Zertifikatsnummer: 210733

Gültigkeit bis 07.07.2022

kennzahlen gestützter KLIMA SCHUTZ®

Wir sind klimaneutral

United Nations Carbon offset platform

References: VC19653/ VC19657/ VC19659/ VC19660/2021

Bronze-Zertifikat für kennzahlengestützten

KLIMASCHUTZ

Dem Studierendenwerk Karlsruhe AöR

wird nach erfolgreicher Verifizierung seiner ökologischen Bilanz hiermit das Bronze-Zertifikat für kennzahlengestützten Klimaschutz verliehen.

Die treibhausgasäquivalenten Emissionen für das Jahr 2020 betragen **2.440,45 t CO_2e absolut** bzw. **0,05 t CO_2e / Studierende.**

Die Gesamtemissionen der Wohnanlagen auf die Wohnplätze verteilt ergeben eine Relation von **0,50 t CO_2e / Wohnplatz.**

Zuordnung der Emissionen

- Wohnanlagen: 1.393,32 t CO_2e
- Gastronomie: 1.031,26 t CO_2e
- Fuhrpark und Sonstiges: 15,87 t CO_2e

Zertifizierte Kompensationen **2.441,00 CERs absolut** (1 CER entspricht - 1 t CO_2)

- Certified Emission Reductions (CERs): 41,00 CERs
  Reference: VC19653/2021
- Certified Emission Reductions (CERs): 450,00 CERs
  Reference: VC19657/2021
- Certified Emission Reductions (CERs): 550,00 CERs
  Reference: VC19659/2021
- Certified Emission Reductions (CERs): 1.400,00 CERs
  Reference: VC19660/2021

Bei der Auswahl der zu bilanzierenden Emissionsquellen wurden alle Grundvorgaben des Greenhouse-Gas-Protocol berücksichtigt. Alle eingereichten Unterlagen entsprechen formal und inhaltlich den aktuellen Anforderungen. Die enthaltenen Daten haben sich, nach stichprobenhafter Kontrolle, als valide erwiesen und die abgeleiteten Kennzahlen wurden nachvollziehbar berechnet.
Das Unternehmen verfügt somit über die entsprechenden ökologischen Kennzahlen, die eine fundierte Verfolgung von gesetzlichen und freiwilligen Optimierungsmaßnahmen im Rahmen der Treibhausgasminderungsziele Deutschlands ermöglichen.

Gemäß des Kyoto-Protokolls (Art. 12 Abs. 3b) erreicht das Studierendenwerk Karlsruhe AöR, mit einem Saldo der zurechenbaren treibhausgasäquivalenten Emissionen von 0 t im Jahr 2020, Klimaneutralität auf Unternehmensebene. Da CERs, als Zertifikate des Clean Development Mechanism, einem staatenübergreifenden Mechanismus zur Minderung von Treibhausgasemissionen nach § 3 Absatz 2 des Bundes-Klimaschutzgesetzes angehören, ist das Studierendenwerk Karlsruhe AöR berechtigt sich bis zur nächsten vorgesehenen Jahresbilanzierung als klimaneutral zu bezeichnen.

Mannheim, 07.07.2021

Quantifizierung der Treibhausgase

Jan Karcher
Geschäftsführer, Green Vision Solutions GmbH

Verifizierung

Dr. Walter Kohler
Vereinsvorsitzender, Deutscher Klimaschutz e.V.

Zertifiziert durch den Deutschen Klimaschutz e.V.

Treibhausgasäquivalente Emissionen	Studierendenwerk Karlsruhe AöR 2020	Zertifizierte Kompensationen	
Fuhrpark	**[t CO2e]**	**Certified Emission Reductions (CERs)**	**[t CO2e]**
KA-SW 1710	2,41	Reference: VC19660/2021	1.400,00
KA-SW 833	2,37	Reference: VC19659/2021	550,00
KA-SW 830	1,50	Reference: VC19657/2021	450,00
KA-SW 178	1,27	Reference: VC19653/2021	41,00
KA-SW 1717	1,16	**Zwischensumme**	**2.441,00**
KA-SW 345	1,14		
KA-SW 832	0,98	Abgrenzungsposten für Überkompensation	-0,55
KA-SW 1718	0,83		
KA-SW 1709	0,82		
KA-SW 635	0,58		
KA-SW 1708	0,58		
KA-SW 831	0,50		
KA-BP 891	0,48		
KA-SW 240	0,47		
KA-SW 860	0,32		
KA-SW 3105	0,28		
KA-SW 767	0,18		
Zwischensumme	**15,87**		
Wohnanlagen			
75175, Hagenschießstr. 1-3	180,36		
76131, Bernhardstr. 11/Rudolfstr. 20	172,18		
76131, Willy-Andreas-Allee 11,15,17	80,30		
76131, Waldhornstr. 36	78,30		
75175, St.-Georgen-Str. 15-17	77,28		
76187, Nancystr. 18	72,04		
76149, Tennesseeallee 14	66,86		
76131, Zähringerstr. 4	60,31		
76187, Nancystr. 20	60,06		
76187, Nancystr. 24	59,25		
76139, Beuthener Str. 6	58,43		
76187, Josef-Schofer-Str. 2	56,35		
76131, Am Schloss Gottesaue 1	47,54		
76131, Rintheimer Querallee 2	35,14		
76149, Tennesseeallee 28	33,40		
75175, Wurmberger Str. 4c	31,77		
76149, Tennesseeallee 36	29,19		
76131, Klosterweg 7	28,86		
76133, Adlerstr. 41	27,57		
76149, Tennesseeallee 20	25,83		
76131, Adenauerring 7	23,27		
75175, Lion-Feuchtwanger-Allee 24	22,75		
75175, Hagenschießstr. 5	22,53		
76149, Tennesseeallee 8	20,79		
76131, Englerstr. 14	16,56		
76131, Zähringerstr. 10	6,40		
Zwischensumme	**1.393,32**		
Gastronomie			
76131 Mensa A7+Verwaltung	702,66		
76131 Molktestr. 12, Mensa II	114,33		
75175 Tiefenbronner Str. 65, Mensa III	113,91		
76133 Erzbergerstr. 121, Duale HS	29,76		
76131 Cafeteria Engesserstraße	29,61		
76133 Cafeteria Bismarckstraße	13,20		
76131 Mensa Schloss Gottesaue	11,82		
76131 Cafebar Am Zirkel	7,60		
75175 Mensa Holzgarten	6,32		
76131 Cafeteria Englerstraße	2,06		
Zwischensumme	**1.031,26**		
Verantwortete treibhausgasäquivalente Emissionen insgesamt [t CO2e]	**2.440,45**	**Kompensierte treibhausgasäquivalente Emissionen insgesamt [t CO2e]**	**2.440,45**

United Nations
Framework Convention on
Climate Change

DATE: 30 JUNE 2021
REFERENCE: VC19660/2021

VOLUNTARY CANCELLATION CERTIFICATE

Presented to

Studierendenwerk Karlsruhe AöR

Reason for cancellation

I am offsetting greenhouse gas emissions for my company

Number of units cancelled

1,400 CERs

Equivalent to 1,400 tonne(s) of CO_2

Start serial number: CL-5-23231696-2-2-0-4800
End serial number: CL-5-23233095-2-2-0-4800

The certificate is issued in accordance with the procedure for voluntary cancellation in the CDM Registry. The reason included in this certificate is provided by the cancellor.

United Nations
Framework Convention on
Climate Change

DATE: 30 JUNE 2021
REFERENCE: VC19659/2021

VOLUNTARY CANCELLATION CERTIFICATE

Presented to

Studierendenwerk Karlsruhe AöR

Reason for cancellation

I am offsetting greenhouse gas emissions for my company

Number of units cancelled

550 CERs

Equivalent to 550 tonne(s) of CO_2

Start serial number: CL-5-23231146-2-2-0-4800
End serial number: CL-5-23231695-2-2-0-4800

The certificate is issued in accordance with the procedure for voluntary cancellation in the CDM Registry. The reason included in this certificate is provided by the cancellor.

United Nations
Framework Convention on
Climate Change

DATE: 30 JUNE 2021
REFERENCE: VC19657/2021

VOLUNTARY CANCELLATION CERTIFICATE

Presented to

Studierendenwerk Karlsruhe AöR

Reason for cancellation

I am offsetting greenhouse gas emissions for my company

Number of units cancelled

450 CERs

Equivalent to 450 tonne(s) of CO_2

Start serial number: CL-5-23230696-2-2-0-4800
End serial number: CL-5-23231145-2-2-0-4800

The certificate is issued in accordance with the procedure for voluntary cancellation in the CDM Registry. The reason included in this certificate is provided by the cancellor.

United Nations
Framework Convention on
Climate Change

DATE: 30 JUNE 2021
REFERENCE: VC19653/2021

VOLUNTARY CANCELLATION CERTIFICATE

Presented to

Studierendenwerk Karlsruhe AöR

Reason for cancellation

I am offsetting greenhouse gas emissions for my company

Number of units cancelled

41 CERs

Equivalent to 41 tonne(s) of CO_2

Start serial number: CL-5-23230655-2-2-0-4800
End serial number: CL-5-23230695-2-2-0-4800

The certificate is issued in accordance with the procedure for voluntary cancellation in the CDM Registry. The reason included in this certificate is provided by the cancellor.

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	San Clemente Hydroelectric Power Plant
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	2.0
Completion date of the PDD	10/09/2018
Project participants	Colbún S.A.
Host Party	Chile
Applied methodologies and standardized baselines	AMS-I.D.: Grid connected renewable electricity generation - Version 18.0
Sectoral scopes linked to the applied methodologies	Sectoral Scope 01: Energy Industries (renewable/non-renewable)
Estimated amount of annual average GHG emission reductions	12,620

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The San Clemente hydroelectric power plant (the Project), developed by Colbún S.A., is a run-of-river hydroelectric power plant of 5.5 MW nominal capacity, which utilizes the water of the Sanatorio brook. The project uses water from the Maitenes (or Taco General) irrigation system, which is conducted at the exit of the Maitenes tunnel. The water of the irrigation system is supplied by the Colbún reservoir[1].

The project diverts a nominal flow of 17 m^3/s to a Kaplan turbine and the turbinated water is returned to the Sanatorio Brook 2 km downstream. A 66 kV transmission line delivers the energy production to the Chiburgo substation, where is injected to the grid.

The project started operations in September 2010, when the energy started being delivered to the Grid, displacing energy partially generated by fossil fuel-fired power plants and reducing GHG emissions. The project will generate 28,470 MWh per year that will be supplied to the grid, which provides electricity to 93% of Chilean population. The project displaces electricity generated by fossil fuel-fired power plants, avoiding GHG emissions estimated in 12,620 tCO_2e per year and 88,340 tCO_2e in the second crediting period.

The implementation of the project will contribute to sustainable development:

- Reducing the effects of the combustion of fossil fuels, both locally and globally.

- Being a source of employment in the geographical zone where it is located, contributing to the local sustainability (50% of the full workforce to be employed during the construction phase of San Clemente was sourced locally, positively impacting the community of San Clemente, host of the project, which has a high level of rural population, poverty and unemployment compared to the national average). This results in an enhancement of the economic activity during both the construction period and the lifetime of the project.

- Helping to satisfy the increasing demand of electricity in Chile using clean and renewable local resources, reducing the reliance on imported fossil fuels.

- Increasing commercial activity through clean and renewable source of power.

- Developing capacity building inside the company for future projects with similar characteristics and introducing and demonstrating environmentally-friendly power generation techniques for the VII Region of Chile.

- Contributing to fiscal accounts though the payment of taxes (locally and nationally).

- Helping Chile to reduce its fossil fuel import used for electricity generation.

- Improving the commercial activity since the increase of the people/workers during construction and operation in the area will require more services like food, transport, and others.

[1] Upstream the project activity there is an existing reservoir named "Embalse Colbún", which was constructed for the operation of "Colbún Power Plant" (474 MW, operating since 1985). The reservoir has a capacity of 1,116,000 m^3, equivalent to 552,000 MWh. The regulation of the reservoir is made in order to optimize the power generation at "Colbún Power Plant" and has no relation with the project activity.

A.2. Location of project activity

>>

The project is located in the San Clemente commune, Talca Province, VII Region of Maule, about 33km south east of the city of Talca, in an area known as Sanatorio, close to the north bank of the Maule River and downstream from the Colbún reservoir.

The specific coordinates of the project are:

Table 1. Project Coordinates

	South	West
Intake	35º 35' 48.1"	71º 20' 15.7"
Adduction channel	35º 35' 48.4"	71º 20' 18.1"
Forebay tank	35º 35' 50.5"	71º 21' 42.2"
Power house	35º 35' 50.7"	71º 21' 20.2"
Penstock	35º 35' 51.5"	71º 21' 17.8"
Discharge channel	35º 35' 50.4"	71º 21' 20.8"

Source: Own elaboration, 2018

The location of the project activity is illustrated in the following figures:

Figure 1. Project location inside VII Región del Maule

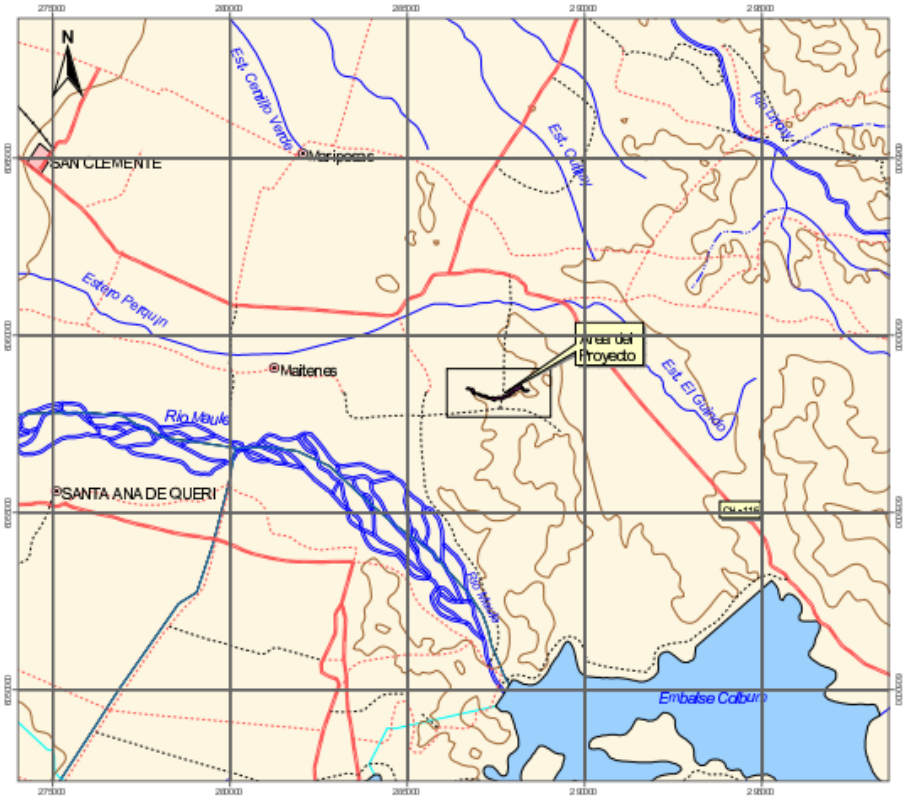

Figure 2. Project location

A.3. Technologies/measures

>>

The technology to be used in the unit is a run-of-river hydropower generation technology, consisting of water intakes, adduction channel and penstocks leading to a vertical axe Kaplan turbine (5.5 MW) coupled with a vertical axe generator (6.3MVA). The unit also has a powerhouse and pipeline leading the water to the turbine where the electricity is generated.

The water is diverted immediately at the Maitenes tunnel exit. The water is driven through the adduction channel, to a penstock that leads the water to the powerhouse, which houses a Kaplan turbine and the associated generation equipment. The water is returned to the Sanatorio brook through a return channel.

There will be one (1) substation with a transformer that elevates the tension up to 66 kV for the project activity. Then, the electricity will be transmitted through a 7.2 km transmission line to Chiburgo Substation.

The specific characteristic of the hydropower unit are shown in the following table:

Table 2. Technical characteristics of the project activity

Turbine	Generator
Type: Kaplan CAT Axis: Vertical Nominal flow: 17m^3/s Nominal capacity: 5.5 MW[2] Net height of fall: 35.5 m	Axis: Vertical Capacity: 5,985 kW Apparent capacity: 6,300 kVA Frequency: 50 Hz Voltage: 6,600 V

[2] During the different stages of the project (basic engineer, detailed engineer, request of environmental approval) there were minor modifications in the installed capacity. 5.5 MW corresponds to the definitive nominal value.

Turbine	Generator
	Speed: 428.6 rpm

Source: Turbine and generator data sheet.

The technology utilized is a safe and sound clean technology with a minimal impact on the environment. The project construction and operation meet Chilean environmental standards (see section D). The turbine utilized in this project was imported from Italy and the generator was imported from Spain. Also, the technicians and engineers from the equipment supplier trained the operational and maintenance power plant staff.

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 Party)	Colbún S.A.	No

A.5. Public funding of project activity

>>
The project does not consider public funding.

A.6. History of project activity

>> This PDD covers the second crediting period of the registered CDM project activity “San Clemente Hydroelectric Power Plant”, ref. N° 4800.

The project participant confirms that the proposed CDM project activity is neither registered as another CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA); and is not a project activity that has been deregistered.

A.7. Debundling

>>
According with Appendix C to the simplified modalities and procedures for the small-scale CDM project activities, 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; and

(c) Registered within the previous 2 years; and

(d) Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point.

Since these conditions are not met by the proposed project activity, it is not considered a debundled component and is eligible to use the simplified modalities and procedures for small-scale CDM project activities.

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

>>

Approved small scale methodology: AMS-I.D Grid connected renewable electricity generation Version 18.0. Sectoral Scope 01, in effect as of EB 81. Available at: http://cdm.unfccc.int/filestorage/2/P/7/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC/EB81_repan24_AMS-I.D_ver18.pdf?t=T0J8cDk2c3Q3fDBQffouDwqHXrinfATDQnVC

The following approved and called by the mentioned methodology tools were used:

- Tool to calculate the emission factor for an electricity system. Version 07.0. Available at: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

- Methodological Tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period. Version 03.0.1 Available at: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

B.2. Applicability of methodologies and standardized baselines

>>

The chosen methodology for the development of the project design document is the AMS-I.D Grid connected renewable electricity generation Version 18.0; the applicability conditions in this methodology and its fulfilment reasons are presented in the following table.

Applicability conditions	Fulfilment
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 project activity is a Greenfield plant; therefore, letter (a) is fulfilled.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir; (b) 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/m2; (c) 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.	Not applicable, since the project does not consider a reservoir.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the	The project activity has nominal capacity of 5.5 MW, completely by renewable sources.

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.	
Combined heat and power (co-generation) systems are not eligible under this category.	The project activity is not a co-generation system.
In the case of project activities that involve the capacity 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.	Not applicable, since the project activity is not a capacity addition.
In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.	Not applicable, since the project activity is not a retrofit, rehabilitation or replacement.
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.	Not applicable, since the project activity is not a landfill gas, waste gas, wastewater treatment or agro-industries project.
In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	Not applicable, since the project activity does not uses biomass.

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

>>

According to AMS-I.D "Grid connected renewable electricity generation" Version 18.0, the boundary is defined by the project power plant and all power plants connected physically to the electricity system. Thus, the boundary of the project activity is the electricity system where the project activity is connected to. As described in section B.4, until November 21th, 2017 the relevant electricity system was the "Sistema Interconectado Central" (SIC[3]) grid and since that date, the national system called "Sistema Eléctrico Nacional" (SEN[4]) which considers the interconnection of the "Sistema Interconectado Central" (SIC) grid and the "Sistema Interconectado Del Norte Grande" (SING[5]) grid. Considering this, all GHG emissions generated by the power plants of this electricity system are accounted as part of the baseline emissions.

[3] In English: "Central Interconnected System"

[4] In English: "National Electric System"

[5] In English: "Great North Interconnected System"

	Source	GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	The project will supply zero-emissions renewable energy to the grid	CO_2	No	Not considered as an emission source
		CH_4	No	Not considered as an emission source
		N_2O	No	Not considered as an emission source

The following figure represents a flow diagram of the project boundary.

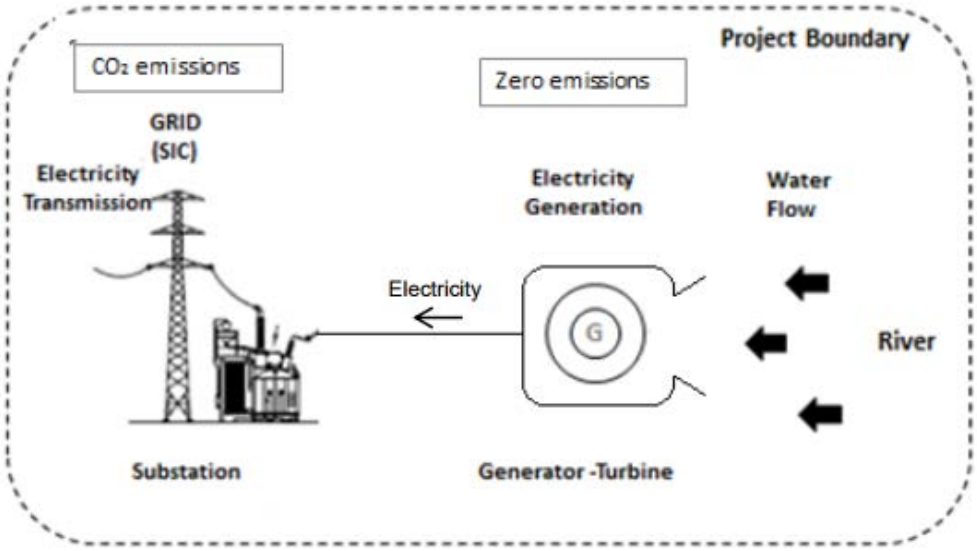

Figure 3. Flow diagram of the project activity

B.4. Establishment and description of baseline scenario

>>

As per methodology AMS-I.D Version 18.0, the baseline scenario for a Greenfield power plant is that the electricity delivered to the grid that would have otherwise been generated by the operation of the currently operating power plants and by the addition of new generation sources.

At the time of the project registration under the CDM, the boundaries of the baseline scenario of the San Clemente project activity was the "Sistema Interconectado Central" (SIC) grid, as it was connected to this electric system, which covered an extension from the northern city of Tal Tal, located at the II Región of Antofagasta, to the southern island of Chiloé, located at the X Región of Los Lagos, including all the regions between them (from II to X, including RM and XIV Región de Los Ríos).

In November 21th, 2017, the SIC grid was interconnected to the "Sistema Interconectado Del Norte Grande" (SING) grid, creating a new electric system called Sistema Eléctrico Nacional (SEN), which represents 99% of the installed capacity of the country, covering from Arica, in the XV Región de Arica y Parinacota (the most northern region in the Chile) to Chiloé.

The ex-ante emission reduction calculation considers the emission factor according to the "Tool to calculate the emission factor for an electricity system"; the methodological choice is described in section B.6.1.

Description of the identified Baseline Scenario

The baseline scenario for the Project is the continuing operation of the existing and future power plants, but without the San Clemente electricity generation, necessary to meet the actual electricity demand. In the project scenario the same electricity demand is met with the San Clemente electricity generation dispatched in the base load, displacing the generation from existing power plants and future power developments. Because the project uses renewable sources to produce electricity, there are no additional emissions from the project activity and the emissions reductions are generated by the displaced generation.

Validity of the baseline of the project activity

According to the CDM project standard for project activities Version 01.0, the validity of the original baseline or its update should be assessed as per the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1).

The tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period. The tool consists of two steps:

Step 1: Assess the validity of the current baseline for the next crediting period

The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

According to the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1)", "if the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2".

There are no new national and/or sectoral policies that have come into effect after the submission of the project for the first validation that are applicable to the project activity. The baseline complies with the national environmental and electricity policies:

- Law of general bases of the environment, created in 1994[6].
- General law of electric services, created in 2007[7].

According to the registered PDD, the original baseline is "the electricity delivered to the grid that would have otherwise been generated by the operation of the currently operating power plants and by the addition of new generation sources."

The original baseline complies with all the current relevant mandatory national and sectoral policies.

Step 1.2: Assess the impact of circumstances

According to the tool, "in the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period".

[6] https://www.leychile.cl/Navegar?idNorma=30667

[7] https://www.leychile.cl/Navegar?idNorma=258171

Currently, the market characteristics for the electricity sector are still the same than described in the original baseline scenario. In fact, the planning authority (CNE[8]) is still the same as originally described and the private sector is still the responsible actor in electricity generation, distribution and transmission market. There have not been relevant changes to the original circumstances in the market that could affect the applicability of the original baseline scenario.

The conditions used to determine the baseline emissions in the previous crediting period are still valid, as baseline emissions depend on the grid connected power plants operation.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

According to the tool, "this sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology".

The tool also clarifies that it should be assessed "whether the remaining technical lifetime of the equipment that would have continued to be used in the absence of the project activity, as determined in the PDD, exceeds the crediting period for which renewal is requested".

Since the baseline scenario identified at the validation of the project has not been modified and the baseline didn't consider the use of any existing equipment by the project participant, because in the absence of the project activity the energy generated would have been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid, this substep is not applicable.

Step 1.4: Assessment of the validity of the data and parameters

According to the tool, in this step it should be assessed "whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated".

As the grid's emission factor calculation (which is relevant for the baseline emissions determination) is calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system", including IPCC default values and local relevant data and parameters, both monitored and not monitored, the current data and parameters need to be updated for the second crediting period.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

According to the tool, in this step it should be updated "the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period"

Since the original baseline is still in compliance with the current relevant mandatory national and/or sectoral policies of Chile and there are no new circumstances which may impact the validity of the project activity baseline, this step is not applied.

[8] https://www.cne.cl/normativas/electrica/sector-electrico/

Step 2.2: Update the data and parameters

According to the tool "if the application of Step 1.4 showed that the data and/or parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4."

Specifically, as mentioned in Step 1.4, the emission factor has been updated, considering the latest IPCC default values and local relevant data and parameters. This information can be reviewed in section B.6.2 of the PDD.

B.5. Demonstration of additionality

>>

In the paragraphs below it is demonstrated that the proposed project activity is additional as per options provided under attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Investment barrier

The financial indicator for this analysis is the Internal Rate of Return (IRR), which is the indicator commonly used to determine the investment decision. According the law of electricity in Chile (DFL 4 / 2006)[9], the suitable benchmark value for power projects is 10%, used too to determine node prices, transmission line and distribution investment.

The Project developer of the plant hydropower San Clemente will invest US$ 17,240,978 in engineering and inspection costs, civil works, and montage of the powerhouse and transmission lines.

As a result of an economic evaluation carried out at San Clemente Project the following results are obtained: an IRR of 8.78% excluding income from CERs, which makes it unprofitable for financing the investment; an IRR of 10.70% considering income of CERs, which shows the importance of the benefits of the CDM in order to achieve better performance to help to overcome its implementation.

The IRR is under the benchmark, excluding CER incomes, but their consideration increases the profitability of the project benefiting all financial indicators, strengthening the cash flow and reducing the risks of operating the small power plant. Therefore, the CDM income on the project helps to overcome the investment barrier.

The table below shows the parameters used to calculate the economic assessment[10]:

Table 3. Parameters used for the economic assessment

Energy Production	28,470 MWh/year	
Total Investment (CAPEX)	17.2 MMUS$	
Energy Price (2009-2013) US$/MWh	2009	148.6
	2010	118.6
	2011	80.1

[9] https://www.leychile.cl/Navegar?idNorma=258171

[10] The starting date of the project was in an electric market with no law No 20,257 "Law for General Electric Services related to production of electric energy with non conventional renewable energy sources" ("Ley General de Servicios eléctricos respecto de la generación de energía eléctrica con fuentes de energía renovables no convencionales"), since this regulation was emitted on April 1st, 2008. The economic assessment was made in January 2008.

	2012: 64.3 2013: 49.9
Average Energy Price of long-term (2014 onwards)	50 US$/MWh
Period of assessment	20 years
CERs Price	20 US$/$tCO_2e$
O&M Costs	259.000 US$/year
Firm Capacity	3.04 MW/month
Firm Capacity Price (US$/kW-month)	2009: 8.07 2010: 7.66 2011: 7.28 2012: 6.92 2013 and on: 6.92
IRR without CDM	8.78%
IRR with CDM	10.70%

The project was evaluated considering 100% equity because no debt was projected.

For the period 2009-2013 the project was evaluated with an energy price estimation based on the official projections of the Comisión Nacional de Energía (National Energy Commission) of the "Informe de Fijación de Precio Nudo October 2007" (Node Price Fixation Report, October 2007)[11]. From 2014 onward a fixed long term price based on coal fired power plants development was considered.

A sensitivity analysis was developed for the IRR, including variables that constitute more than 20% of the income/cost (CAPEX, energy production and energy price) and also less significant variables for reference (O&M and firm capacity), with the following results:

Table 4. Sensitivity analysis

-10%	**+10%**
CAPEX	
10.41%	7.44%
Energy production	
7.30%	10.25%
Energy price	
7.30%	10.25%
O&M cost	
8.98%	8.57%
Firm capacity	
8.57%	8.98%
Firm capacity price	
8.57%	8.98%

The following graph summarizes the sensitivity analysis:

[11] The information is available at: http://antigua.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo/octubre-2007

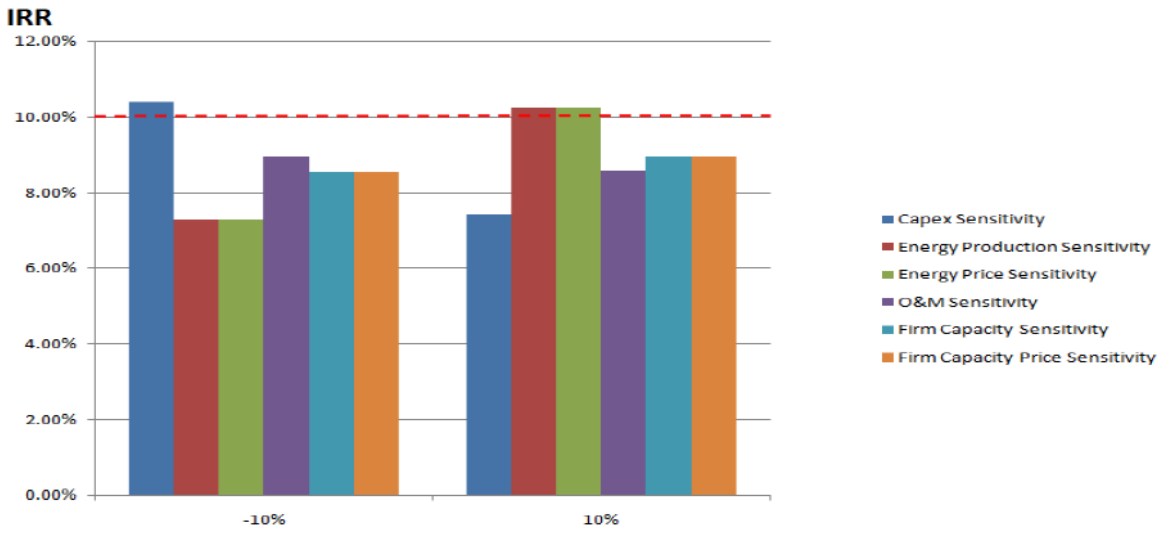

Figure 4. Sensitivity Analysis

10% overproduction of electricity: Considering the 41 years of flow statistics before the project evaluation (and its associated energy generation) a 10% overproduction is very unlikely to happen (less than 15% of the considered years).

10% reduction of CAPEX: Colbún´s previous experience in hydroelectric projects suggests that final investment is not likely to differ from their original budget in more than 5%. As a reference the last two run of river hydro projects that the Company has developed (Hornitos and Chiburgo) presented a CAPEX variation of -1.81% and +5.44% respectively.

10% increase of energy price: This theoretical scenario gives a slightly over the benchmark IRR of 10.25%. This scenario is very unlikely since all variables and parameters were very conservatively estimated.

All the above evidence confirms that Colbun's decision of going forward with the project was definitely supported by the additional incomes of the Clean Development Mechanism (CDM).

Prevailing practice

As it is shown in the paragraphs below, the construction of power plants similar to the project activity is not the prevailing practice, and the prevailing practice would have led to the implementation of fossil fuel-fired power plants, which have higher emissions than the project activity.

As it is shown in table below, there were 23 power plants under construction to be connected to the SIC; 16 of them were fossil fuel-fired power plants (2084.4 MW or 85.1% of the total installed capacity in construction), thus with higher GHG emissions than the project activity. There were seven '0 emissions' power plants under construction: 6 hydro and 1 wind power plant. Five of the '0 emissions' power plants are currently at some stage of CDM process (1 at validation and 4 registered).

It is important to mention that hydroelectric plant Coya-Pangal (not a CDM project activity) is not a new power plant, since before its connection to the SIC (April 2008), this facility supplied to the mine company El Teniente[12]. Therefore, none of the power plants under construction without CDM are similar to the project activity.

[12] http://antigua.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo/abril-2009

Table 5. Power Plants under construction

	CDM Status	Power Plants under construction	Power MW	
0 Emissions	-	Hydroelectric Power Plant Coya-Pangal	10.8	364.44
	Registered – Number 1267	Hydroelectric Power Plant Puclaro	5.6	
	Registered – Number 1267	Hydroelectric Power Plant Ojos de Agua	9	
	Registered – Number 1267	Hydroelectric Power Plant Lircay	19.04	
	-	Wind Power Plant Punta Colorada	20	
	Registered – Number 1267	Hydroelectric Power Plant La Higuera	155	
	At validation	Hydroelectric Power Plant Confluencia	145	
Fossil		Diesel Power Plant Cenizas	17.1	2084.4
		Diesel Turbine Colmito	56	
		Diesel Turbine Espinos	70	
		Diesel Turbine Los Pinos	97	
		Diesel Power Plant Santa Lidia	131	
		Diesel Turbine Cardones 01	141	
		Diesel Turbine Campanario IV CA	42	
		Thermoelectric Power Plant Punta Colorada Fuel I	16.3	
		Diesel Turbine Newen	15	
		LNG Open Cycle Quintero I ope Diesel	240	
		Coal Power Plant Guacolda III	135	
		Diesel Turbine Campanario IV CC	60	

Source: "Fijación de precio nudo, abril 2008"[13]

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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Baseline emissions

According to the AMS-I.D Version 18.0 methodology, the baseline emissions from electricity generation in power plants that are displaced due to the project activity include only CO_2 emissions, assuming that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

Equation 1. Baseline emissions calculation

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

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).

[13] http://antigua.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo/abril-2008

$EF_{grid,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system" (Version 07.0). (tCO_2/MWh).

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ for greenfield power plants is shown on the following equation:

Equation 2. $EG_{PJ,y}$ calculation

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

Where:

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

Calculation of $EF_{grid,y}$

The emission factor is calculated according to the "Tool to calculate the emission factor for an electricity system" Version 07.0. The followed steps are shown next.

Step 1. Identify the relevant electricity systems

The determination of the relevant electricity system was made following the Option 2, considering the dispatch area covered by the responsible dispatch centre for each year of the ex-ante emission factor calculation requirements. In this case, since in November 21th, 2017, the SIC grid was connected to the SING grid, creating a new electricity system called SEN, which considers a single dispatch area coordinated by the National Electricity Coordinator (CEN); thus, the relevant electricity system is the SEN[14].

As the "Tool to calculate the emission factor for an electricity system" requires an annual based emission factor calculation, and the interconnection occurred during 2017, therefore the relevant electricity system is SEN for 2017 and SIC for 2015 and 2016.

The systems include the project site and the geographical extent of each grid and all electricity generation plants that are connected to these grids at the relevant years. The selection of these grids as the appropriate electric power system is in accordance with "Tool to calculate the emission factor for an electricity system" (Version 07.0).

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

Option I (Only grid power plants are included in the calculation) has been chosen for the project activity.

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

The operating margin was calculated using the Simple OM method (option a), as both of the requirements presented in the "Tool to calculate the emission factor for an electricity system" (Version 07.0) are fulfilled:

(a) Low-cost/must-run resources constitute less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most

[14] http://bcn.cl/22vt9

recent years; or 2) based on long-term averages for hydroelectricity production (minimum time frame of 15 years).

As seen in the following table, the average of the five most recent years is below 50 per cent.

Table 6. LCMR share calculation

Year	2013	2014	2015	2016	2017[15]	Average
LCMR	22,308,559	27,739,293	29,009,657	25,719,984	31,866,349	
Total	50,885,613	52,224,354	52,898,828	53,900,416	74,176,345	
%	43.84%	53.12%	54.84%	47.72%	42.96%	48.49%

Source: Own elaboration, 2018

The Simple OM has been calculated ex-ante, taking into account the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission. Data from 2015 to 2017 is the most recent data available.

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

As determined in Step 3, the Simple OM method (a) has been selected:

Acc ording to the Tool to calculate the emission factor for an electricity system (Version 07.0), the Simple OM may be calculated by one of the following options:

(a) **Option A:** Based on the net electricity generation and a CO_2 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.

As data for Option A is actually available, this option will be used for the calculation; under this option, the simple OM emission factor is calculated based on the net electricity generation and an emission factor for each power unit, as follows:

Equation 3. OM emission factor calculation

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

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh).
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh).
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh).
m	=	All grid power units serving the grid in year y except low-cost/must-run power units.
y	=	The relevant year as per the data vintage chosen in Step 3 (2015 to 2017).

Ex ante $EF_{grid,OMsimple,y}$ is calculated as an annual generation weighted average of $EF_{grid,OMsimple,2015}$, $EF_{grid,OMsimple,2016}$ and $EF_{grid,OMsimple,2017}$.

[15] Considers the generation of SEN grid.

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

The emission factor of each power unit m should be determined as follows:

• **Option A1** - If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) is determined as follows:

Equation 4. Emission factor per power unit calculation

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh).
$FC_{i,m,y}$	=	Amount of 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).
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* (tCO_2/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 units.
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 (2015 to 2017).

• **Option A2** - In for a power unit m only data on electricity generation and the fuel types used is available, the emission factor is determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

Equation 5. CO_2 emission factor based on efficiency

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh).
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ).
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio).
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.

Where several fuel types are used in the power unit, the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y}$ is used.

• **Option A3** - If for a power unit *m* only data on electricity generation is available, an emission factor of 0 t CO_2/MWh can be assumed as a simple and conservative approach.

Since information is available for all power plants/units, only options A1 and A2 are used.

Determination of $EG_{m,y}$

As off-grid power plants were not considered, $EG_{m,y}$ is determined as per the provisions in the monitoring tables.

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

The BM emission factor is determined in accordance to Option 1 of the "Tool to calculate the emission factor of an electricity system" (Version 07.0), where for the second crediting period the build margin emission factor is calculated ex-ante based on the most recent information available (2017) on units already built for sample group *m* at the time of PDD submission to the DOE for validation.

Capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin was determined as per the following procedure provided in the "Tool to calculate the emission factor for an electricity system" (Version 07.0), based on the electricity system defined according to option 2, as described in step 1 above:

(a) Identify the set of five power units, excluding units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET5\text{-}units}$, 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) ($SET_{\geq 20\ per\ cent}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\ per\ cent}$, in MWh);

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\ per\ cent}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. As none of the power units started to supply energy more than 10 years ago, Steps (d), (e) and (f) were ignored.

The build margin emissions factor is the generation-weighted average emission factor (t CO_2/MWh) of all power units m during the most recent year y (2017) for which electricity generation data is available, calculated as follows:

Equation 6. BM emission factor calculation

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh).

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

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh).
m	=	Power units included in the build margin.
y	=	Most recent historical year for which electricity generation data is available.

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per guidance in Step 4, using options A1 or A2 (represented by Equations 4 and 5 in Step 4), using for y the most recent historical year (2017) for which power generation data is available, and using as m the power units included in the build margin.

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emissions factor ($EF_{grid,CM,y}$) is based on the Weighted average CM method (a), as follows:

Equation 7. CM Emission factor calculation

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

Where:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emissions factor in year y (tCO_2/MWh).
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh).
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh).
w_{OM}	=	Weighting of operating margin emissions factor (per cent).
w_{BM}	=	Weighting of build margin emissions factor (per cent).

The default values established in the "Tool to calculate the emission factor for an electricity system" (Version 07.0) for the weighting of the OM (w_{OM} = 25%) and for the weighting of the BM (w_{BM} = 75%), are used in the calculation of the baseline emission factor, as the project activity is neither wind nor solar power generation (option b) and it is on its second crediting period.

Project emissions

According to the approved small-scale methodology AMS-I.D Version 18.0, and considering that the project activity is not a geothermal power plant, nor a reservoir hydro power plant, the project emissions are zero ($PE_y=0$).

Leakage emissions

The project does not consider any leakage.

Emission Reductions

According to the approved small scale methodology AMS-I.D Version 18.0, the project activity's emission reduction is determined by the following equation.

Equation 8. Emission Reduction Calculation

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO_2).
BE_y	=	Baseline emissions in year y (tCO_2).
PE_y	=	Project emissions in year y (tCO_2).

LE_y = Leakage emissions in year y (tCO_2).

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EG_{m,y}$
Data unit	MWh
Description	Net electricity generated by power plant/unit *m,* in year *y*.
Source of data	Daily real operation information from "Coordinador Eléctrico Nacional"[16]
Value(s) applied	Available in attached spreadsheet (Emission Factor and ER calculation spreadsheet.xls)
Choice of data or measurement methods and procedures	Official publications by the "Coordinador Eléctrico Nacional", as it is the official data source for the power plants connected to the SEN grid (SIC for 2015 and 2016).
Purpose of data	Calculation of baseline emissions
Additional comment	Data from years 2015, 2016 and 2017 was considered.

Data/Parameter	$FC_{i,m,y}$
Data unit	kg or m^3
Description	Amount of fuel type *i* consumed by power plant/unit min year *y*
Source of data	"Coordinador Eléctrico Nacional" and "Economic Dispatch Center of the Central Interconnected System" statistics yearbook are used. If a power plant was not available in it, the latest available CNE node price report was used, as it contains specific fuel consumption (amount of fuel per generation unit) for each power plant.
Value(s) applied	Available in attached spreadsheet (Emission Factor and ER calculation spreadsheet.xls)
Choice of data or measurement methods and procedures	Official publications by the "Coordinador Eléctrico Nacional", CDEC-SIC and CNE, as they are the official data sources for electricity generation fuel consumptions.
Purpose of data	Calculation of baseline emissions
Additional comment	-

[16] SIC statistics, 2017. Real operation. Available at: https://sic.coordinadorelectrico.cl/informes-y-documentos/fichas/operacion-real/

<table>
<tr><td>Data/Parameter</td><td>NCV_{i,y}</td></tr>
<tr><td>Data unit</td><td>GJ/kg or GJ/m^3</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) per mass or volume unit of a fuel.</td></tr>
<tr><td>Source of data</td><td>CNE, Balance Energético 2015, Frame A2 (Gross Calorific Value)</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th></th><th>NCV (GJ/kg or GJ/m^3)</th></tr>
<tr><td>Reservoir (hydro)</td><td>-</td></tr>
<tr><td>Run off river (hydro)</td><td>-</td></tr>
<tr><td>Wind</td><td>-</td></tr>
<tr><td>Solar</td><td>-</td></tr>
<tr><td>Biomass</td><td>-</td></tr>
<tr><td>Biogas</td><td>-</td></tr>
<tr><td>Coal</td><td>0.0278</td></tr>
<tr><td>Coke</td><td>0.0278</td></tr>
<tr><td>Diesel</td><td>0.0434</td></tr>
<tr><td>Natural Gas, LNG</td><td>0.0352</td></tr>
<tr><td>IFO 180, Fuel oil</td><td>0.0418</td></tr>
<tr><td>LPG, Butane, Propane</td><td>0.0481</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>Official national default values were used, as fuel supplier values were not available, according to the “Tool to calculate the emission factor for an electricity system Version 07.0” data priorities.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>In order to transform GCV (Gross Calorific Value) in NCV, the following conversion factors for each fuel type was used:
<table>
<tr><th>Fuel type</th><th>Conversion Factor GCV to NCV</th></tr>
<tr><td>Solid</td><td>0.95</td></tr>
<tr><td>Liquid fuels</td><td>0.95</td></tr>
<tr><td>Gas fuels</td><td>0.90</td></tr>
</table>
Source: IPCC, 2006. V.2 Workbook Chapter 1 Energy page 1.16</td></tr>
</table>

Data/Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fuel type *i* used in power unit *m* in year *y*
Source of data	IPCC, 2006. Guidelines for national greenhouse gas inventories. V2_2_Ch1_Introduction, Table 1.4
Value(s) applied	See table below
Choice of data or measurement methods and procedures	IPCC default values at the lower limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories were used, as neither fuel supplier values nor regional or national average default values were available.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Fuel Type	EF_{CO2} (tCO_2/GJ)
Reservoir (hydro)	-
Run off river (hydro)	-
Wind	-
Solar	-
Biomass	-
Biogas	-
Coal	0.0895
Coke	0.0829
Diesel	0.0726
Natural Gas, LNG	0.0543
IFO 180, Fuel oil	0.0755
Butane, Propane	0.0616
LPG	0.0616

Data/Parameter	$\eta_{m,y}$ (Efficiency factor)
Data unit	%
Description	Default efficiency factors for power plants depending on the generation technology
Source of data	Table 2, Appendix of Tool 9: "Determining the baseline efficiency of thermal or electric energy generation systems Version 02.0".
Value(s) applied	Values are available at the Tool to calculate the emission factor for an electricity system (Appendix 1).
Choice of data or measurement methods and procedures	Table 2, Appendix of Tool 9: "Determining the baseline efficiency of thermal or electric energy generation systems Version 02.0" values were used, as neither (a) manufacturer's specifications nor (b) utility, dispatch center or official records were available.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor in year y
Source of data	Calculates according to "Tool to calculate the emission factor for an electricity system (version 07.0)"
Value(s) applied	0.44328
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system" (version 07.0).
Purpose of data	Calculation of baseline emissions
Additional comment	Combined margin CO_2 emission factor is calculated ex-ante and will be kept fixed for the second crediting period.

B.6.3. Ex ante calculation of emission reductions

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Baseline emissions calculation

As described in section B.6.1, the baseline emissions are calculated using the Equation 1, for it, $EF_{grid,y}$ is calculated according to the following steps:

Emission factor calculation

The ex ante emission factor was calculated using the most recent information, from year 2017.

Step 1. Identify the relevant electricity systems

The determination of the relevant electricity system was made following the Option 2, considering the dispatch area covered by the responsible dispatch centre for each year of the ex-ante emission factor calculation requirements. In this case, since in November 21th, 2017, the SIC grid was connected to the SING grid, creating a new electricity system called SEN, which considers a single

dispatch area coordinated by the National Electricity Coordinator (CEN); thus, the relevant electricity system is the SEN[17].

As the "Tool to calculate the emission factor for an electricity system" requires an annual based emission factor calculation, and the interconnection occurred during 2017, therefore the relevant electricity system is SEN for 2017 and SIC for 2015 and 2016.

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

Option I: (Only grid power plants are included in the calculation).

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

Simple Operating Margin has been selected as the conditions declared in section B.6.1 are fulfilled.

Additionally, the operating margin is calculated ex-ante, as the generation-weighted average CO_2 emission factor of each unit for the most recent 3 years (2015-2017), are available at the time of PDD submission.

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

The Simple OM emission factor is calculated based on the net electricity generation and the emission factor for each power unit, not including low-cost/must-run units, according to Equation 3, described previously in Section B.6.1.

For the yearly emission factor calculation, $EG_{m,y}$ and $EF_{EL,m,y}$ values must be determined for each power unit included in the anaylisis (excluding low-cost/must-run). The following table shows a summarized version of power plants listed for the calculation of the $EF_{grid,OMsimple,2017}$ value. The same method has been used for 2015 and 2016 data.

Table 7. Power units list for OM calculation

Power unit m	Fuels	$EG_{m,y}$	$EF_{EL,m,y}$
Andes@Diesel Oil	Diesel Oil	6,236.5	0.7608823
Antilhue TG@Diesel Oil	Diesel Oil	9,693.0	0.7062742
Biocruz@Natural Gas	Natural Gas	2,146.4	0.5045705
Biomar@Diesel Oil	Diesel Oil	0.4	0.6963895
Bocamina 1@Bituminous Coal	Bituminous Coal	730,349.0	0.8900991
Bocamina 2@Bituminous Coal	Bituminous Coal	2,211,533.0	0.8035810
Calle-Calle@Diesel Oil	Diesel Oil	10,933.2	0.6963020
Campiche@Petcoke	Petcoke	2,268,649.0	0.8244605
Candelaria 1@Diesel Oil	Diesel Oil	35,452.0	0.8261810
Candelaria 1@LNG	LNG	74,923.0	0.5978931
Candelaria 2@Diesel Oil	Diesel Oil	35,640.0	0.8261810
…	…	…	…

Source: Own Elaboration, 2018

The CO_2 emission factor of power unit m in year y ($EF_{EL,m,y}$) was calculated considering Option A1 when available and otherwise considering Option A2 described in B.6.1. The attached spreadsheet (Emission Factor and ER calculation spreadsheet.xls) present all the values of $NCV_{i,y}$ and $EF_{CO2,i,y}$

[17] http://bcn.cl/22vt9

used on the calculation of CO_2 emission factor for years 2015, 2016 and 2017 according to the equations already described previously in B.6.1.

An example of the calculation considering Option A1 is provided using 2016 data for Antilhue TG diesel power unit:

Equation 9. EF_{EL} option A1 calculation example

$$EF_{EL,m,y} = \frac{2{,}175{,}016\ (kg) \times 0.04335 \left(\frac{GJ}{kg}\right) \times 0.0726\ \left(\frac{tCO_2}{GJ}\right)}{9{,}693\ (MWh)} = 0.70627\ \left(\frac{tCO_3}{MWh}\right)$$

An example of the calculation considering Option A2 is provided using 2015 data for CMPC Tissue which is a Natural Gas based power unit:

Equation 10. EF_{EL} option A2 calculation example

$$EF_{EL,m,y} = \frac{0.0543\ \left(\frac{tCO_2}{GJ}\right) \times 3.6}{0.375} = 0.521 \left(\frac{tCO_2}{MWh}\right)$$

After the determination of $EG_{m,y}$ and $EF_{EL,m,y}$ values for each power unit, the Equation 3 should be applied, in order to calculate the $EF_{grid,OMsimple,y}$ for each year.

The calculation of the $EF_{grid,OM}$ value, considering the generation weighted average for 2015, 2016 and 2017 results are shown in the following table.

Table 8. EF OM results

Year	2015	2016	2017
$EF_{grid,OMsimple,y}$	0.67118	0.67782	0.80437
$Generation_y$	52,898,828	53,900,416	74,176,345
$EF_{grid,OM}$	**0.72774**		

Source: Own Elaboration, 2018

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

The build margin emission factor was determined in accordance to Option 1 of the "Tool to calculate the emission factor of an electricity system" (Version 07.0), where for the second crediting period the build margin emission factor is calculated ex-ante based on the most recent information available (2017) on units already built for sample group *m* at the time of PDD submission to the DOE for validation.

The BM emission factor was calculated in accordance to Equation 6 described previously in section B.6.1., as it is elaborated for 2017 it considers the SEN grid for the calculation.

The set of power capacity addition in the electricity system that comprise 20% of the system generation (in MWh) and that has been built most recently is selected because it comprises the larger annual generation compared to the set of 5 power units (shown in Table 20) that have been built most recently. The values used for estimating the emission factor for each power unit included in the BM emission factor are the same that the ones used for the OM emission factor year 2017 and can be seen in the spreadsheet (Emission Factor calculation spreadsheet.xls) of the project, as well as the group of power units included in the calculation.

The table below shows the generation of the 5 power units that have been built most recently.

Table 9. Set of five power units that started to supply electricity to the grid most recently

Starting date	Power unit	Fuel type	Total generation (MWh)
November 9th 2017	Valle de la Luna	Solar	2,261.5
November 8th 2017	San Francisco	Solar	2,462.7
November 8th 2017	La Quinta	Solar	2,428.1
November 3rd 2017	Antay	Solar	5,332.7
September 21th 2017	El Pelícano	Solar	87,171.7
		Total	**99,656.7**

Source: Own elaboration, 2018

The annual electricity generation of the project activity system, excluding power units registered as CDM project activities is AEG_{total} = 68,978,856 MWh. The set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (SET≥20%) and is presented in the Appendix 4 of this document. Their annual electricity generation ($AEG_{SET\geq 20\%}$ in MWh) is 13,999,803 MWh, which represents 20.3% of the annual electricity generation of the project activity system, excluding power units registered as CDM project activities (20% falls on part of the generation of a power unit, thus the generation of that unit is fully included in the calculation).

Comparing the generation of $AEG_{SET5\text{-}units}$ (99,656 MWh) and generation of $SET_{\geq 20\%}$ (13,999,803 MWh) the set of power units that comprises the larger annual electricity generation is $SET_{\geq 20\%}$, then it is selected as SET_{sample}.

Therefore, the build margin is:

Equation 11. EF_{BM} result

$$EF_{grid,BM} = 0.34846 \left(\frac{tCO_2}{MWh}\right)$$

Step 6: Calculate the combined margin emissions factor

Using the weighted average $EF_{grid,OM}$ and $EF_{grid,BM}$ values and the weighting values of the OM and the BM, the CM estimation is calculated as Equation 7 described previously in Section B.6.1.

As the project activity is on its second crediting period, the weighting of the OM and the BM is w_{OM} = 0.25 and w_{BM} = 0.75.

In the following table, input values for the ex–ante combined margin emission factor for the electricity system are shown:

Table 10. CM emission factor calculation

Parameter	Unit	Value
$EF_{grid,CM}$	tCO_2/MWh	0.44328
$EF_{grid,BM}$	tCO_2/MWh	0.34846
$EF_{grid,OM}$	tCO_2/MWh	0.72774
w_{OM}	%	25
w_{BM}	%	75

Source: Own elaboration, 2018

Therefore, the combined margin is:

Equation 12: $EF_{grid,CM}$ result

$$EF_{grid,CM} = 0.44328 \left(\frac{tCO_2}{MWh}\right)$$

Calculation of $EG_{PJ,y}$

As the project is a greenfield power plant:

Equation 13: Project *EG* estimation

$$EG_{PJ,y} = EG_{facility,y} = 28{,}470(MWh)$$

Baseline emissions

Baseline emissions are calculated according to Equation 1 previously described in Section B.6.1.

In the following table, values considered for baseline emissions calculation are shown:

Table 11: Baseline emissions calculation

Parameter	Unit	Value
Baseline emissions (BE_y)	tCO_2	12,620
Electricity generation ($EG_{PJ,y}$)	MWh	28,470
CM emission factor ($EF_{grid,CM,y}$)	tCO_2/MWh	0.44328

Source: Own elaboration, 2018

The baseline emissions are rounded off in a conservative manner.

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
01/11/2018 – 31/10/2019	12,620	0	0	12,620
01/11/2019 – 31/10/2020	12,620	0	0	12,620
01/11/2020 – 31/10/2021	12,620	0	0	12,620
01/11/2021 – 31/10/2022	12,620	0	0	12,620
01/11/2022 – 31/10/2023	12,620	0	0	12,620
01/11/2023 – 31/10/2024	12,620	0	0	12,620
01/11/2024 – 31/10/2025	12,620	0	0	12,620
Total	88,340	0	0	88,340
Total number of crediting years	7			
Annual average over the crediting period	12,620	0	0	12,620

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

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

Source of data	Direct measurement from one electricity meter
Value(s) applied	28,470
Measurement methods and procedures	Measured by bi-directional energy meters installed at the grid interface for electricity export to the grid (measures the electicity from the power plant and from the grid).
Monitoring frequency	Electricity meters with continuous measurement and at least monthly recording
QA/QC procedures	Meter should have a maximum error of 0.2% and be calibrated every one or two years according to local standards for electricity transactions in "Coordinador Eléctrico Nacional". Monitored data is cross checked against records for sold electricity which are publicly available at the "Coordinador Eléctrico Nacional" web page (www.coordinador.cl)
Purpose of data	Calculation of baseline emissions
Additional comment	As the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then $EG_{PJ,y} = EG_{facility,y}$ The monitoring methodology involves the net electricity supplied to the grid, in year y.

B.7.2. Sampling plan

>>
Not applicable

B.7.3. Other elements of monitoring plan

>>

The monitoring system consists of metering the net electricity supplied by the project activity to the grid.

The project participant has developed a Management and Operation System Manual in order to establish all the procedures and responsibilities related to the fulfilment of the CDM related issues. This System includes all the procedures related to the monitoring plan, such as the monitoring and calibration/verification procedures, in order to assure the proper development of the activities of the monitoring plan.

Monitoring procedures

Energy baseline ($EG_{PJ,y}$) is hourly collected from a bi-directional continuous meter (Class 0.2S), with monthly recording. This meter is located at the Chiburgo's Substation (main meter). This measurement is cross-checked with the records from the bi-directional electricity meter (Class 0.2S), located at the Generation Bus (secondary meter),used to inform the energy delivered to the grid to the national electricity coordinator "Coordinador Eléctrico Nacional" acquired according to the following procedure:

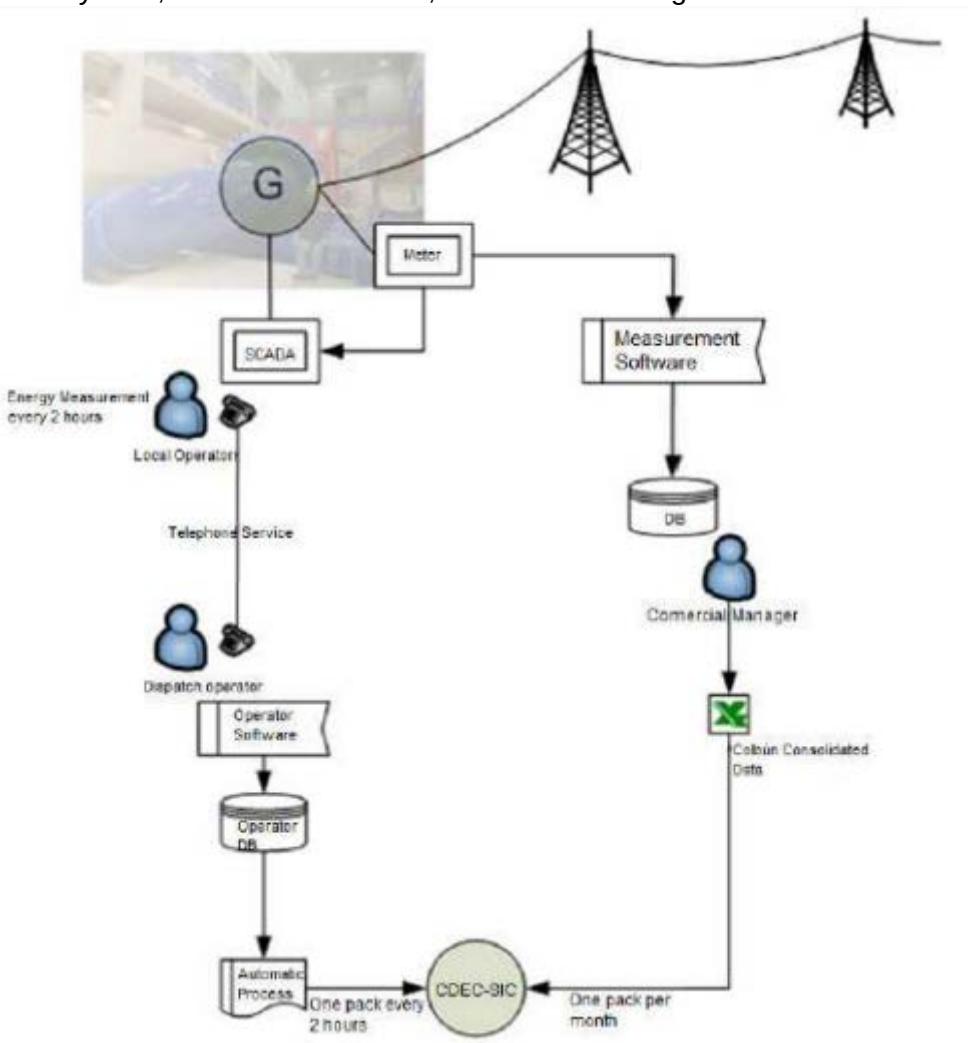
The operator of the Operation Center enters the electric generation data to the Operations database through the "OPERADOR" application, which is automatically uploaded to the "Coordinador Eléctrico Nacional" Server via dedicated communications link.

On the other hand, commercial invoicing system consists in centralized meter reading software, which reads automatically from the meter, through dedicated Ethernet data link, the electric pulses measurements done by the local meter every 15 minutes, and stores them in the invoicing system database.

Once a month the Commercial Manager transfers the power plant energy generation data, from the invoicing system database to an Excel spreadsheet, and uploads it in the "Coordinador Eléctrico Nacional" server via dedicated communications link, for purposes of invoicing by "Coordinador Eléctrico Nacional".

Electricity measurements from the two databases of both systems are cross checked in order to validate the information.

The data capture system, as described above, is shown in the Figure 5.



Source: Project participant

Figure 5. Data capture and "Coordinador Eléctrico Nacional" upload

Energy Measurement Equipment Periodic Verification Procedure

The Electricity Meters Management Department, together with the Power Plant Operation Department, arranges an annual verification of the electricity meter.

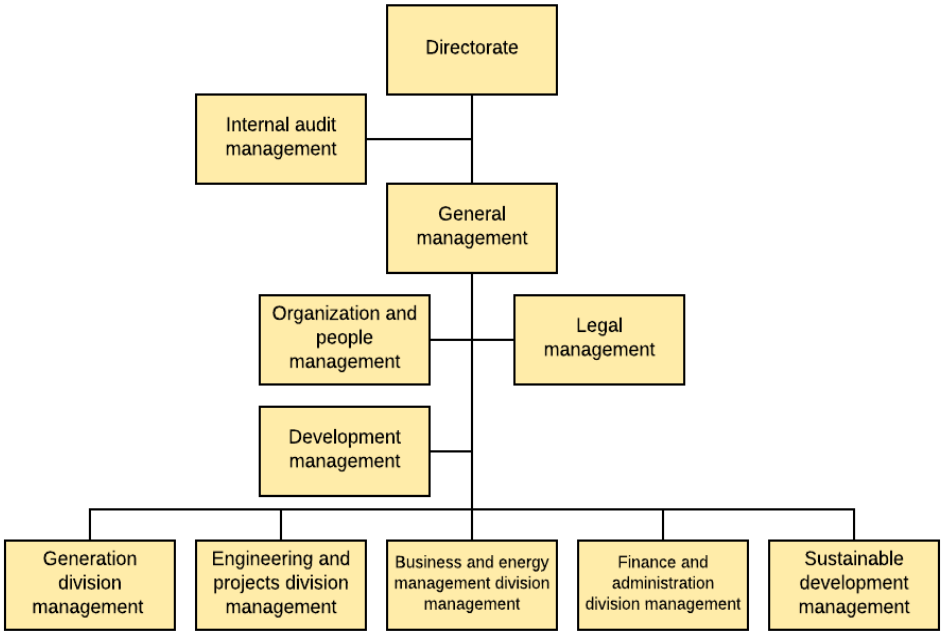
The verification is performed every one or two years by a qualified and competent certifier, authorized by the national official organism (Electricity and Fuels Superintendent, SEC for its Spanish acronym). The verification procedure consists in comparing the measurement equipment with a higher precision reference meter, in order to certify the meter precision. A single verification certificate is then issued for each meter. If the equipment does not fulfil the Class 0.2, it will be immediately replaced.

For the verification of the energy measuring equipment, the Chilean Official Regulation NCh N°2542. Of2001 (or equivalent in case of replacement) "Alternating Current Watt-Meter for Active Energy (Classes 0.2 S and 0.5 S)" is applied. The elaboration of the NCh 2542 considered the

international norm IEC 60687 “Alternating Current Watt-Meter for Active Energy (Classes 0.2 S and 0.5 S)” in addition to others like NCh 2024/1 and IEC 61036.

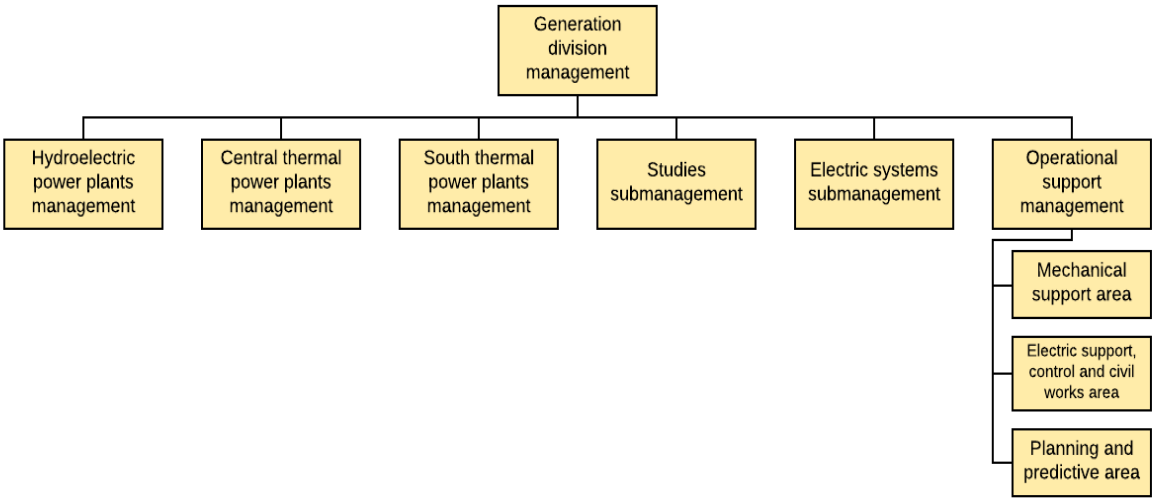
Operational and Management structure

The following figures show the General Management, Generation division and Sustainable developement division structures, which are responsible of the project management and monitoring procedures declared in the PDD.



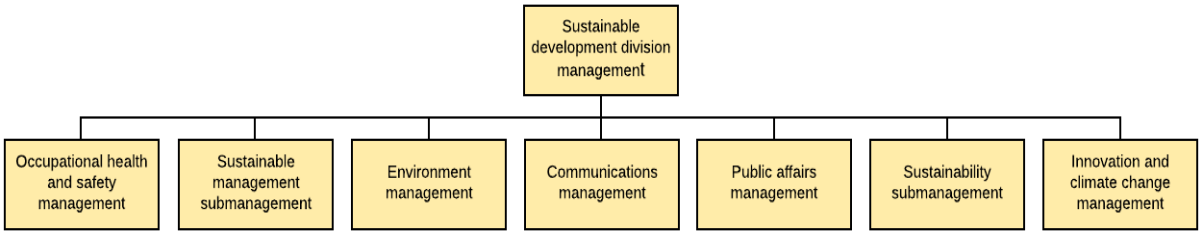
Source: Project participant

Figure 6. General Management structure



Source: Project participant

Figure 7. Generation division structure



Source: Project participant

Figure 8. Sustainable development division structure

Under this structure CDM related responsibilities are accomplished as follows:

- Internal training:

  I. Trainings related to specific operational procedures such as PO.17. "Verification of energy meters under the carbon market standards" and PO.18. "Data collection from energy meters for carbon market reports", established in the Management and Operation System Manual, and CDM topics are executed by the Innovation and Climate Change department from the Sustainable Development Division.

  II. Operator trainings are performed by a staff which is established by the Power Plant Manager (from the Hydroelectric Power Plants Department - Generation Division).

- Monitoring and record keeping of power generation data (data recording, measurements, etc.): The responsible for monitoring related data to the CER's calculation are the Power Plant Staff (Operations) (from the Generation Division), TI Management (from Finance and Administration Division).

- Generation and maintenance activities: Power plant staff as a part of the Generation Division.

- CER's calculation: This is performed by the Innovation and Climate Change Department (as part of the Sustainable Development Division) and includes accounting for the generation of ERs including monitoring, record keeping, computation of ERs, on site trainings, audits and verifications.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>
The starting date of the CDM project activity is 26/06/2008. In that date, the Memorandum of Understanding to proceed with the contract to deliver project activity equipment was signed. This has been established as the earliest real action for the implementation of the project activity.

The project activity started its operations on September 16th 2010.

C.2. Expected operational lifetime of project activity

>>

The expected lifetime of the project activity is at least 65 years[18]

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable crediting period (Second crediting period)

C.3.2. Start date of crediting period

>>
01/11/2018

C.3.3. Duration of crediting period

>>
7 years and 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
According with Chilean environmental law (Nº 19.300[19], article 10.c) power plants with more than 3 MW of installed capacity should formally analyse its environmental impacts through the Environmental Impact Assessment System, SEIA[20]. This article also states that transmission lines must go through the SEIA if they are greater than 23 kV.

Based on the nature of the projects or activities and its potential impacts, the analysis of the environmental impacts in the SEIA could be presented trough an Environmental Impact Assessment ("Estudio de Impacto Ambiental", EIA) or an Environmental Impact Declaration ("Declaración de Impacto Ambiental", DIA), according with the requirements of law 19.300 (article 11) and Supreme Decree (SD) Nº 40 / 2012[21] (Regulation of the SEIA, articles 4 to 11).

At the time of the project registration, the environmental assessment process was coordinated by National Environmental Commission ("Comisión Nacional de Medio Ambiente", CONAMA) through its Executive Board or Regional Offices ("Comisión Regional de Medio Ambiente", COREMA) (actually the Environmental Assessment Service, SEA[22], is the relevant institution). In the assessment process all relevant governmental offices participated, they can request revisions and/or modifications to the project in order to comply with the specific regulations.

According to this legislation, environmental impacts of San Clemente Hydroelectric Power Plant were assessed in a DIA[23], which was evaluated by CONAMA Maule Region and approved by an Environmental Resolution Qualification ("Resolución de Calificación Ambiental", RCA) Nº 270 on September 12th, 2007.

---

[18] It is expected that San Clemente Power Plant can operate during at least 65 years considering that this kind of facilities have a long lifetime: around the world (including Chile) there are run of river power plants that have been operating for even more than 65 years. (Source: Small Hydro Power, State of The Art and Applications, by C.Dragu, T. Sels, Member, IEEE and R. Belmans, Senior Member, IEEE). It is worth to mention that the aforementioned lifetimes are reached only if the corresponding expenditures or reinvestments, related to rehabilitations and spare parts in the generation equipments, channels or sand traps, are carried out on time.

[19] Available at https://www.leychile.cl/Navegar?idNorma=30667

[20] In Spanish "Sistema de Evaluación de Impacto Ambiental" (SEIA).

[21] Available at https://www.leychile.cl/Navegar?idNorma=1053563

[22] In Spanish "Servicio de Evaluación Ambiental"

[23] Available at https://www.e-seia.cl/documentos/documento.php?idDocumento=2171321

It is noteworthy that during the development of basic engineering of the project (year 2008), minor adjustments [24] were made to the original design in search of technical and environmental optimization. Environmental optimization has allowed the reduction of forest area to intervene, decrease the impact area to the vegetation and flora, and removing a detour in the existing public road.

These changes were informed to and approved by the same environmental authority. Therefore, the environmental license or permit (RCA No. 270) was complemented by "Ord. COREMA Nº 660, from October 2nd, 2008".

D.2. Environmental impact assessment

>>
As stated in section D.1, the project went through the Environmental Impact Assessment System by presenting a DIA. The main environmental effects analysed in that document are as follows:

a) Building Stage

The building stage is the phase of the project that contributes to the generation of environmental impacts due to the construction of civil works, but since is a small run-of-river plant; the Project have minor impacts on the environment.

The impacts are related with the machinery used, the land movements and the workers activities on the area:

- Emissions of particulate matter, gases such as carbon monoxide, hydrocarbons and nitrogen oxides. The rural characteristics allow a high dispersion of the particular matter.
- The liquid effluents correspond to a domestic wastewater type generated by the staff. There is a modular treatment plant. The management of chemical toilets is made by an authorized and specialized company.
- The solid wastes come mainly from the domestic work of the workers daily activities; they are stored in secure locations and eventually disposed into a landfill by a certified company. Waste electrical components, among others which cannot be reused by the company, are sent to certified landfills.
- In the case of the environmental impact of noise, the level increase by construction activities. This implements specific measures that allow the noise levels to meet the standards defined by the SD N° 146/97.
- Regarding the flora and fauna, no significant impacts were anticipated, since there are few existing species that are sensitive to changes in the landscape; also, the involved area is small.
- Regarding the impact on human communities, no significant impacts were anticipated because the project is developed in areas that do not have large concentrations of people.

All the safety measures during the building stage of the project are taken according to the Chilean legislation.

b) Operation Stage

During this phase of the activity, no major environmental impacts are produced inside the project boundaries.

- Only air emissions from vehicles travelling once a month from the station facilities
- No wastewater or liquid industrial waste is generated. Chemical bathrooms are contracted only when necessary, in order to implement repairs that demands several hours of work.

[24] There were changes in the number of turbines, adduction channel length, pressure pipe length, surface of the power house, return channel length, layout of public road and the area of intervened native forest.

- No solid waste is generated.
- Noise emissions are produced primarily by the operation of the turbines inside the power house and discharge of water returned to the Sanatorium Brook. The technology generates low noise and vibration, then, noise will not exceed 10 dB (A) over the existing baseline noise average, thus complying with the requirements of the DS 146/97 (for recipients in rural areas).
- The equipment involved, such as electrical conductors, is designed to prevent the loss and dissipation of energy to the environment, so there are no effects over the population.

Considering the remote-operation of the facilities, the operation of the project does not generate solid waste, sewage or industrial liquid waste.

c) Abandonment Stage

The project activity will have an operational lifetime of at least 65 years. At the end of its lifetime, there are two alternatives. The first is the dismantling of equipment and facilities, which could then be traded in the market. The second alternative is that the equipment are refurbished and upgraded and / or been removed to give space to new technology equipment. The authorities will be informed and all activities will comply with Chilean regulations.

It is clear that the proposed activity will not generate a significant impact on the area of influence, because the project is a small run–of–river plant.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

According to the Environmental Impact Assessment System procedures, all the projects must be evaluated by the relevant authorities. As a publicity measure to maintain the community duly informed, the National or Regional Environment Commission, as corresponds, shall publish every month on the first working day, in the Official Newspaper and in a national or regional one, a list of the projects and activities that were submitted to the Chilean Environmental Impact Assessment System during the previous month. Additionally, the relevant Commission shall deliver a copy of the list to the municipalities of the places where the works or activities envisaged in the project under evaluation are to be carried out. The whole process can be follow by the web, through the link of the National Commission of the Environment (CONAMA) www.e-seia.cl.

As stated in Section D, the Project went through the Environmental Impact Assessment System (through a DIA), thus complied with the informative procedures mentioned before.

In addition to these procedures, the project developer held one meeting (June 28rd 2007) with members of the neighbourhood council Sanatorio Alto, Parents Association and the Director of the local school, a representative of the association of potable water in the rural village and a policemen, in order to inform about the project, it's environmental licensing process and receive their opinions. The invitation method was through invitation letters.

The agenda that was developed at the meeting held in June includes the following points:

- Company history
- Current power plants under construction and projects
- Responsibilities to communities and the environment, where they mention the Chacabuquito project, which was the first electric generator in the world to be registered as CDM project
- Project San Clemente Hydroelectric Power Plant (location, justification, purpose, basic characteristics, benefits that will bring the central building of the community
- Q&A

All doubts and questions from the community held at the meeting were answered at the time; the specific requests made by the community were forwarded to the specifics Colbun's department in order to be assessed.

E.2. Summary of comments received

>>
During the environmental evaluation no comments were received from the community. During the meeting held with the members of the Sanatorio Alto stakeholders, no negative comments of the project activity were made. The comments received were related with:

- Change of location of the board of neighbours of Sanatorio Alto to facility of the Christian community that is located in the chapel of the sector
- Concern about risk of accidental fall into the discharge channel
- Purchase of school supplies for the Leopoldo Guarda School
- Concern about noise level during construction and operation phase
- Extend the potable water network in order to cover the demand in the community

Additionally, the community requested a free electricity supply, the Colbún representatives answered that it was not possible because the electricity distribution is not a responsibility of the company.

E.3. Consideration of comments received

>>
In relation with the requests of the members of Sanatorio Alto, the acts of the compromises made by Colbún were:

- September 10th, 2009. Relocation of Sanatorio Alto's neighbourhood council's seat, (which includes the facilities and electricity supply, rural water, bathroom and kitchen).
- October 07th, 2009. Delivery of the school supplies to Leopoldo Guarda School, Sector Buenos Aires.

Other compromises:

- The discharge channel was covered to prevent any kind of danger.
- In order to have a minimal level of noise, during the construction phase were installed mobile barriers and the machine house was installed underground.
- The company Colbún contracted local manpower through a construction company.
- The company Colbún extended the potable water network in order to supply water to sectors that before did not have access.

SECTION F. Approval and authorization

>>
The Letter of approval is available in the following link:
https://cdm.unfccc.int/UserManagement/FileStorage/12UOKMIQ4H5EFCPTDV3LBSX07GYJRW

Appendix 1. Contact information of project participants

Organization name	Colbún S.A.
Country	Chile
Address	Av. Apoquindo 4775, 11th floor
Telephone	+56 2 460 4000
Fax	-
E-mail	jschaeffer@colbun.cl
Website	www.colbun.cl
Contact person	Mr. Juan Pablo Schaeffer

Appendix 2. Affirmation regarding public funding

There will be no public funding.

Appendix 3. Applicability of methodologies and standardized baselines

No information related to the Applicability of methodologies and standardized baselines.

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

BASELINE INFORMATION

(i) Emissions Reduction

The following information is used to estimate the emissions reduction of the associated to the implementation of the project activity:

Table 12. Power plants 2015 energy generation and fuel consumption data

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Abanico@Run of the River	Run of the River	280,302.0	0	-
Aconcagua UBlanco@Run of the River	Run of the River	145,304.7	0	-
Aconcagua UJuncal@Run of the River	Run of the River	103,174.6	0	-
Alfalfal@Run of the River	Run of the River	694,311.7	0	-
Allipen@Run of the River	Run of the River	18,131.0	0	-
Alto Renaico@Run of the River	Run of the River	3.1	0	-
Angostura@Dam	Dam	1,220,693.0	0	-
Antilhue TG@Diesel Oil	Diesel Oil	8,095.0	1,860,750	-
Antuco@Dam	Dam	1,378,341.0	0	-
Arauco@Biomass	Biomass	85,346.3	0	-
Auxiliar del Maipo@Run of the River	Run of the River	25,173.4	0	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Biocruz@Natural Gas	Natural Gas	3,196.9	-	264.0
Biomar@Diesel Oil	Diesel Oil	11.6	-	221.2
Bocamina 1@Bituminous Coal	Bituminous Coal	207,030.0	73,951,116	-
Bocamina 2@Bituminous Coal	Bituminous Coal	749,409.0	241,669,414	-
Masisa@Biomass	Biomass	46,809.2	0	-
Callao@Run of the River	Run of the River	9,464.1	0	-
Calle-Calle@Diesel Oil	Diesel Oil	12,498.2	2,771,912	-
Campiche@Petcoke	Petcoke	2,119,265.0	757,001,458	-
Candelaria 1@Diesel Oil	Diesel Oil	1,897.0	510,081	-
Candelaria 1@LNG	LNG	2,692.0	842,133	-
Candelaria 2@Diesel Oil	Diesel Oil	1,816.0	488,301	-
Candelaria 2@LNG	LNG	4,858.0	1,519,718	-
Canutillar@Dam	Dam	839,863.0	0	-
Cañete@Diesel Oil	Diesel Oil	405.0	95,335	-
Capullo@Run of the River	Run of the River	57,249.6	0	-
Cardones@Diesel Oil	Diesel Oil	4,181.2	999,297	-
Carena@Run of the River	Run of the River	71,158.9	0	-
Casablanca 1@Diesel Oil	Diesel Oil	50.7	13,232	-
Cem Bio Bio@Diesel Oil	Diesel Oil	175.1	33,619	-
Cem Bio Bio@Residual Fuel Oil	Residual Fuel Oil	29,890.7	6,515,894	-
Chacabuquito@Run of the River	Run of the River	72,436.6	0	-
Chacayes@Run of the River	Run of the River	477,811.6	0	-
Chiburgo@Run of the River	Run of the River	69,518.0	0	-
Chiloe@Diesel Oil	Diesel Oil	13.6	3,832	-
Cholguan@Biomass	Biomass	61,902.2	0	-
Chuyaca@Diesel Oil	Diesel Oil	2,687.1	640,149	-
Cipreses@Dam	Dam	312,488.0	0	-
CMPC Cordillera@Natural Gas	Natural Gas	13,428.4	2,819,964	-
CMPC Pacifico@Biomass	Biomass	209,023.5	0	-
CMPC Santa Fe@Biomass	Biomass	67,744.9	0	-
CMPC Tissue@Natural Gas	Natural Gas	79.7	-	-
Colbun@Dam	Dam	1,881,436.0	0	-
Colihues@Residual Fuel Oil	Residual Fuel Oil	41,614.5	8,902,711	-
Collil@Run of the River	Run of the River	22,850.9	0	-
Colmito@Diesel Oil	Diesel Oil	11,905.3	-	248.0
Colmito@LNG	LNG	14,665.9	6,464,183	-
Concon@Diesel Oil	Diesel Oil	65.6	15,647	-
Confluencia@Run of the River	Run of the River	402,275.0	0	-
Constitucion@Diesel Oil	Diesel Oil	800.3	225,481	-
Celco@Biomass	Biomass	35,294.3	0	-
Celco@Residual Fuel Oil	Residual Fuel Oil	55.1	17,632	-
Contulmo@Diesel Oil	Diesel Oil	2.8	608	-
Coya@Run of the River	Run of the River	80,531.3	0	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Curacautin@Diesel Oil	Diesel Oil	1,432.1	313,406	-
Curanilahue@Diesel Oil	Diesel Oil	170.5	38,889	-
Curauma@Diesel Oil	Diesel Oil	66.0	17,250	-
Curillinque@Run of the River	Run of the River	482,889.0	0	-
Diego de Almagro@Diesel Oil	Diesel Oil	1,022.0	344,397	-
Danisco@Diesel Oil	Diesel Oil	0.6	87	-
Degan@Diesel Oil	Diesel Oil	549.0	120,090	-
Diuto@Run of the River	Run of the River	9,895.6	0	-
Don Walterio@Run of the River	Run of the River	14,883.2	0	-
Dongo@Run of the River	Run of the River	15,856.9	0	-
Donguil@Run of the River	Run of the River	1,110.2	0	-
Eagon@Diesel Oil	Diesel Oil	3.8	841	-
El Canelo@Run of the River	Run of the River	13,640.3	0	-
El Llano@Run of the River	Run of the River	4,916.9	0	-
El Manzano@Run of the River	Run of the River	25,835.8	0	-
El Paso@Run of the River	Run of the River	38,487.4	0	-
El Peñon@Diesel Oil	Diesel Oil	80,428.6	17,774,373	-
El Rincon@Run of the River	Run of the River	2,355.8	0	-
El Salvador@Diesel Oil	Diesel Oil	664.0	258,128	-
El Toro@Dam	Dam	1,114,268.0	0	-
Emelda 1@Diesel Oil	Diesel Oil	174.5	50,961	-
Emelda 2@Diesel Oil	Diesel Oil	61.5	19,294	-
Energia Bio Bio@Biomass	Biomass	43,139.3	0	-
Coelemu@Biomass	Biomass	32,098.8	0	-
Energia Pacifico@Biomass	Biomass	87,792.3	0	-
Ensenada@Run of the River	Run of the River	1,933.7	0	-
Canela 1@Wind	Wind	23,066.4	0	-
Canela 2@Wind	Wind	111,076.3	0	-
Cuel@Wind	Wind	93,809.6	0	-
El Arrayan@Wind	Wind	277,068.1	0	-
Lebu@Wind	Wind	8,673.9	0	-
Los Cururos@Wind	Wind	258,140.7	0	-
Monte Redondo@Wind	Wind	99,870.4	0	-
Punta Colorada@Wind	Wind	22,931.6	0	-
Punta Palmeras@Wind	Wind	110,897.2	0	-
Raki@Wind	Wind	7,034.0	0	-
San Pedro@Wind	Wind	105,532.1	0	-
Talinay@Wind	Wind	169,105.3	0	-
Talinay Poniente@Wind	Wind	170,893.5	0	-
Taltal@Wind	Wind	267,305.3	0	-
Totoral@Wind	Wind	80,611.9	0	-
Ucuquer@Wind	Wind	18,170.1	0	-
Ucuquer 2@Wind	Wind	26,762.3	0	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Escuadron@Biomass	Biomass	75,180.6	0	-
Esperanza 1@Diesel Oil	Diesel Oil	3.2	797	-
Esperanza 2@Diesel Oil	Diesel Oil	4.7	1,123	-
Estancilla@Diesel Oil	Diesel Oil	173.6	39,581	-
Eyzaguirre@Run of the River	Run of the River	4,953.4	0	-
Florida@Run of the River	Run of the River	90,755.8	0	-
Guacolda 1@Bituminous Coal	Bituminous Coal	858,755.3	290,602,800	-
Guacolda 2@Bituminous Coal	Bituminous Coal	994,402.5	336,505,809	-
Guacolda 3@Bituminous Coal	Bituminous Coal	1,223,784.4	386,348,738	-
Guacolda 4@Bituminous Coal	Bituminous Coal	1,175,591.3	376,483,114	-
Guacolda 5@Bituminous Coal	Bituminous Coal	295,077.5	103,277,122	-
Guayacan@Run of the River	Run of the River	75,522.0	0	-
Horcones@Diesel Oil	Diesel Oil	380.9	133,742	-
Hornitos@Run of the River	Run of the River	160,956.1	0	-
Huasco TG@Diesel Oil	Diesel Oil	163.0	56,721	-
Huasco TG@Residual Fuel Oil	Residual Fuel Oil	189.0	70,140	-
Isla@Run of the River	Run of the River	400,146.0	0	-
Itata@Run of the River	Run of the River	16.2	0	-
JCE@Diesel Oil	Diesel Oil	3.9	-	217.1
Juncalito@Run of the River	Run of the River	2,371.6	0	-
La Arena@Run of the River	Run of the River	20,673.4	0	-
La Higuera@Run of the River	Run of the River	536,951.4	0	-
Laja@Biomass	Biomass	34,065.0	0	-
Laja 1@Run of the River	Run of the River	95,697.0	0	-
CMPC Laja@Biomass	Biomass	7,562.7	0	-
Las Flores@Run of the River	Run of the River	8,715.7	0	-
Las Pampas@Biomass	Biomass	2,655.6	0	-
Las Vegas@Diesel Oil	Diesel Oil	98.6	23,667	-
Las Vertientes@Run of the River	Run of the River	11,909.0	0	-
Lautaro@Biomass	Biomass	9.5	0	-
Lautaro Comasa 1@Biomass	Biomass	165,429.6	0	-
Lautaro Comasa 2@Biomass	Biomass	137,907.1	0	-
Lebu@Diesel Oil	Diesel Oil	857.1	162,766	-
Lican@Run of the River	Run of the River	77,760.9	0	-
Licanten@Biomass	Biomass	38,997.1	0	-
Linares Norte@Diesel Oil	Diesel Oil	60.0	13,246	-
Lircay@Run of the River	Run of the River	123,442.3	0	-
Lleuquereo@Run of the River	Run of the River	6,277.0	0	-
Loma Alta@Run of the River	Run of the River	217,418.0	0	-
Loma Los Colorados 1@Biomass	Biomass	367.0	0	-
Loma Los Colorados 2@Biomass	Biomass	119,932.5	0	-
Lonquimay@Diesel Oil	Diesel Oil	47.4	11,543	-
Los Alamos@Diesel Oil	Diesel Oil	231.6	55,955	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Los Bajos@Run of the River	Run of the River	34,804.0	0	-
Los Corrales 1@Run of the River	Run of the River	5,595.1	0	-
Los Corrales 2@Run of the River	Run of the River	4,572.8	0	-
Los Espinos@Diesel Oil	Diesel Oil	35,774.9	7,925,968	-
Los Guindos@Diesel Oil	Diesel Oil	6,996.4	1,548,741	-
Los Hierros 1@Run of the River	Run of the River	129,089.3	0	-
Los Hierros 2@Run of the River	Run of the River	23,404.8	0	-
Los Molles@Run of the River	Run of the River	33,642.9	0	-
Los Morros@Run of the River	Run of the River	12,814.2	0	-
Los Padres@Run of the River	Run of the River	5,702.7	0	-
Los Pinos@Diesel Oil	Diesel Oil	180,309.0	34,346,697	-
Los Quilos@Run of the River	Run of the River	175,207.7	0	-
Los Vientos TG@Diesel Oil	Diesel Oil	76,754.3	20,492,440	-
Louisiana Pacific@Diesel Oil	Diesel Oil	76.7	25,665	-
Machicura@Dam	Dam	406,922.0	0	-
Maisan@Run of the River	Run of the River	2,144.6	0	-
Maitenes@Run of the River	Run of the River	101,302.4	0	-
Mallarauco@Run of the River	Run of the River	25,546.7	0	-
Mampil@Run of the River	Run of the River	144,885.0	0	-
Maria Elena@Run of the River	Run of the River	758.3	0	-
Mariposas@Run of the River	Run of the River	25,525.8	0	-
Maule@Diesel Oil	Diesel Oil	217.0	61,139	-
Bonito@Run of the River	Run of the River	44,912.9	0	-
Muchi@Run of the River	Run of the River	3,071.0	0	-
Multiexport 1@Diesel Oil	Diesel Oil	1.0	243	-
Multiexport 2@Diesel Oil	Diesel Oil	2.1	-	221.2
Nalcas@Run of the River	Run of the River	18,460.8	0	-
Nehuenco 1@Diesel Oil	Diesel Oil	50,401.0	8,026,302	-
Nehuenco 1@LNG	LNG	1,296,732.0	250,984,164	-
Nehuenco 2@Diesel Oil	Diesel Oil	1,312.0	204,498	-
Nehuenco 2@LNG	LNG	2,115,680.0	375,693,992	-
Nehuenco 9B@Diesel Oil	Diesel Oil	308.0	83,832	-
Nehuenco 9B@LNG	LNG	1,675.0	532,675	-
Newen@Natural Gas	Natural Gas	4,421.8	1,272,833	-
Newen@Propane gas	Propane gas	1,960.3	472,166	-
Nueva Aldea 1@Biomass	Biomass	72,591.2	0	-
Nueva Aldea 2@Diesel Oil	Diesel Oil	50.5	14,635	-
Nueva Aldea 3@Biomass	Biomass	243,060.7	0	-
Nueva Renca@Diesel Oil	Diesel Oil	78,644.0	13,656,572	-
Nueva Renca@LPG	LPG	17,953.0	3,451,859	-
Nueva Renca@LNG	LNG	1,743,544.0	346,280,527	-
Nueva Ventanas@Bituminous Coal	Bituminous Coal	2,254,565.0	784,254,944	-
Ojos de Agua@Run of the River	Run of the River	50,036.9	0	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Olivos@Diesel Oil	Diesel Oil	4,006.8	902,060	-
Palmucho@Run of the River	Run of the River	236,661.0	0	-
Pangue@Dam	Dam	1,709,402.0	0	-
Pehuenche@Dam	Dam	2,279,918.0	0	-
Pehui@Run of the River	Run of the River	5,704.6	0	-
Petropower@Petcoke	Petcoke	505,050.0	190,840,718	-
Peuchen@Run of the River	Run of the River	195,982.8	0	-
Pichilonco@Run of the River	Run of the River	4,475.6	0	-
Picoiquén@Run of the River	Run of the River	59,621.4	0	-
Pilmaiquen@Run of the River	Run of the River	220,593.9	0	-
Placilla@Diesel Oil	Diesel Oil	749.3	174,974	-
Providencia@Run of the River	Run of the River	36,128.1	0	-
Puclaro@Run of the River	Run of the River	3,335.2	0	-
Pulelfu@Run of the River	Run of the River	46,087.8	0	-
Pullinque@Run of the River	Run of the River	219,206.3	0	-
Punta Colorada@Diesel Oil	Diesel Oil	600.5	114,671	-
Punta Colorada@Residual Fuel Oil	Residual Fuel Oil	20,122.4	4,406,806	-
Puntilla@Run of the River	Run of the River	97,095.8	0	-
Purisima@Run of the River	Run of the River	3,309.4	0	-
Quellon 2@Diesel Oil	Diesel Oil	3,937.8	937,839	-
Queltehues@Run of the River	Run of the River	303,275.0	0	-
Quillaileo@Run of the River	Run of the River	958.9	0	-
Quilleco@Run of the River	Run of the River	325,449.0	0	-
Quintay@Diesel Oil	Diesel Oil	888.1	207,380	-
Quintero 1@LNG	LNG	256,321.0	80,802,267	-
Quintero 2@LNG	LNG	287,228.0	90,545,346	-
Ralco@Dam	Dam	2,489,856.0	0	-
Rapel@Dam	Dam	581,377.0	0	-
Reca@Run of the River	Run of the River	7,132.9	0	-
Renaico@Run of the River	Run of the River	52,136.8	0	-
Rio Huasco@Run of the River	Run of the River	3,816.2	0	-
Robleria@Run of the River	Run of the River	16,626.1	0	-
Rucatayo@Dam	Dam	245,134.6	0	-
Rucue@Run of the River	Run of the River	802,457.0	0	-
San Andres@Run of the River	Run of the River	113,414.7	0	-
San Clemente@Run of the River	Run of the River	16,307.2	0	-
San Francisco de Mostazal@Diesel Oil	Diesel Oil	156.8	48,449	-
San Gregorio@Diesel Oil	Diesel Oil	128.5	28,388	-
San Ignacio@Run of the River	Run of the River	171,326.0	0	-
San Isidro 1@Diesel Oil	Diesel Oil	1,127.0	202,022	-
San Isidro 1@LNG	LNG	877,809.0	172,849,370	-
San Isidro 2@Diesel Oil	Diesel Oil	20,732.0	3,450,418	-
San Isidro 2@LNG	LNG	1,671,958.0	297,762,344	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
San Lorenzo 3@Diesel Oil	Diesel Oil	74.0	18,559	-
Santa Irene@Biomass	Biomass	2,718.0	0	-
Santa Lidia@Diesel Oil	Diesel Oil	18,548.1	4,896,217	-
Santa Maria@Bituminous Coal	Bituminous Coal	2,404,882.0	782,437,016	-
Santa Marta@Biomass	Biomass	93,591.7	0	-
Sauce Andes@Run of the River	Run of the River	4,627.0	0	-
Sauzal 50Hz@Run of the River	Run of the River	384,428.9	0	-
Sauzal 60Hz@Run of the River	Run of the River	2,322.5	0	-
Sauzalito@Run of the River	Run of the River	66,436.0	0	-
Skretting@Diesel Oil	Diesel Oil	2.5	553	-
Skretting Osorno@Diesel Oil	Diesel Oil	3.4	738	-
Carrera Pinto@Solar	Solar	249.2	0	-
Chañares@Solar	Solar	66,236.2	0	-
Diego de Almagro@Solar	Solar	46,161.9	0	-
El Pilar-Los Amarillos@Solar	Solar	1,312.5	0	-
Esperanza@Solar	Solar	5,637.1	0	-
Javiera@Solar	Solar	110,363.0	0	-
Lagunilla@Solar	Solar	1,059.4	0	-
Lalackama@Solar	Solar	128,041.7	0	-
Lalackama 2@Solar	Solar	10,027.5	0	-
Las Terrazas@Solar	Solar	6,475.3	0	-
Llano de Llampos@Solar	Solar	247,379.5	0	-
Loma Los Colorados@Solar	Solar	722.2	0	-
Luna@Solar	Solar	1,901.2	0	-
Luz del Norte@Solar	Solar	84,187.7	0	-
PSF Lomas Coloradas@Solar	Solar	4,335.0	0	-
PSF Pama@Solar	Solar	4,384.0	0	-
PV Salvador@Solar	Solar	162,921.2	0	-
San Andres@Solar	Solar	94,624.5	0	-
Santa Cecilia@Solar	Solar	5,918.7	0	-
SDGx01@Solar	Solar	2,082.0	0	-
Sol@Solar	Solar	1,457.9	0	-
Tambo Real@Solar	Solar	4,112.6	0	-
Techos de Altamira@Solar	Solar	145.5	0	-
Santa Fe@Biomass	Biomass	196,585.8	0	-
Tal Tal 1@Diesel Oil	Diesel Oil	7,278.0	1,844,915	-
Tal Tal 1@LNG	LNG	106,219.0	32,119,988	-
Tal Tal 2@Diesel Oil	Diesel Oil	5,131.0	1,300,667	-
Tal Tal 2@LNG	LNG	105,325.0	31,849,648	-
Tamm@Biomass	Biomass	154.4	0	-
Tapihue@Natural Gas	Natural Gas	2,007.1	595,836	-
Teno@Diesel Oil	Diesel Oil	25,380.6	5,565,855	-
Termopacifico@Diesel Oil	Diesel Oil	1,747.5	393,170	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Coronel@Natural Gas	Natural Gas	20,952.9	5,689,360	-
Coronel@Diesel Oil	Diesel Oil	32,719.0	7,289,136	-
Tirua@Diesel Oil	Diesel Oil	146.6	41,817	-
Tomaval@Diesel Oil	Diesel Oil	3,869.0	400,344	-
Totoral@Diesel Oil	Diesel Oil	93.3	21,776	-
Chufken@Diesel Oil	Diesel Oil	932.5	223,263	-
Trailelfu@Run of the River	Run of the River	587.8	0	-
Trapen@Diesel Oil	Diesel Oil	112,124.2	24,595,257	-
Trebal Mapocho@Biomass	Biomass	40,471.9	0	-
Trueno@Run of the River	Run of the River	22,870.0	0	-
Truful Truful@Run of the River	Run of the River	5,887.2	0	-
Valdivia@Biomass	Biomass	270,458.5	0	-
Valdivia@Residual Fuel Oil	Residual Fuel Oil	6,101.5	1,952,480	-
Ventanas 1@Bituminous Coal	Bituminous Coal	619,715.0	243,036,730	-
Ventanas 2@Bituminous Coal	Bituminous Coal	1,032,537.0	388,601,495	-
Viñales@Biomass	Biomass	212,762.5	0	-
Volcan@Run of the River	Run of the River	80,816.0	0	-
Watts I@Diesel Oil	Diesel Oil	1.2	265	-
Watts II@Diesel Oil	Diesel Oil	1.3	288	-

Table 13. Power plants 2016 energy generation and fuel consumption data

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Abanico@Run of the River	Run of the River	255,197.0	-	-
Aconcagua UBlanco@Run of the River	Run of the River	228,195.4	-	-
Aconcagua UJuncal@Run of the River	Run of the River	117,375.1	-	-
Alfalfal@Run of the River	Run of the River	869,818.9	-	-
Allipen@Run of the River	Run of the River	17,905.0	-	-
Alto Renaico@Run of the River	Run of the River	6,571.7	-	-
Andes@Diesel Oil	Diesel Oil	6,236.5	1,507,622	-
Angostura@Dam	Dam	657,430.0	-	-
Antilhue TG@Diesel Oil	Diesel Oil	9,693.0	2,175,017	-
Antuco@Dam	Dam	1,079,426.0	-	-
Arauco@Biomass	Biomass	94,530.7	-	-
Auxiliar del Maipo@Run of the River	Run of the River	34,936.4	-	-
Biocruz@Natural Gas	Natural Gas	2,146.4	566,636	-
Biomar@Diesel Oil	Diesel Oil	0.4	87	-
Bocamina 1@Bituminous Coal	Bituminous Coal	730,349.0	260,880,663	-
Bocamina 2@Bituminous Coal	Bituminous Coal	2,211,533.0	713,175,162	-
Bonito@Run of the River	Run of the River	34,509.8	-	-
Bureo@Run of the River	Run of the River	6,107.8	-	-
Callao@Run of the River	Run of the River	6,335.0	-	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Calle-Calle@Diesel Oil	Diesel Oil	10,933.2	2,418,677	-
Campiche@Petcoke	Petcoke	2,268,649.0	810,361,423	-
Candelaria 1@Diesel Oil	Diesel Oil	35,452.0	9,305,657	-
Candelaria 1@LNG	LNG	74,923.0	23,438,012	-
Candelaria 2@Diesel Oil	Diesel Oil	35,640.0	9,355,004	-
Candelaria 2@LNG	LNG	73,736.0	23,066,685	-
Canela 1@Wind	Wind	20,134.5	-	-
Canela 2@Wind	Wind	89,412.1	-	-
Canutillar@Dam	Dam	590,163.0	-	-
Cañete@Diesel Oil	Diesel Oil	10.2	2,455	-
Capullo@Run of the River	Run of the River	46,236.1	-	-
Carena@Run of the River	Run of the River	68,026.9	-	-
Carilafquen@Run of the River	Run of the River	67,742.1	-	-
Carrera Pinto@Solar	Solar	120,124.8	-	-
Casablanca 1@Diesel Oil	Diesel Oil	23.3	5,945	-
Celco@Biomass	Biomass	39,053.3	-	-
Cem Bio Bio@Diesel Oil	Diesel Oil	510.8	98,069	-
Cem Bio Bio@Residual Fuel Oil	Residual Fuel Oil	15,952.8	3,477,531	-
Chacabuquito@Run of the River	Run of the River	98,285.9	-	-
Chacayes@Run of the River	Run of the River	328,003.6	-	-
Chañares@Solar	Solar	67,790.6	-	-
Chiburgo@Run of the River	Run of the River	63,074.0	-	-
Chiloe@Diesel Oil	Diesel Oil	17.8	5,015	-
Cholguan@Biomass	Biomass	89,615.2	-	-
Chuchiñi@Solar	Solar	2,684.1	-	-
Chufken@Diesel Oil	Diesel Oil	314.4	75,966	-
Chuyaca@Diesel Oil	Diesel Oil	3,728.9	827,329	-
Cipreses@Dam	Dam	435,824.0	-	-
CMPC Cordillera@Natural Gas	Natural Gas	115,646.0	-	116.4
CMPC Laja@Biomass	Biomass	105,764.5	-	-
CMPC Pacifico@Biomass	Biomass	199,428.0	-	-
CMPC Santa Fe@Biomass	Biomass	28,559.3	-	-
CMPC Tissue@Natural Gas	Natural Gas	10,961.4	-	303.7
Coelemu@Biomass	Biomass	33,221.2	-	-
Colbun@Dam	Dam	1,263,591.0	-	-
Colihues@Diesel Oil	Diesel Oil	16,793.5	-	214.0
Colihues@Residual Fuel Oil	Residual Fuel Oil	20,744.4	4,437,626	-
Colmito@Diesel Oil	Diesel Oil	455.3	135,673	-
Colmito@LNG	LNG	7,947.5	2,183,263	-
Concon@Diesel Oil	Diesel Oil	30.0	6,996	-
Conejo@Solar	Solar	110,313.9	-	-
Confluencia@Run of the River	Run of the River	462,656.1	-	-
Constitucion@Diesel Oil	Diesel Oil	1,442.1	406,299	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Cordillerilla@Solar	Solar	322.7	-	-
Coronel@Diesel Oil	Diesel Oil	16,519.2	3,665,513	-
Coronel@Natural Gas	Natural Gas	6,555.1	1,793,320	-
Coya@Run of the River	Run of the River	84,755.3	-	-
Cuel@Wind	Wind	76,191.9	-	-
Cumpeo@Run of the River	Run of the River	9,315.0	-	-
Curacautin@Diesel Oil	Diesel Oil	339.4	74,818	-
Curanilahue@Diesel Oil	Diesel Oil	18.6	4,264	-
Curauma@Diesel Oil	Diesel Oil	53.9	13,738	-
Curillinque@Run of the River	Run of the River	484,558.0	-	-
Danisco@Diesel Oil	Diesel Oil	0.2	43	-
Degan@Diesel Oil	Diesel Oil	10,864.6	2,376,555	-
Diego de Almagro@Diesel Oil	Diesel Oil	279.0	94,018	-
Diego de Almagro@Solar	Solar	50,800.6	-	-
Diuto@Run of the River	Run of the River	24,477.7	-	-
Don Walterio@Run of the River	Run of the River	3,557.7	-	-
Dongo@Run of the River	Run of the River	9,491.6	-	-
Donguil@Run of the River	Run of the River	1,246.2	-	-
Eagon@Diesel Oil	Diesel Oil	10.4	2,299	-
El Agrio@Run of the River	Run of the River	5,007.8	-	-
El Arrayan@Wind	Wind	253,296.1	-	-
El Canelo@Run of the River	Run of the River	15,931.7	-	-
El Divisadero@Solar	Solar	3,559.9	-	-
El Galpon@Run of the River	Run of the River	4,030.0	-	-
El Llano@Run of the River	Run of the River	5,832.8	-	-
El Manzano@Run of the River	Run of the River	21,363.8	-	-
El Mirador@Run of the River	Run of the River	229.0	-	-
El Paso@Run of the River	Run of the River	134,417.0	-	-
El Peñon@Diesel Oil	Diesel Oil	14,298.7	3,136,588	-
El Pilar-Los Amarillos@Solar	Solar	2,346.4	-	-
El Rincon@Run of the River	Run of the River	1,962.9	-	-
El Romero@Solar	Solar	39,065.2	-	-
El Salvador@Diesel Oil	Diesel Oil	105.3	35,484	-
El Toro@Dam	Dam	1,118,623.0	-	-
Emelda 1@Diesel Oil	Diesel Oil	290.1	84,712	-
Emelda 2@Diesel Oil	Diesel Oil	128.8	40,447	-
Energia Pacifico@Biomass	Biomass	82,742.3	-	-
Escuadron@Biomass	Biomass	76,322.2	-	-
Esperanza 1@Diesel Oil	Diesel Oil	56.1	13,625	-
Esperanza 2@Diesel Oil	Diesel Oil	142.0	33,101	-
Esperanza TG@Diesel Oil	Diesel Oil	161.1	56,608	-
Esperanza@Solar	Solar	2,027.3	-	-
Estancilla@Diesel Oil	Diesel Oil	650.2	148,246	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Eyzaguirre@Run of the River	Run of the River	6,278.4	-	-
Florida@Run of the River	Run of the River	124,904.9	-	-
Guacolda 1@Bituminous Coal	Bituminous Coal	973,896.2	359,950,459	-
Guacolda 2@Bituminous Coal	Bituminous Coal	960,651.0	355,449,678	-
Guacolda 3@Bituminous Coal	Bituminous Coal	1,052,710.6	359,893,366	-
Guacolda 4@Bituminous Coal	Bituminous Coal	890,203.1	312,018,703	-
Guacolda 5@Bituminous Coal	Bituminous Coal	897,041.4	312,162,733	-
Guayacan@Run of the River	Run of the River	91,472.8	-	-
Horcones@Diesel Oil	Diesel Oil	1,170.4	401,166	-
Hormiga Solar@Solar	Solar	8.9	-	-
Hornitos@Run of the River	Run of the River	264,571.8	-	-
Huasco TG@Diesel Oil	Diesel Oil	161.0	56,025	-
Huasco TG@Residual Fuel Oil	Residual Fuel Oil	3.0	1,086	-
Isla@Run of the River	Run of the River	407,910.0	-	-
Itata@Run of the River	Run of the River	25,719.1	-	-
Javiera@Solar	Solar	145,571.9	-	-
Juncalito@Run of the River	Run of the River	2,493.0	-	-
La Arena@Run of the River	Run of the River	12,871.8	-	-
La Chapeana@Solar	Solar	3,832.2	-	-
La Esperanza@Wind	Wind	16,220.0	-	-
La Higuera@Run of the River	Run of the River	693,696.4	-	-
La Paloma@Run of the River	Run of the River	2,987.1	-	-
La Silla@Solar	Solar	2,701.1	-	-
Lagunilla@Solar	Solar	4,181.3	-	-
Laja 1@Run of the River	Run of the River	44,689.0	-	-
Laja@Biomass	Biomass	29,932.0	-	-
Lalackama 2@Solar	Solar	39,268.7	-	-
Lalackama@Solar	Solar	128,524.7	-	-
Las Araucarias@Solar	Solar	93.1	-	-
Las Flores@Run of the River	Run of the River	10,072.7	-	-
Las Mollacas@Solar	Solar	3,356.1	-	-
Las Pampas@Biomass	Biomass	2,162.9	-	-
Las Terrazas@Solar	Solar	3,366.5	-	-
Las Vegas@Diesel Oil	Diesel Oil	60.1	10,312	-
Las Vertientes@Run of the River	Run of the River	7,676.9	-	-
Lautaro Comasa 1@Biomass	Biomass	158,012.0	-	-
Lautaro Comasa 2@Biomass	Biomass	126,759.7	-	-
Lautaro@Biomass	Biomass	6.9	-	-
Lebu@Diesel Oil	Diesel Oil	11.4	2,747	-
Lebu@Wind	Wind	18,215.9	-	-
Lican@Run of the River	Run of the River	58,334.3	-	-
Licanten@Biomass	Biomass	31,642.2	-	-
Linares Norte@Diesel Oil	Diesel Oil	17.5	3,778	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Lircay@Run of the River	Run of the River	121,342.9	-	-
Llano de Llampos@Solar	Solar	235,747.6	-	-
Lleuquereo@Run of the River	Run of the River	5,754.4	-	-
Loma Alta@Run of the River	Run of the River	201,522.0	-	-
Loma Los Colorados 1@Biomass	Biomass	2,085.3	-	-
Loma Los Colorados 2@Biomass	Biomass	127,614.7	-	-
Loma Los Colorados@Solar	Solar	1,391.1	-	-
Lonquimay@Diesel Oil	Diesel Oil	27.2	7,277	-
Los Alamos@Diesel Oil	Diesel Oil	26.7	6,446	-
Los Bajos@Run of the River	Run of the River	44,775.8	-	-
Los Bueno Aires@Wind	Wind	41,991.7	-	-
Los Corrales 1@Run of the River	Run of the River	4,760.5	-	-
Los Corrales 2@Run of the River	Run of the River	3,356.4	-	-
Los Cururos@Wind	Wind	206,679.5	-	-
Los Espinos@Diesel Oil	Diesel Oil	4,192.9	927,673	-
Los Guindos@Diesel Oil	Diesel Oil	37,583.7	9,169,962	-
Los Hierros 1@Run of the River	Run of the River	111,177.3	-	-
Los Hierros 2@Run of the River	Run of the River	20,249.3	-	-
Los Loros@Solar	Solar	23,550.4	-	-
Los Molles@Run of the River	Run of the River	77,023.0	-	-
Los Morros@Run of the River	Run of the River	20,561.6	-	-
Los Padres@Run of the River	Run of the River	3,968.0	-	-
Los Pinos@Diesel Oil	Diesel Oil	86,673.0	16,117,002	-
Los Quilos@Run of the River	Run of the River	260,150.0	-	-
Los Vientos TG@Diesel Oil	Diesel Oil	31,763.5	8,480,424	-
Louisiana Pacific@Diesel Oil	Diesel Oil	2.4	541	-
Luna@Solar	Solar	5,716.0	-	-
Luz del Norte@Solar	Solar	273,089.6	-	-
Machicura@Dam	Dam	279,012.0	-	-
Maisan@Run of the River	Run of the River	1,182.2	-	-
Maitenes@Run of the River	Run of the River	104,032.2	-	-
Malalcahuello@Run of the River	Run of the River	18,151.3	-	-
Mallarauco@Run of the River	Run of the River	25,660.7	-	-
Mampil@Run of the River	Run of the River	90,532.1	-	-
Maria Elena@Run of the River	Run of the River	171.3	-	-
Mariposas@Run of the River	Run of the River	19,563.0	-	-
Masisa@Biomass	Biomass	48,378.5	-	-
Maule@Diesel Oil	Diesel Oil	527.2	148,547	-
Molinera Villarica@Run of the River	Run of the River	90.7	-	-
Monte Redondo@Wind	Wind	72,724.7	-	-
Muchi@Run of the River	Run of the River	999.8	-	-
Multiexport 1@Diesel Oil	Diesel Oil	0.2	44	-
Multiexport 2@Diesel Oil	Diesel Oil	0.6	143	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Munilque 1@Run of the River	Run of the River	1,856.1	-	-
Munilque 2@Run of the River	Run of the River	1,947.9	-	-
Nalcas@Run of the River	Run of the River	14,044.5	-	-
Nehuenco 1@Diesel Oil	Diesel Oil	121,026.0	18,908,858	-
Nehuenco 1@LNG	LNG	2,158,323.0	417,746,223	-
Nehuenco 2@Diesel Oil	Diesel Oil	21,151.0	3,296,757	-
Nehuenco 2@LNG	LNG	1,283,397.0	227,900,506	-
Nehuenco 9B@Diesel Oil	Diesel Oil	5,559.0	1,471,458	-
Nehuenco 9B@LNG	LNG	3,461.0	1,082,054	-
Newen@Diesel Oil	Diesel Oil	58.0	16,457	-
Newen@Natural Gas	Natural Gas	464.0	151,506	-
Newen@Propane Gas	Propane Gas	7.1	1,705	-
Nueva Aldea 1@Biomass	Biomass	72,730.6	-	-
Nueva Aldea 2@Diesel Oil	Diesel Oil	31.6	9,158	-
Nueva Aldea 3@Biomass	Biomass	267,237.4	-	-
Nueva Renca@Diesel Oil	Diesel Oil	94,671.6	15,800,311	-
Nueva Renca@LNG	LNG	2,001,076.4	394,758,222	-
Nueva Renca@LPG	LPG	21,574.0	4,148,076	-
Nueva Ventanas@Bituminous Coal	Bituminous Coal	2,165,583.0	753,302,378	-
Ojos de Agua@Run of the River	Run of the River	44,711.1	-	-
Olivos@Diesel Oil	Diesel Oil	1,068.4	246,800	-
Palmucho@Run of the River	Run of the River	218,821.0	-	-
Pampa Solar Norte@Solar	Solar	129,377.2	-	-
Pangue@Dam	Dam	832,179.0	-	-
Pehuenche@Dam	Dam	1,678,791.0	-	-
Pehui@Run of the River	Run of the River	1,537.8	-	-
Petropower@Petcoke	Petcoke	497,111.0	187,840,848	-
Peuchen@Run of the River	Run of the River	118,340.6	-	-
Pichilonco@Run of the River	Run of the River	3,085.5	-	-
Picoiquén@Run of the River	Run of the River	56,326.3	-	-
Pilmaiquen@Run of the River	Run of the River	163,510.6	-	-
Placilla@Diesel Oil	Diesel Oil	61.0	13,910	-
Providencia@Run of the River	Run of the River	24,772.9	-	-
PSF Lomas Coloradas@Solar	Solar	4,360.4	-	-
PSF Pama@Solar	Solar	4,278.1	-	-
Puclaro@Run of the River	Run of the River	19,339.2	-	-
Pulelfu@Run of the River	Run of the River	39,444.0	-	-
Pullinque@Run of the River	Run of the River	139,204.5	-	-
Punta Colorada@Diesel Oil	Diesel Oil	78.5	14,991	-
Punta Colorada@Residual Fuel Oil	Residual Fuel Oil	900.0	197,056	-
Punta Colorada@Wind	Wind	20,917.8	-	-
Punta Palmeras@Wind	Wind	95,233.0	-	-
Puntilla@Run of the River	Run of the River	136,845.2	-	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Purisima@Run of the River	Run of the River	2,683.1	-	-
PV Salvador@Solar	Solar	159,309.9	-	-
Quellon 2@Diesel Oil	Diesel Oil	1,101.9	262,247	-
Queltehues@Run of the River	Run of the River	346,794.0	-	-
Quilapilún@Solar	Solar	49,430.1	-	-
Quillaileo@Run of the River	Run of the River	1,923.9	-	-
Quilleco@Run of the River	Run of the River	224,440.0	-	-
Quintay@Diesel Oil	Diesel Oil	91.5	20,863	-
Quintero 1@LNG	LNG	103,469.0	32,617,420	-
Quintero 2@LNG	LNG	152,091.0	47,944,950	-
Raki@Wind	Wind	9,001.8	-	-
Ralco@Dam	Dam	1,029,575.0	-	-
Rapel@Dam	Dam	715,801.0	-	-
Reca@Run of the River	Run of the River	5,326.7	-	-
Renaico@Run of the River	Run of the River	48,106.9	-	-
Renaico@Wind	Wind	129,805.7	-	-
Rio Huasco@Run of the River	Run of the River	21,551.4	-	-
Rio Mulchen@Run of the River	Run of the River	2,883.5	-	-
Robleria@Run of the River	Run of the River	10,979.0	-	-
Rucatayo@Dam	Dam	164,870.2	-	-
Rucue@Run of the River	Run of the River	542,579.0	-	-
San Andres@Run of the River	Run of the River	129,481.0	-	-
San Andres@Solar	Solar	65,950.6	-	-
San Clemente@Run of the River	Run of the River	16,543.5	-	-
San Gregorio@Diesel Oil	Diesel Oil	15.3	3,289	-
San Ignacio@Run of the River	Run of the River	90,394.0	-	-
San Isidro 1@Diesel Oil	Diesel Oil	342.0	61,306	-
San Isidro 1@LNG	LNG	1,412,262.0	278,088,510	-
San Isidro 2@Diesel Oil	Diesel Oil	12,955.0	2,138,660	-
San Isidro 2@LNG	LNG	2,713,061.0	483,174,460	-
San Juan@Wind	Wind	124,831.5	-	-
San Lorenzo 1@Diesel Oil	Diesel Oil	104.8	35,841	-
San Lorenzo 3@Diesel Oil	Diesel Oil	2.0	579	-
San Pedro II@Wind	Wind	2,097.6	-	-
San Pedro@Wind	Wind	84,472.7	-	-
Santa Cecilia@Solar	Solar	5,752.3	-	-
Santa Fe@Biomass	Biomass	387,680.0	-	-
Santa Irene@Biomass	Biomass	2,688.1	-	-
Santa Julia@Solar	Solar	3,567.1	-	-
Santa Lidia@Diesel Oil	Diesel Oil	17,312.1	4,569,929	-
Santa Maria@Bituminous Coal	Bituminous Coal	2,504,908.0	814,980,836	-
Santa Marta@Biomass	Biomass	73,335.9	-	-
Sauce Andes@Run of the River	Run of the River	4,133.5	-	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Sauzal 50Hz@Run of the River	Run of the River	464,472.0	-	-
Sauzal 60Hz@Run of the River	Run of the River	5,485.8	-	-
Sauzalito@Run of the River	Run of the River	83,316.0	-	-
SDGx01@Solar	Solar	867.4	-	-
Skretting@Diesel Oil	Diesel Oil	0.2	48	-
Sol@Solar	Solar	5,771.1	-	-
Southern@Diesel Oil	Diesel Oil	0.4	91	-
Tal Tal 1@Diesel Oil	Diesel Oil	2,451.0	621,309	-
Tal Tal 1@LNG	LNG	53,470.0	16,169,007	-
Tal Tal 1@Natural Gas	Natural Gas	279.0	84,368	-
Tal Tal 2@Diesel Oil	Diesel Oil	1,226.0	310,781	-
Tal Tal 2@LNG	LNG	19,190.0	5,802,941	-
Talinay Poniente@Wind	Wind	172,026.2	-	-
Talinay@Wind	Wind	177,247.1	-	-
Taltal@Wind	Wind	286,341.4	-	-
Tambo Real@Solar	Solar	1,464.1	-	-
Tamm@Biomass	Biomass	0.3	-	-
Tapihue@Natural Gas	Natural Gas	6.9	2,031	-
Techos de Altamira@Solar	Solar	138.5	-	-
Teno@Diesel Oil	Diesel Oil	13,566.0	2,974,960	-
Termopacifico@Diesel Oil	Diesel Oil	1,494.9	336,334	-
Til Til@Solar	Solar	3,044.3	-	-
Tirua@Diesel Oil	Diesel Oil	44.6	11,915	-
Tomaval@Diesel Oil	Diesel Oil	894.7	234,411	-
Totoral@Diesel Oil	Diesel Oil	53.7	-	233.5
Totoral@Wind	Wind	66,042.5	-	-
Trailelfu@Run of the River	Run of the River	4,894.0	-	-
Tranquil@Run of the River	Run of the River	291.8	-	-
Trapen@Diesel Oil	Diesel Oil	125,136.3	27,441,831	-
Trebal Mapocho@Biomass	Biomass	47,204.8	-	-
Trueno@Run of the River	Run of the River	17,569.5	-	-
Truful Truful@Run of the River	Run of the River	5,896.4	-	-
Ucuquer 2@Wind	Wind	24,228.5	-	-
Ucuquer@Wind	Wind	17,308.5	-	-
Valdivia@Biomass	Biomass	271,837.9	-	-
Valdivia@Residual Fuel Oil	Residual Fuel Oil	6,458.3	2,066,656	-
Ventanas 1@Bituminous Coal	Bituminous Coal	681,908.0	269,091,661	-
Ventanas 2@Bituminous Coal	Bituminous Coal	1,338,707.0	503,830,412	-
Viñales@Biomass	Biomass	244,814.4	-	-
Volcan@Run of the River	Run of the River	104,784.0	-	-
Yungay 1@Diesel Oil	Diesel Oil	301.1	84,308	-
Yungay 2@Diesel Oil	Diesel Oil	321.0	80,884	-
Yungay 3@Diesel Oil	Diesel Oil	309.3	84,756	-

Power unit	Fuel	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Yungay 4@Diesel Oil	Diesel Oil	231.4	68,723	-

Table 14. Power plants 2017 energy generation and fuel consumption data

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Abanico@Run of the River	Run of the River	SIC	234,034.0	-	-
Aconcagua UBlanco@Run of the River	Run of the River	SIC	222,674.3	-	-
Aconcagua UJuncal@Run of the River	Run of the River	SIC	121,936.8	-	-
Alfalfal@Run of the River	Run of the River	SIC	771,286.1	-	-
Allipen@Run of the River	Run of the River	SIC	19,468.0	-	-
Alto Renaico@Run of the River	Run of the River	SIC	9,016.1	-	-
Ancoa@Dam	Dam	SIC	21,801.1	-	-
Andes 1@Residual Fuel Oil	Residual Fuel Oil	SIC	1,160.8	-	240.9
Andes 2@Residual Fuel Oil	Residual Fuel Oil	SIC	1,135.7	-	240.9
Andes 3@Residual Fuel Oil	Residual Fuel Oil	SIC	1,169.4	-	236.8
Andes 4@Residual Fuel Oil	Residual Fuel Oil	SIC	1,721.6	-	247.0
Angostura@Dam	Dam	SIC	1,097,449.0	-	-
Antay@Solar	Solar	SIC	5,332.7	-	-
Antilhue TG@Diesel Oil	Diesel Oil	SIC	42,830.0	-	234.8
Antuco@Dam	Dam	SIC	1,171,680.0	-	-
Arauco@Biomass	Biomass	SIC	43,825.6	-	-
Auxiliar del Maipo@Run of the River	Run of the River	SIC	34,545.6	-	-
Bellavista@Solar	Solar	SIC	3,517.5	-	-
Biocruz@Natural Gas	Natural Gas	SIC	111.3	-	336.5
Bocamina 1@Bituminous Coal	Bituminous Coal	SIC	655,946.0	-	380.0
Bocamina 2@Bituminous Coal	Bituminous Coal	SIC	1,842,273.0	-	377.8
Boquiamargo@Run of the River	Run of the River	SIC	418.7	-	-
Bureo@Run of the River	Run of the River	SIC	9,339.5	-	-
Callao@Run of the River	Run of the River	SIC	11,949.5	-	-
Calle-Calle@Diesel Oil	Diesel Oil	SIC	586.1	-	228.2
Campiche@Petcoke	Petcoke	SIC	1,822,943.0	-	380.0
Candelaria 1@Diesel Oil	Diesel Oil	SIC	34,050.0	-	276.0
Candelaria 1@LNG	LNG	SIC	60,469.6	-	314.4
Candelaria 2@Diesel Oil	Diesel Oil	SIC	39,707.0	-	276.0
Candelaria 2@LNG	LNG	SIC	55,165.0	-	314.4
Canela 1@Wind	Wind	SIC	28,023.7	-	-
Canela 2@Wind	Wind	SIC	101,822.3	-	-
Canutillar@Dam	Dam	SIC	920,834.0	-	-
Cañete@Diesel Oil	Diesel Oil	SIC	90.1	-	241.6
Capullo@Run of the River	Run of the River	SIC	79,428.2	-	-
Cardones@Diesel Oil	Diesel Oil	SIC	5,986.5	-	231.5
Carena@Run of the River	Run of the River	SIC	69,138.8	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Carilafquen@Run of the River	Run of the River	SIC	61,461.6	-	-
Carrera Pinto@Solar	Solar	SIC	180,298.7	-	-
Casablanca 1@Diesel Oil	Diesel Oil	SIC	4.3	-	231.5
Cem Bio Bio@Residual Fuel Oil	Residual Fuel Oil	SIC	8,259.2	-	218.0
Cenizas@Diesel Oil	Diesel Oil	SIC	274.0	-	230.3
Chacabuquito@Run of the River	Run of the River	SIC	132,368.0	-	-
Chacayes@Run of the River	Run of the River	SIC	426,232.8	-	-
Chañares@Solar	Solar	SIC	82,077.5	-	-
Chiburgo@Run of the River	Run of the River	SIC	60,115.0	-	-
Chiloe@Diesel Oil	Diesel Oil	SIC	3.5	-	281.7
Cholguan@Biomass	Biomass	SIC	67,701.0	-	-
Chuchiñi@Solar	Solar	SIC	5,594.3	-	-
Chufken@Diesel Oil	Diesel Oil	SIC	70.7	-	241.6
Chuyaca@Diesel Oil	Diesel Oil	SIC	29.8	-	253.5
Cipreses@Dam	Dam	SIC	148,098.0	-	-
CMPC Cordillera@Natural Gas	Natural Gas	SIC	164,154.9	-	112.0
CMPC Laja@Biomass	Biomass	SIC	107,526.2	-	-
CMPC Pacifico@Biomass	Biomass	SIC	176,945.9	-	-
CMPC Santa Fe@Biomass	Biomass	SIC	31,751.7	-	-
CMPC Tissue@Natural Gas	Natural Gas	SIC	11,680.8	-	303.7
Coelemu@Biomass	Biomass	SIC	33,465.3	-	-
Colbun@Dam	Dam	SIC	1,390,306.0	-	-
Colihues@Diesel Oil	Diesel Oil	SIC	6.1	-	214.0
Colihues@Residual Fuel Oil	Residual Fuel Oil	SIC	15,765.4	-	214.0
Collil@Run of the River	Run of the River	SIC	28,664.5	-	-
Colmito@Diesel Oil	Diesel Oil	SIC	6,638.9	-	248.3
Colmito@LNG	LNG	SIC	6,013.8	-	263.4
Concon@Diesel Oil	Diesel Oil	SIC	6.5	-	202.8
Conejo@Solar	Solar	SIC	238,500.2	-	-
Confluencia@Run of the River	Run of the River	SIC	24,475.7	-	-
Constitucion@Biomass	Biomass	SIC	36,419.5	-	-
Constitucion@Diesel Oil	Diesel Oil	SIC	2,689.1	-	281.7
Cordillerilla@Solar	Solar	SIC	2,466.0	-	-
Coronel@Diesel Oil	Diesel Oil	SIC	9,967.3	-	228.2
Coronel@Natural Gas	Natural Gas	SIC	6,260.7	-	-
Coya@Run of the River	Run of the River	SIC	55,735.0	-	-
Cuel@Wind	Wind	SIC	91,893.1	-	-
Cumpeo@Run of the River	Run of the River	SIC	14,446.1	-	-
Curacautin@Diesel Oil	Diesel Oil	SIC	194.7	-	220.4
Curauma@Diesel Oil	Diesel Oil	SIC	1.6	-	194.5
Curillinque@Run of the River	Run of the River	SIC	372,757.0	-	-
Cuz Cuz@Solar	Solar	SIC	1,853.5	-	-
Degan@Diesel Oil	Diesel Oil	SIC	2,776.2	-	218.7

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Diego de Almagro@Diesel Oil	Diesel Oil	SIC	449.0	-	337.0
Diego de Almagro@Solar	Solar	SIC	58,925.5	-	-
Diuto@Run of the River	Run of the River	SIC	15,892.2	-	-
Don Walterio@Run of the River	Run of the River	SIC	12.4	-	-
Dona Carmen@Solar	Solar	SIC	11,577.3	-	-
Dona Hilda@Run of the River	Run of the River	SIC	856.2	-	-
Dongo@Run of the River	Run of the River	SIC	19,111.1	-	-
Donguil@Run of the River	Run of the River	SIC	1,337.9	-	-
Dos Valles@Run of the River	Run of the River	SIC	2,643.7	-	-
El Agrio@Run of the River	Run of the River	SIC	9,648.4	-	-
El Arrayan@Wind	Wind	SIC	284,443.1	-	-
El Canelo@Run of the River	Run of the River	SIC	17,936.6	-	-
El Colorado@Run of the River	Run of the River	SIC	8,203.6	-	-
El Galpon@Run of the River	Run of the River	SIC	6,477.0	-	-
El Llano@Run of the River	Run of the River	SIC	5,055.8	-	-
El Manzano@Run of the River	Run of the River	SIC	22,798.0	-	-
El Mirador@Run of the River	Run of the River	SIC	2,304.3	-	-
El Nogal@Diesel Oil	Diesel Oil	SIC	162.7	-	-
El Paso@Run of the River	Run of the River	SIC	120,508.0	-	-
El Pelicano@Solar	Solar	SIC	87,171.7	-	-
El Peñon@Diesel Oil	Diesel Oil	SIC	10,578.7	-	219.3
El Pilar-Los Amarillos@Solar	Solar	SIC	150.1	-	-
El Rincon@Run of the River	Run of the River	SIC	1,991.4	-	-
El Romero@Solar	Solar	SIC	269,462.4	-	-
El Salvador@Diesel Oil	Diesel Oil	SIC	283.3	-	337.0
El Toro@Dam	Dam	SIC	678,051.0	-	-
El Totoral@Diesel Oil	Diesel Oil	SIC	97.9	-	198.5
Emelda 1@Diesel Oil	Diesel Oil	SIC	282.0	-	292.0
Emelda 2@Diesel Oil	Diesel Oil	SIC	242.2	-	314.0
Energia Pacifico@Biomass	Biomass	SIC	118,131.1	-	-
Escuadron@Biomass	Biomass	SIC	44,681.5	-	-
Esperanza 1@Diesel Oil	Diesel Oil	SIC	39.3	-	336.0
Esperanza 2@Diesel Oil	Diesel Oil	SIC	95.1	-	189.0
Esperanza TG@Diesel Oil	Diesel Oil	SIC	250.3	-	186.5
Esperanza@Solar	Solar	SIC	119.7	-	-
Estancilla@Diesel Oil	Diesel Oil	SIC	253.0	-	228.0
Eyzaguirre@Run of the River	Run of the River	SIC	6,043.4	-	-
Florida 1@Run of the River	Run of the River	SIC	1,317.3	-	-
Florida 2@Run of the River	Run of the River	SIC	89,920.2	-	-
Florida 3@Run of the River	Run of the River	SIC	18,054.4	-	-
Guacolda 1@Bituminous Coal	Bituminous Coal	SIC	665,758.0	-	396.0
Guacolda 2@Bituminous Coal	Bituminous Coal	SIC	543,222.8	-	397.0
Guacolda 3@Bituminous Coal	Bituminous Coal	SIC	708,800.2	-	382.0

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Guacolda 4@Bituminous Coal	Bituminous Coal	SIC	821,189.0	-	384.0
Guacolda 5@Bituminous Coal	Bituminous Coal	SIC	838,958.8	-	384.0
Guayacan@Run of the River	Run of the River	SIC	73,310.0	-	-
Hidrobonito 1@run of the River	run of the River	SIC	46,099.8	-	-
Hidrobonito 2@run of the River	run of the River	SIC	12,643.1	-	-
Horcones@Diesel Oil	Diesel Oil	SIC	437.3	-	347.0
Hormiga@Solar	Solar	SIC	3,954.1	-	-
Hornitos@Run of the River	Run of the River	SIC	208,268.8	-	-
Huasco TG@Diesel Oil	Diesel Oil	SIC	528.0	-	348.0
Huasco TG@Residual Fuel Oil	Residual Fuel Oil	SIC	8.0	-	348.0
Isla@Run of the River	Run of the River	SIC	336,979.1	-	-
Itata@Run of the River	Run of the River	SIC	60,649.6	-	-
Javiera@Solar	Solar	SIC	141,511.5	-	-
Juncalito@Run of the River	Run of the River	SIC	1,946.8	-	-
La Arena@Run of the River	Run of the River	SIC	23,570.1	-	-
La Bifurcada@Run of the River	Run of the River	SIC	224.7	-	-
La Chapeana@Solar	Solar	SIC	2,997.4	-	-
La Confluencia@Run of the River	Run of the River	SIC	284,964.8	-	-
La Esperanza@Wind	Wind	SIC	32,583.3	-	-
La Higuera@Run of the River	Run of the River	SIC	467,342.1	-	-
La Mina@Run of the River	Run of the River	SIC	38,207.8	-	-
La Montaña@Run of the River	Run of the River	SIC	7,670.0	-	-
La Paloma@Run of the River	Run of the River	SIC	9,418.5	-	-
La Quinta@Solar	Solar	SIC	2,428.1	-	-
La Silla@Solar	Solar	SIC	4,453.5	-	-
La Viña-Alto La Viña@Run of the River	Run of the River	SIC	532.1	-	-
Laguna Verde TG@Diesel Oil	Diesel Oil	SIC	455.0	-	264.0
Laguna Verde TV@Diesel Oil	Diesel Oil	SIC	193.0	-	412.0
Lagunilla@Solar	Solar	SIC	376.7	-	-
Laja 1@Run of the River	Run of the River	SIC	90,192.3	-	-
Laja@Biomass	Biomass	SIC	28,771.0	-	-
Lalackama 2@Solar	Solar	SIC	37,672.0	-	-
Lalackama@Solar	Solar	SIC	126,123.6	-	-
Las Araucarias@Solar	Solar	SIC	176.0	-	-
Las Flores@Run of the River	Run of the River	SIC	13,842.2	-	-
Las Mollacas@Solar	Solar	SIC	2,937.0	-	-
Las Pampas@Biomass	Biomass	SIC	2,123.3	-	-
Las Terrazas@Solar	Solar	SIC	2,578.9	-	-
Las Turcas@Solar	Solar	SIC	2,014.1	-	-
Las Vegas@Diesel Oil	Diesel Oil	SIC	8.0	-	241.4
Las Vertientes@Run of the River	Run of the River	SIC	10,588.9	-	-
Lautaro Comasa 1@Biomass	Biomass	SIC	171,536.5	-	-
Lautaro Comasa 2@Biomass	Biomass	SIC	134,612.8	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Lebu III@Wind	Wind	SIC	4,828.2	-	-
Lebu@Diesel Oil	Diesel Oil	SIC	61.9	-	241.6
Lebu@Wind	Wind	SIC	22,164.2	-	-
Lepanto@Biogas	Biogas	SIC	544.4	-	-
Lican@Run of the River	Run of the River	SIC	87,621.9	-	-
Licanten@Biomass	Biomass	SIC	17,981.3	-	-
Linares Norte@Diesel Oil	Diesel Oil	SIC	8.7	-	187.8
Lircay@Run of the River	Run of the River	SIC	120,362.3	-	-
Llano de Llampos@Solar	Solar	SIC	234,668.1	-	-
Lleuquereo@Run of the River	Run of the River	SIC	8,555.6	-	-
Loma Alta@Run of the River	Run of the River	SIC	149,196.5	-	-
Loma Los Colorados 1@Biomass	Biomass	SIC	478.6	-	-
Loma Los Colorados 2@Biomass	Biomass	SIC	137,620.5	-	-
Loma Los Colorados@Solar	Solar	SIC	1,507.8	-	-
Lonquimay@Diesel Oil	Diesel Oil	SIC	385.6	-	267.2
Los Alamos@Diesel Oil	Diesel Oil	SIC	0.7	-	241.6
Los Bajos@Run of the River	Run of the River	SIC	40,115.9	-	-
Los Bueno Aires@Wind	Wind	SIC	78,512.1	-	-
Los Corrales 1@Run of the River	Run of the River	SIC	6,134.5	-	-
Los Corrales 2@Run of the River	Run of the River	SIC	4,978.5	-	-
Los Cururos@Wind	Wind	SIC	230,007.0	-	-
Los Espinos@Diesel Oil	Diesel Oil	SIC	726.6	-	221.0
Los Guindos@Diesel Oil	Diesel Oil	SIC	7,301.6	-	244.3
Los Hierros 1@Run of the River	Run of the River	SIC	118,496.3	-	-
Los Hierros 2@Run of the River	Run of the River	SIC	22,191.5	-	-
Los Loros@Solar	Solar	SIC	26,190.1	-	-
Los Molles@Run of the River	Run of the River	SIC	68,563.3	-	-
Los Morros@Run of the River	Run of the River	SIC	16,531.2	-	-
Los Padres@Run of the River	Run of the River	SIC	8,228.0	-	-
Los Pinos@Diesel Oil	Diesel Oil	SIC	70,331.0	-	194.6
Los Quilos@Run of the River	Run of the River	SIC	224,156.9	-	-
Los Vientos TG@Diesel Oil	Diesel Oil	SIC	18,005.7	-	267.0
Luna@Solar	Solar	SIC	5,612.2	-	-
Luz del Norte@Solar	Solar	SIC	300,353.5	-	-
Machicura@Dam	Dam	SIC	304,707.0	-	-
Maisan@Run of the River	Run of the River	SIC	1,785.6	-	-
Maitenes@Run of the River	Run of the River	SIC	103,457.5	-	-
Malalcahuello@Run of the River	Run of the River	SIC	21,333.6	-	-
Mallarauco@Run of the River	Run of the River	SIC	26,051.6	-	-
Mampil@Run of the River	Run of the River	SIC	152,528.7	-	-
Maria Elena@Run of the River	Run of the River	SIC	0.7	-	-
Mariposas@Run of the River	Run of the River	SIC	26,411.6	-	-
Masisa@Biomass	Biomass	SIC	41,140.0	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Maule@Diesel Oil	Diesel Oil	SIC	393.0	-	281.7
Monte Redondo@Wind	Wind	SIC	80,240.0	-	-
Muchi@Run of the River	Run of the River	SIC	3,110.8	-	-
Munilque 1@Run of the River	Run of the River	SIC	3,169.5	-	-
Munilque 2@Run of the River	Run of the River	SIC	3,386.5	-	-
Nalcas@Run of the River	Run of the River	SIC	31,778.7	-	-
Nehuenco 1@Diesel Oil	Diesel Oil	SIC	2,722.0	-	162.7
Nehuenco 1@LNG	LNG	SIC	1,895,823.0	-	218.3
Nehuenco 2@Diesel Oil	Diesel Oil	SIC	15,649.0	-	162.5
Nehuenco 2@LNG	LNG	SIC	1,765,347.0	-	200.5
Nehuenco 9B@Diesel Oil	Diesel Oil	SIC	802.0	-	280.8
Nehuenco 9B@LNG	LNG	SIC	2,191.0	-	-
Newen@Diesel Oil	Diesel Oil	SIC	654.4	-	240.9
Newen@Natural Gas	Natural Gas	SIC	6,392.4	-	-
Newen@Propane Gas	Propane Gas	SIC	257.4	-	-
Nueva Aldea 1@Biomass	Biomass	SIC	52,083.5	-	-
Nueva Aldea 2@Diesel Oil	Diesel Oil	SIC	18.5	-	-
Nueva Aldea 3@Biomass	Biomass	SIC	268,920.8	-	-
Nueva Renca@Diesel Oil	Diesel Oil	SIC	132,561.0	-	171.0
Nueva Renca@LNG	LNG	SIC	1,693,681.0	-	197.0
Nueva Renca@LPG	LPG	SIC	7,356.0	-	-
Nueva Ventanas@Bituminous Coal	Bituminous Coal	SIC	1,927,212.0	-	380.0
Ojos de Agua@Run of the River	Run of the River	SIC	40,102.5	-	-
Olivos@Diesel Oil	Diesel Oil	SIC	63.7	-	231.0
Palmucho@Run of the River	Run of the River	SIC	219,208.0	-	-
Pampa Solar Norte@Solar	Solar	SIC	158,893.4	-	-
Pangue@Dam	Dam	SIC	1,451,679.0	-	-
Pehuenche@Dam	Dam	SIC	1,915,665.0	-	-
Pehui@Run of the River	Run of the River	SIC	6.1	-	-
Petropower@Petcoke	Petcoke	SIC	436,012.6	-	-
Peuchen@Run of the River	Run of the River	SIC	202,552.4	-	-
Pichilonco@Run of the River	Run of the River	SIC	5,570.2	-	-
Picoiquén@Run of the River	Run of the River	SIC	94,414.7	-	-
Pilmaiquen@Run of the River	Run of the River	SIC	278,030.3	-	-
Piloto Solar Cardones@Solar	Solar	SIC	345.9	-	-
Placilla@Diesel Oil	Diesel Oil	SIC	18.8	-	236.3
Providencia@Run of the River	Run of the River	SIC	39,485.6	-	-
PSF Lomas Coloradas@Solar	Solar	SIC	4,400.4	-	-
PSF Pama@Solar	Solar	SIC	4,126.6	-	-
Puclaro@Run of the River	Run of the River	SIC	43,935.2	-	-
Pulelfu@Run of the River	Run of the River	SIC	62,368.1	-	-
Pullinque@Run of the River	Run of the River	SIC	208,641.3	-	-
Punta Colorada@Diesel Oil	Diesel Oil	SIC	73.5	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Punta Colorada@Residual Fuel Oil	Residual Fuel Oil	SIC	89.1	-	219.0
Punta Colorada@Wind	Wind	SIC	7,887.9	-	-
Punta Palmeras@Wind	Wind	SIC	116,357.4	-	-
Puntilla@Run of the River	Run of the River	SIC	129,639.3	-	-
Purisima@Run of the River	Run of the River	SIC	2,281.9	-	-
PV Salvador@Solar	Solar	SIC	156,599.5	-	-
Quellon 2@Diesel Oil	Diesel Oil	SIC	160.4	-	253.5
Queltehues@Run of the River	Run of the River	SIC	341,056.0	-	-
Quilapilun@Solar	Solar	SIC	191,196.5	-	-
Quillaileo@Run of the River	Run of the River	SIC	1,651.7	-	-
Quilleco@Run of the River	Run of the River	SIC	282,399.0	-	-
Quintay@Diesel Oil	Diesel Oil	SIC	23.5	-	198.5
Quintero 1@LNG	LNG	SIC	215,368.0	-	317.5
Quintero 2@LNG	LNG	SIC	195,539.0	-	317.5
Ralco@Dam	Dam	SIC	1,990,268.0	-	-
Rapel@Dam	Dam	SIC	623,718.0	-	-
Reca@Run of the River	Run of the River	SIC	8,687.2	-	-
Renaico@Run of the River	Run of the River	SIC	44,043.7	-	-
Renaico@Wind	Wind	SIC	275,960.7	-	-
Renca 1@Diesel Oil	Diesel Oil	SIC	951.2	-	365.0
Renca 2@Diesel Oil	Diesel Oil	SIC	741.2	-	365.0
Riñinahue@Run of the River	Run of the River	SIC	6,263.8	-	-
Rio Colorado@Run of the River	Run of the River	SIC	48,491.5	-	-
Rio Huasco@Run of the River	Run of the River	SIC	45,141.6	-	-
Rio Mulchen@Run of the River	Run of the River	SIC	7,607.8	-	-
Robleria@Run of the River	Run of the River	SIC	14,273.6	-	-
Rucatayo@Dam	Dam	SIC	304,072.8	-	-
Rucue@Run of the River	Run of the River	SIC	686,588.0	-	-
San Andres@Run of the River	Run of the River	SIC	127,978.7	-	-
San Andres@Solar	Solar	SIC	61,750.4	-	-
San Clemente@Run of the River	Run of the River	SIC	12,811.6	-	-
San Francisco@Solar	Solar	SIC	2,462.7	-	-
San Gregorio@Diesel Oil	Diesel Oil	SIC	0.3	-	187.8
San Ignacio@Run of the River	Run of the River	SIC	121,213.5	-	-
San Isidro 1@Diesel Oil	Diesel Oil	SIC	5,594.0	-	182.6
San Isidro 1@LNG	LNG	SIC	1,638,181.0	-	195.0
San Isidro 2@Diesel Oil	Diesel Oil	SIC	2,743.0	-	185.4
San Isidro 2@LNG	LNG	SIC	2,304,228.0	-	202.9
San Juan@Wind	Wind	SIC	564,278.7	-	-
San Lorenzo 1@Diesel Oil	Diesel Oil	SIC	392.8	-	342.0
San Lorenzo 2@Diesel Oil	Diesel Oil	SIC	343.3	-	380.4
San Lorenzo 3@Diesel Oil	Diesel Oil	SIC	116.3	-	289.0
San Pedro II@Wind	Wind	SIC	139,389.6	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
San Pedro@Wind	Wind	SIC	102,613.4	-	-
Santa Cecilia@Solar	Solar	SIC	5,608.3	-	-
Santa Fe@Biomass	Biomass	SIC	378,976.9	-	-
Santa Irene@Biomass	Biomass	SIC	2,002.3	-	-
Santa Julia@Solar	Solar	SIC	7,147.0	-	-
Santa Lidia@Diesel Oil	Diesel Oil	SIC	921.1	-	264.0
Santa Maria@Bituminous Coal	Bituminous Coal	SIC	2,716,160.0	-	352.0
Santa Marta@Biomass	Biomass	SIC	74,876.7	-	-
Sauce Andes@Run of the River	Run of the River	SIC	1,856.0	-	-
Sauzal 50Hz@Run of the River	Run of the River	SIC	270,291.0	-	-
Sauzal 60Hz@Run of the River	Run of the River	SIC	90,850.8	-	-
Sauzalito@Run of the River	Run of the River	SIC	70,526.0	-	-
Sol@Solar	Solar	SIC	5,457.6	-	-
Tal Tal 1@Diesel Oil	Diesel Oil	SIC	46,010.0	-	254.0
Tal Tal 1@LNG	LNG	SIC	80,980.0	-	303.0
Tal Tal 1@Natural Gas	Natural Gas	SIC	1.0	-	-
Tal Tal 2@Diesel Oil	Diesel Oil	SIC	6,277.0	-	254.0
Tal Tal 2@LNG	LNG	SIC	38,802.0	-	-
Talinay Poniente@Wind	Wind	SIC	176,773.5	-	-
Talinay@Wind	Wind	SIC	187,881.2	-	-
Taltal@Wind	Wind	SIC	295,671.1	-	-
Tapihue@Natural Gas	Natural Gas	SIC	13.6	-	293.0
Techos de Altamira@Solar	Solar	SIC	111.1	-	-
Teno@Diesel Oil	Diesel Oil	SIC	21,184.5	-	219.3
Termopacifico@Diesel Oil	Diesel Oil	SIC	3,585.9	-	469.3
Til Til@Solar	Solar	SIC	5,012.0	-	-
Tirua@Diesel Oil	Diesel Oil	SIC	48.8	-	267.2
Totoral@Wind	Wind	SIC	77,189.6	-	-
Trailelfu@Run of the River	Run of the River	SIC	10,177.3	-	-
Tranquil@Run of the River	Run of the River	SIC	8,963.4	-	-
Trapen@Diesel Oil	Diesel Oil	SIC	14,769.7	-	219.3
Trebal Mapocho@Biomass	Biomass	SIC	49,270.2	-	-
Trongol-Curanilahue@Diesel Oil	Diesel Oil	SIC	3.6	-	229.6
Trueno@Run of the River	Run of the River	SIC	26,836.4	-	-
Truful Truful@Run of the River	Run of the River	SIC	4,959.6	-	-
Ucuquer 2@Wind	Wind	SIC	27,841.5	-	-
Ucuquer@Wind	Wind	SIC	21,009.6	-	-
Valdivia@Biomass	Biomass	SIC	219,354.0	-	-
Valdivia@Residual Fuel Oil	Residual Fuel Oil	SIC	3,047.6	-	-
Valle de la Luna@Solar	Solar	SIC	2,261.5	-	-
Ventanas 1@Bituminous Coal	Bituminous Coal	SIC	614,839.0	-	415.0
Ventanas 2@Bituminous Coal	Bituminous Coal	SIC	1,059,302.0	-	397.0
Viñales@Biomass	Biomass	SIC	221,109.6	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Volcan@Run of the River	Run of the River	SIC	97,645.0	-	-
Yungay 1@Diesel Oil	Diesel Oil	SIC	350.4	-	280.0
Yungay 2@Diesel Oil	Diesel Oil	SIC	484.1	-	252.0
Yungay 3@Diesel Oil	Diesel Oil	SIC	427.9	-	274.0
Yungay 4@Diesel Oil	Diesel Oil	SIC	546.3	-	297.0
Andes@Solar	Solar	SING	63,882.1	-	-
NTO1@Bituminous coal	Bituminous coal	SING	964,138.8	-	419.7
NTO2@Bituminous coal	Bituminous coal	SING	1,000,118.2	-	407.4
CTA1@Bituminous coal	Bituminous coal	SING	1,078,733.0	-	387.8
ANG1@Bituminous coal	Bituminous coal	SING	1,944,535.4	-	394.8
ANG2@Bituminous coal	Bituminous coal	SING	1,886,485.1	-	396.2
Cerro Dominador@Solar	Solar	SING	99,073.3	-	-
CCR1@Bituminous coal	Bituminous coal	SING	1,687,604.7	-	403.7
CCR2@Bituminous coal	Bituminous coal	SING	1,590,407.2	-	409.4
Sierra Gorda Este@Wind	Wind	SING	309,399.7	-	-
Finis Terrae@Solar	Solar	SING	399,970.2	-	-
CHAP1@Run of the river	Run of the river	SING	37,947.5	-	-
CTM1@Bituminous coal	Bituminous coal	SING	401,781.0	-	471.8
CTM2@Bituminous coal	Bituminous coal	SING	666,105.0	-	420.5
CTM3 TG@Diesel oil	Diesel oil	SING	3,842.0	-	208.5
CTM3 TG@Natural gas	Natural gas	SING	161,799.0	-	219.7
CTM3 TV@Diesel oil	Diesel oil	SING	1,142.0	-	208.5
CTM3 TV@Natural gas	Natural gas	SING	87,684.0	-	219.7
CTM3 TG CP@Natural gas	Natural gas	SING	956.0	-	208.5
CTM3 TV CP@Natural gas	Natural gas	SING	487.0	-	219.7
GMAR1@Diesel oil	Diesel oil	SING	805.2	-	247.7
M1AR1@Diesel oil	Diesel oil	SING	302.8	-	253.4
M2AR1@Diesel oil	Diesel oil	SING	168.0	-	252.6
Pampa Camarones@Solar	Solar	SING	16,959.2	-	-
El Águila I@Solar	Solar	SING	3,713.0	-	-
TG1@Diesel oil	Diesel oil	SING	6,550.0	-	380.3
TG2@Diesel oil	Diesel oil	SING	8,394.7	-	380.3
TG3@Diesel oil	Diesel oil	SING	4,064.1	-	285.7
TG3@Natural gas	Natural gas	SING	4,452.7	-	-
U12@Bituminous coal	Bituminous coal	SING	334,641.5	-	475.0
U13@Bituminous coal	Bituminous coal	SING	237,144.6	-	492.7
U14@Bituminous coal	Bituminous coal	SING	674,187.7	-	433.0
U15@Bituminous coal	Bituminous coal	SING	742,375.0	-	417.4
U16 TG@Diesel oil	Diesel oil	SING	1,796.5	-	163.8
U16 TG@Natural gas	Natural gas	SING	539,685.5	-	210.5
U16 TV@Natural gas	Natural gas	SING	227,127.9	-	210.5
U16 TG CP@Natural gas	Natural gas	SING	15,793.5	-	210.5
U16 TV CP@Natural gas	Natural gas	SING	6,739.3	-	210.5

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
U16 TG CP2@Natural gas	Natural gas	SING	1,800.3	-	210.5
U16 TV CP2@Natural gas	Natural gas	SING	771.1	-	210.5
MIMB2@Diesel oil	Diesel oil	SING	194.6	-	251.1
MIMB3@Diesel oil	Diesel oil	SING	159.7	-	251.1
MIMB4@Diesel oil	Diesel oil	SING	613.2	-	251.1
MIMB6@Diesel oil	Diesel oil	SING	211.0	-	251.1
MIMB8@Diesel oil	Diesel oil	SING	198.4	-	251.1
MIMB9@Diesel oil	Diesel oil	SING	510.7	-	251.1
UG1@Residual fuel oil	Residual fuel oil	SING	6,515.7	-	187.1
UG2@Residual fuel oil	Residual fuel oil	SING	6,437.3	-	189.0
UG3@Residual fuel oil	Residual fuel oil	SING	6,407.3	-	182.4
UG4@Residual fuel oil	Residual fuel oil	SING	6,434.7	-	185.2
UG5@Residual fuel oil	Residual fuel oil	SING	5,669.8	-	193.7
UG6@Residual fuel oil	Residual fuel oil	SING	7,114.4	-	189.9
ZOFRI 1@Diesel oil	Diesel oil	SING	33.8	-	220.8
ZOFRI 13@Diesel oil	Diesel oil	SING	187.6	-	218.3
ZOFRI 2@Diesel oil	Diesel oil	SING	110.9	-	218.2
ZOFRI 3@Diesel oil	Diesel oil	SING	119.6	-	218.2
ZOFRI 4@Diesel oil	Diesel oil	SING	124.9	-	218.2
ZOFRI 5@Diesel oil	Diesel oil	SING	66.4	-	218.2
ZOFRI 6@Diesel oil	Diesel oil	SING	48.1	-	193.9
ZOFRI 10@Diesel oil	Diesel oil	SING	89.3	-	206.7
ZOFRI 11@Diesel oil	Diesel oil	SING	8.2	-	206.7
ZOFRI 12@Diesel oil	Diesel oil	SING	95.4	-	206.7
ZOFRI 7@Diesel oil	Diesel oil	SING	92.5	-	206.7
ZOFRI 8@Diesel oil	Diesel oil	SING	92.6	-	206.7
ZOFRI 9@Diesel oil	Diesel oil	SING	92.4	-	206.7
Uribe@Solar	Solar	SING	143,921.8	-	-
CC1@Diesel oil	Diesel oil	SING	54,055.0	-	182.2
CC1@Natural gas	Natural gas	SING	16,571.8	-	203.3
CC2@Diesel oil	Diesel oil	SING	48,409.6	-	177.4
CC2@Natural gas	Natural gas	SING	3,281.0	-	203.3
CTTAR@Bituminous coal	Bituminous coal	SING	512,804.1	-	433.6
TGTAR@Diesel oil	Diesel oil	SING	4,479.9	-	395.2
Maria Elena@Solar	Solar	SING	190,845.5	-	-
G1A@Geothermal	Geothermal	SING	25,512.4	-	-
G2A@Geothermal	Geothermal	SING	38,277.5	-	-
Bolero@Solar	Solar	SING	195,682.4	-	-
CTH1@Bituminous coal	Bituminous coal	SING	1,032,790.0	-	401.2
INACAL@Diesel oil	Diesel oil	SING	891.5	-	227.6
PAM@Cogeneration	Cogeneration	SING	136,932.2	-	-
AGB@Diesel oil	Diesel oil	SING	367.2	-	231.0
Jama 1@Solar	Solar	SING	98,805.7	-	-

Power unit	Fuel	System	EG_y	Fuel Consumption (kg/y or m^3/y)	Specific Fuel Consumption (kg/MWh or m^3/MWh)
Jama 2@Solar	Solar	SING	68,559.0	-	-
PAS 2@Solar	Solar	SING	21,495.4	-	-
PAS 3@Solar	Solar	SING	45,928.2	-	-
Puerto Seco@Solar	Solar	SING	15,984.8	-	-
La Huayca II@Solar	Solar	SING	59,097.1	-	-
Kelar@Diesel oil	Diesel oil	SING	119,566.2	-	161.4
Kelar@Natural gas	Natural gas	SING	843,414.6	-	187.0
Portada@Diesel oil	Diesel oil	SING	408.5	-	208.7
Valle de los Vientos@Wind	Wind	SING	251,974.8	-	-
Calama Solar I@Solar	Solar	SING	10,344.0	-	-
CAVA@Run of the river	Run of the river	SING	14,895.1	-	-
MHAH@Run of the river	Run of the river	SING	6,220.0	-	-
MHSR@Run of the river	Run of the river	SING	3,262.0	-	-
MHT2@Run of the river	Run of the river	SING	6,214.8	-	-
Los Puquios@Solar	Solar	SING	2,422.2	-	-
PICA@Solar	Solar	SING	618.1	-	-
PAS 1@Solar	Solar	SING	22,136.3	-	-

Table 15. Build Margin Calculation Data

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL,m,y}$
Ancoa@Dam	2017	21,801.1	0.03161%	0.03161%	0.00000
Puerto Seco@Solar	2017	15,984.8	0.02317%	0.05478%	0.00000
U16 TG@Natural gas	2017	539,685.5	0.78239%	0.83717%	0.40228
U16 TV@Natural gas	2017	227,127.9	0.32927%	1.16644%	0.40228
U16 TG CP@Natural gas	2017	15,793.5	0.02290%	1.18934%	0.40228
U16 TV CP@Natural gas	2017	6,739.3	0.00977%	1.19911%	0.40228
U16 TG CP2@Natural gas	2017	1,800.3	0.00261%	1.20172%	0.40228
U16 TV CP2@Natural gas	2017	771.1	0.00112%	1.20284%	0.40228
Bolero@Solar	2017	195,682.4	0.28368%	1.48652%	0.00000
Uribe@Solar	2017	143,921.8	0.20865%	1.69517%	0.00000
Antay@Solar	2017	5,332.7	0.00773%	1.70290%	0.00000
Bellavista@Solar	2017	3,517.5	0.00510%	1.70800%	0.00000
Cuz Cuz@Solar	2017	1,853.5	0.00269%	1.71069%	0.00000
Dona Carmen@Solar	2017	11,577.3	0.01678%	1.72747%	0.00000
Dos Valles@Run of the River	2017	2,643.7	0.00383%	1.73130%	0.00000
El Nogal@Diesel Oil	2017	162.7	0.00024%	1.73154%	0.42155
El Pelicano@Solar	2017	87,171.7	0.12637%	1.85791%	0.00000
La Bifurcada@Run of the River	2017	224.7	0.00033%	1.85824%	0.00000
La Mina@Run of the River	2017	38,207.8	0.05539%	1.91363%	0.00000
La Quinta@Solar	2017	2,428.1	0.00352%	1.91715%	0.00000
La Viña-Alto La Viña@Run of the River	2017	532.1	0.00077%	1.91792%	0.00000
Las Turcas@Solar	2017	2,014.1	0.00292%	1.92084%	0.00000
Lebu III@Wind	2017	4,828.2	0.00700%	1.92784%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Lepanto@Biogas	2017	544.4	0.00079%	1.92863%	0.00000
Piloto Solar Cardones@Solar	2017	345.9	0.00050%	1.92913%	0.00000
Quilapilun@Solar	2017	191,196.5	0.27718%	2.20631%	0.00000
San Francisco@Solar	2017	2,462.7	0.00357%	2.20988%	0.00000
Valle de la Luna@Solar	2017	2,261.5	0.00328%	2.21316%	0.00000
Cerro Dominador@Solar	2017	99,073.3	0.14363%	2.35679%	0.00000
Sierra Gorda Este@Wind	2016	309,399.7	0.44854%	2.80533%	0.00000
Carilafquen@Run of the River	2016	61,461.6	0.08910%	2.89443%	0.00000
Cumpeo@Run of the River	2016	14,446.1	0.02094%	2.91538%	0.00000
Cordillerilla@Solar	2016	2,466.0	0.00358%	2.91895%	0.00000
El Colorado@Run of the River	2016	8,203.6	0.01189%	2.93084%	0.00000
Conejo@Solar	2016	238,500.2	0.34576%	3.27660%	0.00000
CCR2@Bituminous coal	2016	1,590,407.2	2.30564%	5.58225%	1.02013
Kelar@Diesel oil	2016	119,566.2	0.17334%	5.75558%	0.50792
Kelar@Natural gas	2016	843,414.6	1.22271%	6.97830%	0.35742
El Agrio@Run of the River	2016	9,648.4	0.01399%	6.99229%	0.00000
Chuchiñi@Solar	2016	5,594.3	0.00811%	7.00040%	0.00000
Andes 1@Residual Fuel Oil	2016	1,160.8	0.00168%	7.00208%	0.75955
Andes 2@Residual Fuel Oil	2016	1,135.7	0.00165%	7.00373%	0.75955
Andes 3@Residual Fuel Oil	2016	1,169.4	0.00170%	7.00542%	0.74678
Andes 4@Residual Fuel Oil	2016	1,721.6	0.00250%	7.00792%	0.77869
Pampa Camarones@Solar	2016	16,959.2	0.02459%	7.03250%	0.00000
UG1@Residual fuel oil	2016	6,515.7	0.00945%	7.04195%	0.58998
UG2@Residual fuel oil	2016	6,437.3	0.00933%	7.05128%	0.59594
UG3@Residual fuel oil	2016	6,407.3	0.00929%	7.06057%	0.57508
UG4@Residual fuel oil	2016	6,434.7	0.00933%	7.06990%	0.58402
UG5@Residual fuel oil	2016	5,669.8	0.00822%	7.07812%	0.61084
UG6@Residual fuel oil	2016	7,114.4	0.01031%	7.08843%	0.59892
CCR1@Bituminous coal	2016	1,687,604.7	2.44655%	9.53499%	1.00598
Jama 2@Solar	2016	68,559.0	0.09939%	9.63438%	0.00000
Finis Terrae@Solar	2016	399,970.2	0.57984%	10.21422%	0.00000
El Galpon@Run of the River	2016	6,477.0	0.00939%	10.22361%	0.00000
El Romero@Solar	2016	269,462.4	0.39064%	10.61426%	0.00000
Hormiga@Solar	2016	3,954.1	0.00573%	10.61999%	0.00000
La Chapeana@Solar	2016	2,997.4	0.00435%	10.62433%	0.00000
La Esperanza@Wind	2016	32,583.3	0.04724%	10.67157%	0.00000
La Montaña@Run of the River	2016	7,670.0	0.01112%	10.68269%	0.00000
La Silla@Solar	2016	4,453.5	0.00646%	10.68915%	0.00000
Las Araucarias@Solar	2016	176.0	0.00026%	10.68940%	0.00000
Las Mollacas@Solar	2016	2,937.0	0.00426%	10.69366%	0.00000
Los Bueno Aires@Wind	2016	78,512.1	0.11382%	10.80748%	0.00000
Los Loros@Solar	2016	26,190.1	0.03797%	10.84545%	0.00000
Malalcahuello@Run of the River	2016	21,333.6	0.03093%	10.87638%	0.00000
Pampa Solar Norte@Solar	2016	158,893.4	0.23035%	11.10673%	0.00000
San Juan@Wind	2016	564,278.7	0.81805%	11.92477%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
San Pedro II@Wind	2016	139,389.6	0.20208%	12.12685%	0.00000
Santa Julia@Solar	2016	7,147.0	0.01036%	12.13721%	0.00000
Til Til@Solar	2016	5,012.0	0.00727%	12.14448%	0.00000
Tranquil@Run of the River	2016	8,963.4	0.01299%	12.15747%	0.00000
Renaico@Wind	2016	275,960.7	0.40007%	12.55754%	0.00000
ZOFRI 1@Diesel oil	2015	33.8	0.00005%	12.55759%	0.69488
La Huayca II@Solar	2015	59,097.1	0.08567%	12.64326%	0.00000
PAS 1@Solar	2015	22,136.3	0.03209%	12.67535%	0.00000
Jama 1@Solar	2015	98,805.7	0.14324%	12.81859%	0.00000
Bureo@Run of the River	2015	9,339.5	0.01354%	12.83213%	0.00000
Carrera Pinto@Solar	2015	180,298.7	0.26138%	13.09351%	0.00000
Chañares@Solar	2015	82,077.5	0.11899%	13.21250%	0.00000
CMPC Cordillera@Natural Gas	2015	164,154.9	0.23798%	13.45048%	0.21406
CMPC Laja@Biomass	2015	107,526.2	0.15588%	13.60636%	0.00000
CMPC Tissue@Natural Gas	2015	11,680.8	0.01693%	13.62330%	0.58048
El Mirador@Run of the River	2015	2,304.3	0.00334%	13.62664%	0.00000
El Paso@Run of the River	2015	120,508.0	0.17470%	13.80134%	0.00000
El Pilar-Los Amarillos@Solar	2015	150.1	0.00022%	13.80156%	0.00000
Guacolda 5@Bituminous Coal	2015	838,958.8	1.21626%	15.01781%	0.95688
Itata@Run of the River	2015	60,649.6	0.08792%	15.10574%	0.00000
Javiera@Solar	2015	141,511.5	0.20515%	15.31089%	0.00000
Lagunilla@Solar	2015	376.7	0.00055%	15.31144%	0.00000
Lalackama 2@Solar	2015	37,672.0	0.05461%	15.36605%	0.00000
Lalackama@Solar	2015	126,123.6	0.18284%	15.54890%	0.00000
Las Flores@Run of the River	2015	13,842.2	0.02007%	15.56896%	0.00000
Lautaro Comasa 2@Biomass	2015	134,612.8	0.19515%	15.76411%	0.00000
Lleuquereo@Run of the River	2015	8,555.6	0.01240%	15.77652%	0.00000
Loma Los Colorados@Solar	2015	1,507.8	0.00219%	15.77870%	0.00000
Los Guindos@Diesel Oil	2015	7,301.6	0.01059%	15.78929%	0.76894
Luna@Solar	2015	5,612.2	0.00814%	15.79742%	0.00000
Luz del Norte@Solar	2015	300,353.5	0.43543%	16.23285%	0.00000
Munilque 1@Run of the River	2015	3,169.5	0.00459%	16.23745%	0.00000
Munilque 2@Run of the River	2015	3,386.5	0.00491%	16.24236%	0.00000
Pulelfu@Run of the River	2015	62,368.1	0.09042%	16.33277%	0.00000
PV Salvador@Solar	2015	156,599.5	0.22703%	16.55980%	0.00000
Rio Mulchen@Run of the River	2015	7,607.8	0.01103%	16.57083%	0.00000
Sol@Solar	2015	5,457.6	0.00791%	16.57874%	0.00000
Talinay Poniente@Wind	2015	176,773.5	0.25627%	16.83501%	0.00000
Taltal@Wind	2015	295,671.1	0.42864%	17.26365%	0.00000
Trailelfu@Run of the River	2015	10,177.3	0.01475%	17.27841%	0.00000
Los Puquios@Solar	2015	2,422.2	0.00351%	17.28192%	0.00000
Maria Elena@Solar	23/11/2014	190,845.5	0.27667%	17.55859%	0.00000
MHSR@Run of the river	21/11/2014	3,262.0	0.00473%	17.56332%	0.00000
Maria Elena@Run of the River	14/11/2014	0.7	0.00000%	17.56332%	0.00000
Collil@Run of the River	11/11/2014	28,664.5	0.04156%	17.60488%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Ucuquer 2@Wind	22/10/2014	27,841.5	0.04036%	17.64524%	0.00000
San Lorenzo 3@Diesel Oil	17/09/2014	116.3	0.00017%	17.64541%	0.90963
Las Terrazas@Solar	28/08/2014	2,578.9	0.00374%	17.64914%	0.00000
Pichilonco@Run of the River	18/08/2014	5,570.2	0.00808%	17.65722%	0.00000
Portada@Diesel oil	09/08/2014	408.5	0.00059%	17.65781%	0.65701
Los Cururos@Wind	23/07/2014	230,007.0	0.33345%	17.99126%	0.00000
PSF Lomas Coloradas@Solar	19/06/2014	4,400.4	0.00638%	17.99764%	0.00000
PSF Pama@Solar	19/06/2014	4,126.6	0.00598%	18.00362%	0.00000
Los Padres@Run of the River	22/05/2014	8,228.0	0.01193%	18.01555%	0.00000
Boquiamargo@Run of the River	19/05/2014	418.7	0.00061%	18.01615%	0.00000
Quillaileo@Run of the River	09/05/2014	1,651.7	0.00239%	18.01855%	0.00000
CMPC Pacifico@Biomass	01/05/2014	176,945.9	0.25652%	18.27507%	0.00000
Llano de Llampos@Solar	30/04/2014	234,668.1	0.34020%	18.61527%	0.00000
San Andres@Solar	30/04/2014	61,750.4	0.08952%	18.70480%	0.00000
Angostura@Dam	25/04/2014	1,097,449.0	1.59099%	20.29579%	0.00000
Energia Pacifico@Biomass	01/04/2014	118,131.1	0.17126%	20.46705%	0.00000
Santa Marta@Biomass	31/03/2014	74,876.7	0.10855%	20.57560%	0.00000
Techos de Altamira@Solar	28/03/2014	111.1	0.00016%	20.57576%	0.00000
PAS 3@Solar	21/03/2014	45,928.2	0.06658%	20.64234%	0.00000
PAS 2@Solar	09/03/2014	21,495.4	0.03116%	20.67350%	0.00000
Coelemu@Biomass	04/03/2014	33,465.3	0.04852%	20.72202%	0.00000
El Llano@Run of the River	2013	5,055.8	0.00733%	20.72935%	0.00000
Las Vertientes@Run of the River	2013	10,588.9	0.01535%	20.74470%	0.00000
Esperanza@Solar	2013	119.7	0.00017%	20.74487%	0.00000
Santa Cecilia@Solar	2013	5,608.3	0.00813%	20.75300%	0.00000
Maisan@Run of the River	2013	1,785.6	0.00259%	20.75559%	0.00000
Las Pampas@Biomass	2013	2,123.3	0.00308%	20.75867%	0.00000
Rio Huasco@Run of the River	2013	45,141.6	0.06544%	20.82411%	0.00000
Estancilla@Diesel Oil	2013	253.0	0.00037%	20.82448%	0.71764
Renaico@Run of the River	2013	44,043.7	0.06385%	20.88833%	0.00000
Santa Irene@Biomass	2013	2,002.3	0.00290%	20.89123%	0.00000
Los Alamos@Diesel Oil	2013	0.7	0.00000%	20.89123%	0.76044
El Águila I@Solar	2013	3,713.0	0.00538%	20.89662%	0.00000
Viñales@Biomass	2013	221,109.6	0.32055%	21.21716%	0.00000
Cholguan@Biomass	2013	67,701.0	0.09815%	21.31531%	0.00000
ZOFRI 13@Diesel oil	2013	187.6	0.00027%	21.31558%	0.68711
AGB@Diesel oil	2013	367.2	0.00053%	21.31611%	0.72714
Don Walterio@Run of the River	2013	12.4	0.00002%	21.31613%	0.00000
Campiche@Petcoke	2013	1,822,943.0	2.64276%	23.95889%	0.87709
Los Corrales 2@Run of the River	2013	4,978.5	0.00722%	23.96611%	0.00000
Ucuquer@Wind	2013	21,009.6	0.03046%	23.99656%	0.00000
Alto Renaico@Run of the River	2013	9,016.1	0.01307%	24.00963%	0.00000
Rucatayo@Dam	2012	304,072.8	0.44082%	24.45046%	0.00000
Bocamina 2@Bituminous Coal	2012	1,842,273.0	2.67078%	27.12123%	0.94149
Santa Fe@Biomass	2012	378,976.9	0.54941%	27.67064%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Biocruz@Natural Gas	2012	111.3	0.00016%	27.67081%	0.64314
Santa Maria@Bituminous Coal	2012	2,716,160.0	3.93767%	31.60848%	0.87714
El Canelo@Run of the River	2012	17,936.6	0.02600%	31.63448%	0.00000
Purisima@Run of the River	2012	2,281.9	0.00331%	31.63779%	0.00000
Trebal Mapocho@Biomass	2012	49,270.2	0.07143%	31.70922%	0.00000
Trongol-Curanilahue@Diesel Oil	2012	3.6	0.00001%	31.70922%	0.72267
CTA1@Bituminous coal	2011	1,078,733.0	1.56386%	33.27308%	0.96636
ANG2@Bituminous coal	2011	1,886,485.1	2.73487%	36.00796%	0.98728
CTH1@Bituminous coal	2011	1,032,790.0	1.49726%	37.50521%	0.99969
Calle-Calle@Diesel Oil	2011	586.1	0.00085%	37.50606%	0.71811
Confluencia@Run of the River	2011	24,475.7	0.03548%	37.54154%	0.00000
Diuto@Run of the River	2011	15,892.2	0.02304%	37.56458%	0.00000
Donguil@Run of the River	2011	1,337.9	0.00194%	37.56652%	0.00000
Lonquimay@Diesel Oil	2011	385.6	0.00056%	37.56708%	0.84102
Mallarauco@Run of the River	2011	26,051.6	0.03777%	37.60485%	0.00000
Mariposas@Run of the River	2011	26,411.6	0.03829%	37.64314%	0.00000
Muchi@Run of the River	2011	3,110.8	0.00451%	37.64765%	0.00000
Punta Colorada@Wind	2011	7,887.9	0.01144%	37.65908%	0.00000
Reca@Run of the River	2011	8,687.2	0.01259%	37.67168%	0.00000
Tirua@Diesel Oil	2011	48.8	0.00007%	37.67175%	0.84102
ANG1@Bituminous coal	2010	1,944,535.4	2.81903%	40.49078%	0.98383
MHAH@Run of the river	2010	6,220.0	0.00902%	40.49980%	0.00000
MHT2@Run of the river	2010	6,214.8	0.00901%	40.50881%	0.00000
Cem Bio Bio@Residual Fuel Oil	2010	8,259.2	0.01197%	40.52078%	0.68738
Colihues@Diesel Oil	2010	6.1	0.00001%	40.52079%	0.67357
Colihues@Residual Fuel Oil	2010	15,765.4	0.02286%	40.54364%	0.67477
Dona Hilda@Run of the River	2010	856.2	0.00124%	40.54489%	0.00000
El Salvador@Diesel Oil	2010	283.3	0.00041%	40.54530%	1.06072
Emelda 1@Diesel Oil	2010	282.0	0.00041%	40.54571%	0.91908
Emelda 2@Diesel Oil	2010	242.2	0.00035%	40.54606%	0.98832
Guacolda 4@Bituminous Coal	2010	821,189.0	1.19049%	41.73655%	0.95688
Juncalito@Run of the River	2010	1,946.8	0.00282%	41.73937%	0.00000
Los Corrales 1@Run of the River	2010	6,134.5	0.00889%	41.74827%	0.00000
Nueva Ventanas@Bituminous Coal	2010	1,927,212.0	2.79392%	44.54218%	0.94691
Punta Colorada@Diesel Oil	2010	73.5	0.00011%	44.54229%	0.43560
Punta Colorada@Residual Fuel Oil	2010	89.1	0.00013%	44.54242%	0.69054
San Lorenzo 2@Diesel Oil	2010	343.3	0.00050%	44.54292%	1.19732
Yungay 4@Diesel Oil	2010	546.3	0.00079%	44.54371%	0.93481
ZOFRI 10@Diesel oil	2009	89.3	0.00013%	44.54384%	0.65047
ZOFRI 11@Diesel oil	2009	8.2	0.00001%	44.54385%	0.65047
ZOFRI 12@Diesel oil	2009	95.4	0.00014%	44.54399%	0.65047
ZOFRI 7@Diesel oil	2009	92.5	0.00013%	44.54412%	0.65047
ZOFRI 8@Diesel oil	2009	92.6	0.00013%	44.54426%	0.65047
ZOFRI 9@Diesel oil	2009	92.4	0.00013%	44.54439%	0.65047
INACAL@Diesel oil	2009	891.5	0.00129%	44.54568%	0.71633

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL,m,y}$
Cardones@Diesel Oil	2009	5,986.5	0.00868%	44.55436%	0.72863
Cenizas@Diesel Oil	2009	274.0	0.00040%	44.55476%	0.72487
El Peñon@Diesel Oil	2009	10,578.7	0.01534%	44.57009%	0.69025
Guacolda 3@Bituminous Coal	2009	708,800.2	1.02756%	45.59766%	0.95190
Linares Norte@Diesel Oil	2009	8.7	0.00001%	45.59767%	0.59105
Los Espinos@Diesel Oil	2009	726.6	0.00105%	45.59872%	0.69560
Los Pinos@Diesel Oil	2009	70,331.0	0.10196%	45.70068%	0.61249
Newen@Diesel Oil	2009	654.4	0.00095%	45.70163%	0.75814
Newen@Natural Gas	2009	6,392.4	0.00927%	45.71090%	0.31529
Newen@Propane Gas	2009	257.4	0.00037%	45.71127%	0.35768
Pehui@Run of the River	2009	6.1	0.00001%	45.71128%	0.00000
Quintero 1@LNG	2009	215,368.0	0.31222%	46.02350%	0.60675
Quintero 2@LNG	2009	195,539.0	0.28348%	46.30698%	0.60675
San Gregorio@Diesel Oil	2009	0.3	0.00000%	46.30698%	0.59105
San Lorenzo 1@Diesel Oil	2009	392.8	0.00057%	46.30755%	1.07645
Santa Lidia@Diesel Oil	2009	921.1	0.00134%	46.30889%	0.83095
Tapihue@Natural Gas	2009	13.6	0.00002%	46.30890%	0.56000
Teno@Diesel Oil	2009	21,184.5	0.03071%	46.33962%	0.69025
Termopacifico@Diesel Oil	2009	3,585.9	0.00520%	46.34482%	1.47725
Trapen@Diesel Oil	2009	14,769.7	0.02141%	46.36623%	0.69025
Truful Truful@Run of the River	2009	4,959.6	0.00719%	46.37342%	0.00000
Chiloe@Diesel Oil	2008	3.5	0.00001%	46.37342%	0.88680
Chuyaca@Diesel Oil	2008	29.8	0.00004%	46.37347%	0.79790
Colmito@Diesel Oil	2008	6,638.9	0.00962%	46.38309%	0.78147
Colmito@LNG	2008	6,013.8	0.00872%	46.39181%	0.50345
Coya@Run of the River	2008	55,735.0	0.08080%	46.47261%	0.00000
El Totoral@Diesel Oil	2008	97.9	0.00014%	46.47275%	0.62476
Nueva Aldea 3@Biomass	2008	268,920.8	0.38986%	46.86261%	0.00000
Olivos@Diesel Oil	2008	63.7	0.00009%	46.86270%	0.72708
Placilla@Diesel Oil	2008	18.8	0.00003%	46.86273%	0.74376
Quellon 2@Diesel Oil	2008	160.4	0.00023%	46.86296%	0.79790
Quintay@Diesel Oil	2008	23.5	0.00003%	46.86300%	0.62476
San Isidro 2@Diesel Oil	2008	2,743.0	0.00398%	46.86697%	0.58361
San Isidro 2@LNG	2008	2,304,228.0	3.34048%	50.20746%	0.38772
Yungay 3@Diesel Oil	2008	427.9	0.00062%	50.20808%	0.86242
ZOFRI 6@Diesel oil	2007	48.1	0.00007%	50.20815%	0.61028
ZOFRI 2@Diesel oil	2007	110.9	0.00016%	50.20831%	0.68680
ZOFRI 3@Diesel oil	2007	119.6	0.00017%	50.20848%	0.68680
ZOFRI 4@Diesel oil	2007	124.9	0.00018%	50.20866%	0.68680
ZOFRI 5@Diesel oil	2007	66.4	0.00010%	50.20876%	0.68680
Cañete@Diesel Oil	2007	90.1	0.00013%	50.20889%	0.76044
Casablanca 1@Diesel Oil	2007	4.3	0.00001%	50.20890%	0.72863
Chiburgo@Run of the River	2007	60,115.0	0.08715%	50.29605%	0.00000
Chufken@Diesel Oil	2007	70.7	0.00010%	50.29615%	0.76044
Concon@Diesel Oil	2007	6.5	0.00001%	50.29616%	0.63824

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Constitucion@Biomass	2007	36,419.5	0.05280%	50.34896%	0.00000
Constitucion@Diesel Oil	2007	2,689.1	0.00390%	50.35285%	0.88680
Curacautin@Diesel Oil	2007	194.7	0.00028%	50.35314%	0.69376
Curauma@Diesel Oil	2007	1.6	0.00000%	50.35314%	0.61205
Degan@Diesel Oil	2007	2,776.2	0.00402%	50.35716%	0.68850
El Rincon@Run of the River	2007	1,991.4	0.00289%	50.36005%	0.00000
Esperanza 1@Diesel Oil	2007	39.3	0.00006%	50.36011%	1.05757
Esperanza 2@Diesel Oil	2007	95.1	0.00014%	50.36024%	0.59488
Esperanza TG@Diesel Oil	2007	250.3	0.00036%	50.36061%	0.58695
Eyzaguirre@Run of the River	2007	6,043.4	0.00876%	50.36937%	0.00000
Las Vegas@Diesel Oil	2007	8.0	0.00001%	50.36938%	0.75981
Lebu@Diesel Oil	2007	61.9	0.00009%	50.36947%	0.76044
Los Vientos TG@Diesel Oil	2007	18,005.7	0.02610%	50.39557%	0.84039
Maule@Diesel Oil	2007	393.0	0.00057%	50.39614%	0.88680
Palmucho@Run of the River	2007	219,208.0	0.31779%	50.71393%	0.00000
Yungay 1@Diesel Oil	2007	350.4	0.00051%	50.71444%	0.88131
Yungay 2@Diesel Oil	2007	484.1	0.00070%	50.71514%	0.79318
Nueva Aldea 2@Diesel Oil	2006	18.5	0.00003%	50.71517%	0.43560
Antilhue TG@Diesel Oil	2005	42,830.0	0.06209%	50.77726%	0.73909
Candelaria 1@Diesel Oil	2005	34,050.0	0.04936%	50.82662%	0.86881
Candelaria 1@LNG	2005	60,469.6	0.08766%	50.91429%	0.60090
Candelaria 2@Diesel Oil	2005	39,707.0	0.05756%	50.97185%	0.86881
Candelaria 2@LNG	2005	55,165.0	0.07997%	51.05183%	0.60090
Coronel@Diesel Oil	2005	9,967.3	0.01445%	51.06628%	0.71811
Coronel@Natural Gas	2005	6,260.7	0.00908%	51.07535%	0.32580
Horcones@Diesel Oil	2004	437.3	0.00063%	51.07599%	1.09219
Laguna Verde TG@Diesel Oil	2004	455.0	0.00066%	51.07665%	0.83095
Licanten@Biomass	2004	17,981.3	0.02607%	51.10271%	0.00000
Nehuenco 2@LNG	2004	1,765,347.0	2.55926%	53.66197%	0.38327
Ralco@Dam	2004	1,990,268.0	2.88533%	56.54730%	0.00000
Valdivia@Residual Fuel Oil	2004	3,047.6	0.00442%	56.55172%	0.45300
Nehuenco 2@Diesel Oil	2003	15,649.0	0.02269%	56.57441%	0.51134
Nehuenco 9B@Diesel Oil	2002	802.0	0.00116%	56.57557%	0.88390
Nehuenco 9B@LNG	2002	2,191.0	0.00318%	56.57875%	0.32580
U16 TG@Diesel oil	2000	1,796.5	0.00260%	56.58135%	0.51556
Mampil@Run of the River	2000	152,528.7	0.22112%	56.80247%	0.00000
Peuchen@Run of the River	2000	202,552.4	0.29364%	57.09612%	0.00000
Tal Tal 1@Diesel Oil	2000	46,010.0	0.06670%	57.16282%	0.79947
Tal Tal 1@LNG	2000	80,980.0	0.11740%	57.28022%	0.57911
Tal Tal 1@Natural Gas	2000	1.0	0.00000%	57.28022%	0.54634
Tal Tal 2@Diesel Oil	2000	6,277.0	0.00910%	57.28932%	0.79947
Tal Tal 2@LNG	2000	38,802.0	0.05625%	57.34557%	0.54634
CC1@Diesel oil	1999	54,055.0	0.07836%	57.42394%	0.57343
CC1@Natural gas	1999	16,571.8	0.02402%	57.44796%	0.38856
CC2@Diesel oil	1999	48,409.6	0.07018%	57.51814%	0.55828

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL,m,y}$
CC2@Natural gas	1999	3,281.0	0.00476%	57.52290%	0.38856
NTO1@Bituminous coal	1999	964,138.8	1.39773%	58.92063%	1.04572
NTO2@Bituminous coal	1999	1,000,118.2	1.44989%	60.37052%	1.01517
TG1@Diesel oil	1999	6,550.0	0.00950%	60.38002%	1.19711
TG2@Diesel oil	1999	8,394.7	0.01217%	60.39219%	1.19711
TG3@Diesel oil	1999	4,064.1	0.00589%	60.39808%	0.89924
TG3@Natural gas	1999	4,452.7	0.00646%	60.40453%	0.42496
U15@Bituminous coal	1999	742,375.0	1.07624%	61.48077%	1.04005
MIMB2@Diesel oil	1999	194.6	0.00028%	61.48105%	0.79038
MIMB3@Diesel oil	1999	159.7	0.00023%	61.48128%	0.79038
MIMB4@Diesel oil	1999	613.2	0.00089%	61.48217%	0.79038
MIMB6@Diesel oil	1999	211.0	0.00031%	61.48248%	0.79038
MIMB8@Diesel oil	1999	198.4	0.00029%	61.48276%	0.79038
MIMB9@Diesel oil	1999	510.7	0.00074%	61.48350%	0.79038
CTTAR@Bituminous coal	1999	512,804.1	0.74342%	62.22693%	1.08042
TGTAR@Diesel oil	1999	4,479.9	0.00649%	62.23342%	1.24404
Nehuenco 1@Diesel Oil	1998	2,722.0	0.00395%	62.23737%	0.51203
Nehuenco 1@LNG	1998	1,895,823.0	2.74841%	64.98578%	0.41730
Petropower@Petcoke	1998	436,012.6	0.63210%	65.61787%	0.64878
Rucue@Run of the River	1998	686,588.0	0.99536%	66.61323%	0.00000
San Isidro 1@Diesel Oil	1998	5,594.0	0.00811%	66.62134%	0.57470
San Isidro 1@LNG	1998	1,638,181.0	2.37490%	68.99625%	0.37271
Loma Alta@Run of the River	1997	149,196.5	0.21629%	69.21254%	0.00000
Nueva Renca@Diesel Oil	1997	132,561.0	0.19218%	69.40472%	0.53823
Nueva Renca@LNG	1997	1,693,681.0	2.45536%	71.86008%	0.37652
Nueva Renca@LPG	1997	7,356.0	0.01066%	71.87074%	0.48209
Puntilla@Run of the River	1997	129,639.3	0.18794%	72.05868%	0.00000
Arauco@Biomass	1996	43,825.6	0.06353%	72.12222%	0.00000
Guacolda 2@Bituminous Coal	1996	543,222.8	0.78752%	72.90974%	0.98928
Pangue@Dam	1996	1,451,679.0	2.10453%	75.01427%	0.00000
Capullo@Run of the River	1995	79,428.2	0.11515%	75.12942%	0.00000
Guacolda 1@Bituminous Coal	1995	665,758.0	0.96516%	76.09458%	0.98678
Laja@Biomass	1995	28,771.0	0.04171%	76.13629%	0.00000
CTM1@Bituminous coal	1995	401,781.0	0.58247%	76.71876%	1.17575
CTM2@Bituminous coal	1995	666,105.0	0.96567%	77.68442%	1.04791
CTM3 TG@Diesel oil	1995	3,842.0	0.00557%	77.68999%	0.65631
CTM3 TG@Natural gas	1995	161,799.0	0.23456%	77.92456%	0.41982
CTM3 TV@Diesel oil	1995	1,142.0	0.00166%	77.92621%	0.65631
CTM3 TV@Natural gas	1995	87,684.0	0.12712%	78.05333%	0.41982
CTM3 TG CP@Natural gas	1995	956.0	0.00139%	78.05472%	0.39853
CTM3 TV CP@Natural gas	1995	487.0	0.00071%	78.05542%	0.41982
CAVA@Run of the river	1995	14,895.1	0.02159%	78.07701%	0.00000
Aconcagua UJuncal@Run of the River	1994	121,936.8	0.17677%	78.25379%	0.00000
Aconcagua UBlanco@Run of the River	1993	222,674.3	0.32282%	78.57660%	0.00000
Curillinque@Run of the River	1993	372,757.0	0.54039%	79.11700%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Alfalfal@Run of the River	1991	771,286.1	1.11815%	80.23515%	0.00000
CMPC Santa Fe@Biomass	1991	31,751.7	0.04603%	80.28118%	0.00000
Pehuenche@Dam	1991	1,915,665.0	2.77718%	83.05835%	0.00000
Canutillar@Dam	1990	920,834.0	1.33495%	84.39331%	0.00000
U14@Bituminous coal	1987	674,187.7	0.97738%	85.37069%	1.07890
Colbun@Dam	1985	1,390,306.0	2.01555%	87.38624%	0.00000
Machicura@Dam	1985	304,707.0	0.44174%	87.82798%	0.00000
U13@Bituminous coal	1985	237,144.6	0.34379%	88.17178%	1.22781
U12@Bituminous coal	1983	334,641.5	0.48514%	88.65691%	1.18375
Antuco@Dam	1981	1,171,680.0	1.69861%	90.35552%	0.00000
Diego de Almagro@Diesel Oil	1981	449.0	0.00065%	90.35617%	1.06072
Diego de Almagro@Solar	1981	58,925.5	0.08543%	90.44160%	0.00000
Huasco TG@Residual Fuel Oil	1979	8.0	0.00001%	90.44161%	1.09729
Huasco TG@Diesel Oil	1977	528.0	0.00077%	90.44237%	1.09534
Ventanas 2@Bituminous Coal	1977	1,059,302.0	1.53569%	91.97806%	0.98928
El Toro@Dam	1973	678,051.0	0.98298%	92.96105%	0.00000
GMAR1@Diesel oil	1973	805.2	0.00117%	92.96221%	0.77949
Bocamina 1@Bituminous Coal	1970	655,946.0	0.95094%	93.91315%	0.94691
Rapel@Dam	1968	623,718.0	0.90422%	94.81737%	0.00000
CHAP1@Run of the river	1967	37,947.5	0.05501%	94.87238%	0.00000
M2AR1@Diesel oil	1964	168.0	0.00024%	94.87262%	0.79504
Isla@Run of the River	1963	336,979.1	0.48853%	95.36115%	0.00000
Auxiliar del Maipo@Run of the River	1962	34,545.6	0.05008%	95.41123%	0.00000
Pullinque@Run of the River	1962	208,641.3	0.30247%	95.71370%	0.00000
Renca 1@Diesel Oil	1962	951.2	0.00138%	95.71508%	1.14885
Renca 2@Diesel Oil	1962	741.2	0.00107%	95.71616%	1.14885
Riñinahue@Run of the River	1962	6,263.8	0.00908%	95.72524%	0.00000
Rio Colorado@Run of the River	1962	48,491.5	0.07030%	95.79554%	0.00000
San Ignacio@Run of the River	1962	121,213.5	0.17573%	95.97126%	0.00000
Sauzalito@Run of the River	1959	70,526.0	0.10224%	96.07350%	0.00000
Cipreses@Dam	1955	148,098.0	0.21470%	96.28821%	0.00000
M1AR1@Diesel oil	1953	302.8	0.00044%	96.28864%	0.79753
Los Molles@Run of the River	1952	68,563.3	0.09940%	96.38804%	0.00000
Laguna Verde TV@Diesel Oil	1949	193.0	0.00028%	96.38832%	1.29678
Abanico@Run of the River	1948	234,034.0	0.33928%	96.72761%	0.00000
Sauzal 50Hz@Run of the River	1948	270,291.0	0.39185%	97.11945%	0.00000
Sauzal 60Hz@Run of the River	1948	90,850.8	0.13171%	97.25116%	0.00000
Los Bajos@Run of the River	1944	40,115.9	0.05816%	97.30932%	0.00000
Pilmaiquen@Run of the River	1944	278,030.3	0.40307%	97.71238%	0.00000
Volcan@Run of the River	1944	97,645.0	0.14156%	97.85394%	0.00000
Carena@Run of the River	1943	69,138.8	0.10023%	97.95417%	0.00000
Los Quilos@Run of the River	1943	224,156.9	0.32496%	98.27914%	0.00000
Los Morros@Run of the River	1930	16,531.2	0.02397%	98.30310%	0.00000
Queltehues@Run of the River	1928	341,056.0	0.49444%	98.79754%	0.00000
Maitenes@Run of the River	1923	103,457.5	0.14998%	98.94752%	0.00000

Power Unit	Start Year	EG_{2017}	% EG	% Accumulated	$EF_{EL.m.y}$
Florida 1@Run of the River	1909	1,317.3	0.00191%	98.94943%	0.00000
Florida 2@Run of the River	1909	89,920.2	0.13036%	99.07979%	0.00000
Florida 3@Run of the River	1909	18,054.4	0.02617%	99.10597%	0.00000
Sauce Andes@Run of the River	1909	1,856.0	0.00269%	99.10866%	0.00000
Ventanas 1@Bituminous Coal	1905	614,839.0	0.89134%	100.00000%	1.03413

Table 16. Fossil Fuel Data

Fuel type i	CO_2 Emission Factor $EF_{CO2,i,y}$; $EF_{CO2,m,i,y}$; $EF_{CO2,k,i,y}$ [tCO_2/GJ]	Gross calorific Value $GCV_{i,y}$ [Kcal/Kg; Kcal/m^3 (gas)]	GCV to NCV conversion factor according to IPCC guidelines	Net Calorific Value $NCV_{i,y}$ [GJ/kg; GJ/m^3 (gas)]
Coal	0.0895	7,000	0.95	0.027842
Diesel	0.0726	10,900	0.95	0.043354
Natural Gas	0.0543	9,341	0.90	0.035198
IFO 180	0.0755	10,500	0.95	0.041763
Residual Fuel Oil	0.0755	10,500	0.95	0.041763
LPG	0.0616	12,100	0.90	0.045594

Appendix 5. Further background information on monitoring plan

All related information is provided in the PDD.

Appendix 6. Summary report of comments received from local stakeholders

All information is provided in the PDD.

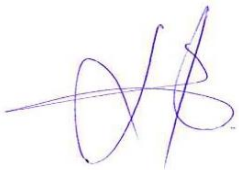
Appendix 7. Summary of post-registration changes

Not applicable.

Validation report form for renewal of crediting period for CDM project activities

(Version 02.0)

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

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	San Clemente Hydroelectric Power Plant Ref number: 4800
Number and duration of the next crediting period	2 (01/11/2018 – 31/10/2025)
Version number of the validation report for RCP	02
Completion date of the validation report for RCP	18/09/2018
Version number of PDD to which this report applies	2
Project participant(s)	Colbún S.A
Host Party	Chile
Applied methodologies and standardized baselines	AMS-I.D.: Grid connected renewable electricity generation - Version 18.0
Mandatory sectoral scopes linked to the applied methodologies	Sectoral scope: 1 (Energy industries (renewable - / non-renewable sources)
Conditional sectoral scopes linked to the applied methodologies	NA
Estimated annual average GHG emission reductions or net anthropogenic GHG removals in the next crediting period	12,620 tCO_2e
Name and UNFCCC reference number of the DOE:	AENOR INTERNACIONAL, S.A.U. (AENOR)- 0021
Name, position and signature of the approver of the validation report for RCP	

	Jose Luis Fuentes Climate Change Manager

SECTION A. Executive summary

>> AENOR has been contracted by Colbún S.A. as a project participant, to undertake the validation for the renewal of the crediting period for the CDM project activity "San Clemente Hydroelectric Power Plant". The validation has been performed through a process of document review based on the PDD Version 1.0, dated 12/02/2018, initially submitted for validation and the subsequent revisions, follow-up email interviews with the stakeholders, resolution of outstanding issues and issuance of the validation report for RCP.

The San Clemente hydroelectric power plant (the Project), developed by Colbún S.A., is a run-of-river hydroelectric power plant of 5.5 MW nominal capacity, which utilizes the water of the Sanatorio brook. The project uses water from the Maitenes (or Taco General) irrigation system, which is conducted at the exit of the Maitenes tunnel. The water of the irrigation system is supplied by the Colbún reservoir[1].

The project diverts a nominal flow of 17 m^3/s to a Kaplan turbine and the turbinated water is returned to the Sanatorio Brook 2 km downstream. A 66 kV transmission line delivers the energy production to the Chiburgo substation, where is injected to the grid.

The project started operations in September 2010, when the energy started being delivered to the Grid, displacing energy partially generated by fossil fuel-fired power plants and reducing GHG emissions. The project will generate 28,470 MWh per year that will be supplied to the grid, which provides electricity to 93% of Chilean population. The project displaces electricity generated by fossil fuel-fired power plants, avoiding GHG emissions estimated in 12,620 tCO2e per year and 88,340 tCO2e in the second crediting period.

The project is located in the San Clemente commune, Talca Province, VII Region of Maule, about 33km south east of the city of Talca, in an area known as Sanatorio, close to the north bank of the Maule River and downstream from the Colbún reservoir.

The project activity was registered with reference number 4800 on 22/09/2011 as a CDM project with a renewable 7 years crediting period. Then, the first crediting period is from 01/11/2011 to 31/10/2018. Therefore; the second crediting period will be from 01/11/2018 to 31/10/2025.

Scope of the Validation

The scope of the validation is to assess all aspects described in the CDM Project Standard version 01.0 /1/ related to the purpose of renewal of the crediting period project relating to the baseline, estimated emissions reductions and the monitoring plan using an approved baseline and monitoring methodology.

The following documents were reviewed as part of the scope of the activity:

- The initial version of the updated PDD /2/, including baseline study and Monitoring Plan.
- Approved Methodology: AMS-I.D.: Grid connected renewable electricity generation - Version 18.0 /3/
- Decision 3/CMP.1 and relevant decisions and guidelines from the EB
- CDM Validation and Verification Standard for project activities, version 01.0 /4/
- CDM project cycle procedure for project activities 01.0 /5/

[1] Upstream the project activity there is an existing reservoir named "Embalse Colbún", which was constructed for the operation of "Colbún Power Plant" (474 MW, operating since 1985). The reservoir has a capacity of 1,116,000 m3, equivalent to 552,000 MWh. The regulation of the reservoir is made in order to optimize the power generation at "Colbún Power Plant" and has no relation with the project activity.

- CDM project standard for project activities 01.0. /1/.
- Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” version 03.0.1 /6/.
- Tool to calculate the emission factor for an electricity system version 07.0. /7/
- •• Associated documentation (EF calculation, etc.)

The validation scope is defined as an independent and objective review of the PDD, the project’s baseline study and monitoring plan, and other relevant documents. The information in these documents is reviewed against Kyoto Protocol requirements, UNFCCC rules and associated interpretations. AENOR, based on the Specific Instruction for the Validation, verification and certification of clean development mechanism (CDM) project activities (IE/DTC/0039) /9/, has used a risk-based approach in the validation, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consultancy services to the Client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the PDD.

Validation Process

The project validation assessment for renewal of crediting period aims to be a risk-based approach and is based on the methodology developed in the CDM Validation and Verification Standard, an initiative of Designated and Applicant Entities, which aims to harmonise the approach and quality of all such assessments.

The validation for the renewal of the crediting period began in 19/02/2018 when the PP provided the initial version of the PDD, and was concluded in October 2018, with the submission of the final validation report for RCP. The validation was performed in the manner of an audit, where, a desk review of the PDD was undertaken against the latest version of the approved methodology and CDM and other relevant criteria applying to the project.

As a final step of the validation, the validation report for RCP and the protocol have to undergo internal quality control by means of a technical review following the procedures of AENOR. The technical reviewer is a competent person from AENOR, independent of the team that carried out the validation of the project activity.

In order to ensure transparency, a validation protocol was customised for the project, according to Specific Instruction IE-DCT-039. The protocol shows, in a transparent manner, criteria (requirements), means of validation and the results derived from validating the identified criteria.

The validation protocol serves the following purposes:

- It organises, provides details and clarifies the requirements a CDM project is expected to meet.
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The Project Design Document submitted by the PP was reviewed against the approved methodology and against CDM and other relevant criteria. Additional background documents related to the project design, rules and regulations issued by the government and baseline were also validated.

The project participant was requested to address all validation findings and finally provided the validation team with sufficient evidence to determine that the applicable CDM requirements have been met. The project participant modified the initial updated PDD to resolve the validation team concerns and resubmitted a final version of the updated PDD /10/. AENOR has prepared this report based on the final updated PDD.

All Corrective Action Requests (CAR) and Clarification Actions (CL) have been checked by the validation team and have been adequately resolved.

All the validation findings are summarized in section C.4 below and documented in more detail in Appendix 4.

The ex-ante emission factor of the national grid of Chile and the ex-ante estimates of emissions reductions have been calculated correctly on the basis of the approved methodology AMS-I.D.: Grid connected renewable electricity generation - Version 18.0 and the "Tool to calculate the emission factor for an electricity system" version 07.0.

In AENOR's opinion, the GHG emissions reductions of the annual average over the crediting period and the total emissions reductions for the crediting period from 01/11/2018 to 31/10/2025, were calculated correctly and amount 12,620 tonnes of CO2 equivalent.

SECTION B. Validation team, technical reviewer and approver

B.1. Validation team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Validation findings
1.	Team Leader	IR	Llorente Pérez	Elena	AENOR	Yes	No	No	Yes
2.	Validator	IR							
..	Technical Expert								
..	…								
..	Financial/ Other Expert								
..	…								
..	Trainee								
..	…								

B.2. Technical reviewer and approver of the validation report for RCP

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	Pellitero Martínez	Marcelino	AENOR
…	Technical reviewer	IR			AENOR
…	Approver	IR	Fuentes Pérez	José Luis	AENOR

SECTION C. Means of validation

C.1. Desk/document review

>> The Project Design Document submitted by the PP was reviewed against the approved methodology and against CDM and other relevant criteria. Additional background documents

related to the project design, rules and regulations issued by the government and baseline were also validated.
To address the corrective actions and clarification requests that arose from the desk review, the consultants revised the initial project design document submitted and developed the final PDD.

C.2. On-site inspection

In accordance with paragraph 30 of the CDM Validation and Verification Standard for project activities it is not mandatory to conduct an on-site inspection. This section it is not applicable.

Duration of on-site inspection:				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**

C.3. Interviews

In accordance with paragraph 30 of the CDM Validation and Verification Standard for project activities it is not mandatory to conduct an on-site inspection. This section it is not applicable.

No.	**Interviewee**			**Date**	**Subject**	**Team member**
	Last name	**First name**	**Affiliation**			

C.4. Sampling approach

There has been no sampling approach. This section it is not applicable.

C.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Area of validation findings	**No. of CL**	**No. of CAR**	**No. of FAR**
Compliance with PDD form	---		---
Application of baseline and monitoring methodology and standardized baseline	1		---
Validity of original baseline or its update	---	2	---
Estimated GHG emission reductions or net anthropogenic GHG removals		3,4	---
Validity of monitoring plan	---		---
Crediting period	---	---	---
Project participants	---		---
Others (please specify)	---	1	---
Total	1	4	---

SECTION D. Validation findings

D.1. Compliance with PDD form

Means of validation	The compliance of the PDD with the valid version of the PDD form was checked through desk-review of last version of the PDD (version 10.1), last version of applicable PDD form/11/, which includes in its attachment the instructions for filling out it, CDM rules and references and supported documents provided by the project participants.
Findings	No findings were found regarding this issue.
Conclusion	The PDD was completed in the version 10.1 of the PDD form, latest version valid. The audit team checked that the information transferred to the later valid

	version of the PDD is materially the same as that in the registered PDD, except for the relevant sections of the PDD updated in accordance with the relevant requirements in the Project standard (sections of the PDD of the project activity relating to the baseline, estimated GHG emission reductions or net anthropogenic GHG removals, the monitoring plan and the crediting period using a baseline and monitoring methodology). In AENOR´s opinion the final version of the PDD has been completed using the latest version of the applicable CDM-PDD form and has followed the instructions for filling out attached at the end of the form.

D.2. Application of baseline and monitoring methodology and standardized baseline

Means of validation	The audit team has determined that the valid version of the approved baseline and monitoring methodology selected by the project participants in the registered PDD (AMS-I.D.: Grid connected renewable electricity generation - Version 18.0) has been used in the updated PDD for the renewal of the crediting period and it has been correctly considered the applicability criteria required by the methodology which were listed below: 1. The 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 project activity is a Greenfield plant; therefore, letter (a) is fulfilled. 2. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir; (b) 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/m2; (c) 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/m2. Not applicable, since the project does not consider a reservoir. 3. If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the 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. The project activity has nominal capacity of 5.5 MW, completely by renewable sources. 4. Combined heat and power (co-generation) systems are not eligible under this category. The project activity is not a co-generation system

	5. In the case of project activities that involve the capacity 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. Not applicable, since the project activity is not a capacity addition. 6. In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW. Not applicable, since the project activity is not a retrofit, rehabilitation or replacement. 6. 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. Not applicable, since the project activity is not a landfill gas, waste gas, wastewater treatment or agro-industries project. 7. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply. Not applicable, since the project activity does not uses biomass. The additionality and the baseline scenario of the project activity are not required to be reassessed. No standardized baseline is applied in this project.
Findings	No findings were found regarding this issue.
Conclusion	According to the paragraph 403 of the VVS v01.0, the validation team has confirmed, after performing the desk review, that the baseline and monitoring methodology has been applied correctly as well as its associated tools and guidelines. In particular the validation team has reviewed the final PDD, associated documents (calculation spreadsheets and evidence provided by the PP for closing the corrective actions and clarifications), and previous validation/verification documentation and information received in the interviews kept during the onsite visit to assess the relevant information contained in the PDD for each applicability condition listed in the selected methodology. In AENOR´s opinion the PPs have applied the correct version of the approved baseline and monitoring methodology in the final version of the PDD, and all applicability criteria have been described properly, in accordance with the evidence provided by the PPs and the requirements of the applicable methodology and the CDM Project Standard.

D.3. Validity of original baseline or its update

Means of validation	The audit team checked if the original baseline is still valid or if it must be updated through an assessment of the following issues: (a) The impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period of the registered CDM project activity at the time of requesting renewal of crediting period of the project activity; (b) The correctness of the application of the approved methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period of the registered CDM project activity.
Findings	**CL 1-Evidence to the validation team should be provided to prove that the steps of the assessment of the validity of the original baseline are met.**
Conclusion	In AENOR´s opinion, the PPs have documented in the final version of the PDD the issues considered for assessing the validity of the baseline for the next crediting period in accordance with the requirements established in the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" and the Project Standard. Therefore, according to the step 1.1., the audit team could check the current baseline complies with all relevant mandatory national and sectorial polices. Moreover, according to the step 1.2., the audit team could assess that there are no important changes in the market characteristics and the conditions used to determine the baseline emissions in the previous crediting period are still valid. On the other hand, the step 1.3. is not applied because the tool clarifies that it should be assessed "whether the remaining technical lifetime of the equipment that would have continued to be used in the absence of the project activity, as determined in the PDD, exceeds the crediting period for which renewal is requested" and the project activity does not increase the lifetime of the technical equipment during the crediting period. Regarding the step 1.4 and the validity of the data and parameters, all parameters regarding the grid emission factor calculation have been updated for this second crediting period according to the Tool to calculate the emission factor for an electricity system (Version 07.0). The following parameters have been considered by the PP for calculating the emission factor of the national grid, as it is required by the tool: • Amount of fuel type i consumed by power plant/unit m in year y ($FC_{i,m,y}$). • Net calorific value (energy content) of fuel type i in year y ($NCV_{i,y}$). • CO_2 emission factor of fuel type i used in power unit m in year y ($EFCO_{2,i,y}$ and $EFCO_{2,m,i,y}$). • Net electricity generated by power plant/unit m or n in year y or hour h ($EG_{m,y}$ and $EG_{n,h}$) • Average net energy conversion efficiency of power unit m in year y ($\eta_{m,y}$). • Electricity displaced by the project activity in hour h of year y, or in year y ($EG_{PJ,h}$ and $EG_{PJ,y}$). Detailed information regarding these parameters is included in below sections of this validation report.

D.4. Estimated emission reductions or net anthropogenic removals

Means of validation	The audit team checked that the estimated GHG emission reductions in the updated PDD comply with the applicable requirements in the Project standard, and the valid

version of the methodologies and tools that are applicable to the registered CDM project activity as follows:

Emission Reduction (ER_y)

AMS-I.D Version 18.0 methodology, the baseline emissions from electricity generation in power plants requires the emission reduction (ER_y) by the project activity to be calculated as the difference between the baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (LE_y).

$ER_y = BE_y - PE_y - L_y$

ER_y = 12,620 tCO_2/yr

Determination of the project activity emissions (PE_y)

According to the approved small-scale methodology AMS-I.D Version 18.0, and considering that the project activity is not a geothermal power plant, nor a reservoir hydro power plant, the project emissions are zero (*PE_y=0*).

Determine the emission factor for the grid

The baseline emission factor for the grid ($EF_{grid,y}$) has been calculated as a combined margin emission factor, using the "Tool to calculate the emission factor for an electricity system" version 07.0.

The determination of the relevant electricity system was made following the Option 2, considering the dispatch area covered by the responsible dispatch centre for each year of the ex-ante emission factor calculation requirements. In this case, since in November 21th, 2017, the SIC grid was connected to the SING grid, creating a new electricity system called SEN, which considers a single dispatch area coordinated by the National Electricity Coordinator (CEN); thus, the relevant electricity system is the SEN.

As the "Tool to calculate the emission factor for an electricity system" requires an annual based emission factor calculation, and the interconnection occurred during 2017, therefore the relevant electricity system is SEN for 2017 and SIC for 2015 and 2016.The Project participant has chosen to calculate the operating margin and build margin emission factor the option I and only grid power plants are included in the calculation.

In terms of vintage of data, the period considered for the calculation is 2015-2017.

As data for Option A is actually available, this option will be used for the calculation; under this option, the simple OM emission factor is calculated based on the net electricity generation and an emission factor for each power unit, as follows:

The operating margin emission factor is calculated as follows:

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

$EF_{grid,OMsimple,y}$ =Simple operating 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=All grid power units serving the grid in year y except low-cost/must-run power units.

y=The relevant year as per the data vintage chosen in Step 3 (2015 to 2017).

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

The emission factor of each power unit m is determined, options A1 and A2 of the tool are applied as follow:

• **Option A1** - If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) is determined as follows:

Equation 1. Emission factor per power unit calculation

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh).
$FC_{i,m,y}$	=	Amount of 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).
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* (tCO_2/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 units.
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 (2015 to 2017).

• **Option A2** - In for a power unit m only data on electricity generation and the fuel types used is available, the emission factor is determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

Equation 2. CO_2 emission factor based on efficiency

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh).
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio).
m	=	All power units serving the grid in year *y* except low-cost/must-run power unit
y	=	The relevant year as per the data vintage chosen in Step 3.

Where several fuel types are used in the power unit, the fuel type with the lowest CO_2

emission factor for $EF_{CO2,m,i,y}$ is used.

Calculate the build margin (BM) emission factor

The BM emission factor is determined in accordance to Option 1 of the "Tool to calculate the emission factor of an electricity system" (Version 07.0), where for the second crediting period the build margin emission factor is calculated ex-ante based on the most recent information available (2017) on units already built for sample group *m* at the time of PDD submission to the DOE for validation.

Equation 3. BM emission factor calculation

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh).
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh).
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh).
m	=	Power units included in the build margin.
y	=	Most recent historical year for which electricity generation data is available.

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per guidance in Step 4, using options A1 or A2 (represented by Equations 4 and 5 in Step 4), using for y the most recent historical year (2017) for which power generation data is available, and using as m the power units included in the build margin.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{OM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

EF_{OM}: 0.72774 tCO_2/MWh

EF_{BM} = 0.34846 tCO_2/MWh

EF_{CM} = (0.72774 x 0.25) + (0.34846 x 0.75) = **0.44328 tCO_2/MWh**

BE_y = 12,620 tCO_2/yr

Leakage

	The project does not consider any leakage.
Findings	CAR 2-The PDD shall correctly identified the relevant option chosen in accordance with the "tool to calculate the emission factor for an electricity system" for the identification of the relevant electricity system". CAR 3- In accordance with "the tool to calculate the emission factor for an electricity system", section 42, if the ex ante option is chosen, the most recent data available at the time of submission of the CDM-PP to the DOE shall be used.
Conclusion	In AENOR´s opinion, the PPs have documented in the final version of the PDD and the spreadsheets the calculation, data, formulae and information of the estimated GHG emission reductions in accordance with the requirements of the latest approved version of the methodology and tools applied to the determination of the emission reductions and the project emissions. The methodology for calculating emission reductions is transparently documented in the latest version of the PDD and it complies with existing good practice. The PDD clearly documents how each equation is applied and the actual calculations are clearly presented in the annexed spreadsheets. The selection of parameters and GHG calculations is complete and transparent. The accuracy of the calculations has been verified. The emissions estimated can be replicated using the data and parameter values provided in the PDD and supporting files submitted for validation. Data sources have been validated by AENOR. AENOR has validated that data and assumptions considered are listed in the PDD and spreadsheet calculations are consistent with stated data. Furthermore, AENOR has reproduced the calculation in a clear and transparent manner to obtain the same results, which confirms that the baseline methodology has been correctly applied. Therefore, AENOR, based on the above assessment, confirms that: · All assumptions and data used by the project participant is listed in the PDD, including their references and sources; · All documentation used by project participant as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD; · All values used in the PDD are considered reasonable in the context of the proposed CDM project activity; · The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions; and All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.

D.5. Validity of monitoring plan

Means of validation	The audit team checked that the monitoring plan in the updated PDD complies with the applicable requirements in the Project standard, and the valid version of the methodologies and tools that are applicable to the registered CDM project activity. On the other hand, the parameter included in the monitoring plan to be monitored during the second crediting period are the following:

Data/Parameter	$EGP_{J,y} = EG_{facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project power plant to the grid in year y
Source of data	Direct measurement from one electricity meter
Value(s) applied	28,470

	Measurement methods and procedures	Measured by bi-directional energy meters installed at the grid interface for electricity export to the grid (measures the electicity from the power plant and from the grid).
	Monitoring frequency	Electricity meters with continuous measurement and at least monthly recording
	QA/QC procedures	Meter should have a maximum error of 0.2% and be calibrated every one or two years according to local standards for electricity transactions in "Coordinador Eléctrico Nacional". Monitored data is cross checked against records for sold electricity which are publicly available at the "Coordinador Eléctrico Nacional" web page (www.coordinador.cl)
	Purpose of data	Calculation of baseline emissions
	Additional comment	As the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then $EG_{PJ,y} = EG_{facility,y}$ The monitoring methodology involves the net electricity supplied to the grid, in year y.
Findings	**CAR 4-The monitored parameter it is not in accordance with the applied methodology for the project activity, for instance, the description and measurement method for the parameter.**	
Conclusion	In AENOR´s opinion, the PPs have documented in the monitoring plan of the final version of the PDD all requirements established by the latest approved version of the methodology and tools applied to determine the emissions reductions of the project activity and its project emissions. Authority and responsibilities are well defined and Quality Assurance and Quality Control procedures are managed in order to reduce the uncertainties of the emissions reduction monitored. Provisions of calibration frequencies of all the equipment involved in the monitoring are included in the PDD and are deemed as appropriate by the DOE team because they are defined according to the specifications stated in the applied methodologies and tools	

D.6. Crediting period

Means of validation	The audit team checked that the PPs notified the secretariat of the intention to request the renewal of the crediting period by 180 days prior to the date of expiration of the first crediting period, and therefore, the second crediting period of the registered CDM project activity commences on the day immediately after the expiration of the first crediting period.
Findings	No findings were found regarding this issue.
Conclusion	The end of the first crediting period is on 31/10/2018, and the notification of the PPs to the secretariat was sent on 19/02/2018, more than 180 days prior to the date of expiration of the first crediting period. Therefore, the second crediting period commences on 01/11/2018.

D.7. Project participants

Means of validation	AENOR has checked that the name of the project participant included in the updated PDD is consistent with the name of the project participant in the registered PDD.

Findings	CAR 1-The information of the project participant is not consistent in Annex 1 of the PDD with the information included in the latest MoC
Conclusion	AENOR reviewed the project participant' information included in the final version of the updated PDD (version 2 dated on 10/09/2018) against the same information included in the latest registered PDD (version 7.1; 28/07/2011) /12/ and the latest MoC submitted in the web site of UNFCCC (valid as of 28/09/2015). Therefore, the audit team found that the name of project participant in the updated PDD is consistent with the names of the project participant in the registered PDD and it is also consistent with the information included in the MoC submitted in the web site of UNFCCC.

D.8. Post-registration changes

Type of post-registration changes (PRCs)	Confirmation (Y/N)	Validation report for PRCs	
		Version	**Completion date**
Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline	N		
Corrections	N		
Inclusion of a monitoring plan to a registered project activity	N		
Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline	N		
Changes to the project design of a registered project activity	N		
Types of changes specific to afforestation and reforestation project activities	N		

SECTION E. Internal quality control

>>Following the completion of the assessment process by the validation team, all documentation undergoes an internal quality control through a technical review before submission to the CDM-EB. The Technical reviewer is a qualified member of AENOR, independent from the team that carried out the validation of the project activity. The technical reviewer or the team appointed for the technical review are qualified in the technical area(s) and sectoral scope(s) of the project activity.

SECTION F. Validation opinion

>>AENOR has performed the validation of the renewal of the crediting period of the project "San Clemente Hydroelectric Power Plant". The validation was performed on the basis of UNFCCC criteria and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

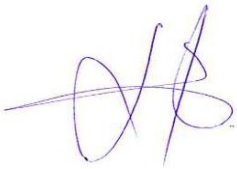
The validation consisted of the following phases: i) a desk review of the project design and the baseline and monitoring plan; ii) the resolution of outstanding issues and the issuance of the final validation report and opinion. In the course of the validation process 4 corrective actions and 1 clarifications were raised, all have been successfully closed.

The review of the project design documentation has provided to AENOR enough evidence to determine the validity of the original baseline scenario and the update of the baseline. The project correctly applies the baseline and monitoring methodology AMS-I.D.: Grid connected renewable electricity generation - Version 18.0.

The calculation of the project emission reductions is carried out in a transparent and conservative manner, so the project activity is likely to achieve the average estimated amount of emission reductions of 12,620 tCO2e per year over the 2nd renewable crediting period.

In AENOR´s opinion, the project meets all relevant UNFCCC requirements and the relevant host country criteria for the renewal of the crediting period. Hence, AENOR requests the renewal of the crediting period of the project.

The validation has been performed using a risk based approach, as described above. The only purpose of this report is its use during the registration process as part of the CDM project cycle. Hence, AENOR cannot be held liable by any party for decisions made or not made based on the validation opinion, which goes beyond the purpose.



Elena Llorente Pérez
Team Leader

Jose Luis Fuentes
Authorized person

Appendix 1. Abbreviations

Abbreviations	Full texts
AMS-I.D.	Grid connected renewable electricity generation - Version 18.0
BM	Build margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CL	Clarification Action
CM	Combined margin
CO2	Carbon dioxide
DECISION 17/CP.7	Modalities and Procedures for a Clean Development Mechanism as Defined in Article 12 of the Kyoto Protocol
DOE	Designated operational Entity
DR	Desk review
EB	Executive Board of the CDM of the Kyoto Protocol
EF	Emission factor
GHG	Greenhouse Gasses
GSC	Global stakeholder consultation
GWh	Electrical Giga Watt hour
IPPC	Intergovernmental Panel on Climate Change
km	Kilometre
kV	Kilovolt
kW	Kilowatt
LC/MR	Low cost/Must run
LoA	Letter of Approval
m	metre
m3/sec	Cubic metre per second
MoC	Modality of Communication
MP	Monitoring plan
MW	Megawatt
OM	Operating margin
PDD	Project Design Document
PP	Project participant
RCP	Renewal of crediting period
tCO2e	Carbon dioxide equivalent tonnes
UNFCCC	United Nations Framework Convention on Climate Change

Appendix 2. Competence of team members and technical reviewers

CERTIFICATE OF QUALIFICATION

Subject: Validation and technical review team for “San Clemente Hydroelectric Power Plant”

Madrid, 20/09/2018

Hereby I confirm the following records of qualification, according with AENOR internal instruction “Validation, Verification and Certification of Clean Development Mechanism (CDM) project activities” IE-DTC-039, and with regard to the validation process of the above mentioned project activity:

Name: Elena Llorente Pérez

CDM team leader: YES

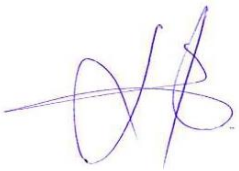
CDM validator: YES

CDM verifier: N.A.

External technical expert: N.A.

Technical areas related with the project activity:

1 : Energy industries (renewable - / non-renewable sources)



Jose Luis Fuentes
Climate Change Manager

CERTIFICATE OF QUALIFICATION

Subject: Validation and technical review team for “San Clemente Hydroelectric Power Plant”

Madrid, 20/09/2018

Hereby I confirm the following records of qualification, according with AENOR internal instruction “Validation, Verification and Certification of Clean Development Mechanism (CDM) project activities” IE-DTC-039, and with regard to the validation process of the above mentioned project activity:

Name: Marcelino PELLITERO MARTÍNEZ

CDM team leader: NO

CDM Tehnical reviewer: YES

CDM verifier: N.A.

External technical expert: N.A.

Technical areas related with the project activity:

1 : Energy industries (renewable - / non-renewable sources)

José Luis Fuentes
Climate Change Manager

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	UNFCCC	CDM project standard for project activities	Version 01.0	UNFCCC
2	PP	Initial registered PDD	Version 7.1	PP
3	UNFCCC	AMS-I.D.: Grid connected renewable electricity generation	Version 18.0	UNFCCC
4	UNFCCC	CDM Validation and Verification Standard for project activities,	Version 01.0	UNFCCC
5	UNFCCC	CDM Project Cycle Procedure for project activities •	Version 01.0	UNFCCC
6	UNFCCC	Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"	Version 03.0.1	UNFCCC
7	UNFCCC	Tool to calculate the emission factor for an electricity system	Version 07.0.	UNFCCC
8	PP	Spreadsheets EF_ERs	31_05_18 Emission factor Calculation spreadsheet	PP
9	AENOR	Specific Instruction for the Validation, verification and certification of clean development mechanism (CDM) project activities	(IE/DTC/0039)	AENOR
10	PP	Final PDD	version 2	PP
11	UNFCCC	CDM-PDD form	version 10.1	UNFCCC
12	PP	Registered PDD	Version 7.1; 28/07/2011	UNFCCC
13	CDEC-SIC	Annual Report	2015	CDES-SIC
14	CDEC-SIC	Annual Report	2016	CDES-SIC
15	CEN	Annual Report	2017	CEN
16	CNE	Fuels	2015	CNE
17	CNE	Fuels	2016	CNE
18	CNE	Fuels	2017	CNE

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. CL from this validation

CL ID	01	**Section no.**	B.2	**Date:** 10/04/2018
Description of CL				
Evidence to the validation team should be provided to prove that the steps of the assessment of the validity of the original baseline are met.				
Project participant response				**Date:** 18/06/2018
The section was modified in order to include references to the applicable national and/or sectoral policies that confirm the validity of the original baseline. https://www.leychile.cl/Navegar?idNorma=30667 https://www.leychile.cl/Navegar?idNorma=258171 https://www.cne.cl/normativas/electrica/sector-electrico/				
DOE assessment				**Date:** 02/08/2018
The evidence has been provided. This CL is closed				

Table 2. CAR from this validation

CAR ID	01	**Section no.**	Appendix 1	**Date:** 10/04/2018
Description of CAR				
The information of the project participant is not consistent in Annex 1 of the PDD with the information included in the latest MoC				
Project participant response				**Date:** 18/06/2018
The table in the Annex 1 was modified to be consistent with the information of the latest MoC.				
Documentation provided by project participant				
N/A				
DOE assessment				**Date:** 02/08/2018
The contact information in Appendix 1 has been corrected				

CAR ID	02	**Section no.**	B.6	**Date:** 10/04/2018
Description of CAR				
The PDD shall correctly identified the relevant option chosen in accordance with the "tool to calculate the emission factor for an electricity system" for the identification of the relevant electricity system				
Project participant response				**Date:** 18/06/2018
The identification of the relevant electricity system section was modified in order to include the option chosen in accordance with the Tool.				
Documentation provided by project participant				
N/A				

DOE assessment	Date: 02/08/2018
The relevant grid has been corrected identified in section B.6. The following issues should be updated in accordance with the tool as well: • Step 5, BM option. • Section B.6.2., the choice of data of the ex-ante parameters. • Section B.6.3., step 1, the relevant section in the PDD of the identified electricity system. • Step 5, BM option (sections B.6.1. and B.6.3.) was updated in order to include the reference to the chosen option. • The choice of data parameter was updated for each parameter in order to fulfill the Tool requirements (section B.6.2.). • Step 1 of section B.6.3. was updated to include the reference to the chosen option for the identified electricity system.	
Documentation provided by project participant	
PDD has been updated	
DOE assessment	
The information included in the PDD it is correct.	

CAR ID	03	Section no.	B.6	Date: 10/04/2018
Description of CAR				
In accordance with "the tool to calculate the emission factor for an electricity system", section 42, if the ex ante option is chosen, the most recent data available at the time of submission of the CDM-PP to the DOE shall be used				
Project participant response				**Date:** 18/06/2018
The calculation of the emission factor was updated considering the most recent data according to the ex-ante option (2015-2017). The results were updated in the PDD				
Documentation provided by project participant				
DOE assessment				**Date:** 02/08/2018
Ok, the emission factor has been updated. The following issues should be clarified: -The data provided for the specific fuel consumption, "final technical report"(SIC) it is not for the whole year according to the name of the document, for instance for the 2017 data, the fuel consumption is until July 2017. -For the data 2017, the following power plant has not been included: Andes 1@diesel, but the power plant with the highest emission factor is in the excel, Andes 1@Residual Fuel Oil. -The data of specific fuel consumption of data 2017 for the SING plants does not coincide with the document provided, for instance U16 TV CP@Natural gas, 210,5. -The total data of electricity generation 2017 and LCMR from the EF Excel does not coincide with table 6, page 16 of the PDD.				

Project participant response	**Date:** 03/08/2018
- The document “final technical report” provides the most recent information for the specific fuel consumption of the power plants and its representative for the whole year as it is used for the calculation of energy prices. For 2017, the report dated July 2017 is applicable for the whole second semester, so is the most recent information for the year 2017. -During 2017, Andes power plant generated using residual fuel oil instead of diesel as in the previous year; this is shown in the daily generation reports (please review the daily generation reports, named “OP170125.xls” and “OP170804.xls”). -Data of specific fuel consumption for 2017 SING power plants does coincide with the provided document. Total data of electricity generation 2017 and LCMR were updated in the Table 6 of the PDD according to the EF spreadsheet values.	
Documentation provided by project participant	
Two examples of daily generation reports where “Andes Generación (1, 2, 3 and 4) FO6” power plant generation is shown.	
DOE assessment	**Date:** 14/08/2018
The final version of the PDD includes the information required by the tool .	

CAR ID	04	**Section no.**	B.7	**Date:** 10/04/2018
Description of CAR				
The monitored parameter it is not in accordance with the applied methodology for the project activity, for instance, the description and measurement method for the parameter.				
Project participant response				**Date:** 18/06/2018
The parameter table was redrafted in accordance with the applied methodology.				
Documentation provided by project participant				
Updated PDD				
DOE assessment				**Date:** 02/08/2018
Electricity meters measurement characteristics were included in section B.7.1.				

Table 3. FAR from this validation

FAR ID	xx	**Section no.**		**Date:** DD/MM/YYYY
Description of FAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Document information

Version	*Date*	*Description*
02.0	31 October 2017	Revision to align with the requirements of the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.

Decision Class: Regulatory
Document Type: Form
Business Function: Renewal of crediting period
Keywords: crediting period, project activities, validation report