MONITORING REPORT

Trupan Biomass Power Plant in Chile

CDM Registration Reference Number: 0259

VERSION 01

Monitoring period:

From: October 01, 2008
To: December 31, 2009

Celulosa Arauco y Constitución S.A.

July, 2010

SUMMARY TABLE

Name of the CDM project activity:	Trupan Biomass Power Plant in Chile
CDM registration reference number:	0259
Starting date of the project activity:	04/04/2001
Starting date of the first crediting period:	01/05/2003
Length of the first crediting period:	Seven (7) years.
Maximum length of the crediting period:	3 x Seven (7) years
Period covered by the current monitoring report:	01 October 2008 – 31 December 2009 (both days included)
Total net emission reductions claimed in the monitored period:	**192,738 tCO_2eq**

1. Project description and current status

Project description

The project activity consists in a new 30 MW biomass cogeneration power plant located inside of the Trupan MDF wood panel complex by Arauco: the Trupan Industrial Complex. The Project is designed to use own and third party biomass for electric power generation that would have otherwise been left in piles to natural decay. Approximately 50% of the generated power is destined to serve the internal needs of the Trupan complex, while the remaining 50% is sold mainly in the spot market and to some direct customers of Arauco Generación[1].

The Project is presented by Celulosa Arauco y Constitución S.A. (from now on, Arauco) a leading forestry and pulp-producing company in South America; but the project itself was realized by Paneles Arauco S.A. (Trupan), an MDF / wood panel board producing company in Chile, subsidiary of Arauco.

The new Power Plant was part of the expansion project of the Trupan wood panel mill (Trupan Line Nº 2). Before implementing this project activity, Trupan had steam generation capacity but no electric power generation capacity, so the Complex sourced all its electric power requirements through the grid[2]. However, when the Trupan management evaluated the expansion project, it considered the surplus of biomass available in the region, the environmental benefits associated to the use of a higher-end technology, the possibilities offered by the Kyoto Protocol and decided to build a new on-site biomass Power Plant. This new power plant had enough capacity not only to fulfill the power needs of the Trupan complex, but also to generate a considerable power surplus to the grid.

From a technical perspective, this decision involved installing a high-pressure boiler and a steam turbine, which meant going clearly beyond the common practice of the Panel board Industry in Chile. Given that installing a high-pressure boiler and a condensing turbogenerator implied a higher operational complexity and a higher cost than the more conventional solution (e.g. a saturated-steam boiler with no power generation), the decision of building the Trupan power plant project relied on the possibility of not depending on the SIC grid for electric power, on selling surplus power to the grid and on the benefits from being a CDM project activity.

The proposed project activity assists Chile's sustainable growth by providing electricity to the Trupan Complex and to the SIC through biomass power generation. Without the Trupan Power Plant, not only there would have been no clean energy injection to the SIC, but the Trupan Complex itself would have had to continue sourcing its electric power requirements from the grid. In addition, this Project accomplishes an additional greenhouse (GHG) reduction benefit

[1] Arauco Generación S.A. is a subsidiary of Arauco and provides administration services in the power generation business area.

[2] The Trupan Complex had an energy contract with Endesa S.A., one of the largest power companies in Chile.

derived from a reduced disposal or uncontrolled burning of biomass, which results into significantly lower methane emissions[3].

The Project Proponent believes that biomass power generation constitutes a sustainable source of power generation that brings clear advantages to mitigate global warming. Using the available natural resources in a rational way, the Trupan project activity helps to enhance the development of renewable energy sources in Chile, in particular the use of biomass generated as a by-product of the forestry industry, which has a significant potential in the country. The proposed project is a good example of demonstrating the viability of electricity generation as a source of revenue not only to the Wood Panel industry, but also to all forest-related industries. It is worthy to highlight, however, that none of the wood panel mills in Chile (and very few in the world) have this additional power generation capacity, making the Trupan Power Plant facility quite unique and particular in its type.

Baseline methodology

Arauco developed the baseline and monitoring methodology originally proposed for the Trupan Power Plant project activity, the NM0081. Though the Executive Board approved this methodology, a new and broader methodology was developed, which was approved and published by the CDM Executive Board. This methodology resulted from a consolidation of the existing approved methodologies for grid-connected biomass CDM project activities, including the one developed by Arauco. This consolidated methodology is the one applied for the Trupan project activity. The name of the baseline methodology applied to the project activity is:

"Consolidated baseline methodology for grid-connected electricity generation from biomass residues", ACM0006. (Version 01)

Applied baseline scenario for the project activity: Nº 3.

Documentation

The project was validated by DNV and registered in June 06, 2006. The Project Design Document, validation report, request for registration and registration approval are available on the UNFCCC website: http://cdm.unfccc.int/Projects/registered.html

[3] All the biomass attributable to the project activity is brought from third parties.

Implementation and current status

The Trupan CDM project activity has been completed and operated just as described in the registered CDM PDD.

Sustainability, economic and social well-being

The Trupan biomass power plant reduces carbon emissions by replacing fossil fuel-based electricity generation. The project promotes sustainable development by:

- Fostering the diversification of electricity generation towards renewable energy sources in the country.
- Using clean, efficient and top of the line technology to generate power, thus, conserving natural resources and the environment.
- Becoming a benchmark of an efficient and renewable energy generation project in the country. This encourages the development of modern and more efficient generation of electricity and heat throughout the country using renewable biomass sources.

2. Monitored parameters

All parameters needed to make the emission reduction calculations have been monitored according to the monitoring plan. The following table below provides information about the monitored data for the project and baseline emission data variables. Note that:

- 2008 values correspond to October to December year data.
- 2009 values correspond to full year data.

Project activity monitored data

ID number.	Data variable.	2008 value	2009 value	Monitoring systems and procedures
1. $BF_{i,y}$	Quantity of biomass type i combusted in the project plant.	69,065 (BDt)[4]	272,052 (BDt)	Biomass residues transported to the power plant by trucks is duly measured (weight and volume) at the entrance of the power plant. Biomass residues generated internally are also measured (weight and volume) using containers of known (measured) volumetric capacity. This variable is monitored continuously.
2. NCV_i	Net calorific value of biomass fuel type i.	18.59 (GJ/ton)	17.93 (GJ/ton)	The net calorific value of the biomass residues used in the power plant is measured in reputed external laboratories and according to proper industry standards. This variable is monitored once a year.
3. EF_{CH4}	Methane emission factor for combustion of biomass in the project plant.	15 (Kg CH_4/TJ) (unadjusted factor). 15.3 (Kg CH_4/TJ), considering a conservativeness factor of 1.02.	15 (Kg CH_4/TJ) (unadjusted factor). 15.3 (Kg CH_4/TJ), considering a conservativeness factor of 1.02.	The Project Proponent chose the default emission factor for controlled burning of biomass residues provided by the ACM0006 (Version 01). The reasons for which the 1.02 conservativeness factor was chosen can be found in page N° 58, section E.11 of the registered PDD. For further details about this emission factor see the "Additional data" section of this Monitoring Report.
4. AVD_y	Average return trip distance between biomass fuel supply sites	159 (km)	159 (km)	Distances from biomass suppliers to the Plant were continuously monitored and recorded. This variable is reported on a monthly basis for the calculation of the project activity emission reductions.

[4] BDt stands for "Bone dry ton" which means dry ton.

	and the project site.			
5. TL_y	Average truck load of the trucks used for transportation of biomass.	19.2 (ton/truck)	19.94 (ton/truck)	Truck loads from transport subcontractors were continuously monitored and recorded by the Procurement Department of the Trupan Complex. This variable is reported on a monthly basis for the calculation of the emission reductions.
6. $EF_{km,CO2}$	Average CO_2 emission factor for transportation of biomass with trucks.	1.397 (tCO_2/km)	1.235 (tCO_2/km)	Average fuel consumption was obtained from the transportation subcontractors, which was then used to calculate the corresponding CO_2 emission factor.
7. $F_{Trans,i,y}$ (in the PDD, this variable appears as $OF_{i,y}$)	Fuel consumption of fuel type i used for transportation of biomass.	37,454 (lt.) of diesel.	145,952 (lt.) of diesel.	This variable is obtained from the transportation subcontractors. This variable is monitored continuously.
8. $COEF_{CO2,i}$	CO_2 emission factor for the fuel type i.	Diesel: 3.177 (tCO_2/ton) LPG: 2.923 (tCO_2/ton)	Diesel: 3.176 (tCO2/ton) LPG: 2.920 (tCO_2/ton)	These emission factors were determined using the net calorific values, carbon content and fraction of carbon oxidized of the corresponding fossil fuels. These emission factors were determined annually.
9. $FF_{project\ plant,i,y}$ (in the PDD, this variable appears as FF_y)	On-site fossil fuel consumption of fuel type i for co-firing in the project plant.	Diesel consumption: 32,583 (lt.) LPG consumption: 303 (lt.)	Diesel consumption: 77,601 (lt.) LPG consumption: 919 (lt.)	Fossil fuel consumption in the power boiler is measured by dedicated meters. Note that only the fossil fuel attributed to the project activity is reported here. This variable is continuously monitored.
10. $EG_{project\ plant,y}$	Net quantity of electricity generated in the project plant during the year y.	50.6 (GWh)	181.3 (GWh)	The electricity generated by the project plant is continuously measured using dedicated meters. This variable is continuously monitored.
11. Q_y	Net quantity of heat generated from firing biomass in the project plant.	483,480 (GJ)	1,885,419 (GJ)	The net quantity of heat generated from firing biomass residues in the project plant is measured using dedicated meters. This variable is continuously monitored.
12. EF_y	CO_2 emission factor of the	664.98 (tCO_2/GWh)	636.74 (tCO_2/GWh)	This emission factor is calculated using equation N° 10 of the ACM0002 (Version 06), as the

	grid.			average of the OM and BM emission factors. The calculation of this emission factor is in the Annex of this Monitoring Report.
13. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	860.2 (tCO_2/GWh)	837.0 (tCO_2/GWh)	This emission factor is calculated using equation N° 4 of the ACM0002 (Version 06), according the simple adjusted OM method. Full year data was used to calculate each emission factor. The calculation of this emission factor is in the Annex of this Monitoring Report.
14. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	469.7 (tCO_2/GWh)	436.4 (tCO_2/GWh)	This emission factor is calculated using equation N° 9 of the ACM0002 (Version 06). In this case, the BM was calculated for each year (ex-post) and in each case, the weighted average of the emission coefficients of the most recent power plants responsible for 20% of the total power generation each year was used. Full year data was used to calculate each emission factor. The calculation of this emission factor is in the Annex of this Monitoring Report.
15. $F_{i,y}$	Amount of each fossil fuel consumed by each power source / plant.	See the Annex at the end of this Monitoring Report.	See the Annex at the end of this Monitoring Report.	This information was directly obtained from the CDEC-SIC Dispatch Center or directly from the electric power companies themselves.
16. $COEF_i$	CO_2 emission coefficient of each fuel type i consumed by the electric power generators in the relevant grid.	Units in (tCO_2/000ton) except Nat. Gas (tCO_2/MMm^3) Coal: 2,814 Petcoke: 2,857 Diesel: 3,378 Nat. Gas: 2,193 IFO 180: 3,401	Units in (tCO_2/000ton) except Nat. Gas (tCO_2/MMm^3) Coal: 2,814 Petcoke: 2,857 Diesel: 3,378 Nat. Gas: 2,193 IFO 180: 3,401 Butane: 3,195 Propane: 3,195	This factor was calculated using IPCC default values (Carbon content and fraction of carbon oxidized) and local national data (Net calorific values of the corresponding fossil fuels).
17. $GEN_{j/k/n,y}$	Electricity generation of each power source / plant j/k or n.	See the Annex at the end of this Monitoring Report.	See the Annex at the end of this Monitoring Report.	This information was directly obtained from the CDEC-SIC Dispatch Center.
18.	Identification of power source / plant for the OM	See the Annex at the end of this Monitoring Report.	See the Annex at the end of this Monitoring Report.	This information was directly obtained from the CDEC-SIC Dispatch Center.

	calculation.			
19.	Identification of power source / plant for the BM calculation.	See the Annex at the end of this Monitoring Report.	See the Annex at the end of this Monitoring Report.	This information was directly obtained from the CDEC-SIC Dispatch Center.
20. λ_y	Fraction of time during which low-cost / must-run sources are on the margin.	0	0.00022831050	This factor was calculated from information directly obtained from the CDEC-SIC Dispatch Center.
21.a $GEN_{j/k/ll,y}$ IMPORTS	Electricity imports to the project electricity system.	Does not apply, since there is no interconnection with other transmission systems.	Does not apply, since there is no interconnection with other transmission systems.	This information was directly obtained from the CDEC-SIC Dispatch Center.
21.b $COEF_{i,j,y}$ IMPORTS	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur).	Does not apply, since there is no interconnection with other transmission systems.	Does not apply, since there is no interconnection with other transmission systems.	This information was directly obtained from the CDEC-SIC Dispatch Center.
22. $BF_{i,y}$	Amount of biomass type i for which leakage could not ruled out using one of the approaches in the baseline methodology.	0 (BDt)	0 (BDt)	The project did not cause any leakage effect during the monitored period.
23.	Amount of biomass of type i fired in all grid-connected power plants in the region / country.	See table on the leakage section of this Monitoring Report.	See table on the leakage section of this Monitoring Report.	Leakage effects were duly considered following the L2 criteria of the ACM0006 (Version 01).
24.	Amount of biomass of type i that is available in	See table on the leakage section of this Monitoring Report.	See table on the leakage section of this Monitoring Report.	Leakage effects were duly considered following the L2 criteria of the ACM0006 (Version 01).

	surplus in the region / country.			
25. $COEF_{CO2,j}$	CO_2 emission factor of the most carbon intensive fuel in the calculation of the combined margin with methodology ACM0002.	Units in (tCO_2/000ton) IFO 180: 3,401	Units in (tCO_2/000ton) IFO 180: 3,401	This variable was not used, however, since the project activity did not cause any leakage effects in the monitored period.

<u>Other monitored data:</u>

ID number.	**Data variable.**	**Additional comments**
26.	Biomass moisture	Biomass moisture is constantly measured at the Trupan Complex, using proper calibrated meters.
27.	Biomass origin	All biomass fuels used in the Trupan power plant fully comply with the Chilean law. This ensures the renewable origin of the biomass. For more details, please see Annex Nº 4 or the registered PDD.

To perform the emission reduction calculation, the Project Proponent monitored the following additional data:

<u>Additional data:</u>

BDt / m^3st	This factor was monitored each month to determine the amount of bone-dry ton (BDt) of biomass from humid volumetric quantities of biomass (cubic meters). To do so, the volume, the biomass humidity and the weight of the biomass were used and monitored at the plant.
CH_4 emission factor for uncontrolled burning of biomass	According to the baseline methodology ACM0006 (Version 01), page 33, the Project Proponent may undertake measurements or use referenced default values to calculate the CH_4 baseline emissions from uncontrolled burning of biomass. Given that by the time the PDD was written there were no local measurements available, the validator indicated the Project Proponent to use the IPCC default factor corrected by the lowest conservativeness factor (Table Nº4, page 34 of the ACM0006 Version 01). This generated extremely conservative CH_4 baseline emissions for the project activity, since when the biomass residues are burned in piles in the open air, the combustion occurs under very low oxygen presence conditions and therefore is very inefficient. Inefficient combustion leads to high CH_4 emissions. As a result, the Project Proponent explicitly mentioned in page 67 of the registered PDD and in page A39 of the validation report that a local CH_4 measurement would be attempted in the future in order to have a more accurate and fair estimation of the baseline emissions from this source. During September 2006, the Project Proponent hired the U.S. Forest Service of Missoula, USA to conduct a local measurement of the CH_4 emission factor for uncontrolled burning of biomass in the nearby area of the Power Plant. The result of this measurement indicated a CH_4 emission factor for uncontrolled burning of the same type of biomass used in the Trupan Power Plant of 740.5 (Kg CH_4/TJ), with an associated standard deviation of 162.2 (Kg CH_4/TJ). According to Table 4 of the ACM0006 (Version 01) baseline methodology, this led to a conservativeness factor of 0.94[5], resulting in an adjusted CH_4 baseline emission factor for uncontrolled burning of biomass of 696.1 (Kg CH_4/TJ). The conservativeness and appropriateness of this measured factor has been subsequently ratified by other (new) measurements carried out by the Project Proponent for other CDM project activities in the region. The emission factor used in this case is lower than the same emission factor measured under very conservative conditions.
CH_4 emission factor for controlled burning of biomass in the power boiler	The Project Proponent requested the U.S. Forest Service of Montana to carry out a CH_4 emission factor measurement for controlled burning of biomass in two fluidized bed boilers, similar to the one used in the Trupan biomass power plant (in fact, one of the boilers was the Trupan boiler). The results of the measurements indicated that the CH_4 concentration in the flue gases (in ppm) was actually lower than the concentration of CH_4 found in the clean air. In other words, the combustion of the biomass residues in a fluidized bed boiler was so efficient, that actually withdrew CH_4 from the clean air[6]. Considering this result and that the Project Proponent is using a positive (15.3 (Kg CH_4/TJ)) IPCC default factor for controlled burning of biomass to calculate this project emission source, this calculation is extremely conservative.
ε_{boiler}	This is the energy efficiency of the boiler that would be used in the absence of the project activity. This parameter is used in equation 24 of the ACM0006 (Version 01). The efficiency of the boiler that would have been installed in the absence of the project activity is 85%. This efficiency value was determined based on the efficiency calculation of a real low-pressure boiler installed in one of the Arauco industrial facilities. The efficiency was calculated in accordance with the ASME PTC 4.1 standard and was further validated by an expert opinion from a highly reputed consulting company, in the field of heat and power generation.

[5] A 95% confidence interval was calculated to determine the corresponding uncertainty range for the sample mean.

[6] According to the final measurement report, the flue gases of the power boiler presented lower concentration of CH_4 (0.55 ppm) than clean air levels (1.7 ppm to 2 ppm). Therefore, the combustion process in power generation resulted in a net loss of CH_4 from the air used.

<table>
<tr><td>Density of fossil fuels used on-site</td><td>Density values for each year were obtained from reputed laboratories.
<table>
<tr><th></th><th>2008</th><th>2009</th></tr>
<tr><td>Diesel</td><td>0.84 (kg/lt)</td><td>0.84 (kg/lt)</td></tr>
<tr><td>LPG (liquid phase)</td><td>508 (kg/m^3)</td><td>508 (kg/m^3)</td></tr>
</table></td></tr>
</table>

<u>Leakage</u>

Though there are no official studies in the country about the supply / demand situation of forest biomass in the relevant area, the Project Proponent performed annual studies for 2008 and 2009 using official bulletins from INFOR[7] as well as other (whenever available) official sources to calculate the biomass supply and demand in the Trupan Power Plant influence area[8]. This study was part of the monitoring plan of the Trupan project activity and was carried out according approach L2 of the baseline methodology.

A detailed Excel spreadsheet with the monitored data and the calculation of the forest biomass supply / demand situation each year was provided to the DOE to establish the quality and validity of the data sources and the accuracy of the calculated numbers. The following table provides the final results of such study:

SUPPLY / DEMAND SITUATION

(According to the "L2" criteria to establish leakage in the ACM0006 baseline methodology)

TRUPAN INFLUENCE AREA SUPPLY / DEMAND SITUATION

Biomass supply		2008	2009
Total supply	(m^3st/yr)	9,657,828	11,318,264
Biomass demand			
Total demand	(m^3st/yr)	5,983,276	7,343,719
Total supply / total demand	**(number)**	**1.6141**	**1.5412**

According to the table above, it is clear that the quantity of available biomass in the influence area of the project activity is greater than the 25% threshold established in option L2 of the consolidated baseline methodology. This is consistent with the fact that in the last years the existing biomass power plant in the Trupan influence area continue to function without restriction and that new biomass based projects are currently being considered in the area[9].

From the above analysis, it is possible to conclude that the Trupan biomass Power Plant has not caused a biomass supply shortage in its influence area and therefore has not caused other biomass consumers to switch from biomass fuels to fossil fuel sources. For these reasons, the associated leakage to the Trupan project activity is considered to be zero.

$$L_y = 0$$

[7] INFOR stands for "Instituto Nacional Forestal" or "National Forestry Institute" in English.

[8] The Trupan influence area is clearly defined in page 65 of the registered PDD.

[9] Including some prospective CDM biomass projects.

Biomass sources

The Trupan Power Plant sources a significant portion of its biomass fuels from nearby sawmills. As established in the registered PDD, the monitoring plan includes the monitoring of variable Nº 27, which establishes that the biomass that is being used in the Trupan Power Plant comes from sustainable sources.

Each time a biomass supplier delivers biomass fuels to the Trupan Power Plant, the supplier must sign a reception bill in which the supplier declares to know and comply with the outstanding Chilean forest law. This law mandates that all harvested forest plantations must be replanted; therefore it guarantees the sustainable source of the biomass fuels (as well as the source of any other products from the forest industry). The law also establishes that the purchase of products that come from illegally managed forestlands is also considered illegal in Chile.

The Chilean forest law is stringent and effectively monitored by the corresponding authority. Failing to comply with the law may imply hefty penalties for the transgressors in some cases. For these reasons all the Arauco industrial facilities tend to be very selective in choosing their suppliers and have tight quality controls in the reception of the raw-materials.

Annex 4 of the registered PDD provides more official information and evidence that further confirms the sustainable origin of the biomass type generated in the region (and country) used in this project activity.

Quality assurance

Quality control and quality assurance mechanisms for the monitored data were implemented as mentioned in the registered PDD. The following table provides the corresponding information for the monitored period.

Data	Uncertainty level	QA/QC procedures implemented during the monitored period.
1	Low	All instruments involved in the measurement of biomass flows received maintenance and calibration according to the manufacturer's manual and / or proper industry standards. Since the Trupan plant (as well as most of Arauco subsidiaries) uses the SAP systems, there are periodic and continuous consistency checks between the information that is loaded in SAP and the receipts from all suppliers including biomass. This is necessary not only to ensure the accuracy of the information used to calculate the Trupan net emission reductions, but also to ensure the good quality of the information used for accounting and tax-reporting purposes. This further ensures the good quality of the information used to calculate the emission reductions of the Trupan project. In addition to the above, the Project Proponent carried out energy balances on a periodic basis as a consistency crosschecking measure. All biomass values were consistent with the efficiency of the power plant.
2	Low	During the monitored period, the NCV of the biomass per type combusted in the Power Boiler was measured each year, presenting minimum differences from one year to another. Comparisons with corresponding IPCC default values also validated and confirmed the measured values.
3, 6, 8, 16, 21.b, 25	Low (CO_2) / Medium (CH_4)	Local values were used whenever possible. In cases in which they were not available, IPCC factors were used instead.
4	Low	Since the location of each biomass supplier is known (i.e. 99% of the biomass comes from permanent type sawmills in the nearby area), distances were obtained from the transportation subcontractors and verified in regional roadmaps.
5	Low	Trucks that transport the biomass are all of known (recorded) sizes. This variable was obtained from measured data (weight and volume of the cargo). Electronic weighbridges in which the measurements were performed receive periodic calibration and maintenance.
7, 9	Low	Fuel meters received periodic maintenance and calibration and the consistency of metered fuel consumption was checked with purchase dispatch bills.
10	Low	Electricity meters received periodic maintenance and calibration as per instructed by the equipment manufacturer. In addition, the Trupan administration performed periodic (monthly) consistency checks in the Trupan substation electric bus where the Trupan Power Plant connects to the SIC grid. Finally, the plant manager also performed consistency checks between the total energy generated by the cogeneration plant (heat and power) and the amount of fuels combusted in the power plant during the monitored period. All values proved to be consistent and in line with the energy efficiency of the power plant.

11	Low	Heat quantities are directly measured by dedicated steam flow meters and pressure / temperature meters. The associated uncertainty is very low, since these parameters are key to the production processes of the Trupan plant and therefore, receive periodic maintenance according to proper industry standards.
12, 13, 14, 15, 17, 18, 19, 20, 21a	Low	As mentioned in the PDD, the quality control of this data is beyond the control of the project operator. However, the Project Proponent calculated this emission coefficient from official and publicly available data from the CDEC-SIC Dispatch Center.
22, 23, 24	Medium	The biomass surplus index was calculated using as much official information as possible. Practical consistency checks were performed whenever it was feasible (i.e. low cost biomass power plants in the influence area continue being low cost-must run power units after the Trupan Power Plant started operating).
26	Low	The measured data is constantly compared with historic data in order to avoid or minimize errors.
27	Low	In most cases, the Trupan biomass suppliers have some kind of sustainability certification (i.e. Certfor) or have signed supply contracts explicitly declaring to comply with the outstanding forest Chilean law which guarantees a sustainable origin of the biomass sold to the Trupan plant. Further quality assurance of this variable can be found in Annex Nº 4 of the registered PDD.

In addition to the above, the project proponent developed a dedicated information system designed exclusively to guarantee the quality of the information related to the Trupan CDM project activity. During 2006/2007, this system was successfully incorporated to the Trupan’s ISO-14,001 / OHSAS 18,001 systems.

3. Emission reductions

3.1 Calculation formulas

As presented in the PDD and according to the baseline methodology, the net emission reduction calculation formula for the Trupan project is:

Project Activity Net Emission savings = Baseline Emissions – Project Activity Emissions – Leakage

or

$$PNE_y = BL_{E,y} - EM_{P,y} - L_y$$

or

$$PNE_y = (BL_{E1,y} + BL_{E2,y}) - (P_{E1,y} + P_{E2,y} + P_{E3,y} + P_{E4,y}) - L_y$$

Where:

$BL_{E1,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).
$BL_{E2,y}$: Baseline emissions from avoided biomass disposal (tCO_2eq/yr).

$P_{E1,y}$: Project emissions from biomass controlled burning in the Power Plant (tCO_2eq/yr).
$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO_2/yr).
$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Power Plant (tCO_2/yr).

L_y : Are the leakage emissions (tCO_2/yr).

3.2 Emission reduction calculation

Please note the following:

1. The baseline and project emissions calculations below may present some minor imprecision due to some decimal rounding.

2. Since the emission reduction calculation for the project activity was done monthly, the calculation below (carried out for the entire monitored period) had to consider weighted averages for some variables.

Baseline emissions

1. Baseline emissions due to electricity displacement

In this case, the electricity displaced from the grid corresponds to the net quantity of electricity generation in the project plant ($EG_y = EG_{projectplant}$). The baseline emissions due to electricity displacement are calculated using equation N° 8 of the ACM0006 (Version 01).

According to the above, the net electricity displaced by the project activity is calculated as follows:

Data:

	Units	**2008**	**2009**
(1) Combined margin for the SIC grid	(tCO_2/GWh)	664.98	636.74
(2) Net quantity of electricity displaced by the p.a.	(GWh)	50.6	181.3

Calculations:

(3) Total grid emission savings	**(1)*(2)**	**33,633 (tCO_2)**	**115,423 (tCO_2)**

2. Baseline emissions due to burning of anthropogenic sources of biomass residues

To calculate this emission source, it is necessary first to calculate the quantity of biomass residues used as a result of the project activity. In this case, this is done using equation N° 24 of the ACM0006 (Version 01).

Data:

	Units	2008	2009
(1) Total biomass residues combusted.	(BDt)	69,065	272,052
(2) Net calorific value of biomass (dry basis).	(GJ/ton)	18.59	17.93
(3) Quantity of heat generated in the cogen. plant.	(GJ)	483,480	1,885,419
(4) Energy efficiency of the baseline boiler.	(%)	85%	85%
(5) EF_{CH4} for uncontrolled biomass burning	(Kg CH_4/TJ)	696.1	696.1
(6) CH_4 global warming potential	(number)	21	21

Calculations:

(7) Biomass combusted in the baseline	(3)/[(2)*(4)]	30,591 (BDt)	123,693 (BDt)
(8) Incremental biomass use	(1)-(7)	38,474 (BDt)	148,359 (BDt)
(9) CH_4 avoidance baseline emissions	**[(8)*(2)/1,000,000]*(5)*(6)**	**10,457 (tCO_2)**	**38,889 (tCO_2)**

Total baseline emissions

Baseline emission sources	2008	2009
Baseline emissions due to electricity displacement	33,633 (tCO_2)	115,423 (tCO_2)
Baseline emissions due to methane avoidance	10,457 (tCO_2eq)	38,889 (tCO_2eq)
Total baseline emissions	**44,089 (tCO_2eq)**	**154,312 (tCO_2eq)**

Project emissions

1. Carbon dioxide emissions from biomass residues transportation to the power plant

This emission source is calculated using equation N° 4 of the ACM0006 (Version 01l).

Data:

	Units	2008	2009
(1) Biomass brought from 3rd parties related to the p. plant (dry)	(BDt)	38,474	148,359
(2) Biomass average humidity (wet basis) (See note)	(%)	49.27%	49.97%
(3) Approximate load for 1 trip	(ton)	19.2	19.94
(4) Average round trip	(km)	159	159
(5) Emission factor for heavy truck transportation (See note)	(tCO_2/km)	1.397	1.235

Note: Since this parameter is reported monthly, an average was used for simplicity.

Calculations:

(6) Biomass transported (wet)	(1)/[1 – (2)]	75,848 (wet ton)	296,598 (wet ton)
(7) Number of trips needed	(6) / (3)	3,951 (trips)	14,871 (trips)
(8) Total distance traveled	(4)*(7)	627,315 (km)	2,360,831 (km)
(9) Total emissions	**(5)*(8)*(1ton/1,000kg)**	**877 (tCO_2)**	**2,916 (tCO_2)**

2. Carbon dioxide emissions from on-site consumption of fossil fuels

This emission source is calculated using equation N° 6 of the ACM0006 (Version 01). The project activity implies additional fossil fuel consumption due to:

- Fossil fuel consumption is due to operational reasons due to additional biomass consumption (e.g. biomass too wet in winter, etc.).

- Fossil fuel consumption due to on-site additional biomass transportation.

Data:

	Units	2008	2009
(1) Additional diesel consumption in the Power Boiler	(lt.)	32,583	77,601
(2) Additional LPG consumption in the Power Boiler	(lt.)	303	919
(3) Additional diesel consumption for on-site biomass transp.	(lt.)	37,454	145,952
(4) Diesel density	(kg/lt)	0.84	0.84
(5) LPG density	(kg/m^3)	508	508
(6) Diesel CO_2 emission factor	(tCO_2/ton)	3.177	3.176
(7) LPG CO_2 emission factor	(tCO_2/ton)	2.923	2.920

Calculations:

(8) Diesel in Power Boiler	[(1)*(4)/1,000]*(6)	86.97 (tCO_2)	207.06 (tCO_2)
(9) LPG in Power Boiler	{[(2)*(5)/1,000]/1,000}*(7)	0.45 (tCO_2)	1.36 (tCO_2)
(10) Diesel in on-site biomass transport.	[(3)*(4)/1,000]*(6)	100 (tCO_2)	389 (tCO_2)
(11) Total emissions	**(8)+(9)+(10)**	**187 (tCO_2)**	**598 (tCO_2)**

4. Methane emissions from combustion of biomass residues

This emission source is calculated using equation N° 7 of the ACM0006 (Version 01). Since the project activity implies additional biomass from forest operations consumption in the power

boiler, the only source of methane emissions attributed to the project activity is the one related to this additional consumption under controlled burning conditions.

Data:

	Units	2008	2009
(1) Biomass related to project activity	(BDt)	38,474	148,359
(2) Net calorific value of biomass (dry basis).	(GJ/ton)	18.59	17.93
(3) EF_{CH4} for controlled biomass burning	(Kg CH_4/TJ)	15.3	15.3
(4) CH_4 global warming potential	(number)	21	21

Calculations:

(5) CH_4 emissions	**[(1)*(2)*(3)/1,000,000]*(4)**	**230 (tCO_2)**	**855 (tCO_2)**

Total project emissions

Project emission sources	2008	2009
Project emissions from biomass transportation to the power plant	877 (tCO_2)	2,916 (tCO_2)
Project emissions from on-site consumption of fossil fuels	187 (tCO_2)	598 (tCO_2)
Project emissions from biomass controlled burning	230 (tCO_2eq)	855 (tCO_2eq)
Total project emissions	**1,294 (tCO_2eq)**	**4,369 (tCO_2eq)**

Net emission reductions for the monitored period

	2008	2009
Baseline emissions	44,089 (tCO_2eq)	154,312 (tCO_2eq)
Project emissions	-1,294 (tCO_2eq)	-4,369 (CO_2eq)
Leakage	0 (tCO_2)	0 (tCO_2)
Net emission reductions	**42,796 (tCO_2eq)**	**149,943 (tCO_2eq)**

Summary of the monthly emission reductions for the monitored period

For the calculation of the net emission reductions of the Trupan biomass power plant project activity, an Excel spreadsheet with the monitored data and the monthly calculation of the net emission reductions was provided to the DOE for the verification of the calculated numbers. For informative purposes, this monitoring report provides a table that shows the monthly net emission reduction of the project activity:

Net emission savings per month

		Baseline emissions		Project activity emissions				
	Net emission savings	Grid emissions	Methane emissions	Methane in P.B.	Fossil fuel in P.B.	Transport onsite	Transport to P. Plant	Leakage
(Months)	(tCO_2eq/yr)	(tCO_2/yr)	(tCO_2eq/yr)	(tCO_2eq/yr)	(tCO_2/yr)	(tCO_2/yr)	(tCO_2/yr)	(tCO_2/yr)
Year 2008								
October	**14,200**	11,518	3,058	67	16	32	262	0
November	**14,445**	10,869	4,024	88	25	35	298	0
December	**14,150**	11,245	3,375	74	46	33	316	0
Total year 2008	**42,796**	**33,633**	**10,457**	**230**	**87**	**100**	**877**	**0**
Year 2009								
January	**10,157**	8,200	2,283	50	64	34	178	0
February	**13,353**	10,338	3,393	75	8	35	261	0
March	**13,441**	10,289	3,542	78	42	32	239	0
April	**13,719**	10,759	3,370	74	11	36	289	0
May	**14,118**	10,931	3,614	79	4	29	315	0
June	**14,234**	10,927	3,693	81	9	34	262	0
July	**14,782**	10,974	4,248	93	3	34	310	0
August	**13,606**	10,635	3,425	75	29	47	302	0
September	**13,188**	9,861	3,696	81	10	32	246	0
October	**14,286**	10,961	3,693	81	1	31	255	0
November	**8,631**	6,287	2,580	57	4	26	148	0
December	**6,427**	5,259	1,352	30	23	21	110	0
Total year 2009	**149,943**	**115,423**	**38,889**	**855**	**208**	**389**	**2,916**	**0**
4th verif (Oct 08-Dec 09)	192,738.6	149,055.2	49,346.2	1,084.7	295.8	489.4	3,792.9	0.0
Total emissions claimed	192,738	149,055	49,346	1,085	296	489	3,793	0

Note: Net emission savings = Baseline emissions - Project activity emissions - Leakage.

According to the project PDD, the estimated emission reductions for the period covered by this monitoring report should have been 129,918 CERs. The monitored emissions are 48% higher than the estimated emissions in the PDD. This difference can be explained by the following reasons:

- A higher grid emission factor for the year 2008 than the one originally estimated in the PDD. The actual grid emission factor for 2008 was 665.0 (tCO_2/GWh), while the estimated grid emission factor for 2008 was in the PDD was 528.2 (tCO_2/GWh). The actual grid emission factor for 2009 was virtually the same as the one estimated in the PDD. The reason for the higher grid emission factor in 2008 was the replacement of natural gas[10] used for power generation for more carbon-intensive fossil-fuels, such as coal and diesel. This increased the overall GHG emissions in the SIC grid.

[10] Argentina stopped sending natural gas in 2004.

- A higher amount of CH_4 emission in the baseline compared to the baseline emission estimated in the PDD. The actual monitored CH_4 emissions was 49,346 (tCO_2eq), while the estimated amount of CH_4 emissions estimated in the PDD was 12,854 (tCO_2eq). There are two reasons that explain this:

    1. A higher CH_4 emission factor for uncontrolled burning of biomass residues than the one originally used in the PDD: 696.1 (Kg CH_4/TJ) instead of 219 (Kg CH_4/TJ). The higher CH_4 emission factor was directly measured by the Project Proponent, since the default emission factor originally used in the PDD severely underestimated the CH_4 emissions when burning the biomass residues in the open air. It must be noted though, that the measured methane emission factor used in this case was ratified with subsequent on-site measurements carried out by the Project Proponent under very conservative conditions; therefore the calculation of the baseline emissions using this factor remains conservative.

    2. A higher amount of biomass related to the project activity (e.g. for power generation) than the amount originally calculated in the PDD: 186,833 (BDt) versus 145,456 (BDt). This can be explained due to a change in the biomass calculation methodology. In the registered PDD, the Project Proponent used a fixed biomass performance index (from an energy/mass balance) to calculate the biomass related to the project activity instead of using equation N° 24 of the ACM0006 (Version 01). This was subsequently corrected, and a new Monitoring Plan was approved in order to use equation N° 24 in the future, instead of the biomass performance index.

The combined effect of the reasons mentioned above resulted in higher emission reductions than the emission reductions originally estimated in the PDD.

ANNEX

POWER GENERATION IN 2008

POWER PLANT	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	LOW COST / MUST RUN	TOTAL GEN 2008	UNITS SPEC. CONSUMP.	SPECIFIC CONSUMPTION
Abanico	136	Run of the river	Hydro	Yes	342	N.C.	0.000
Aconcagua	73	Run of the river	Hydro	Yes	439	N.C.	0.000
Alfalfal	178	Run of the river	Hydro	Yes	907	N.C.	0.000
Ancud	3	Diesel engines	Diesel	No	6	(Kg/KWh)	0.242
Antilhue new (I and II)	50	Open cycle	Diesel	No		(Kg/KWh)	0.240
Antilhue TG	101	Open cycle	Diesel	No	241	(Kg/KWh)	0.240
Antuco	320	Reservoir	Hydro	Yes	1,440	N.C.	0.000
Arauco	15	Biomass / Steam	Biomass	Yes	12	N.C.	0.000
Bocamina	125	Coal / Steam	Coal	No	958	(Kg/KWh)	0.388
Campanario	118	Open cycle	Natural Gas	No	19	(m^3-std/KWh)	0.392
Campanario Diesel	118	Open cycle	Diesel	No	221	(Kg/KWh)	0.250
Candelaria (Open cycle) 1	125	Open cycle	Natural Gas	No	23	(m^3-std/KWh)	0.296
Candelaria (Open cycle) 1 Diesel	125	Open cycle	Diesel	No	264	(Kg/KWh)	0.289
Candelaria (Open cycle) 2	129	Open cycle	Natural Gas	No	12	(m^3-std/KWh)	0.296
Candelaria (Open cycle) 2 Diesel	129	Open cycle	Diesel	No	278	(Kg/KWh)	0.289
Canutillar	172	Reservoir	Hydro	Yes	798	N.C.	0.000
Cañete	2	Diesel engines	Diesel	No	5	(Kg/KWh)	0.242
Capullo	12	Run of the river	Hydro	Yes	69	N.C.	0.000
Casablanca	2	Diesel engines	Diesel	No	0	(Kg/KWh)	0.231
Casablanca 1	1	Diesel engines	Diesel	No	4	(Kg/KWh)	0.231
Casablanca 2	0	Diesel engines	Diesel	No	0	(Kg/KWh)	0.278
Celco	13	Biomass / Steam	Biomass	Yes	43	N.C.	0.000
Chacabuquito	25	Run of the river	Hydro	Yes	177	N.C.	0.000
Chiburgo	20	Run of the river	Hydro	Yes	99	N.C.	0.000
Cholguán	13	Biomass / Steam	Biomass	Yes	90	N.C.	0.000
Cipreses	106	Reservoir	Hydro	Yes	480	N.C.	0.000
Colbún+Mach	569	Reservoir	Hydro	Yes	3,234	N.C.	0.000
Collipulli	3	Diesel engines	Diesel	No	8	(Kg/KWh)	0.242
Concon	3	Diesel engines	Diesel	No	7	(Kg/KWh)	0.226
Constitución	10	Biomass / Steam	Biomass	Yes	58	N.C.	0.000
Constitución 1	9	Diesel engines	Diesel	No	11	(Kg/KWh)	0.298
Constitución 2	6	Diesel engines	Diesel	No		(Kg/KWh)	0.298
Coronel	46	Open cycle	Natural Gas	No	1	(m^3-std/KWh)	0.238
Coronel Diesel	46	Open cycle	Diesel	No	74	(Kg/KWh)	0.224
Curacautin	3	Diesel engines	Diesel	No	6	(Kg/KWh)	0.220
Curanilahue	2	Diesel engines	Diesel	No	0	(Kg/KWh)	0.000
Curauma	3	Diesel engines	Diesel	No	6	(Kg/KWh)	0.230
Curillinque	89	Run of the river	Hydro	Yes	605	N.C.	0.000
D. de Almagro	24	Open cycle	Diesel	No	58	(Kg/KWh)	0.353
Degan	36	Diesel engines	Diesel	No	68	(Kg/KWh)	0.219
El Rincón	0	Run of the river	Hydro	Yes	3	N.C.	0.000
El Toro	450	Reservoir	Hydro	Yes	1,206	N.C.	0.000
Esperanza 1	2	Diesel engines	Diesel	No	5	(Kg/KWh)	0.218
Esperanza 2	2	Diesel engines	Diesel	No	4	(Kg/KWh)	0.226
Esperanza TG	18	Open cycle	Diesel	No	4	(Kg/KWh)	0.341
Eyzaguirre	2	Run of the river	Hydro	Yes	9	N.C.	0.000
Florida	28	Run of the river	Hydro	Yes	155	N.C.	0.000
FPC	12	Biomass / Steam	Biomass	Yes	77	N.C.	0.000
Generadores Saesa	N.A.	Diesel engines	Diesel	No		(Kg/KWh)	0.000
Guacolda I	152	Coal / Steam	Coal / Petcoke	No	1,245	(Kg/KWh)	0.373
Guacolda II	152	Coal / Steam	Coal / Petcoke	No	1,285	(Kg/KWh)	0.369
Horcones Diesel	24	Open cycle	Diesel	No	7	(Kg/KWh)	0.343
Horcones TG	24	Open cycle	Natural Gas	No	0	(m^3-std/KWh)	0.377
Huasco TG Diesel	64	Open cycle	Diesel	No	0	(Kg/KWh)	0.348
Huasco TG IFO	64	Open cycle	IFO 180	No	160	(Kg/KWh)	0.372
Huasco TV	16	Coal / Steam	Coal	No	0	(Kg/KWh)	0.974
Isla	68	Run of the river	Hydro	Yes	494	N.C.	0.000
L. Verde TG	19	Open cycle	Diesel	No	39	(Kg/KWh)	0.260
L. Verde TV	55	Coal / Steam	Coal	No	247	(Kg/KWh)	0.718
Laja	10	Biomass / Steam	Biomass	Yes	54	N.C.	0.000
Las Vegas	2	Diesel engines	Diesel	No	6	(Kg/KWh)	0.231
Lebu	2	Diesel engines	Diesel	No	4	(Kg/KWh)	0.242
Licantén	6	Biomass / Steam	Biomass	Yes	13	N.C.	0.000
Loma Alta	40	Run of the river	Hydro	Yes	256	N.C.	0.000
Los Molles	18	Run of the river	Hydro	Yes	68	N.C.	0.000
Los Morros	3	Run of the river	Hydro	Yes	18	N.C.	0.000
Los Quilos	39	Run of the river	Hydro	Yes	282	N.C.	0.000
Los Sauces	3	Diesel engines	Diesel	No	5	(Kg/KWh)	0.242
LosVientos_TG	125	Open cycle	Diesel	No	381	(Kg/KWh)	0.255
Maitenes	29	Run of the river	Hydro	Yes	137	N.C.	0.000
Mampil	49	Run of the river	Hydro	Yes	163	N.C.	0.000
Maule	6	Diesel engines	Diesel	No	5	(Kg/KWh)	0.298
Monte Patria	9	Diesel engines	Diesel	No	17	(Kg/KWh)	0.282
Nehuenco	368	Combined cycle	Natural Gas	No	0	(m^3-std/KWh)	0.198
Nehuenco (Open cycle)	250	Open cycle	Diesel	No		(Kg/KWh)	0.000
Nehuenco 9B	108	Open cycle	Natural Gas	No	98	(m^3-std/KWh)	0.336
Nehuenco 9B Diesel	108	Open cycle	Diesel	No	137	(Kg/KWh)	0.292
Nehuenco Diesel	368	Combined cycle	Diesel	No	312	(Kg/KWh)	0.160
Nehuenco II	390	Combined cycle	Natural Gas	No	190	(m^3-std/KWh)	0.196
Nehuenco II (Open cycle)	250	Open cycle	Natural Gas	No		(m^3-std/KWh)	0.000
Nehuenco II Diesel	376	Combined cycle	Diesel	No	2,203	(Kg/KWh)	0.166
Nueva Aldea 1	13	Biomass / Steam	Biomass	Yes	107	N.C.	0.000
Nueva Aldea 2	10	Open cycle	Diesel	No	0	(Kg/KWh)	0.290
Nueva Aldea 3	20	Biomass / Steam	Biomass	Yes	210	N.C.	0.000
Nueva Renca	379	Combined cycle	Natural Gas	No	1	(m^3-std/KWh)	0.219
Nueva Renca Diesel	379	Combined cycle	Diesel	No	1,502	(Kg/KWh)	0.176
Others	4	N.A.	Hydro	Yes		N.C.	0.000
Pangue	467	Reservoir	Hydro	Yes	1,789	N.C.	0.000
Pehuenche	566	Reservoir	Hydro	Yes	2,754	N.C.	0.000
Petropower	75	Petcoke / Steam	Petcoke	Yes	494	(Kg/KWh)	0.373
Peuchén	77	Run of the river	Hydro	Yes	243	N.C.	0.000
Pilmaiquén	39	Run of the river	Hydro	Yes	244	N.C.	0.000
Pullinque	48	Run of the river	Hydro	Yes	220	N.C.	0.000
Punitaqui	9	Diesel engines	Diesel	No	18	(Kg/KWh)	0.282
Puntilla	14	Run of the river	Hydro	Yes	149	N.C.	0.000
Quellón	5	Diesel engines	Diesel	No	10	(Kg/KWh)	0.242
Quilleco	70	Run of the river	Hydro	Yes	363	N.C.	0.000
Ralco	690	Reservoir	Hydro	Yes	2,573	N.C.	0.000
Rapel	378	Reservoir	Hydro	Yes	1,034	N.C.	0.000
Renca	97	Diesel / Steam	Diesel	No	12	(Kg/KWh)	0.295
Rucúe	178	Run of the river	Hydro	Yes	888	N.C.	0.000
S. Fco. Mostazal	26	Open cycle	Diesel	No	33	(Kg/KWh)	0.310
San Ignacio	37	Run of the river	Hydro	Yes	213	N.C.	0.000
San Isidro	379	Combined cycle	Natural Gas	No	795	(m^3-std/KWh)	0.278
San Isidro 2 Diesel	248	Combined cycle	Diesel	No	1,647	(Kg/KWh)	0.237
San Isidro 2	248	Combined cycle	Natural Gas	No	1	(m^3-std/KWh)	0.278
San Isidro Diesel	379	Combined cycle	Diesel	No	590	(Kg/KWh)	0.179
Sauce Andes	1	Run of the river	Hydro	Yes	8	N.C.	0.000
Sauzal 50 Hz	77	Run of the river	Hydro	Yes	490	N.C.	0.000
Sauzal 60 Hz	77	Run of the river	Hydro	Yes	0	N.C.	0.000
Sauzalito	12	Run of the river	Hydro	Yes	85	N.C.	0.000
Taltal (I and II)	245	Open cycle	Natural Gas	No	104	(m^3-std/KWh)	0.331
Taltal I Diesel	120	Open cycle	Diesel	No	333	(Kg/KWh)	0.279
Taltal II Diesel	120	Open cycle	Diesel	No	603	(Kg/KWh)	0.270
Traigen	2	Diesel engines	Diesel	No	3	(Kg/KWh)	0.242
Valdivia	61	Biomass / Steam	Biomass	Yes	219	N.C.	0.000
Ventanas 1	118	Coal / Steam	Coal	No	942	(Kg/KWh)	0.391
Ventanas 2	220	Coal / Steam	Coal	No	1,634	(Kg/KWh)	0.373
Victoria		Diesel engines	Diesel	No	0	(Kg/KWh)	0.000
Volcán	13	Run of the river	Hydro	Yes	101	N.C.	0.000
Queltehues	49	Run of the river	Hydro	Yes	359	N.C.	0.000
Canela	18	Wind	Wind	Yes	31	N.C.	0.000
Palmucho	32	Run of the river	Hydro	Yes	225	N.C.	0.000
Hornitos	55	Run of the river	Hydro	Yes	256	N.C.	0.000
Ojos de Agua	9	Run of the river	Hydro	Yes	19	N.C.	0.000
Olivos	2	Open cycle	Diesel	No	28	(Kg/KWh)	0.225
Placilla	3	Open cycle	Diesel	No	3	(Kg/KWh)	0.270
Puclaro		Run of the river	Hydro	Yes	33	N.C.	0.000
Quintay	3	Open cycle	Diesel	No	3	(Kg/KWh)	0.270
Totoral	3	Open cycle	Diesel	No	3	(Kg/KWh)	0.270
Chiloé		Diesel engines	Diesel	No	0	(Kg/KWh)	0.269
Quellón II	10	Diesel engines	Diesel	No	4	(Kg/KWh)	0.222
Coya	35	Run of the river	Hydro	Yes	43	N.C.	0.000
Colmito	55	Open cycle	Diesel	No	3	(Kg/KWh)	0.259
Los Pinos	97	Open cycle	Diesel	No	7	(Kg/KWh)	0.204
Chuyaca	3	Diesel engines	Diesel	No	0	(Kg/KWh)	0.209
Skretting		Diesel engines	Diesel	No	0	(Kg/KWh)	0.217
Lircay	19	Run of the river	Hydro	Yes	27	N.C.	0.000
Cenizas	17	Diesel engines	IFO 180	No	0	(Kg/KWh)	0.235
Santa Lidia	136	Open cycle	Diesel	No	1	(Kg/KWh)	0.256
TOTAL					**41,808**		

POWER GENERATION IN 2009

POWER PLANT	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	LOW COST / MUST RUN	TOTAL GEN 2009	UNITS SPEC. CONSUMP.	SPECIFIC CONSUMPTION
Los molles	18	Run of the river	Hydro	Yes	48.0	N.C.	0.000
Sauce Andes	1	Run of the river	Hydro	Yes	7.4	N.C.	0.000
Aconcagua	73	Run of the river	Hydro	Yes	409.7	N.C.	0.000
Los Quilos	39	Run of the river	Hydro	Yes	262.7	N.C.	0.000
Florida	28	Run of the river	Hydro	Yes	143.2	N.C.	0.000
Maitenes	29	Run of the river	Hydro	Yes	130.5	N.C.	0.000
Alfalfal	178	Run of the river	Hydro	Yes	893.8	N.C.	0.000
Queltehues	49	Run of the river	Hydro	Yes	343.0	N.C.	0.000
Puntilla	14	Run of the river	Hydro	Yes	149.0	N.C.	0.000
Volcan	63	Run of the river	Hydro	Yes	102.7	N.C.	0.000
Los Morros	4	Run of the river	Hydro	Yes	19.1	N.C.	0.000
Sauzal 50Hz	89	Run of the river	Hydro	Yes	472.4	N.C.	0.000
Sauzal 60Hz	N.A.	Run of the river	Hydro	Yes	0.0	N.C.	0.000
Sauzalito	12	Run of the river	Hydro	Yes	81.9	N.C.	0.000
Currillinque	89	Run of the river	Hydro	Yes	616.7	N.C.	0.000
San Ignacio	37	Run of the river	Hydro	Yes	201.9	N.C.	0.000
Loma Alta	40	Run of the river	Hydro	Yes	271.8	N.C.	0.000
Rucue	178	Run of the river	Hydro	Yes	1,016.9	N.C.	0.000
Pullinque	48	Run of the river	Hydro	Yes	229.0	N.C.	0.000
Pilmaiquén	39	Run of the river	Hydro	Yes	248.9	N.C.	0.000
Capullo	12	Run of the river	Hydro	Yes	64.9	N.C.	0.000
Peuchén	77	Run of the river	Hydro	Yes	269.1	N.C.	0.000
Mampil	49	Run of the river	Hydro	Yes	177.3	N.C.	0.000
Chacabuquito	25	Run of the river	Hydro	Yes	161.1	N.C.	0.000
Antuco	320	Reservoir	Hydro	Yes	1,610.9	N.C.	0.000
Abanico	136	Run of the river	Hydro	Yes	346.4	N.C.	0.000
Isla	68	Run of the river	Hydro	Yes	446.3	N.C.	0.000
Colbún+Mach.	569	Reservoir	Hydro	Yes	2,776.1	N.C.	0.000
Eyzaguirre	2	Run of the river	Hydro	Yes	8.3	N.C.	0.000
Quilleco	70	Run of the river	Hydro	Yes	414.4	N.C.	0.000
El Rincón	0	Run of the river	Hydro	Yes	2.1	N.C.	0.000
Chiburgo	20	Run of the river	Hydro	Yes	82.7	N.C.	0.000
Palmucho	32	Run of the river	Hydro	Yes	244.1	N.C.	0.000
Hornitos	55	Run of the river	Hydro	Yes	269.6	N.C.	0.000
Puclaro	5	Run of the river	Hydro	Yes	41.0	N.C.	0.000
Ojos de agua	9	Run of the river	Hydro	Yes	37.1	N.C.	0.000
Coya	35	Run of the river	Hydro	Yes	91.6	N.C.	0.000
Lircay	19	Run of the river	Hydro	Yes	122.0	N.C.	0.000
EL Manzano	5	Run of the river	Hydro	Yes	26.7	N.C.	0.000
Pehui	1	Run of the river	Hydro	Yes	3.6	N.C.	0.000
Truful Truful	N.A.	Run of the river	Hydro	Yes	0.0	N.C.	0.000
Taltal 2	245	Open cycle	Natural Gas	No	123.3	(m^3-std/KWh)	0.320
Taltal 2 Diesel	120	Open cycle	Diesel	No	83.9	(Kg/KWh)	0.275
Taltal 1	245	Open cycle	Natural Gas	No	116.6	(m^3-std/KWh)	0.320
Taltal 1 Diesel	120	Open cycle	Diesel	No	118.8	(Kg/KWh)	0.275
D. Almagro	24	Open cycle	Diesel	No	24.3	(Kg/KWh)	0.356
Guacolda 1	152	Coal / Steam	Coal / Petcoke	No	1,266.9	(Kg/KWh)	0.403
Guacolda 2	152	Coal / Steam	Coal / Petcoke	No	1,217.0	(Kg/KWh)	0.404
Guacolda 3	135	Coal / Steam	Coal	No	721.7	(Kg/KWh)	0.350
Huasco TV	16	Coal / Steam	Coal	No	0.0	(Kg/KWh)	0.937
Huasco TG	58	Open cycle	Diesel	No	0.6	(Kg/KWh)	0.362
Huasco TG IFO	58	Open cycle	IFO 180	No	22.8	(Kg/KWh)	0.362
L.Verde TG	17	Open cycle	Diesel	No	18.9	(Kg/KWh)	0.253
Los Vientos TG	121	Open cycle	Diesel	No	154.7	(Kg/KWh)	0.265
Nehuenco	368	Combined cycle	Natural Gas	No	111.6	(m^3-std/KWh)	0.204
Nehuenco Diesel	368	Combined cycle	Diesel	No	942.3	(Kg/KWh)	0.161
Nehuenco TG 9B	108	Open cycle	Natural Gas	No	25.0	(m^3-std/KWh)	0.338
Nehuenco TG 9B Diese	108	Open cycle	Diesel	No	17.2	(Kg/KWh)	0.288
Nehuenco II	390	Combined cycle	Natural Gas	No	12.8	(m^3-std/KWh)	0.198
Nehuenco II Diesel	376	Combined cycle	Diesel	No	1,525.8	(Kg/KWh)	0.166
San Isidro	379	Combined cycle	Natural Gas	No	398.6	(m^3-std/KWh)	0.290
San Isidro Diesel	379	Combined cycle	Diesel	No	585.5	(Kg/KWh)	0.169
San Isidro GNL	350	Combined cycle	Natural Gas	No	694.3	(m^3-std/KWh)	0.290
San Isidro II	370	Combined cycle	Natural Gas	No	116.0	(m^3-std/KWh)	0.203
San Isidro II Diesel	370	Combined cycle	Diesel	No	1,415.1	(Kg/KWh)	0.195
San Isidro II GNL	370	Combined cycle	Natural Gas	No	271.2	(m^3-std/KWh)	0.203
Ventanas 1	120	Coal / Steam	Coal	No	883.6	(Kg/KWh)	0.386
Ventanas 2	220	Coal / Steam	Coal	No	1,670.9	(Kg/KWh)	0.372
Nueva Ventanas	240	Coal / Steam	Coal	No	122.6	(Kg/KWh)	0.375
L.Verde	49	Coal / Steam	Coal	No	20.2	(Kg/KWh)	0.714
Nueva Renca	379	Combined cycle	Natural Gas	No	18.6	(m^3-std/KWh)	0.211
Nueva Renca Diesel	379	Combined cycle	Diesel	No	1,257.4	(Kg/KWh)	0.176
Renca	97	Diesel / Steam	Diesel	No	0.3	(Kg/KWh)	0.363
Constitución	9	Biomass / Steam	Biomass	Yes	56.2	N.C.	0.000
Constitución A.	20	Biomass / Steam	Biomass	Yes	49.3	N.C.	0.000
Petropower	75	Petcoke / Steam	Petcoke	Yes	483.0	(Kg/KWh)	0.373
Laja	9	Biomass / Steam	Biomass	Yes	46.3	N.C.	0.000
Bocamina	128	Coal / Steam	Coal	No	919.1	(Kg/KWh)	0.401
Arauco	33	Biomass / Steam	Biomass	Yes	11.0	N.C.	0.000
San Fco. Mostazal	26	Open cycle	Diesel	No	2.2	(Kg/KWh)	0.322
Cholguán	13	Biomass / Steam	Biomass	Yes	76.4	N.C.	0.000
Licantén	6	Biomass / Steam	Biomass	Yes	20.3	N.C.	0.000
Valdivia	61	Biomass / Steam	Biomass	Yes	258.7	N.C.	0.000
Antilhue TG	50	Open cycle	Diesel	No	112.7	(Kg/KWh)	0.589
Horcones TG	24	Open cycle	Natural Gas	No	0.0	(m^3-std/KWh)	0.379
Horcones Diesel	24	Open cycle	Diesel	No	1.5	(Kg/KWh)	0.340
TG_Coronel	46	Open cycle	Natural Gas	No	3.0	(m^3-std/KWh)	0.259
TG_Coronel Diesel	46	Open cycle	Diesel	No	23.5	(Kg/KWh)	0.225
Nueva Aldea	13	Biomass / Steam	Biomass	Yes	103.1	N.C.	0.000
Nueva Aldea 2	10	Open cycle	Diesel	No	0.0	(Kg/KWh)	0.290
Nueva Aldea 3	20	Biomass / Steam	Biomass	Yes	266.7	N.C.	0.000
Candelaria 1	125	Open cycle	Natural Gas	No	21.1	(m^3-std/KWh)	0.329
Candelaria 1 Diesel	125	Open cycle	Diesel	No	68.4	(Kg/KWh)	0.277
Candelaria 2	129	Open cycle	Natural Gas	No	7.3	(m^3-std/KWh)	0.329
Candelaria 2 Diesel	129	Open cycle	Diesel	No	28.9	(Kg/KWh)	0.277
Lebu	2	Diesel engines	Diesel	No	1.8	(Kg/KWh)	0.242
Cañete	3	Diesel engines	Diesel	No	2.8	(Kg/KWh)	0.242
Los Sauces	2	Diesel engines	Diesel	No	4.0	(Kg/KWh)	0.242
Traiguen	N.A.	Diesel engines	Diesel	No	4.0	(Kg/KWh)	0.242
Curacautin	3	Diesel engines	Diesel	No	2.8	(Kg/KWh)	0.220
Ancud	3	Diesel engines	Diesel	No	0.6	(Kg/KWh)	0.242
Collipulli	3	Diesel engines	Diesel	No	2.2	(Kg/KWh)	0.242
Quellon	9	Diesel engines	Diesel	No	1.4	(Kg/KWh)	0.242
Campanario Gas 1	56	Open cycle	Natural Gas	No	0.0	(m^3-std/KWh)	0.319
Campanario Gas 2	56	Open cycle	Natural Gas	No	0.0	(m^3-std/KWh)	0.319
Campanario Gas 3	56	Open cycle	Natural Gas	No	0.0	(m^3-std/KWh)	0.319
Campanario Diesel 1	56	Open cycle	Diesel	No	4.9	(Kg/KWh)	0.261
Campanario Diesel 2	56	Open cycle	Diesel	No	32.6	(Kg/KWh)	0.247
Campanario Diesel 3	56	Open cycle	Diesel	No	66.7	(Kg/KWh)	0.245
Casablanca 1	1	Diesel engines	Diesel	No	1.0	(Kg/KWh)	0.231
Casablanca 2	0	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.278
Las Vegas	2	Diesel engines	Diesel	No	1.5	(Kg/KWh)	0.275
Curauma	2	Diesel engines	Diesel	No	1.6	(Kg/KWh)	0.274
Concon	2	Diesel engines	Diesel	No	1.9	(Kg/KWh)	0.229
FPC + FPC 2	12	Biomass / Steam	Biomass	Yes	77.7	N.C.	0.000
Constitución 1	9	Diesel engines	Diesel	No	0.8	(Kg/KWh)	0.298
Maule	6	Diesel engines	Diesel	No	0.3	(Kg/KWh)	0.282
Monte Patria	9	Diesel engines	Diesel	No	6.4	(Kg/KWh)	0.282
Punitaqui	9	Diesel engines	Diesel	No	7.8	(Kg/KWh)	0.282
Esperanza 1	2	Diesel engines	Diesel	No	1.5	(Kg/KWh)	0.341
Esperanza 2	2	Diesel engines	Diesel	No	0.9	(Kg/KWh)	0.218
Esperanza TG	18	Open cycle	Diesel	No	0.0	(Kg/KWh)	0.226
Degan	34	Diesel engines	Diesel	No	42.4	(Kg/KWh)	0.214
Olivos	2	Open cycle	Diesel	No	51.9	(Kg/KWh)	0.228
Totoral	3	Open cycle	Diesel	No	2.4	(Kg/KWh)	0.228
Quintay	3	Open cycle	Diesel	No	3.0	(Kg/KWh)	0.228
Placilla	3	Open cycle	Diesel	No	2.9	(Kg/KWh)	0.228
Chiloé	9	Diesel engines	Diesel	No	0.7	(Kg/KWh)	0.269
Quellon II	10	Diesel engines	Diesel	No	15.5	(Kg/KWh)	0.222
Colmito	55	Open cycle	Diesel	No	5.2	(Kg/KWh)	0.298
Los pinos	92	Open cycle	Diesel	No	108.4	(Kg/KWh)	0.191
Chuyaca	3	Diesel engines	Diesel	No	2.4	(Kg/KWh)	0.185
Chuyaca 2	18	Diesel engines	Diesel	No	0.1	(Kg/KWh)	0.210
Skretting	3	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.220
Cenizas	17	Diesel engines	Diesel	No	46.9	(Kg/KWh)	0.230
Santa Lidia	136	Open cycle	Diesel	No	9.6	(Kg/KWh)	0.259
Trapén	90	Diesel engines	Diesel	No	47.8	(Kg/KWh)	0.217
Los Espinos	96	Diesel engines	Diesel	No	28.7	(Kg/KWh)	0.221
San Gregorio + Linares	1	Diesel engines	Diesel	No	0.2	(Kg/KWh)	0.210
Biomar	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.222
Eagon	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.221
Salmofood I	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.230
Salmofood II	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.220
Teno	50	Diesel engines	Diesel	No	2.1	(Kg/KWh)	0.217
Newen Diesel	15	Open cycle	Diesel	No	0.0	(Kg/KWh)	0.290
Newen Butano	15	Open cycle	Butane Gas	No	2.7	(m^3-std/KWh)	0.455
Newen Propano	15	Open cycle	Propane Gas	No	0.8	(m^3-std/KWh)	0.436
Newen Gas Natural	15	Open cycle	Natural Gas	No	0.9	(m^3-std/KWh)	0.330
Newen Mezcla Butano/	15	Open cycle	Butane/Propane	No	0.0	(m^3-std/KWh)	0.445
Watts	3	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.221
Multiexport I	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.221
Multiexport II	2	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.221
Tierra Amarilla	142	Diesel engines	Diesel	No	23.7	(Kg/KWh)	0.239
Quintero	240	Open cycle	Natural Gas	No	7.1	(m^3-std/KWh)	0.340
Quintero GNL	N.A.	Open cycle	Natural Gas	No	15.2	(m^3-std/KWh)	0.340
Louisiana Pacific	3	Diesel engines	Diesel	No	0.0	(Kg/KWh)	0.221
El Peñón	80	Diesel engines	Diesel	No	11.4	(Kg/KWh)	0.217
San Lorenzo de D. De A	60	Diesel engines	Diesel	No	0.6	(Kg/KWh)	0.337
Tapihue	N.A.	Diesel engines	Natural Gas	No	0.8	(m^3-std/KWh)	0.283
Termopacífico	96	Diesel engines	Diesel	No	5.3	(Kg/KWh)	0.225
El Toro	450	Reservoir	Hydro	Yes	1,516.2	N.C.	0.000
Rapel	378	Reservoir	Hydro	Yes	732.4	N.C.	0.000
Canutillar	172	Reservoir	Hydro	Yes	911.4	N.C.	0.000
Cipreses	106	Reservoir	Hydro	Yes	498.7	N.C.	0.000
Pehuenche	566	Reservoir	Hydro	Yes	2,729.9	N.C.	0.000
Pangue	467	Reservoir	Hydro	Yes	2,139.4	N.C.	0.000
Ralco	690	Reservoir	Hydro	Yes	3,128.4	N.C.	0.000
Canela	18	Wind	Wind	Yes	37.4	N.C.	0.000
Canela 2	60	Wind	Wind	Yes	19.4	N.C.	0.000
Lebu (Cristoro)	3	Wind	Wind	Yes	3.2	N.C.	0.000
Totoral (eólica)	46	Wind	Wind	Yes	4.0	N.C.	0.000
Monte Redondo	74	Wind	Wind	Yes	6.1	N.C.	0.000
Total					**41,752**		

OPERATING MARGIN CALCULATION, 2008

		2008
Total emissions from non-low cost / must run power plants	(tCO_2/yr)	14,541,473
Total emissions from low-cost / must-run power plants	(tCO_2/yr)	526,164
Total energy generated in the SIC	(GWh/yr)	41,808
Total energy by non-Low cost / must run power plants	(GWh/yr)	16,904
Total energy by low cost / must run power plants	(GWh/yr)	24,903
Factor λ	(number)	0.0000000
Operating Margin	**(tCO_2/GWh)**	**860.23**

Note: Low cost / must run units present very low GHG emissions, since they are basically hydro plants and very few biomass plants.

OPERATING MARGIN CALCULATION, 2009

		2009
Total emissions from non-low cost / must run power plants	(tCO_2/yr)	13,171,928
Total emissions from low-cost / must-run power plants	(tCO_2/yr)	514,544
Total energy generated in the SIC	(GWh/yr)	41,752
Total energy by non-Low cost / must run power plants	(GWh/yr)	15,733
Total energy by low cost / must run power plants	(GWh/yr)	26,019
Factor λ	(number)	0.0002283105
Operating Margin	**(tCO_2/GWh)**	**837.04**

Note: Low cost / must run units present very low GHG emissions, since they are basically hydro plants and very few biomass plants.

BUILD MARGIN CALCULATION, 2008

	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	START OPERATION	CDM PROYECT	TOTAL GEN IN 2008 (GWh)	(tCO_2/GWh)
Santa Lidia	136.00	Open cycle	Diesel	09-Dic-08	No	0.5	864.7
Cenizas	16.50	Diesel engines	IFO 180	21-Oct-08	No	0.1	800.3
Lircay	19.04	Run of the river	Hydro	08-Oct-08	No	26.7	0.0
Skretting	0.00	Diesel engines	Diesel	30-Jun-05	No	0.0	733.3
Chuyaca	2.50	Diesel engines	Diesel	26-Nov-08	No	0.1	705.0
Los Pinos	97.00	Open cycle	Diesel	23-Sep-08	No	7.1	689.1
Chiloé	0.00	Diesel engines	Diesel	01-Jul-08	No	0.1	908.0
Quellón II	10.00	Diesel engines	Diesel	01-Ago-08	No	3.6	749.5
Coya	34.80	Run of the river	Hydro	01-Jul-08	No	43.5	0.0
Colmito	55.00	Open cycle	Diesel	01-Ago-08	No	2.6	874.9
Ojos de Agua	9.00	Run of the river	Hydro	01-Jun-08	Yes	0.0	0.0
Puclaro	0.00	Run of the river	Hydro	01-May-08	Yes	0.0	0.0
Totoral	3.00	Open cycle	Diesel	Abr-2008	No	3.4	912.0
Quintay	3.00	Open cycle	Diesel	Abr-2008	No	3.2	912.0
Placilla	3.00	Open cycle	Diesel	Abr-2008	No	3.0	912.0
Olivos	1.94	Open cycle	Diesel	01-Feb-08	No	28.3	761.0
Hornitos	55.00	Run of the river	Hydro	30-Sep-07	Yes	0.0	0.0
Palmucho	32.00	Run of the river	Hydro	29-Sep-07	No	225.1	0.0
Canela	18.20	Wind	Wind	31-Ago-07	No	30.7	0.0
Esperanza TG	17.90	Open cycle	Diesel	22-Ago-07	No	3.6	1,152.8
Maule	6.00	Diesel engines	Diesel	23-Jul-07	No	5.2	1,005.2
Chiburgo	19.50	Run of the river	Hydro	19-Jul-07	No	98.9	0.0
Monte Patria	9.00	Diesel engines	Diesel	12-Jul-07	No	17.1	951.5
Constitución 2	5.70	Diesel engines	Diesel	07-Jul-07	No	0.0	1,005.2
Punitaqui	9.00	Diesel engines	Diesel	06-Jul-07	No	18.1	951.5
Constitución 1	9.00	Diesel engines	Diesel	06-Jul-07	No	10.8	1,005.2
Degan	36.00	Diesel engines	Diesel	04-Jul-07	No	68.3	738.7
Esperanza 1	1.70	Diesel engines	Diesel	29-Jun-07	No	4.5	737.7
FPC	11.60	Biomass / Steam	Biomass	27-Jun-07	No	77.2	0.0
Esperanza 2	1.50	Diesel engines	Diesel	27-Jun-07	No	4.5	764.4
Curanilahue	2.10	Diesel engines	Diesel	27-Jun-07	No	0.0	0.0
Horcones Diesel	24.30	Open cycle	Diesel	20-Jun-07	No	6.8	1,157.7
Nehuenco II Diesel	376.10	Combined cycle	Diesel	15-May-07	No	2202.9	561.7
Quilleco	70.00	Run of the river	Hydro	30-Abr-07	Yes	0.0	0.0
San Isidro 2 Diesel	248.30	Combined cycle	Diesel	23-Abr-07	No	1646.9	801.0
San Isidro 2	248.30	Combined cycle	Natural Gas	23-Abr-07	No	1.0	610.5
El Rincón	0.30	Run of the river	Hydro	23-Abr-07	No	2.5	0.0
Concon	2.72	Diesel engines	Diesel	23-Abr-07	No	7.2	762.7
Las Vegas	2.32	Diesel engines	Diesel	20-Abr-07	No	6.1	780.6
Curauma	2.50	Diesel engines	Diesel	20-Abr-07	No	5.9	776.3
Casablanca 2	0.48	Diesel engines	Diesel	20-Abr-07	No	0.1	939.2
Casablanca 1	1.30	Diesel engines	Diesel	20-Abr-07	No	4.1	781.1
Casablanca	1.78	Diesel engines	Diesel	20-Abr-07	No	0.0	781.1
Campanario Diesel	118.00	Open cycle	Diesel	21-Mar-07	No	221.3	845.8
Campanario	118.00	Open cycle	Natural Gas	21-Mar-07	No	18.9	859.4
Eyzaguirre	1.50	Run of the river	Hydro	12-Mar-07	No	8.7	0.0
LosVientos_TG	125.00	Open cycle	Diesel	03-Ene-07	No	380.8	861.4
Los Sauces	2.50	Diesel engines	Diesel	03-Ene-07	No	4.7	816.1
Nueva Aldea 3	20.00	Biomass / Steam	Biomass	10-Sep-06	Yes	0.0	0.0
Nueva Aldea 2	10.00	Open cycle	Diesel	01-May-06	No	0.0	978.9
Candelaria (Open cycle) 1 Diesel	125.30	Open cycle	Diesel	16-May-05	No	263.5	974.6
Candelaria (Open cycle) 1	125.30	Open cycle	Natural Gas	16-May-05	No	22.8	649.9
Coronel Diesel	45.70	Open cycle	Diesel	01-May-05	No	73.9	758.1
Coronel	45.70	Open cycle	Natural Gas	01-May-05	No	0.7	521.0
Candelaria (Open cycle) 2 Diesel	128.60	Open cycle	Diesel	01-May-05	No	278.0	974.6
Candelaria (Open cycle) 2	128.60	Open cycle	Natural Gas	01-May-05	No	12.4	649.9
Nueva Aldea 1	13.00	Biomass / Steam	Biomass	01-Abr-05	Yes	0.0	0.0
Antilhue TG	101.30	Open cycle	Diesel	07-Ene-05	No	241.1	809.4
Antilhue new (I and II)	50.30	Open cycle	Diesel	07-Ene-05	No	0.0	809.4
Ralco	690.00	Reservoir	Hydro	01-Sep-04	No	2572.6	0.0

TOTAL GEN. PER YEAR	(GWh / yr)		41,807.7
20% OF GEN. PER YEAR	(GWh / yr)		8,361.5
5 MOST RECENT PLANT GEN	(GWh / yr)		34.5

EMISSION FACTOR 5 PLANTS	(tCO_2/GWh)		159.1
EMISSION FACTOR 20% GEN	(tCO_2/GWh)		469.7

BUILD MARGIN	(tCO_2/GWh)		469.7

BUILD MARGIN CALCULATION, 2009

	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	START OPERATION	CDM PROYECT	TOTAL GEN IN 2009 (GWh)	(tCO_2/GWh)
Totoral (eólica)	46.00	Wind	Wind	2009	No	4.01	0.00
Monte Redondo	74.00	Wind	Wind	2009	No	6.07	0.00
Quintero GNL	N.A.	Open cycle	Natural Gas	2009	No	15.19	745.46
Canela 2	60.00	Wind	Wind	2009	No	19.40	0.00
Quintero	240.00	Open cycle	Natural Gas	2009	No	7.10	745.46
Tapihue	N.A.	Diesel engines	Natural Gas	2009	No	0.78	620.47
Termopacífico	96.00	Diesel engines	Diesel	2009	No	5.26	760.02
Nueva Ventanas	240.00	Coal / Steam	Coal	2009	No	122.65	1055.10
Truful Truful	N.A.	Run of the river	Hydro	2009	No	0.00	0.00
San Lorenzo de D. De Almagro	60.00	Diesel engines	Diesel	2009	No	0.63	1138.34
San Isidro GNL	350.00	Combined cycle	Natural Gas	2009	No	694.27	636.20
Louisiana Pacific	2.90	Diesel engines	Diesel	2009	No	0.00	747.18
El Peñón	80.00	Diesel engines	Diesel	2009	No	11.43	732.99
Pehui	1.00	Run of the river	Hydro	2009	No	3.63	0.00
San Gregorio + Linares Norte	0.80	Diesel engines	Diesel	2009	No	0.23	709.35
Newen Diesel	15.00	Open cycle	Diesel	2009	No	0.00	979.58
Newen Propano	15.00	Open cycle	Propane Gas	2009	No	0.75	1394.24
Newen Gas Natural	15.00	Open cycle	Natural Gas	2009	No	0.93	723.54
Newen Mezcla Butano/Propano	15.00	Open cycle	Butane/Propane	2009	No	0.00	1423.28
Watts	2.64	Diesel engines	Diesel	2009	Yes	0.00	747.18
Multiexport I	1.60	Diesel engines	Diesel	2009	No	0.00	747.18
Multiexport II	1.60	Diesel engines	Diesel	2009	No	0.00	747.18
Tierra Amarilla	142.00	Diesel engines	Diesel	2009	No	23.65	807.31
Teno	50.00	Diesel engines	Diesel	2009	No	2.08	732.99
Newen Butano	15.00	Open cycle	Butane Gas	2009	No	2.74	1452.33
Lebu (Cristoro)	2.76	Wind	Wind	2009	No	3.15	0.00
Guacolda 3	135.00	Coal / Steam	Coal	2009	No	721.70	984.76
Biomar	2.40	Diesel engines	Diesel	2009	No	0.00	749.55
Eagon	2.40	Diesel engines	Diesel	2009	No	0.00	747.52
Salmofood I	1.60	Diesel engines	Diesel	2009	No	0.00	776.91
Salmofood II	1.60	Diesel engines	Diesel	2009	No	0.02	743.13
Campanario Diesel 2	56.00	Open cycle	Diesel	2009	No	32.58	834.33
Campanario Diesel 3	56.00	Open cycle	Diesel	2009	No	66.71	827.57
Chuyaca 2	17.50	Diesel engines	Diesel	2009	No	0.08	709.35
Trapén	90.00	Diesel engines	Diesel	2009	No	47.80	732.99
Los Espinos	96.00	Diesel engines	Diesel	2009	No	28.65	746.51
EL Manzano	4.70	Run of the river	Hydro	2009	No	26.69	0.00
Santa Lidia	136.00	Open cycle	Diesel	2008	No	9.60	874.86
Chuyaca	2.50	Diesel engines	Diesel	2008	No	2.43	624.23
Cenizas	16.50	Diesel engines	Diesel	2008	No	46.94	776.91
Lircay	19.04	Run of the river	Hydro	2008	Yes	0.00	0.00
Los pinos	92.10	Open cycle	Diesel	2008	No	108.44	644.09
Quellon II	10.00	Diesel engines	Diesel	2008	No	15.48	749.88
Colmito	55.00	Open cycle	Diesel	2008	No	5.20	1006.60
Coya	34.80	Run of the river	Hydro	2008	No	91.61	0.00
Chiloé	9.00	Diesel engines	Diesel	2008	No	0.69	908.64
Ojos de agua	9.00	Run of the river	Hydro	2008	Yes	0.00	0.00
Puclaro	5.20	Run of the river	Hydro	2008	Yes	0.00	0.00
Totoral	3.00	Open cycle	Diesel	2008	No	2.40	771.77
Quintay	3.00	Open cycle	Diesel	2008	No	3.03	771.77
Placilla	3.00	Open cycle	Diesel	2008	No	2.94	771.77
Olivos	1.90	Open cycle	Diesel	2008	No	51.92	769.11
Skretting	2.70	Diesel engines	Diesel	2008	No	0.00	743.13
Palmucho	32.00	Run of the river	Hydro	2007	No	244.10	0.00
Hornitos	55.00	Run of the river	Hydro	2007	Yes	0.00	0.00
Canela	18.20	Wind	Wind	2007	Yes	0.00	0.00
Esperanza TG	17.90	Open cycle	Diesel	2007	No	0.01	763.26
Maule	5.70	Diesel engines	Diesel	2007	No	0.32	952.56
Chiburgo	19.50	Run of the river	Hydro	2007	No	82.72	0.00
Monte Patria	8.60	Diesel engines	Diesel	2007	No	6.41	951.54
Constitución 1	8.60	Diesel engines	Diesel	2007	No	0.77	1005.25
Punitaqui	8.60	Diesel engines	Diesel	2007	No	7.82	951.54
Degan	34.20	Diesel engines	Diesel	2007	No	42.42	721.38
Esperanza 1	1.70	Diesel engines	Diesel	2007	No	1.48	1151.98
Esperanza 2	1.50	Diesel engines	Diesel	2007	No	0.87	737.72
FPC + FPC 2	11.60	Biomass / Steam	Biomass	2007	No	77.66	0.00
Horcones Diesel	24.30	Open cycle	Diesel	2007	No	1.48	1147.42
Nehuenco II Diesel	376.10	Combined cycle	Diesel	2007	No	1525.76	560.81
Quilleco	70.00	Run of the river	Hydro	2007	Yes	0.00	0.00
El Rincón	0.30	Run of the river	Hydro	2007	No	2.15	0.00
San Isidro II	370.00	Combined cycle	Natural Gas	2007	No	115.96	445.09
San Isidro II Diesel	370.00	Combined cycle	Diesel	2007	No	1415.14	657.03
Concon	2.20	Diesel engines	Diesel	2007	No	1.92	774.61
San Isidro II GNL	370.00	Combined cycle	Natural Gas	2007	No	271.23	445.09
Casablanca 1	1.30	Diesel engines	Diesel	2007	No	1.04	781.14
Casablanca 2	0.48	Diesel engines	Diesel	2007	No	0.00	939.18
Las Vegas	2.20	Diesel engines	Diesel	2007	No	1.48	928.91
Curauma	2.40	Diesel engines	Diesel	2007	No	1.65	924.18
Campanario Gas 1	56.00	Open cycle	Natural Gas	2007	No	0.00	699.69
Campanario Diesel 1	56.00	Open cycle	Diesel	2007	No	4.95	881.62
Eyzaguirre	2.10	Run of the river	Hydro	2007	No	8.27	0.00
Los Vientos TG	120.80	Open cycle	Diesel	2007	No	154.70	894.77
Los Sauces	2.40	Diesel engines	Diesel	2007	No	4.05	816.09
Nueva Aldea 3	20.00	Biomass / Steam	Biomass	2006	Yes	0.00	0.00
Nueva Aldea 2	10.00	Open cycle	Diesel	2006	No	0.00	978.90
Candelaria 1	125.30	Open cycle	Natural Gas	2005	No	21.11	721.08
Candelaria 1 Diesel	125.30	Open cycle	Diesel	2005	No	68.42	934.27
TG_Coronel	45.70	Open cycle	Natural Gas	2005	No	3.03	568.48
TG_Coronel Diesel	45.70	Open cycle	Diesel	2005	No	23.45	760.09
Candelaria 2	128.60	Open cycle	Natural Gas	2005	No	7.32	721.08
Candelaria 2 Diesel	128.60	Open cycle	Diesel	2005	No	28.94	934.27
Nueva Aldea	13.00	Biomass / Steam	Biomass	2005	Yes	0.00	0.00
Antilhue TG	50.30	Open cycle	Diesel	2005	No	112.71	1988.20
Horcones TG	24.30	Open cycle	Natural Gas	2004	No	0.01	830.90
Ralco	690.00	Reservoir	Hydro	2004	No	3128.43	0.00

TOTAL GEN. PER YEAR	(GWh / yr)	41,751.7
20% OF GEN. PER YEAR	(GWh / yr)	8,350.3
5 MOST RECENT PLANT GEN	(GWh / yr)	51.8

EMISSION FACTOR 5 PLANTS	(tCO_2/GWh)	320.97
EMISSION FACTOR 20% GEN	(tCO_2/GWh)	436.44

BUILD MARGIN	(tCO_2/GWh)	436.44

Note: Calculation excludes CDM plants (if any), plants that have been moved and retired plants at the calculation date.

COMBINED MARGIN CALCULATION, 2008

OM: Calculated ex post (Option 2, the year in which the emissions occur)
BM: Calculated ex-post (Option 2, updated annually from the date the first emissions occur

		2008
Operating Margin	(tCO_2/GWh)	860.23
Build Margin	(tCO_2/GWh)	469.73
Combined Margin	**(tCO_2/GWh)**	**664.98**

COMBINED MARGIN CALCULATION, 2009

OM: Calculated ex post (Option 2, the year in which the emissions occur)
BM: Calculated ex-post (Option 2, updated annually from the date the first emissions occur)

		2009
Operating Margin	(tCO_2/GWh)	837.04
Build Margin	(tCO_2/GWh)	436.44
Combined Margin	**(tCO_2/GWh)**	**636.74**

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