Project design document form

(Version 10.1)

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

BASIC INFORMATION	
Title of the project activity	Rinconada PV CDM Project
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	01
Completion date of the PDD	27/Mar./2019
Project participants	DE Energia SpA
Host Party	Chile
Applied methodologies and standardized baselines	AMS I.D/Version 18 "Grid connected renewable electricity generation"
Sectoral scopes linked to the applied methodologies	Sectoral Scope: 01, Energy Industries (renewable and non-renewable sources)
Estimated amount of annual average GHG emission reductions	13,672 tCO_2/yr

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Rinconada PV CDM Project ("the Project") is to construct and operate photovoltaic power generation project with the generation capacity of 8MW in the central region of Chile. The project is expected to generate 20,581 MWh annually and will connect to the national power grid in Chile (SEN, Sistema Eléctrico Nacional).

DE Energia SpA owns the power generation facility under the proposed project. The power plant will be located in Rengo, O'Higgins Region, Chile. This photovoltaic power plant will utilize renewable energy sources for electricity generation, which contributes to GHG emission reduction by displacing existing power generation activities based on fossil fuel including oil and coal. As a result, the operation of the proposed solar power plant will result in the reduction of 13,672 tonnes CO_{2e}/y.

General information of the proposed PV power plant		
Major stakeholders of the project	Project Owner	DE Energia SpA
	Major Investor	Dealim Energy Co. Ltd.
Power Generation and Supply	Technology	Photovoltaic power generation
	Capacity (MW, AC)	8.0
	Expected COD[1]	June-2019
	Grid Connection	SEN (Sistema Eléctrico Nacional) Grid in Chile

Baseline Scenario

As per the applicable CDM methodology AMS-I.D., a Greenfield power plant is defined as "*a new renewable energy power plant that is constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity*".

As the project activity falls under the definition of a Greenfield power plant, the baseline scenario as per the applied methodology is the following:

The baseline scenario is that the electricity delivered to the 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 into the grid.

[1] Commercial Operation Date

The scenario existing prior to the implementation of the project activity, is electricity delivered to the grid by the project activity that 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”.

As determined in Section B.4 of this PDD, the baseline scenario for this project relates to the electricity from the operation of existing grid-connected power plants and by the addition of new generation sources. The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity.

As established in Section B.3, the project boundary includes the CO_2 emissions from electricity generation in fossil fuel-fired power plants that are displaced due to the project activity.

Relevance to Sustainable Development

The project is consistent with the national laws and sustainable development policies, strategies, plans and addresses the national sustainable development. In addition, the proposed project will contribute to sustainable development and the reduction of national emissions of GHG as follows:

- The proposed project can diversify sources of electric generation and be a model case as a photovoltaic power generation that utilizes solar energy.
- Following the replacement of fossil fuel by renewable energy, the effects of decreasing GHG and air pollution are expected.
- The photovoltaic power generation will contribute toward the improvement of air quality and better living condition of the country by reducing the air pollution

1) Environmental Development:

The project does not contribute to the GHG emissions such as CO2, NOx, SOx, etc. and harmful pollutants and suspended airborne particulate matter associated with fossil fuel-based power plants.

- Electricity produced by renewable energy generation will displace electricity supplied from the national grid, so the use of fossil fuels will be reduced.
- The project observes the relevant regulations in Chile such as social and environmental considerations during the RCA (Environmental License in Chile).

- The project activity does not involve any equipment with moving component and hence it is free of noise pollution.
- The project activity does not involve any waste generation and hence there will be no discarded waste and related waste management, as in biomass or biogas projects.
- The project activity does not contaminate the soil and water.
- The project activity contributes towards conserving fossil fuels.

2) Social Development:

- The project activity supports the national policy of Chile for developing and promoting the use of renewable energy in the energy sector.
- The project activity diversifies the power sources and makes use of clean energy.
- The project activity improves the public infrastructure in Chile by enhancing power generation capacity connected to the grid.

3) Economic Development:

- The project activity reduces the import of expensive fossil fuel, thereby facilitating the saving of the cost of obtaining foreign energy sources.
- The project is expected to contribute to increasing the employment opportunity of the country during construction and during operations;
- The project activity accelerate foreign investment for developing renewable energy sources such as solar power in the country

4) Technological Development:

- The project activity contributes to expanding the utilization of renewable energy technologies in the country.
- The project entails the import of expertise and experts in terms of solar energy sector from foreign countries and accelerates the global sharing of relevant technological knowledge.
- The project contributes to the improvement of the skill set for local inhabitants through training and capacity building for employment for the project

A.2. Location of project activity

The power plant of the proposed project activity is to be located in the central region of Chile. The following picture and table describes the detailed location of this power plant.

- **Name of Power Plant:** Rinconada
- **Coordinate (UTM) of the power plant**
  Zone: 19H Easting: 332803, Northing: 6191234
- **Administrative location:** Rengo, O'Higgins Region, Chile

[Figure] Location of power plants under the proposed CDM project

A.3. Technologies/measures

Categorization of Technology according to UNFCCC terms

Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)

Project Type : I - Renewable Energy Projects

Project Category : I.D. - Grid connected renewable electricity generation (Version 18, EB 81)

Technological Specification

The proposed CDM project activity will generate power using solar energy, which is a renewable source of energy. The solar PV system mainly consists of PV modules, inverters, monitoring devices and etc. The solar PV cells convert solar radiation into DC current. The solar panels are installed in arrays. The modules in each array are connected in parallel and/or series in order to get the preferred current & voltage which match with the rated input parameters of the inverter. The inverter connected in each array converts the DC current to AC current. The electricity collected from all the inverters and the voltage of the collected electricity is stepped up and transported to the national grid.

Capacity and Expected Amount of Power Generation

The following table specifies the AC/DC capacity of the proposed power plant and expected amount of power generation per year.

(Rinconada Power Plant)	Expected design of the project
DC Capacity of the plant	9,633 kw
AC Capacity of the plant	8,000 kw
Expected power generation	20,581 MWh/year

The layout of PV modules

The following table describes the layout of photovoltaic modules for project sites which constitutes the proposed CDM project.

[Figure] Layout of Power Plant

Technical specification of PV module

As for the power generation module including solar penal, the following table describes the technical characteristics of the photovoltaic modules to be installed for project sites.

Technical Aspect of PV Module	Specification
Manufacturer	Trinasolar
Peak Power Watts	340
Maximum Power Voltage	38.2
Maximum Power Current	8.90
Open Circuit Voltage	46.2
Short Circuit Current	9.50
Module efficiency (%)	17.5
Size (mm)	1960 × 992 × 40 mm
Weight (kg)	22.5~26.0

Technical specification of inverter

Among the inverters installed in the proposed project power plant, major technical characteristics are summarized in the table below.

	Technical Aspect of Inverter	Specification
Input (DC)	PV array power range	1,620 - 2,128 kWp
	Voltage Range MPP	910 - 1,300 V
	Maximum voltage	1,500 V
	Maximum current	1,850 A
Output (DC)	Power IP54 @30 ºC / @50 ºC	1,637 kVA / 1,473 kVA
	Power IP56 @27 ºC / @50 ºC	1,637 kVA / 1,449 kVA
	Rated voltage	630 V IT System
	Frequency	50 / 60 Hz

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)	DE Energia SpA (Private Entity)	No

A.5. Public funding of project activity

There is no Annex-I countries' public funding or Official Development Assistance (ODA) involved in this Project activity.

A.6. History of project activity

The project proponent confirms 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.

And further declares that:

(a) The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA;

(b) The proposed CDM project activity is not 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) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Based on the Methodological tool - Assessment of debundling for small-scale project activities (Ver. 4), debundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.

According to this guideline stated above and the provisions prescribed in "Clean development mechanism project standard", a proposed small-scale project activity shall be deemed to be a

debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;
(b) In the same project category and technology/measure;
(c) Registered within past two years; and
(d) Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point.

Assessment of debundling for the projects covered under this bundling CDM projects and existing CDM projects

The project participants of this proposed bundling CDM project activities hereby confirm that all power plants covered by this bundling CDM project are not the debundled component of a large scale project as there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity (a) with the same project participants; (b) in the same project category and technology/measure; and (c) registered within past two years; and (d) whose project boundary is within 1 km of the project boundary of the proposed CDM projects at the closest point.

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

Reference: The project activity meets the eligibility criteria to use the simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7. Details of methodology for baseline calculations for CDM projects of capacity less than 15 MW are available in the "Appendix B of the simplified modalities and procedure for small scale CDM project activities".

- **Type I** : Renewable Energy Project (Small Scale)
- **Category** : I. "D", Grid Connected Renewable Electricity Generation
- **Methodology** : AMS-I.D Grid Connected Renewable Electricity Generation (Version 18)[2]

Reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.

CDM Standard and Tools referred to in this PDD include:

- The CDM glossary (Ver. 9.1)
- CDM Project Standard (Ver 2.0)
- Tool to calculate the emission factor for an electricity system (Ver. 7.0)
- Demonstration of additionality of small-scale project activities (Ver. 12)
- Assessment of debundling for small-scale project activities (Ver. 4)

B.2. Applicability of methodologies and standardized baselines

The project activity involves the generation of grid-connected electricity from renewable solar energy. The project activity has an installed capacity of less than 15 MW which is the maximum qualifying capacity for a small scale CDM project activity under Type-I of the small scale methodologies. The installed capacity will not increase throughout the crediting period, therefore, the project activity will remain within the limit of small scale in each year of the crediting period.

[2] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

Review of applicability of the AMS I.D (Ver. 18)

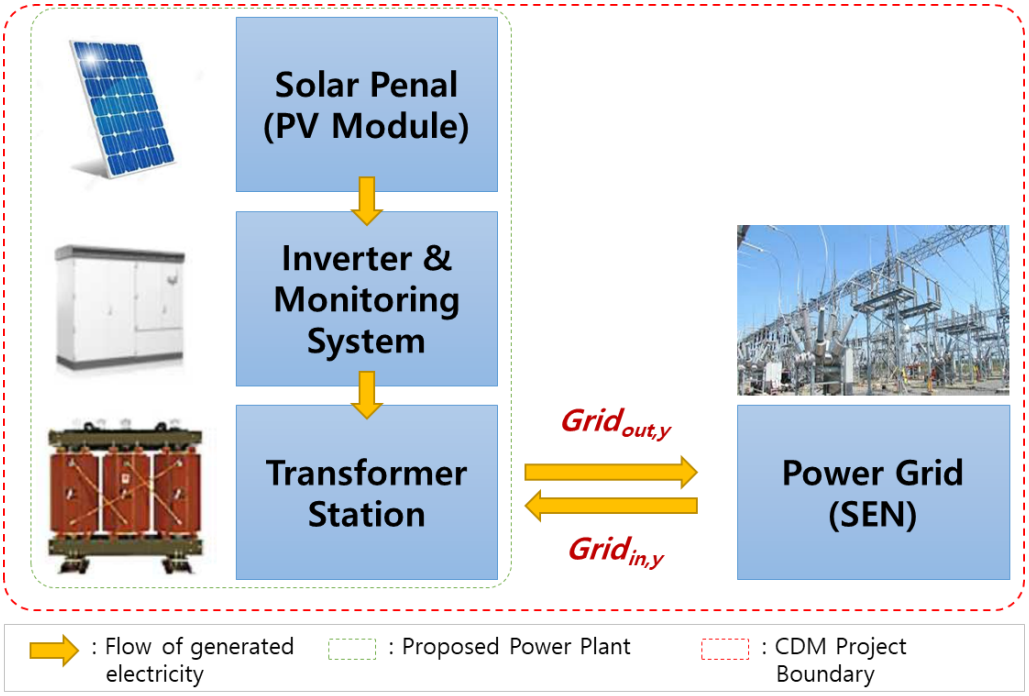
Applicability criteria suggested in AMS I.D. Ver.18	Review of the applicability for this CDM Project
1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid. (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The project activity is the renewable energy generation project involving the construction and operation of photovoltaic-based power generation plants. Generated electricity will be supplied to the grid. In this regard, the project is considered to be within the scope of this methodology.
2. Illustration of respective situations under which each of the methodology (i.e. "AMS-I.D.: Grid connected renewable electricity generation", "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" and "AMS-I.A.: Electricity generation by the user) applies is included in the appendix.	According to the 'Appendix. Scope of AMS-I.D., AMS-I.F. and AMS-I.A. based on project types' of AMS I.D. Ver. 18, AMS I.D is applicable when the project supplies electricity to a national/regional grid, which corresponds to the design of this project.
3. This methodology is applicable to project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	The proposed projects can be categorized as (a) Install a Greenfield plant.
4. Hydropower plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: The project activity is implemented in an existing reservoir with no change in the volume of reservoir; The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The project is a solar power project and thus the criterion is not applicable to this project activity.
5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the	The total installed capacity (DC) of the power plant for this project is lower than this 15-MW threshold.

eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	
6. Combined heat and power (co-generation) systems are not eligible under this category.	Project activity is a renewable solar energy project and is not a combined heat and power system. Hence the criteria are not applicable to the project activity
7. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units	The project activity is Greenfield and there is no existing power generation facility at the site. Hence the criteria are not applicable to the project activity
8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable, the solar project is a Greenfield project activity and this project is not the enhancement or up gradation project.
9. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as “AMS-I.C.: Thermal energy production with or without electricity” shall be explored.	The Project activity is a renewable solar Photovoltaic power project and is not a landfill gas, waste gas, wastewater treatment and agro-industries projects or recovered methane emissions project. Hence the criteria are not applicable to the project activity
10. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply.	The Project activity is photovoltaic-based power generation project and is not a biomass project. Hence the criteria are not applicable to the project activity.

As discussed above, the proposed CDM project satisfies the applicability criteria suggested in the AMS I.D (Ver. 18). In addition, the project participants will ensure that the installation and operation of this project do not violate these criteria during the CDM crediting period.

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

As defined in methodology AMS-I.D. (ver.18), the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to. Hence the project boundary includes the PV power plant, inverters, transformers, metering system, and the national gird.



[Figure] Project Boundary

Although the AMS I.D (Ver. 18) does not explicitly offers an exhaustive list of greenhouse gases to be considered in the methodology, the major greenhouse gas considered in this methodology is carbon dioxide as CO2 emission factor for grid-connected power generation in the baseline scenario is considered for the calculation of emission reductions as described in the equation below.

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

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$	=	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)
$EF_{grid,y}$	=	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" (tCO_2/MWh)

Therefore, the project boundary includes CO2 as the major greenhouse gas that would have emitted from the operation of grid-connected fossil fuel-based power plants in the absence of the project activity.

B.4. Establishment and description of baseline scenario

As the project activity is the installation of a Greenfield power plant, the baseline scenario is the following as described in the applied CDM methodology (AMS I.D Ver. 18):

19. The baseline scenario is that the electricity delivered to the 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 into the grid. .. (omitted)

The project activity involved setting up a solar plant to harness the power of sunlight to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the national grid in Chile (SEN), which is based largely on fossil fuel-fired plants. Hence, the baseline for the project activity is the equivalent amount of electricity supplied from the existing national grid.

Based on this consideration, the combined margin ($EF_{grid,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) (having weightage 25%) and build margin (BM) (having weightage 75%). Calculations for this combined margin is based on data from an official source (where available) and made publically available.

The combined margin of the national grid used for the project activity is as follows:

Parameter	Value	Definition of parameter	Source
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO2 emission factor for the project electricity system in year y	**0.7478**
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO2 emission factor for the project electricity system in year y	**0.4138**
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO2 emission factor for the project electricity system in year y	**0.6643**

B.5. Demonstration of additionality

Prior Consideration of CDM

CDM Project Standard (Ver 2.0) Section 7.1 states that “For a proposed CDM project activity with a start date on or after 2 August 2008, the project participants shall notify the designated national authority (DNA) of the host Party of the project activity, if such DNA exists, and the UNFCCC secretariat (hereinafter referred to as the Secretariat), in writing of the commencement of the project activity and their intention to seek the CDM status for the project activity, or, through a DOE, publish the PDD for global stakeholder consultation, within 180 days of the start date in accordance with the “CDM project cycle procedure for project activities”.

The CDM glossary (Ver. 9.1) states the definition of the starting date as follows.

For a CDM project activity (non-A/R) or CPA (non-A/R), the date on which the project participants commit to making expenditures for the construction or modification of the main equipment or facility (e.g. a wind turbine), or for the provision or modification of a service (e.g. distribution of energy-efficient light bulbs, change of transport management system), for the CDM project activity or CPA. Where a contract is signed for such expenditures (e.g. for procurement of a wind turbine), it is the date on which the contract is signed. In other cases, it is the date on which such expenditures are incurred. If the CDM project activity or CPA involves more than one of such contracts or incurred expenditures, it is the first of the respective dates. Activities incurring minor pre-project expenses (e.g. feasibility studies, preliminary surveys) are not considered in the determination of the start date.

Since the starting date of the project is expected to be early April of 2019 (Date of Signing the EPC Contract), the project participant submitted the prior consideration form to the Chilean DNA and the UNFCCC in March of 2019. Such notification is done in compliance with the relevant UNFCCC standards (e.g. Notification written in a UNFCCC format for prior consideration of CDM). This clearly shows that the project participant has considered CDM benefits necessary in the decision of proceeding this project activity.

The following table descrisbes major historical and future activities to proceed with the proposed project activity.

[Table] Historical activity and plan for the proposed CDM project

Event	Applicability by the power plant
RCA[3]	27-Aug-2018
IFC[4]	4-Oct-2018
Building Permit	31-Oct-2018
COD[5] (Commercial Operation Date)	Jun-2019 (expected)

Additionality Assessment

According to Section 5 of Methodological Tool - Demonstration of additionality of small-scale project activities (Ver. 12), PP shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) **Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions.
(b) **Technological barrier**: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.
(c) **Barrier due to prevailing practice**: prevailing practice or existing regulatory or policy requirements would have led to the implementation of technology with higher emissions.
(d) **Other barriers**: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources or capacity to absorb new technologies, emissions would have been higher.

According to paragraph 11 of the same tool, demonstration of barriers, as explained above, is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW). This so-called positive list includes of the following grid-connected and off-grid renewable electricity generation technologies:

[3] Resolucion de Calificacion Ambiental which is environmental approval in Chile.

[4] Sectoral permit in Chile to be processed to build non-agricultural buildings in the rural sector, for which this change in land use must be requested.

[5] COD: Commercial Operation Date (Start date of supplying generated electricity to the grid). For the power plants which started commercial operation at the time of PDD preparation, exact date is specified. In case that the commercial operation has not been started, expected Month of commercial operation is suggested in this table.

(i) Solar technologies (photovoltaic and solar thermal electricity generation);

(ii) Off-shore wind technologies;

(iii) Marine technologies (wave, tidal);

(iv) Building-integrated wind turbines or household rooftop wind turbines of a size up to 100 kW;

(v) Biomass internal gasification combined cycle (BIGCC);

As the capacity of power generation for this project is within the threshold suggested above (e.g. installed capacity up to 15 MW) in addition to the fact that these plants adopt solar technology stated in the positive list. Therefore, the proposed CDM project will not go through a demonstration of (a)~(d) barriers according to the Tool.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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Applied Methodology: AMS - I.D, version 18, EB 81

Baseline emissions

The baseline emission calculation for the project activity is attributable to the CO_2 Emission that could have been produced by the fossil fuel based power plants in absence of the proposed project activity. Therefore the amount of electricity supplied to the national grid will be multiplied by the grid emission factor of the respective grid to calculate the baseline emissions reduced by the proposed project activity.

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

Where,

$\mathbf{BE_y}$	=	Baseline emissions in year y (t CO_2)
$\mathbf{EG_{PJ,y}}$	=	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)
$\mathbf{EF_{grid,y}}$	=	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)

Calculation of $EG_{PJ,y}$

According to Paragraph 26 of AMS I.D Ver. 18, if the project activity is the installation of a greenfield power plant, the quantity of net electricity generation is as follows;

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

Where,

$EG_{PJ,facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh)

In addition, any amount of electricity imported from the grid to the project power plants, if any, will be considered to calculate the $EG_{PJ,facility,y}$ in accordance with the following equation.

$EG_{PJ,facility,y} = Grid_{out,y} – Grid_{in,y}$

Where,

$Grid_{out,y}$ = Quantity of electricity generation that is exported from the project power plant to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$Grid_{in,y}$ = Quantity of electricity generation that is imported from the grid as a result of the implementation of the CDM project activity in year y (MWh)

Calculation of $EF_{grid,y}$

As per the "Tool to calculate the emission factor for an electricity system" Version 7.0, the following steps have been followed to calculate the emission factor of the grid for this project.

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 power systems

For determining the electricity emission factors, the project participant shall identify the relevant project electricity system. Similarly, the project participants shall identify any connected electricity systems.

Historically, the Chilean electric power grid is organised into four independent systems[6]: the Central Interconnected System (SIC, Sistema Interconectado Central), serving the central part of the country; the Northern Interconnected System (SING, Sistema Interconectado del Norte Grande), serving the north; and two small systems, Aysén and Magallanes serving the south. All electric power generation, transmission and distribution activities are implemented by the private sector under the supervision of the National Energy Commission (CNE).

In November 2017, Chile completed the interconnection of its Northern electrical grid, or "Sistema Interconectado del Norte Grande" (SING), with its Central Grid, or Sistema Interconectado Central" (SIC). This integration resulted in the National Electric System (Sistema Eléctrico Nacional, or SEN)[7]. As the power plants covered under this proposed CDM project provides all the generated electricity to the SEN grid, the relevant power system for this project corresponds to the SEN grid.

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

Project participants have the option of choosing between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I is selected for this project and only grid power plants are included in the calculation of emission factor.

STEP 3: Select a method to determine the operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

[6] Source: 2015 Energy Statistical Yearbook Chile, https://www.cne.cl/wp-content/uploads/2016/07/AnuarioCNE2015_vFinal-Ingles.pdf

[7] For detailed explanations, refer to https://www.export.gov/article?id=Chile-Energy

The data required to calculate simple adjusted OM or Dispatch data analysis is not possible due to lack of availability of this activity data to the project developers. The choice of other two options for calculating the operating margin emission factor depends on the generation of electricity from low cost/must run (LCMR) sources. In the context of the methodology low cost/mustrun resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

Share of power generation by technologies (% of Net Generation)

Year	2014	2015	2016	2017	2018
Biomass	3.9%	3.3%	3.6%	3.3%	3.2%
Carbon	40.6%	39.2%	43.6%	39.1%	38.2%
Coal + Petcoke	0.8%	0.7%	0.7%	0.6%	0.6%
Cogeneration	0.2%	0.2%	0.2%	0.2%	0.2%
Wind	2.0%	2.9%	3.1%	4.7%	4.7%
Fuel Oil	0.3%	0.1%	0.2%	0.1%	0.0%
Natural gas	2.9%	3.6%	2.5%	2.6%	4.6%
LNG	11.5%	11.9%	13.9%	13.6%	10.5%
Hydraulic (Reservoir)	16.9%	16.2%	10.8%	12.7%	14.4%
Hydraulics (Run-of-River)	16.8%	17.1%	15.7%	16.6%	16.2%
Petcoke	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel oil	3.6%	2.9%	2.4%	1.1%	0.4%
Geothermal				0.1%	0.3%
Solar	0.7%	1.9%	3.5%	5.3%	6.8%
TOTAL	100%	100%	100%	100%	100%

- Proportion of Low Cost/Must Run sources for the last 5 years (‘14~’18, %): **41.3%**
- Proportion of Thermal sources for the last 5 years (’14~’18, %): **58.7%**

The above data shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the national grid is less than 50% of the total generation. Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The “Simple Operating Margin” has been calculated as per the weighted average emissions (in tCO_2/MWh) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low-cost biomass, nuclear and solar generation;

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- ***Ex ante option:*** *If the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation;*

Or

- ***Ex post option:*** *If the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.. (omitted)*

Ex-ante option is selected for this project as mode of calculating the OM which is based on 3-year weighted average of power generation data during the most recent years available at the time of submission of CDM-PDD to the DOE for validation.

STEP 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

(a) Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or
(b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For this project, Option A (Calculation based on average efficiency and electricity generation of each plant) is selected. Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

Determination of $EF_{grid,OMsimple,y}$

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

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO2 emission factor in year *y* (t CO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit m in year y (t CO2/MWh)
m	=	All 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 in Step 3

The operating margin emission factor has been calculated using a 3 year data vintage. The annual sum of electricity generation and CO2 emissions are described below. Based on these data, OM CO_2 emissions for the last three years are calculated and $EF_{grid,OM}$ (3-year weighted average) corresponds to 0.7478 tCO_2/MWh.

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m should be determined in accordance with one of the following options.

(a) Option A1 - If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:
(b) Option A2 - If 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 CO2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

For this project, Option A1 is selected. Therefore, fuel consumption and electricity generation for each power unit m is utilized to calculate its GHG emission factor.

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (t CO2/MWh)
$FC_{i,m,y}$	=	Amount of fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fuel type *i* in year *y* (t CO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All power units serving the grid in year *y* except low-cost/must-run power u nits
i	=	All fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

According to the selected options and equations described above, the OM emission factor for this project is calculated as summarized in the table below. For detail information about the OM calculation, refer to the separate calculation sheet.

OM Calculation

Year	Operating margin CO_2 emission factor in year *y*	Electricity generation	GHG Emissions
	$EF_{grid,OM,y}$	$\sum EG_{m,y}$	$\sum FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,I,y}$
	tCO_2/MWh	MWh/y	tCO2/y
2018	0.7281	41,018,074	29,865,002
2017	0.7536	41,289,252	31,116,291
2016	0.7606	45,022,449	34,242,082
Total	-	127,329,775	95,223,375

(3-year weighted average) $EF_{grid,OM}$	**0.7478**

STEP 5: Calculate the build margin emission factor ($EF_{BM,y}$)

In terms of vintage of data based on which to calculate the BM emission factor, project participants can choose between one of the following two options:

- *Option 1* - for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should 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. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period;
- *Option 2* - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

For this project, Option 1 is chosen to calculate the build margin emission factor. BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

Determination of sample group of power units *m*

The sample group of power units *m* used to calculate the build margin should be 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 ($SET_{5\ units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, 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 per cent of AEG_{total} (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\ percent}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\ percent}$, in MWh);

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\ percent}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in *SETsample* started to

supply electricity to the grid. If none of the power units in *SETsample* started to supply electricity to the grid more than 10 years ago, then use *SETsample* to calculate the build margin. In this case ignore Steps (d), (e) and (f).

According to the guidance suggested above, $SET_{5\text{-units}}$ and $SET_{\geq 20\ percent}$ are calculated as suggested in the table below. As $SET_{\geq 20\ percent}$ comprises the larger annual electricity generation, $SET_{\geq 20\ percent}$ is selected as SET_{sample}.

Options	Power Generation in 2018	Selected option for this project
$AEG_{SET\geq 20\%}$	14,402,127	O
$AEG_{SET\text{-}5\text{-}units}$	640,990	

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units *m* during the most recent year y for which electricity generation data is available. Therefore, based on this sample group, BM emission factor is calculated as follows.

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit m in year *y* (tCO2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

Build margin CO_2 emission factor in year *y*	Electricity generation	GHG Emissions
$EF_{grid,BM,y}$	$\sum EG_{m,y}$	$\sum EG_{m,y} \times EF_{EL,m,y}$
tCO_2/MWh	MWh/y	tCO2/y
0.4138	14,402,127	5,959,777

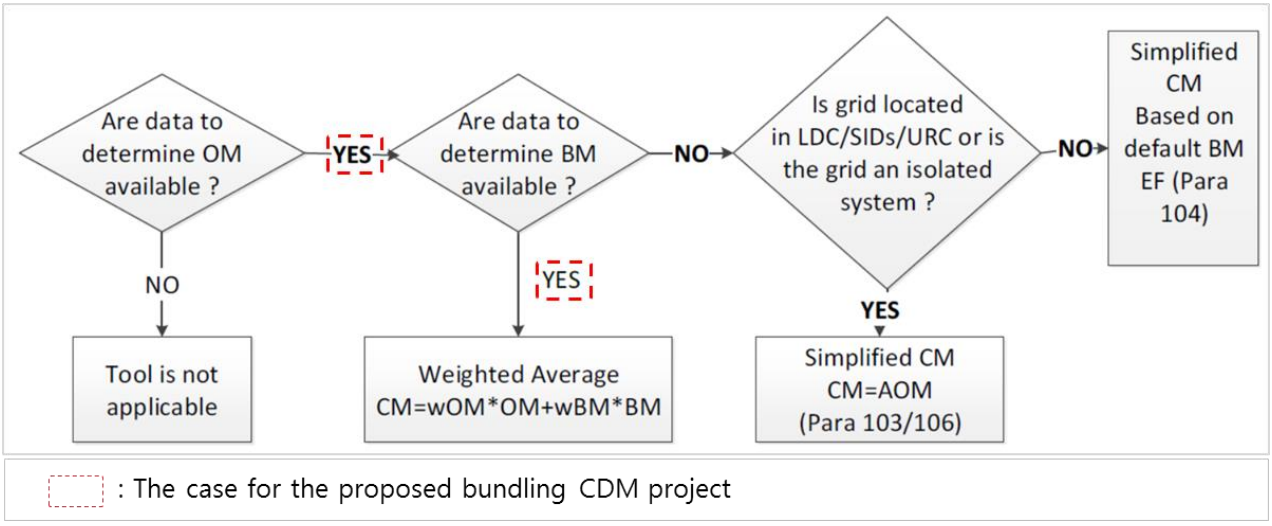
STEP 6: Calculate the combined margin (CM) emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

Based on the guideline suggested in the tool, this project adopts Option (a) Weighted average CM.



[Figure] Selection of the option for the calculation of a CM emission factor

Calculation of Baseline Emission Factor ($EF_{grid,CM,y}$)

The baseline emission factor is calculated as the weighted average of the Operating Margin emission factor **($EF_{grid,OM,y}$)** and the Build Margin emission factor **($EF_{grid,BM,y}$)**:

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

Where,

$EF_{grid,BM,y}$	=	Build margin CO2 emission factor in year *y* (t CO2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO2 emission factor in year *y* (t CO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (per cent)
w_{BM}	=	Weighting of build margin emissions factor (per cent)

According to the Tool, for Wind and solar power generation project activities, w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

EF_{OM}	**0.7478**	**tonCO2/MWh**
EF_{BM}	**0.4138**	**tonCO2/MWh**
w_{OM}	**75**	%
w_{BM}	**25**	%

Combined Margin Emissions Factor

$EF_{grid,CM,y}$	**0.6643**	**tonCO2/MWh**

Project Emissions

According to AMS I.D Ver.18, it states that, for most renewable power generation projects activities, PE_y=0. The exceptional cases including on-site fossil fuel combustion during the project activity, emission from the operation of geothermal power plants due to the release of non-condensable gases, emission from water reservoir of Hydro should be accounted for the project emission. Since the proposed CDM project activity does not involve these cases, project emissions of this project is assumed to be zero (PE_y=0).

Leakage Emissions: According to AMS I.D Ver.18, in case of biomass-based projects (e.g. capacity addition to biomass power plants, see para. 29 of the methodology), leakage emissions should be considered in the calculation of emission reductions. However, as this project involves greenfield construction of photovoltaic power generation plants, the leakage emissions from this project assumed to be zero (LE_y=0).

Emission reduction (ER_y): The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel-fired power plant by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission.

$ER_y = BE_y - PE_y - LE_y$

Where,

ER_y = Emission reductions in tCO_2/year

BE_y = Baseline emissions in tCO_2/year

PE_y = Project emissions in tCO_2/year

LE_y = Leakage emissions in tCO_2/year

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO2/MWh
Description	Operating Margin CO2 emission factor in year y
Source of data	Calculated
Value(s) applied	0.7478
Choice of data or Measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, Version 7" as 3-year generation weighted average using data for the year 2016~2018. The data are obtained from the National Energy Commission of Chile in Mar. of 2019.
Purpose of data	Calculation of the Baseline Emission.
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO2/MWh
Description	Build Margin CO2 emission factor in year y
Source of data	Calculated
Value(s) applied	0.4138
Choice of data or Measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, Version 7" BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period. The data are obtained from the National Energy Commission of Chile in Mar. of 2019.
Purpose of data	Calculation of the Baseline Emission.
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,y}$
Unit	tCO2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated
Value(s) applied	0.6643

Choice of data or Measurement methods and procedures	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ *Where:* W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25% Value for W_{BM} and W_{OM} are decided according to "Tool to calculate the emission factor for an electricity system, Version 7".
Purpose of data	Calculation of the Baseline Emission.
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

B.6.3. Ex-ante calculation of emission reductions

The formula used to calculate the net emission reduction for the project activity is

$ER_y = BE_y - PE_y - LE_y$

Where,

ER_y = Emission Reduction in tCO_2/year

BE_y = Baseline emission in tCO_2/year

PE_y = Project emissions in tCO_2/year

LE_y = Leakage Emissions in tCO_2/year

Baseline Emission (BE_y)

The baseline emissions are the product of electrical energy baseline $EG_{PJ,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by an emission factor.

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

Where,

BE_y = Baseline emissions in year y (t CO_2)

$EG_{PJ,y}$ = 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)

$EF_{grid,y}$ = 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)

$EG_{PJ,y} = EG_{PJ,facility,y} = Grid_{out,y} – Grid_{in,y}$

Where,

$Grid_{out,y}$ = Quantity of electricity generation that is exported from the project power plant to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$Grid_{in,y}$ = Quantity of electricity generation that is imported from the grid as a result of the implementation of the CDM project activity in year y (MWh)

Expected power generation

The expected amount of power generation is calculated based on the Solargis model and its data[8]. Documented evidence of the investigation is submitted to the validating DOE for its review.

Variable	Descriptions	Value	Source
-	**Installed capacity (MW)**	8.0	On the basis of Alternating Current (AC)
$Grid_{out,y}$	**Quantity of electricity generation exported to the grid (MWh)**	20,602	PVSYST Report for Rinconada Power Plant
-	**Expected proportion between $Grid_{out,y}$ and $Grid_{in,y}$**	0.1%	Actual data of $Grid_{out,y}$ and $Grid_{in,y}$ for the sampled power plant during Apr. of 2019
$Grid_{in,y}$	**Quantity of electricity generation imported from the grid (MWh)**	21	Calculated
$EG_{PJ,y}$		20,581	Calculated

Based on these values, the expected annual amount of power generation for this CDM project is described in the table below.

$EG_{PJ,y}$ *(MWh)*	Power Plant: Rinconada
Year 1	20,581
Year 2	20,581
Year 3	20,581
Year 4	20,581
Year 5	20,581
Year 6	20,581
Year 7	20,581
Annual Average (MWh/y)	**20,581**
Total for Crediting Period (MWh/7 years)	**144,070**

[8] Web-based homepage of Solargis: https://solargis.com (As of 1st Feb 2019)

Baseline emissions

Year	BE_y (tCO_2)	=	$EG_{PJ,y}$ (MWh)	x	$EF_{grid,y}$ (tCO_2/MWh)
Year 1	13,672	=	20,581	**x**	0.6643
Year 2	13,672	=	20,581	**x**	0.6643
Year 3	13,672	=	20,581	**x**	0.6643
Year 4	13,672	=	20,581	**x**	0.6643
Year 5	13,672	=	20,581	**x**	0.6643
Year 6	13,672	=	20,581	**x**	0.6643
Year 7	13,672	=	20,581	**x**	0.6643
Average	13,672	=	20,581	**x**	0.6643

Project Emissions and Leakage emissions

As explained in the B.1 above, $PE_y = LE_y = 0$.

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

Unit: tCO_2

	ER_y	=	BE_y	-	PE_y	-	LE_y
Year 1	13,672	=	13,672	-	0	-	0
Year 2	13,672	=	13,672	-	0	-	0
Year 3	13,672	=	13,672	-	0	-	0
Year 4	13,672	=	13,672	-	0	-	0
Year 5	13,672	=	13,672	-	0	-	0
Year 6	13,672	=	13,672	-	0	-	0
Year 7	13,672	=	13,672	-	0	-	0
Total	**95,704**		**95,704**		**0**		**0**
Average	**13,672**	=	**13,672**	-	**0**	-	**0**

Total ER for the crediting period (7 years):

95,704 tCO_2

Average ER per year during the crediting period:

13,672 tCO_2

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{PJ,y}$
Unit	MWh/y
Description	Quantity of net electricity generation supplied by the project activity to the grid in year y
Source of data	Calculated
Value(s) applied	For ex-ante ER calculation: 20,581 MWh
Measurement methods and procedures	This parameter will be calculated in consideration of $Grid_{out,y}$ and $Grid_{in,y}$.
Monitoring frequency QA/QC procedures	Continuously measurement and monthly recording
Purpose of data	To calculate the ex-post baseline emissions during the crediting period.
Additional comment	Data will be archived electronically for a period of 2 years after the end of the crediting period.

Data/Parameter	$Grid_{out,y}$
Unit	MWh/y
Description	Quantity of electricity generation that is exported from the project power plant to the grid as a result of the implementation of the CDM project activity in year y
Source of data	Electricity meter readings from the meters at the project site
Value(s) applied	For ex-post ER calculation: To be monitored during the crediting period For ex-ante ER calculation: 20,602 MWh
Measurement methods and procedures	• Direct and continuous measurement by monitoring equipment (Energy Meters) • Frequency of Calibration for monitoring equipment: At least once in 5 years and in accordance with relevant Chilean regulation. • Monitoring data to be reported in a paper and archived electronically
Monitoring frequency QA/QC procedures	Continuously measurement and monthly recording
Purpose of data	To calculate the ex-post baseline emissions during the crediting period.
Additional comment	

Data/Parameter	$Grid_{in,y}$
Unit	MWh/y
Description	Quantity of electricity generation that is imported from the grid as a result of the implementation of the CDM project activity in year y
Source of data	Electricity meter readings from the meters at the project site
Value(s) applied	For ex-post ER calculation: To be monitored during the crediting period For ex-ante ER calculation: 21 MWh
Measurement methods and procedures	• Direct and continuous measurement by monitoring equipment (Energy Meters) • Frequency of Calibration for monitoring equipment: At least once in 5 years and in accordance with relevant Chilean regulation. • Monitoring data to be reported in a paper and archived electronically
Monitoring frequency QA/QC procedures	Continuously measurement and monthly recording
Purpose of data	To calculate the ex-post baseline emissions during the crediting period.
Additional comment	

B.7.2. Sampling plan

>>

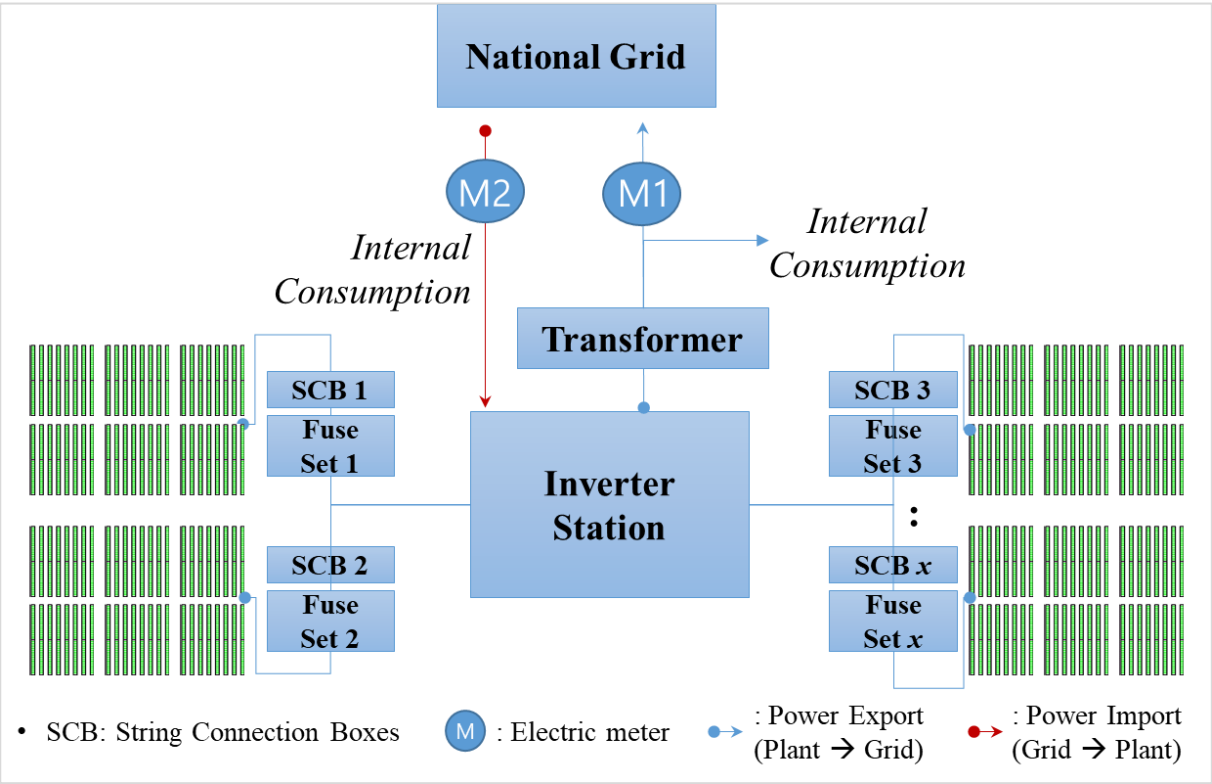
No Sampling Plan is required over the monitoring period for this project.

B.7.3. Other elements of a monitoring plan

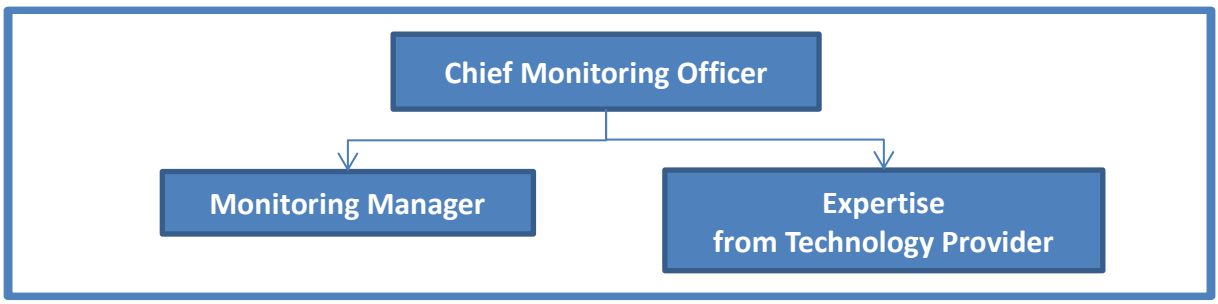
Monitoring Equipment

As for the amount of electricity generated by the proposed project activity, the electric meter (M1 as described in the picture below) will monitor $Grid_{out,y}$ (Quantity of electricity generation that is exported from the project power plant to the grid as a result of the implementation of the CDM project activity in year y). Monitoring data of M1 excludes the electricity that is generated by the proposed power plant and, subsequently, consumed within the power plant.

As for the amount of electricity purchased from the Grid and to be consumed within the proposed power plant, the electric meter will monitor $Grid_{in,y}$ (Quantity of electricity generation that is imported from the grid as a result of the implementation of the CDM project activity in year y).



Organization of Monitoring Team



The monitoring plan is designed in consideration of characteristics of operating grid-connected solar power plants. This monitoring plan includes the organization, data storage and archiving, QA/QC of monitoring practices.

Position and Reporting	Job Description
Chief Operating Manager	• Manages the collection, recording and storage of data; • Reviews completeness and consistency of the monitored and archived data and deals with issues concerning any irregularities; • Ensures ongoing compliance with the CDM monitoring plan; • Supervises meter calibration requirements; • Prepares periodical Emission Reduction Report
Monitoring Manager	• Supporting Chief Monitoring Manager in doing his roles and responsibilities • Preparation necessary documents concerning CDM MRV activities • Communication with stakeholders concerning CDM MRV activities
O&M Provider	• Offering overall services related to O&M of power plant • Delegate or advises the roles and responsibilities of Chief Operating Officer or Operating Manager

Data collection and archiving

The IT-based electronized system will be installed and operated to support the local management and control of PV power plants.

- Recording and visualization of measurement points.
- Works together with the remote monitoring solutions

This IT-based data management system will be equipped with interfaces for system components of the power plant. Based on this system, the monitoring manager can control the inverters and actuators connected to the system from the control center. Export & Import readings from main & check meter will be collected under the supervision of the monitoring manager. Export and Import data would be recorded and stored in logs as well as in electronic form periodically. The period of storage of the monitored data will be 2 years after the end of the crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Personnel training

In order to ensure proper functioning of the project activity andmonitoring of emission reductions, the operating managers will be suffciently trained about the monitoring plan of the PDD as well as relevant MRV standard and process of UNFCCC CDM.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

Date of signing the EPC contract for this project
(Date is not specified but expected to be completed in Apr/2019)

C.2. Expected operational lifetime of project activity

>>
25 Years, 0 Months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable.

C.3.2. Start date of crediting period

>>
15th December 2019

C.3.3. Duration of crediting period

>>
7 Years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

In accordance with the environmental law set by the Republic of Chile (Law No. 19,300, Article 10.c[9]), all power plants with larger than 3MW of installed capacity including solar technology, should formally analyse its environmental impacts through the Environmental Impact Evaluation System (Sistema de Evaluación de Impacto Ambiental, SEIA) in order to obtain an Environmental Qualification Resolution (Resolución de Calificación Ambiental, RCA). If the project activity requires to be submitted to the SEIA and it results to be authorized, the proper authorities will make public their response through the RCA published on the Environmental Evaluation System (Servicio de Evaluación Ambiental, SEA) website. If the project activity does not require the SEIA, a written letter expressing this matter is elaborated and presented to the project activity developer. SEA evaluates the environmental impacts to certify the compliance with environmental requirements which are applied to the projects. Once the SEA confirms the environmental fulfilment, the RCA is issued. The application for the RCA may adopt the simplified form of an Environmental Impact Statement (Declaración de Impacto Ambiental, DIA) unless they have significant impacts, in accordance with Article 11 of the law stated above, in which case an EIA shall be presented.

The proposed CDM project completed the DIA process for the RCA. The DIA for this project was accepted for processing on September 22, 2017. After the evaluation, the SEA issued the Consolidated Evaluation Report (Informe Consolidado de Evaluacion, ICE) and agreed the content of the project in the session No. 10 on August 23, 2018. RCA has been published on August 27, 2018 by SEA. As described above, the proposed project completed the environmental consideration and approval process as required by the Chilean government. Evaluation result of the SEA is further specified in the D.2 below.

[9] Last version available at http://www.leychile.cl/Navegar?idNorma=30667

D.2. Environmental impact assessment

>>

The SEIA result presents that the proposed project activity is in compliance with national criteria and requirement in Chile in terms of investigation and management about potential environmental and social impact from this project. Specifically, the project is approved by the national authority that it does not generate effects, characteristics or circumstances contemplated in Article 11 of the Law 19,300. The following is major impact of the proposed project activity, which is acknowledged by the SEA.

Human health

No effects are generated on the human well-being close to the project, due to compliance with the maximum permitted limits of the regulation relevant to the project. Project activities generating atmospheric emissions are mainly related to scarp, excavation, combustion of the retro excavator and transit on unpaved roads due to internal combustion of the machinery. However given the nature of the project, the emission are not of great magnitude. In the operation phase, the emission level is negligible, of only 0.01 ton/year of PM10 and no emission of PM2.5 considering the plant operates remotely, daily vehicle operation is not necessary.

In order to control the generation of emissions, the following measures are considered with relevant documentation to approve each activity;

a. All types of vehicles within the park area must run at a speed lower than 30 km/h;
b. Humidification of work fronts, work areas and access roads will be carried out twice every day, once at the beginning of the working day and once around noon throughout the construction phase.

Regarding noise pollution, the projected sound pressure levels comply with the regulatory limits of the D.S. No. 38/11 of the MMA for both day and night time, in all phases of the project by installing sound-absorbing walls.

Liquid effluents from sewage and solid waste will be removed periodically, its frequency depends on the occasion of project stage and type of waste.

Natural resources

The Project does not generate significant adverse effects on natural resources, including soil, water and air, in accordance with Article 6 of the SEIA Regulation; therefore, the Project does not need to be evaluated by means of an Environmental Impact Study.

The efforts have been made to develop the project in the area of soils with low agricultural productivity, and the location of the project area does not generate erosion, losses and changes in the physical, chemical and biological properties of the soil.

In terms of flora component, there were no species registered in the conservation category according to the Wildlife Classification Regulation (Reglamento de Clasificación de Especies Silvestres) of the MMA, nor native forest formation in the project area. 24 species of wild animal were discovered through two extensive field survey. In consideration of the information obtained, there is no loss of individuals or specimens of a population in conservation category with high densities, invasion of individuals or fauna specimens, disturbance of fauna, population modification, changes in their properties such as size or density of population, structure of age and sex, migratory movements and reproductive potential. The water resource will get no impacts since there is no intervention on the part of the project on natural or artificial channels.

Resettlement and other alteration of local communities

The Project does not generate resettlement of human communities, or significant alteration of the life systems and customs of human groups.

The economic characteristics of the area of influence indicate that it is a population that is linked mainly to agricultural activity. Given the characteristics of the project and the site where it is implemented, it does not intervene in the use or access to natural resources that sustain the economy of the human groups in the area of influence. On the other hand, there were no traditional or medicinal uses of natural resources in the area of influence of the project.

Project site – town, protected areas

The project site is located in an area far from populations, resources and protected areas, priority sites for conservation, protected wetlands and glaciers, susceptible to be directly affected by the project or its areas of influence, as well as the environmental value of the territory in which is intended to be emplaced, since this is regulated by existing territorial planning instruments.

Scenic or touristic value

Based on the impact analysis on the landscape, the project site was qualified as low visual quality. Therefore, there is no impact on the landscape or tourism value of the project. On a voluntary basis, the project owner would install a natural barrier of tree species in the eastern part of the plant.

Historical and cultural heritage – monuments, anthropological, and archaeological sites

There is no impact to monuments sites with anthropological, archaeological, historical value and, in general, those belonging to the cultural heritage.

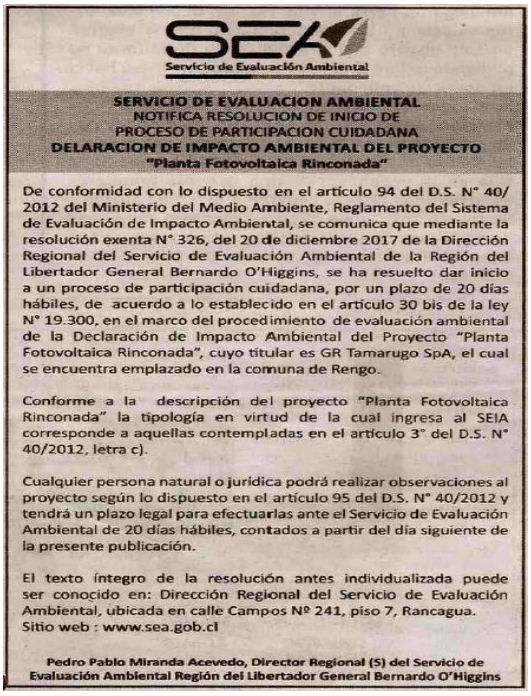
SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

According to '7.8.9. Timing of local stakeholder consultation' of CDM project standard for project activities (Ver. 2), the project participants shall complete the local stakeholder consultation process at the timing required by the rules of the host Party on local stakeholder consultation, if such rules exist.

In chile, as part of the Environmental Impact Evaluation System (Sistema de Evaluación de Impacto Ambiental, SEIA) of Chile, the business activities subject to the DIA or EIA may be requested to implement PAS (Citizen Participation) process. According to Article 30 bis. Of Law No. 19300, citizen participation is to ensure that the public has the rights to access and know the relevant information of the project and its SEIA activities, make observations and obtain a reasonable responses from the business operators and the public authorities.

As for this proposed project activity, the PAS process has officially initiated by the SEA in December of 2017 for 20 days in the framework of SEIA procedure. Subsequently, this announcement was also made in public through a number of methods including newspaper. In addition, off-line consultation meeting was held on 16th January 2019.



SEA
Servicio de Evaluación Ambiental

SERVICIO DE EVALUACION AMBIENTAL
NOTIFICA RESOLUCION DE INICIO DE
PROCESO DE PARTICIPACION CUIDADANA
DELARACION DE IMPACTO AMBIENTAL DEL PROYECTO
"Planta Fotovoltaica Rinconada"

De conformidad con lo dispuesto en el artículo 94 del D.S. N° 40/ 2012 del Ministerio del Medio Ambiente, Reglamento del Sistema de Evaluación de Impacto Ambiental, se comunica que mediante la resolución exenta N° 326, del 20 de diciembre 2017 de la Dirección Regional del Servicio de Evaluación Ambiental de la Región del Libertador General Bernardo O'Higgins, se ha resuelto dar inicio a un proceso de participación cuidadana, por un plazo de 20 días hábiles, de acuerdo a lo establecido en el artículo 30 bis de la ley N° 19.300, en el marco del procedimiento de evaluación ambiental de la Declaración de Impacto Ambiental del Proyecto "Planta Fotovoltaica Rinconada", cuyo titular es GR Tamarugo SpA, el cual se encuentra emplazado en la comuna de Rengo.

Conforme a la descripción del proyecto "Planta Fotovoltaica Rinconada" la tipología en virtud de la cual ingresa al SEIA corresponde a aquellas contempladas en el artículo 3° del D.S. N° 40/2012, letra c).

Cualquier persona natural o jurídica podrá realizar observaciones al proyecto según lo dispuesto en el artículo 95 del D.S. N° 40/2012 y tendrá un plazo legal para efectuarlas ante el Servicio de Evaluación Ambiental de 20 días hábiles, contados a partir del día siguiente de la presente publicación.

El texto íntegro de la resolución antes individualizada puede ser conocido en: Dirección Regional del Servicio de Evaluación Ambiental, ubicada en calle Campos Nº 241, piso 7, Rancagua.
Sitio web : www.sea.gob.cl

Pedro Pablo Miranda Acevedo, Director Regional (S) del Servicio de Evaluación Ambiental Región del Libertador General Bernardo O'Higgins

[Figure] Newspaper notice of the PAC process

E.2. Summary of comments received

During the course of 20-day process in the PAC, no negative comments has been submitted to the SEA including the consultation workshop held in 16th Jan 2018. The date and schedule of the meeting was arranged with the confirmation of the leaders of local community in advance. 15 local people in La Chimba participated. In the meeting, explanation of the project and the follow-up discussions of the project was done.

In this consultation meeting, the project and its potential impact with necessary plan to manage it was presented to the local participants. The SEA coordinated and accompanied this dialogue with the local community, providing information on the deadlines for the formulation of citizen observations, distributing forms of observations and collecting observations, comments and concerns of citizens.

The activities of the PAC as a whole is summarized and issued by the SEA, which does not show any opposition or negative opinion of the local people concerning this project.

[Figure] Participants of consultation meeting

E.3. Consideration of comments received

No comments has been received during the PAC process.

SECTION F. Approval and authorization

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As of the time of submitting the PDD to the DOE for validation, the letter of approval for project participants for this project is n/a (i.e. LoA has not been issued yet).

Appendix 1. Contact information of project participants

Organization name	DE Energia SpA
Country	Chile
Address	Miraflores 222, 28th Floor, Santiago Chile
Telephone	+56 9 5091 1356
Fax	N/A
E-mail	jbham@daelimenergy.com jhyoo@daelimenergy.com
Website	N/A
Contact person	Mr. Jongbeom Ham Mr. Jinhee Yoo

Appendix 2. Affirmation regarding public funding

There is no public funding or Official Development Funding Assistance is involved in financing of the Project.

Appendix 3. Applicability of methodologies and standardized baselines

The applicability of the methodology has been discussed in chapter B.2. No further discussion is required. No standardized baseline is applied for this project. [10]

[10]

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

The below tables summarise the data and calculations to calculate the EF of National Grid. Please see attached spreadsheet for more information.

A. Values and sources of emission factors, calorific values and conversion factors

- **Emission Factor of fossil fuel type *i***

	Emission Factor of fossil fuel type $_i$	
Parameter	**EF $_{co2,i}$**	
Unit	**(tCO2/GJ)**	
Source	Source: IPCC 2006 Guidelines for national greenhouse gas inventories. V2_2_Ch1_Introduction, Table 1.4.	
Fuel Type	Coal	0.0873
	Diesel Oil	0.0726
	Diesel Oil - Fuel Oil IFO-180	0.0726
	Fuel Oil No.6	0.0755
	Fuel Oil IFO-180	0.0755
	Fuel Oil IFO-380	0.0755
	Natural gas	0.0543
	LPG	0.0631
	Coke	0.0975
	Propane	0.0631

- **Gross Calorific Values**

	Gross Calorific Value		
Parameter	**GCV$_i$**		
Source	Balance Nacional De Energia 2017, Ministry of Energy, Chile		
Fuel Type	Coal	7,000	kcal/kg
	Diesel Oil	10,900	kcal/kg
	Diesel Oil - Fuel Oil IFO-180	10,900	kcal/kg
	Fuel Oil No.6	10,500	kcal/kg
	Fuel Oil IFO-180	10,500	kcal/kg
	Fuel Oil IFO-380	10,500	kcal/kg
	Natural gas	9,341	kcal/m^3
	LPG	12,100	kcal/kg
	Coke	7,000	kcal/kg
	Propane	12,100	kcal/kg

- **Conversion factor (GCF to NCV)**

	Conversion Factor
Parameter	*(GCV to NCV)*

Unit	(%)	
Source	IPCC, 2006. Guidelines for national greenhouse gas inventories. V2_2_Ch1_Introduction, Page 1.16	
Fuel Type	Coal	95%
	Diesel Oil	95%
	Diesel Oil - Fuel Oil IFO-180	95%
	Fuel Oil No.6	95%
	Fuel Oil IFO-180	95%
	Fuel Oil IFO-380	95%
	Natural gas	90%
	LPG	95%
	Coke	95%
	Propane	95%

- **Other conversion factor (GCF to NCV)**

Conversion Units		
Unit	**Equivalent**	
MMBTU	30.265	m^3
1 Kcal	0.00000418	GJ
1 dam^3	1,000	m^3
1 m^3 LPG	0.5524	Ton
1 m^3 of Diesel	0.840	Ton

B. Information on Fuel Consumption and Power Generation for OM Calculation

- **List of plants connected to the SEN grid for OM Calculation (2016~2018)**

Year	Name of Power Plant	TYPE OF COMBUSTIBLE FUEL	FUEL UNIT	FUEL CONSUMPTION	GENERATION [MWh]
2016	Andes Generación	Diesel Oil	Ton	1,009	4,168
2016	Andes Generación	Fuel Oil IFO-180	Ton	107	440
2016	Andes Generación	Fuel Oil No.6	Ton	392	1,622
2017	Andes Generación	Fuel Oil No.6	Ton	1,255	5,186
2018	Andes Generación	Fuel Oil No.6	Ton	723	2,987
2016	Antilhue TG	Diesel Oil	Ton	2,228	9,693
2017	Antilhue TG	Diesel Oil	Ton	9,849	42,830
2018	Antilhue TG	Diesel Oil	Ton	4,430	18,866
2016	Atacama	Diesel Oil	Ton	63,758	226,340
2016	Atacama	Natural gas	m3	1,078,247	7,673
2017	Atacama	Diesel Oil	Ton	13,300	35,406
2017	Atacama	Natural gas	m3	4,157,537	11,027
2018	Atacama	Diesel Oil	Ton	6,144	24,013
2018	Atacama	Natural gas	m3	15,668,209	59,674
2016	Atacama	Diesel Oil	Ton	90,440	338,529

2016	Atacama	Natural gas	m3	2,638,558	19,577
2017	Atacama	Diesel Oil	Ton	11,782	31,954
2017	Atacama	Natural gas	m3	928,406	2,558
2018	Atacama	Diesel Oil	Ton	4,851	19,648
2018	Atacama	Natural gas	m3	6,326,385	23,280
2016	Biocruz	Natural gas	m3	566,650	2,146
2017	Biocruz	Natural gas	m3	28,195	107
2018	Biocruz	Natural gas	m3	352,639	1,336
2018	biomar	Diesel Oil	Ton	54	243
2016	Bocamina	Coal	Ton	260,881	730,349
2017	Bocamina	Coal	Ton	234,304	655,946
2018	Bocamina	Coal	Ton	202,701	567,472
2016	Bocamina II	Coal	Ton	713,175	2,211,533
2017	Bocamina II	Coal	Ton	594,096	1,842,273
2018	Bocamina II	Coal	Ton	797,775	2,291,705
2016	Calle-Calle	Diesel Oil	Ton	2,419	10,932
2017	Calle-Calle	Diesel Oil	Ton	130	586
2018	Calle-Calle	Diesel Oil	Ton	23	104
2016	Campiche	Coal	Ton	810,361	2,268,649
2017	Campiche	Coal	Ton	651,155	1,822,943
2018	Campiche	Coal	Ton	664,588	1,860,548
2016	Candelaria 1	Diesel Oil	Ton	9,533	35,452
2016	Candelaria 1	Natural gas	m3	23,438,012	74,923
2017	Candelaria 1	Diesel Oil	Ton	9,157	34,050
2017	Candelaria 1	Natural gas	m3	18,916,572	60,470
2018	Candelaria 1	Diesel Oil	Ton	1,163	4,236
2018	Candelaria 1	Natural gas	m3	921,341	2,945
2016	Candelaria 2	Diesel Oil	Ton	9,583	35,640
2016	Candelaria 2	Natural gas	m3	23,066,685	73,736
2017	Candelaria 2	Diesel Oil	Ton	10,677	39,707
2017	Candelaria 2	Natural gas	m3	17,257,157	55,165
2018	Candelaria 2	Diesel Oil	Ton	384	1,398
2018	Candelaria 2	Natural gas	m3	759,234	2,427
2016	Cañete	Diesel Oil	Ton	2	8
2017	Cañete	Diesel Oil	Ton	22	90
2018	Cañete	Diesel Oil	Ton	36	148
2017	Cardones	Diesel Oil	Ton	1,431	5,986
2018	Cardones	Diesel Oil	Ton	256	1,072
2016	Casablanca 1	Diesel Oil	Ton	6	22
2017	Casablanca 1	Diesel Oil	Ton	1	2

2016	Cem Bio Bio	Diesel Oil	Ton	98	511
2016	Cem Bio Bio	Fuel Oil No.6	Ton	3,478	15,953
2017	Cem Bio Bio	Fuel Oil No.6	Ton	1,800	8,259
2018	Cem Bio Bio	Fuel Oil No.6	Ton	657	3,016
2017	Cenizas	Fuel Oil IFO-180	Ton	63	274
2018	Cenizas	Fuel Oil IFO-180	Ton	70	302
2016	Chiloé	Diesel Oil	Ton	5	17
2017	Chiloé	Diesel Oil	Ton	1	2
2018	Chiloé	Diesel Oil	Ton	1	2
2016	Chufkén	Diesel Oil	Ton	157	649
2017	Chufkén	Diesel Oil	Ton	34	141
2018	Chufkén	Diesel Oil	Ton	34	139
2016	Chuyaca	Diesel Oil	Ton	827	3,726
2017	Chuyaca	Diesel Oil	Ton	6	26
2018	Chuyaca	Diesel Oil	Ton	22	88
2018	CMPC Cordillera	Natural gas	m3	8,177,490	73,013
2017	CMPC Tissue	Natural gas	m3	801,517	7,156
2018	CMPC Tissue	Natural gas	m3	1,090,186	9,734
2016	Cochrane	Coal	Ton	243,068	671,461
2017	Cochrane	Coal	Ton	577,649	1,544,679
2018	Cochrane	Coal	Ton	584,764	1,635,672
2016	Cochrane	Coal	Ton	223,119	599,572
2017	Cochrane	Coal	Ton	555,853	1,472,319
2018	Cochrane	Coal	Ton	586,726	1,641,290
2016	Colihues U1	Fuel Oil IFO-180	Ton	4,438	20,744
2017	Colihues U1	Fuel Oil IFO-180	Ton	3,372	15,765
2018	Colihues U1	Fuel Oil No.6	Ton	510	2,384
2017	Colihues U2	Diesel Oil	Ton	1	6
2016	Colmito	Diesel Oil	Ton	136	455
2016	Colmito	Natural gas	m3	2,337,857	7,948
2017	Colmito	Diesel Oil	Ton	1,978	6,639
2017	Colmito	Natural gas	m3	1,769,033	6,014
2018	Colmito	Diesel Oil	Ton	1,797	7,238
2018	Colmito	Natural gas	m3	803,801	3,052
2016	Concón	Diesel Oil	Ton	4	18
2017	Concón	Diesel Oil	Ton	1	3
2016	Constitución 1	Diesel Oil	Ton	406	1,442
2017	Constitución 1	Diesel Oil	Ton	758	2,689
2018	Constitución 1	Diesel Oil	Ton	378	1,343
2016	Curacautín	Diesel Oil	Ton	81	366

2017	Curacautín	Diesel Oil	Ton	42	192
2018	Curacautín	Diesel Oil	Ton	22	98
2016	Curanilahue	Diesel Oil	Ton	6	25
2017	Curanilahue	Diesel Oil	Ton	1	4
2018	Curanilahue	Diesel Oil	Ton	12	53
2016	Curauma	Diesel Oil	Ton	13	51
2016	Danisco	Diesel Oil	Ton	2	9
2018	Danisco	Diesel Oil	Ton	20	91
2016	Degañ	Diesel Oil	Ton	2,377	10,865
2017	Degañ	Diesel Oil	Ton	607	2,775
2018	Degañ	Diesel Oil	Ton	99	454
2016	Diego de Almagro	Diesel Oil	Ton	94	278
2017	Diego de Almagro	Diesel Oil	Ton	151	449
2018	Diego de Almagro	Diesel Oil	Ton	54	161
2016	Diesel Aguas Blancas	Diesel Oil	Ton	838	1,677
2017	Diesel Aguas Blancas	Diesel Oil	Ton	119	365
2018	Diesel Aguas Blancas	Diesel Oil	Ton	56	220
2016	Diesel Arica	Diesel Oil	Ton	1,829	7,237
2017	Diesel Arica	Diesel Oil	Ton	197	803
2018	Diesel Arica	Diesel Oil	Ton	122	497
2016	Diesel Arica	Diesel Oil	Ton	534	2,225
2017	Diesel Arica	Diesel Oil	Ton	72	302
2018	Diesel Arica	Diesel Oil	Ton	37	153
2016	Diesel Arica	Diesel Oil	Ton	263	1,066
2017	Diesel Arica	Diesel Oil	Ton	40	166
2018	Diesel Arica	Diesel Oil	Ton	25	105
2016	Diesel Inacal	Diesel Oil	Ton	879	937
2016	Diesel Inacal	Fuel Oil No.6	Ton	3,727	4,781
2017	Diesel Inacal	Diesel Oil	Ton	561	885
2018	Diesel Inacal	Diesel Oil	Ton	82	297
2016	Diesel Iquique	Diesel Oil	Ton	34	139
2016	Diesel Iquique	Diesel Oil	Ton	239	873
2016	Diesel La Portada	Diesel Oil	Ton	708	969
2017	Diesel La Portada	Diesel Oil	Ton	186	407
2018	Diesel La Portada	Diesel Oil	Ton	38	166
2016	Diesel Mantos Blancos	Diesel Oil	Ton	18,094	13,805
2017	Diesel Mantos Blancos	Diesel Oil	Ton	1,251	1,880
2018	Diesel Mantos Blancos	Diesel Oil	Ton	92	362
2016	Diesel Tamaya	Fuel Oil No.6	Ton	2	8
2016	Diesel Zofri	Diesel Oil	Ton	74	248

2017	Diesel Zofri	Diesel Oil	Ton	11	33
2018	Diesel Zofri	Diesel Oil	Ton	3	8
2016	Diesel Zofri	Diesel Oil	Ton	2,836	3,431
2017	Diesel Zofri	Diesel Oil	Ton	228	415
2018	Diesel Zofri	Diesel Oil	Ton	25	117
2016	Diesel Zofri	Diesel Oil	Ton	128	450
2017	Diesel Zofri	Diesel Oil	Ton	12	48
2018	Diesel Zofri	Diesel Oil	Ton	3	13
2017	El Nogal	Diesel Oil	Ton	9	38
2016	El Peñón	Diesel Oil	Ton	3,137	14,299
2017	El Peñón	Diesel Oil	Ton	2,320	10,579
2018	El Peñón	Diesel Oil	Ton	1,253	5,713
2016	El Salvador	Diesel Oil	Ton	35	105
2017	El Salvador	Diesel Oil	Ton	95	283
2018	El Salvador	Diesel Oil	Ton	69	204
2016	El Totoral	Diesel Oil	Ton	12	51
2017	El Totoral	Diesel Oil	Ton	3	12
2016	Emelda U1	Diesel Oil - Fuel Oil IFO-180	Ton	85	290
2017	Emelda U1	Diesel Oil - Fuel Oil IFO-180	Ton	82	282
2018	Emelda U1	Diesel Oil	Ton	16	56
2016	Emelda U2	Diesel Oil - Fuel Oil IFO-180	Ton	40	129
2017	Emelda U2	Diesel Oil - Fuel Oil IFO-180	Ton	76	241
2018	Emelda U2	Diesel Oil	Ton	5	16
2016	Esperanza 1	Diesel Oil	Ton	14	56
2017	Esperanza 1	Diesel Oil	Ton	10	39
2018	Esperanza 1	Diesel Oil	Ton	1	6
2016	Esperanza 2	Diesel Oil	Ton	34	142
2017	Esperanza 2	Diesel Oil	Ton	23	95
2018	Esperanza 2	Diesel Oil	Ton	3	12
2016	Esperanza TG	Diesel Oil	Ton	58	161
2017	Esperanza TG	Diesel Oil	Ton	91	250
2016	Estancilla	Diesel Oil	Ton	148	650
2017	Estancilla	Diesel Oil	Ton	37	160
2018	Estancilla	Diesel Oil	Ton	5	22
2016	Estandartes	Diesel Oil	Ton	179	1,589
2017	Estandartes	Diesel Oil	Ton	39	185
2018	Estandartes	Diesel Oil	Ton	11	51

2016	Estandartes	Diesel Oil	Ton	6,151	5,207
2017	Estandartes	Diesel Oil	Ton	340	460
2018	Estandartes	Diesel Oil	Ton	28	131
2016	Guacolda 1	Coal	Ton	359,950	973,716
2017	Guacolda 1	Coal	Ton	247,822	665,758
2018	Guacolda 1	Coal	Ton	343,622	922,926
2016	Guacolda 2	Coal	Ton	355,450	960,775
2017	Guacolda 2	Coal	Ton	202,720	543,223
2018	Guacolda 2	Coal	Ton	298,400	798,564
2016	Guacolda 3	Coal	Ton	359,893	1,052,726
2017	Guacolda 3	Coal	Ton	244,227	708,800
2018	Guacolda 3	Coal	Ton	333,410	969,132
2016	Guacolda 4	Coal	Ton	312,019	890,436
2017	Guacolda 4	Coal	Ton	288,533	821,189
2018	Guacolda 4	Coal	Ton	314,289	895,595
2016	Guacolda 5	Coal	Ton	312,163	897,266
2017	Guacolda 5	Coal	Ton	294,777	838,959
2018	Guacolda 5	Coal	Ton	328,827	939,325
2018	hbs Natural gas	Natural gas	m3	2,700	10
2016	Horcones	Diesel Oil	Ton	411	1,170
2017	Horcones	Diesel Oil	Ton	155	437
2018	Horcones	Diesel Oil	Ton	110	311
2016	Huasco TG	Diesel Oil	Ton	56	161
2016	Huasco TG	Fuel Oil IFO-180	Ton	1	3
2017	Huasco TG	Diesel Oil	Ton	184	528
2017	Huasco TG	Fuel Oil IFO-180	Ton	3	8
2018	Huasco TG	Diesel Oil	Ton	104	299
2018	Huasco TG	Fuel Oil IFO-180	Ton	13	36
2016	Kelar	Diesel Oil	Ton	7,320	28,397
2016	Kelar	Natural gas	m3	97,958,444	266,919
2017	Kelar	Diesel Oil	Ton	23,013	80,514
2017	Kelar	Natural gas	m3	179,998,388	567,876
2018	Kelar	Diesel Oil	Ton	1,546	6,827
2018	Kelar	Natural gas	m3	352,657,111	1,822,664
2017	Laguna Verde TG	Diesel Oil	Ton	132	501
2017	Laguna Verde TV	Diesel Oil	Ton	61	147
2016	Las Vegas	Diesel Oil	Ton	10	43
2017	Las Vegas	Diesel Oil	Ton	1	6
2016	Lebu	Diesel Oil	Ton	1	6
2017	Lebu	Diesel Oil	Ton	15	62

2018	Lebu	Diesel Oil	Ton	36	150
2016	Linares Norte	Diesel Oil	Ton	3	16
2017	Linares Norte	Diesel Oil	Ton	2	10
2016	Lonquimay	Diesel Oil	Ton	7	27
2017	Lonquimay	Diesel Oil	Ton	103	386
2018	Lonquimay	Diesel Oil	Ton	18	68
2016	Los Álamos	Diesel Oil	Ton	6	27
2018	Los Álamos	Diesel Oil	Ton	3	13
2016	Los Espinos	Diesel Oil	Ton	928	4,193
2017	Los Espinos	Diesel Oil	Ton	162	750
2018	Los Espinos	Diesel Oil	Ton	833	3,765
2016	Los Guindos	Diesel Oil	Ton	9,170	37,584
2017	Los Guindos	Diesel Oil	Ton	1,781	7,302
2018	Los Guindos	Diesel Oil	Ton	1,590	6,511
2016	Los Pinos	Diesel Oil	Ton	16,509	86,665
2017	Los Pinos	Diesel Oil	Ton	13,398	70,331
2018	Los Pinos	Diesel Oil	Ton	6,621	34,027
2016	Los Vientos	Diesel Oil	Ton	603	2,259
2017	Los Vientos	Diesel Oil	Ton	4,765	17,846
2018	Los Vientos	Diesel Oil	Ton	10,104	37,846
2016	Los Vientos TG	Diesel Oil	Ton	7,877	29,505
2018	louisiana pacific	Diesel Oil	Ton	15	69
2016	Lousiana Pacific II	Diesel Oil	Ton	1	5
2018	Lousiana Pacific II	Diesel Oil	Ton	9	43
2016	Maule	Diesel Oil	Ton	149	527
2017	Maule	Diesel Oil	Ton	111	393
2018	Maule	Diesel Oil	Ton	63	223
2018	multiexport i	Diesel Oil	Ton	3	15
2018	multiexport ii	Diesel Oil	Ton	1	4
2016	Nehuenco	Diesel Oil	Ton	18,909	121,026
2016	Nehuenco	Natural gas	m3	418,180,482	2,159,712
2017	Nehuenco	Diesel Oil	Ton	430	2,722
2017	Nehuenco	Natural gas	m3	367,624,005	1,898,014
2018	Nehuenco	Diesel Oil	Ton	1,794	11,243
2018	Nehuenco	Natural gas	m3	331,744,270	1,732,596
2016	Nehuenco II	Diesel Oil	Ton	3,297	21,151
2016	Nehuenco II	Natural gas	m3	227,900,506	1,283,397
2017	Nehuenco II	Diesel Oil	Ton	2,443	15,649
2017	Nehuenco II	Natural gas	m3	313,483,259	1,765,347
2018	Nehuenco II	Diesel Oil	Ton	1,385	8,701

2018	Nehuenco II	Natural gas	m3	373,161,599	2,101,396
2016	Nehuenco TG 9B	Diesel Oil	Ton	1,513	5,559
2016	Nehuenco TG 9B	Natural gas	m3	647,794	2,072
2017	Nehuenco TG 9B	Diesel Oil	Ton	218	802
2018	Nehuenco TG 9B	Natural gas	m3	3,224,590	10,314
2016	Newen	Diesel Oil	Ton	16	58
2016	Newen	Natural gas	m3	151,506	464
2016	Newen	Propane	Ton	2	7
2017	Newen	Diesel Oil	Ton	186	654
2017	Newen	Natural gas	m3	2,087,347	6,392
2017	Newen	Propane	Ton	62	257
2018	Newen	Diesel Oil	Ton	44	153
2018	Newen	Natural gas	m3	137,050	511
2018	Newen	Propane	Ton	29	120
2016	Nueva Aldea II	Diesel Oil	Ton	9	31
2017	Nueva Aldea II	Diesel Oil	Ton	5	18
2018	Nueva Aldea II	Diesel Oil	Ton	7	26
2016	Nueva Renca	Diesel Oil	Ton	15,800	94,672
2016	Nueva Renca	Natural gas	m3	394,758,222	2,000,323
2017	Nueva Renca	Diesel Oil	Ton	22,124	132,561
2017	Nueva Renca	Natural gas	m3	331,348,909	1,679,015
2018	Nueva Renca	Diesel Oil	Ton	4,955	29,689
2018	Nueva Renca	Natural gas	m3	115,060,386	583,134
2016	Nueva Renca FA	LPG	Ton	4,148	21,574
2016	Nueva Renca FA	Natural gas	m3	185,569	753
2017	Nueva Renca FA	LPG	Ton	1,414	7,356
2017	Nueva Renca FA	Natural gas	m3	3,614,289	14,666
2018	Nueva Renca FA	LPG	Ton	407	2,115
2018	Nueva Renca FA	Natural gas	m3	458,612	1,880
2016	Nueva Ventanas	Coal	Ton	753,302	2,165,583
2017	Nueva Ventanas	Coal	Ton	670,385	1,927,212
2018	Nueva Ventanas	Coal	Ton	724,123	2,081,699
2016	Olivos	Diesel Oil	Ton	247	1,068
2017	Olivos	Diesel Oil	Ton	15	64
2018	Olivos	Diesel Oil	Ton	60	259
2016	Petropower	Coke	Ton	187,841	497,111
2017	Petropower	Coke	Ton	164,754	436,013
2018	Petropower	Coke	Ton	165,422	437,780
2016	Placilla	Diesel Oil	Ton	13	57
2017	Placilla	Diesel Oil	Ton	4	16

2017	Planta Curicó	Natural gas	m3	10,213,470	91,192
2018	Planta Curicó	Natural gas	m3	9,315,018	83,170
2016	Punta Colorada	Diesel Oil	Ton	15	79
2016	Punta Colorada	Fuel Oil IFO-380	Ton	197	900
2017	Punta Colorada	Diesel Oil	Ton	14	74
2017	Punta Colorada	Fuel Oil IFO-380	Ton	20	89
2018	Punta Colorada	Fuel Oil IFO-380	Ton	24	109
2016	Quellón II	Diesel Oil	Ton	262	1,102
2017	Quellón II	Diesel Oil	Ton	38	158
2018	Quellón II	Diesel Oil	Ton	15	61
2016	Quintay	Diesel Oil	Ton	21	89
2017	Quintay	Diesel Oil	Ton	5	20
2016	Quintero A	Natural gas	m3	32,617,420	103,469
2017	Quintero A	Natural gas	m3	67,892,302	215,368
2018	Quintero A	Natural gas	m3	40,017,015	126,942
2016	Quintero B	Natural gas	m3	47,944,950	152,091
2017	Quintero B	Natural gas	m3	61,641,436	195,539
2018	Quintero B	Natural gas	m3	34,998,102	111,021
2017	Renca U1	Diesel Oil	Ton	347	951
2017	Renca U2	Diesel Oil	Ton	270	741
2016	San Gregorio	Diesel Oil	Ton	3	13
2016	San Isidro	Diesel Oil	Ton	61	342
2016	San Isidro	Natural gas	m3	278,088,510	1,412,262
2017	San Isidro	Diesel Oil	Ton	1,003	5,594
2017	San Isidro	Natural gas	m3	322,574,221	1,638,181
2018	San Isidro	Diesel Oil	Ton	712	3,957
2018	San Isidro	Natural gas	m3	229,943,785	1,168,570
2016	San Isidro II	Diesel Oil	Ton	2,139	12,955
2016	San Isidro II	Natural gas	m3	483,174,460	2,713,061
2017	San Isidro II	Diesel Oil	Ton	453	2,743
2017	San Isidro II	Natural gas	m3	410,364,573	2,304,228
2018	San Isidro II	Diesel Oil	Ton	2,025	11,438
2018	San Isidro II	Natural gas	m3	410,046,491	2,169,087
2016	San Lorenzo de D. de Almagro	Diesel Oil	Ton	36	106
2017	San Lorenzo de D. de Almagro	Diesel Oil	Ton	299	852
2018	San Lorenzo de D. de Almagro	Diesel Oil	Ton	234	663
2016	Santa Lidia	Diesel Oil	Ton	4,570	17,312
2017	Santa Lidia	Diesel Oil	Ton	243	921

2018	Santa Lidia	Diesel Oil	Ton	97	366
2016	Santa María	Coal	Ton	814,981	2,504,908
2017	Santa María	Coal	Ton	883,712	2,716,160
2018	Santa María	Coal	Ton	852,212	2,619,340
2018	skretting osorno	Diesel Oil	Ton	1	5
2016	Taltal 1	Diesel Oil	Ton	621	2,451
2016	Taltal 1	Natural gas	m3	16,253,375	53,749
2017	Taltal 1	Diesel Oil	Ton	11,663	46,010
2017	Taltal 1	Natural gas	m3	24,487,866	80,980
2018	Taltal 1	Diesel Oil	Ton	2,686	10,596
2018	Taltal 1	Natural gas	m3	8,453,727	27,956
2016	Taltal 2	Diesel Oil	Ton	311	1,226
2016	Taltal 2	Natural gas	m3	5,802,941	19,190
2017	Taltal 2	Diesel Oil	Ton	1,591	6,277
2017	Taltal 2	Natural gas	m3	11,733,190	38,801
2018	Taltal 2	Diesel Oil	Ton	1,739	6,859
2018	Taltal 2	Natural gas	m3	2,858,530	9,453
2016	Tapihue	Natural gas	m3	3,753	12
2017	Tapihue	Natural gas	m3	4,810	15
2018	Tapihue	Natural gas	m3	13,983	49
2016	Teno	Diesel Oil	Ton	2,975	13,564
2017	Teno	Diesel Oil	Ton	4,646	21,184
2018	Teno	Diesel Oil	Ton	1,167	5,323
2016	Termoeléctrica Andina	Coal	Ton	455,217	1,264,093
2017	Termoeléctrica Andina	Coal	Ton	393,022	1,078,733
2018	Termoeléctrica Andina	Coal	Ton	356,839	1,014,796
2016	Termoeléctrica Angamos	Coal	Ton	801,859	2,148,511
2017	Termoeléctrica Angamos	Coal	Ton	695,559	1,944,535
2018	Termoeléctrica Angamos	Coal	Ton	603,165	1,763,619
2016	Termoeléctrica Angamos	Coal	Ton	838,460	2,255,211
2017	Termoeléctrica Angamos	Coal	Ton	668,296	1,886,485
2018	Termoeléctrica Angamos	Coal	Ton	647,416	1,917,145
2016	Termoeléctrica Hornitos	Coal	Ton	398,160	1,105,964
2017	Termoeléctrica Hornitos	Coal	Ton	388,398	1,032,790
2018	Termoeléctrica Hornitos	Coal	Ton	338,208	945,465
2016	Termoeléctrica Mejillones	Coal	Ton	400,519	971,158
2017	Termoeléctrica Mejillones	Coal	Ton	179,881	401,781
2018	Termoeléctrica Mejillones	Coal	Ton	160,784	381,670
2016	Termoeléctrica Mejillones	Coal	Ton	400,289	1,012,563
2017	Termoeléctrica Mejillones	Coal	Ton	274,872	666,105

2018	Termoeléctrica Mejillones	Coal	Ton	184,198	474,352
2016	Termoeléctrica Mejillones	Natural gas	m3	95,848,414	290,211
2017	Termoeléctrica Mejillones	Diesel Oil	Ton	825	3,842
2017	Termoeléctrica Mejillones	Natural gas	m3	57,356,886	162,755
2018	Termoeléctrica Mejillones	Diesel Oil	Ton	952	4,239
2018	Termoeléctrica Mejillones	Natural gas	m3	80,537,180	337,037
2016	Termoeléctrica Norgener	Coal	Ton	343,439	941,788
2017	Termoeléctrica Norgener	Coal	Ton	383,278	964,139
2018	Termoeléctrica Norgener	Coal	Ton	333,831	880,520
2016	Termoeléctrica Norgener	Coal	Ton	361,231	962,588
2017	Termoeléctrica Norgener	Coal	Ton	387,720	1,000,118
2018	Termoeléctrica Norgener	Coal	Ton	351,194	950,239
2016	Termoeléctrica Tarapacá	Coal	Ton	163,254	383,189
2017	Termoeléctrica Tarapacá	Coal	Ton	210,325	512,804
2018	Termoeléctrica Tarapacá	Coal	Ton	4,873	12,079
2016	Termoeléctrica Tarapacá	Diesel Oil	Ton	5,222	8,272
2017	Termoeléctrica Tarapacá	Diesel Oil	Ton	2,294	4,480
2018	Termoeléctrica Tarapacá	Diesel Oil	Ton	317	592
2016	Termoeléctrica Tocopilla	Diesel Oil	Ton	2,290	5,960
2017	Termoeléctrica Tocopilla	Diesel Oil	Ton	2,758	6,550
2018	Termoeléctrica Tocopilla	Diesel Oil	Ton	88	168
2016	Termoeléctrica Tocopilla	Diesel Oil	Ton	2,023	4,845
2017	Termoeléctrica Tocopilla	Diesel Oil	Ton	3,524	8,395
2018	Termoeléctrica Tocopilla	Diesel Oil	Ton	134	263
2016	Termoeléctrica Tocopilla	Diesel Oil	Ton	3,501	7,481
2016	Termoeléctrica Tocopilla	Natural gas	m3	1,128,416	3,616
2017	Termoeléctrica Tocopilla	Diesel Oil	Ton	1,714	4,064
2017	Termoeléctrica Tocopilla	Natural gas	m3	2,400,794	4,453
2018	Termoeléctrica Tocopilla	Diesel Oil	Ton	129	375
2018	Termoeléctrica Tocopilla	Natural gas	m3	4,049,856	9,654
2016	Termoeléctrica Tocopilla	Coal	Ton	207,224	440,259
2017	Termoeléctrica Tocopilla	Coal	Ton	152,959	334,641
2018	Termoeléctrica Tocopilla	Coal	Ton	61,850	142,782
2016	Termoeléctrica Tocopilla	Coal	Ton	197,763	434,161
2017	Termoeléctrica Tocopilla	Coal	Ton	112,138	237,145
2018	Termoeléctrica Tocopilla	Coal	Ton	46,274	103,046
2016	Termoeléctrica Tocopilla	Coal	Ton	382,090	898,378
2017	Termoeléctrica Tocopilla	Coal	Ton	287,075	674,188
2018	Termoeléctrica Tocopilla	Coal	Ton	189,883	470,314
2016	Termoeléctrica Tocopilla	Coal	Ton	336,440	825,982

2017	Termoeléctrica Tocopilla	Coal	Ton	295,246	742,375
2018	Termoeléctrica Tocopilla	Coal	Ton	202,581	534,533
2016	Termoeléctrica Tocopilla	Natural gas	m3	147,782,619	716,021
2017	Termoeléctrica Tocopilla	Natural gas	m3	176,913,946	557,279
2018	Termoeléctrica Tocopilla	Diesel Oil	Ton	1,562	8,002
2018	Termoeléctrica Tocopilla	Natural gas	m3	204,753,151	984,481
2016	Termopacífico	Diesel Oil	Ton	336	1,495
2017	Termopacífico	Diesel Oil	Ton	807	3,586
2018	Termopacífico	Diesel Oil	Ton	174	775
2016	TG_Coronel	Diesel Oil	Ton	3,546	15,980
2016	TG_Coronel	Natural gas	m3	1,938,571	7,084
2017	TG_Coronel	Diesel Oil	Ton	2,212	9,967
2017	TG_Coronel	Natural gas	m3	1,713,306	6,261
2018	TG_Coronel	Diesel Oil	Ton	643	2,868
2018	TG_Coronel	Natural gas	m3	411,680	1,504
2016	Tirúa	Diesel Oil	Ton	12	46
2017	Tirúa	Diesel Oil	Ton	13	48
2018	Tirúa	Diesel Oil	Ton	42	158
2016	Tomaval 1	Natural gas	m3	234,425	895
2017	Tomaval 1	Natural gas	m3	19,702	75
2018	Tomaval 1	Natural gas	m3	505,382	1,929
2016	Trapén	Diesel Oil	Ton	27,442	125,136
2017	Trapén	Diesel Oil	Ton	3,239	14,770
2018	Trapén	Diesel Oil	Ton	1,021	4,656
2016	Ujina	Diesel Oil	Ton	12	55
2016	Ujina	Fuel Oil No.6	Ton	2,888	14,733
2017	Ujina	Fuel Oil No.6	Ton	1,277	6,487
2018	Ujina	Fuel Oil No.6	Ton	182	917
2016	Ujina	Diesel Oil	Ton	21	99
2016	Ujina	Fuel Oil No.6	Ton	2,702	13,722
2017	Ujina	Fuel Oil No.6	Ton	1,267	6,407
2018	Ujina	Fuel Oil No.6	Ton	154	778
2016	Ujina	Diesel Oil	Ton	36	191
2016	Ujina	Fuel Oil No.6	Ton	2,860	15,213
2017	Ujina	Fuel Oil No.6	Ton	1,197	6,374
2018	Ujina	Fuel Oil No.6	Ton	174	922
2016	Ujina	Diesel Oil	Ton	21	114
2016	Ujina	Fuel Oil No.6	Ton	2,907	14,880
2017	Ujina	Fuel Oil No.6	Ton	1,250	6,403
2018	Ujina	Fuel Oil No.6	Ton	172	887

2016	Ujina	Diesel Oil	Ton	21	100
2016	Ujina	Fuel Oil No.6	Ton	3,739	18,839
2017	Ujina	Fuel Oil No.6	Ton	1,134	5,670
2018	Ujina	Fuel Oil No.6	Ton	111	546
2016	Ujina	Diesel Oil	Ton	24	118
2016	Ujina	Fuel Oil No.6	Ton	3,743	19,046
2017	Ujina	Fuel Oil No.6	Ton	1,415	7,077
2018	Ujina	Fuel Oil No.6	Ton	156	778
2016	Valdivia	Fuel Oil No.6	Ton	2,067	6,458
2017	Valdivia	Fuel Oil No.6	Ton	975	3,048
2018	Valdivia	Fuel Oil No.6	Ton	96	300
2016	Ventanas 1	Coal	Ton	269,092	686,152
2017	Ventanas 1	Coal	Ton	241,124	614,839
2018	Ventanas 1	Coal	Ton	230,018	586,519
2016	Ventanas 2	Coal	Ton	503,830	1,338,707
2017	Ventanas 2	Coal	Ton	398,675	1,059,302
2018	Ventanas 2	Coal	Ton	532,647	1,415,275
2018	watts i	Diesel Oil	Ton	4	18
2018	watts ii	Diesel Oil	Ton	6	28
2016	Yungay 1	Diesel Oil	Ton	84	301
2017	Yungay 1	Diesel Oil	Ton	98	350
2018	Yungay 1	Diesel Oil	Ton	36	129
2016	Yungay 2	Diesel Oil	Ton	81	321
2017	Yungay 2	Diesel Oil	Ton	122	484
2018	Yungay 2	Diesel Oil	Ton	38	152
2016	Yungay 3	Diesel Oil	Ton	85	309
2017	Yungay 3	Diesel Oil	Ton	117	428
2018	Yungay 3	Diesel Oil	Ton	39	143
2016	Yungay 4 CA	Diesel Oil	Ton	69	231
2017	Yungay 4 CA	Diesel Oil	Ton	162	546
2018	Yungay 4 CA	Diesel Oil	Ton	11	37

C. Information of power plants to be considered for BM Calculation

- **Selection of Sample group of power units *m***

Options	Power Generation in 2018	Selected option for this project
$AEG_{SET\geq20\%}$	14,653,258	O
$AEG_{SET\text{-}5\text{-}units}$	416,954	

- **List of plants connected to the SEN grid for BM Calculation**

$AEG_{SET\geq20\%}$ is comprised of the power plants in the following table below.

Name of Power Plant	Technology	Power Generation in 2018 [MWh]	GHG Emissions in 2018 (tCO2/y)	Start-up Date
SOLAR EL ÁGUILA I	Solar	4,935	0	2018-10-04
Solar El Pelícano	Solar	274,986	0	2018-09-13
CERRO DOMINADOR	Solar	302,183	0	2018-07-04
HUAYCA1	Solar	0	0	2018-06-04
HUAYCA2	Solar	58,887	0	2018-06-04
FV BOLERO_Solar	Solar	358,874	0	2018-04-06
Parque Sierra Gorda_Eólico	Wind Power	350,833	0	2018-04-04
Hidro La Mina	Hydropower: Run-of-River	78,147	0	2018-02-21
Solar Doña Carmen Solar	Solar	50,270	0	2017-11-29
Solar Valle de la Luna II	Solar	5,465	0	2017-11-09
Solar San Francisco	Solar	6,156	0	2017-11-08
Solar La Quinta	Solar	6,147	0	2017-11-08
Solar Antay	Solar	24,999	0	2017-11-03
La Bifurcada	Hydropower: Run-of-River	837	0	2017-09-09
PUERTO SECO SOLAR	Solar	29,713	0	2017-09-01
La Viña - Alto La Viña	Hydropower: Run-of-River	2,232	0	2017-08-28
Riñinahue	Hydropower: Run-of-River	6,822	0	2017-08-23
Solar Las Turcas	Solar	4,138	0	2017-06-01
Wind Power San Pedro II	Wind Power	109,163	0	2017-05-19
PMGD CALAMA_Solar	Solar	CDM Registered	0	2017-05-12
PARQUE SOLAR FINIS TERRAE_Solar	Solar	405,288	0	2017-04-18
Solar Cordillerilla	Solar	1,316	0	2017-03-27
Wind Power San Juan	Wind Power	564,179	0	2017-03-16
Solar Quilapilún	Solar	206,289	0	2017-03-09

Solar El Romero	Solar	410,651	0	2017-03-03
Solar Cuz Cuz	Solar	4,974	0	2017-03-02
Solar Cardones	Solar	438	0	2017-02-21
Wind Power La Esperanza	Wind Power	24,532	0	2017-02-13
Solar El Boco	Solar	2,891	0	2017-01-30
URIBE_Solar	Solar	152,860	0	2017-01-08
Kelar	Diesel Oil	CDM Registered	4,857	2016-12-27
Kelar	Natural gas	CDM Registered	672,922	2016-12-27
Solar San Pedro	Solar	2,432	0	2016-12-01
Tránquil	Hydropower: Run-of-River	12,471	0	2016-11-23
La Montaña 1	Hydropower: Run-of-River	5,085	0	2016-11-16
Carilafquén	Hydropower: Run-of-River	21,747	0	2016-10-28
Solar Hormiga Solar	Solar	4,487	0	2016-10-27
Cumpeo	Hydropower: Run-of-River	18,433	0	2016-10-26
Solar Pampa Solar Norte	Solar	194,311	0	2016-10-19
Cochrane	Coal	1,641,290	1,423,795	2016-10-12
Solar Alturas de Ovalle	Solar	2,151	0	2016-10-04
Wind Power Renaico	Wind Power	260,126	0	2016-09-12
Itata Hidro	Hydropower: Run-of-River	68,708	0	2016-09-09
Solar Conejo	Solar	286,616	0	2016-09-08
hbs Natural gas	Natural gas	10	5	2016-09-01
Wind Power Los Buenos Aires	Wind Power	74,525	0	2016-08-30
El Colorado	Hydropower: Run-of-River	7,429	0	2016-08-29
Solar Los Loros	Solar	89,597	0	2016-08-17
Solar La Silla	Solar	4,560	0	2016-08-12
Solar El Divisadero	Solar	2,443	0	2016-08-10
Cochrane	Coal	1,635,672	1,419,034	2016-07-09
Pulelfu	Hydropower: Run-of-River	64,238	0	2016-07-07
El Agrio	Hydropower: Run-of-River	9,762	0	2016-07-07
El Galpón	Hydropower: Run-of-River	7,053	0	2016-06-28
CMPC Tissue	Natural gas	9,734	2,080	2016-06-16
Solar Chuchiñi	Solar	5,132	0	2016-06-09
Solar Til Til	Solar	4,784	0	2016-05-19
Chanleufu	Hydropower: Run-of-River	84	0	2016-05-19
Andes Generación	Fuel Oil No.6	2,987	2,275	2016-05-17
Solar Las Araucarias	Solar	121	0	2016-05-12
PARQUE SOLAR PAMPA CAMARONES	Solar	14,883	0	2016-05-04

Solar Carrera Pinto	Solar	234,354	0	2016-05-03
CMPC Cordillera	Natural gas	73,013	15,604	2016-04-25
Río Mulchén	Hydropower: Run-of-River	CDM Registered	0	2016-04-01
Ujina	Fuel Oil No.6	CDM Registered	572	2016-03-29
Ujina	Fuel Oil No.6	778	486	2016-03-29
Ujina	Fuel Oil No.6	922	549	2016-03-29
Ujina	Fuel Oil No.6	887	542	2016-03-29
Ujina	Fuel Oil No.6	546	348	2016-03-29
Ujina	Fuel Oil No.6	778	490	2016-03-29
Solar Bellavista	Solar	4,371	0	2016-03-23
Solar Santa Julia	Solar	6,900	0	2016-03-17
Molinera Villarrica	Hydropower: Run-of-River	665	0	2016-03-03
Molinera Villarrica	Hydropower: Run-of-River	665	0	2016-03-03
El Paso	Hydropower: Run-of-River	101,657	0	2016-03-02
Malalcahuello	Hydropower: Run-of-River	28,400	0	2016-03-01
Solar La Chapeana	Solar	5,338	0	2016-03-01
Solar Las Mollacas	Solar	4,629	0	2016-03-01
Luz del Norte	Solar	CDM Registered	0	2016-02-24
Solar Lagunilla	Solar	2,487	0	2016-02-05
SOLAR JAMA 2_Solar	Solar	66,992	0	2016-01-21
Guacolda 5	Coal	939,325	797,958	2015-12-15
PMGD PICA_Solar	Solar	CDM Registered	0	2015-12-10
Eólica Huajache	Wind Power	6,012	0	2015-11-25
PAS1_Solar	Solar	0	0	2015-11-04
El Mirador	Hydropower: Run-of-River	6,473	0	2015-11-02
Trailelfú	Hydropower: Run-of-River	10,051	0	2015-10-16
Solar Sol	Solar	4,999	0	2015-10-05
Los Hierros II	Hydropower: Run-of-River	19,379	0	2015-09-21
Solar Luna	Solar	4,863	0	2015-09-16
Solar Lalackama 2	Solar	44,872	0	2015-08-31
Munilque	Hydropower: Run-of-River	6,713	0	2015-08-13
Picoiquén	Hydropower: Run-of-River	94,812	0	2015-08-13
LOS PUQUIOS	Solar	0	0	2015-08-11
Lleuquereo	Hydropower: Run-of-River	8,578	0	2015-08-07
Los Guindos	Diesel Oil	6,511	4,998	2015-07-30
Raki	Wind Power	7,671	0	2015-07-30
Bureo	Hydropower: Run-of-River	8,090	0	2015-07-13

Salvador RTS	Solar	0	0	2015-07-07
Solar Lalackama	Solar	147,661	0	2015-06-02
Laja 1	Hydropower: Run-of-River	CDM Registered	0	2015-05-28
Solar Chañares	Solar	92,445	0	2015-05-28
MINIHIDRO SANTA ROSA	Hydropower: Run-of-River	0	0	2015-05-26
Talinay Poniente	Wind Power	199,270	0	2015-05-26
Solar Javiera	Solar	161,405	0	2015-05-19
SOLAR JAMA 1_Solar	Solar	96,145	0	2015-04-14
Santa Fe	Biomass	331,463	0	2015-04-10
Wind Power Taltal	Wind Power	268,396	0	2015-02-09
MARIA ELENA FV_Solar	Solar	186,384	0	2015-01-21
Las Flores	Hydropower: Run-of-River	CDM Registered	0	2015-01-08
Solar Diego de Almagro	Solar	67,563	0	2014-12-11
Punta Palmeras	Wind Power	CDM Registered	0	2014-11-19
María Elena	Hydropower: Run-of-River	408	0	2014-11-14
Collil	Hydropower: Run-of-River	25,034	0	2014-11-11
Las Pampas	Biomass	411	0	2014-10-25
Ucuquer 2	Wind Power	24,307	0	2014-10-22
Las Terrazas	Solar	1,143	0	2014-08-28
Pichilonco	Hydropower: Run-of-River	5,492	0	2014-08-18
Diesel La Portada	Diesel Oil	166	119	2014-08-09
Eólica Los Cururos	Wind Power	235,395	0	2014-07-23
San Pedro	Wind Power	CDM Registered	0	2014-06-27
San Andrés	Hydropower: Run-of-River	CDM Registered	0	2014-06-23
Solar San Andrés	Solar	100,610	0	2014-06-23
Solar PSF Lomas Coloradas	Solar	4,041	0	2014-06-19
PAS3_Solar	Solar	CDM Registered	0	2014-06-07
El Arrayán	Wind Power	CDM Registered	0	2014-06-06
Los Padres	Hydropower: Run-of-River	7,519	0	2014-05-22
Boquiamargo	Hydropower: Run-of-River	422	0	2014-05-19
Quillaileo	Hydropower: Run-of-River	872	0	2014-05-09
Llano de Llampos	Solar	246,325	0	2014-04-30
Los Hierros	Hydropower: Run-of-River	CDM Registered	0	2014-04-12

Santa Marta	Biomass	CDM Registered	0	2014-03-31
PAS2_Solar	Solar	CDM Registered	0	2014-03-29
Techos de Altamira	Solar	53	0	2014-03-28
Wind Power VALLE DE LOS VIENTOS_Eólico	Wind Power	CDM Registered	0	2014-03-21
Coelemu	Biomass	20,673	0	2014-03-04
CMPC Pacífico	Biomass	178,633	0	2014-01-01
El Llano	Hydropower: Run-of-River	2,142	0	2013-12-23
Las Vertientes	Hydropower: Run-of-River	11,092	0	2013-12-23
Santa Cecilia	Solar	4,298	0	2013-12-15
Maisan	Hydropower: Run-of-River	2,133	0	2013-12-10
Diesel Zofri	Diesel Oil	8	8	2013-10-17
Diesel Zofri	Diesel Oil	117	78	2013-10-17
Diesel Zofri	Diesel Oil	13	10	2013-10-17
Estandartes	Diesel Oil	51	35	2013-10-17
Estandartes	Diesel Oil	131	87	2013-10-17
Río Huasco	Hydropower: Run-of-River	36,636	0	2013-10-09
Renaico	Hydropower: Run-of-River	45,174	0	2013-09-03
Santa Irene	Biomass	575	0	2013-09-03
SDGx01	Solar	0	0	2013-08-08
Los Álamos	Diesel Oil	13	10	2013-07-27
Viñales	Biomass	242,509	0	2013-07-01
Diesel Aguas Blancas	Diesel Oil	220	174	2013-06-04
MC1	Hydropower: Run-of-River	41,296	0	2013-05-29
MC2	Hydropower: Run-of-River	11,859	0	2013-05-29
Ensenada	Hydropower: Run-of-River	CDM Registered	0	2013-05-23
Ancali	Biomass	0	0	2013-05-06
CMPC Laja	Biomass	131,673	0	2013-05-01
Don Walterio	Hydropower: Run-of-River	8,598	0	2013-04-25
Robleria	Hydropower: Run-of-River	CDM Registered	0	2013-04-24
Talinay Oriente	Wind Power	CDM Registered	0	2013-04-13
Providencia	Hydropower: Run-of-River	CDM Registered	0	2013-03-28
Campiche	Coal	1,860,548	1,612,740	2013-03-15

Appendix 5. Further background information on monitoring plan

Comprehensive Monitoring Information is provided in Section B.7. No further detail is required.

Appendix 6. Summary report of comments received from local stakeholders

The explanation of the comments received from the stakeholder consultation process is detailed in Section E.2 of this PDD and no further detail is required.

Appendix 7. Summary of post-registration changes

Not Applicable.