Project design document form for CDM project activities

(Version 05.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Punta Palmeras Wind Power Project
Version number of the PDD	2
Completion date of the PDD	13/10/2014
Project participant(s)	Punta Palmeras S.A.
Host Party	Chile
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope: 1; Energy industries (renewable/non renewable sources). Large Scale Consolidated Methodology ACM0002. Grid connected electricity generation form renewable sources. Version 14.0.0
Estimated amount of annual average GHG emission reductions	83,581 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The main purpose of this project activity is to generate clean electricity from renewable wind resources, through the development of the Punta Palmeras wind farm. The project activity is promoted by Punta Palmeras S.A.

The total installed capacity of this project activity is 45 MW from 15 WTGs, each with a capacity of 3 MW. A second phase may come in future with 7 more turbines and 21 MW. This second phase is not considered part of the proposed project activity.

Electricity generated by the Punta Palmera's project will displace electricity from the national electricity grid, supplied partly from fossil fuels, resulting in a reduction in greenhouse gas (GHG) emissions.

The electricity generated will be supplied to the Central Interconnected System (Sistema Interconectado Central - SIC) under a long-term Power Purchase Agreement (PPA).

The proposed project activity is aimed to be developed as a CDM project. The project has notified the Chile DNA the commencement of the project activity and the intention to seek the CDM status.

The following Large Scale Consolidated Methodology will be used: ACM0002, 'Grid-connected electricity generation from renewable sources'. Currently, no renewable power project is operated at the project site. The project activity will be a greenfield project activity that will supply energy to the Central Interconnected System (SIC-Sistema Interconectado Central).

The project site could be characterized as big extensions of brush without use. In the proximities of the investment there are little urban areas. Proper urban areas are further than 30 Km. There are no national monuments, areas of tourist interest or special sites near by the project.

The baseline scenario is the same as the scenario existing prior to the implementation of the project activity.

The estimate amount of annual average GHG emission reductions is 83,581 tCO_2e. The total reductions will be 835,810 tCO_2e for the 10 years crediting period.

Contribution to Sustainable development:
The project will contribute to the sustainable development of Chile as it will foster and stimulate the expansion of renewable energy technologies, reduce the country's dependency on fuel imports and consequently improve trade balance. It will also strengthen and diversify the national energy supply.

Social and Economic well-being:
The proposed project activity would lead to direct and indirect benefits to the region, through the generation of local employment in areas in and around the project activity, and the improved conditions for developing economic activities, which may result from the empowerment of vulnerable sections of society dwelling near the project area due to the creation of employment opportunities.

Environmental well-being:
Wind energy is one of the cleanest, most sustainable ways of generating electricity, which produces no emissions such as sulphur oxides (SOx), nitrogen oxides (NOx), or particulates. Because wind energy is a renewable resource, the project will also contribute to resource conservation, of coal, diesel, and other non-renewable energy resources.

Technological well-being:
The development of the proposed project activity is important now, in that it acts as a stimulus and an accelerant to the wind and renewable energy sector in Chile. This will also assist in further encouraging research and development efforts by technology providers, which will lead to the development of better and more efficient equipment.

All the above are the contribution of the project activity for the sustainable development.

A.2. Location of project activity

A.2.1. Host Party

Chile

A.2.2. Region/State/Province etc.

Region IV of Coquimbo. Choapa province.

A.2.3. City/Town/Community etc.

Canela community.

A.2.4. Physical/Geographical location

Geographic coordinates: The site of Punta Palmeras is located at a latitude and longitude of around 31°14'19.79"S; 71°36'57.57"O (Latitude: -31.238831°; Longitude: -71.615990°) at 20 Km north from Canela Baja city and 3 Km West from the Road 5 North. Those coordinates correspond to Punta Palmeras's substation located in the wind investment site before the transmission line.

A.3. Technologies and/or measures

The Project activity is a new grid connected wind based renewable energy source, zero emission power project connected to the Central Interconnected System (SIC-Sistema Interconectado Central) of Chile. Prior to the implementation of the project activity, no renewable power project was operated at the project site.

The project is a 45 MW wind power project, expected to produce 124,155 MWh per annum with an average capacity factor of 31.5%. The operational lifetime is 20 years.

Characteristic	Amount	Unit
Total Power Capacity	45	MW
Turbine AW116/3000 IEC IIA T92	15	Not applicable
Rated Power per turbine	3	MW
Cut in-cut-out wind	3-25	m/s
Generator voltage	12,000	V
Equivalent annual operating hours	2,759	Hrs
Annual Production	124,155	MWh
Capacity factor	31.5	%
Transmission line length	6.5	Km
Transmission line Voltage	220	kV
Diameter	116	m
Hub Height	92	m
Nominal rotational speed	Variable 9.2…15.6	rpm

AW116/3000 IEC IIA T92 is a wind turbine fabricated by Acciona, a company with 20 years experience of leadership in the sector, with 8,480 MW of renewable installed capacity as of December 2013, of which 6,965 MW installed correspond to wind power.

The AW116/3000 IEC IIA T92 is a 3000 kW power-rated horizontal shaft wind turbine, with three blades, variable speed, 380 kV rated voltage and frequency of 50-60 Hz.; Certified by Germanischer Lloyd (GL) for a design duration of 20 years. This turbine gathers the most advanced technologies that Acciona Windpower has developed up to the moment.

As wind speed increases, the amount of available energy increases. The wind generally blows more consistently at higher speeds at greater heights. The maximum energy can be harnessed by a wind turbine is roughly proportional to the swept area of the rotor.[1] New designed turbines of 3 MW allows the site with the best technology for its resource: higher hubs, bigger diameters… than a 1.5 MW turbine. This benefits Chile with a better position to reach the country's objectives..

The wind turbine has a control software (SCADA) for monitoring and automatically managing the operation, licenses needed will be owned by the proponent. A double-fed asynchronous generator of Insulated Gate Bipolar Transistor's (Pulse Width Modulated) improves voltage and frequency stability, supplies reactive power to the grid when required and operates the power factor in inductive or capacitive power as required.

The transmission line will be connected to the Central Interconnected System (SIC-Sistema Interconectado Central). Transformer will be a 220 kV and 6.5 km long line, running from the wind farm control house were the transformer is located to the Las Palmas substation.

The implementation of the wind project will contribute to the sustainable development of Chile as it will foster and stimulate the expansion of renewable energy technologies. This will also assist in further encouraging research and development efforts by technology providers, which will lead to the development of better and more efficient equipment. Once constructed, the plant will be operated by Chile's personnel, so transfer will be guaranteed.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (host)	Punta Palmeras S.A. (Private entity)	No

The project participant, Punta Palmeras S.A is a company created for a specific purpose of develop and operate Punta Palmeras Wind Power Project. The company will design, finance, construct, commission, operate and maintain the wind investment during 20 years.

A.5. Public funding of project activity

No public funding from parties included in Appendix 1 is available for the project activity.

[1] IRENA: Renewable energy technologies. Cost analysis series. June 2012. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-WIND_POWER.pdf

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

The methodology applied for this project activity is:

Title: "Grid-connected electricity generation from renewable sources"

Reference: Approved large scale consolidated baseline methodology ACM0002, Version 14.0.0, EB75[2].

ACM0002 draws upon the following tools which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system[3] (Version 04.0, EB75)
- Tool for the demonstration and assessment of additionality[4] (Version 07.0.0, EB70)

B.2. Applicability of methodology and standardized baseline

The Project activity is a new grid connected wind based renewable energy source, zero emission power project connected to the Central Interconnected System (SIC-Sistema Interconectado Central) of Chile. Prior to the implementation of the project activity, no renewable power project was operated at the project site. Hence the project activity is a green field project activity.

ACM0002 – Applicability Conditions	Project Applicability
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, wave power plant/unit or tidal power plant/unit	The project activity is an installation of new wind power project at a site were no renewable power plant was operated prior to the implementation of the project activity (green field plant); hence the project activity meets the applicability criterion.
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 16 to calculate the parameter $EG_{PJ\ y}$): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity is a newly grid connected wind power project. Hence this criterion is not applicable.
In case of hydro power plants, one of the following conditions must apply: • *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of*	The project activity is a new grid connected wind power plant; hence these conditions are not applicable.

[2] http://cdm.unfccc.int/filestorage/A/0/4/A04BWNRKLUEP6O1QX75YVTH28JDICZ/EB%2075_repan13_ACM0002_ver%2014.0.pdf?t=dmx8bjVrbDk4fDC-S9iwHpwNkPitJNWCEMoZ

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

reservoirs, or • *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or* • *The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.*	
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^{2}all the following conditions must apply: • *The power density calculated for the entire project activity using equation 5 is greater than 4W/m2;* • *Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;* • *Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;* • *Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m2, is lower than 15MW;* • *Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2, is less than 10 per cent of the total installed capacity of the project activity from multiple reservoirs.*	The project activity is a new grid connected wind power plant; hence these conditions are not applicable.
The methodology is not applicable to the following: *• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;* *• Biomass fired power plants;* *•Hydro power plant that result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m^2.*	Project activity does not involve: • Switching from fossil fuels to renewable energy sources at the site of the project activity. • Biomass fired plants. • Construction of new reservoir or increase in an existing reservoir.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result	This project activity is a newly grid connected wind power project.

of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance"	

Since the project generates and exports renewable electricity to the grid system, hence the choice of project type and category is justified.

B.3. Project boundary

As per the **Approved Large Scale Consolidated Methodology ACM0002**, the project boundary is "*The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to*."

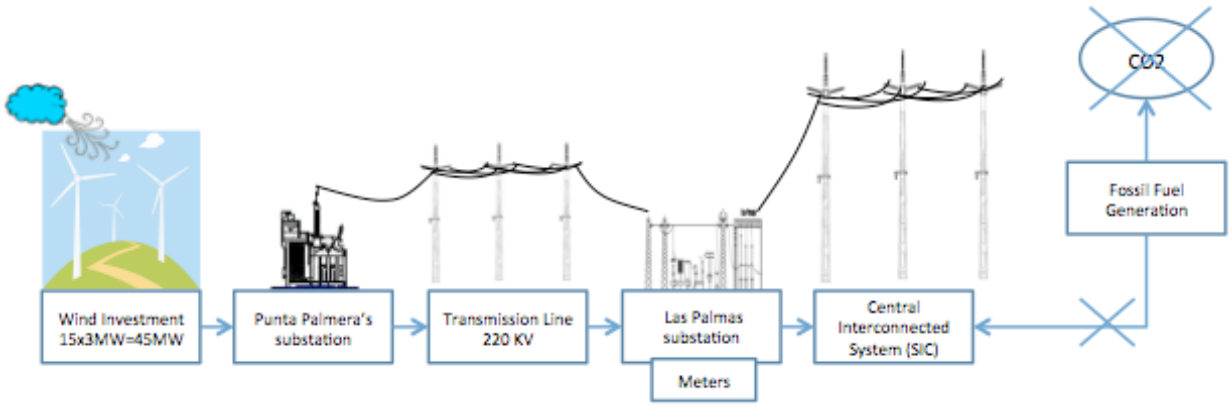
According to the "Tool to calculate the emission factor for an electricity system", grid/project electricity system *'is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity… and that can be dispatched without significant transmission constraints'*.

Chile has four interconnected electric systems[5]:

- The SING (Sistema Interconectado del Norte Grande) which covers the territory between the cities Arica and Antofagasta with 28.06% of the installed capacity in the country.
- The SIC (Sistema Interconectado Central) which goes from Taltal to Chiloé with a 71.03% of the installed capacity in the country.
- The SE Aysén (Sistema Electrico de Aysén) which serves the XI region with a 0.29% of the installed capacity in the country.
- The SE Magallanes (Sistema de Magallanes) which serves the XII region with a 0.62% of the installed capacity in the country.

Punta Palmeras Wind Power project will be part of the SIC[6]. The Central Interconnected System (SIC-Sistema Interconectado Central) is the defined electricity system for the project activity so all power plants connected to it, are included in the project boundary.

A schematic of the project boundary is given below:



As per the approved Large Scale Consolidated Methodology, ACM0002, Version 14.0.0, following gases and emission sources has been included in the project boundary.

[5] CNE: http://www.cne.cl/energias/electricidad/sistemas-electricos access on October 2013.

[6] SIC interconnection map. Source CDEC: http://www2.cdec-sic.cl/wp-content/uploads/2014/03/mapa_sic_2013.pdf

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	In the baseline scenario, electricity would have been sourced from the Central Interconnected System (SIC-Sistema Interconectado Central) which in-turn would be connected to fossil fuel fired power plants which emits CO_2.
		CH_4	No	Excluded for Simplification. This is conservative.
		N_2O	No	Excluded for Simplification. This is conservative.
Project scenario	Electricity generation from the project activity	CO_2	No	As per ACM0002 project emissions are not considered for wind power project.
		CH_4	No	As per ACM0002 project emissions are not considered for wind power project.
		N_2O	No	As per ACM0002 project emissions are not considered for wind power project.

Since project activity is a wind farm project, no project emissions are accounted for the project, this assumption is in line with ACM0002.

B.4. Establishment and description of baseline scenario

Identification of Baseline Scenario:
As this project installs a new grid connected renewable power plant, the baseline according to the methodology ACM0002, version 14.0.0

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

The most plausible baseline scenario identified for the project activity is continuation of current practice, i.e. operation of grid connected power sources. As per the approved Large Scale Consolidated Methodology ACM0002 14.0.0, since the project activity does not modify or retrofit an existing facility, the applicable baseline shall be the electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".

Accordingly the baseline emissions are given as:

$BE_Y = EG_{PJ,Y} * EF_{grid, CM,y}$

Where
BE_y = Baseline Emissions in year (tCO_2/yr)
$EG_{pj, y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid, CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y

calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The project activity is the installation of a grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

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

Where

$EG_{pj,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

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

B.5. Demonstration of additionality

Timeline of events of the project activity.

The start of the project activity is prior to the date of publication of the PDD for global stakeholder consultation.

Date	Event	Support/Reference
3/2/2009	Initial project of Punta Palmeras Wind Power Project presentation.	Information SEA website [7]
2/9/2009	Initial project of Punta Palmeras Wind Power Project was approved by the regional commission of environment of the Coquimbo's region.	Information SEA website[8]
15/12/2010	Environmental impact Assesment resolution for the initial project of Punta Palmeras	Information SEA website[9]
30/7/2012	Presentation of Punta Palmeras modification to the Environmental impact Assessment Evaluation.	Information SEA website[10]. The objective of the project is to satisfy the increasing demand of energy and reduce the GHG gases.
26/11/2012	Tender Colbun	Submission proposal bid.

[7] http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=3498566

[8] Annex VII, Resolutions Associated to the Project, document nº1 SEA information: http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

[9] http://seia.sea.gob.cl/archivos/Anexo_VII_Resoluciones_-_DIA_PEPP_R0_20120713.pdf

[10] http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

26/12/2012	Environmental impact assessment resolution for the modification	Information SEA website [11].
21/6/2013	PPA signature	Starting date. Contract signed between Colbún and Punta Palmera's
25/9/2013	EPC contract signature	Contract given to validator
27/9/2013	Date when Punta Palmeras sent the Prior Consideration of the CDM of the project Punta Palmeras Wind Power Project to the UNFCCC.	Copy of email
27/9/2013	Date when Punta Palmeras presented the project to Chile DNA	Copy of email
30/9/2013	Date when Punta Palmeras asked for validation quotations	Copy of emails.
1/10/2013	Receipt confirmation from UNFCCC.	Copy of the email CDM Registration and Issuance team UNFCCC secretariat.[12]
12/3/2014 to 10/4/2014	Public stakeholder consultation of Punta Palmeras Wind Power Project.	UNFCCC website information[13]
07/10/2014	Date when Punta Palmeras received the Letter of Approval	Copy of the LoA in Spanish and English

The timeline of events proves that the project activity has considered GHG reductions since its origin. It is proved with the "Prior Consideration of the CDM Form" document which was developed in conformity with the latest version of the CDM Project Standard, and which Punta Palmeras sent within six months of the project activity starting date.

Analysis of the additionality of the project

The project is a clean energy project and the energy produced is fed into power deficit grid. Additional energy supplied from the project activity will help in meeting the energy demand of the region and later increasing the reliability of the grid. This in the business-as usual scenario would have been met with the help of conventional fossil fuel based power plants.

As per the selected methodology ACM0002, the project developer is required to establish that the GHG emission reductions due to the project activity are additional to those that would have occurred in the absence of the current project activity as per the Methodological Tool "Demonstration and assessment of additionality" by employing following steps:

[11] Document 42 SEA Information: http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

[12] http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html

[13] http://cdm.unfccc.int/Projects/Validation/DB/23OZTN2AHZFX96DKCBATX1DF1522OU/view.html

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Step 2: Investment analysis (OR)
Step 3: Barrier analysis
Step 4: Common Practice analysis

Project proponent establishes additionality on the ground of Step 1, 2 and 4.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
'This step is optional. If it is not applied it shall be considered that the proposed project activity is not the first-of-its-kind'

Outcome of step 0. Project participant does not apply to this step.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations
In sub-step 1a and 1b, it is required to *'identify realistic and credible alternative(s) available to the project participants or similar project developers that provide output or services comparable with the proposed CDM project activity... The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements…'*

Sub-step 1a: Define alternatives to the project activity:
As this project installs a new grid connected renewable power plant, the baseline scenario according to the Large Scale Consolidated Methodology ACM0002, version 14.0.0, is *Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system."*

As per the Tool for the demonstration and assessment of additionality, version 07.0.0, number 8: *'Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity*'.

Alternative 1:The proposed project activity undertaken without being registered as a CDM project activity.

Alternative 2: Continuation of the current situation (no project activity or other alternatives undertaken).

At this moment, there is no power plants with similar technology in the group of plants within the stipulated range for sub-step 4.a functioning in Chile that has proceed without seeking registration under UNFCCC. The most plausible baseline scenario identified for the project activity is continuation of current practice (i.e. operation of grid connected power sources) which is a more attractive alternative than the proposed project activity.

Outcome of step 1a: Continuation of present scenario of grid-supplied power would be a conservative approach to baseline establishment.

Sub-step 1b: Consistency with mandatory laws and regulations

According to the paragraph 24 of the 'Tool for the demonstration and assessment of additionality' *"The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g.*

to mitigate local air pollution. (This sub-step does no consider national and local policies that do not have legally-binding status)"

With the approval of the General Law of Electricity Services (Ley General de Servicios Eléctricos – LGSE) in 1982, Chile laid the basis for the creation of a competitive electricity system. The associated regulatory framework has been improved over the years, maintaining its original goal as a system operated at a minimum global cost.

The changes introduced in the LGSE, which became official in March 2004 through the Law 19,940, modify several aspects of the electricity market affecting all generators by introducing elements especially applicable to Non-Conventional Renewable Energy (NRCE). Likewise, Law 20,257 that came into force on April 2008, made it mandatory for electricity companies selling directly to final customers to incorporate a certain percentage of NCRE into the electricity they trade. This law consolidates the efforts of the Chilean State to remove barriers to the incorporation of NCRE to the objectives of supply security and environmental sustainability that govern Chile's energy policy.

Regulatory framework of the electricity sector[14]:

- Law Decree nº 4, General law of Electricity Services (LGSE). The legal structure that regulates the activity of the electricity sector is DFL 4, enacted in May 12, 2006, by the Ministry of Economy, Development and Reconstruction that establishes the consolidated coordinated and systematized text of DFL nº1 dated 1982 on electricity matters. DFL 1 was modified in 2004 and subsequently in 2005 through the enactment of laws 19,940 and 20,028 called Short Law 1 and Short Law 2 respectively.
  DFL 4 regulates the production, transport, distribution, concessions and electricity tariffs. The General Law of Electricity Services and its supplementary regulations determines the technical and safety standards to be used by an electric installation in Chile.
- Law 19,940 (Short Law I) was enacted by the Ministry od the Economy, Development and Reconstruction in 2004. The key objectives of this initiative were to provide major consumers levels of security and supply quality at reasonable prices.
- Law 20,018 (Short Law II) enacted in 2005 by the same Ministry. It came about as a result of the uncertainty over the availability of Argentinian natural gas that hindered the estimation of future prices and revenue levels from electricity sales.
- Law 20,220 enacted in 2007 modifies the LGSE with respect to safeguarding the security of supply to regulated customers and the adequacy of electricity systems.
- Law 20,257 enacted in 2008. Modifies the LGSE regarding the generation of electricity using non-conventional renewable sources.
- Supreme Decree nº 327, seeks to include all the aspects regulated by LGSE, repealing provisions contained in disperse and partial regulations.
- Supreme Decree nº 244, create provisions for companies whose generation capacity surplus is less than 9 MW and/or that operate with a non-conventional energy source with a capacity surplus of less than 20 MW.
- Supreme Decree nº 62, regulates transfers of capacity between companies with generations units synchronised to an electricity system, resulting from the coordination of operations established by the LGSE.

Outcome of Step 1b: The alternative scenario, as per Step 1a, to project activity is in compliance with mandatory legislation and regulations.

Step2: Investment Analysis

Determine whether the proposed project activity is not:

[14] CNE, Non-Conventional Renewable Energy in the Chilean Electricity Market. 2009. http://www.giz.de/en/downloads/sp-ERNC-mercado-electrico-chileno.pdf

a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the of certified emission reductions (CERs).

To conduct the investment analysis, use the following sub-steps:

Sub-step 2a: Determine appropriate analysis method
Since the project activity shall generate financial income from sale of power to the grid, we shall rule out Option I (simple cost analysis) and apply either Option II (Investment comparison analysis) or Option III (Benchmark analysis).

According to the paragraph 19 of the **Guidance on the Assessment of the Investment Analysis**[15], version 05, Annex 05, EB 62, *"…if the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate"*

Outcome of Step 2a: In line with the guidance, Benchmark Approach is considered as appropriate benchmark for this project activity.

Sub-step 2b: Option III - Apply Benchmark analysis
The purpose of the investment analysis is to determine whether the proposed project activity is financially attractive or not without the revenue from sale of certified emission reductions (CERs). This is done by comparing the financial returns from the project to that of a suitable benchmark and if the returns of the project activity are less than the benchmark, it can be said that the project is not a financially viable option.

Selection of financial indicator:
The Internal Rate Return is one of the most widely accepted financial indicators for project evaluation. Project participant will estimate post tax project IRR because is the most suitable for the project type and decision context.

According to the paragraph 37 of the 'Tool for the demonstration and assessment of additionality': *'… the financial/economic analysis shall be based on parameters that are standard in the market…'*.

And according to paragraph 38: *'Discount rates and benchmarks shall be derived from:*

d) Government/official approved benchmark where such benchmarks are used for investment decisions; …'

Project participant will use a benchmark that complies with tool 38.d derived from the Chilean National Decree nº 4 (D.F.L. nº 4/20018[16]). In its article nº 174 establishes that for valuation activities in transmission and generation of electricity the annual discount rate shall be 10% *in real terms*.

Outcome of Step 2b: Project participant decides to use benchmark value of 10% in real terms as it is an official approved benchmark used for investment decisions.

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

[15] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

[16] http://www.leychile.cl/Navegar?idNorma=258171

Punta Palmeras S.A. is an independent production company that has only a customer the first twelve years of generation: Colbún S.A.. Up to the 20 years project's life, energy should be sold to the market.

The project investment analysis, on a 20-year Project basis, this price would yield:

Annual Production (MWh/year)	124,155
PPA Price (US$/MWh) 12 years	100.00
Average Sales Price (US$/MWh) [17]	96.44
Firm Capacity Price (US$/MW/year) [18]	118,942
Average Annual Income (US$)	12,891,818
Total Investment (US$)	88,470,000
Average Annual Operational Cost (US$)	2,453,000
Project Duration (years)	20
Corporate Tax (percentage)	20
Residual value (US$)	0
IRR (%) without CER Sales	8.18%

The IRR of the project activity without the CER's incomes (8.18%) is below the financial benchmark (10%), demonstrating that the project activity by itself is not economically feasible. However, the environmental and sustainable development contribution to the country, the derived image and economical benefits that Punta Palmeras S.A. will acquire derived from the project activity registration as a CDM project activity are a substantial and important incentive for the project implementation.

Outcome of Step 2c: As can be seen from above mentioned information, ex-post project IRR is less than the benchmark IRR, and hence it can be said that the project is not financially attractive.

Sub-Step 2d: Sensitivity analysis

The purpose of sensitivity analysis is to conclude that financial un-attractiveness is robust to reasonable variations in the critical assumptions.

The sensitivity analysis has been done in accordance with the paragraphs 20 and 21 of the **Guidance on the Assessment of the Investment Analysis**, Version 05, Annex 05, EB 62, *"Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation… and the result of this variation should be presented in the PDD and be reproducible in the associated spread sheets…The DOE should assess in detail whether the range of variations is reasonable in the project context… As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances...*"

Parameter	% total investment	% total revenues	% total costs	Included?
Plant Capacity Factor and energy sales/revenues		93.36%		Yes
Market energy sales price/revenues		37.78%		Yes

[17] Node price report April 2012 CNE Annex nº 2 14.1 and penalization factors results 18.3: http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo/abril-2012

[18] Node price report April 2012 CNE Annex nº 2 14.2 and penalization factors results 18.3: http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo/abril-2012

Project Investment	100%			Yes
Operating and Maintenance Costs			71.02%	Yes

Plant Capacity Factor, Market energy sales price/revenues, Project Investment and Operating and Maintenance Costs are selected as sensitive parameters to check financial attractiveness. The investment analysis provides a valid argument in favor of additionality only if it consistently supports the conclusion that the project activity is likely to be financially unattractive. The effect of the variation in these four parameters on the Project IRR is summarized below:

Plant Capacity Factor:
The overall potential for wind depends heavily on accurately mapping the wind resource. There is currently a lack of data, particularly for developing countries and at heights greater than 80 m.[19]

There is also an inherent variability in Wind power generation from year to year, caused by the cyclic non-systematic variations in the wind patterns. As a result, it is important to carry out the effect of varying plant capacity factor (with +/-10% change in generation) on the Project IRR. Although +/- 10% variation in generation is unlikely, said sensitivity is considered conservative based on extensive historical analysis done by the project proponent itself, coupled with its global experience in project prospecting, analysis, execution and operation, which spans over two decades in different parts of the world.

Estimated power generation calculated and real generation is expected to deviate less than 10% normally if we take into account ten years period, as is expected in these estimates. However, we can see more significant differences between energy estimated and energy produced in individual years, particularly during the first years of a wind farm's life. Once the farm has been in operation for longer, this difference typically becomes smaller. Also not all sites behave the same way: some of them have higher deviations more frequently. Even with in-depth knowledge and experience of wind farms and wind resource, as Acciona has, deviations greater than 10% (in either direction) could occur in some years. In the examples we have reviewed, wind farms with more than 15 years operation, had deviations higher than 10% in specific years, even if not overall.

The wind power project's dependence on plant capacity factor poses a significant risk to the financial viability of the project activity. The sensitivity analysis of the Project IRR with the variation of capacity factor demonstrates the risk associated with the project. The following table shows the impact of variations in the Project IRR with a change of ±10% in the Capacity Factor:

% change in Cap.Factor	**-10%**	**+10%**
Project IRR	6.70	9.59

Even at 35.61% capacity factor which is 13.05% more than the base capacity factor (31.50%), the Project IRR barely reaches the selected benchmark default value. For the Project IRR to reach the benchmark, the capacity factor has to consistently be 13.05% more than the base throughout the project lifetime of twenty years.

These values of capacity factor have been arrived after collection and analysis of exhaustive data on wind in the project region. In order to have a relation with the conservatism of the data used for the project, other projects registered in the area (Monte Redondo, Canela I and II and Totoral) have been checked and Punta Palmeras do have higher capacity factor, in average, 12% higher.

[19] IRENA: Renewable Energy Technologies. Cost Analisys Series. June 2012. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-WIND_POWER.pdf

Thus, the possibility of the project activity to consistently achieve a capacity factor of more than what is estimated is deemed unlikely.

Market energy sales prices/revenues (MESP):
For this project activity Energy sales prices conditions are fixed by the tender for the first 12 years. So variation in spot price could really occur in the last 8 years of the project activity. Variations in the Project IRR with a change of ±10% in the market energy sales prices/revenues in all years:

% change in MESP	**-10%**	**+10%**
Project IRR	6.81	9.49

The average price considered in the project is higher than most of the projects registered before in the region, so this possibility is considered not very likely.

Even taking the sensitivity analysis up to a +14.05 % of change in the Energy sales prices in the twenty years, benchmark is not reached. Taking into account that we have a PPA for the first twelve years, if this calculation is made in the years the energy is sold to the market, it is need up to a + 76% change in the Energy sales prices to reach the benchmark.

In order to have a relation with the conservatism of the data used for the project, all other projects registered under UNFCCC in Chile have been analysed, average energy generation price used in the project is around 20.37% higher. The possibility to have higher average prices is considered not very likely.

Project Investment:
Project investment also has a significant and considerable effect on the Project IRR. Variations in the Project IRR with a change of ±10% in project investment:

% change in Project invest	**-10%**	**+10%**
Project IRR	9.48	7.07

For the Project IRR to reach the benchmark, the Project Investment has to be -13,50% less than the base.

As per IRENA study, capital investment costs for onshore wind investments could range within 1,700 to 2,450 USD/kW, 90 to 96% of them could be all costs except development and engineering cost, licensing procedures, consultancy, permits, SCADA and monitoring.[20]. The investment of the proposed project is within the range shown by the study. Contract information signed justifying 92.57% of the total investment of these type of costs has been shown to validator.

Following IRENA's document, the reality is that the share of different costs components varies by country and project, depending on turbine costs, site requirements, the competitiveness of the local wind industry[21] In order to have a relation of the conservatism of the data used and the approach to the country, all other projects registered under UNFCCC in Chile have been analysed. Project investment per MW is around 7.27% lower. Thus, investment is in the range of other previous wind farm projects in Chile.

[20] IRENA: Renewable Energy Technologies. Cost Analisys Series. June 2012. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-WIND_POWER.pdf

[21] IRENA: Renewable Energy Technologies. Cost Analisys Series. June 2012. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-WIND_POWER.pdf

With the contracts signed, to obtain a 10% decrease in the total investment, an decrease of a 134.56% should happen in the rest of the concepts. So, negative variation in project investment of such magnitude is considered highly unlikely.

Operating and Maintenance Costs (O&M):
O&M cost have a significant effect on Project IRR. Variations in the Project IRR with a change of ±10% in Operating and Maintenance annual costs:

% change in O&M	**-10%**	**+10%**
Project IRR	8.37	7.98

For the Project IRR to reach the benchmark, the Operating and Maintenance Annual Cost has to be -96.00% less than the base. Thus, a variation in the Operating and Maintenance Costs of this magnitude is considered highly unlikely.

Project participant has found information about operation and maintenance costs. IRENA's information about these costs in different countries in the world do show that they account for a minimum of 0.010 to 0.043 USD/kWh. It can be concluded that Operating and Maintenance costs of the project, having more issues included, are in the indicate range. Punta Palmera's Operating and Maintenance cost is 0.0140 USD/kWh.

Outcome of Step 2d: This sensitivity analysis result shows that the variation in Plant Capacity Factor, Market energy sales price/revenues, Project Investment and O&M Cost does not improve the Project IRR to the 10% benchmark value even under favourable circumstances. The above table clearly shows that the project activity requires CDM revenues to overcome the Investment Barriers.

Step 3: Barrier analysis

Not applicable.

Step 4: Common practice analysis

As per paragraph 57 of the Tool for the demonstration and assessment of additionality, version 07.0.0, "*The above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a* ***credibility check*** *to complement the investment analysis (Step 2) or barrier analysis (Step 3).*"

Sub-step 4a: The proposed CDM project activity applies measure(s) that are listed in the definitions section above

The project is a new investment in renewable energy so it is included in one of the four types of measures that are currently covered in the framework under paragraph number 13(b)(ii) of the Tool for the demonstration and assessment of additionality, version 07.0.0.

As per paragraph 58 of the Tool for the demonstration and assessment of additionality, version 07.0.0, *"…The latest version of the "Guidelines on common practice" available on the UNFCCC website shall be applied.'*

The latest "Guidelines on common practice" available are the ones given under EB69 Annex 8: the version 02.0. In its first paragraph it states: *"Applicable geographical area should be the entire host country...*" and gives and stepwise approach for common practice calculation:

Step 1. Calculate applicable output range as +/- 50% of the design output or capacity of the proposed project activity.

For this project the range will include projects within 22.5 to 67.5 MW of installed capacity.

Step 2. Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

a) *The projects are located in the applicable geographical area;*
b) *The projects apply the same measure as the proposed project activity;*
c) *The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;*
d) *The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;*
e) *The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;*
f) *The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.*

The applicable geographical area should be the entire host country.

Projects considered in the same measure would be determined by definitions 2.b of the guidelines: *'Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy)…'*

The proposed project uses the wind resources to generate electricity, therefore, only wind power projects will be chosen for the common practice.

The proposed project will use wind to generate electricity to be transmitted to SIC.

Wind power projects in a range within 22.5 to 67.5 MW of installed capacity will be considered.

The start date of the project activity is June 21th 2013 and the project design document is published for global stakeholder consultation on the March 12th 2014, therefore, start date will be used in search.

Outcome Step 3: we are looking for wind projects in Chile, in a range within 22.5 to 67.5 MW of installed capacity that started commercial operation before June 21th 2013.

As it could be seen in table below, there are 3 plants that comply with all requirements set in this step

Plant Name (plants which comply with requirements of methodology in "Step 2")	Operation Start Date	Installed Capacity (MW)	Applied Technology	Registered in CDM
Canela II	2009	60	Wind	Ref. 5028
Monte Redondo	2010	48	Wind	Ref. 4449
Totoral	2010	46	Wind	Ref. 3252

Source: CNE (http://www.cne.cl/estadisticas/energia/electricidad)

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

All plants have been registered under UNFCCC, so 0 plants will be N_{all}.

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

There is nothing to compare. So N_{diff}. will be 0.

Step 5: calculate factor F=1- N_{diff}/N_{all} representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

Using the values of N_{all} and N_{diff}: F=1<0.2 and N_{all} - N_{diff} =0<3.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all} - N_{diff} *is greater than 3.*

Outcome of Step 4: The project activity is not regarded as "common practice", then the proposed project activity is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The generated power from this project activity is supplied to the Central Interconnected System (SIC-Sistema Interconectado Central). This project activity is a grid connected renewable energy project, emission reduction quantity depends on the net units of energy exported to the grid (in MWh) and the baseline emission factor of the Chile SIC grid.

Formula used to calculate the net emission reduction for the project activity is

$ER_y = BE_y – PE_y$

Where,

ER_y	-	Emission Reduction in year y (tCO_2)
BE_y	-	Baseline emission in year y (tCO_2)
PE_y	-	Project emissions in year y (tCO_2)

Project Emission
This project activity is a grid connected wind power generation. Hence there is no project emission from the project activity.

$PE_y = 0\ tCO_2/year$

There is no GHG emission within the project boundary. So the above equation is simplified to:

$ER_y = BE_y$

Baseline Emission (BEy)
Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity (EG_Y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{CO2\ elec}$) as follows:

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

If the Project activity is the installation of a new grid-connected renewable power plant/unit at a site were no renewable power plant was operated prior to the implementation of the project activity, then:

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

$BE_y=EG_{facility,y}* EF_{grid, CM, y}$

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)
$EG_{facility,y}$ =Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)
$EF_{grid, CM, y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Baseline emission factor (EF_{CO2})
A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' based on that baseline emission factor has been calculated Ex-ante based.

The following steps to be used to calculate the baseline emission factor:

Step 1. Identify the relevant electricity systems

For the purpose of determining the electricity emission factor*, 'A grid/project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints'.*

'In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country'.

For this project, the connected grid is the Central Interconnected System (SIC-Sistema Interconectado Central) and all connected power plants (without significant transmission constraints) are included in the project boundary. The project is fully located in a non Annex I country: Chile.

There are no electricity transfers from other connected electricity systems to the project electricity system (electricity imports) nor electricity transfers to connected electricity systems (electricity exports).

Step 2 Choose whether to include off-grid power plants in the project electricity system (optional)
Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

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

The Project Participant chooses that only grid power plants are included in the calculation (Option I) to calculate the operating margin and build margin Emission Factor. There is no off-grid power plant to be included in the project electricity system.

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

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

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

Any of the four methods can be used. However, *the simple OM method (option a) can be used if low-cost/must-run resources constitute less than 50% of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production*.

As per definitions in 'Tool to calculate the emission factor for an electricity system', version 04.0, low.cost/must-run resources *'are defined as power plants with low marginal generation costs or dispatched independently of the daily or seasonal load of the grid. They include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation'*.

All plants in SIC, except Thermal, have been considered low cost-must run plants.

% over total generation/year	2008	2009	2010	2011	2012	Average
Low cost/must run	58,45%	61,22%	51,87%	47,32%	45,68%	52,91%
No low cost/must run	41,55%	38,78%	48,13%	52,68%	54,32%	47,09%

Since 2010 not favorable conditions in hydro made a significant increase in thermal generation. Even though the above table shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for the SIC Chile grid is 52.91%[22], which is slightly higher than 50% of the total generation. Thus, Simple OM method cannot be used for calculating the emission factor and project participant selects Simple Adjusted OM method for calculating the emission factor.

For the Simple Adjusted OM, the emissions factor can be calculated using either of the two following data vintages:

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

Or

• *Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.*

[22] For year 2008 and 2009 elaborated from yearly data in https://www.cdec-sic.cl/est_opera_privada.php. For years 2010 to 2012 Elaborated from source data, Daily Real Operation used for baseline calculation: http://www2.cdec-sic.cl/informes-y-documentos/fichas/operacion-real/

The project proponent choose an ex ante option for calculation of the OM with a three year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation (2010, 2011 and 2012), without requirement to monitor and recalculate the emission factor during the crediting period.

Step 4 Calculate the Operating Margin emission factor according to the selected method

Simple adjusted OM emission factor ($EF_{grid,\ OM\text{-}adj,y}$) is a variation of the simple OM, where the power plants/units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m)... it is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y) \times \frac{\sum_m EG_{m,y} \times EF_{EF,m,y}}{\sum_m EG_{m,y}} + \lambda_y \times \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where:

$EF_{grid,\ OM\text{-}adj,y}$	*= Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh)*
λ_y	*= Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y*
$EG_{m.y}$	*= Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)*
$EG_{k,y}$	*= Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)*
$EF_{EL,m.y}$	*= CO_2 emission factor of power unit m in year y (tCO_2/MWh)*
$EF_{EL,k,y}$	*= CO_2 emission factor of power unit k in year y (tCO_2/MWh)*
m	*= All grid power units serving the grid in year y except low-cost/must-run power units*
k	*= All low-cost/must-run grid power units serving the grid in year y*
y	*= The relevant year as per the data vintage chosen in Step 3*

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 ($EF_{EL,m,y}$) should be determined as follows:

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

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*

Option A2.
If for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{co2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$ = *CO_2 emission factor of power unit m in year y (tCO_2/MWh)*
$EF_{CO2,i,y}$ = *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*

Source of information used for calculation is:

- Yearly generation has been elaborated from daily real operation[23]
- Gross Caloric Values have been obtained from the Energy Minister [24] and converted into Net Caloric Values using the conversion as per IPCC 2006 Guidelines[25].
- Yearly consumption has been obtained from:
  - CDEC-SIC year book 2013[26].
  - CNE price report October (2010, 2011 and 2012) [27] if there is not information in CDEC-SIC source or the information is not consistent with the generation.
  - Option A2, already explained, is used when there is no consumption information in the two previous sources.

Depending on information available formula option A1 (consumption is shown in CDEC-SIC or CNE information) or formula option A2 (no consumption information found) is used to calculate $EF_{CO2,i,y}$.

For grid power plants, $EG_{m,y}$ should be determined as per the provisions in the monitoring tables.

There are no imports and it is assumed that all low-cost/must-run plants produce zero net emissions, thus $EF_{EL,k,y}$ =0 and second part of the formula $EF_{grid, OM\text{-}adj,y}$ is 0:

$$\lambda_y \times \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

[23] CEDEC-SIC. https://www.cdec-sic.cl/est_opera_publica.php#C5

[24] Energy Minister: http://antiguo.minenergia.cl/minwww/opencms/14_portal_informacion/06_Estadisticas/Balances_Energ.html

[25] IPCC Guidelines 2006: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[26] CEDEC-SIC: https://www.cdec-sic.cl/datos/anuario2013.pdf

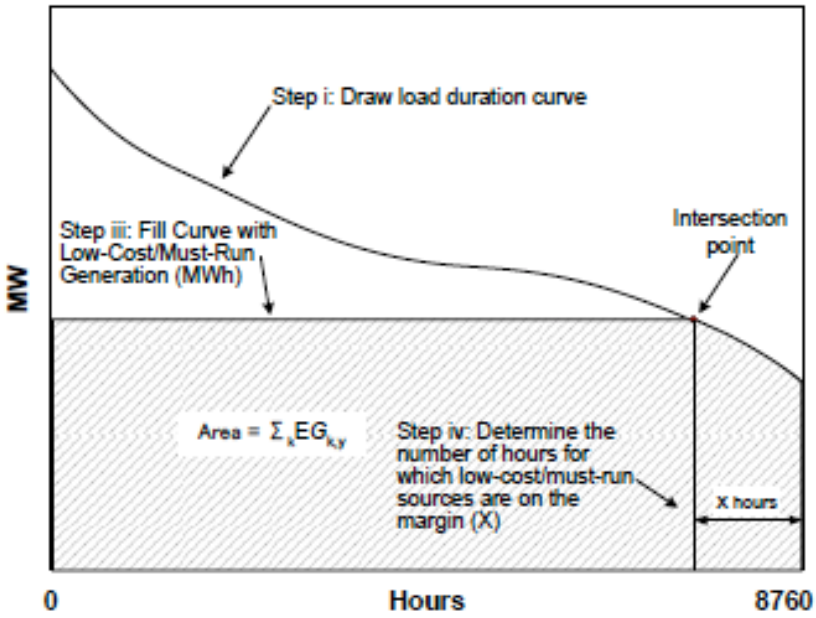
[27] CNE: http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo

so there is no need to calculate $EG_{k,y}$

The parameter λ_y is defined as follows:

$$\lambda_y\,(\%) = \frac{\text{Number of hours low - cost / must - run sources are on the margin in year y}}{\text{8760 hours per year}}$$

Illustration of Lambda Calculation for Simple Adjusted OM Method, as per tool to calculate the emission factor for an electricity system:



Lambda values used to calculate the operating margin emission factor have been estimated as follows:

λ_{2010} = 0.0067
λ_{2011} = 0.0001
λ_{2012} = 0.0000 because the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and Lambda is equal to zero

$EF_{grid,\ OM\text{-}adj,2010\text{-}2012}$ = 0.6776 tCO_2/MWh.

More information is given in Appendix 4.

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

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1
For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2

For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 as described above is chosen in the project activity. Build Margin is calculated *ex ante* based on the most recent information available at the time of submission of CDM-PDD. The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

$EF_{grid,BM,y}$ = *Build margin CO_2 emission factor in year y (tCO_2/MWh);*
$EG_{m,y}$ = *Net quantity for 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 power generation data is available*

The sample group of power units m used to calculate the build margin should be determines as per the following procedure…

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

The project participant has selected the 5 power units (excluding the power units registered as CDM project activities) that started to supply electricity to the grid most recently. $AEG_{SET\text{-}5\ units}$ in 2012: 936,762.32 MWh (1.99% of the total generation of 2012).

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% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\geq 20\%}$ in MWh);*

$AEG_{SET\geq 20\%}$ = 8,014,738.80 MWh
AEG_{total} = 46,871,575.63 MWh (25.90% of the total generation of 2012).

The set of power units (excluding registered as CDM), that started to supply electricity to the grid most recently and that comprise 20% Annual Electricity Generation are shown below.

PLANT UNIT NAME	COMMISIONING DATE (1)		TOTAL YEAR GENERATION 2012	t CO2	% over Total	% Acum.
Tambo Real	2012	Solar	144,30	-	0%	0,00%
Rucatayo	2012	Run of river (hydro)	59.139,10	-	0%	0,13%
Nalcas Registered 8981	2012	Run of river (hydro)	-	-	0%	0,13%
Callao registered 8982	2012	Run of river (hydro)	-	-	0%	0,13%
El Canelo	2012	Run of river (hydro)	10.870,10	-	0%	0,15%
Bocamina II	2012	Thermal	507.222,20	442.308,47	1%	1,23%
Allipen Regitered 7836	2012	Run of river (hydro)	-	-	0%	1,23%
Sta Fe	2012	Biomass	359.386,62	-	1%	2,00%
Purísima	2012	Run of river (hydro)	1.175,62	-	0%	2,00%
Lautaro - Comasa Registered 8099	2012	Biomass	-	-	0%	2,00%
Santa María	2012	Thermal	1.852.887,00	1.599.536,93	4%	5,95%
Lebu	2012	Thermal	114,20	75,56	0%	5,95%
Tomaval	2011-2012	Thermal	31,58	15,63	0%	5,95%
JCE	2011	Thermal	13,40	8,87	0%	5,95%
Reca	2011	Run of river (hydro)	7.895,01	-	0%	5,97%
Skretting Osorno	2011	Thermal	530,30	314,75	0%	5,97%
Danisco	2011	Thermal	1,50	0,99	0%	5,97%
La Arena Registered 6404	2011	Run of river (hydro)	-	-	0%	5,97%
Muchi	2011	Run of river (hydro)	1.466,14	-	0%	5,98%
HBS	2011	Biomass	15,86	-	0%	5,98%
Punta Colorada Eólica	2011	Wind	12.895,75	-	0%	6,00%
Chacayes Registered 6848	2011	Run of river (hydro)	-	-	0%	6,00%
Lonquimay	2011	Run of river (hydro)	19,90	-	0%	6,00%
Tirúa	2011	Run of river (hydro)	38,90	-	0%	6,00%
Mallarauco	2011	Run of river (hydro)	24.726,11	-	0%	6,06%
Licán -Validation-	2011	Run of river (hydro)	83.118,58	-	0%	6,23%
Diuto	2011	Run of river (hydro)	20.931,50	-	0%	6,28%
Los Sauces II	2011	Thermal	3.947,10	2.518,02	0%	6,29%
Calle-Calle	2011	Thermal	11.260,10	8.183,56	0%	6,31%
Mariposas -rejected-	2011	Run of river (hydro)	29.695,58	-	0%	6,37%
Confluencia Registered 4229	2011	Run of river (hydro)	-	-	0%	6,37%
Cabrero-Masisa	2011	Biomass	51.335,30	-	0%	6,48%
Guayacán Registered 3830	2011	Run of river (hydro)	-	-	0%	6,48%
La Higuera	2011	Thermal	-	-	0%	6,48%
Lousiana Pacific II	2011	Thermal	-	-	0%	6,48%
Loma Los Colorados Registered 822	2007-2011	Biomass	-	-	0%	6,48%
Dongo Registered 8162	2010	Run of river (hydro)	-	-	0%	6,48%
Punta Colorada IFO	2010	Thermal	45.608,64	31.494,40	0%	6,58%
Los Corrales	2010	Run of river (hydro)	5.679,80	-	0%	6,59%
Emelda U2	2010	Thermal	46,80	46,25	0%	6,59%
Juncalito	2010	Run of river (hydro)	3.572,80	-	0%	6,60%
El Tártaro	2010	Run of river (hydro)	582,20	-	0%	6,60%
El Salvador	2010	Thermal	26,00	27,58	0%	6,60%
San Clemente Registered 4800	2010	Run of river (hydro)	-	-	0%	6,60%
Emelda U1	2010	Thermal	656,10	629,50	0%	6,60%
Colihues IFO	2010	Thermal	56.294,27	38.736,16	0%	6,72%
Trueno Registered 4337	2010	Run of river (hydro)	-	-	0%	6,72%
La Paloma Registered 3791	2010	Run of river (hydro)	-	-	0%	6,72%
Yungay (Ex-Campanario) Diesel 4	2010	Thermal	448,12	214,91	0%	6,72%
Guacolda 4	2010	Thermal	1.193.763,90	1.051.822,00	3%	9,27%
Totoral Registered 3252	2010	Wind	-	-	0%	9,27%
Monte Redondo Registered 4449	2010	Wind	-	-	0%	9,27%
Nueva Ventanas	2010	Thermal	2.287.385,00	2.106.135,87	5%	14,15%
San Lorenzo de D. Almagro U1+U2	2009-2010	Thermal	-	-	0%	14,15%
CBB-Centro	2010	Thermal	-	-	0%	14,15%
Doña Hilda	2010	Run of river (hydro)	-	-	0%	14,15%
Canela 2 Registered 5028	2009	Wind	-	-	0%	14,15%
Termopacífico	2009	Thermal	16.937,91	11.960,59	0%	14,19%
El Peñón	2009	Thermal	123.069,96	83.409,36	0%	14,45%
Quintero GNL A	2009	Thermal	59.969,00	34.663,92	0%	14,58%
Guacolda 3	2009	Thermal	1.185.919,00	1.055.559,81	3%	17,11%
Quintero GNL B	2009	Thermal	101.057,00	58.414,05	0%	17,32%

Newen Gas Natural	2009	Thermal	16.363,57	8.098,10	0%	17,36%
Newen Diesel	2009	Thermal	-	-	0%	17,36%
Newen Propano	2009	Thermal	5.311,70	2.982,08	0%	17,37%
Chuyaca	2008-2009	Thermal	6.014,70	4.406,53	0%	17,38%
Teno	2009	Thermal	59.087,62	40.288,30	0%	17,51%
Santa Lidia	2009	Thermal	26.511,90	22.347,41	0%	17,57%
Los pinos	2009	Thermal	224.901,00	149.192,60	0%	18,05%
Las cenizas	2009	Thermal	48.225,50	39.029,29	0%	18,15%
Los espinos	2009	Thermal	16.634,60	11.960,59	0%	18,18%
Lircay Registered 2417	2009	Hydro	-	-	0%	18,18%
Trapén	2009	Thermal	116.967,77	79.317,58	0%	18,43%
Biomar	2009	Thermal	3,90	2,58	0%	18,43%
Curicó	2009	Thermal	1.566,20	1.293,92	0%	18,44%
Eagon	2009	Thermal	403,10	314,75	0%	18,44%
Linares norte	2009	Thermal	146,86	121,57	0%	18,44%
Lousiana Pacific	2009	Thermal	414,90	314,75	0%	18,44%
Multiexport I-II	2009	Thermal	0,20	0,13	0%	18,44%
Salmofood	2009	Thermal	-	-	0%	18,44%
San Gregorio	2009	Thermal	124,86	103,36	0%	18,44%
Tapihue	2009	Thermal	2.329,15	1.152,66	0%	18,44%
Truful Truful	2009	Run of river (hydro)	3.223,10	-	0%	18,45%
Cardones	2009	Thermal	-	-	0%	18,45%
Watt I-II	2009	Thermal	313,10	314,75	0%	18,45%
Orafti	2009	Thermal	-	-	0%	18,45%
Pehui	2009	Run of river (hydro)	6.181,52	-	0%	18,46%
Escuadrón (ex FPC) Registered 2264	2008-2009	Biomass	-	-	0%	18,46%
Placilla	2008	Thermal	978,29	629,50	0%	18,47%
Totoral	2008	Thermal	2.013,66	1.573,76	0%	18,47%
Quintay	2008	Thermal	2.786,90	1.888,51	0%	18,48%
Quellon II	2008	Thermal	16.155,50	12.904,85	0%	18,51%
Colmito	2008	Thermal	799,76	750,14	0%	18,51%
Olivos	2008	Thermal	7.011,90	5.036,04	0%	18,53%
Chiloé	2008	Thermal	7.583,20	6.295,05	0%	18,54%
Coya	2008	Run of river (hydro)	79.661,20	-	0%	18,71%
Ojos de agua Registered 937	2008	Run of river (hydro)	-	-	0%	18,71%
Yungay (Ex-Campanario) Diesel 3	2008	Thermal	1.199,34	575,17	0%	18,72%
Nueva Aldea III Registered 346	2008	Biomass	-	-	0%	18,72%
Hornitos Registered 1374	2008	Run of river (hydro)	-	-	0%	18,72%
Skretting	2008	Thermal	107,90	71,39	0%	18,72%
Puclaro	2008	Run of river (hydro)	-	-	0%	18,72%
El Manzano Registered 4227	2008	Run of river (hydro)	-	-	0%	18,72%
Canela Registered 1958	27/12/07	Wind	-	-	0%	18,72%
Palmucho	28/11/07	Run of river (hydro)	231.972,00	-	0%	19,21%
Chiburgo	19/07/07	Run of river (hydro)	67.545,70	-	0%	19,36%
Monte Patria	06/07/07	Thermal	-	-	0%	19,36%
Punitaqui	06/07/07	Thermal	-	-	0%	19,36%
Degan	04/07/07	Thermal	19.045,90	13.113,12	0%	19,40%
Esperanza TG	22/08/07	Thermal	-	-	0%	19,40%
Esperanza 2	29/06/07	Thermal	249,47	232,76	0%	19,40%
Esperanza 1	27/06/07	Thermal	80,45	108,52	0%	19,40%
Maule (prev. Constitution 2)	07/06/07	Thermal	592,90	944,26	0%	19,40%
Quilleco Registered 1265	28/05/07	Run of river (hydro)	-	-	0%	19,40%
San Isidro II (2)	2007-2008	Thermal	3.045.889,00	1.083.297,57	6%	25,90%
Total Generation Building Margin 2012, AEGSET≥ 20%			12.138.276,57	8.014.738,80		
Total Generation 2012, AEGtotal			46.871.575,63			

(1) Commisioning date has been completed using CDEC-SIC year book 2013 information (pages 32 to 34). Source: https://www.cdec-sic.cl/datos/anuario2013.pdf. For year 2007 we have used data from CDEC-SIC year book 2008 (page 3) https://www.cdec-sic.cl/datos/anuario2008/ingles/index_eng.html

(2) First unit in April 23 rd 2007 and second unit in January 21st 2008. In order to be conservative not included unit 2007 date. Source CEDEC-SIC year book 2008 (page 3) and CEDEC-SIC year book 2009 (page 7).

Plants registered under UNFCCC, registration number added to the plant name

Plant under validation or rejected

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

AEG $_{SET\geq 20\%}$ > AEG $_{SET\text{-}5\ units}$

No plants are older than 10 years.

AEG $_{SET\text{-}sample\text{-}CDM}$= AEG $_{SET\geq 20\%}$ = 8,014,738.80 MWh, (17,10% of AEG $_{total}$).

Step 6:Calculate the combined margin emissions factor

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

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option a) should be used as the preferred option… The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = 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 (%)

w_{BM} = Weighting of build margin emissions factor (%)

EF_{OM} = 0.6776 tCO_2/MWh

w_{OM}[28] = 0.75

EF_{BM} = 0.6603 tCO_2/MWh

w_{BM} = 0.25

$EF_{grid\ CM,2012}$ = 0.75 *0.6776 + 0.25 *0.6603

= 0.6732 tCO_2/MWh

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$FC_{i,m,y}$**
Unit	For Diesel and Coal Tn/year; for Natural Gas m^3/year
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	CDEC-SIC year book 2013. Yearly consumption, pages 74 and 75 and CNE.. Yearly price report October. Frame nº6[29].
Value(s) applied	Values provided in Appendix 4

[28] For the project activities like wind & solar: w_{OM} = 0.75 and w_{BM}= 0.25 is used as a default values.

[29] Source CDEC-SIC: https://www.cdec-sic.cl/datos/anuario2013.pdf.

Source CNE, select information October 2010, 2011 and 2011 and then download Definitive Information Report: http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo

Choice of data or Measurement methods and procedures	As per *Tool to calculate the emission factor for an electricity system* once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).
Purpose of data	Calculation of baseline emissions
Additional comment	Values applied for option A1 of the emission factor calculation

Data / Parameter	**$NCV_{i,y}$**
Unit	For Diesel and Coal GJ/tn; for Natural Gas GJ/m^3
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	Energy Minister, Chile Government. National Energy Balance Report, Frame A2[30]
Value(s) applied	IFO: 10,500 kCal/kg Fuel Oil: 10,500 kCal/kg Diesel: 10,900 kCal/kg Coal: 7,000 kCal/kg Coke: 7,000 kCal/kg LPG: 12,100 kCal/m^3 Natural Gas: 9,341 kCal/m^3
Choice of data or Measurement methods and procedures	Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).
Purpose of data	Calculation of baseline emissions
Additional comment	The National Energy Balance Report includes Gross Calorific Values (GCV) for different types of fuel. These values were corrected to Net Calorific Values (NCV) based on IPPC assumptions stating that for liquid and solid fuels NCV is 5% lower than GCV, and for gas fuels NCV is 10% lower than GCV.

Data / Parameter	**$EF_{CO2,i,y}$**
Unit	tCO_2/TJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter 1 of Vol 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories[31]

[30] http://antiguo.minenergia.cl/minwww/opencms/14_portal_informacion/06_Estadisticas/Balances_Energ.html

31 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

Value(s) applied	IFO: 75.5 tCO_2/TJ Fuel Oil: 75.5 tCO_2/TJ Diesel: 72.6 tCO_2/TJ Coal: 89.5 tCO_2/TJ Coke: 95.7 tCO_2/TJ LPG: 61.6 tCO_2/TJ Natural Gas: 54.3 tCO_2/TJ
Choice of data or Measurement methods and procedures	As per *Tool to calculate the emission factor for an electricity system,* once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).
Purpose of data	Calculation of baseline emissions
Additional comment	Lower Default Emission Factor has been used in a conservative manner

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	CDEC-SIC, daily Real Operation[32].
Value(s) applied	Values provided in Appendix 4
Choice of data or Measurement methods and procedures	Simple adjusted OM: Ex ante, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation. BM: Ex ante, following the guidance in Steps 5 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	Daily generation is used to calculate monthly and yearly generations. Yearly generation is crosschecked with hourly generation used for Lambda calculation

Data / Parameter	$\eta_{m,y}$
Unit	Dimensionless (%)
Description	Average net energy conversion efficiency of power plant/unit *m* or *k* in year *y*
Source of data	Tool to calculate the emission factor for an electricity system. Version 04.0 Appendix 1[33].

[32] https://www.cdec-sic.cl/est_opera_publica.php#C5

33http://cdm.unfccc.int/filestorage/z/a/6WYDEP2G30AT5NQOMJKC8XIRL7VUF1.pdf/eb70_repan22.pdf?t=S0l8bXd2bm0zfDDmDwE1p_Su-_K4YQT21SUV

Value(s) applied	For new units (after 2000): IFO 39.5% Diesel 39.5% Coal 39.0% LPG 39.5% Natural Gas 39.5% For unit Laguna Verde (before 2000) in year 2011: 30.0%
Choice of data or Measurement methods and procedures	As per *Tool to calculate the emission factor for an electricity system* once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).
Purpose of data	Calculation of baseline emissions
Additional comment	Values applied for option A2 of the emission factor calculation when no consumption values from CDEC-SIC or CNE are available.

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	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" (Ex-ante)
Source of data	Calculated
Value(s) applied	0.6732
Choice of data or Measurement methods and procedures	We have chosen to calculate the emission factor ex-ante because it is simpler for the project development. The value was calculated as per the "*Tool to calculate the emission factor for an electricity system*", the calculation data is provided in Appendix 4
Purpose of data	Calculation of baseline emissions
Additional comment	

B.6.3. Ex ante calculation of emission reductions

Formula used to calculate the net emission reduction for the project activity is

$$ER_y = BE_y - PE_y$$

As explained in section B.6.1 PE_y are zero. There is no GHG emission within the project boundary. So the above equation is simplified to

$$ER_y = BE_y$$

Baseline Emission (BE_y)

Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity ($EG_{facility,y}$) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{grid, CM, y}$) as follows:

$$BE_y = EG_{facility,y} * EF_{grid, CM, y}$$

Where:

$EF_{grid, CM, y}$ = 0.6732 tCO_2/MWh

$EG_{facility,y}$ = 124,155 MWh/year

Putting EG and EF in above formula

$$ER_y = 83{,}581\ tCO_2/year$$

The total Emission Reduction (ER) from this project activity is 835,810 tCO_2

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 2015	83,581	0	0	83,581
Year 2016	83,581	0	0	83,581
Year 2017	83,581	0	0	83,581
Year 2018	83,581	0	0	83,581
Year 2019	83,581	0	0	83,581
Year 2020	83,581	0	0	83,581
Year 2021	83,581	0	0	83,581
Year 2022	83,581	0	0	83,581
Year 2023	83,581	0	0	83,581
Year 2024	83,581	0	0	83,581
Total	835,810	0	0	835,810
Total number of crediting years	10			
Annual average over the crediting period	83,581	0	0	83,581

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the grid (SIC) in year y
Source of data	Energy meters installed in the project site and in the interconnection point.
Value(s) applied	124,155 MWh
Measurement methods and procedures	Net electricity supplied by the project activity to the grid. The metering equipment complies with laws and regulations[34] and will be properly calibrated by independent provider. Calculated from energy exported by the project to the grid and energy imported by the project from the grid, directly obtained from the metering equipment. Double check by receipt of sales. Site Manager will be responsible.

[34] Source: Technical Norm for Security and Quality in the Service (Norma Técnica de Seguridad y Calidad de Servicio: RM 85/2009 con RM 68/2010 (texto refundido).) : http://www.cdec-sic.cl/contenido_es.php?categoria_id=2&contenido_id=000010

Procedure Manual for the systems of measurement and supervision in the CDEC-SIC. July 2000 (Manual de Procedimientos para los sistemas de medición y sistemas de supervisión en el CDEC-SIC. Julio de 2000): http://www.ecosoft.cl/clientes/Colbun/documents/Manual_CDEC_Medicion_Supervision.pdf

Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	The metering equipment will be periodically calibrated and checked for accuracy, according to standards of the grid operator (CDEC-SIC), to ensure that any error resulting from such equipment shall not exceed +/- 0.2% of full-scale rating. To guarantee QA/QC, it will be double checked by receipts of electricity sales.
Purpose of data	Calculation of baseline emissions
Additional comment	The data will be archived electronically. Archived data will be kept during the crediting period and two years later.

B.7.2. Sampling plan

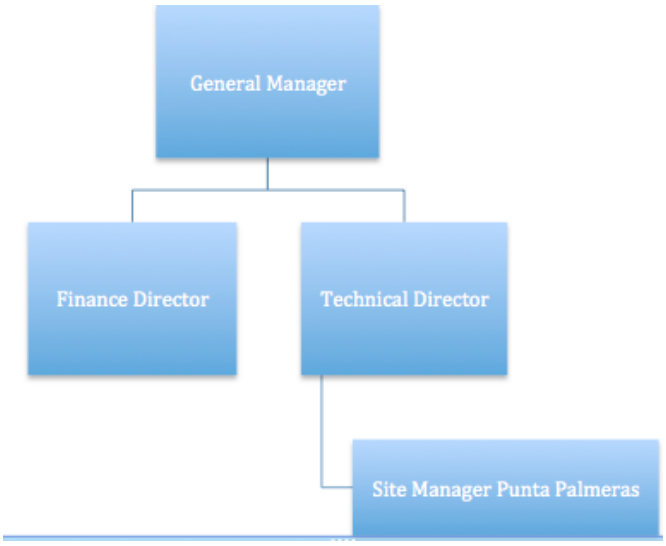
No sampling approach will be used.

B.7.3. Other elements of monitoring plan

According to approved Large Scale Consolidated Methodology ACM0002 Version 14.0.0, Sectoral Scope 1, "Grid connected electricity generation from renewable sources" is proposed to be used to monitor the emission reductions.

Important information on monitoring is provided below:

Organisational structure: Following management structure is proposed to be implemented at site for the monitoring of project activity. There might be changes in this structure in terms of roles however the responsibilities undertaken by the roles would always be maintained.



Role	Responsibility
General Manager	Overall responsible for the management of project activity
Technical Director	Ensure correctness of data and compliance of monitoring methodology
Finance Director	Generation of invoices and CER calculation
Site Manager	Ensuring proper data recording and calibration of relevant meters as per legal requirements.

Generating point: This would be exact place where energy is generated at the various individual windmills

Interconnection point: It is the connection point of the electrical line between the wind-farm and the grid.

Point of measurement: Place where meter is connected to measure energy fed into the grid (SIC) at the interconnection point. Meters are located in the interconnection point substation Las Palmas operated by Transelec

There are two measurement meters in Las Palmas substation:

Main meter: This would primarily be used for accounting and billing of electricity. The meter will be properly registered by the system operator (CDEC-SIC).

Check meter: Will be used for accounting and billing of electricity in case of failure of main meter. The project owner will keep a back-up meter installed that can be accessed in case of mal-functioning of the main meter.. If the main meter is mal-functioning, the first option for billing is to use the readings from the check meter. If this action is not possible due to any reason, the net energy generation will be calculated by the CDEC-SIC using data from third parties for energy billing purposes, located in the same substation.

All the meters would be equal or higher than 0.2% accuracy class and will be sealed.

Data recording and storage:
Quantity of net electricity generation supplied by the project plant to the grid is continuously measured by meters (with, at least, hourly measurement). Electricity generation related evidence or data will, at least monthly recorded and will be stored in the electronic format and/or hard copy format during the running of the project and for a minimum of two years after the end of the crediting period or the last issuance, whichever is later. Remote access, through data acquisition software, to the main meter reading will be possible.

Main and check meters reading:
The reading shall be taken on a continuous and online basis and will be sent remotely to the grid operator. Standards and requirements of the grid operator will be fulfilled. The same will form the basis for raising invoice and receiving payments for net electricity sold. Data integrity between main and check meters reading will be performed. If there is any discrepancy, a report explaining the problem detected and the corrective actions to be taken will be created and documented.

The metering equipment will be properly configured and checked periodically according to Chile law and/or PPA. A start-up configuration and checking of metering equipment is also expected to occur before project activity's commercial operation.

Data uncertainty:
In case the Main and/or Check meters are found to be faulty, the correction factor as per the requirements stated in PPA would be applied to determine the electricity generation for that period.

B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

Date of completion: 16 June 2014.

Nuria Iturriagagoitia
Propuesta Asesores S.L.
Calle Berroa nº 2 oficina 607
31192 Tajonar (Navarra, Spain)
Phone: (+34) 948.150.249
Fax: (+34) 948. 852.144
niturriagagoitia@propuestasesores.com

The entity is not listed as Project Participant.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

The start date of the project activity is the date when Punta Palmeras S.A. signed the PPA: 21/06/2013

C.1.2. Expected operational lifetime of project activity

20 years, 0 months.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Project activity will use fixed crediting period.

C.2.2. Start date of crediting period

01/01/2015 or effective date of registration, whichever is later.

C.2.3. Length of crediting period

10 years, 0 months.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

According to the Environmental General Basis Law 19.300 [35], article 10, sub article c) power plants with a an installed capacity larger than 3MW shall be submitted to the Environmental Impact Assessment Evaluation. A confirmation of the procedure could be seen in article 3 sub article c) of the Regulation of the Environmental Impact Assessment stated in the Decree nº 95/2001[36].

In September 2nd 2009 the initial project of Punta Palmeras Wind Power Project was approved by the regional commission of environment of the Coquimbo's region.[37]

[35] National Sytem of Environmental Information. SINIA: http://www.sinia.cl/1292/articles-51743_Ley19300_12_2011.pdf

[36] Biblioteca del Congreso Nacional de Chile: http://www.leychile.cl/Consulta/listaMasSolicitadasxmat?agr=1020&sub=517&tipCat=1

[37] Annex VII, Resolutions Associated to the Project, document nº1 SEA information: http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

The project was modified in July 17th 2012, turbines initially used were changed to a newer technology (from 1.5 MW to 3 MW per turbine) and the number of wind turbines decreased from 69 to 22 units. The area affected has no increased.[38]

Favourable resolution was made on December 26th, 2012[39]. The Punta Palmeras Wind Power Project will develop 15 from the 22 units. A second phase may come in future with 7 more turbines and 21 MW.

The project has to comply with the Environmental General Basis Law 19.300 and should demonstrate it does not present any of the effects, characteristics or circumstances of the article 11 included the environmental requirements contents in articles 94, 96 and 99 of the regulation of the Environmental Impact Assessment evaluation.

D.2. Environmental impact assessment

As per the resolution 0122 dated December 26th, 2012 from Environmental Assessment Service (Servicio de Evaluación Ambiental), there are not significant environmental impacts. The location of the project and the mitigation strategies taken avoid the adverse environmental effects.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

According to the Environmental Impact Assessment System (SEIA) procedures at the time of project evaluation, stakeholders should be duly informed. The project participant has been in permanent communication with the local stakeholders. On February 3rd, 2009 the secretary of the Environmental Commission of the IV Coquimbo region gave all information related to the project to 17 stakeholders related to the project. All of them were informed that clarifications and more information could be asked. In July 30th 2012, the Director of the Environmental Impact Assessment of the IV Coquimbo region invited 15 stakeholder to a physic presentation of the project with the opportunity to clarify doubts and respond to queries. A visit to the site was also included. The presentation was made on August 14th 2012 with seven participants. Explanations about the modifications of the original project were made.

A special document was elaborated for CDM presentations which explained global warming problem, the scientific evidence that this warming is caused mainly by human activities and the Kyoto Protocol as a first big agreement to curb emissions. Project activity description and its contribution to curb emission was also explained. Before the PDD submission, the project trained personnel held three special CDM local stakeholder consultations.

- On February 6th, 2014 presentation was made to 16 attendants of the meeting, most of them were partners of the fisherman association including the presence of the president and the secretary.
- On February 14th, 2014 presentation was made to 5 attendants of the utility Colbún.
- On March 3rd, 2014 presentation was made to 8 attendants of the Canela Municipality most of them were city councillor. Major was also present.

[38] Project Description document nº1 SEA information: http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

[39] Document 42 SEA Information: http://seia.sea.gob.cl/expediente/expedientesEvaluacion.php?modo=ficha&id_expediente=7132611

E.2. Summary of comments received

Different clarifications were required to the project participant during SEA processing, reforestation and turist/educational information were suggested.

In the fisherman association comments received were more related to the access to the common path, the improvements will be done and the access through the new gate.

In the Colbún meeting, attendants were more interested in the PDD registration and issuance procedures and the CERs property and Colbún obligations/rights over carbon assets.

In the Canela Municipality meeting attendants were interested in educational meetings in schools with the objective of helping in environmental and natural resources education. They were also interested in having space, in the access to the project, were information about the Canela Comuna could be displayed.

E.3. Report on consideration of comments received

During SEA procedure voluntary reforestation agreement for the temporal areas used during construction was made as well as the installation of some educational/touristic elements with the information about benefits of renewable generation in the access to the project.

Explanations were made with the fisherman association about path improvements and the access gate future control.

Personnel of the project explained the status of the project under the registration process: PDD is almost finished so it is expected we will need six months to obtain registration and another twelve to eighteen months to get CER's issued. It was clarified that Colbún has not obligation to buy CERs to the owner (project participant) but has the wright of first option.

The Project participants offered the coordination of the school meetings in order to help in environmental and natural resources education. They also will look for the possibility of giving space for Canela Comuna information in the access to the Project.

SECTION F. Approval and authorization

Letter of Approval form Chile DNA was received on October 7th, 2014 by the project participant. Decision by the DNA was taken on September 10th, 2014.

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Punta Palmeras S.A.
Street/P.O. Box	Apoquindo 4499, piso 4
Building	Not applicable
City	Santiago
State/Region	Comuna de las Condes
Postcode	Not applicable
Country	Chile
Telephone	+ 562 2 7515160
Fax	Not applicable
E-mail	fabio.fuente.figueroa@acciona.com
Website	Not applicable
Contact person	Not applicable
Title	Gerente de Ingenieria y Construcción
Salutation	Mr.
Last name	De la Fuente Figueroa
Middle name	Not applicable
First name	Fabio
Department	Not applicable
Mobile	Not applicable
Direct fax	Not applicable
Direct tel.	Not applicable
Personal e-mail	fabio.fuente.figueroa@acciona.com

Appendix 2. Affirmation regarding public funding

Appendix 3. Applicability of methodology and standardized baseline

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

As explained in B.6.2 following are the values applied for net energy generation by power plant/unit *m* in year *y*; followed by the amount of fossil fuel type consumed by power plant/unit *m* in year *y* for each vintage year.

	TOTAL YEAR GENERATION IN MWh		
PLANT NAME UNITS	2010	2011	2012
Run of river (hydro)	9.800.760,54	9.604.149,62	9.794.889,53
Los Molles	28.343,00	27.387,00	25.901,00
Sauce Andes	6.333,98	5.070,97	6.122,46
Aconcagua Ublanco (1)	328.146,10	193.096,70	211.518,45
Aconcagua Ujuncal (1)	39.806,10	99.287,70	115.097,20
Los Quilos	213.570,50	199.667,60	216.441,70
Florida	118.661,00	75.141,00	87.280,00
Maitenes	129.722,16	115.590,14	97.923,70
Alfalfal	845.500,00	671.519,42	693.624,93
Queltehues	357.686,00	309.226,00	318.133,00
Puntilla	146.902,60	121.258,60	119.917,20
Volcan	107.659,00	87.663,00	92.152,00
Los Morros	17.353,50	10.193,10	11.426,44
Sauzal 50Hz	423.943,00	387.163,00	427.459,00
Sauzal 60Hz	-	294,70	-
Sauzalito	72.404,00	68.047,00	69.774,00
Curillinque	621.357,00	482.410,00	517.018,25
San Ignacio	122.229,00	171.869,00	129.642,00
Loma Alta	270.328,00	227.146,00	231.089,00
Rucue	943.174,00	918.233,00	796.772,00
Pullinque	209.844,00	198.407,80	185.147,07
Pilmaiquén	263.127,00	239.280,00	238.604,20
Capullo	72.746,00	70.271,00	67.801,00
Peuchén	166.450,92	221.253,09	176.521,99
Mampil	106.542,44	158.041,99	124.392,40
Chacabuquito	136.617,00	122.718,10	131.592,90
Antuco	1.448.334,00	1.470.889,00	1.395.746,00
Abanico	315.050,00	282.864,00	267.126,00
Isla	488.228,00	386.850,00	402.815,00
Machicura	340.602,00	411.442,00	350.798,00
Eyzaguirre	6.685,90	3.792,40	6.377,80
Quilleco	387.240,00	376.786,00	327.819,00
El Rincón	2.446,90	2.498,60	2.451,90
Chiburgo	75.847,00	67.390,00	67.545,70
Palmucho	232.351,00	224.097,00	231.972,00
Hornitos	195.559,40	173.421,60	176.789,90
Puclaro	24.379,02	14.544,69	1.495,70
Ojos de Agua	49.804,58	41.305,68	44.175,56
Coya	83.303,90	69.362,50	79.661,20
Lircay	121.921,00	119.985,80	125.668,46
El Manzano	27.498,07	25.087,50	26.127,30
Pehui	7.133,90	6.580,17	6.181,52
Truful Truful	36,07	1.736,01	3.223,10
La Paloma	3.983,10	4.349,90	682,20
Trueno	19.652,40	25.975,20	23.041,50
San Clemente	5.924,44	17.269,50	11.540,60
Carbomet	20.660,01	41.046,47	55.932,95
La Higuera	168.757,77	199.297,20	-
Juncalito	1.263,28	2.625,40	3.572,80
El Tártaro	138,00	498,10	582,20
Guayacán	20.806,10	73.161,90	56.030,40
Confluencia	3.935,10	130.511,90	149.932,40
Mariposas	601,90	29.790,20	29.695,58
Los Corrales	171,40	2.838,20	5.679,80
Carena		50.551,80	76.890,30
Diuto		5.024,50	20.931,50
Dongo		13.251,20	18.986,50
Mallarauco		12.236,28	24.726,11
Licán		41.659,60	83.118,58
Chacayes		93.099,10	511.073,10
Muchi		489,61	1.466,14
La Arena		1.604,70	12.101,40
Reca			7.895,01

Purísima			1.175,62
Allipen			10.628,10
El Canelo			10.870,10
Nalcas			6.615,14
Callao			3.117,97
Rucatayo			59.139,10
Providencia			2.138,40
Thermal	20.789.665,06	24.296.162,77	26.539.898,58
Taltal 1+ 2 GNL	1.700,00	82.497,00	600.746,00
Taltal 1+2	55.788,00	522,00	-
Taltal 1+ 2 Diesel	90.607,00	66.471,00	15.190,00
D. Almagro	442,00	675,00	8,00
El Salvador	297,00	209,00	26,00
Guacolda 1	1.138.228,00	1.173.637,00	841.265,32
Guacolda 2	1.109.142,00	1.003.168,00	1.201.339,89
Guacolda 3	1.199.068,00	1.289.490,00	1.185.919,00
Guacolda 4	1.036.581,40	1.228.616,20	1.193.763,90
Huasco TV	-	-	23,38
Huasco TG	927,00	847,00	16,00
Huasco TG IFO	142,00	215,00	181,00
Laguna Verde TG	4.211,00	1.459,00	3.777,00
Los Vientos TG	49.179,66	45.216,36	97.054,77
Nehuenco Diesel	673.473,00	796.372,00	494.134,00
Nehuenco GNL	199.755,00	738.891,00	1.172.334,00
Nehuenco TG 9B	2.924,00	4.506,00	-
Nehuenco TG 9B Diesel	580,00	16,00	3.052,00
Nehuenco TG 9B GNL	3.704,00	15.564,00	907,00
Nehuenco II	213.237,00	-	-
Nehuenco II Diesel	1.547.613,00	507.633,00	1.236.873,00
Nehuenco II GNL	765.882,00	1.327.291,00	1.068.946,00
San Isidro	31.297,00	3.694,00	-
San Isidro Diesel	43.621,00	6.073,00	1.837,00
San Isidro GNL	2.161.265,00	2.502.079,00	2.532.659,00
San Isidro II	16.930,00	-	-
San Isidro II Diesel	87.217,00	8.045,00	1.747,00
San Isidro II GNL	2.846.343,00	3.043.464,00	3.045.889,00
Ventanas 1	914.308,00	907.267,00	872.453,00
Ventanas 2	1.157.271,00	1.431.906,00	1.435.825,00
Nueva Ventanas	1.998.142,00	2.026.899,00	2.287.385,00
Laguna Verde	284,00	438,00	-
Nueva Renca GNL		1.728.736,00	1.445.212,00
Nueva Renca FA		1.362,00	44.936,00
Nueva Renca FA_GNL			27.422,00
Nueva Renca	611.541,00	35.803,00	13.980,00
Nueva Renca Diesel	1.300.008,20	281.908,00	327.047,00
Renca U1	2.653,00	26.542,00	-
Renca U2		1.283,00	-
Campiche			728,50
Petropower	65.518,00	349.126,00	534.083,00
Bocamina	215.770,00	928.573,00	1.043.110,00
Bocamina II			507.222,20
San Fco. Mostazal	619,80	15.843,00	954,26
Antilhue TG	71.742,00	207.952,00	135.817,00
Horcones TG	312,60	91,30	-
Horcones Diesel	6.260,30	11.776,90	971,00
TG_Coronel	29.036,80	9.514,10	22.685,90
TG_Coronel Diesel	63.477,90	105.398,90	13.732,76
Nueva Aldea 2	-	-	345,40
Candelaria 1 Diesel	48.571,00	31.294,00	69.755,00
Candelaria 1+ GNL	43.217,00	141.055,00	-
Candelaria 1 TG C. Navia		2.605,00	-
Candelaria 1 GNL C. Navia		2.663,00	-
Candelaria 1 TD C. Navia		19.815,00	4.065,00
Candelaria 2 Diesel	46.559,00	64.536,00	64.329,00
Candelaria 2 + GNL	44.494,00	179.957,00	-

Candelaria 2 TG C. Navia		5.024,00	-
Candelaria 2 TD C. Navia		8.448,00	6.920,00
Curanilahue	51,80	-	-
Lebu	55,90	-	114,20
Cañete	728,00	3.746,50	4.809,70
Los Sauces	1.106,70	1.706,60	1.430,40
Los Sauces II		4.348,30	3.947,10
Traigen	1.114,70	3.195,90	1.738,40
Curacautin	1.565,20	2.507,60	2.101,50
Ancud	834,30	1.895,50	-
Collipulli	646,20	1.446,30	816,60
Quellon	757,60	2.750,30	2.271,00
Yungay G1 (ex Campanario Gas 1) (2)	-	1.080,86	-
Yungay G2 (ex Campanario Gas 2) (2)	-	1.008,30	-
Yungay G3 (ex Campanario Gas 3) (2)	105,93	5.306,55	-
Yungay Diesel 1 (ex Campanario Diesel 1) (2)	5.596,25	14.439,67	749,31
Yungay Diesel 2 (ex Campanario Diesel 2) (2)	6.243,00	9.289,54	884,83
Yungay Diesel 3 (ex Campanario Diesel 3) (2)	11.734,74	42.481,97	1.199,34
Yungay Diesel 4 (ex Campanario Diesel 4) (2)	2.283,51	3.846,12	448,12
Casablanca 1	221,11	245,93	428,06
Casablanca 2	0,31	25,58	-
Las Vegas	673,31	1.704,79	987,78
Curauma	480,03	654,32	939,97
Concon	406,44	1.282,09	1.399,82
Constitución 1	1.887,00	5.634,40	2.859,60
Maule (prev. Constitution 2)	646,70	3.099,30	592,90
Monte Patria	172,40	114,10	-
Punitaqui	283,10	341,10	-
Esperanza 1	1.019,80	1.881,20	80,45
Esperanza 2	803,50	814,60	249,47
Esperanza TG	14,90	2.245,70	-
Degan	41.051,16	80.784,30	19.045,90
Olivos	4.019,00	29.546,70	7.011,90
Totoral	428,98	2.265,93	2.013,66
Quintay	935,18	3.106,30	2.786,90
Placilla	1.120,68	982,81	978,29
Chiloé	1,10	4.918,30	7.583,20
Quellon II	14.376,40	21.954,80	16.155,50
Colmito	1.108,07	6.835,70	799,76
Los Pinos	174.311,00	265.247,00	224.901,00
Chuyaca	5.495,00	18.875,10	6.014,70
Skretting	59,40	44,40	107,90
Cenizas	26.865,80	42.553,60	48.225,50
Santa Lidia	49.516,25	147.215,17	26.511,90
Trapén	42.689,80	170.040,50	116.967,77
Los Espinos	14.201,40	107.783,10	16.634,60
San Gregorio	264,64	636,38	124,86
Linares Norte	142,29	474,31	146,86
Biomar	1,80	1,91	3,90
Eagon	14,50	719,80	403,10
Salmofood II	75,50	5,30	-
Teno	58.042,10	114.253,90	59.087,62
Newen Diesel	599,70	-	-
Newen Butano	-	-	10.745,60
Newen LPG (propano)	8.325,00	11.915,40	5.311,70
Newen Gas Natural	29.865,20	35.098,20	16.363,57
Watts	-	306,00	313,10
Multiexport I	-	120,50	-
Multiexport II	-	212,90	0,20
Tierra Amarilla	2.180,66	761,99	465,00
Quintero DIESEL A	10.498,00	17.763,00	4.585,00
Quintero DIESEL B	6.259,00	28.690,00	22.629,00
Quintero GNL A	124.054,00	102.439,00	59.969,00
Quintero GNL B	121.784,00	72.186,00	101.057,00
Lousiana Pacific	0,40	780,00	414,90

El Peñón	57.820,50	168.505,00	123.069,96
San Lorenzo de D. de Almagro U1	234,50	388,00	-
San Lorenzo de D. de Almagro U2	74,70	24,20	-
Tapihue	1.049,82	2.027,18	2.329,15
Termopacífico	19.786,44	49.807,30	16.937,91
Quidico	43,10		
Emelda U1	1.108,40	1.041,90	656,10
Emelda U2	78,00	185,50	46,80
Colihues IFO	21.981,90	50.536,59	56.294,27
Colihues DIE	145,50	-	-
Curicó	384,80	1.234,90	1.566,20
Punta Colorada IFO	5.113,70	65.178,91	45.608,64
Punta Colorada Diesel		4.852,80	1.723,94
Calle-Calle		17.083,70	11.260,10
Cem Bio Bio IFO	4.185,60	57.459,70	62.420,70
Cem Bio Bio DIESEL	-	464,70	1.632,70
Polincay		9,10	385,60
Lautaro		377,80	369,20
Tomaval		2.898,50	31,58
Skretting Osorno		-	530,30
Lonquimay		10,90	19,90
Tirúa		6,30	38,90
Danisco		-	1,50
JCE		-	13,40
Santa María		95.991,60	1.852.887,00
Reservoir (hydro)	11.418.690,00	11.003.842,00	10.307.720,00
El Toro	1.784.247,00	1.397.033,00	1.529.193,00
Rapel	469.720,00	335.303,00	635.244,00
Canutillar	1.162.424,00	715.907,00	1.044.127,00
Cipreses	517.338,00	190.028,00	401.530,00
Colbun	1.542.401,00	1.913.935,00	1.572.803,00
Pehuenche	2.091.261,00	2.282.243,00	1.921.651,00
Pangue	1.630.702,00	1.725.084,00	1.368.657,00
Ralco	2.220.597,00	2.444.309,00	1.834.515,00
Wind	325.262,78	324.139,97	383.307,77
Canela 1	28.375,22	24.006,67	27.992,60
Canela 2	122.611,26	107.824,20	131.907,50
Lebu (Cristoro)	6.799,60	9.089,90	10.306,40
Totoral (eólica)	84.686,10	77.490,90	86.439,12
Monte Redondo	82.790,60	101.788,50	113.766,40
Punta Colorada Eólica		3.939,80	12.895,75
Solar	-	-	144,30
Tambo Real	-	-	144,30
Biomass	857.182,41	889.651,09	1.830.674,44
Constitución	51.547,14	53.757,66	34.855,70
Constitución A.	30.943,20	37.357,70	25.723,40
Laja	44.722,00	45.873,00	49.285,00
Arauco	15.232,10	91.072,90	129.423,60
Cholguán	81.610,60	89.658,30	82.931,50
Licantén	21.460,70	28.729,97	36.016,20
Valdivia	225.085,60	100.763,40	245.338,30
Nueva Aldea	93.908,80	97.981,00	121.432,00
Nueva Aldea 3	192.852,80	106.985,00	95.818,90
Viñales			99.294,10
Escuadrón (3)	90.547,97	78.453,20	101.069,10
Loma Los Colorados	7.913,70	7.785,90	7.792,10
Loma Los Colorados II		17.545,10	80.838,70
Cabrero-Masisa	1.357,80	46.780,30	51.335,30
HBS		27,60	15,86
Energía Pacífico		34.105,01	100.254,22
Lautaro-Comasa		52.775,05	209.863,84
Sta Fe			359.386,62
Total Generation SIC	43.191.560,79	46.117.945,45	48.856.634,61

FUEL CONSUMPTION 2010				
Thermal	**FUEL TYPE**	**UNIT**	**CONSUMPTION**	**$\eta_{m,i}$**
Taltal 1+ 2 GNL	Natural Gas	Million m^3	0,50	
Taltal 1+2	Natural Gas	Million m^3	16,90	
Taltal 1+ 2 Diesel	Diesel	Thousand Tn	23,00	
D. Almagro	Diesel	Thousand Tn	0,20	
El Salvador	Diesel	Thousand Tn	0,10	
Guacolda 1	Coal	Thousand Tn	438,90	
Guacolda 2	Coal	Thousand Tn	423,30	
Guacolda 3	Coal	Thousand Tn	437,80	
Guacolda 4	Coal	Thousand Tn	326,30	
Huasco TG	Diesel	Thousand Tn	0,60	
Huasco TG IFO	IFO-180	Tn/MWh	0,362	
Laguna Verde TG	Diesel	Thousand Tn	1,00	
Los Vientos TG	Diesel	Thousand Tn	14,00	
Nehuenco Diesel	Diesel	Thousand Tn	111,20	
Nehuenco GNL	Natural Gas	Million m^3	39,80	
Nehuenco TG 9B	Natural Gas	Million m^3	1,60	
Nehuenco TG 9B Diesel	Diesel	Thousand Tn	0,20	
Nehuenco TG 9B GNL	Natural Gas	Million m^3	0,00	
Nehuenco II	Natural Gas	Million m^3	139,80	
Nehuenco II Diesel	Diesel	Thousand Tn	252,90	
Nehuenco II GNL	Natural Gas	dam3/MWh	0,181	
San Isidro	Natural Gas	Million m^3	6,40	
San Isidro Diesel	Diesel	Thousand Tn	7,90	
San Isidro GNL	Natural Gas	Million m^3	437,30	
San Isidro II	Natural Gas	Million m^3	3,10	
San Isidro II Diesel	Diesel	Thousand Tn	14,80	
San Isidro II GNL	Natural Gas	Million m^3	522,30	
Ventanas 1	Coal	Thousand Tn	346,80	
Ventanas 2	Coal	Thousand Tn	450,40	
Nueva Ventanas	Coal	Thousand Tn	745,40	
Laguna Verde	Diesel	Tn/MWh	0,470	
Nueva Renca GNL				
Nueva Renca	Natural Gas	Million m^3	116,20	
Nueva Renca Diesel	Diesel	Thousand Tn	227,20	
Renca U1	Diesel	Thousand Tn	0,80	
Petropower	Coal	Thousand Tn	31,90	
Bocamina	Coal	Thousand Tn	82,00	
San Fco. Mostazal	Diesel	Thousand Tn	0,30	
Antilhue TG	Diesel	Thousand Tn	18,50	
Horcones TG	Natural Gas	Million m^3	0,10	
Horcones Diesel	Diesel	Thousand Tn	3,30	
TG_Coronel	Natural Gas	Million m^3	3,20	
TG_Coronel Diesel	Diesel	Thousand Tn	16,60	
Candelaria 1 Diesel	Diesel	Thousand Tn	13,68	
Candelaria 2 Diesel	Diesel	Thousand Tn	13,12	
Candelaria 1 GNL	Natural Gas	Million m^3	14,29	
Candelaria 2 GNL	Natural Gas	Million m^3	14,71	
Curanilahue	Diesel			39,5%
Lebu	Diesel			39,5%
Cañete	Diesel	Thousand Tn	0,20	
Los Sauces	Diesel	Thousand Tn	0,20	
Traigen	Diesel	Thousand Tn	0,20	
Curacautin	Diesel	Thousand Tn	0,40	
Ancud	Diesel	Ton/MWh	0,242	
Collipulli	Diesel	Thousand Tn	0,10	
Quellon	Diesel			39,5%
Yungay G3 (ex Campanario Gas 3)	Natural Gas			39,5%
Yungay Diesel 1 (ex Campanario Diesel 1)	Diesel	Thousand Tn	1,41	

Yungay Diesel 2 (ex Campanario Diesel 2)	Diesel	Thousand Tn	1,57	
Yungay Diesel 3 (ex Campanario Diesel 3)	Diesel	Thousand Tn	2,95	
Yungay Diesel 4 (ex Campanario Diesel 4)	Diesel	Thousand Tn	0,57	
Casablanca 1	Diesel	Thousand Tn	0,10	
Casablanca 2	Diesel	Thousand Tn	0,00	
Las Vegas	Diesel	Thousand Tn	0,10	
Curauma	Diesel	Thousand Tn	0,20	
Concon	Diesel	Thousand Tn	0,20	
Constitución 1	Diesel	Thousand Tn	0,40	
Maule	Diesel	Thousand Tn	0,10	
Monte Patria	Diesel			39,5%
Punitaqui	Diesel	Thousand Tn	0,10	
Esperanza 1	Diesel	m3/MWh	0,406	
Esperanza 2	Diesel	m3/MWh	0,260	
Esperanza TG	Diesel	m3/MWh	0,269	
Degan	Diesel	Thousand Tn	8,70	
Olivos	Diesel	Thousand Tn	0,90	
Totoral	Diesel	Thousand Tn	0,10	
Quintay	Diesel	Thousand Tn	0,20	
Placilla	Diesel	Thousand Tn	0,20	
Chiloé	Diesel	Ton/MWh	0,269	
Quellon II	Diesel	Thousand Tn	3,20	
Colmito	Diesel	Ton/MWh	0,298	
Los Pinos	Diesel	Thousand Tn	36,80	
Chuyaca	Diesel	Thousand Tn	1,40	
Skretting	Diesel			39,5%
Cenizas	Diesel	Thousand Tn	6,70	
Santa Lidia	Diesel	Thousand Tn	12,90	
Trapén	Diesel	Thousand Tn	8,90	
Los Espinos	Diesel	Thousand Tn	3,00	
San Gregorio	Diesel	Thousand Tn	0,10	
Linares Norte	Diesel	m3/MWh	0,263	
Biomar	Diesel			39,5%
Eagon	Diesel			39,5%
Salmofood II	Diesel			39,5%
Teno	Diesel	Thousand Tn	12,40	
Newen Gas Natural	Natural Gas			39,5%
Newen Diesel	Diesel			39,5%
Newen LPG (propano)	LPG			39,5%
Tierra Amarilla	Diesel	Thousand Tn	0,70	
Quintero DIESEL A	Diesel	Thousand Tn	2,57	
Quintero DIESEL B	Diesel	Thousand Tn	1,53	
Quintero GNL A	Natural Gas	Million m^3	34,21	
Quintero GNL B	Natural Gas	Million m^3	33,59	
Louisiana Pacific	Diesel			39,5%
El Peñón	Diesel	Thousand Tn	12,30	
San Lorenzo de D. de Almagro U1	Diesel	Thousand Tn	0,15	
San Lorenzo de D. de Almagro U2	Diesel	Thousand Tn	0,05	
Tapihue	Natural Gas			39,5%
Termopacífico	Diesel	Thousand Tn	4,50	
Quidico (3)	Diesel			39,5%
Emelda U1	Diesel	Ton/MWh	0,288	
Emelda U2	Diesel	Ton/MWh	0,360	
Colihues IFO	IFO-180			39,5%
Colihues DIE	Diesel	Ton/MWh	0,214	
Curicó	Coal			39,0%
Punta Colorada IFO	IFO-180			39,5%
Cem Bio Bio IFO	IFO-180			39,5%

Source: CDEC-SIC year book 2013. Yearly consumption. Pages 74 and 75. https://www.cdec-sic.cl/datos/anuario2013.pdf.

Source:CNE. Price report October 2010. Frame nº 6. http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo

Option A2 of the 'Tool to calculate the emission factor for an electricity system'. http://cdm.unfccc.int/filestorage/z/a/6WYDEP2G30AT5NQOMJKC8XIRL7VUF1.pdf/eb70_repan22.pdf?t=S0l8bXd2bm0zfDDmDwE1p_Su-_K4YQT21SUV

Do not generate during this year

FUEL CONSUMPTION 2011				
Thermal	**FUEL TYPE**	**UNIT**	**CONSUMPTION**	**η m,i**
Taltal 1+ 2 GNL	Natural Gas	Million m^3	27,0	
Taltal 1+2	Natural Gas			39,5%
Taltal 1+ 2 Diesel	Diesel	Thousand Tn	19,4	
D. Almagro	Diesel	Thousand Tn	0,3	
El Salvador	Diesel	Thousand Tn	0,1	
Guacolda 1	Coal	Thousand Tn	567,1	
Guacolda 2	Coal	Thousand Tn	462,5	
Guacolda 3	Coal	Thousand Tn	520,2	
Guacolda 4	Coal	Thousand Tn	536,0	
Huasco TG	Diesel	Thousand Tn	0,5	
Huasco TG IFO	IFO-180	Tn/MWh	0,348	
Laguna Verde TG	Diesel	Thousand Tn	0,6	
Los Vientos TG	Diesel	Thousand Tn	12,6	
Nehuenco Diesel	Diesel	Thousand Tn	130,9	
Nehuenco GNL	Natural Gas	Million m^3	134,7	
Nehuenco TG 9B	Natural Gas	dam3/MWh	0,248	
Nehuenco TG 9B Diesel	Diesel	m3/MWh	0,327	
Nehuenco TG 9B GNL	Natural Gas	Million m^3	2,8	
Nehuenco II Diesel	Diesel	Thousand Tn	83,5	
Nehuenco II GNL	Natural Gas	Million m^3	242,0	
San Isidro	Natural Gas			39,5%
San Isidro Diesel	Diesel	Thousand Tn	1,1	
San Isidro GNL	Natural Gas	Million m^3	483,5	
San Isidro II Diesel	Diesel	Thousand Tn	1,5	
San Isidro II GNL	Natural Gas	Million m^3	564,5	
Ventanas 1	Coal	Thousand Tn	347,6	
Ventanas 2	Coal	Thousand Tn	551,0	
Nueva Ventanas	Coal	Thousand Tn	733,9	
Laguna Verde	Diesel			30,0%
Nueva Renca GNL	Natural Gas	Million m^3	341,6	
Nueva Renca FA	Diesel			46,0%
Nueva Renca	Natural Gas	Million m^3	7,1	
Nueva Renca Diesel	Diesel	Thousand Tn	57,8	
Renca U1	Diesel	Ton/MWh	0,365	
Renca U2	Diesel			39,5%
Petropower	Coal	Thousand Tn	140,2	
Bocamina	Coal	Thousand Tn	375,8	
San Fco. Mostazal	Diesel	Thousand Tn	5,5	
Antilhue TG	Diesel	Thousand Tn	53,7	
Horcones TG	Natural Gas			39,5%
Horcones Diesel	Diesel	m3/MWh	0,418	
TG_Coronel	Natural Gas			39,5%
TG_Coronel Diesel	Diesel	Thousand Tn	29,3	
Candelaria 2	Natural Gas	Million m^3	5,4	
Candelaria 1 TG C. Navia	Natural Gas			39,5%
Candelaria 2 TG C. Navia	Natural Gas			39,5%
Candelaria 1 Diesel	Diesel	Thousand Tn	8,8	
Candelaria 2 Diesel	Diesel	Thousand Tn	18,2	
Candelaria 1 TD C. Navia Navia	Diesel			39,5%
Candelaria 2 TD C. Navia	Diesel			39,5%
Candelaria 1 GNL	Natural Gas	Million m^3	90,3	
Candelaria 2 GNL	Natural Gas	Million m^3	115,1	
Candelaria 1 GNL C. Navia	Natural Gas	Million m^3	1,7	
Cañete	Diesel	Thousand Tn	1,0	
Los Sauces	Diesel	Thousand Tn	0,4	
Los Sauces II	Diesel	Thousand Tn	1,1	
Traigen	Diesel	Thousand Tn	0,8	
Curacautin	Diesel	Thousand Tn	0,7	
Ancud	Diesel	Thousand Tn	0,5	
Collipulli	Diesel	Thousand Tn	0,40	
Quellon	Diesel	Thousand Tn	0,70	
Yungay G1 (ex Campanario Gas 1)	Natural Gas			39,5%
Yungay G2 (ex Campanario Gas 2)	Natural Gas			39,5%
Yungay G3 (ex Campanario Gas 3)	Natural Gas			39,5%
Yungay Diesel 1 (ex Campanario Diesel 1)	Diesel			39,5%
Yungay Diesel 2 (ex Campanario Diesel 2)	Diesel			39,5%
Yungay Diesel 3 (ex Campanario Diesel 3)	Diesel			39,5%
Yungay Diesel 4 (ex Campanario Diesel 4)	Diesel			39,5%

Casablanca 1	Diesel	Thousand Tn	0,1	
Casablanca 2	Diesel	Thousand Tn	0,0	
Las Vegas	Diesel	Thousand Tn	0,4	
Curauma	Diesel	Thousand Tn	0,2	
Concon	Diesel	Thousand Tn	0,4	
Constitución 1	Diesel	Thousand Tn	1,6	
Maule	Diesel	Thousand Tn	0,9	
Monte Patria	Diesel			39,5%
Punitaqui	Diesel	Thousand Tn	0,1	
Esperanza 1	Diesel	m3/MWh	0,429	
Esperanza 2	Diesel	m3/MWh	0,296	
Esperanza TG	Diesel	m3/MWh	0,284	
Degan	Diesel	Thousand Tn	17,8	
Olivos	Diesel	Thousand Tn	6,7	
Totoral	Diesel	Thousand Tn	0,6	
Quintay	Diesel	Thousand Tn	0,7	
Placilla	Diesel	Thousand Tn	0,2	
Chiloé	Diesel	Thousand Tn	1,3	
Quellon II	Diesel	Thousand Tn	6,4	
Colmito	Diesel	Ton/MWh	0,298	
Los Pinos	Diesel	Thousand Tn	56,0	
Chuyaca	Diesel	Thousand Tn	5,2	
Skretting	Diesel			39,5%
Cenizas	Diesel	Thousand Tn	11,4	
Santa Lidia	Diesel	Thousand Tn	38,5	
Trapén	Diesel	Thousand Tn	36,6	
Los Espinos	Diesel	Thousand Tn	23,4	
San Gregorio	Diesel	Thousand Tn	0,1	
Linares Norte	Diesel	Thousand Tn	0,1	
Biomar	Diesel			39,5%
Eagon	Diesel	Thousand Tn	0,2	
Salmofood II	Diesel			39,5%
Teno	Diesel	Thousand Tn	24,8	
Newen Gas Natural	Natural Gas			39,5%
Newen Propano	LPG			39,5%
Watts	Diesel			39,5%
Multiexport I+II	Diesel			39,5%
Tierra Amarilla	Diesel	Thousand Tn	0,2	
Quintero DIESEL A	Diesel	Thousand Tn	4,6	
Quintero DIESEL B	Diesel	Thousand Tn	7,5	
Quintero GNL A	Natural Gas	Million m^3	32,1	
Quintero GNL B	Natural Gas	Million m^3	22,6	
Louisiana Pacific	Diesel	Thousand Tn	0,2	
El Peñón	Diesel	Thousand Tn	36,3	
San Lorenzo de D. de Almagro U1	Diesel	Ton/MWh	0,342	
San Lorenzo de D. de Almagro U2	Diesel	Ton/MWh	0,380	
Tapihue	Natural Gas			39,5%
Termopacífico	Diesel	Thousand Tn	11,4	
Emelda U1	Diesel	Ton/MWh	0,288	
Emelda U2	Diesel	Ton/MWh	0,360	
Colihues IFO	IFO-180			39,5%
Curicó	Coal			39,0%
Punta Colorada Diesel	Diesel			39,5%
Punta Colorada IFO	IFO-180	Ton/MWh	0,219	
Calle-Calle	Diesel	Thousand Tn	4,4	
Cem Bio Bio IFO	IFO-180	Ton/MWh	0,218	
Cem Bio Bio DIESEL	Diesel			39,5%
Polincay	Diesel			39,5%
Lautaro	Diesel	Thousand Tn	0,1	
Tomaval	Natural Gas			39,5%
Lonquimay	Diesel			39,5%
Tirúa	Diesel			39,5%
Santa María	Coal	Ton/MWh	0,352	

Source: CDEC-SIC year book 2013. Yearly consumption. Pages 74 and 75. https://www.cdec-sic.cl/datos/anuario2013.pdf.

Source:CNE. Price report October 2011. Frame nº 6. http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo

Option A2 of the 'Tool to calculate the emission factor for an electricity system'. http://cdm.unfccc.int/filestorage/z/a/6WYDEP2G30AT5NQOMJKC8XIRL7VUF1.pdf/eb70_repan22.pdf?t=S0l8bXd2bm0zfDDmDwE1p_Su-_K4YQT21SUV

Do not generate during this year

FUEL CONSUMPTION 2012				
Thermal	**FUEL TYPE**	**UNIT**	**CONSUMPTION**	**η m,i**
Taltal 1+ 2 GNL	Natural Gas	Million m^3	204,0	
Taltal 1+ 2 Diesel	Diesel	Thousand Tn	4,3	
D. Almagro	Diesel	Ton/MWh	0,337	
El Salvador	Diesel	Ton/MWh	0,337	
Guacolda 1	Coal	Thousand Tn	319,8	
Guacolda 2	Coal	Thousand Tn	443,8	
Guacolda 3	Coal	Thousand Tn	423,6	
Guacolda 4	Coal	Thousand Tn	422,1	
Huasco TG	Diesel			39,5%
Huasco TG IFO	IFO-180	Tn/MWh	0,348	
Laguna Verde TG	Diesel	Thousand Tn	1,0	
Los Vientos TG	Diesel	Thousand Tn	27,6	
Nehuenco Diesel	Diesel	Thousand Tn	82,2	
Nehuenco GNL	Natural Gas	Million m^3	221,7	
Nehuenco TG 9B Diesel	Diesel	Thousand Tn	0,5	
Nehuenco TG 9B GNL	Natural Gas	dam3/MWh	0,248	
Nehuenco II Diesel	Diesel	Thousand Tn	205,7	
Nehuenco II GNL	Natural Gas	Million m^3	202,2	
San Isidro Diesel	Diesel	Thousand Tn	0,4	
San Isidro GNL	Natural Gas	Million m^3	499,2	
San Isidro II Diesel	Diesel	Thousand Tn	0,4	
San Isidro II GNL	Natural Gas	Million m^3	566,8	
Ventanas 1	Coal	Thousand Tn	188,2	
Ventanas 2	Coal	Tn/MWh	0,397	
Nueva Ventanas	Coal	Thousand Tn	845,2	
Nueva Renca FA_GNL	Natural Gas			60,0%
Nueva Renca GNL	Natural Gas	Million m^3	309,6	
Nueva Renca FA	Diesel			60,0%
Nueva Renca	Natural Gas	Million m^3	3,0	
Nueva Renca Diesel	Diesel	Thousand Tn	57,9	
Campiche	Coal	Ton/MWh	0,375	
Petropower	Coal	Thousand Tn	204,0	
Bocamina	Coal	Thousand Tn	404,1	
Bocamina II	Coal	Thousand Tn	177,5	
San Fco. Mostazal	Diesel	Thousand Tn	0,3	
Antilhue TG	Diesel	Thousand Tn	31,2	
Horcones Diesel	Diesel	m3/MWh	0,418	
TG_Coronel	Natural Gas			39,5%
TG_Coronel Diesel	Diesel	Thousand Tn	2,9	
Nueva Aldea 2	Diesel			39,5%
Candelaria 1 Diesel	Diesel	m3/MWh	0,322	
Candelaria 2 Diesel	Diesel	m3/MWh	0,322	
Candelaria 1 TD C. Navia	Diesel			39,5%
Candelaria 2 TD C. Navia	Diesel			39,5%
Lebu	Diesel			39,5%
Cañete	Diesel	Thousand Tn	1,1	
Los Sauces	Diesel	Thousand Tn	0,3	
Los Sauces II	Diesel	Thousand Tn	0,8	
Traigen	Diesel	Thousand Tn	0,4	
Curacautin	Diesel	Thousand Tn	0,5	
Collipulli	Diesel	Thousand Tn	0,20	
Quellon	Diesel	Thousand Tn	0,60	
Yungay Diesel 1 (ex Campanario Diesel 1)	Diesel	Thousand Tn	0,1	
Yungay Diesel 2 (ex Campanario Diesel 2)	Diesel	Thousand Tn	0,1	
Yungay Diesel 3 (ex Campanario Diesel 3)	Diesel	Thousand Tn	0,2	
Yungay Diesel 4 (ex Campanario Diesel 4)	Diesel	Thousand Tn	0,1	
Casablanca 1	Diesel	Thousand Tn	0,1	
Las Vegas	Diesel	Thousand Tn	0,2	
Curauma	Diesel	Thousand Tn	0,3	
Concon	Diesel	Thousand Tn	0,4	

Constitución 1	Diesel	Thousand Tn	0,8	
Maule	Diesel	Thousand Tn	0,3	
Esperanza 1	Diesel	m3/MWh	0,429	
Esperanza 2	Diesel	m3/MWh	0,296	
Degan	Diesel	m3/MWh	0,219	
Olivos	Diesel	Thousand Tn	1,6	
Totoral	Diesel	Thousand Tn	0,5	
Quintay	Diesel	Thousand Tn	0,6	
Placilla	Diesel	Thousand Tn	0,2	
Chiloé	Diesel	Thousand Tn	2,0	
Quellon II	Diesel	Thousand Tn	4,1	
Colmito	Diesel	Ton/MWh	0,298	
Los Pinos	Diesel	Thousand Tn	47,4	
Chuyaca	Diesel	Thousand Tn	1,4	
Skretting	Diesel			39,5%
Cenizas	Diesel	Thousand Tn	12,4	
Santa Lidia	Diesel	Thousand Tn	7,1	
Trapén	Diesel	Thousand Tn	25,2	
Los Espinos	Diesel	Thousand Tn	3,8	
San Gregorio	Diesel	m3/MWh	0,263	
Linares Norte	Diesel	m3/MWh	0,263	
Biomar	Diesel			39,5%
Eagon	Diesel	Thousand Tn	0,1	
Teno	Diesel	Thousand Tn	12,8	
Newen Gas Natural	Natural Gas			39,5%
Newen Propano	LPG			39,5%
Watts	Diesel	Thousand Tn	0,1	
Multiexport I+II	Diesel			39,5%
Tierra Amarilla	Diesel			39,5%
Quintero DIESEL A	Diesel	Thousand Tn	1,1	
Quintero DIESEL B	Diesel	Thousand Tn	5,7	
Quintero GNL A	Natural Gas	Million m^3	18,1	
Quintero GNL B	Natural Gas	Million m^3	30,6	
Louisiana Pacific	Diesel	Thousand Tn	0,1	
El Peñón	Diesel	Thousand Tn	26,5	
Tapihue	Natural Gas			39,5%
Termopacífico	Diesel	Thousand Tn	3,8	
Emelda U1	Diesel	Thousand Tn	0,2	
Emelda U2	Diesel	Ton/MWh	0,314	
Colihues IFO	IFO-180			39,5%
Colihues DIE	Diesel			
Curicó	Coal			39,0%
Punta Colorada Diesel	Diesel			39,5%
Punta Colorada IFO	IFO-180	Ton/MWh	0,219	
Calle-Calle	Diesel	Thousand Tn	2,6	
Cem Bio Bio IFO	IFO-180	Ton/MWh	0,218	
Cem Bio Bio DIESEL	Diesel			39,5%
Polincay	Diesel			39,5%
Lautaro	Diesel	Thousand Tn	0,1	
Tomaval	Natural Gas			39,5%
Skretting Osorno	Diesel	Thousand Tn	0,1	
Lonquimay	Diesel			39,5%
Tirúa	Diesel			39,5%
Danisco	Diesel			39,5%
JCE	Diesel			39,5%
Santa María	Coal	Thousand Tn	641,9	

Source: CDEC-SIC year book 2013. Yearly consumption. Pages 74 and 75. https://www.cdec-sic.cl/datos/anuario2013.pdf.

Source:CNE. Price report October 2012. Frame nº 6. http://www.cne.cl/tarificacion/electricidad/precios-de-nudo-de-corto-plazo

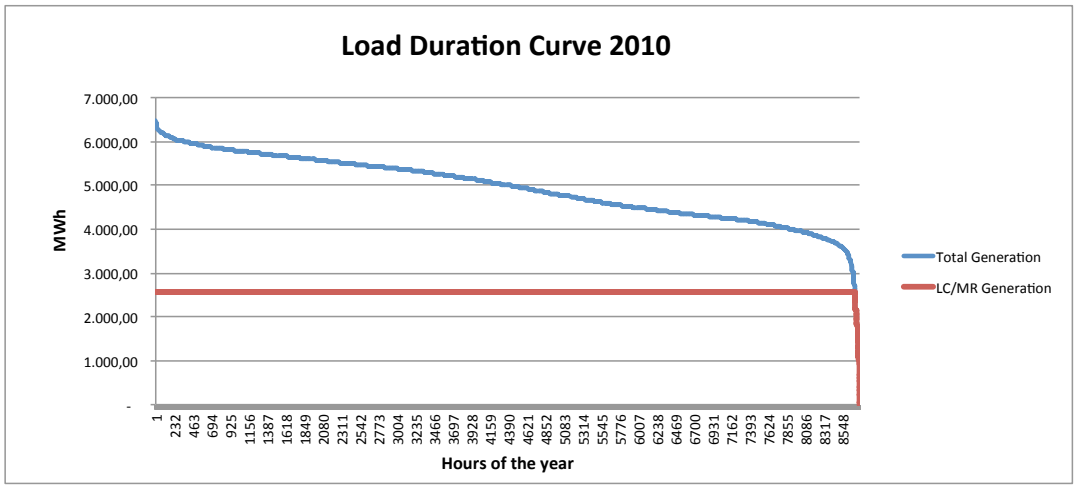
Option A2 of the 'Tool to calculate the emission factor for an electricity system'. http://cdm.unfccc.int/filestorage/z/a/6WYDEP2G30AT5NQOMJKC8XIRL7VUF1.pdf/eb70_repan22.pdf?t=S0l8bXd2bm0zfDDmDwE1p_Su-_K4YQT21SUV

Do not generate during this year

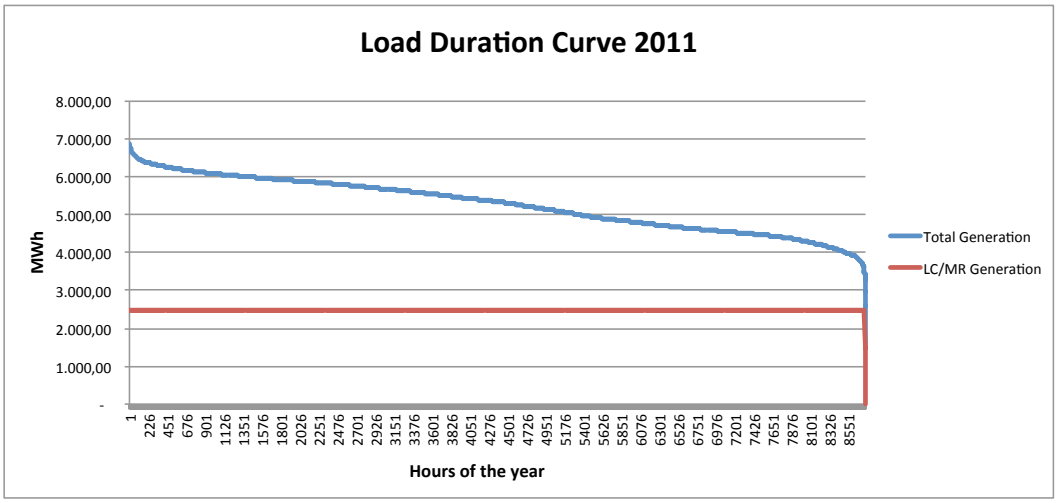
Consumption CDEC-SIC: MVC, diesel, 11.9 Thousand Ton, not related to any generation

Lambda factors have been elaborated from Daily Real Operation years 2010, 2011 and 2012. Daily real generation has been separate and crosscheck with annual real generation. Once confirm data were correct, hourly decreasing load was produced and load duration curves plot.

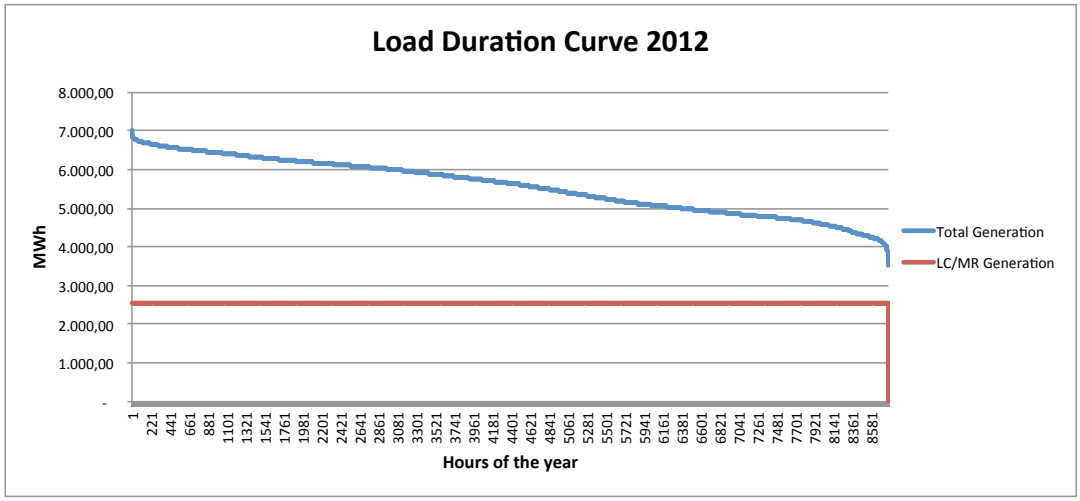
Results for the three years are as follows:



Total Generation ($\sum EG_{m,y} + \sum EG_{k,y}$)	MWh	43.191.561
A) Gen LC/MR ($\sum EG_{k,y}$)	MWh	22.401.896
B) Gen LC/MR (area down the curve)	MWh	22.401.896
Diference	-	- 0,01
y-axis intersection	MWh	2.573,47
x-axis intersection	Hours	8.701
Lambda 2010 (λ)	%	0,006735



Total Generation ($\sum EG_{m,y} + \sum EG_{k,y}$)	MWh	46.117.945
A) Gen LC/MR ($\sum EG_{k,y}$)	MWh	21.821.783
B) Gen LC/MR (area down the curve)	MWh	21.821.783
Diference	-	- 0,00
y-axis intersection	MWh	2.491,64
x-axis intersection	Hours	8.759,00
Lambda 2011 (λ)	%	0,000114



Total Generation ($\sum EG_{m,y} + \sum EG_{k,y}$)	MWh	48.856.635
A) Gen LC/MR ($\sum EG_{k,y}$)	MWh	22.316.736
B) Gen LC/MR (area down the curve)	MWh	22.316.736
Diference	-	- 0,00
y-axis intersection	MWh	2.540,90
x-axis intersection	Hours	8.784,00
Lambda 2012 (λ) NOTE.	%	0,000000

NOTE: If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and Lambda is equal to zero.

Summarized conclusion of the analysis of emission factor calculation:

Emission factors for the Chilean SIC

Baseline	EF OM,y (tCO2/MWh)	η y	EF grid,OM-adj,y (tCO2/MWh)	Generation [MWh]
2010	0,6638	0,0067	0,6593	43.191.561
2011	0,7069	0,0001	0,7068	46.117.945
2012	0,6660	0,0000	0,6660	48.856.635
	EF grid OM-adj, 2010-2012 0,6776			EF grid BM,2012 0,6603
	Weights wind and solar projects w OM = 0,75 w BM = 0,25			**EFy [tCO2/MWh] wind and solar projects** **0,6732**

Appendix 5. Further background information on monitoring plan

Appendix 6. Summary of post registration changes

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