	271,710.4	0.0
CERRO PABELLON_Geotermica	Geothermal	31/05/2019	CDM Registered	CDM Registered
Solar El Laurel	Solar	29/05/2019	8,022.0	0.0
Solar Pedreros	Solar	23/05/2019	3,887.2	0.0
IEM	Coal	16/05/2019	737,056.9	625,221.3
Solar Encon Solar	Solar	23/04/2019	10,501.3	0.0
Solar Fotovolt Solar I	Solar	23/04/2019	940.2	0.0
Solar GR Santa Rosa	Solar	12/04/2019	CDM registered	CDM registered
Solar Pirque	Solar	11/04/2019	3,736.9	0.0
Solar Marín	Solar	27/02/2019	6,146.0	0.0
Minihidro Correntoso	Hydropower: Run of the river	22/02/2019	15,851.3	0.0
Minihidro Palmar	Hydropower: Run of the river	22/02/2019	15,427.4	0.0
Solar Cachiyuyo 2	Solar	15/02/2019	19,928.4	0.0
Solar Calle Larga	Solar	15/02/2019	6,042.9	0.0
Solar La Blanquina	Solar	15/02/2019	12,665.7	0.0
Solar Malaquita 2	Solar	15/02/2019	20,271.3	0.0
Zapallar	Diesel	15/02/2019	0.0	0.0
Solar Valle Este 2	Solar	13/02/2019	18,754.6	0.0
Solar Valle Oeste 2	Solar	13/02/2019	18,573.0	0.0
Cogeneradora Aconcagua	Biomass	9/02/2019	1,163.6	0.0
Eólica Aurora	Wind	1/02/2019	161,256.5	0.0
Solar Alicahue	Solar	19/01/2019	5,233.7	0.0
Solar El Queule	Solar	19/01/2019	1,638.8	0.0
Punta Baja Solar	Solar	18/01/2019	3,950.2	0.0
Solar Olivillo	Solar	27/12/2018	17,800.0	0.0
Solar Piquero	Solar	6/12/2018	6,119.2	0.0
Solar El Quemado	Solar	20/11/2018	6,219.2	0.0
Solar Rodeo	Solar	17/11/2018	5,537.9	0.0
Solar Las Palomas	Solar	31/10/2018	5,974.3	0.0
Solar Catán	Solar	23/10/2018	5,456.3	0.0
SOLAR EL ÁGUILA I	Solar	4/10/2018	3,928.8	0.0
Solar El Pelícano	Solar	13/09/2018	290,274.3	0.0

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM) (MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
Solar El Chincol	Solar	7/09/2018	6,754.3	0.0
Solar El Picurio	Solar	4/09/2018	6,361.2	0.0
Solar Ocoa	Solar	1/09/2018	6,061.1	0.0
Solar Villa Prat	Solar	22/08/2018	5,640.9	0.0
Solar Santa Laura	Solar	17/08/2018	5,281.1	0.0
Solar Los Patos	Solar	9/08/2018	5,482.6	0.0
Solar Los Libertadores	Solar	8/08/2018	9,209.0	0.0
Solar Talhuén	Solar	1/08/2018	8,192.5	0.0
Solar La Acacia	Solar	28/07/2018	6,348.4	0.0
CERRO DOMINADOR	Solar	4/07/2018	300,793.0	0.0
Solar Peralillo	Solar	12/06/2018	6,549.0	0.0
Eólica Cabo Leones	Wind	10/06/2018	CDM Registered	CDM Registered
Degañ	Diesel	5/06/2018	474.2	326.0
HUAYCA1	Solar	4/06/2018	0.0	0.0
HUAYCA2	Solar	4/06/2018	51,227.7	0.0
Solar Amparo del Sol	Solar	1/06/2018	6,211.7	0.0
Solar Mostazal	Solar	26/05/2018	20,660.3	0.0
Solar Ovejería	Solar	25/05/2018	20,038.7	0.0
Solar Luders	Solar	23/05/2018	6,968.9	0.0
Eólica Sarco	Wind	1/05/2018	92,599.0	0.0
FV BOLERO_Solar	Solar	6/04/2018	366,910.2	0.0
Parque Sierra Gorda_Eólico	Wind	4/04/2018	356,459.2	0.0
Solar El Sauce	Solar	27/03/2018	6,296.8	0.0
Solar Chancon	Solar	21/03/2018	5,493.2	0.0
Solar El Pitio	Solar	13/03/2018	6,300.5	0.0
Hidro La Mina	Hydropower: Run of the river	21/02/2018	67,521.1	0.0
Embalse Ancoa	Hydropower: Reservoir	16/02/2018	77,150.6	0.0
Solar Santiago	Solar	31/01/2018	199,550.6	0.0
El Campesino 1	Biomass	24/01/2018	1,172.1	0.0
Solar Portezuelo	Solar	16/01/2018	5,657.2	0.0
Solar Los Gorriones	Solar	5/01/2018	6,508.1	0.0
Solar Cernicalo 1	Solar	21/12/2017	3,448.5	0.0
Solar Cernicalo 2	Solar	21/12/2017	3,294.8	0.0
Río Colorado	Hydropower: Run of the river	21/12/2017	49,267.1	0.0
Solar La Manga I	Solar	13/12/2017	4,431.9	0.0
Solar Doña Carmen Solar	Solar	29/11/2017	61,894.7	0.0
Solar Chimbarongo	Solar	21/11/2017	5,070.7	0.0
Santuario Solar	Solar	17/11/2017	7,410.0	0.0
Solar Valle de la Luna II	Solar	9/11/2017	6,134.6	0.0
Solar La Quinta	Solar	8/11/2017	CDM Registered	CDM Registered
Solar San Francisco	Solar	8/11/2017	7,111.8	0.0
Solar Antay	Solar	3/11/2017	24,822.4	0.0
Solar El Pilpen	Solar	2/11/2017	7,160.6	0.0
Solar El Roble	Solar	19/10/2017	18,232.5	0.0

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM) (MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
Lepanto	Biomass	18/10/2017	0.0	0.0
Solar Panquehue II	Solar	18/10/2017	12,110.1	0.0
Solar Don Eugenio	Solar	26/09/2017	6,122.7	0.0
La Bifurcada	Hydropower: Run of the river	9/09/2017	1,205.6	0.0
PUERTO SECO SOLAR	Solar	1/09/2017	30,032.4	0.0
La Viña - Alto La Viña	Hydropower: Run of the river	28/08/2017	3,437.1	0.0
Riñinahue	Hydropower: Run of the river	23/08/2017	6,934.4	0.0
Solar Cabilsol	Solar	28/07/2017	5,497.5	0.0
Solar Las Turcas	Solar	1/06/2017	4,254.2	0.0
Eólica San Pedro II	Wind	19/05/2017	112,835.5	0.0
PMGD CALAMA_Solar	Solar	12/05/2017	18,349.1	0.0
PARQUE SOLAR FINIS TERRAE_Solar	Solar	18/04/2017	387,475.3	0.0
Solar Marchigue 2	Solar	31/03/2017	14,401.3	0.0
Solar Cordillerilla	Solar	27/03/2017	1,440.2	0.0
Eólica San Juan	Wind	16/03/2017	589,780.0	0.0
Solar Quilapilún	Solar	9/03/2017	214,690.0	0.0
Solar El Romero	Solar	3/03/2017	461,397.7	0.0
Solar Cuz Cuz	Solar	2/03/2017	5,521.4	0.0
Solar Cardones	Solar	21/02/2017	417.7	0.0
Eólica La Esperanza	Wind	13/02/2017	17,658.1	0.0
Solar El Boco	Solar	30/01/2017	5,975.2	0.0
URIBE_Solar	Solar	8/01/2017	154,322.3	0.0
Solar La Esperanza II	Solar	30/12/2016	18,867.1	0.0
Eólica Las Peñas	Wind	28/12/2016	30,690.3	0.0
Kelar	Diesel	27/12/2016	CDM registered	CDM registered
Kelar	LNG	27/12/2016	CDM registered	CDM registered
Parque Eólico Lebu III	Wind	14/12/2016	6,651.0	0.0
Solar Ñilhue	Solar	1/12/2016	1,810.7	0.0
Solar San Pedro	Solar	1/12/2016	5,553.7	0.0
Newen	Propane	27/11/2016	0.0	0.0
Newen	Diesel	27/11/2016	0.0	0.0
Newen	Natural gas	27/11/2016	369.1	203.4
Tránquil	Hydropower: Run of the river	23/11/2016	0.0	0.0
La Montaña 1	Hydropower: Run of the river	16/11/2016	1,403.4	0.0
Carilafquén	Hydropower: Run of the river	28/10/2016	59,660.6	0.0
Solar Hormiga Solar	Solar	27/10/2016	4,584.6	0.0
Cumpeo	Hydropower: Run of the river	26/10/2016	25,961.2	0.0
Solar Pampa Solar Norte	Solar	19/10/2016	206,218.5	0.0
Solar Alturas de Ovalle	Solar	4/10/2016	11,011.4	0.0
Eólica Renaico	Wind	12/09/2016	280,540.1	0.0
Itata Hidro	Hydropower: Run of the river	9/09/2016	53,700.7	0.0
Solar Conejo	Solar	8/09/2016	305,716.0	0.0
hbs gnl	Natural gas	1/09/2016	0.0	0.0
Eólica Los Buenos Aires	Wind	30/08/2016	82,570.5	0.0

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM) (MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
El Colorado	Hydropower: Run of the river	29/08/2016	6,477.1	0.0
Solar Los Loros	Solar	17/08/2016	100,147.3	0.0
Solar La Silla	Solar	12/08/2016	4,583.4	0.0
Solar El Divisadero	Solar	10/08/2016	8,828.4	0.0
Cochrane	Coal	9/07/2016	1,679,646.4	1,487,796.1
Cochrane	Coal	9/07/2016	1,696,310.2	1,431,523.5
El Agrio	Hydropower: Run of the river	7/07/2016	9,871.4	0.0
Pulelfu	Hydropower: Run of the river	7/07/2016	53,544.6	0.0
El Galpón	Hydropower: Run of the river	28/06/2016	5,806.0	0.0
CMPC Tissue	LNG	16/06/2016	10,510.2	2,246.2
Solar Chuchiñi	Solar	9/06/2016	4,933.4	0.0
Solar Til Til	Solar	19/05/2016	3,543.0	0.0
Chanleufu	Hydropower: Run of the river	19/05/2016	1,784.6	0.0
Andes Generación	Diesel	17/05/2016	123.8	95.2
Andes Generación	Fuel N°6	17/05/2016	16.2	12.5
Solar Las Araucarias	Solar	12/05/2016	0.0	0.0
Alto Renaico	Hydropower: Run of the river	9/05/2016	8,246.7	0.0
PARQUE SOLAR PAMPA CAMARONES	Solar	4/05/2016	13,001.0	0.0
Solar Carrera Pinto	Solar	3/05/2016	238,325.5	0.0
CMPC Cordillera	LNG	25/04/2016	1,324.3	283.0
Río Mulchén	Hydropower: Run of the river	1/04/2016	2,336.5	0.0
Ujina	Fuel N°6	29/03/2016	0.0	0.0
Ujina	Fuel N°6	29/03/2016	289.3	181.3
Ujina	Fuel N°6	29/03/2016	38.5	24.0
Ujina	Fuel N°6	29/03/2016	270.6	164.3
Ujina	Fuel N°6	29/03/2016	297.4	181.3
Ujina	Fuel N°6	29/03/2016	301.2	187.0
Solar Bellavista	Solar	23/03/2016	3,759.8	0.0
Solar Santa Julia	Solar	17/03/2016	7,301.8	0.0
Molinera Villarrica	Hydropower: Run of the river	3/03/2016	1,358.3	0.0
El Paso	Hydropower: Run of the river	2/03/2016	88,664.5	0.0
Solar La Chapeana	Solar	1/03/2016	4,887.3	0.0
Solar Las Mollacas	Solar	1/03/2016	5,247.5	0.0
Malalcahuello	Hydropower: Run of the river	1/03/2016	13,151.9	0.0
Luz del Norte	Solar	24/02/2016	393,051.1	0.0
Solar Lagunilla	Solar	5/02/2016	6,724.1	0.0
SOLAR JAMA 2_Solar	Solar	21/01/2016	65,995.5	0.0
El Molle	Biomass	18/12/2015	15,475.0	0.0
Guacolda 5	Coal	15/12/2015	1,100,511.0	883,962.5
PMGD PICA_Solar	Solar	10/12/2015	CDM registered	CDM registered
Eólica Huajache	Wind	25/11/2015	14,210.1	0.0
PAS1_Solar	Solar	4/11/2015	0.0	0.0
El Mirador	Hydropower: Run of the river	2/11/2015	10,778.8	0.0
Trailelfú	Hydropower: Run of the river	16/10/2015	7,841.5	0.0

Power Plant	Type	Start-up Date	Gen 2019 *(Excluding CDM) (MWh)*	GHG Emissions in 2019 (tCO2/y) *(excluding CDM)*
Solar El Pilar - Los Amarillos	Solar	15/10/2015	0.0	0.0
Solar Sol	Solar	5/10/2015	6,409.0	0.0
Los Hierros II	Hydropower: Run of the river	21/09/2015	19,203.2	0.0
Solar Luna	Solar	16/09/2015	9,252.3	0.0
Solar Lalackama 2	Solar	31/08/2015	46,758.9	0.0
Munilque	Hydropower: Run of the river	13/08/2015	773.9	0.0
Picoiquén	Hydropower: Run of the river	13/08/2015	CDM Registered	CDM Registered
LOS PUQUIOS	Solar	11/08/2015	1,159.3	0.0
Lleuquereo	Hydropower: Run of the river	7/08/2015	7,518.1	0.0
Los Guindos	Diesel	30/07/2015	0.0	0.0
Raki	Wind	30/07/2015	18,372.4	0.0
Bureo	Hydropower: Run of the river	13/07/2015	8,362.3	0.0
Salvador RTS	Solar	7/07/2015	0.0	0.0
Solar Lalackama	Solar	2/06/2015	154,951.6	0.0
Solar Chañares	Solar	28/05/2015	92,814.7	0.0
Laja 1	Hydropower: Run of the river	28/05/2015	CDM registered	CDM registered
Talinay Poniente	Wind	26/05/2015	203,800.7	0.0
Solar Javiera	Solar	19/05/2015	172,234.0	0.0
SOLAR JAMA 1_Solar	Solar	14/04/2015	95,170.5	0.0
Santa Fe	Biomass	10/04/2015	6,900.0	0.0
Eólica Taltal	Wind	9/02/2015	307,674.0	0.0

***Notes**:*

Note 1: Low-Cost/Must-Run power plant for which data on electricity generation and fuel consumption is available. Therefore, the Emission Factor has been calculated following Option A.1., taking into account that for Run-of-River, hydropower: Reservoir, Solar, Eolic or Biomass fired power plants, the fuel type emission factor is equal to zero.

Table A4-10. Results for $EF_{Grid,BM,y}$

Results for $EF_{grid,BM,y}$	
$EF_{grid,BM,y}$ (tCO2/MWh)	**0.3181**

Table A4-11. Results for $EF_{Grid,CM,y}$

Emission factors for the Chilean SEN interconnected grid

Baseline	$EF_{grid,OMsimple,y}$ [tCO_2/MWh]		Net Generation [MWh] [53]
2017	0.6513		42,048,156652
2018	0.7265		41,018,147
2019	0.7010		42,104,818
	$EF_{grid,OMsimple,2017-2019}$	$EF_{grid,BM,2019}$	$EF_{grid,CM,2017,2018,2019}$ [tCO_2/MWh] wind and solar projects
	0.6926	**0.3181**	
	Weights_wind and solar projects	Weights_all other projects	
	w_{OM} = 0.75	w_{OM} = 0.50	
	w_{BM} = 0.25	w_{BM} = 0.50	**0.5990**

Table A4-12. Data for $EG_{m,y}$

Power Plant Name	Gen 2019 *(MWh)*
Ciruelillo	0.0
Copiulemu	0.0
Solar Luce	1,441.5
Palacios	6,771.8
TER Doña Javiera	0.0
Solar Bellavista 1	4,315.6
Solar San Isidro	503.1
Solar Tricahue 2	7,175.2
Eólica San Gabriel	147,785.3
Solar La Ligua	861.5
Solar Villa Seca	1,118.6
Solar RLA	1,927.2
Dos Valles	8,955.2
Dos Valles	8,955.2
Solar Las Lechuzas	2,997.3
Solar Placilla	684.8
Solar Huatacondo	135,165.3
Calfuco	0.0
Solar Poblacion	3,372.8
Río Azul	0.0
Eólica La Flor	6,905.0
Solar Doñihue	5,796.6
Solar Jose Soler Mallafre	983.3
Tucúquere	2,806.1
Eólica El Nogal	7,773.3
Solar Las Perdices	2,595.1
Solar Ariztia	2,320.7

[53] Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh).

Power Plant Name	Gen 2019 *(MWh)*
Solar Jaururo	1,208.1
Solar Marchihue VII	2,289.9
Solar Vituco 2B	2,658.2
Solar Canesa I	3,032.2
Solar Santa Adriana	1,514.2
Solar Crucero	3,311.9
Central Cumbres	61,930.7
Solar Talca	7,947.3
Solar Illapel 5X	3,023.8
Solar Chalinga	3,007.3
Solar Cruz	3,634.9
Solar Las Codornices	3,287.7
Solar Montt	3,425.2
Solar Ranguil	2,126.9
Solar Lo Sierra	2,439.4
Solar Casuto	3,232.2
Solar Norte Chico I	1,976.1
Diesel PRP Gami	0.0
Diesel Los Sauces	0.0
Diesel Picoltué	0.0
Solar Lipangue	2,706.5
Solar La Lajuela	9,764.7
Solar Altos de Til Til	2,146.3
Solar Rovian	9,001.6
Diesel Almendrado	0.0
Solar Santa Clara	4,057.2
Eólica Punta Sierra	271,710.4
CERRO PABELLON_Geotermica	CDM Registered
Solar El Laurel	8,022.0
Solar Pedreros	3,887.2
IEM	737,056.9
Solar Encon Solar	10,501.3
Solar Fotovolt Solar I	940.2
Solar GR Santa Rosa	CDM registered
Solar Pirque	3,736.9
Solar Marín	6,146.0
Minihidro Correntoso	15,851.3
Minihidro Palmar	15,427.4
Solar Cachiyuyo 2	19,928.4
Solar Calle Larga	6,042.9
Solar La Blanquina	12,665.7
Solar Malaquita 2	20,271.3
Zapallar	0.0
Solar Valle Este 2	18,754.6
Solar Valle Oeste 2	18,573.0
Cogeneradora Aconcagua	1,163.6
Eólica Aurora	161,256.5
Solar Alicahue	5,233.7
Solar El Queule	1,638.8
Punta Baja Solar	3,950.2
Solar Olivillo	17,800.0
Solar Piquero	6,119.2
Solar El Quemado	6,219.2
Solar Rodeo	5,537.9
Solar Las Palomas	5,974.3
Solar Catán	5,456.3
SOLAR EL ÁGUILA I	3,928.8
Solar El Pelícano	290,274.3
Solar El Chincol	6,754.3

Power Plant Name	Gen 2019 *(MWh)*
Solar El Picurio	6,361.2
Solar Ocoa	6,061.1
Solar Villa Prat	5,640.9
Solar Santa Laura	5,281.1
Solar Los Patos	5,482.6
Solar Los Libertadores	9,209.0
Solar Talhuén	8,192.5
Solar La Acacia	6,348.4
CERRO DOMINADOR	300,793.0
Solar Peralillo	6,549.0
Eólica Cabo Leones	CDM Registered
Degañ	474.2
HUAYCA1	0.0
HUAYCA2	51,227.7
Solar Amparo del Sol	6,211.7
Solar Mostazal	20,660.3
Solar Ovejería	20,038.7
Solar Luders	6,968.9
Eólica Sarco	92,599.0
FV BOLERO_Solar	366,910.2
Parque Sierra Gorda_Eólico	356,459.2
Solar El Sauce	6,296.8
Solar Chancon	5,493.2
Solar El Pitio	6,300.5
Hidro La Mina	67,521.1
Embalse Ancoa	77,150.6
Solar Santiago	199,550.6
El Campesino 1	1,172.1
Solar Portezuelo	5,657.2
Solar Los Gorriones	6,508.1
Solar Cernicalo 1	3,448.5
Solar Cernicalo 2	3,294.8
Río Colorado	49,267.1
Solar La Manga I	4,431.9
Solar Doña Carmen Solar	61,894.7
Solar Chimbarongo	5,070.7
Santuario Solar	7,410.0
Solar Valle de la Luna II	6,134.6
Solar La Quinta	CDM Registered
Solar San Francisco	7,111.8
Solar Antay	24,822.4
Solar El Pilpen	7,160.6
Solar El Roble	18,232.5
Lepanto	0.0
Solar Panquehue II	12,110.1
Solar Don Eugenio	6,122.7
La Bifurcada	1,205.6
PUERTO SECO SOLAR	30,032.4
La Viña - Alto La Viña	3,437.1
Riñinahue	6,934.4
Solar Cabilsol	5,497.5
Solar Las Turcas	4,254.2
Eólica San Pedro II	112,835.5
PMGD CALAMA_Solar	18,349.1
PARQUE SOLAR FINIS TERRAE_Solar	387,475.3
Solar Marchigue 2	14,401.3
Solar Cordillerilla	1,440.2
Eólica San Juan	589,780.0
Solar Quilapilún	214,690.0

Power Plant Name	**Gen 2019** *(MWh)*
Solar El Romero	461,397.7
Solar Cuz Cuz	5,521.4
Solar Cardones	417.7
Eólica La Esperanza	17,658.1
Solar El Boco	5,975.2
URIBE_Solar	154,322.3
Solar La Esperanza II	18,867.1
Eólica Las Peñas	30,690.3
Kelar	CDM registered
Kelar	CDM registered
Parque Eólico Lebu III	6,651.0
Solar Ñilhue	1,810.7
Solar San Pedro	5,553.7
Newen	0.0
Newen	0.0
Newen	369.1
Tránquil	0.0
La Montaña 1	1,403.4
Carilafquén	59,660.6
Solar Hormiga Solar	4,584.6
Cumpeo	25,961.2
Solar Pampa Solar Norte	206,218.5
Solar Alturas de Ovalle	11,011.4
Eólica Renaico	280,540.1
Itata Hidro	53,700.7
Solar Conejo	305,716.0
hbs gnl	0.0
Eólica Los Buenos Aires	82,570.5
El Colorado	6,477.1
Solar Los Loros	100,147.3
Solar La Silla	4,583.4
Solar El Divisadero	8,828.4
Cochrane	1,679,646.4
Cochrane	1,696,310.2
El Agrio	9,871.4
Pulelfu	53,544.6
El Galpón	5,806.0
CMPC Tissue	10,510.2
Solar Chuchiñi	4,933.4
Solar Til Til	3,543.0
Chanleufu	1,784.6
Andes Generación	123.8
Andes Generación	16.2
Solar Las Araucarias	0.0
Alto Renaico	8,246.7
PARQUE SOLAR PAMPA CAMARONES	13,001.0
Solar Carrera Pinto	238,325.5
CMPC Cordillera	1,324.3
Río Mulchén	2,336.5
Ujina	0.0
Ujina	289.3
Ujina	38.5
Ujina	270.6
Ujina	297.4
Ujina	301.2
Solar Bellavista	3,759.8
Solar Santa Julia	7,301.8
Molinera Villarrica	1,358.3
El Paso	88,664.5

Power Plant Name	Gen 2019 *(MWh)*
Solar La Chapeana	4,887.3
Solar Las Mollacas	5,247.5
Malalcahuello	13,151.9
Luz del Norte	393,051.1
Solar Lagunilla	6,724.1
SOLAR JAMA 2_Solar	65,995.5
El Molle	15,475.0
Guacolda 5	1,100,511.0
PMGD PICA_Solar	CDM registered
Eólica Huajache	14,210.1
PAS1_Solar	0.0
El Mirador	10,778.8
Trailelfú	7,841.5
Solar El Pilar - Los Amarillos	0.0
Solar Sol	6,409.0
Los Hierros II	19,203.2
Solar Luna	9,252.3
Solar Lalackama 2	46,758.9
Munilque	773.9
Picoiquén	CDM Registered
LOS PUQUIOS	1,159.3
Lleuquereo	7,518.1
Los Guindos	0.0
Raki	18,372.4
Bureo	8,362.3
Salvador RTS	0.0
Solar Lalackama	154,951.6
Solar Chañares	92,814.7
Laja 1	CDM registered
Talinay Poniente	203,800.7
Solar Javiera	172,234.0
SOLAR JAMA 1_Solar	95,170.5
Santa Fe	6,900.0
Eólica Taltal	307,674.0
MARIA ELENA FV_Solar	218,306.7
Las Flores	12,471.9
Solar Diego de Almagro	71,673.1
Punta Palmeras	CDM registered
María Elena	983.6
Collil	23,379.7
Las Pampas	0.0
Ucuquer 2	14,777.2
Las Terrazas	1,039.4
Pichilonco	5,427.0
Diesel La Portada	19.7
Solar PSF Pama	4,336.7
Eólica Los Cururos	248,387.7
San Pedro	CDM Registered
Solar San Andrés	116,830.8
San Andrés	CDM Registered
Solar PSF Lomas Coloradas	4,241.8
PAS3_Solar	45,453.4
Eólica El Arrayán	CDM Registered
Los Padres	6,234.4
Boquiamargo	0.0
Quillaileo	1,443.6
Llano de Llampos	257,730.7
Los Hierros	CDM Registered
Santa Marta	CDM Registered

Power Plant Name	Gen 2019 *(MWh)*
Energía Bio Bio	0.0
PAS2_Solar	21,286.6
Techos de Altamira	0.0
Eólica VALLE DE LOS VIENTOS_Eólico	CDM Registered
Coelemu	29,847.7
Los Bajos	22,076.1
CMPC Pacífico	118,043.9
El Llano	1,920.4
Las Vertientes	13,352.0
Solar La Frontera	9,335.6
Santa Cecilia	5,544.0
Negrete	94,058.8
Maisan	2,050.0
Diesel Zofri	0.0
Diesel Zofri	0.0
Diesel Zofri	0.0
Diesel Zofri	0.0
Diesel Zofri	0.0
Río Huasco	19,074.1
Santa Irene	0.0
Renaico	40,064.0
SDGx01	1,370.4
Los Álamos	2.3
Viñales	236,615.6
Solar Hornitos	151.4
Diesel Aguas Blancas	143.5
MC2	18,467.5
MC1	34,844.8
Ensenada	CDM registered
Ancali	0.0
CMPC Laja	153,897.4
Don Walterio	20,971.7
Robleria	CDM Registered
Talinay Oriente	CDM registered
Providencia	CDM Registered
Campiche	1,725,617.0
Tamm	0.0
Los Corrales II	4,538.1
Estancilla	42.0
Ucuquer	20,831.5
Rucatayo	248,828.8
Tambo Real	5,450.0
Trebal Mapocho	6,204.3
Bocamina II	2,333,196.0
PAM	128,995.3
Callao	CDM Registered
Nalcas	CDM Registered
Biocruz	2,251.3
Santa María	1,934,102.0
Curanilahue	9.3
El Canelo	21,443.3
Allipen	CDM Registered
Lautaro-Comasa	CDM Registered
Lautaro	CDM Registered
Planta Curicó	0.0
Purísima	2,299.0
CONSTITUCION	0.0
Cabrero	CDM Registered
Energía Pacífico	113,351.0

Power Plant Name	Gen 2019 *(MWh)*
Lautaro-Comasa 2	CDM Registered
Chacayes	CDM Registered
Punta Colorada Eólica	7,543.5
La Arena	CDM Registered
Muchi	2,257.3
Loma Los Colorados II	CDM Registered
Danisco	0.0
Reca	7,459.7
Termoeléctrica Hornitos	877,686.9
Lonquimay	96.0
Tirúa	14.5
Termoeléctrica Andina	737,597.7
Mallarauco	25,035.9
HBS	408.2
Licán	75,071.8
Skretting Osorno	0.0
Donguil	741.1
La Higuera	CDM Registered
Confluencia	CDM Registered
Calle-Calle	610.2
Diuto	23,835.2
Termoeléctrica Angamos	2,068,339.3
Termoeléctrica Angamos	2,120,690.1
Tomaval 1	3,048.3
Guayacán	CDM Registered
Mariposas	23,137.2
Lousiana Pacific II	7.3
Cem Bio Bio	1,018.3
Dongo	CDM Registered
Punta Colorada	0.0
Doña Hilda	2,847.8
CAVANCHA_PASADA	15,963.6
Los Corrales	238.3
SAN CLEMENTE	CDM Registered
El Tártaro	64.8
Chuyaca	271.5
Solar PV Salvador	186,335.2
El Salvador	116.1
Yungay 4 CA	50.7
Colihues U1	0.0
Emelda U2	629.7
Emelda U1	233.5
TRUENO	CDM Registered
Guacolda 4	967,253.0
LA PALOMA	CDM Registered
Nueva Ventanas	1,687,314.0
Loma Los Colorados	708.2
Monte Redondo	CDM Registered
Canela 2	CDM Registered
Termopacífico	958.1
San Lorenzo de D. de Almagro	0.0
Diego de Almagro	172.0
Diesel Inacal	44.3
Truful Truful	6,330.5
Quintero B	67,773.0
Quintero A	77,380.0
Tapihue	157.2
Guacolda 3	1,035,208.4
El Peñón	410.7

Power Plant Name	Gen 2019 *(MWh)*
Cardones	31.9
Louisiana Pacific	202.5
Teno	720.1
Parque Eólico Lebu	CDM Registered
Santa Lidia	1,829.0
Los Pinos	13,437.0
Los Espinos	2,242.7
Lircay	CDM Registered
Multiexport II	2.7
Multiexport I	3.3
Watts I	0.0
Watts II	0.0
Biomar	814.7
Cenizas	0.0
Trapén	45,545.1
Quellón II	0.0
Colmito	5,219.5
Colmito	52,900.4
Olivos	0.0
Coya	0.0
Chiloé	333.9
Ojos de Agua	CDM Registered
Yungay 3	172.0
Nueva Aldea 3	235,346.4
Puclaro	CDM Registered
Eólica Totoral	CDM Registered
FPC	25,846.5
San Isidro II	34.0
San Isidro II	1,561,050.0
San Isidro II	758,167.0
El Manzano	CDM Registered
Hornitos	CDM Registered
Canela	CDM Registered
Palmucho	235,026.0
Chiburgo	66,875.0
Esperanza 1	13.5
Esperanza 2	12.8
Maule	269.3
Constitución 1	1,120.4
Curacautín	104.2
Cañete	26.9
Lebu	4.2
Quilleco	CDM Registered
El Rincón	2,073.5
Yungay 1	118.2
Yungay 2	121.1
Los Vientos	76,899.7
Curauma	6.2
Nueva Aldea II	CDM Registered
Candelaria 2	560.0
Candelaria 2	36,236.0
Candelaria 2	375.0
Candelaria 1	47,608.5
Candelaria 1	709.0
TG_Coronel	265.1
TG_Coronel	1,145.6
Nueva Aldea	CDM Registered
Antilhue TG	52,163.5
Horcones	CDM Registered

Power Plant Name	Gen 2019 *(MWh)*
RALCO	2,309,853.0
Valdivia	CDM Registered
Valdivia LN	0.0
Valdivia	0.0
Nehuenco II	0.0
Nehuenco II	778,744.0
Nehuenco II	1,953,823.0
Licantén	19,315.9
Licantén LN	0.0
Cholguán	36,980.5
Eyzaguirre	3,177.4
Nehuenco TG 9B	1,852.0
Nehuenco TG 9B	614.0
CHACABUQUITO	CDM Registered
Pehui	5,622.9
Taltal 2	1,508.0
Taltal 2	14,622.0
Taltal 1	420.0
Taltal 1	3,056.0
MAMPIL	141,646.7
PEUCHEN	190,669.5
Atacama	3,560.8
Atacama	78,709.0
Atacama	6,419.0
Atacama	215,546.1
Termoeléctrica Tarapacá	614,131.2
Termoeléctrica Tarapacá	112.3
San Isidro	326.0
Nehuenco	0.0
Petropower	392,476.5
RUCUE	715,126.0
San Isidro	971,946.0
San Isidro	334,138.0
Nehuenco	544,757.0
Nehuenco	1,142,704.0
Nueva Renca FA	19.0
Nueva Renca FA	193.0
Nueva Renca	0.0
LOMA ALTA	166,711.0
Nueva Renca	1,710,345.0
Nueva Renca	0.0
Celco	50,405.0
PANGUE	1,669,874.0
SAN IGNACIO	87,060.0
Guacolda 2	943,523.0
Diesel Mantos Blancos	1.1
LAJA	30,935.0
Termoeléctrica Mejillones	0.0
Termoeléctrica Norgener	966,723.4
Termoeléctrica Mejillones	4,401.1
Termoeléctrica Mejillones	844,399.2
CAPULLO	69,552.4
Termoeléctrica Mejillones	259,074.7
Termoeléctrica Mejillones	228,973.4
Termoeléctrica Norgener	925,755.9
Guacolda 1	1,049,378.0
Juncalito	2,232.9
ACONCAGUA	225,756.0
Florida 3	18,870.9

Power Plant Name	Gen 2019 *(MWh)*
CURILLINQUE	417,520.4
PEHUENCHE	1,543,143.0
ALFALFAL	657,536.6
CANUTILLAR	647,068.0
MACHICURA	263,356.0
COLBUN	1,166,238.0
Arauco	45,087.9
ANTUCO	1,264,259.0
Huasco TG	0.0
Huasco TG	57.0
Ventanas 2	879,278.0
EL TORO	1,125,829.0
Bocamina	600,244.0
RAPEL	144,752.0
CHAPIQUIÑA _PASADA	38,970.3
Ventanas 1	190,496.0
ISLA	371,551.0
Auxiliar Maipo	19,939.3
PULLINQUE	188,019.0
Termoeléctrica Tocopilla	0.0
Termoeléctrica Tocopilla	1,072,176.3
Termoeléctrica Tocopilla	0.0
Termoeléctrica Tocopilla	9,043.7
Termoeléctrica Tocopilla	41,399.0
Termoeléctrica Tocopilla	112,337.8
Termoeléctrica Tocopilla	0.0
Termoeléctrica Tocopilla	22,650.4
Termoeléctrica Tocopilla	0.0
Termoeléctrica Tocopilla	0.0
SAUZALITO	54,061.0
CIPRESES	269,343.3
Diesel Arica	0.2
Diesel Arica	0.9
Diesel Arica	14.3
LOS MOLLES	30,829.8
SAUZAL 60 HZ	6,523.9
ABANICO	268,730.8
SAUZAL	287,968.0
VOLCAN	76,744.4
PILMAIQUEN	230,421.6
Carena	32,898.2
LOS QUILOS	141,222.4
LOS MORROS	6,386.8
QUELTEHUES	279,337.9
EPSA	77,009.9
MAITENES	98,177.9
SAUCE ANDES	3,165.2
Florida 2	42,321.0
ANDES SOLAR_Solar	CDM registered
Angostura	1,171,107.0
Solar Loma Los Colorados	1,041.8
Chufkén	6.6

Notes:

Note 1: source of thermoelectric generation information: "Consumos de Combustible de Centrales del Sistema Energético Nacional. Comisión Nacional de Energía, Gobierno de Chile. 2020"

Note 2: source of renewable generation information: "Generación Bruta del Sistema Energético Nacional. Comisión Nacional de Energía, Gobierno de Chile. 2020"

Note 3: some Power Plants names are repeated because they refer to different units and fuels. Depending on the year they use different fuels, so they are reported separately.

Note 4: this power plant was not connected in that year.

Table A4-13. Fuel consumption [(1)]

Fuel Type	Density	GCV [(9)]		NCV [(11)]	
	(kg/m3)	*(kcal/kg)*	*(kcal/m3)*	*(GJ/ton)*	*(GJ/m3)*
Coal	-	7,000		27.80	
Natural Gas	-		9,341		0.0351
LPG [(2), (6)]	552.40	12,100		45.50	
LNG [(3)]	-		9,341		0.0351
Petcoke	-	7,000		27.80	
Diesel [(4)]	840	10,900		43.28	
Fuel-Oil [(5), (8)]	945	10,500		41.70	

Fuel Properties

Unit	Natural Gas *(m3)*[(7)]	m3	GJ
Mbtu	0.0302650		
Mmbtu	30.2650		
dam3		1,000	
Mm3 [(10)]		1,000	
kcal			0.000004180

Conversion Factors

Fuel Type	EF *(tCO_2/GJ)*	EF *(tCO_2/ton)*	EF *(tCO_2/m^3)*
Coal	0.0873	2.43	
Natural Gas	0.0543		0.00191
LPG [(2), (6)]	0.0616	2.80	1.54895
LNG [(3)]	0.0543		0.00191
Petcoke	0.0829	2.30	
Diesel [(4)]	0.0726	3.14	
Fuel-Oil [(5), (8)]	0.0755	3.15	

Emission Factors [(12)]

Notes:

Note 1: source of fuel consumption information: "Consumos de Combustible de Centrales del Sistema Energético Nacional. Comisión Nacional de Energía, Gobierno de Chile. 2020"

Note 2: the "Butano" and "Propano" categories, as appear at the data source (Table 1), since they are all included into Liquified Petroleum Gases (LPG), as defined by the International Panel on Climate Change at "2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1", are going to be considered, at the time of calculating its emission factors, grouped into LPG category

Note 3: since Liquified Natural Gas consumption is measured in gaseous state, therefore its density is the same than the normal conditions natural gas and therefore the natural gas emission factor and calorific value is applied.

Note 4: the "Petróleo-Diésel - Petróleo IFO-180" category, as appear at the data source (Table 1), is going to be considered as "Diesel" to calculate the net quantity of fossil fuels consumptiom in the SEN System. As it represents about a 0,02% of the total Diesel consumption, this hypothesis is considered valid and without significative contribution or impact in the final results.

Note 5: the "Petróleo FO6", "Petróleo Nº6", "Petróleo IFO 180" and "Petróleo IFO 380" categories, as appear at the data source (Table 1), since they are all kinds of Fuel Oil, considering their Gross Calorific Value is the same (see GCV data source), they are going to be considered grouped into Fuel-Oil category (Table 2 and Table 3) when calculating their emission factor.

Note 6: source for density data: Chilean National Energy Balance 2018 ("Balance Nacional de Energía 2018. Comisión Nacional de Energía, División de Prospectiva y Política Energética del Ministerio de Energía. Ministerio de Energía de Chile, 2019").

Note 7: source for conversion factor: Chilean National Energy Balance 2018 ("Balance Nacional de Energía 2018. Comisión Nacional de Energía, División de Prospectiva y Política Energética del Ministerio de Energía. Ministerio de Energía de Chile, 2019").

Note 8: source for density data: Chilean National Energy Balance 2018 ("Balance Nacional de Energía 2018. Comisión Nacional de Energía, División de Prospectiva y Política Energética del Ministerio de Energía. Ministerio de Energía de Chile, 2093"). Since the density conversion factor has been only used for Petroleum No.6, its density has been established in Table 3

Note 9: source for GCV: Chilean National Energy Balance 2018 ("Balance Nacional de Energía 2018. Comisión Nacional de Energía, División de Prospectiva y Política Energética del Ministerio de Energía. Ministerio de Energía de Chile, 2019").

Note 10: source for conversion factor: National Statistics Institute of Chile (Instituto Nacional de Estadística, INE de Chile).

Note 11: The CNE Energy Balance Report includes Gross Calorific Values (GCV) for the different types of fuel. These values were corrected to Net Calorific Values (NCV) based on the IPCC 2006 assumptions. Net Calorific Value has been calculated as established by IPCC, following the next criteria: "The difference between NCV and GCV is the latent heat of vaporisation of the water produced during combustion of the fuel. As a consequence for coal and oil, the NCV is about 5 percent less than the GCV For most forms of natural and manufactured gas, the NCV is about 10 percent less". That means, from National or official values for GCV, NCV has been obtained applying a correction factor of 0,95 for solid or liquid fuels and a correction factor of 0,90 for gas type fuels. That approach have been proposed by the IPCC in "2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1"

Note 12: Unit-converted from values showed in: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 1, Table 1.4 (lower limit of the 95% confidence intervals

Note 13: source for the emission factor value applicable to biogas power generation: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 2, CHAPTER 2, Table 2.2

Appendix 5. Further background information on monitoring plan

Not applicable.

Appendix 6. Summary report of comments received from local stakeholders

Not applicable.

Appendix 7. Summary of post-registration changes

Not applicable.

Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

Version	*Date*	*Description*
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document