CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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SECTION A. General description of project activity

A.1 Title of the project activity:

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Project for the reduction of greenhouse gas emissions of Hidroelectrica La Confluencia S.A.
Version number: Version 8
Date: November 1st, 2010

PDD revision history

PDD version	Date	Note
Version 01	2007	
Version 02	January 2008	Submission to DOE
Version 03	4th December 2009	Submission to DNV
Version 04	28 May 2010	Amendments due to validation findings
Version 05	14 July 2010	Amendments due to validation findings
Version 06	09 September 2010	Amendments due to validation findings
Version 07	15 September 2010	Amendments due to validation findings
Version 08	1 November 2010	Updating to version 12.1 of ACM0002

A.2. Description of the project activity:

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Purpose of project activity

The La Confluencia Project (hereafter, the Project) is being developed by Hidroeléctrica La Confluencia S.A. (HLC). The Project was originally conceived in 2002 as part of one larger project, La Higuera, which was designed as a 300MW single scheme run of river project. However, due to the excessive risks associated with such a large project and a landowner unwilling to accept the project the design was modified. The resulting reengineering established two schemes, La Higuera and the upstream La Confluencia. La Confluencia was originally approved under the same environmental impact study as the La Higuera project in August 2004. Full time development and design work on La Confluencia only commenced in 2006, after La Higuera project reached financial close and was registered as a CDM project activity. Subsequent optimisations made to the Project have been submitted and approved under the Environmental Impact Assessment System (SEIA). HLC undertook additional public consultation meetings regarding these modifications, despite not being required to under the SEIA.

The Project consists of the construction of a 163.22 MW run of river hydropower facility comprising a two branch water conveyance system. The purpose of the project is to utilise the hydrological resources of the Tinguiririca, Portillo and Azufre Rivers in a run of river scheme to generate and supply zero emission energy to the Chilean Central electricity grid (SIC). The Project will deliver an average of 656 GWh_{el} p.a. into the SIC. The Project will generate certified emission reductions (CERs) by displacing electricity generation from grid connected fossil fuel-fired power plants that would otherwise be generating electricity. The Project is immediately upstream of the La Higuera Hydroelectric Project and is designed to operate independently and in conjunction with La Higuera. When operating in conjunction water from the La Confluencia powerhouse tailrace is discharged directly into the La Higuera intake system.

The Project has a 13 year Power Purchase Agreement (PPA) with Chile's largest distribution company, Chilectra, for 345-390GWh p.a. This contract was required in order to raise non-recourse project financing. Delivery obligations commence in January 2011.

Contribution to sustainable development

The Project will contribute to the social welfare of the 6th region in Chile, where local employment opportunities and infrastructure are poor. Construction of the Project will last 33 months, with the Contractor required to attempt to source at least 30% of its workforce locally. The La Higuera Project is currently employing approximately four hundred employees out of a total workforce of fifteen hundred from the local region, and this project will add significantly to this figure. Road access to the valley and its upper reaches is limited to a few months in summer due to the treacherous nature of the road. The construction Contractor will upgrade the I-45 road beside the Tinguiririca River within the Project area, which will be improved to provide expected year-round access, open up the area to income generating activities including tourism, as well as provide for the better utilisation of the natural resources such as thermal springs, climbing, archaeological sites and other recreational activities. The Joint Venture is also undertaking a significant community sponsorship program to foster education, training and developing new businesses in the local communities.

The Project has applied sound principles for sustainable run-of-river hydropower development in line with the EU ETS Compliance Report[1] requirements and will thereby be able to sell carbon emission reductions into the European Trading System (ETS). Although the Project does not have any large dams built on the river, the Project is larger than 20 MW and is therefore currently asked by the EU member states to submit a Compliance Report detailing sustainability issues like consultation, transparency, environment, sustainable development and use of the river by all stakeholders.

The Project is also particularly relevant to the sustainable development of the Chilean electricity sector, which is currently undergoing a fuel supply crisis. Following the introduction of imported Argentinean natural gas in 1996, most additional capacity needs have been met by combined cycle natural gas plants. However, in 2004 Argentina restricted the exports of natural gas into Chile and subsequent gas restrictions have forced many of these plants to reduce generation and use diesel where environmental permissions exist. As a result of this the Chilean Government is actively seeking alternative forms of energy to supply a system with an internal growth demand of 350-400 MW per annum. Unfortunately, renewable energies are not a priority, and system expansion will favour thermal energy like coal fired plants[2].
The Project uses the consolidated methodology ACM0002 version 12.1 to establish the emissions reductions resulting from the Project Activity. Based on the ex ante application of this methodology the Project is conservatively estimated to reduce emissions by 423,120 tonnes of CO_2 per year that would have otherwise been emitted via the baseline operation of the Chilean grid to which the Project will be connected. The emission reductions are expected to increase as the thermal electric capacity of the grid switches to coal from natural gas. As a run of river project with significant socio-economic benefits and no significant environmental impacts the additional sustainable development benefits in the face of new

[1] Compliance Report assessing application of article 11 b (6) of Emissions Trading Directive to Hydroelectric Project Activities exceeding 20 MW" - http://ec.europa.eu/environment/climat/emission/ji_cdm_en.htm.

[2] April 2007 CNE Node Price Fixation Report, *Comisión Nacional de Energia.*

coal burning investments in the power sector highlight the importance of this Project to the Chilean energy sector and the global environment.

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (host)	Hidroeléctrica La Confluencia S.A (HLC)	No
The project will be conducted as a unilateral CDM project activity. No investor country Letter of Approval is therefore required.		

Table 1 - Project participants

Contact details information on project participants are provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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The Project will be located in the valley of the Tinguiririca, Azufre and Portillo Rivers. These rivers rise in the Andes Mountains about 120km south of Santiago and flow generally westwards to the Pacific Ocean. The Azufre and Portillo rivers combine and join the Tinguiririca immediately downstream of the La Confluencia powerhouse. The nearest major town to the project area is San Fernando. The location of the Project activity is shown in Figure 1 below.

Figure 1 - Location of Project Activity. *Source* www.expedia.com

A.4.1.1. Host Party(ies):

>>
Chile

A.4.1.2. Region/State/Province etc.:

>>
6th Administrative Region, Chile

A.4.1.3. City/Town/Community etc:

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The nearest community to the Project is Puente Negro, approximately 40 km downstream from the powerhouse. The nearest town is San Fernando, which is on the Ruta 5 PanAmerican Highway, 142 km south of the capital city, Santiago.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The Project is located on the Tinguiririca, Portillo and Azufre rivers, between the elevations of 1100 m.a.s.l. and 1460 m.a.s.l. , as indicated in Figure 2. The powerhouse is located on the northern bank of the Tinguiririca river, some 500 m upstream from the junction with the Portillo river, at approximately UTM(PSAD56) 358,100, 6,144,550. The La Confluencia project can be divided in two branches, Tinguiririca and Portillo rivers, where the main intakes take the water from.

The coordinate reference used is UTM 19 PSAD 56. The coordinates of the HLC power house, Portillo intake and Tinguiririca intake are as follows:

	Long	Lat
Power house	-70,55138889	-34,82972222
Portillo intake	-70,44694444	-34,76666667
Tinguiririca intake	-70,50361111	-34,91277778

Table 2 - Coordinates of the project activity

Figure 2 – Physical Location of Project Activity

The project area is accessed taking the north-south Ruta 5 toll-way south to San Fernando and turning east at San Fernando to Puente Negro on a sealed road. From Puente Negro the gravel I-45 road follows the Tinguiririca River up to Termas del Flaco. This road is currently only open to the public from December to April each year with defined daily hours for traffic flow direction. There is only partial access to the Azufre and Portillo valleys via a private road from the confluence of the Portillo/Azufre and Tinguiririca rivers.

A.4.2. Category(ies) of project activity:

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The project is a run of the river hydro power project and categorized in Scope Number 1; Sectoral Scope-Energy industries (renewable/non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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The Project consists of intakes and conveyance systems on two branches diverting flows to a surface powerhouse. The Portillo branch comprises a low weir and spillway on the Portillo River at 1460 m.a.s.l. Water is passed through a desander and short open channel before entering an 11 km low pressure tunnel that runs to the surge chamber above the powerhouse at the confluence of the Portillo/Azufre and Tinguiririca rivers. Minor high mountain intake structures and desanders capture water from the Azufre, Los Humos and Riquelme streams and are injected into the Portillo tunnel. The Tinguiririca Branch consists of a low diversion weir and spillway across the Tinguiririca River at 1444 m.a.s.l. that diverts partial flows through a desander and short open channel to an off-river hourly regulation pondage of 1.2 million m^3 live storage capacity. Water from this is taken via a canal to the La Gloria portal, where it enters a 9.3 km low pressure tunnel that joins the surge chamber above the powerhouse. High mountain intakes on the El Ciruelo and La Gloria capture additional flows from these minor streams.

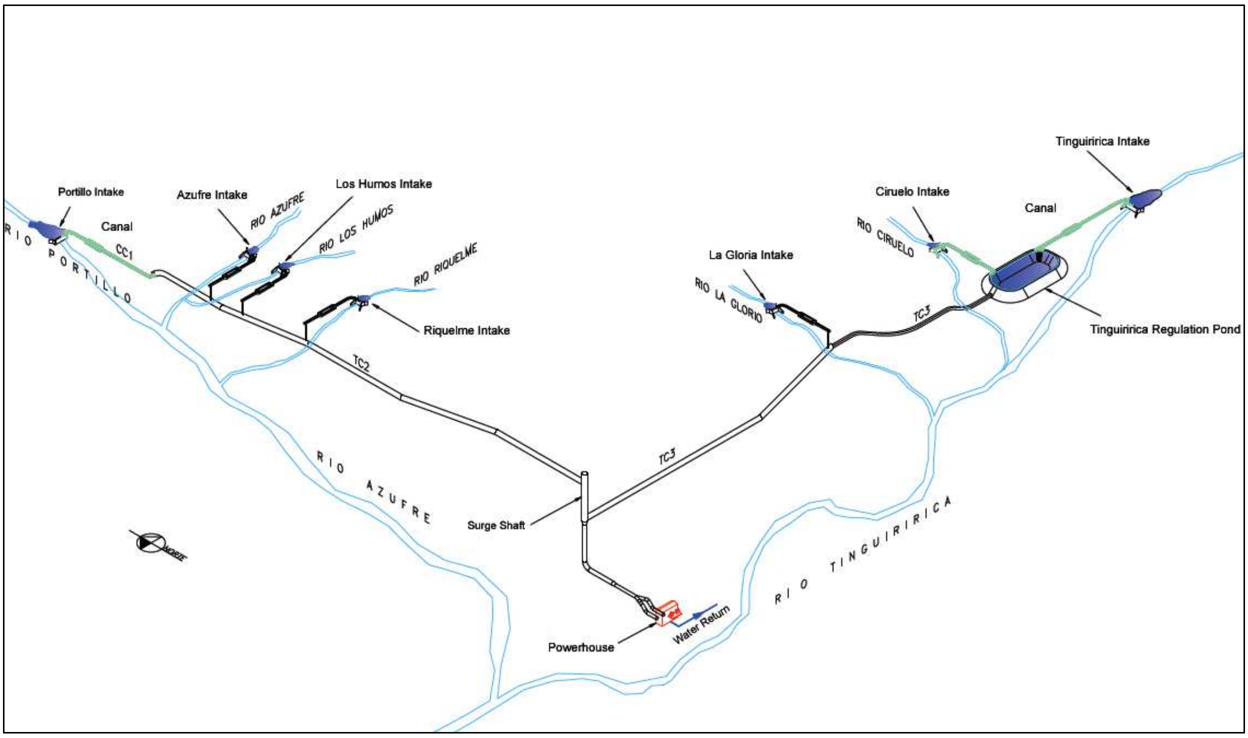

Figure 3 - Schematic layout of Project Activity.

The Tinguiririca and Portillo branch tunnels terminate at a concrete lined vertical shaft dropping to the open air powerhouse via a concrete and steel lined high pressure tunnel. Two Francis type turbines convert the 52.5 cubic metres per second flow into electricity via twin generators. This is conventional hydroelectric technology selected to optimise generation and efficiency based on the historical hydrological data. The water is then discharged into the La Higuera conveyance scheme on the north bank of the Tinguiririca, where it enters a pipe bridge to cross the river prior to entering the La Higuera low pressure tunnel system on the southern side of the Tinguiririca. Water can be spilled directly into the river if La Higuera project is not operating. The electricity is evacuated to the SIC via a 20 km 154/220kv transmission line to the La Higuera power project switchyard, then shares the 38 km transmission line of the La Higuera project to connect to the SIC grid near San Fernando.

Voith Siemens, a leader in hydro mechanical and electrical engineering, is providing state of the art electro-mechanical and control equipment and safety systems, while the turbines are a technology that has been utilised for more than half a century. The turbines and generators will be manufactured in Brazil, while the other equipment will be sourced from Brazil, Chile and other manufacturing bases.

La Confluencia Project		EPC Reference
Gross head	347.5 m	The data to calculate the Gross head: Volume III Owners Requirements Part A- General Scope. Project scope and outline, 3.2 Conceptual Outline Page A-6, paragraph 2 (for water level at the Tinguiririca pond) Page A-7, paragraph 2 (for tailrace outlet

		water elevation)
Turbine type	Francis	Volume III Owners Requirements Part C-Specific Technical Requirements. Section 6 Powerhouse Page C-18, paragraph 1.
Number of Turbines	2	
Design Flow	52.5 m^3/s	Volume III Owners Requirements Part A-General Scope. Section 3 Project scope and outline, 3.3 Overall performance Objective Page A-8, paragraph 3, letter (i)
Annual average Net Generation	656 GWh	Volume III Owners Requirements Part A- General Scope. Section 3 Project scope and outline, 3.4 Functional Requirements, 3.4.5 Owner's Minimum Performance levels, letter (b) Minimum Annual energy Page A-11, paragraph 2.
Generator Type	Synchronous with salient pole	Volume Iv Contractor's Specifications Section C, Hydroelectric Plant 06 Generators. Section 6.9 Electrical Technical Schedules. Page 934.
Generator Capacity (each unit)	95.8MVA	
Normal rotational speed	500 rpm	
Frequency	50Hz	
Storage facilities	Capacity	Volume III Owners Requirements Part C-Specific Technical Requirements. Section 2 Compensation Reservoir(s) Page C-3, paragraph 1, letter (a). Note: surface area is not included in the contract. Surface area can be estimated based on Volume IV Contractor's Specifications Section D, Contractors Drawings
Off channel	1,200,000 m^3	

Table 3 - Summary of project specifications. *Source: EPC Contract*

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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A 7-year renewable crediting period (renewable twice) is selected for the proposed project activity. The project will displace electricity from a more carbon-intensive grid with an ex-ante estimated combined margin emission factor of 0.645 tCO_2/MWh. The project is expected to displace 656 GWh of electricity per year, thus reducing GHG emissions by 423,120 tCO_2e per year in the baseline scenario. Table 4 indicates expected emission reductions over the first crediting period.

Years	Annual estimation of emission reductions in tonnes of CO2e

2011 (01/04/2011-31/03/2012)	423,120
2012 (01/04/2012-31/03/2013)	423,120
2013 (01/04/2013-31/03/2014)	423,120
2014 (01/04/2014-31/03/2015)	423,120
2015 (01/04/2015-31/03/2016)	423,120
2016 (01/04/2016-31/03/2017)	423,120
2017 (01/04/2017-31/03/2018)	423,120
Total estimated reductions (tonnes of CO2 e)	2,961,840
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	423,120

Table 4 - Estimation of emission reductions in tonnes of CO_2e for the crediting period

A.4.5. Public funding of the project activity:

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No public funds from Annex I countries is involved in the Project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Applied methodology:

- Version 12.1 of ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Related tools:

- Version 2 of the "Tool to calculate the emission factor for an electricity system"
- Version 05.2 of the "Tool for the demonstration and assessment of additionality"

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The project activity is a grid connected run-of-river hydropower project, where the grid's geography and system boundaries are explicit and characteristics are readily available through the electricity sector's Regulatory bodies (CNE and CDEC-SIC). This proposed project is a greenfield renewable power generation plant that is eligible to apply version 12.1 of ACM0002 (applicable grid-connected greenfield renewable power generation project activity option (a)). More details of the comparison of the project's characteristics and the applicability criteria as specified in version 12.1 of ACM0002 are given in Table 5.

Applicability conditions in version 12.1 of ACM0002	**Characteristics of the project activity**	**Applicability criterion met?**
The project activity is the installation, capacity addition, retrofit or replacement of a hydro power plant/unit.	The project activity is the installation of a new run-of-river hydro power plant.	Yes
In the case of retrofit/refurbishment, retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures	The project activity is the installation of a new run-of-river hydro power plant.	Yes
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2 of the methodology on page 10 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 the installation of a new run-of-river hydro power plant.	Yes
In the case of retrofits, replacements, or capacity additions, the methodology is only applicable if the most plausible baseline scenario is P2: "The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance."	The project activity is the installation of a new run-of-river hydro power plant.	Yes
In case of hydro power plants, one of the following conditions must apply: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density (installed power generation capacity divided by the surface area at full reservoir level) of the project activity, is greater than 4 W/m2 • The project results in new reservoirs and the power density of the power plant is greater than 4 W/m^2	The Project is a new run-of-river hydro power plant. However, the Project has an off-river hourly storage pond that is used to provide up to eight hours of operation on a daily basis when river flows are low. This facility is not able to provide for storage for more than eight hours and as such is not considered a reservoir. As the pond is built on gravel river terraces there is no significant inundation of vegetation and for conservatism no emissions are considered for	Yes

	this daily storage facility.	
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity	The project activity is a renewable energy project with no fuel-switch involved.	Yes
This methodology is not applicable to hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2	The Project is a new run-of-river hydro power plant.	Yes

Table 5 - Comparison of project's characteristics and eligibility criteria of version 12.1 of ACM0002

This comparison shows clearly that version 12.1 of ACM0002 is applicable to the proposed project activity.

B.3. Description of the sources and gases included in the project electricity system

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According to version 12.1 of ACM0002, the spatial extent of the project boundary includes the HLC and all power plants connected physically to the Chilean Central Interconnected Grid (SIC) grid to which the proposed project is also connected.

Chile has four different grids and there are no interconnections between them. Therefore each grid defines the geographical and system boundaries for proposed projects located within it (see map below).

The flow diagram of the project boundary is shown in Figure 4.

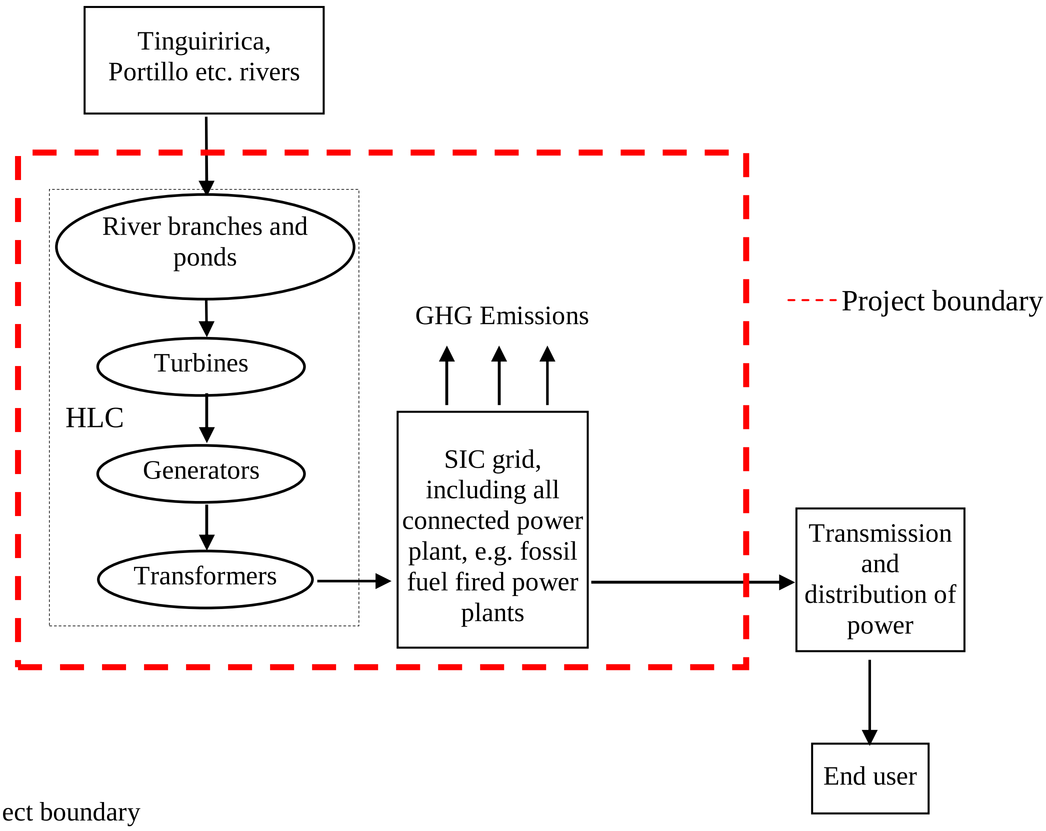

Figure 4 - Project boundary

The Central Interconnected Grid (SIC), to which the La Confluencia project is connected to, comprises the regions 3 to 10 and accounts for 64 percent of the total capacity installed in Chile. The project electricity system of La Confluencia project is the hydroelectric plant and all power plants connected physically to the SIC grid. The SIC grid electricity system's boundary is limited to the spatial extent of the power plants connected to the SIC grid, that can be dispatched without significant constraints. The following diagram illustrates the location and spatial extent of the SIC grid.

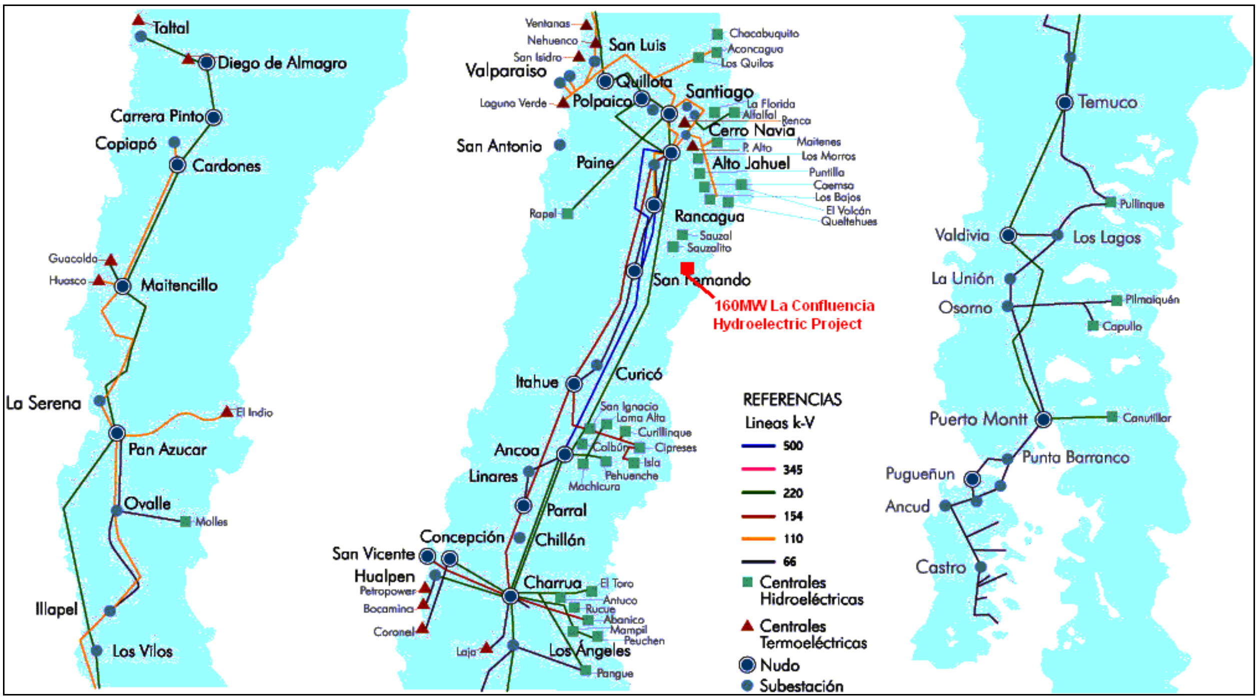

Figure 5 - The Project electricity system- The Central Interconnected Grid (SIC). *Source*: CDEC-SIC

The GHGs and emission sources included in the project boundary are shown in Table 6.

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emission from electricity generation in fossil fuel fired power plants that is displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source. As a zero emission grid connected run of river project no emissions will result.
		CH_4	No	Minor emission source. The Project is a run-of-river hydro power plant, only using an off-river hourly storage pond
		N_2O	No	Minor emission source. As a zero emission grid connected run of river project no emissions will result.

Table 6 - Sources and gases included in or excluded from the project boundary

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The baseline scenario is identified according to the methodology, ACM0002 version 12.1, as the project activity is the installation of a new grid-connected renewable power plant/unit, as follows:

> 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 baseline scenario of the 163.22 MW La Confluencia Hydroelectric Project is the continued operation of the existing power plants and the addition of new generation sources in the Central Interconnected Chilean Grid (SIC) to meet electricity demand. The SIC grid is geographically and physically distinguishable as one of four grids in Chile and is the largest of the grids on a demand basis. It is not interconnected with any other national or international grids. As such the project electricity system, as described in Section B3, is the SIC grid, and all references to emissions within the baseline consider plants connected to the SIC grid. Forty-three percent of the installed generation in the SIC is thermoelectric (see Figure 6). The project activity involves a construction of a zero-emission power source. Thus, the emission reductions are equal to the baseline emissions.

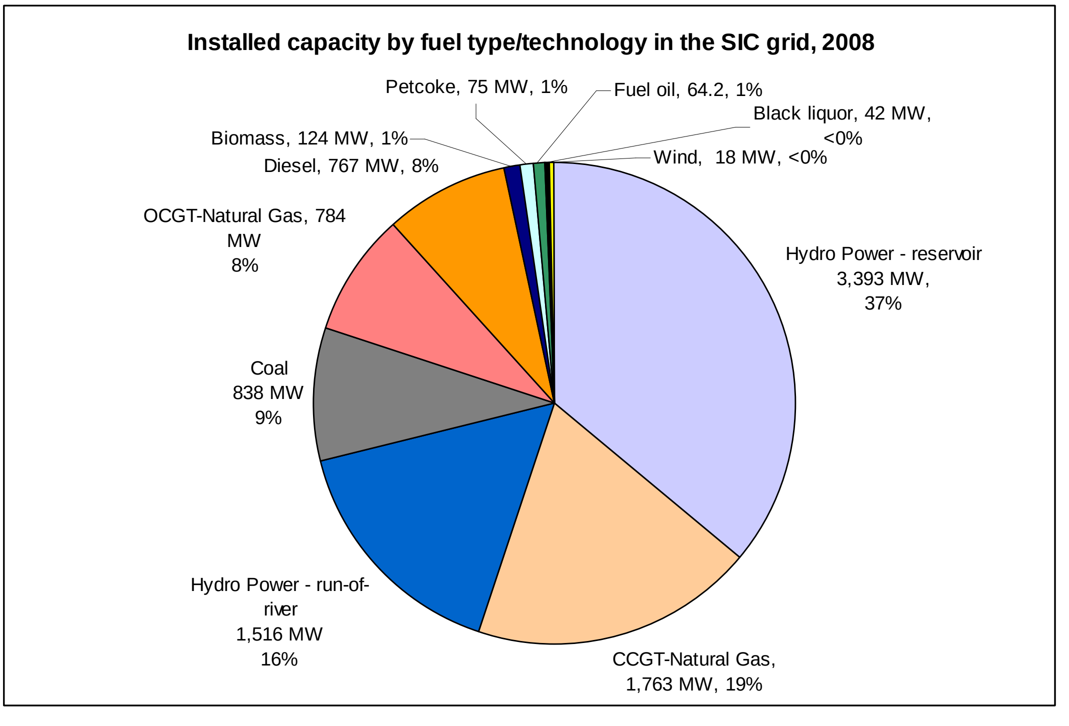

Figure 6 - Installed capacity of the Central Interconnected Grid (SIC) by fuel/generation type, 2008 – ***Source:*** *CNE*[3]

[3] http://www.cne.cl/cnewww/opencms/06_Estadisticas/energia/Electricidad.html

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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According to version 12.1 of ACM0002, the latest version of the "Tool for the demonstration and assessment of additionality" shall be used to demonstrate the additionality of this project activity. Version 05.2 of the additionality tool includes the following steps:

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

Sub-step 1a. Alternatives to the project activity

According to the CDM Validation and Verification Manual (EB 44 – Report – Annex 03 – Version 1 - clause 103), the PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required[4].

According to methodology ACM0002 version 12.1, in cases where the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is defined as follows:

> "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"."

Hence, in accordance with methodology ACM0002, version 12.1, and the "Tool to calculate the emission factor for an electricity system", version 2, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. The baseline emission factor is equal to the combined margin (CM): a weighted average of the operating margin (OM) emission factor and the build margin (BM) emission factor.

Sub-step 1b. Enforcement of applicable laws and regulations

Under the Chilean Electricity Law all the alternatives to the project activity are in compliance with applicable legal and regulatory requirements. No special benefits are established under Chilean laws for renewable energies of the same scope as the proposed project activity.

Step 2: Investment analysis

This step will determine that the proposed project activity is not economically or financially feasible and that the revenue from the sale of Certified Emission Reductions (CERs) can help to the very low profitability of the project.

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[4] http://cdm.unfccc.int/EB/044/eb44_repan03.pdf

Sub-step 2a: Determine appropriate analysis method

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison and the benchmark analysis.

The simple cost analysis is not applicable for the proposed project because the project activity will produce economic benefit other than the CDM related income, notably from electricity sale. The investment comparison analysis is also not applicable for the proposed project because the baseline scenario, as identify in Step 1, providing the same electricity output, is not a specific investment project.

Consequently, the Option III, Benchmark Analysis will be used. The project Internal Rate of Return (IRR) of total investment is the financial indicator used to analyse the project's economic viability within the Chilean context, and it will be compared with a benchmark IRR as explained below.

Sub-step 2b: Option III: Apply Benchmark Analysis

Projects are financially or economically attractive when their IRRs are above the hurdle rate required. Considering that each company, or project, has its own hurdle rate calculated according to their own assumptions and risk profile of their projects, the project IRR should be compared with a benchmark rate.

Consequently, a project will be financially attractive or acceptable when the project IRR is better than the benchmark IRR. According to Article 174 of the Ministry of Economy, Promotion and Reconstruction's DFL Nº 4[5] (Decree with the Force of the Law Nº 4) of 12th of May 2006, an annual discount rate of 10% shall be used to determine the indicative generation and transmission expansion, and regulated prices at generation level. The Law also mandates to use a discount rate of 10% to determine the allowed revenues for Transmission and Distribution activities. Being mandatory that the indicative expansion plans of generation and transmission infrastructure is discounted at a 10% rate, it indirectly creates a benchmark on what the market behaviour should be. Consequently, generation projects that are below the rate normally used in the electricity sector (10%) are less attractive from a financial point of view.

The law was in force and valid at the time of the investment decision. Consequently, 10% is adopted as the benchmark IRR for the proposed project activity.

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

The following parameters and values are used for the calculation and comparison of the IRR financial indicator.

[5] Refunded text of the General Law of Electric Services (http://cne.cl/archivos_bajar/DFL_N4.pdf)

Item	Value	Unit	Source
Installed generation capacity	163.22	MW	HLC Final Investment Case (August 16 2007)
Total Investment	315.29	MUS$	IFC Information Memorandum (July 2007), Annex 2
Expected energy generation p.a.	656	GWh	IFC Information Memorandum (July 2007), Annex 2
Start-up date	January 2011		IFC Information Memorandum (July 2007), Annex 2
Valuation horizon	20	Year	CDM rules
CER crediting period	21	Year	Assumption
Income Tax	17	%	Chilean Legislation
Energy Price (Monomic Energy and power) (average)	43	US$/MWh	IFC Information Memorandum (July 2007), Annex 2
Estimated CER's Price	15	Eur/CER	Assumption
Operation and maintenance costs (average)	4.58	MUS$/year	IFC Information Memorandum (July 2007), Annex 2

Table 7 - Parameters for the Financial Evaluation

After the economic and financial evaluation of the project activity without considering the sale of CERs, it is obtained a project IRR of 7.75%[6]. This shows that the IRR of the proposed project is lower than the benchmark IRR and the project is consequently financially unattractive because of its low profitability.

When the sale of CERs is added to the evaluation, this has a positive impact on the project IRR enhancing it from 7.75% to 9.18% (at an assumed CER price of 10 €/tCO_2e).

Sub-step 2d: Sensitivity analysis

The objective of this analysis is to quantify the impact of reasonable variations of critical variables in the financial indicator (IRR) of the proposed project activity:

Four variables are considered in the following sensitivity analysis:

1. Total investment cost of the Project
2. Power generation output
3. Energy sale prices
4. Operation and maintenance (O&M) costs

[6] For detailed calculation please see final IRR Excel spread sheet

The financial analysis was performed by modifying each of the parameters by 10%, and assessing the impact on the project IRR (without revenues from selling CERs). Results are presented in the following tables.

Table 8 - Impact of the total investment cost on the IRR

Variation (%)	-10	-7.5	-5	-2.5	0	2.5	5	7.5	10
IRR	8.63%	8.39%	8.17%	7.96%	7.75%	7.56%	7.38%	7.20%	7.03%

Table 9 - Impact of power generation output on the IRR

Variation (%)	-10	-7.5	-5	-2.5	0	2.5	5	7.5	10
IRR	6.96%	7.16%	7.36%	7.56%	7.75%	7.95%	8.14%	8.33%	8.52%

Table 10 - Impact of the energy sale prices on the IRR

Variation (%)	-10	-7.5	-5	-2.5	0	2.5	5	7.5	10
IRR	6.31%	6.66%	7.02%	7.38%	7.75%	8.12%	8.50%	8.88%	9.26%

Table 11 - Impact of the O&M costs on the IRR

Variation (%)	-10	-7.5	-5	-2.5	0	2.5	5	7.5	10
IRR	7.88%	7.85%	7.82%	7.78%	7.75%	7.72%	7.69%	7.66%	7.63%

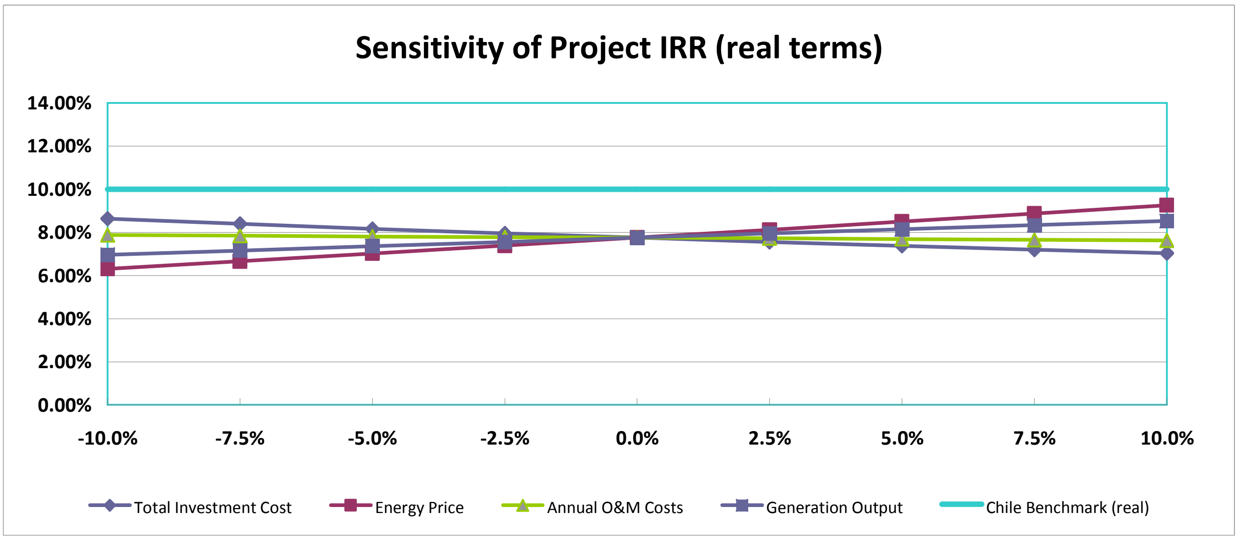

Figure 7 - Sensitivity Analysis of the Proposed Project Activity

The Tables 8-11 and the Figure 7 above show clearly that the most significant risk exposures of the project activity lie with the energy price, the investment costs and the generation output. O&M costs are relatively modest and changes have limited impact on the project finances in this highly capital intensive investment project.

Most significant is the impact of a 10 per cent increase in energy prices, which leads to an IRR of 9.26%. However, 52-58% of the power production is secured through a Power Purchase Agreement (PPA). Thus, in order for the energy price to the project to increase by 10%, spot prices would have to increase by more than 20%. Additionally, the price increase would have to occur quickly and maintain its high level on average across the full 20 year valuation period.

Second in significance are the investment costs. A 10 per cent decrease would improve project viability to reach a level of 8.63%. The investment cost, thus, becomes a variable of adjustment; this means that if project developers put their efforts in reducing the investment costs, the project financial indicators will be impacted in a positive way. However, even a 10% reduction of investment costs would not take the project IRR to a level close to the benchmark IRR. It is unexpected, and improbable, to reach such magnitudes of reductions in investment costs. In fact and it is rather more likely to expect increasing investment costs due to the very long tunnel that must be built for the project. Whilst there is a contingency in the total project cost this would not be sufficient to cover any severe issues (such as very high underground water inflow rates, significant fault zones, or longer sections of poor rock quality than budgeted for) and the Owner would have to pay for this additional cost. Cost and time overruns are very frequent in large civil projects with significant tunnelling, and as such it is more likely that the project cost will actually increase. However, any change from the budget is expected to be limited, because many uncertainties have been secured in contracts already signed. Hence within the reasonable range of total investment costs, the proposed project always gives indicative returns that are not financially attractive.

Similar to energy price and the investment costs variations the energy generation output is an important factor affecting the financial attractiveness of the proposed project activity. An increase by 10% would yield a 0.7% higher IRR, but not enough to pass the benchmark. However, significant long term deviations from the expected levels are unlikely, short of major problems at the plant that would lead to lower production or production stop. Dry and wet years will of course yield lower and higher levels of production for any given year, but the 20-year average would not be affected significantly. The revenue impact from such extreme weather conditions would also be partly offset by energy prices, since energy prices tend to increase in dry years and decrease in wet years in Chile where 53% of installed capacity is hydro.

The sensitivity analysis has also been used to determine the value at which each parameter brings the project's IRR above the benchmark. The necessary changes of the parameters are summarised as follows:

	Required change of parameter to reach benchmark
Total Investment Cost	-22.3%
Energy Price	70.2%
Annual O&M Costs	-185.8%
Generation Output	29.8%

Table 12 - Required change of parameter to reach benchmark

In the following the likelihood and eventual driving factors for reaching such changes is analysed:

- Energy Price: **+ 70.2%** for the entire study horizon. Due to the fact that part of the production is sold via PPA, the increment of the spot prices produces both increased injection revenues and increased purchase costs for supplying the PPA. The main driving factors are demand, fuel prices, and the absence of enough offers of new projects. The actual value of 70.2% considers effects, the increase of the price for the energy generated and the increase of the costs to supply the PPA.

- Investment Costs: **- 22.3%**. Due to the characteristics of the project, it is more probable that costs arise instead of decrease at such level.
- O&M Costs: **- 185.8%**. Scenario impossible to reach.
- Generation: **+ 29.8%**. The available hydrological statistic does not allow inferring such a permanent deviation of the inflow energy of this run-of-river project. Otherwise, the occurrence of wet scenarios produces lower prices due to the hydrothermal composition of the system, so reaching the final IRR goal is unlikely.

In conclusion, although all the analysed variables have impacts on the project IRR, these impacts never allows the project IRR to be placed over the benchmark IRR. Consequently, the project is not financially attractive since the project IRR is never above the 10% benchmark.

Step 3. Barrier Analysis

Project proponents chose to undertake Step 2 Investment Analysis.

Step 4. Common Practice Analysis

Sub-step 4a. Analyse other activities similar to the proposed project activity

The "Tool for the demonstration and assessment of additionality" (Version 05.2) states that:

> "Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis."

Table 13 below lists all run of river hydropower plants connected to the Chilean electricity grid constructed over the last 25 years. The group of "similar projects" to La Confluencia excludes the four most recent projects, since they are all CDM registered. It furthermore excludes projects that are smaller than 100 MW (scale). Only two plants of similar size have been constructed over the last 25 years. Rucúe was put in commercial operation more than 10 years ago, downstream of the Laja reservoir. That allows it to directly benefit from the storage facility of this very large dam. Both the very different investment climate in Chile a decade ago and the difference in commercial risks between a large reservoir and a run-of-river plant like La Confluencia, excludes Rucúe from the list of similar projects. The other seemingly similar plant is Alfalfal. This plant was built in 1991 when the energy and financing situation where completely different and cannot be compared with the current situation.

Name of Project	Installed Capacity (MW)	Year of completion	Associated with large reservoirs	CDM project activity
La Higuera	155	(2009)	no	yes[7]
Hornitos	55	2008	no	yes[8]
Quilleco	70.8	2007	no	yes[9]
Chacabuquito	25.5	2002	no	yes[10]
Mampil	45	2000	no	n.a.
Peuchén	79	2000	no	n.a.
Rucúe	178.4	1998	Laja	n.a.
Puntilla	22	1997	no	n.a.
Loma Alta	40	1997	Maule, Invernada	n.a.
San Ignacio	37	1996	Colbún	n.a.
Capullo	11	1995	no	n.a.
Aconcagua	74	1993	no	n.a.
Curillinque	89	1993	Maule, Invernada	n.a.
Alfalfal	178	1991	no	n.a.

Table 13 - List of run of river plants constructed in the SIC grid over the last 25 years Source: CDEC SIC, 2008. *Estadísticas de Operación 1999/2008* (Chapter 2, Page 23)[11]

In conclusion, none of the hydropower development projects realised in the SIC grid in Chile over the last 25 years is similar to the proposed project activity. Other projects of similar nature that have been announced for development recently are all relying on CER revenues to obtain investment approval.[12]

The Chilean regulator CNE publishes a list of "recommended works-generation" *(Plan de Obras)* to be installed as part of the calculation for fixing the regulated node price. Figure 8 graphically displays this list. This clearly demonstrates that system expansion, by both announced projects and on an economic cost optimisation, is dominated by fossil fuel projects. The La Confluencia run of river project appears on this list, but as a CDM activity it is not considered as the business case as usual

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7 UNFCC ID 248

8 UNFCC ID 1374

9 UNFCC ID 1265

10 UNFCC ID 1052

11 https://www.cdec-sic.cl/contenido_es.php?categoria_id=4&contenido_id=000034

12 Business News Americas- Monday 18th June 2007

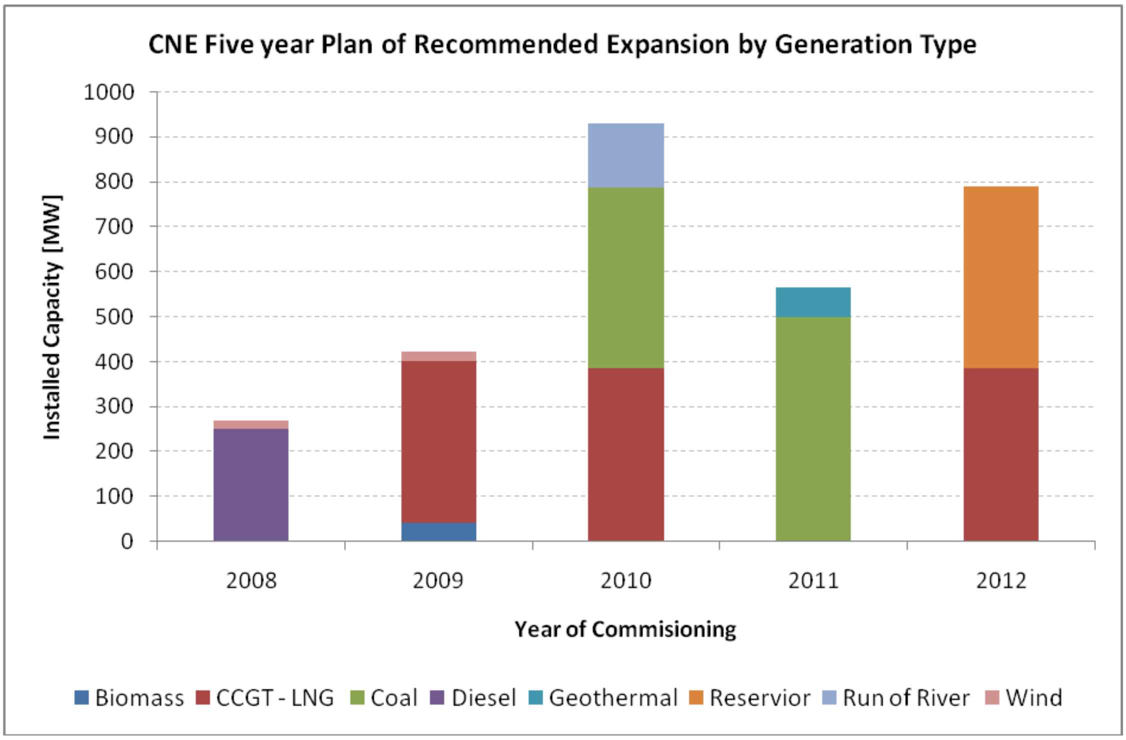

Figure 8 - CNE 5 Year Expansion-CNE Node Fixation Report, CNE April 2007, *Informe Fijación de Precios de Nudo* (Figure N°6, Page 15)

Sub-step 4b. Discuss any similar options that are occurring:

In sub-step 4a, we established that among all hydropower developments over the last 25 years, none were deemed similar to the proposed project activity in La Confluencia.

The few new hydropower projects that have occurred since the CDM became operational, have all been based on revenues from the sale of CERs, and any new projects on the drawing board are including CDM revenues as a necessity. However, as clearly demonstrated in the CNE Node Price Report (April 2007), hydropower does not compete with thermal power and is not expected to represent any significant share of capacity expansions to the grid in the medium term.

Prior consideration of the CDM

According to the requirement of EB 48 Annex 61, 6 a) for supporting the demonstration that the CDM was seriously considered in the decision to implement the project activity, the following references can be used, *inter alia*: minutes and/or notes related to the consideration of the decision by the Board of Directors, *or equivalent*, of the project participant, to undertake the project as a CDM project activity. In its meeting of 16 August 2007, the HLC Board approved the HLC project investment based on an investment case considering the revenues from CER generation. Hence, the final investment decision is to be made by the parent companies of the joint venture, namely SNPI and PHL. The investment case was formally forwarded to the parent shareholder for approval in August '07 and September '07, respectively. SNPI Board members formally approved the investment decision at its Board Meeting on 28 August

2007. In this meeting, the Board emphasises that it based its "decision on a very high probability that the project will receive revenues from the sale of carbon credits under the Kyoto Protocol."[13]

In order to comply with the second requirement of EB 48 Annex 61, 6 b) the project participant has to indicate that continuing and real actions were undertaken to secure CDM status for the project in parallel with its implementation. In case of the HLC project, a joint Environmental Impact Assessment (EIA) for the "twin projects" La Higuera and La Confluencia (same size, same technology and same river) was filed in 2004. The intent to apply for CDM for both projects, La Higuera and La Confluencia, was already stated in the EIA report. Simultaneously to the project planning the project participant approached Det Norske Veritas (DNV) for a quote on the validation for both projects. In August 2005, a Short Form Agreement between DNV and Hidroeléctrica La Higuera S.A. (Pacific Hydro) about the validation of La Higuera and La Confluencia hydro power projects was contracted.[14] At this point in time, La Higuera was developed as a CDM project activity, and finally registered as CDM project activity in March 2006. For the further development of the HLC project as CDM project activity, additional proposals from DOEs were obtained. In September 2007, a new proposal by DNV for validation of the La Confluencia Hydropower (HLC) CDM Project in Chile was received.[15]

Table 14 summaries the time line of the simultaneous development of the CDM and implementation of the HLC project activity.

[13] See Translation of Board Meeting Minutes (*SNPI Board Investment decision_Translated Extract.doc*)

[14] See DNV – Short Form Agreement (*DNV Services Agreement-exec.pdf*)

[15] See *DNV Validation Proposal_La Confluencia_2007-09-24.pdf*

Date	Activity	Comment	Document / Source
25/08/05	Short Form Agreement for validation of La Higuera and La Confluencia projects	Short Form Agreement between Det Norske Veritas (DNV) and Hidroeléctrica La Higuera S.A. (Pacific Hydro) about validation of La Higuera and La Confluencia projects[16]	DNV – Short Form Agreement (*DNV Services Agreement-exec.pdf*)
16/08/07	Investment case presented to the Board of HLC	The board discusses the investment case based on a financial model where CERs are included in the base case, and subject to shareholder's approvals.	Minutes-N16 HLC Extract: *Final Investment Case.pdf* (including CERs in base case)
27-28/8/07	SNPI Board Meeting	SNPI Board approves investment in the development of La Confluencia Hydropower Project, through its 50% ownership in the joint venture Hidroelectrica La Confluencia S.A.: "The board bases this decision on a very high probability that the project will receive revenues from the sale of carbon credits under the Kyoto Protocol"	Translation of Board Meeting Minutes (*SNPI Board Investment decision_Translated Extract.doc*)
24/09/07	CDM Proposal by DNV	Proposal by DNV for validation of the La Confluencia Hydropower CDM Project in Chile	*DNV Validation Proposal_La Confluencia_2007-09-24.pdf*
21/12/07 (starting date of the project activity)	"EPC Contract Full Force and Effect" and "EPC Notice to Proceed"	Contractor and HLC agree that the conditions are met and the contract enters into force.	"EPC Contract Full Force and Effect" and "EPC Notice to Proceed"

Table 14 - Selected milestones during the project development and investment decision process

In conclusion, the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The La Confluencia Project is a run of river hydroelectric project connected to a grid with an accumulation reservoir for hourly storage. The reduced emissions are calculated in accordance with the approved consolidated baseline methodology version 12.1 of ACM0002 along with the "Tool to calculate the emission factor for an electricity system" (version 2), as follows:

Project emissions (PE_y)

For most renewable power generation project activities, $PE_y = 0$. The proposed project activity does not make use of an reservoir hence none project emissions need to be accounted for**Baseline emissions (BE_y)**

[16] Additional email correspondence between DNV and PHL on the ongoing negotiation is available and can be provided on request.

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad \textbf{(1)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2e/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 calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions. For the project activity methodology (a) is used.

(a) Greenfield renewable energy power plants

Since the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, $EG_{PJ,y}$ is calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} \quad \textbf{(2)}$$

Where:

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

Calculation of $EF_{grid,CM,y}$

According to the "Tool to calculate the emission factor for an electricity system" (Version 2) the baseline emission factor ($EF_{grid,CM,y}$) is calculated as combined margin (CM), consisting of the combination of the operating margin (OM) and the build margin (BM) factors. OM and BM are calculated ex-ante based on official data source as public available and will be fixed during the first crediting period. See calculation below.

Application of procedures provided in "Tool to calculate the emission factor for an electricity system" (version 2) for determining the grid emission factor are as follows:

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

STEP 5. Identify the group of power units to be included in the build margin (BM).
STEP 6. Calculate the build margin emission factor.
STEP 7. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electric power system

The project electricity system, as indicated in Section B3, is the Central Interconnected Chilean Grid (SIC). This includes the project site and the geographical extend of the grid and all electricity generation plants that connect to this grid. The selection of this grid as the appropriate electric power system is in accordance with 'Tool to calculate the emission factor for an electricity system" version 2.

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

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

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

The operating margin is calculated using Simple adjusted OM, as data on the operational parameters of the project electricity system are available from official sources, principally CDEC-SIC.

Step 4: Calculate the operating margin emission factor

The simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) 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). As under Option A of the simple OM, it is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows: Since fuel consumption data is provided by CNE and actual generation is known the following formula is applied to calculate $EF_{grid,OM-adj,y}$:

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

(3)

Where:

$EF_{grid,OM-adj,y}$	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 plants *m* in the year *y* (MWh).
$EG_{k,y}$	Net quantity of electricity generated and delivered to the grid by power plants *k* in the year *y* (MWh).
$EF_{EL,m,y}$	CO_2 emission factor for power units *m* in year *y* (tCO_2/MWh)
$EF_{EL,k,y}$	CO_2 emission factor for power units *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

$EF_{EL,m,y}$, $EF_{EL,k,y}$, $EG_{m,y}$ and $EG_{k,y}$ should be determined using the same procedures as those for the parameters $EF_{EL,m,y}$ and $EG_{m,y}$ in Option A1 of the simple OM method (Equation 2) of the 'Tool to calculate the emission factor for an electricity system" version 2) as follows :

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot EF_{CO_2,i,y} \cdot NCV_{i,y}}{EG_{m,y}} \quad \textbf{(4)}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil 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 fossil fuel types combusted in power unit m in year y
y	The relevant year as per the data vintage

The parameter λ_y is defined as follows:

$$\lambda_y (\%) = \frac{\text{Number of hours low-cost / must run sources are on the margin in year y}}{\text{8760 hours per year}} \quad \textbf{(5)}$$

Lambda (λ_y) should be calculated as follows:

Step (i) Plot a **load duration curve**. Collect chronological load data (typically in MW) for each hour of the year *y*, and sort the load data from the highest to the lowest MW level. Plot MW against 8760 hours in the year, in descending order.

Step (ii) Collect power generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units (i.e. $\Sigma_k EG_{k,y}$).

Step (iii) Fill the load duration curve. Plot a horizontal line across the load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from lowcost/must-run power plants/units (i.e. $\Sigma_k EG_{k,y}$).

Step (iv) Determine the „Number of hours for which low-cost/must-run sources are on the margin in year *y*." First, locate the intersection of the horizontal line plotted in Step (iii) and the load duration curve plotted in Step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin.

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

In determining λ_y only grid power units (and no off-grid power plants) should be considered.

Step 5: Identify the cohort of power units to be included in the build margin (BM).

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently; or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation. Power plant registered as CDM project activities should be **e**xcluded from the sample group *m*.

Step 6: Calculate the build margin emission factor.

The Project will apply Option 1 from the "Tool to calculate the emission factor for an electricity system" for the calculation of the Build Margin in the first crediting period. 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.

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year during the most recent year *y* for which power generation data is available, calculated as follows;

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \tag{6}$$

Where:

$EF_{grid,BM,,y}$	Build margin CO_2 emission factor in year *y* (t CO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh).
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (t CO_2/MWh)
$EG_{PJ,,y}$	Total electricity displaced by the project activity in year *y* (MWh)
m	Power units included in the build margin
y	Year in which the project activity is displacing grid electricity.

The CO_2 emission factor ($EF_{EL,m,y}$) of each power unit *m* will be determined using option A1 from the 'Tool to calculate the emission factor for an electricity system" version 2. The following formula is used to determine the yearly y emission factor for each fossil fuel plant in the project electricity system, since specific consumption by each plant is available from official sources:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot EF_{CO_2,i,y} \cdot NCV_{i,y}}{EG_{m,y}} \quad \textbf{(7)}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil 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 fossil fuel types combusted in power unit m in year y
y	The relevant year as per the data vintage

Step 7: Calculate the combined margin emission factor

As the project is a run of river project without any reservoirs the applied weightings to the operating and build margin emissions factors are 0.5 respectively in calculating the CM. These will be changed to 0.25 and 0.75 respectively for the second and third crediting periods.

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(8)}$$

Where:

$EF_{grid,BMy,}$	Build margin CO_2 emission factor in year *y*
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year *y*
w_{OM}	weighting of operating margin emissions factor (%)
w_{BM}	weighting of build margin emissions factor (%)

Leakage (LE_y)

As it is stated in ACM0002 version 12.1, no leakage emissions are considered

Reduction emissions (ER_y)

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(9)}$$

Where:

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

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**EF** $_{grid,OM-adj,,y}$
Data unit:	tCO_2/MWh
Description:	Operating emission factor of grid
Source of data used:	Calculated, vintage 2006-2008
Value applied:	0.797
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is determined ex-ante and applied to the CM with a weighting of 0.5 for the first crediting period. Please, see Annex 3 and provided worksheets (GRID EF LaConfluencia_HydroPP_(2006-2008)_18-05-2010.xls and Load_Duration_Curves_(2006-2008)_La Confluencia_HydroPP_2-12-2009.xls)
Any comment:	

Data / Parameter:	**EF** $_{grid,BM,,y\ y}$
Data unit:	tCO_2/MWh
Description:	Build margin emission factor of grid
Source of data used:	Calculated, see Annex 3
Value applied:	0.494
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is determined ex-ante and applied to the CM with a weighting of 0.5 for the first crediting period. Please, see Annex 3 and provided worksheets (GRID EF LaConfluencia_HydroPP_(2006-2008)_18-05-2010.xls and Load_Duration_Curves_(2006-2008)_La Confluencia_HydroPP_2-12-2009.xls)
Any comment:	

Data / Parameter:	**EF** $_{grid,CM,,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin emission factor
Source of data used:	Calculated, see Annex 3
Value applied:	0.645
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is determined ex-ante and applied for the first crediting period. Please, see Annex 3 and provided worksheets (GRID EF LaConfluencia_HydroPP_(2006-2008)_18-05-2010.xls and Load_Duration_Curves_(2006-2008)_La Confluencia_HydroPP_2-12-2009.xls)
Any comment:	

Data / Parameter:	$EG_{m,y}$ and $EG_{k,y}$
Data unit:	MWh/yr
Description:	Net electricity generated and delivered to the grid by power plant/unit *m,k* in year *y*
Source of data used:	CNE
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official data from all plants connected to the SIC grid.
Any comment:	

Data / Parameter:	$\mathbf{FC_{i,m,y}}$ **,** $\mathbf{FC_{i,k,y}}$ and $\mathbf{FC_{i,y}}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of $FC_{i,y}$) in year *y*
Source of data used:	CNE Node Price Report: 6 monthly reports containing specific fuel consumption provided for each power unit in the system
Value applied:	Details in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple adjusted OM: 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)
Any comment:	Where values are not provided by CNE or CDEC-SIC the value of the previous monitoring period shall be applied.

Data / Parameter:	$\mathbf{EF_{CO2,i,y}}$ **and** $\mathbf{EF_{CO2,m,i,y}}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Coal: 89.5 Diesel: 72.6 Natural gas: 54.3 Petcoke: 82.9 IFO 180 (residual oil): 75.5
Justification of the	No official information available, thus default values are applied.

choice of data or description of measurement methods and procedures actually applied :	Simple adjusted OM: 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)
Any comment:	

Data / Parameter:	**NCV**$_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Petcoke: 29.7 TJ/Gg Diesel: 41.4 TJ/Gg Natural Gas: 46.5 TJ/Gg Coal: 24.0 TJ/Gg Fuel Oil: 39.8 TJ/Gg
Justification of the choice of data or description of measurement methods and procedures actually applied :	No official figures are provided from each fossil fuel plant attached to the grid. As per ACM0002 the lower 95% confidence interval value is used. Simple adjusted OM: 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)
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

Step 1. Identify the relevant power system.

As per B3 and B4 the relevant power system is the SIC grid.

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

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

Step 3: Selection of an operating margin (OM) method

As per B.6.1 the simple adjusted OM is chosen based on the availability of data maintained and made available by the Governmental Agencies responsible for the electrical system in Chile.

Step 4: Operational Margin Calculation

The Operating Margin is established on an ex-ante basis from data of the most recent 3 years (2006-2008) available from official sources.

$EF_{grid\text{-}adj,y}$ =0.797 tCO_2/MWh

Annex 3 shows a summarised version of the calculation and how this result is derived.

Step 5: Identification of the cohort of power units to be included in the build margin (BM).

Application of both methods of identifying the sample group that results in the highest annual generation, as described in B.6.1 gives the following results (2008):

a. Generation from last five power units built: 52,043 MWh
b. Generation from power units that comprise of 20% of the system generation most recently built: 8,797,016 MWh

Based on this method b) was used and the sample group of *m* power units selected.

Step 6: Build Margin Calculation
The Project will apply Option 1 from the "Tool to calculate the emission factor for an electricity system" for the calculation of the Build Margin in the first crediting period. 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 subsequent crediting periods the Build Margin emission factor shall be calculated ex ante at the start of the second crediting period, and this shall also be used for the third crediting period on plants already built from sample group *m*.

$EF_{grid,BM,y}$= 0.494 tCO_2/MWh

See Annex 3 for detailed results for power units *m* in deriving the above value as an estimate for the Project's Build Margin.

Step 7: Calculation of the combined margin (CM) emissions factor.
As per "Tool to calculate the emission factor for an electricity system" the weighted value for the BM and OM is 0.5 for the first crediting period.

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

$$EF_{grid,CM,y} = 0.5*0.797 + 0.5*0.494 = \mathbf{0.}645\ tCO_2/MWh$$[17]

Reduction emissions (ER_y)

Annual amission reductions during the first crediting period are calculated as follows:

$$ER_y = BE_y - PE_y$$

$$\begin{aligned} ER_y &= BE_y - PE_y \\ &= (EG_{PJ,y} \cdot EF_{grid,CM,y}) - 0 \\ &= (0.645\ tCO_2/MWh * 656{,}000\ MWh/yr) - 0 \\ &= 423{,}120\ tCO_2\ p.a. \end{aligned}$$

[17] Please see Annex 3 and the attached spreadsheet for detailed calculation process.

Year (first crediting period)	$EG_{PJ,y}$ (MWh/yr)	$EF_{grid,CM,y}$ (tCO_2/MWh)	$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$ (tCO_2/yr)	$ER_y = BE_y - PE_y$ [with PE_y = 0] (tCO2/yr)
2011 (01/04/2011-31/03/2012)	656,000	0.645	423,120	423,120
2012 (01/04/2012-31/03/2013)	656,000	0.645	423,120	423,120
2013 (01/04/2013-31/03/2014)	656,000	0.645	423,120	423,120
2014 (01/04/2014-31/03/2015)	656,000	0.645	423,120	423,120
2015 (01/04/2015-31/03/2016)	656,000	0.645	423,120	423,120
2016 (01/04/2016-31/03/2017)	656,000	0.645	423,120	423,120
2017 (01/04/2017-31/03/2018)	656,000	0.645	423,120	423,120
Average	656,000		423,120	423,120
Sum	4,592,000		2,961,840	2,961,840

Table 15 - Calculation of emission reduction during the first crediting period

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO_2e/yr)
PE_y = Project emissions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year y (tCO_2e/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)

In total the estimated emission reduction amounts to 2,961,840 tCO_2 over the first crediting period

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

The estimated emission reduction of the project activity is provided in Table 16.

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2 e)
2011 (01/04/2011-31/03/2012)	0	423,120	0	423,120
2012 (01/04/2012-31/03/2013)	0	423,120	0	423,120
2013 (01/04/2013-31/03/2014)	0	423,120	0	423,120

2014 (01/04/2014-31/03/2015)	0	423,120	0	423,120
2015 (01/04/2015-31/03/2016)	0	423,120	0	423,120
2016 (01/04/2016-31/03/2017)	0	423,120	0	423,120
2017 (01/04/2017-31/03/2018)	0	423,120	0	423,120
Total	0	2,961,840	0	2,961,840

Table 16 - Ex-ante estimation of emission reductions

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{PJ,y} = EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	656,000 MWh/yr. Based on hydrological and generation model for the project. The project's average generation is 656,000 GWh per year.
Description of measurement methods and procedures to be applied:	Electricity meters with continuous measurement and at least monthly recording (monitoring frequency)
QA/QC procedures to be applied:	Meter quality is governed by the *Normas Tecnicas* and are required to have a maximum error of 0.2% under Chilean law. Meters are calibrated periodically according to local standards for electricity transactions in CDEC-SIC. The data is utilised by CDEC-SIC for determining the energy balance between generators. Generation data of the Project will be cross checked versus CNE and CDEC-SIC records to ensure data reliability. Since CNE is the national agency information from their records will prevail in the case of dispute arising from differences in generation.
Any comment:	

Data / Parameter:	TEGy
Data unit:	MWh
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y
Source of data to be used:	Direct measurement at the project site

Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording
QA/QC procedures to be applied:	-
Any comment:	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2

B.7.2 Description of the monitoring plan:

>>

Referring to the monitoring methodology of the approved consolidated methodology ACM0002 "**Consolidated baseline methodology for grid-connected electricity generation from renewable sources**":

The monitoring methodology involves the monitoring of the following:

- Quantity of net electricity generation supplied by the project plant/unit to the grid in year y;
- Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y

Proven and qualified monitoring equipment (electricity meter) will be installed meeting relevant local standards at the time of installation. The meters will be installed in accordance with Chilean standards. Records of the meters (type, brand, model and calibration documentation) will be retained for documentation. The systems will allow automated and continuous recording and data will be registered accordingly.

The readings from the meters will be checked for any anomalies before being filed for future reference. All data collected as part of the monitoring will be archived electronically and be kept at least for 2 years after the end of the crediting period. Receipts of electricity sales will be obtained and used for cross checking.

A monitoring report will be prepared at least once a year, including electricity quantity monitoring files, receipts files and, if applicable, repairs record files and emergency situation files as well as corrective actions performed in case of faulty meters.

Operational and Management Structure

The management structure of HLC will take direct responsibility for the collection, verification and processing of information for the quantification of emission reductions to ensure quality and accuracy of all data utilised and results obtained. The organisational structure that is envisioned to manage and undertake the processes identified in steps 1, 2 and 3 is shown below;

Figure 9 - Organisational structure of monitoring

Activities and Responsibilities

- The CDM Coordinator will be responsible for the overall process of calculating emission reductions from the Project. He/she will also be responsible for all obligations entered into under ERPAs executed with third parties and communications with off-takers under these agreements. He/she will coordinate the activities of the Plant Operators and CDEC Coordinator to ensure that all data is verified, stored safely and processed as per this document. This includes the appointment of a DOE and managing of the CER verification process for issuance requests to the Executive Board.
- The CDEC coordinator will be responsible for verification of monthly generation notices received from CDEC and verification of these with Project output. They will coordinate any queries arising from data verifications with the Operations Manager, who maintains all responsibility for output and performance of the Project. The CDEC coordinator will undertake the emission reduction calculations as outlined in this document, reporting to the CDM Coordinator, Operations Manager and General Manager on performance of Project regarding emission reductions.
- Plant Operators will be responsible for monitoring plant output, monitoring energy metre performance vs. expected generation and ensuring all communication links and data storage from the control system is correctly stored and backed up. All data will be stored electronically off site for the duration of the project's useful life, which is expected to be fifty years.
- The Environmental and Social Manager will be responsible for the performance of the Project and ensuring all processes are developed to comply with both Authorities' requirements and Chilean Standards and the implementation of corporate policies with respect to both the environment and community. They will oversee the environmental audits the Project is subject to as a result of obtaining financing from the IFC.

Training

The Plant Operator, La Confluencia Operations Manager and other persons in charges will be trained by HLC CDM team. Furthermore, SN Power will hold an internal training workshop for its Global CDM Team with participation from Chile. Enclosed is the agenda for the monitoring and verification course which the Global SN Power CDM Team will go through on May 18th in Oslo. It will be held by Mari Groos Viddal, who currently works in the carbon team at Statkraft, and who previously worked in the climate change team at DNV (with validation and verification of CDM/JI projects).

Additionally, CDM related presentations will be provided to involved staff including the details and importance of the monitoring for the CDM and the project. People in charge for monitoring, metering and billing will be instructed and trained by HLC CDM team about the CDM and its importance for the validity of the project.

The PP will include in the O&M manuals and QA/QC procedures, the necessary specifications that describe 1) that all new personnel will receive the corresponding training in the project activity and relevant CDM requirements, and, 2) any changes to the equipment or procedures within the project activity will be followed by the corresponding training of the personnel involved.

Further details are provided in Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The baseline study was completed on 02/12/2009. The entity determining the baseline is Valgesta Energía S.A.. Valgesta Energía S.A. is not a Project Participant.

Contact information for Valgesta Energía S.A.:

Nicole Coquelet
Valgesta Energía S.A.
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

The Loan Agreement between the Owner and IFC and syndicate banks was executed on the 23rd of October 2007. Notice to proceed for the EPC Contractor was given on the 21st of December 2007. This date is taken as the start of the project. Commissioning and connection to the grid is expected in September 2010.

C.1.2. Expected operational lifetime of the project activity:

>>

The Project has a financial lifetime of 20 years, although hydroelectric projects typically continue to be operable for 40 years.

C.2 Choice of the crediting period and related information:

The project will use a renewable crediting period.

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

The starting date of the first crediting period will be the 01/04/2011 or the date of registration whichever is later.

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The project complies with the specific applicable regulations of the host country in regard to the Environment Impact Assessment (EIA). The EIA follows the regulations for Environmental Impact Assessment System (SEIA) set in Chile by the Supreme Decree N 30/97 of the Ministry General Secretariat of the Presidency, Regulation for the Environmental Impact Assessment System and its modifications set in Supreme Decree N 95/2001, and the Act N 19300 on the Environmental Framework. Under this framework all electricity generating projects larger than 3MW are required to be approved under the SEIA framework. Under the SEIA the impacts are evaluated under either an EIA or an Environmental Impact Declaration (DIA). The former is a much more thorough and exhaustive study, also requiring public participation in the review of the project.

In February 2004 the La Confluencia Project EIA was presented to CONAMA, the National Environmental Commission, for review and approval. The EIA presented included both the La Higuera Hydroelectric Project and the La Confluencia Project. The EIA was approved by CONAMA in RCA 116 in August 2004.

Following a review of engineering for project optimisation (in terms of economic, environmental and operational criteria) the project underwent some modifications. Most of these modifications included the incorporation of temporary facilities and roads for the construction of La Confluencia that were not included in the original project presented in the EIA. Because none of the modifications were evaluated as being significant impacts this was presented and reviewed as a DIA in October 2006. This was approved in RCA 282 in July 2007.

Some additional environmental permits have been granted during 2008-2009 for the transmission line and some temporary and definitive facilities through the following DIAs: RCA 122/2008, RCA 236/2008, RCA 30/2009, RCA 64/2009, RCA 68/2009, RCA 120/2009, RCA 219/2009, RCA 192/2009.

The EIA and DIAs have also been subject to World Bank's Guidelines and Policies with respect to large hydroelectric projects as a requirement from IFC as the lead arranger in financing for the project. This includes Environmental, Social and Occupational Health and Safety compliance tests and requirements. These World Bank guidelines form the cornerstone of the sustainable development policies of the Equator Principle. Most major financial institutions have signed up to this principle in fostering a broader corporate obligation for environmental and social sustainable development in project financing activities.[18]

The EIA and DIAs discuss a wide range of environmental impacts related to physical, biotic, human, cultural, patrimonial and landscapes impacts during the plant's construction and operation stages. It identifies the risk or contingency zones and the type of risk associated to them. It also discusses a number of corrective measures and establishes an environmental management plan to deal with the impacts identified. This plan addresses the significant and medium impacts providing measures for their mitigation, restoration or compensation.

There are twelve positive impacts identified with effects on the human environment and the social-economic development of the District of San Fernando, where the project is located. The project will allow the generation of clean energy for the region displacing electricity generated from fuel-based power plants. Furthermore, it is going to generate benefits in the form of climate change mitigation.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

The EIA was required based on three criteria following the requirements of the SEIA:

Article 6 letter a)	The intervention by the project's works of the aquatic flora and fauna habitat will be the least possible. However, there are two ichthyic species respectively listed as vulnerable and in danger of extinction that justifies the presentation of an EIA.
Article 6 letter l)	The intervention of the native vegetation will be the least possible. However, there are plant species listed in the red book as conserved and protected as well as subject of intervention restrictions that justify the presentation of an EIA.
Article 6 letter m)	
Article 6 letter o)	Intervention in this area is an activity that must be carried out very carefully due to special features of soils. Intervention is subject of multiple conditions and restricted uses of the soil. Therefore, the presentation of an EIA is justified.

The baseline studies and review of the project activities identified positive and negative impacts of the project. Twelve positive impacts, dominantly socio economic impacts were identified in the EIA. Eighteen negative impacts were identified, of which the only significant impact it is related to the loss of

[18] http://www.equator-principles.com/

habitat for the aquatic fauna and flora. The environmental management plan establishes the measures undertaken to mitigate or compensate the impact, including an ecological flow release considered sufficient to maintain the flora and fauna during periods where flows are reduced. Furthermore, four medium impacts were identified and mitigation measures will be implemented in order to avoid any erosive process and alteration of the landscape after the construction stage.

The DIAs that were approved subsequent to minor modifications did not identify any significant impacts additional to those identified in the EIA.

SECTION E. Stakeholders' comments

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E.1. Brief description how comments by local stakeholders have been invited and compiled:

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The La Confluencia Project has had numerous public consultation periods as part of the La Higuera Project under the EIA submitted in February 2004, and as separate follow up consultations following modifications to the project.

According to the Chilean Environmental Law, a project of the size and characteristics of La Confluencia is required to develop an Environmental Impact Assessment (EIA). The Owner carried out the EIA between December 2001 and December 2003, with the obligation to carry public community consultations through publications in local newspapers and public hearings at a community level. Additionally the concept of a hydroelectric project was presented twice to the regional and local communities and authorities in 2003. This was part of the EIA process that was subsequently terminated, as the project layout changed. However, this process served to highlight key areas of interest, many of which were addressed in the final EIA that was presented in February 2004. This is evidenced by the very high numbers present for the initial presentations, nearly 800, dropping to 100 in the presentation of the EIA that was approved for the Project.

1. Local authorities: More than 15 different authorities were present, including all relevant services dealing with the environmental and sectoral authorizations of the project. CONAMA was responsible for ensuring all relevant authorities were represented. The presentation was done in 2 steps. One related to the technical and environmental aspect of the project and the second one related to the CDM characteristics of the project.

2. Local community: in accordance with the EIA procedure, the community was invited by the environmental authorities at a gathering, in which the project developer would present the major characteristics of the project.

Subsequent presentations were conducted under the same scheme as that used by CONAMA for the obligatory consultations; authorities and public, including representatives from key stakeholders (high impact, lower power) were invited directly and by public announcements.

The following table shows the public consultation process undertaken by the Owner. The two meetings undertaken in 2003 were part of an EIA that was subsequently withdrawn, as the project moved from the north bank to the south bank of the Tinguiririca river.

Only those made in conjunction with the presentation of the EIA for the Projects in 2004 were obligatory under Chilean law, with all subsequent ones being undertaken under the commitment by the Owner to involve stakeholders in the Projects (La Higuera and La Confluencia).

Public Meeting	Forum	Topic	Coordinator	Participants
2003	Puente Negro	Project and EIA presentation	CONAMA	Local communities-70
2003	San Fernando	Project and EIA presentation	CONAMA	Regional public and authorities-600

25 February, 2004	Puente Negro	Project and EIA presentation	CONAMA	Local communities-28
16 March, 2004	San Fernando	Project and EIA presentation	CONAMA	Regional public and authorities-59
22 June, 2007	San Fernando	Voluntary Project presentation of modifications	Owner/ CONAMA	Regional public and authorities
7 September, 2007	San Fernando	Carbon Credit and CDM presentation	Owner	Regional public and authorities

Table 17 - Public consultation process

E.2. Summary of the comments received:

>>

The three main themes raised regarding the project were a) dust and traffic use of the I-45, b) possible contamination of the Tinguiririca River, and, c) the impact on water downstream of the project.
The detailed transcript of the questions was made available to the Validator.

E.3. Report on how due account was taken of any comments received:

>>

Comments were directed at the use and state of the I-45 and possible contamination of water in the Tinguiririca. Both of these elements have been consistent issues raised in presentations to the public and authorities. The Owner had already commenced activities with the Road Authority to address these issues, and steps are well advanced in improving safety, maintenance, access and control of the I-45 in conjunction with all users. This includes the Owner extending the paved section of the I-45 to the town limits of Puente Negro for safety and dust control improvements.
Contamination of the catchment as a result of the Project activity is obviously a significant issue for the Owner and Chilean authorities and these have been strongly addressed in both the EIA requirements placed on the Project, and additional measures included in the EPC Contract to ensure the strongest control, monitoring and application of international best practice and standards by the Contractor.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funds from Annex I countries is involved in the Project.

Annex 3

BASELINE INFORMATION

Plant Emission Factor Calculations

The emission factors $EF_{EL,m,y}$ and $EG_{m,y}$ for the OM and BM calculations in section B6.1, B6.3 and the monitoring methodology are calculated in the following manner:

For each plant in the electric system specific fuel consumption is provided by CNE. This is utilised to establish the CO_2 emission factor for each power unit *m* in the system.

Calculation of simple adjusted OM for the CNE (2006-2008):

Simple Adjusted OM Calculation

	2006	2007	2008
Number of hours per which low-cost/must-run sources are on the margin	52	0	0
Lambda	0.0059	0.0000	0.0000
	2006	**2007**	**2008**
Low-cost/must-run EF [tCO2e/MWh]	0	0	0
Other power plants EF [tCO2e/MWh]	0.734	0.809	0.851

	2006	2007	2008
Simple adjusted OM [tCO2e/MWh]	**0.730**	**0.809**	**0.851**

OM Average 2006-2008	**0.797**
BM 2008	**0.494**
Combined Margin	**0.645**

Combined Margin Calculation (tCO2e/MWh)

OM Average 2006-2008	**0.797**
BM 2008	**0.494**
Combined Margin	**0.645**

Please see for further details: *Grid emission factor calculation (GRID EF LaConfluencia_HydroPP_(2006-2008)_18-05-2010.xls and Load_Duration_Curves_(2006-2008)_La Confluencia_HydroPP_2-12-2009).*

Calculation of BM for the CNE (2008):

Year 2008	BUILD MARGIN CALCULATION				
Total Generation 2008 (MWh)		41,873,952.3			
Power Plant	First Year In Service	Plant / Fuel Type	Energy Generated (MWh)	Emissions (tCO2e)	Accumulated %
Chuyaca	2008	Diesel Oil	82.6	57.7	0.00%
Lircay (CDM)	2008	Hydro Run of River	-		0.00%
Coya	2008	Run of River	43,462.1		0.10%
Colmito	2008	Diesel Oil	4,422.3	3,340.0	0.11%
Quellón II	2008	Diesel Oil	3,550.6	2,480.5	0.12%
Ojo de Agua (CDM)	2008	Hydro Run of River	-		0.12%
Puclaro (CDM)	2008	Hydro Run of River	-		0.12%
Santa Lidia	2008	Diesel Oil	525.5	421.7	0.12%
Cenizas	2008	Diesel Oil	865.4	653.6	0.13%
Totoral	2008	Diesel Oil	3,430.9	3,547.5	0.13%
Los Pinos	2008	Diesel Oil	7,118.2	4,569.7	0.15%
Chiloe	2008	Diesel Oil	110.9	93.9	0.15%
Placilla	2008	Diesel Oil	3,020.5	3,123.2	0.16%
Quintay	2008	Diesel Oil	3,236.9	3,346.9	0.17%
Olivos	2008	Diesel Oil	28,296.4	20,035.5	0.23%
Chiburgo	2007	Hydro Run Of River	98,899.0		0.47%
Con Con	2007	Diesel oil	7,211.2	7,456.3	0.49%
Constitución Elektragen	2007	Diesel Oil	10,754.5	9,543.9	0.51%
Degan	2007	Diesel Oil	68,292.1	47,065.3	0.68%
El rincon	2007	Hydro Run Of River	2,536.4		0.68%
Eolica Canela I (CDM)	2007	Wind Power	-		0.68%
Esperanza	2007	Diesel Oil	12,579.2	14,860.8	0.71%
Eyzaguirre	2007	Hydro Run Of River	8,745.9		0.73%
Fopaco (FPC) (CDM)	2007	Biomass	-		0.73%
Hornitos (CDM)	2007	Hydro Run Of River	-		0.73%
Las vegas	2007	Diesel Oil	6,074.1	6,257.8	0.75%
Maule	2007	Diesel Oil	5,197.1	4,612.1	0.76%
Monte Patria	2007	Diesel Oil	17,085.4	16,022.4	0.80%
Palmucho	2007	Hydro Run Of River	225,076.0		1.34%
Punitaqui	2007	Diesel Oil	18,090.0	16,964.5	1.38%
Quilleco (CDM)	2007	Hydro Run Of River	-		1.38%
San Isidro II	2007	Diesel Oil	998.0	719.2	1.38%
Campanario CA Diesel	2006	Diesel Oil	240,211.2	185,957.8	1.96%
Los Vientos	2006	Diesel Oil	380,793.9	305,573.8	2.87%
Nueva Aldea 3 (CDM)	2006	Biomass	-		2.87%
Antilhue TG	2005	Diesel Oil	241,149.2	207,932.5	3.44%
Candelaria	2005	Diesel Oil	576,633.0	584,307.3	4.82%
Coronel	2005	Diesel Oil / Natural Gas	74,588.0	37,907.2	5.00%
Nueva Aldea 1 (Ex Itata) (CDM)	2005	Biomass	-		5.00%
Nueva Aldea 2 Diesel	2005	Diesel Oil	36.6	47.3	5.00%
Horcones	2004	Diesel Oil / Natural Gas	6,805.6	10,402.4	5.01%
Licantén	2004	Biomass	13,018.4		5.05%
Ralco	2004	Hydro Reservoir	2,578,244.0		11.20%
Valdivia (CDM)	2004	Biomass	-		11.20%
Cholguan (CDM)	2003	Biomass	-		11.20%
Nehuenco II	2003	Diesel Oil / Natural Gas	2,392,508.0	1,625,374.7	16.92%
Chacabuquito (CDM)	2002	Hydro Run Of River	-		16.92%
Nehuenco 9B	2002	Diesel Oil	235,153.0	294,238.1	17.48%
San Fco de Mostazal	2002	Diesel Oil	32,568.8	31,669.9	17.56%
Mampil	2000	Hydro Run Of River	163,277.8		17.95%
Peuchén	2000	Hydro Run Of River	242,580.9		18.53%
Taltal	2000	Diesel Oil / Natural Gas	1,039,786.0	900,660.1	21.01%
Total			8,797,015.6	4,349,243.3	

Build Margin (tCO2e/MWh)	0.494

* As per methodology ACM0002, power plants registered as CDM project activities were excluded from the Efbm calculation.

Please see for further details: *Grid emission factor calculation (GRID EF LaConfluencia_HydroPP_(2006-2008)_18-05-2010.xls).*

Annex 4

MONITORING INFORMATION

Purpose

A.

1. Metering

Energy meters installed at each generator and at the Tinguiririca Substation will provide information on the injection of energy from the Project into the SIC grid. The installation of the meters is shown in Figure 10.

Figure 10 - Location of energy meters

The gross generation of La Confluencia Project is collected by meters M3 and M4. The gross generation of the La Higuera Project is collected by meters M1 and M2. Net generation from both projects injected into the SIC grid is measured by metre M5. All data is collected by the SCADA control systems every 15 minutes and stored as a summed hourly total. This information is automatically transmitted to the CDEC-SIC Dispatch Centre and the respective powerhouses, where is it electronically stored.

The net injection the project is determined on a basis of an algorithm that utilises transmission losses along the La Confluencia high voltage transmission line, HV_{LC} , and the shared La Higuera high voltage transmission line, HV_{LH} , and calculates the net generation of each project from the energy injected and measured by M5.

CDEC-SIC send the net generation injected into the SIC at the end of each month for the Project, which indicates the sum of hourly generation in the month for which the Project receives revenues. This generation and electricity invoice is checked against internal records for integrity.

2. Standards and Calibration of Meters

Grid connected generation projects are obliged under the *Normas Tecnicas* to install metering that has 0.2% accuracy, which is extremely high precision equipment. This equipment is tested at Project Completion prior to the Owner Taking-Over the Project for commercial operation. Meters are tested will be tested according to requirements of the system operator , but at least once every two years according to the Project's maintenance procedures.

3. Data Collection Method

The energy meters are interconnected with the SCADA control system of the project and have remote access connection with CDEC-SIC. The SCADA collects the relevant information from these meters, as per CDEC-SIC specifications and automatically transmits this information via telecommunication network. SCADA information is electronically stored at the powerhouse, thus two data sets are maintained for recording Project output.

4. Data Storage

Data from the metering and SCADA system is stored at the powerhouse on hard disks. This is backed up on a weekly basis, with weekly magnetic tapes being stored off site (in the Santiago Office).

5. Data Processing

Generation by project is monitored on a daily basis by HLC. The CDEC Coordinator is responsible for the monitoring and processing of all information sent to the SIC and the Project, including generating daily, weekly and monthly generation summaries. Net generation of the Project is derived applying the algorithms to account for transmission losses to the CDEC-SIC at the Tinguiririca Substation and is checked against the monthly balance received from CDEC. Thus the Project will have two records of hourly project generation; one supplied by the official CDEC-SIC, and those maintained internally by the Project.

6. Data Verification- QA/QC

Generation projects are obliged to have communications systems, with 100% redundancy, for transmittal of all information from the meters to the CDEC-SIC control room. As such all information will be sent and stored by both the CDEC-SIC and the Project.

CDEC-SIC review and send to each Energy Generation Company the net generation of each project connected to the grid at the end of each month for invoicing purposes. The Project will be paid by the other market participants on a monthly basis for the actual energy generated for each hour in the month for the corresponding marginal cost of the system at each hour. HLC will revise each invoice on a monthly basis to correlate Project generation with that billing information provided by CDEC-SIC. As such there is a thorough data verification process and method established to ensure accuracy. Receipts from the sell of energy and firm capacity will be kept for documentation. For the purposes of determining emission reductions as a result of the Project activity the Project will utilise the information from CDEC-SIC as the official source for all information about generating plants connected to the SIC Grid. In this manner internal information on Project output will be used to verify CDEC-SIC data, providing for improved data integrity and transparency. A monitoring report will be prepared at least once a year, including electricity quantity monitoring files, receipts files and, if applicable, repairs record files and emergency situation files as well as corrective actions performed in case of faulty meters.

In case of emergencies and/or faulty meters, corresponding corrective actions will take place by restoring and/or replacing erroneous measurements with data not affected, i.e. in the unlikely case meter M5 accounting the net generation will fail data from meters M1-4 could be used to estimate the net electricity fed into the grid. If the restoring of data will not be possible erroneous measurements will not be considered for calculating CERs.

Procedures

The procedures and responsibilities are described in Section B 7.2 with respect to the monitoring and calculation of emission reductions for the Project.