

MONITORING REPORT

Nueva Aldea Biomass Power Plant Phase 2

CDM Registration Reference Number: 346

VERSION 01

Monitoring period:

From: October 01, 2008

To: December 31, 2009



Celulosa Arauco y Constitución S.A.

May, 2010

SUMMARY TABLE

Name of the CDM project activity:	Nueva Aldea Biomass Power Plant Phase 2
CDM registration reference number:	346
Starting date of the project activity:	01/07/2004
Starting date of the first crediting period:	01/04/2007 ¹
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:	182,762 tCO₂eq

¹ The original starting date established in the registered PDD was 01/08/2006. Due to some technical problems during the start-up operation, the project proponent requested a delay of the starting date of the first crediting period of 8 months.

1. Project description and current status

The project activity consists in a new 37 MW grid-connected biomass cogeneration power plant located inside a forestry complex by Arauco: the Nueva Aldea Complex or the Nueva Aldea Project. The power plant consists in a new pulp mill equipped with 2 X 70 MW gross generation capacity, of which 37 MW are destined to power generation to the grid.

The project activity is designed to use black liquor² (biomass) for steam and electric power generation in a cogeneration power plant located inside a new bleached pulp mill site. The project activity is owned by Celulosa Arauco y Constitución S.A. (from now on, Arauco), a leading forestry and pulp-producing company in Chile.

Though modern pulp mills are currently designed to be self-sufficient in terms of steam and electric power generation, the Nueva Aldea pulp mill was deliberately designed to generate a considerable amount of surplus power to the grid. Considering the higher cost of building a pulp mill with additional power generation to the grid, the decision of building such power plant relied on the possibility of selling the excess power to the grid and on the benefits of being a CDM project activity.

The project activity assists Chile's sustainable growth by providing electricity to the Nueva Aldea Industrial Complex and to the SIC through biomass power generation, which is a clean and renewable energy source. The Nueva Aldea Phase 2 project participants believe 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 Nueva Aldea Phase 2 project activity helps to promote 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 project is a good example to demonstrate the viability of power generation as a source of revenue not only to the Pulp industry, but also to all forest-related industries. It is worthy to highlight, however, that very few pulp mills in Chile have this additional power generation capacity, making the Nueva Aldea Power Plant Phase 2 quite unique and particular in its type. Although this technological improvement is consistent with the internal policies of efficient energy usage of Arauco; it must be recognized as an initiative that goes beyond the common practice of the Pulp industry in Chile.

Baseline methodology

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 02)

² Black liquor is an organic by-product of the pulp production Kraft cycle and falls under the category of *biomass residue*, according to the “Clarifications of definitions of biomass and consideration of changes in carbon pools due to a CDM project activity”, Annex 8, of 20th Executive Board meeting report.

Applied baseline scenario for the project activity: N° 4.

Documentation

The project was validated by DNV and registered in June 02, 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>

Implementation and current status

The project activity has been completed as planned and described in the Project Design Document (PDD). It has also operated as described in the CDM PDD: The only change has been made in the starting date of the first crediting period of the project activity, due to some technical problems during the start-up process.

Sustainability, economic and social well-being

The Nueva Aldea Phase 2 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 thermal energy 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. Since the original monitoring plan outlined in section D.2 of the PDD deviated from the baseline methodology, the project proponent presented a revised monitoring plan, which was approved by the EB in October 10, 2008. This section provides additional explanatory information about the monitored data.

The following table provides information about the monitored data for the project and baseline emission data variables. Note that 2009 values include full-year monitored data, while the 2009 values, only include data from October to December, 2008.

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 used as fuel in the project plant during the year y in a volume or mass unit.	355,236 (tDS)	1,600,841 (tDS)	This variable was directly monitored using dedicated flow meters. The direct measurement of the % of dry solids and the temperature of the liquid biomass flow allow determining the flow of dry solids to the recovery boiler.
2. NCV_i	Net calorific value of biomass type i per mass or volume of biomass.	9.78 (GJ/tDS)	10.09 (GJ/tDS)	This variable was measured in a specialized laboratory. The measurement was carried out according to proper industry standards.
3. $COEF_{CO_2,i}$	CO_2 emission factor of the fossil fuel type i used in the project plant.	Diesel: 3,377 (tCO ₂ /000ton) Natural Gas: 2,064 (tCO ₂ /MMm ³)	Diesel: 3,177 (tCO ₂ /000ton) Natural Gas: 2,053 (tCO ₂ /MMm ³)	The project proponent used IPCC default factors for these coefficients.
4. $FF_{project\ plant,i,y}$	On-site fossil fuel consumption of fuel type i for co-firing in the project plant.	Diesel: 1,972 (ton) Natural Gas: 107 (ton)	Diesel: 1,310 (ton) Natural Gas: 369 (ton)	Total quantities of fossil fuel per type used in the recovery boiler were constantly monitored at the Power Plant. Emissions from fossil fuel quantities associated to additional power generation were considered project emissions and deducted from the baseline emissions of the project activity. The fossil fuel associated with additional power generation was determined following the indications of section E.1. (pages 44 and 45) of the registered PDD.

Baseline monitored data

ID number.	Data variable.	2008 data	2009 data	Monitoring system and procedures
5. $EG_{\text{project plant},y}$	Net quantity of electricity generated in the project plant during the year y.	186,790 (MWh)	786,930 (MWh)	This variable was monitored using electric meters that are standard in the electric power industry in Chile. In this case, since the project plant consumes the same amount of electricity as the reference plant (e.g. there is not additional electric power consumption associated to the implementation of the project activity), the net electricity generated in the project plant is the same as the total electricity generated in the project plant. The efficiency of the reference plant was determined in such a way that the electric power associated to the implementation of the project activity: EG_y calculated through equation 13, is exactly the increased electricity generation (incremental to baseline generation) as result of the implementation of the project activity.
6. EF_y	CO ₂ emission factor of the grid.	664.98 (tCO ₂ /GWh)	636.74 (tCO ₂ /GWh)	Calculated using equation N° 10 of the ACM0002 (Version 04), as the average of the OM and BM emission factors. The calculation of this emission factor is in the Annex of this Monitoring Report.
7. $EF_{\text{OM},y}$	CO ₂ Operating Margin emission factor of the grid.	860.2 (tCO ₂ /GWh)	837.0 (tCO ₂ /GWh)	Calculated using equation N° 4 of the ACM0002 (Version 04), 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.
8. $EF_{\text{BM},y}$	CO ₂ Build Margin emission factor of the grid.	469.7 (tCO ₂ /GWh)	436.4 (tCO ₂ /GWh)	Calculated using equation N° 9 of the ACM0002 (Version 04). 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.
9. $F_{i,y}$	Amount of each fossil fuel consumed by each power source / plant.	See tables at the end of the Monitoring Report.	See tables at the end of the Monitoring Report.	This information was directly obtained by the CDEC-SIC Dispatch Center or directly from the electric power companies themselves.

10. 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).
11. GEN _{j/k/n,y}	Electricity generation of each power source / plant j/k or n.	See tables at the end of the Monitoring Report	See tables at the end of the Monitoring Report	This information was directly obtained by the CDEC-SIC Dispatch Center.
12.	Identification of power source / plant for the OM calculation.	See tables at the end of the Monitoring Report.	See tables at the end of the Monitoring Report.	This information was directly obtained by the CDEC-SIC Dispatch Center.
13.	Identification of power source / plant for the BM calculation.	See tables at the end of the Monitoring Report.	See tables at the end of the Monitoring Report.	This information was directly obtained by the CDEC-SIC Dispatch Center.
14. 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.
15.a GEN _{j/k/11,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 by the CDEC-SIC Dispatch Center.

15.b COEF _{i,jy} 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 by the CDEC-SIC Dispatch Center.
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Note related to the OM calculation:

In the previous request for issuance (the one that followed the monitoring report of the previous monitoring period), the Executive Board requested further clarification on the reasons the Project Proponent selected option (b) simple adjusted method instead of option (c) dispatch data analysis method for the Operating Margin (OM) calculation. This clarification was provided in full by the Project Proponent in the previous monitoring report and found acceptable by the Executive Board. As a result, the Project Proponent will not provide this explanation again in this monitoring report.

Fixed parameters

ID number.	Data variable.	Additional comments
ε _{el} , other plant(s)	Average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass fired in the project plant in the absence of the project activity.	<p>The reference pulp mill's electric efficiency of 12.31% was calculated taking into account the following considerations:</p> <ul style="list-style-type: none"> The chosen baseline scenario for the Nueva Aldea Phase 2 project activity that states that the reference pulp mill would be self-sufficient in electric and thermal power generation. This baseline scenario is consistent with the current BAT (Best Available Technology) for non-integrated bleached pulp mills, such as the Nueva Aldea Phase 2 pulp mill³. The electric efficiencies of other (modern and recently built) pulp mills in the country. The electric efficiencies of these pulp mills were in the range of 8.0% to 10.5%. <p>According to the above, the chosen efficiency of 12.31% was deemed conservative and appropriate.</p>

³ Please see table 2.46 of the BREF document (the "European IPPC Bureau. 2001. Integrated Pollution Prevention and Control (IPPC), Reference Document on Best Available Techniques in the Pulp and Paper Industry, Seville, Spain, p 111.". The link: <http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm>).

Leakage

As described in section E.2 of the registered PDD, no leakage is anticipated from the implementation of the project activity.

$$L_y = 0$$

Quality assurance

Quality control and quality assurance mechanisms for the monitored data were implemented as mentioned in the registered PDD. The following table provides additional information in the same format as the one used in the PDD.

Data	Uncertainty level	QA/QC procedures implemented during the monitored period.
1.	Low	<p>Biomass flows were crosschecked considering two different biomass flow measurements to the recovery boiler. All instruments received proper maintenance and calibration according to the relevant industry standards.</p> <p>In addition, the project proponent performed an energy / mass balance of the biomass power plant that considered the biomass (black liquor in tDS) burned in the recovery boiler, the heat and the electric power generation during the monitored period. All values were found to be consistent.</p>
2.	Low	The measured net calorific value of the biomass (black liquor) was consistent with the values of net calorific values found for Sulphite Lyes (black liquor) in Table 1.2, Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
3.	Low	IPCC default factors were used in this case.
4.	Low	Fuel meters received periodic maintenance, calibration and the consistency of metered fuel consumption was checked with purchase dispatch bills.
5.	Low	<p>Electricity meters received periodic maintenance and calibration as per instructed by the equipment manufacturer and according proper industry standards.</p> <p>Total power generation takes place in two turbogenerator units at the Nueva Aldea pulp mill. To check the generation of the first unit, a power balance in the corresponding bus was carried out. To check the generation of the second unit, an operation index that considers the total energy generated, the efficiency of the turbogenerator and the total steam that goes through the turbogenerator was calculated.</p>
6, 7, 8, 9, 10, 11, 12, 13, 14, 15a, 15b	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.

In addition to the above and to ensure the accuracy and reliability of the monitored data, the project proponent developed a dedicated information system. This system is part of the Nueva Aldea Phase 2 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 Nueva Aldea Phase 2 project is:

$$\text{Project Activity Net Emission savings} = \text{Baseline Emissions} - \text{Project Activity Emissions} - \text{Leakage}$$

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 (tCO₂/yr).

$BL_{E2,y}$: Baseline emissions from avoided biomass disposal (tCO₂eq/yr).

$P_{E1,y}$: Project emissions from biomass controlled burning in the Power Plant (tCO₂eq/yr).

$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO₂/yr).

$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO₂/yr).

$P_{E4,y}$: Project emissions from fossil fuel consumption in the Power Plant (tCO₂/yr).

L_y : Are the leakage emissions (tCO₂/yr).

In case of the Nueva Aldea Phase 2 project activity, the only terms of the equation above that apply are $BL_{E1,y}$ and $P_{E4,y}$ (leakage is zero), so the net emission reductions of the project can be calculated as:

$$PNE_y = BL_{E1,y} - P_{E4,y}$$

The following section of the Monitoring Report evaluates each part of this equation and calculates the net emission reductions of the Nueva Aldea Phase 2 project activity on a an annual basis. A monthly summary is presented afterwards.

3.2 Emission reduction calculation

Please note that baseline and project emissions calculations below may present some minor imprecision due to some decimal rounding.

Baseline emissions

The net quantity of increased electricity generation is calculated using equation N° 13 of the ACM0006 (Version 02). The total emission reduction due to displacement of electricity is calculated using equation N° 8 of the ACM0006 (Version 02).

The corresponding calculations for the monitored period are presented below.

Data:

	Units	2008	2009
(1) Combined Margin of the grid	(tCO ₂ /GWh)	664.98	636.74
(2) Total net power generation	(GWh)	186.79	786.93
(3) Electric efficiency of the baseline plant	(%)	12.31 (%)	12.31 (%)
(4) Total quantity of biomass fired	(tDs)	355,236	1,600,841
(5) Net calorific value of biomass	(GJ/tDS)	9.78	10.09

Calculations:

		2008	2009
(5) Energy displaced from the grid	$(2) - (3) * [(4) * (5)] * (1 \text{ GWh}) / (3,600 \text{ GJ})$	68 (GWh)	235 (GWh)
(6) Total grid emission savings	(1) * (5)	45,232 (tCO₂)	149,605 (tCO₂)

Total baseline emissions	(tCO₂)	45,232	149,605
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Project emissions

The only project emission corresponds to the consumption of some fossil fuel in the recovery boiler, which is attributable to additional power generation to the grid. This is calculated using equation N° 6 of the ACM0006 (Version 02).

The corresponding calculation is shown below:

Data:

	Units	2008	2009
(1) Diesel consumption	(ton)	1,972	1,310
(2) Natural gas consumption	(ton)	107	369
(3) Diesel emission factor	(tCO ₂ /000ton)	3,377	3,177
(4) Natural gas emission factor	(tCO ₂ /MMm ³)	2,064	2,053
(5) Nat. gas density (gaseous phase)	(Kg/m ³)	0.79	0.78

Calculations:

		2008	2009
(6) Diesel emissions	(1)*(1/1,000)*(3)	6,661 (tCO ₂)	4,161 (tCO ₂)
(7) Nat. gas emissions	[(2)*1,000/(5)]*(1/1,000,000)*(4)	281 (tCO ₂)	971 (tCO ₂)
(8) Total fossil fuel emissions	(tCO₂)	6,942 (tCO₂)	5,133 (tCO₂)

Total project emissions	(tCO₂)	6,942	5,133
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Net emission reductions for the monitored period

		2008	2009
(1) Baseline emissions	(tCO ₂)	45,232	149,605
(2) Project emissions	(tCO ₂)	6,942	5,133
(3) Net emission reductions	(tCO₂)	38,290	144,473

Summary of emission reductions for the monitored period

For the calculation of the net emission reductions of the Nueva Aldea Phase 2 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. A table with the monthly calculation of emission reductions is presented below.

Net emission savings per month			
		Baseline emissions	Project Emissions
Year	Net emission savings	Grid emissions	Fossil fuel in R.B.
(Months)	(tCO₂e/yr)	(tCO₂/yr)	(tCO₂/yr)
Year 2008			
October	8,467	14,595	6,128
November	12,844	13,658	814
December	16,978	16,978	0
Total year 2008	38,290	45,232	6,942
Year 2009			
January	6,756	7,153	397
February	10,674	10,674	0
March	16,489	16,499	10
April	14,517	14,623	106
May	14,651	14,789	139
June	11,564	12,200	636
July	11,469	13,185	1,715
August	13,005	13,008	3
September	11,138	11,406	267
October	11,230	12,502	1,272
November	11,519	11,658	139
December	11,459	11,908	448
Total year 2009	144,473	149,605	5,133
3rd verif (Oct 08- Sept 09)	182,762.1	194,836.6	12,074.4
Total emissions claimed	182,762	194,837	12,074

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

According to the project PDD, the estimated emission reductions for the period covered by this monitoring report should have been 202,328 CERs, which is 11% higher than the actual emission reductions for the monitored period. This difference can be explained by the following reasons:

- A lower power generation of the biomass power plant to the SIC grid during the monitored period. This was mainly due to unanticipated operational problems of the biomass power plant.
- Higher grid emission factors for the years 2008 and 2009 than the ones originally estimated in the PDD. The emission factors estimated in the PDD were 528.17 (tCO₂/GWh) and 637.85 (tCO₂/GWh) for those years, while the monitored emission factors were 664.98 (tCO₂/GWh) and 636.74 (tCO₂/GWh), respectively. The reason for the higher grid emission factors was the replacement of natural gas for more carbon-intensive fuels (e.g. natural gas imports for Argentina became unavailable from 2004 on). This increased the overall GHG emissions in the SIC grid.

- The utilization of fossil fuel for additional electricity generation to the SIC (positive project emissions) during the monitored period. The estimations of project emissions in the PDD were zero.

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

ANNEX

Nueva Aldea Biomass Power Plant Phase 2



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
Alacran	136	Run of the river	Hydro	Yes	342	N.C.	0.000
Acacagagua	73	Run of the river	Hydro	Yes	439	N.C.	0.000
Alfajal	178	Run of the river	Hydro	Yes	907	N.C.	0.000
Alcud	3	Diesel engines	Diesel	No	6	(g/kWh)	0.242
Asitruwe new (I and II)	63	Open cycle	Diesel	No	4	(g/kWh)	0.240
Aditruwe TO	101	Open cycle	Diesel	No	241	(g/kWh)	0.240
Arturo	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	(g/kWh)	0.388
Campanario	118	Open cycle	Natural Gas	No	19	(m³std/kWh)	0.352
Campanario Diesel	118	Open cycle	Diesel	No	221	(g/kWh)	0.250
Candelaria (Open cycle) 1	125	Open cycle	Natural Gas	No	23	(m³std/kWh)	0.296
Candelaria (Open cycle) 1 Diesel	125	Open cycle	Diesel	No	264	(g/kWh)	0.289
Candelaria (Open cycle) 2	129	Open cycle	Natural Gas	No	12	(m³std/kWh)	0.296
Candelaria (Open cycle) 2 Diesel	129	Open cycle	Diesel	No	278	(g/kWh)	0.289
Canillal	172	Reservoir	Hydro	Yes	798	N.C.	0.000
Cafra	2	Diesel engines	Diesel	No	5	(g/kWh)	0.242
Capillo	12	Run of the river	Hydro	Yes	69	N.C.	0.000
Casablanca 1	2	Diesel engines	Diesel	No	0	(g/kWh)	0.231
Casablanca 2	0	Diesel engines	Diesel	No	4	(g/kWh)	0.231
Celco	3	Diesel engines	Diesel	No	0	(g/kWh)	0.278
Chacabuco	25	Biomass / Steam	Biomass	Yes	43	N.C.	0.000
Chiburga	20	Run of the river	Hydro	Yes	177	N.C.	0.000
Cholguán	13	Biomass / Steam	Biomass	Yes	90	N.C.	0.000
Cipreses	108	Reservoir	Hydro	Yes	480	N.C.	0.000
Colbun	589	Reservoir	Hydro	Yes	3,234	N.C.	0.000
Colipulli	3	Diesel engines	Diesel	No	6	(g/kWh)	0.242
Concon	3	Diesel engines	Diesel	No	7	(g/kWh)	0.226
Constitución	10	Biomass / Steam	Biomass	Yes	6	N.C.	0.000
Constitución 1	9	Diesel engines	Diesel	No	11	(g/kWh)	0.298
Constitución 2	6	Diesel engines	Diesel	No	11	(g/kWh)	0.298
Coronel	46	Open cycle	Natural Gas	No	1	(m³std/kWh)	0.238
Coronel Diesel	46	Open cycle	Diesel	No	74	(g/kWh)	0.224
Corsacuan	3	Diesel engines	Diesel	No	6	(g/kWh)	0.220
Cursulhué	2	Diesel engines	Diesel	No	0	(g/kWh)	0.240
Cusuma	3	Diesel engines	Diesel	No	6	(g/kWh)	0.230
Curlingue	89	Run of the river	Hydro	Yes	605	N.C.	0.000
Da de Almagro	24	Open cycle	Coal	No	68	(g/kWh)	0.240
Degan	36	Diesel engines	Diesel	No	68	(g/kWh)	0.219
El Rincón	450	Run of the river	Hydro	Yes	3	N.C.	0.000
El Tero	450	Run of the river	Hydro	Yes	1,206	N.C.	0.000
Esperanza 1	2	Diesel engines	Diesel	No	5	(g/kWh)	0.218
Esperanza 2	2	Diesel engines	Diesel	No	4	(g/kWh)	0.228
Esperanza TO	18	Open cycle	Diesel	No	4	(g/kWh)	0.241
Eyzaguirre	2	Run of the river	Hydro	Yes	9	N.C.	0.000
Florida	28	Run of the river	Hydro	Yes	195	N.C.	0.000
FOC	12	Biomass / Steam	Biomass	Yes	77	N.C.	0.000
Generadores Saesa	N.A.	Diesel engines	Diesel	No	0	(g/kWh)	0.000
Guaecela I	152	Coal / Steam	Coal / Petcoke	No	1,245	(g/kWh)	0.373
Guaecela II	152	Coal / Steam	Coal / Petcoke	No	1,286	(g/kWh)	0.359
Hormones Diesel	24	Open cycle	Natural Gas	No	7	(g/kWh)	0.343
Hormones TO	24	Open cycle	Natural Gas	No	0	(m³std/kWh)	0.377
Huasco TO Diesel	64	Open cycle	Diesel	No	0	(g/kWh)	0.448
Huasco TO IFO	64	Open cycle	IFO 180	No	160	(g/kWh)	0.372
Huasco TV	16	Coal / Steam	Coal	No	0	(g/kWh)	0.974
Isla	68	Run of the river	Hydro	Yes	484	N.C.	0.000
I. Verde TO	19	Open cycle	Diesel	No	38	(g/kWh)	0.280
I. Verde TV	55	Coal / Steam	Coal	No	247	(g/kWh)	0.718
Laja	10	Biomass / Steam	Biomass	Yes	54	N.C.	0.000
Las Vegas	2	Diesel engines	Diesel	No	6	(g/kWh)	0.231
Lubu	2	Diesel engines	Diesel	No	4	(g/kWh)	0.242
Lucanten	6	Biomass / Steam	Biomass	Yes	13	N.C.	0.000
Loma Alta	48	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 Quilios	39	Run of the river	Hydro	Yes	262	N.C.	0.000
Los Sauces	3	Diesel engines	Diesel	No	5	(g/kWh)	0.242
Los Ventos TO	125	Open cycle	Diesel	No	381	(g/kWh)	0.255
Matanzas	29	Run of the river	Hydro	Yes	137	N.C.	0.000
Mampal	49	Run of the river	Hydro	Yes	163	N.C.	0.000
Maude	6	Diesel engines	Diesel	No	5	(g/kWh)	0.288
Monte Plata	9	Diesel engines	Diesel	No	17	(g/kWh)	0.282
Nehuenue	368	Combined cycle	Natural Gas	No	0	(m³std/kWh)	0.198
Nehuenue (Open cycle)	250	Open cycle	Diesel	No	0	(g/kWh)	0.000
Nehuenue SB	108	Open cycle	Natural Gas	No	98	(m³std/kWh)	0.236
Nehuenue SB Diesel	108	Open cycle	Diesel	No	137	(g/kWh)	0.292
Nehuenue Diesel	368	Combined cycle	Diesel	No	312	(g/kWh)	0.160
Nehuenue II	368	Combined cycle	Natural Gas	No	0	(m³std/kWh)	0.185
Nehuenue II (Open cycle)	250	Open cycle	Natural Gas	No	0	(m³std/kWh)	0.242
Nehuenue II Diesel	376	Combined cycle	Diesel	No	2,203	(g/kWh)	0.168
Nueva Aldea 1	13	Biomass / Steam	Biomass	Yes	107	N.C.	0.000
Nueva Aldea 2	10	Open cycle	Diesel	No	0	(g/kWh)	0.290
Nueva Aldea 3	20	Biomass / Steam	Biomass	Yes	210	N.C.	0.000
Nueva Aldea 4	379	Combined cycle	Natural Gas	No	1,502	(m³std/kWh)	0.230
Nueva Renca Diesel	379	Combined cycle	Diesel	No	1,502	(g/kWh)	0.176
Others	4	N.A.	Hydro	Yes	4	N.C.	0.000
Pangua	487	Reservoir	Hydro	Yes	1,789	N.C.	0.000
Nehuenue	566	Reservoir	Hydro	Yes	2,754	N.C.	0.000
Petropro	75	Petcoke / Steam	Petcoke	Yes	494	(g/kWh)	0.373
Prechile	77	Run of the river	Hydro	Yes	243	N.C.	0.000
Pitmanque	39	Run of the river	Hydro	Yes	244	N.C.	0.000
Pullique	49	Run of the river	Hydro	Yes	200	N.C.	0.000
Pitmanque	9	Diesel engines	Diesel	No	10	(g/kWh)	0.282
Quailón	14	Run of the river	Hydro	Yes	149	N.C.	0.000
Quailón	5	Diesel engines	Diesel	No	10	(g/kWh)	0.242
Quillico	70	Run of the river	Hydro	Yes	383	N.C.	0.000
Rico	680	Reservoir	Hydro	Yes	2,873	N.C.	0.000
Rapel	378	Reservoir	Hydro	Yes	1,034	N.C.	0.000
Renca	97	Diesel / Steam	Diesel	No	12	(g/kWh)	0.296
Rucay	178	Run of the river	Hydro	Yes	886	N.C.	0.000
S. Fco. Mostaza	26	Open cycle	Diesel	No	33	(g/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	(m³std/kWh)	0.278
San Isidro 2 Diesel	248	Combined cycle	Diesel	No	1,647	(g/kWh)	0.237
San Isidro 2	248	Combined cycle	Natural Gas	No	1	(m³std/kWh)	0.278
San Isidro Diesel	379	Combined cycle	Diesel	No	550	(g/kWh)	0.179
Sauce Andes	1	Run of the river	Hydro	Yes	8	N.C.	0.000
Saizal 50 Hz	77	Run of the river	Hydro	Yes	490	N.C.	0.000
Saizal 60 Hz	77	Run of the river	Hydro	Yes	6	N.C.	0.000
Saizalito	12	Run of the river	Hydro	Yes	86	N.C.	0.000
Talal II (and III)	245	Open cycle	Natural Gas	No	104	(m³std/kWh)	0.331
Talal Diesel	120	Open cycle	Diesel	No	350	(g/kWh)	0.279
Talal II Diesel	120	Open cycle	Diesel	No	603	(g/kWh)	0.270
Traigen	2	Diesel engines	Diesel	No	3	(g/kWh)	0.242
Valdivia	61	Biomass / Steam	Biomass	Yes	219	N.C.	0.000
Ventanas 1	118	Coal / Steam	Coal	No	842	(g/kWh)	0.391
Ventanas 2	220	Coal / Steam	Coal	No	1,634	(g/kWh)	0.373
Victoria	2	Diesel engines	Diesel	No	0	(g/kWh)	0.000
Volcán	13	Run of the river	Hydro	Yes	101	N.C.	0.000
Quelhuas	49	Run of the river	Hydro	Yes	359	N.C.	0.000
Canal	19	Wind	Wind	Yes	31	N.C.	0.000
Palmucho	32	Run of the river	Hydro	Yes	225	N.C.	0.000
Hormas	55	Run of the river	Hydro	Yes	226	N.C.	0.000
Ojos de Agua	9	Run of the river	Hydro	Yes	19	N.C.	0.000
Quilico	2	Open cycle	Diesel	No	26	(g/kWh)	0.225
Piscalia	3	Open cycle	Diesel	No	3	(g/kWh)	0.270
Pucuro	3	Run of the river	Hydro	Yes	33	N.C.	0.000
Quilico	3	Open cycle	Diesel	No	3	(g/kWh)	0.270
Tuboral	3	Open cycle	Diesel	No	3	(g/kWh)	0.270
Chilón	10	Diesel engines	Diesel	No	0	(g/kWh)	0.289
Quailón II	10	Diesel engines	Diesel	No	4	(g/kWh)	0.222
Coya	35	Run of the river	Hydro	Yes	43	N.C.	0.000
Colmito	55	Open cycle	Diesel	No	3	(g/kWh)	0.259
Los Pinos	97	Run of the river	Hydro	Yes	7	(g/kWh)	0.222
Chayaca	3	Diesel engines	Diesel	No	0	(g/kWh)	0.209
Shoebing	3	Diesel engines	Diesel	No	0	(g/kWh)	0.217
Urco	19	Run of the river	Hydro	Yes	27	N.C.	0.000
Cenzas	0	Diesel engines	IFO 180	No	0	(g/kWh)	0.235
Santa Lida	138	Open cycle	Diesel	No	1	(g/kWh)	0.256
TOTAL					41,266		

POWER GENERATION IN 2009

POWER PLANT	POWER OUTPUT	PLANT TYPE	FUEL TYPE	LOW COST	TOTAL GEN	UNITS SPEC.	SPECIFIC CONSUMPTION
Los molles	136	Run of the river	Hydro	Yes	20	N.C.	0.000
Sauce Andes	1	Run of the river	Hydro	Yes	74	N.C.	0.000
Acacagagua	73	Run of the river	Hydro	Yes	493	N.C.	0.000
Los Quilios	39	Run of the river	Hydro	Yes	262	N.C.	0.000
Florida	28	Run of the river	Hydro	Yes	142	N.C.	0.000
Matanzas	29	Run of the river	Hydro	Yes	135	N.C.	0.000
Alfajal	178	Run of the river	Hydro	Yes	893	N.C.	0.000
Quelhuas	49	Run of the river	Hydro	Yes	240	N.C.	0.000
Pitmanque	14	Run of the river	Hydro	Yes	140	N.C.	0.000
Volcan	32	Run of the river	Hydro	Yes	102	N.C.	0.000
Los Morros	4	Run of the river	Hydro	Yes	19	N.C.	0.000
Saizal 50Hz	89	Run of the river	Hydro	Yes	474	N.C.	0.000
Saizal 60Hz	N.A.	Run of the river	Hydro	Yes	0	N.C.	0.000
Saizalito	12	Run of the river	Hydro	Yes	81	N.C.	0.000
Curlingue	89	Run of the river	Hydro	Yes	116	N.C.	0.000
San Ignacio	37	Run of the river	Hydro	Yes	201	N.C.	0.000
Loma Alta	37	Run of the river	Hydro	Yes	271	N.C.	0.000
Rucay	178	Run of the river	Hydro	Yes	1,016	N.C.	0.000
Pullinque	48	Run of the river	Hydro	Yes	220	N.C.	0.000
Pitmanque	39	Run of the river	Hydro	Yes	240	N.C.	0.000
Capillo	12	Run of the river	Hydro	Yes	64	N.C.	0.000
Prechile	77	Run of the river	Hydro	Yes	269	N.C.	0.000
Mampal	49	Run of the river	Hydro	Yes	173	N.C.	0.000
Chacabuco	25	Run of the river	Hydro	Yes	181	N.C.	0.000
Arturo	320	Reservoir	Hydro	Yes	1,819	N.C.	0.000
Arauco	15	Run of the river	Hydro	Yes	364	N.C.	0.000
Isla	68	Run of the river	Hydro	Yes	483	N.C.	0.000
Colbun	589	Reservoir	Hydro	Yes	2,776	N.C.	0.000
Eyzaguirre	2	Run of the river	Hydro	Yes	9	N.C.	0.000
Quillico	70	Run of the river	Hydro	Yes	414	N.C.	0.000
El Rincón	0	Run of the river	Hydro	Yes	21	N.C.	0.000
Chiburga	20	Run of the river	Hydro	Yes	82	N.C.	0.000
Palmucho	32	Run of the river	Hydro	Yes	241	N.C.	0.000
Hormas	55	Run of the river	Hydro	Yes	269	N.C.	0.000
Pucuro	6	Run of the river	Hydro	Yes	41	N.C.	0.000
Ojos de agua	9	Run of the river	Hydro	Yes	37	N.C.	0.000
Coya	35	Run of the river	Hydro	Yes	91	N.C.	0.000
Urco	19	Run of the river	Hydro	Yes	122	N.C.	0.000
EL Manzano	5	Run of the river	Hydro	Yes	26	N.C.	0.000
Yumbay	1	Run of the river	Hydro	Yes	36	N.C.	0.000
Total Trufil	N.A.	Run of the river	Hydro	Yes	0	N.C.	0.000
Talal 2	Open cycle	Diesel	No	125	(g/kWh)	0.275	
Talal 2 Diesel	126	Open cycle	Diesel	No	839	(g/kWh)	0.275
Talal 1	Open cycle	Natural Gas	No	116	(m³std/kWh)	0.330	
Talal 1 Diesel	120	Open cycle	Diesel	No	1108	(g/kWh)	0.275
Talal 2	Open cycle	Diesel	No	116	(m³std/kWh)	0.330	
Guaacilla 1	162	Coal / Steam	Coal	No	1,266	(g/kWh)	0.403
Guaacilla 2	162	Coal / Steam	Coal	No	1,161	(g/kWh)	0.360
Guaacilla 3	162	Coal / Steam	Coal	No	1,266	(g/kWh)	0.403
Guaacilla 4	162	Coal / Steam	Coal	No	1,161	(g/kWh)	0.360
Guaacilla 5	162	Coal / Steam	Coal	No	1,266	(g/kWh)	0.403
Huasco TV	18	Coal / Steam	Coal	No	721	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	0	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal	No	1,007	(g/kWh)	0.360
Huasco TV	18	Coal / Steam	Coal				

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	(tCO₂/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	(tCO₂/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
Curaura	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
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Nueva Aldea Biomass Power Plant Phase 2



BUILD MARGIN CALCULATION, 2009

	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	START OPERATION	CDM PROYECT	TOTAL GEN IN 2009 (GWh)	(tCO ₂ /GWh)
Totoral (édica)	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
Tempopacifico	96.00	Diesel engines	Diesel	2009	No	5.26	760.02
Nueva Ventanas	240.00	Coal / Steam	Coal	2009	No	122.65	1055.10
Trufil Trufil	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	1139.34
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
Multieport I	1.60	Diesel engines	Diesel	2009	No	0.00	747.18
Multieport 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	26.65	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	844.09
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
Chilad	9.00	Diesel engines	Diesel	2008	No	0.69	909.64
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
Chiburo	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
Quileco	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
Curaua	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	979.90
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	126.60	Open cycle	Natural Gas	2005	No	7.32	721.08
Candelaria 2 Diesel	126.60	Open cycle	Diesel	2005	No	26.94	934.27
Nueva Aldea	13.00	Biomass / Steam	Biomass	2005	Yes	0.00	0.00
Antihue 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	3126.43	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	(tCO₂/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	(tCO₂/GWh)	636.74

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