CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

- Title of the project activity: Nueva Aldea Biomass Power Plant Phase 2 (Nueva Aldea Power Plant Phase 2).
- Version number of the document: Version Nº3.
- Date of the document: 05 January 2006.

A.2. Description of the project activity:

The proposed project activity consist 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 will be destined to generate surplus power to the grid.

The project activity is designed to use black liquor[1] (biomass) for steam and electric power generation in a cogeneration power plant located inside a new a new bleached pulp mill site. The project activity is presented by Celulosa Arauco y Constitución S.A. (from now on, Arauco), a leading forestry and pulp-producing company in the world.

The Nueva Aldea Industrial Complex is built in two phases.

Phase 1, that consists in the construction of:

- A sawmill.
- A plywood mill.
- A log processing mill.
- A biomass cogeneration power plant.

Phase 2 that consists in the construction of:

- A new 856,000 tons per year of bleached kraft pulp mill.

Phase 1 of the Nueva Aldea Project also contemplates a new CDM project activity, which consists on a new 30 MW biomass cogeneration power plant. Due to differences in the way the baseline methodology is applied to the project activity in the two Phases and for better clarity reasons, the Nueva Aldea biomass Power Plant Phase 1 is presented separately in another PDD, therefore a description of this project is not done in this PDD.

[1] 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.

Phase 2 of the Nueva Aldea Project contemplates the construction of a pulp mill, which will add approximately 37 MW to the power surplus of 13 MW generated by the Nueva Aldea biomass power plant in Phase 1. 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 electric power to the grid. Considering the higher cost of building a pulp mill with excess electric power capacity, the decision of building such Power Plant relied on the possibility of not relying on the SIC for electric power, on selling excess power to the grid, on supplying electric power to other mills within the Arauco Group and on the potential benefits from being a CDM project activity.

The proposed project activity will assist 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 activity 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 proposed project is a good example to demonstrate the viability of electricity generation as a source of revenue not only to the Pulp mill industry, but 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 far beyond the common practice of the Pulp mill industry in Chile.

A.3. Project participants:

Name of Party involved(*) ((host) indicates a host Party)	Private and / or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes / No)
Chile (Host)	Celulosa Arauco y Constitución S.A.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

Chile ratified the Kyoto Protocol on August 26, 2002.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Chile (South America).

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

VIII Region of Bío-Bío, Province of Ñuble.

A.4.1.3. City/Town/Community etc:

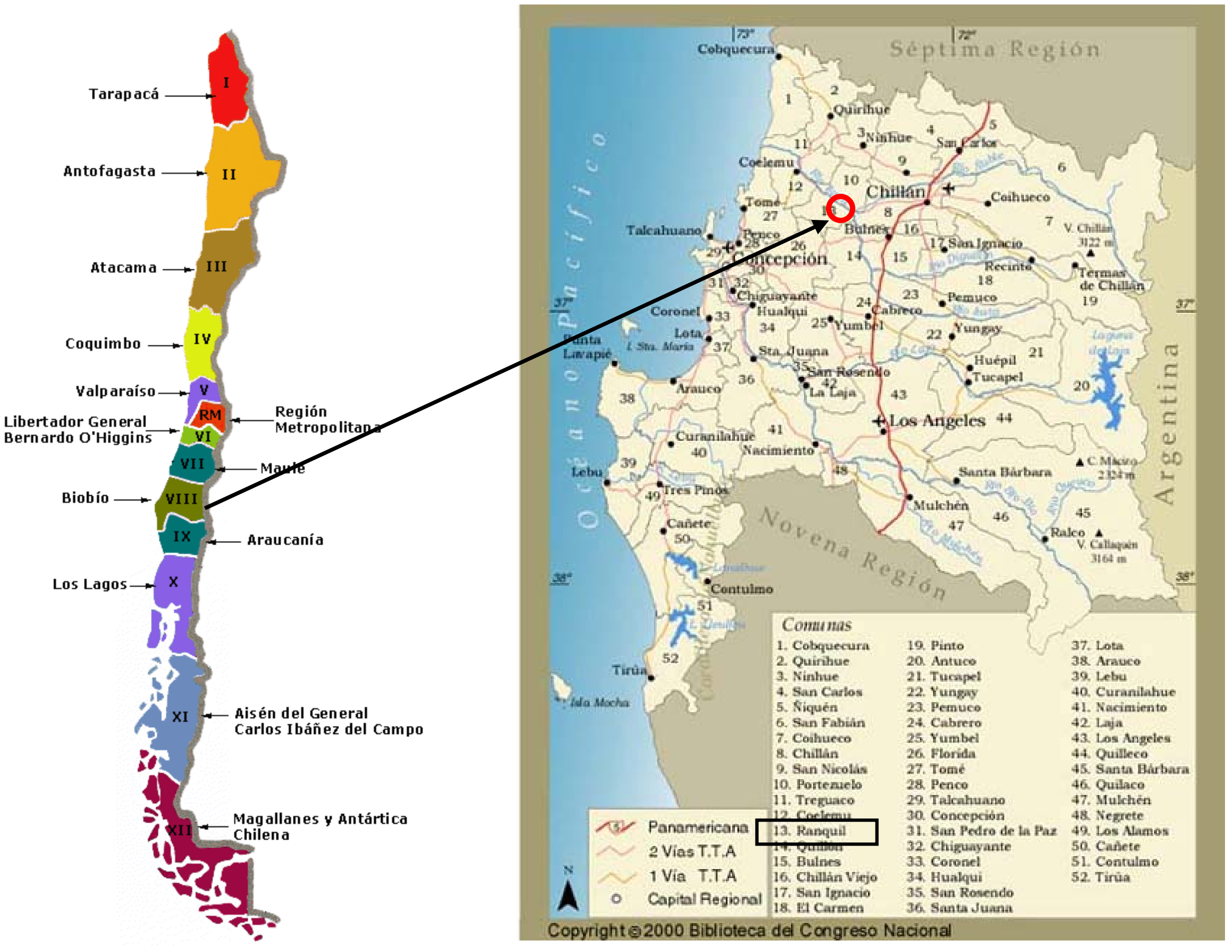
Ránquil (Nueva Aldea area).

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

The proposed project activity is located in the Nueva Aldea Industrial Complex site. The Nueva Aldea Industrial Project is located near the Nueva Aldea community area, Comuna of Ránquil, in the province of Ñuble. It is 30 km. west of the Chillán city and 28 km. Southeast of the Coelemu city in the VIII Region (Bío-Bío Region). The Bío-Bío Region can be directly accessed from Santiago through the 5 Sur or Panamericana Sur highway.

The Bío-Bío Region holds 12,4% of the total Chilean population of 15 million inhabitants, the second most populated after the Metropolitan Region. Its economy relies basically on exports of steel and pulp, wood, fish meal and frozen products.

Figure 1: Geographical location of the Nueva Aldea project activity (Comuna Ránquil).



The overview of the Nueva Aldea Industrial Complex, where the Nueva Aldea Phase 2 project activity is located, is shown in figure 2.

Figure 2: Nueva Aldea Industrial Complex overview

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

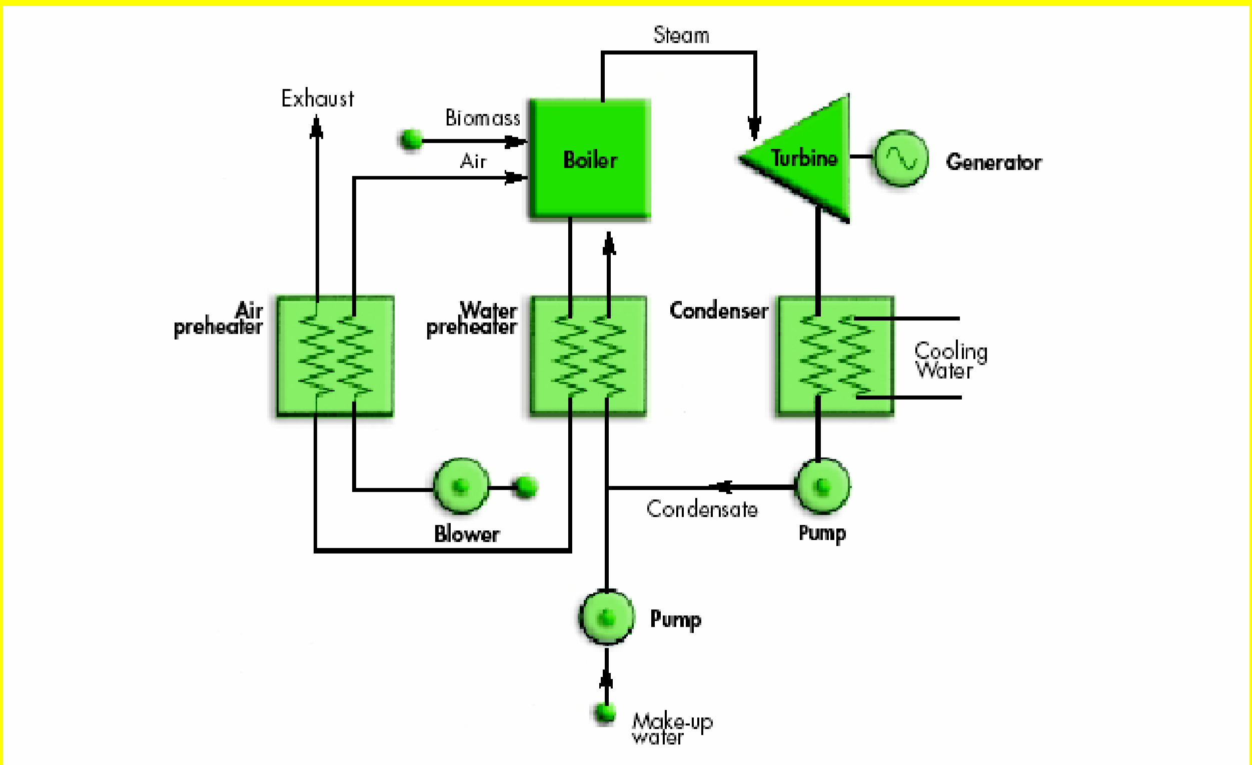
The Nueva Aldea Power Plant Phase 2 is a renewable energy supply side grid-connected project activity, which corresponds to sectoral scope Nº1 of the UNFCCC sectoral scope list for project activities. It involves reduction of emissions of greenhouse gases in the energy sector; more specifically, reduction of GHG emissions sources from fuel combustion in energy industries, according to the list of sector / source categories indicated in Annex A of the Kyoto Protocol.

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

The predominant technology in all parts of the world today for generating megawatt (MW) levels of electricity from biomass is the steam-Rankine cycle, which consists of direct combustion of biomass in a boiler to generate steam, which is then expanded through a turbine. The steam-Rankine technology is a mature technology, having been introduced into commercial use about 100 years ago. Most steam cycle plants are located at industrial sites, where the waste heat from the steam turbine is recovered and used for meeting industrial-process heat needs. Such combined heat and power (CHP), or cogeneration systems provide greater levels of energy services per unit of biomass consumed than systems that generate electric power only.

The steam-Rankine cycle involves heating pressurized water, with the resulting steam expanding to drive a turbine-generator, and then condensing back to water for partial or full recycling to the boiler. A heat exchanger is used in some cases to recover heat from flue gases to preheat combustion air, and a deaerator must be used to remove dissolved oxygen from water before it enters the boiler.

Steam turbines are designed as either "backpressure" or "condensing" turbines. CHP applications typically employ backpressure turbines, wherein steam expands to a pressure that is still substantially above ambient pressure. It leaves the turbine still as a vapor and is sent to satisfy industrial heating needs, where it condenses back to water. It is then partially or fully returned to the boiler. Alternatively, if process steam demands can be met using only a portion of the available steam, a condensing extraction steam turbine (CEST) might be used. This design includes the capability for some steam to be extracted at one or more points along the expansion path for meeting process needs (figure 3). Steam that is not extracted continues to expand to sub-atmospheric pressures, thereby increasing the amount of electricity generated per unit of steam compared to the backpressure turbine. The non-extracted steam is converted back to liquid water in a condenser that utilizes ambient air and/or a cold water source as the coolant.



Source: Williams & Larson, 1993 apud Kartha & Larson, 2000, p. 101.

Figure 3: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine.

Since the Nueva Aldea Power Plant Phase 2 was built in conjunction with the Nueva Aldea Pulp mill, the best way to outline and describe the equipments related to the project activity is to describe how the pulp mill would have been designed if it would have maintained the conventional "business as usual" design, without electric power generation capacity. This changes are outlined in the table below:

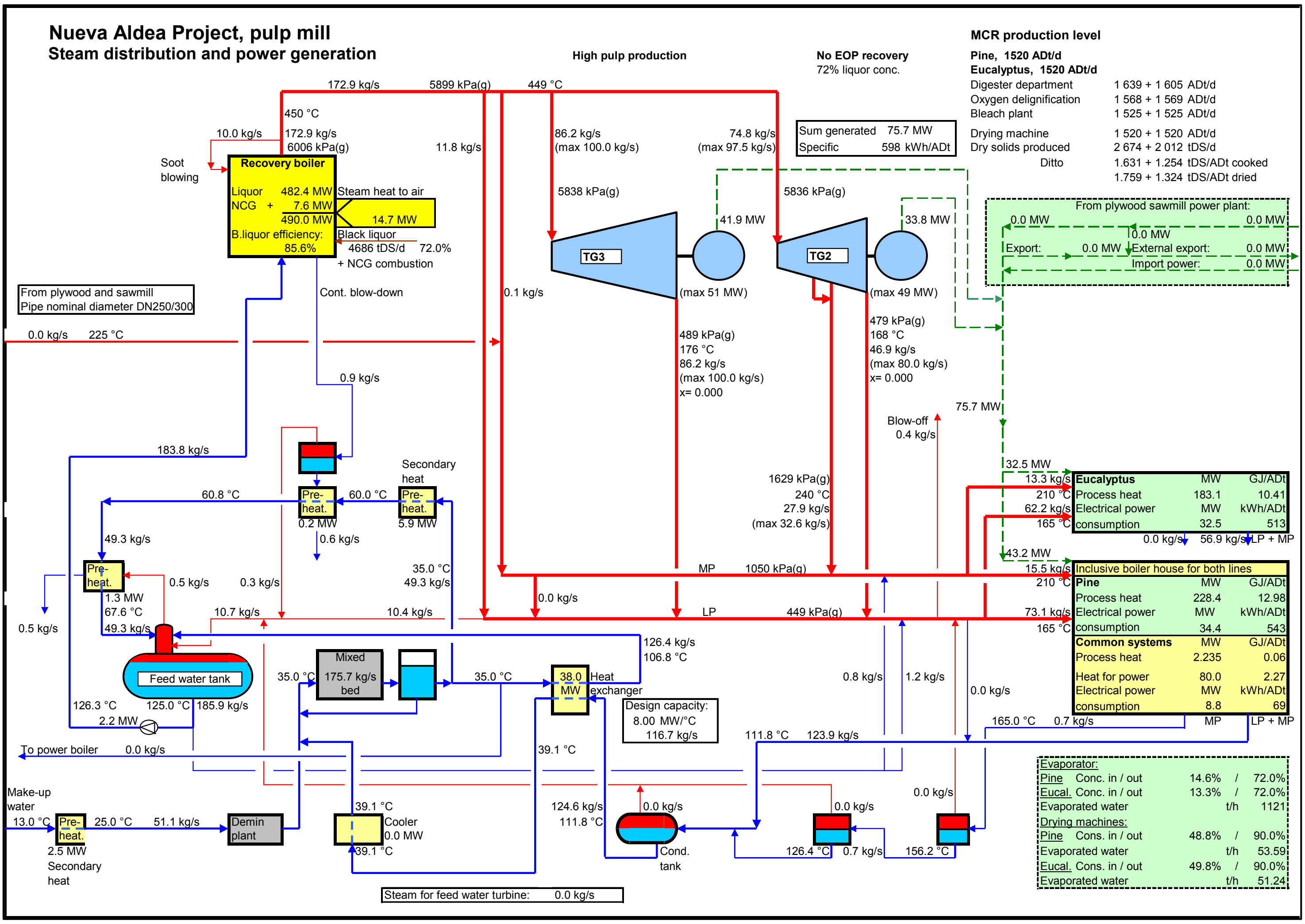
Table 1: Detailed description of the Nueva Aldea Power Plant Phase 2 project activity

Department	Changes
Recovery Boiler	• The recovery boiler would have been designed for the same amount of black liquor to be burned, however the liquor concentration would have been chosen lower, at 72% instead of 80%. • The high-pressure steam data would have been lower, 61 bar(a) 450ºC instead of 85 bar(a) 485ºC. Higher steam data results in a higher investment cost and higher maintenance costs. Lower steam pressure also means less power consumption for the feed water pumps. • The feed water temperature would have been reduced from 135ºC to 125ºC. This would give a smaller and cheaper boiler economizer. The only reason to have a high feed water temperature is to be able to generate more power. • Soot blowing steam would have been taken directly from the boiler and not as extracted steam from a turbine.
Boiler water systems	• The feed water tank would have had the same size, but would have been designed for a lower pressure. • The large heat exchanger to cool the process condensate could be reduced in size, the capacity could be reduced from 8MW/ºC temperature difference to about 6MW/ºC.
Steam Distribution	• Steam is primarily consumed in two pressures, medium pressure MP and low pressure LP. The middle pressure level should be the same also in the baseline case, but the low pressure level would have been selected somewhat higher, 5.5 bar(a) instead of 4.5 bar(a). This would have resulted in less expensive equipment by the consumers, especially the evaporation plant and the drying machine would have needed less heat transfer surface. • Low pressure steam distribution pipes would have been somewhat smaller in size (i.e. less steam carries the same energy).
Turbogenerators	• The real mill is equipped with two 70 MW turbogenerators, one back pressure machine and one condensing machine. Both have extractions to the middle and low pressure systems. In the alternative pulp mill, there would have been no condensing turbine, but two backpressure units. • The size of the turbogenerators would have been smaller, about 2 x 51 MW and middle pressure extraction would have been needed only from one of the units. • In the baseline pulp mill alternative, as there would have not been a condensing machine, there would not have been any condenser

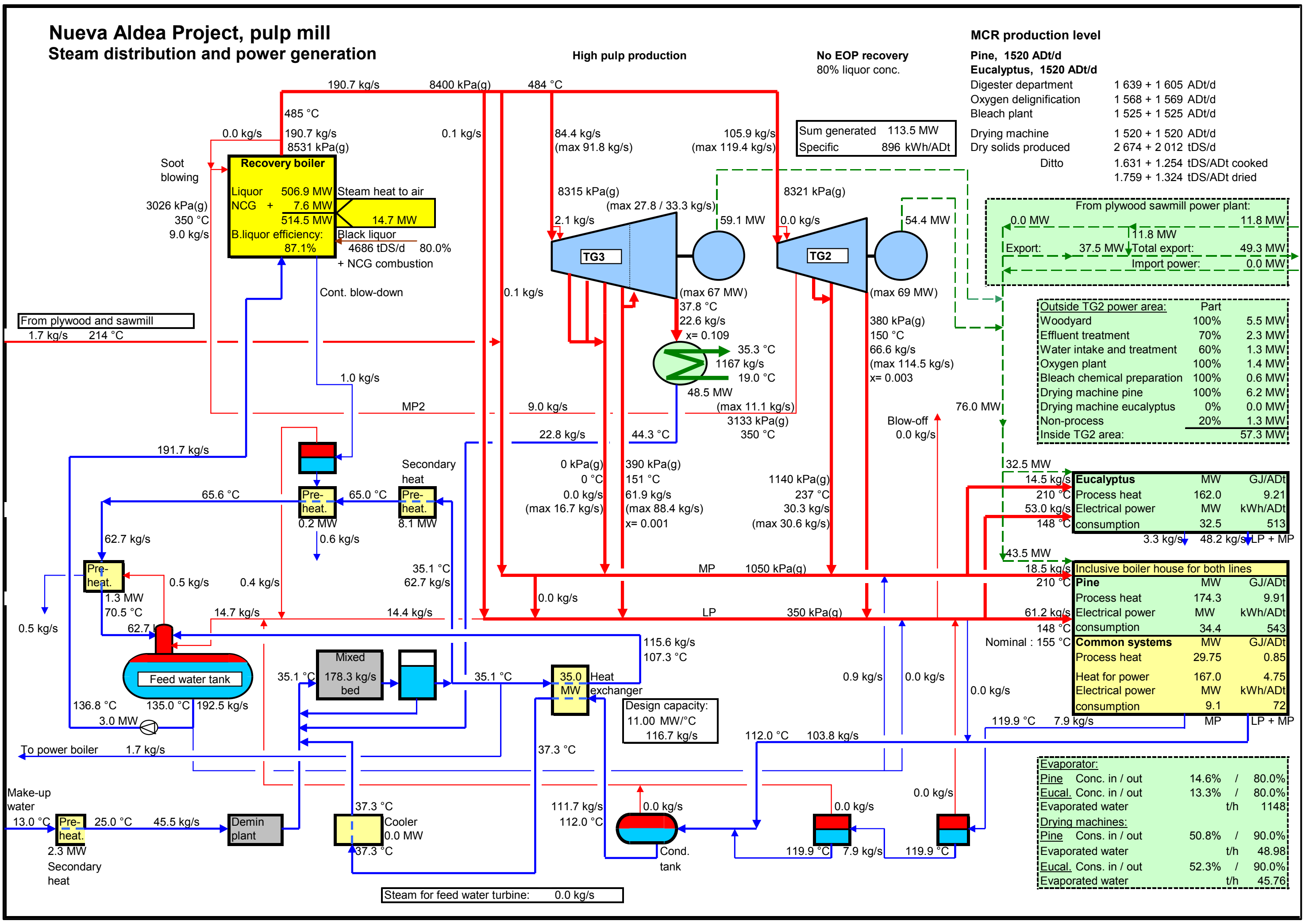
	cooling water system. The size of the cooling tower would have also been considerably reduced. Possible excess of steam would have been blown off as low pressure steam and not condensed.
Evaporator Plant	• The number of effects would have been reduced from 6/7 to 5. This would have reduced the investment cost. • The outlet concentration would have been reduced from 80% to 72%. This would have resulted in a significantly cheaper plant. There would have been no middle pressure steam in the concentrator. • The warm water temperature of 50ºC from the surface condenser would have been reduced to 45ºC to reduce the condenser surface.
Drying Machines	• The drying machines of the real pulp mill are equipped with an expensive shoe press. One main reason for the shoe press is the reduced steam consumption in the dryer, to give more excess steam for condensing power generation. If the electrical power generation would have been reduced, the shoe press would have not been economically justified and would have not been installed. A system without a shoe press would demand a somewhat larger dryer, but the higher low pressure steam would have resulted in a small dryer.
Fibre Line	• The hot water temperature would have been reduced from 85ºC to 80ºC, which would reduce the costs for the heat recovery surface somewhat.
Electrical Systems	• As a result of the lower generation capacity of the baseline pulp mill alternative, it would have been chosen a lower distribution voltage: 13.2KV instead of 15KV. • The total capacity of the electrical system would have been reduced in the alternative case. The capacity of the transformer against the external grid would have been reduced, though still allowing the mill to run without the turbogenerators. • The number of variable speed drives would have been reduced.

As can be seen, the real mill has been designed specifically to be able to generate surplus electric power to the grid.

Nueva Aldea pulp mill configuration without electric power generation capacity



Nueva Aldea pulp mill configuration with electric power generation capacity



A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The Project will reduce anthropogenic GHG emissions by replacing fossil fuel-based electricity with GHG-free biomass CHP power generation. The Project will generate about 878,000 tCO_2eq for the first 7-year crediting period, an average of 125,000 CERs annually.

The Project differs from any of a small number of undertakings hitherto seen in Chile for biomass power generation. While other pulp mills rely mostly on the external grid or small biomass power plants to supplement power deficits, the proposed project activity produces a considerable amount of surplus power from a by-product which is normally used to source thermal and electric energy requirements of pulp mills.

The Project does not quantify any leakage effect related to biomass availability, because the project uses black liquor as the primary fuel source, which is a necessary by product of the Kraft cycle for pulp production. This type of biomass does not generate any form of leakage or fugitive emissions and its amount is determined by the capacity of the facility and the type of pulp the mill produces. These are design parameters that have already been established for the facility, and are independent of the project activity.

Although the most recent modification of the Chilean electric legislation[2] have tried to spur investment in the electric power sector, modifications to the electric legislation introduced in years 1998-1999 and stricter environmental regulations have slowed down investment in the electric industry in the last years. This, together with a relative slow down of the Chilean (and the world's) economy has translated into low investments in new power generation capacity addition in the SIC.

The node price, the price at which all generators sell their power to distribution companies and small customers (less than 0,5 MW) is regulated and fixed by a governmental entity, the CNE[3]. The arrival of cheap natural gas from Argentina during the 90s, marked the development of the SIC capacity towards natural gas combined cycle technology. Since such technology has lower capital costs and shorter payback periods than new hydropower and renewable energy technologies, the private-sector investment criteria favored the combined cycle power plants to other alternatives. This cheaper technology translated into a lower node price signal by the National Authority, making the development of other conventional technologies less attractive and the development of renewable energy technologies very unprofitable and totally unviable. Now, with the recent upturn of the Chilean economy, the lack of investment in the electric power sector will become more evident, which will hopefully contribute to reverse the low trend of investment in the industry.

Despite the better economic perspectives mentioned above; financial, operational and other barriers still represent significant obstacles for the implementation of renewable energy projects in Chile. According to

[2] Short Law I, approved in January 20th, 2004 and Short Law II, approved in May 2005.

[3] CNE stands for "Comisión Nacional de Energía" or National Energy Commission, a public institution that sets the electric power prices for regulated customers

a recent study by the OECD[4], Chile has considerable renewable energy potential, but current barriers and lack of incentives prevent renewable energy sources to become more widely developed. In absence of adequate incentives and national plans, the price levels are simply not compatible (i.e. do not reflect the associated positive externalities) with the diversification of the energy matrix towards more renewable sources. This can be observed in the following table taken from the OECD report:

Energy prices in selected OECD countries, 2002[a]

	Electricity		Oil		Natural Gas	
	Industry (USD/KWh)	Homes (USD/KWh)	Industry (USD/ton)	Homes (USD/000lt)	Industry (USD/10^7Kcal)	Homes (USD/10^7Kcal)
Chile	0.055	0.083	204.6	332.2	216.4	481.3
Canada	..	..	179.2	316.0	125.3	236.2
Mexico	0.056	0.092	117.6	..	122.7	..
France	0.037	0.105	175.6	343.3	171.9	425.6
Poland	0.049	0.084	131.1	356.4	173.1	336.9
Spain	0.048	0.114	184.5	348.4	165.5	496.9
United Kingdom	0.052	0.105	203.1	238.8	146.4	317.0
OECD	0.062[d]	0.102[d]	205.7	364.7	162.0	348.7
Chilean price / OECD price (%)	*87[d]*	*82[d]*	*99*	*91*	*134*	*138.0*
Argentina	0.020	0.035	143.7	215.6	53.0	86.7
Bolivia	0.043	0.055	403.4	327.6	69.9	265.3
Brazil	0.036	0.084	130.3	180.2	98.3	81.2

a) USD = United States dólar at current exchange rate.
b) High sulfur content oil.
c) Light fuel oil.
d) 2001 data.
Source: Latin American Energy Organization; Organization for the Economic Cooperation and Development (OECD); (OIE).

To illustrate the above, during 2004 the Argentinean Government imposed restrictions to its natural gas exports to Chile. As a result, the Chilean national authorities established strong incentives to companies to have diesel as a back-up fuel for their power plants (combined cycles), and decided to reconsider coal and liquefied natural gas as primary energy sources to diversify the energy matrix in Chile. There were also some incentives that favored the development of small (< 20 MW) non-conventional renewable power generation initiatives. As a result, some power plants started operating with diesel and some new coal and liquefied natural gas plants appeared in the expansion plan for the SIC, but no small scale renewable initiatives. This indicates that though the measures for renewable small scale power generation pointed in the right direction, they were clearly not enough to make these type of initiatives a viable option in Chile, as they are in other more developed countries.

An incentive to Arauco, the investor, to pursue this energy sourcing development path is the higher status associated with CDM designation. The proposed project activity will publicly highlight its participant's environmental commitment, in a moment in which the Chilean authorities concern for the environment has become clear and evident. When registered with the CDM Executive Board, the Project will be one of the first CDM projects in Chile. Project participants, particularly Arauco, will also benefit from

[4] OECD Environmental Performance Reviews – Chile, 2005. The Spanish version of this report can be freely downloaded from the CONAMA web page: http://www.conama.cl. CONAMA is the national environmental authority and Chilean DNA.

pioneering the learning experience for the CDM process, opening a new and very attractive option for future project developments, both in Chile and South America.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Chosen crediting period:	Three 7-year crediting periods (21 years)
Years	**Annual estimation of emission reductions in tons of CO_2eq**
2006	92,384
2007	100,721
2008	138,803
2009	167,627
2010	126,144
2011	126,144
2012	126,144
2013	125,424
2014	125,424
2015	125,424
2016	125,424
2017	125,424
2018	125,424
2019	125,424
2020	125,424
2021	125,424
2022	125,424
2023	125,424
2024	125,424
2025	125,424
2026	125,424
Total estimated reductions	**2,633,902**
Total number of crediting years	21
Annual average over the crediting period of estimated reductions (tCO_2eq/yr)	125,424

A.4.5. Public funding of the project activity:

The financial plans for the proposed project activity did not involve public funding. The investment made in Nueva Aldea Industrial Project Phase 2 was financed with Arauco's own resources.

SECTION B. Application of a baseline methodology

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

The name of the approved baseline methodology applied to the project activity is the "Consolidated baseline methodology for grid-connected electricity generation from biomass residues", ACM0006.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The Nueva Aldea Power Plant Phase 2 project activity is a biomass cogeneration power plant which generates electricity and thermal energy[5] from renewable energy sources.

Paragraph 48 of the Marrakesh Accords stipulates that:

"In choosing a baseline methodology for a project activity, project participants shall select from among the following approaches the one deemed most appropriate for the project activity taking into account any guidance by the executive board, and justify the appropriateness of their choice:

a) Existing actual or historical emissions, as applicable; or,
b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 percent of their category".

Since the project activity will serve to reduce emissions from existing emission sources and that biomass is not normally used to generate surplus electric power to the grid, approach a) seems to be the applicable option in selecting the baseline scenario for Nueva Aldea project activity.

According to the chosen baseline methodology, the Nueva Aldea Power Plant Phase 2 fully complies with the applicability criteria:

- The proposed project activity includes the installation of a new power generation plant at a site where currently no power generation occurs. Therefore it is a "power greenfield" project.

Further requirements are also fulfilled by the proposed project activity:

- **No other biomass types than biomass residues are used in the project plant and these biomass residues are the predominant fuel used in the project plant:** The Nueva Aldea Power Plant Phase 2 will source 100% of its biomass requirement from the Nueva Aldea pulping

[5] In this case, the thermal energy is assumed to be part of the baseline scenario, since a pulp mill normally uses biomass to generate thermal energy required in its process.

operation. Occasionally and under very exceptional circumstances, some fossil fuel will be co-fired in the recovery boiler as a back-up fuel.

- **The implementation of the project shall not increase the biomass production in the facility:** The biomass generated in the Nueva Aldea Industrial Complex Phase 2 is absolutely determined by the processing capacity of the pulp mill. This capacity has already been established and will not change due to the implementation of the project activity.

- **The biomass stored at the project facility should not be stored for more than one year:** There is no storage of biomass in the facility, since black liquor is a by-product of the Kraft cycle that is normally burned in the recovery boiler to recover and recycle the inorganic compounds, required in the pulping process.

- **No significant energy quantities, except for transportation for the biomass, is required to prepare the biomass residues for fuel combustion:** This is exactly the case with the Nueva Aldea Power Plant Phase 2 project activity.

B.2. Description of how the methodology is applied in the context of the project activity:

Electricity generation baseline

Within the SIC system, over 60% of the energy produced corresponds to hydro-generated energy. To account for this large portion of low-cost / must run resources, the Project Developer chose to determine the CO_2 emission factor by calculating the Operating and Build Margin coefficients of the SIC grid.

The Operating Margin was calculated using official and publicly available data and adjusted to include some hydropower on the margin. This was done using the Simple Operating Margin calculation methodology with Low-Cost / Must-Run Adjustment method (b) described in the electricity baseline calculation section of the approved methodology for biomass chosen. The Build Margin was also calculated using the same algorithm proposed in the approved methodology. By using a combination of these two emission factors, the Combined Margin, it was possible to estimate the emission factor of the SIC and therefore estimate “what would have happened otherwise”, in terms of GHG emissions.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

The most likely future scenario for the electricity sector in Chile contemplates an increase in the GHG emission factor of the electricity delivered to the SIC grid from an increase in the consumption of fossil fuels, mainly natural gas and coal, in accordance with the deliberate effort of the Chilean government to diversify the nation’s hydro-dominated grid generation capacity towards other cheap energy sources. Therefore, initiatives for producing electricity from a non-GHG emitting source, such as Nueva Aldea Power Plant Phase 2, leads to the avoidance in use or delay in the construction of a fossil-fuel plant with the same capacity as the proposed power plant that would operate in the SIC grid at the margin. In this way, anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the Nueva Aldea Power Plant Phase 2.

To test whether the project is additional or not, the chosen baseline methodology includes the "Tool for the demonstration and assessment of additionality" developed by the Meth Panel and approved by the CDM Executive Board in its 16th meeting. The proposed additionality test consists in a number of requirements the project must fulfill, in order to be considered additional and therefore, not part of the baseline scenario.

As will be shown in the following paragraphs, it is clear that without the incentives derived from the CDM, the benefits generated by the project itself are not enough to overcome the technical, economic and institutional barriers biomass cogeneration projects such as the Nueva Aldea Power Plant face in Chile. Further changes and incentives are still needed in all of these areas to unlock the considerable potential that biomass cogeneration has in Chile.

Step 0: Preliminary screening based on the starting date of the project activity

The Nueva Aldea Power Plant Phase 2 started its construction in 2004 and is currently under construction. Given that the project proponent of the Nueva Aldea Power Plant Phase 2 wishes to have the crediting period starting prior to the registration of the project activity, the following evidence must be provided:

a) Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity:

- The most clear evidence that the starting date of the project activity complies with the above requirements is the date in which the construction of the project actually began. For the Nueva Phase 2 project, the first contract for the installation of the recovery boiler, the evaporators, the turbogenerators and others was signed on July 1st, 2004..

b) Provide evidence that incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and / or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.

- Arauco explicitly considered the postulates and incentives from the CDM in 1999, when Forestal Celco, a subsidiary of Arauco, evaluated and actually implemented a reforestation program in the coastal dry lands in the south part of the country. The company maintained the reforestation program to the point in which it was no longer feasible to continue doing it without the economic incentives of the CDM.

- Arauco also considered the CDM in the implementation of other prior biomass cogeneration initiatives such as the Trupan Power Plant (2001) and the Nueva Aldea Biomass Power Plant Phase 1 (2003). The evidence that supports the biomass cogeneration initiatives of Arauco can be found in some studies carried out by different subsidiaries within the Arauco Group. However, in the last years Arauco has adopted the CDM principles (i.e. sustainable development), as part of its Environmental Corporate Policy and has consistently applied this policy throughout all the areas in which the company participates (forest management, hardboard / MDF / plywood panels, sawmills, pulp, etc.).

- Arauco explicitly mentioned the CDM incentives in the EIS (Environmental Impact Study) of the Nueva Aldea project (Phases 1 and 2). The EIS is an official and public study, that is mandatory by the Chilean Environmental Regulation for all projects of a certain scale in Chile.

- During 2003, and considering the very few (if any) approved methodologies for biomass cogeneration projects suitable for Arauco cogeneration project types, Arauco decided to develop its own CDM competencies, and started to develop a new baseline methodology for its biomass cogeneration projects. The first methodology drafts and calculations are dated June / July 2003. As a result of these developments, Arauco finally presented the first CDM grid-connected baseline methodology for biomass projects in Chile in October 28th 2004, and got the approval of the methodology by the Executive Board by the end of February 2005[6]. The successful development of this methodology demonstrates Arauco serious commitment with the CDM and its intention to continue developing biomass power cogeneration initiatives in the future.

Step 1: Identification of alternatives to the project activity

According to the Consolidated baseline methodology for grid-connected biomass projects chosen for the proposed project activity, realistic and credible alternatives must be separately determined regarding:

- How electric power would be generated in the absence of the CDM project activity.
- For cogeneration projects: how the heat would be generated in the absence of the project activity.
- What would happen to the biomass in the absence of the project activity.

Given that steam and electric power generation for internal consumption is part of the BAU practice in the Pulp mill industry, the proposed project activity only claims emission reductions from on-site surplus power generation that is injected to the grid. Therefore, the project options presented below only correspond to alternative scenarios for surplus electric power generation.

Plausible alternative project scenarios for the Nueva Aldea Power Plant Phase 2 project activity include:

1.1 Conventional self-sufficient pulp mill, without surplus power generation capacity: This is the standard practice in the pulp mill industry in Chile and in the world. The technology for these pulp mills is proven and fully developed. Under this alternative, the pulp mill would be self-sufficient in electric power generation and would have to rely on the external grid for start-ups and other contingencies.

1.2 Conventional self-sufficient pulp mill, with a conventional fossil fuel power unit as back-up: This alternative is similar to the previous one, in that the pulp mill would generate its own power internally, but would back its power requirements with a dedicated gas/diesel power unit. This alternative has three

6 Most of the supporting evidence mentioned here has not been included in this PDD, however the evidence will be made fully available at the validation stage of this project activity.

advantages over the previous one: first, it provides electric power back-up, which can be used under contingencies (i.e. plant stops and maintenances); second, it represents a good business, since the low price of a used / new fossil fuel power back-up units can be rapidly repaid solely on the basis of the firm power revenues (i.e. the unit does not have to operate to repay the investment, just be available to the system); third, it can generate surplus power to the grid when the spot price of electricity is sufficiently high. Arauco has actually implemented this solution in its Arauco mill, where it installed a 25 MW, dual fuel Frame 5 (Horcones power plant) nearby the industrial facility.

1.3 Pulp mill designed to generate additional electric power generation at lower efficiency or at a later stage, not undertaken as a CDM project activity: As the proposed project activity, this is also a possible alternative, however from the project proponent's point of view, such undertaking would not constitute the usual practice in the relevant industry either. It would face similar barriers as the proposed project and therefore, would most likely not happen without the incentives of the CDM. In addition, since the more sophisticated pulp mill would generate additional power based on black liquor, transforming a conventional pulp mill into a net power exporter (on black liquor) at a later stage would be prohibitively expensive[7]. Similarly, a less efficient power producing pulp mill would have slightly lower investment cost than the more efficient counterpart, and would certainly not be able to generate as much surplus electric power as the more efficient mill. This would make the project less attractive from a financial point of view and therefore less viable.

1.4 Conventional pulp mill, but with surplus power generation capacity based on other type of biomass (i.e.: bark): In the pulp mill industry it is usual to have a relatively small bark boiler to supply thermal energy to the pulp mill for start-ups and / or as a supplementary steam source unit. However, installing a larger high-pressure bark or biomass boiler to generate surplus electric power to the grid is not part of the business as usual practice in the pulp mill industry. Such project would face similar barriers as the proposed project activity and, as the previous alternative, would not to happen without the incentives of the CDM either.

1.5 Conventional pulp mill, but with a slight deficit in electric power generation: This is also part of the BAU practice in the pulp mill industry in Chile. In fact, currently there are old and new (under construction) pulp mills that are not self-sufficient in electric power generation. However, given that modern pulp mills tend to be self-sufficient in electric power generation, this alternative does not seem to be a proper (i.e. conservative) baseline scenario for the proposed project activity.

As can be seen, the conventional options presented above are plausible, credible and realistic. Most of them correspond to the BAU practice in the relevant industry. Some of them have even been implemented by Arauco and other competitors in the Pulp mill industry in Chile. They fully comply with the current Chilean environmental regulation, since once the relevant permits are obtained by the corresponding national authorities (CONAMA, COREMA, SNS, etc.) they can operate without any restriction.

Considering the business as usual practice in the Pulp mill industry and the level of feasibility and conservativeness the alternative project must have to be chosen as the baseline scenario, the alternative that most likely and conservatively reflects how the surplus electric power would have been generated if the proposed project activity had not been implemented is the construction of a conventional pulp mill without surplus electric power generation capacity. Such mill would have been self-sufficient in electric and thermal power generation. This more simple pulp mill would have complied with all outstanding

[7] It would imply major changes in key process equipment of the pulp mill. Please see Table 1 in section A.4.3 of this PDD.

legal and environmental regulations in Chile, as the alternative more sophisticated pulp mill currently does. A description as well as a schematic of the alternative pulp mill has already been presented in section A.4.3 of this PDD.

According to Table 1 of the baseline methodology, the baseline scenario that would apply to the proposed project activity is shown below:

Combination of baseline scenarios for the Nueva Aldea Power Plant Phase 2 project activity

Scenario	Project type	Baseline scenario		
		Power generation	Use of biomass	Heat generation
4	Power greenfield projects	P4	B2	H2

Step 2: Investment analysis

Not chosen.

Step 3: Barrier analysis

The Nueva Aldea Phase 2 project activity faces barriers that:

a) Prevent the implementation of this type of proposed project activity; and

b) Do not prevent the implementation of at least one of the alternatives presented in Step 1.

These barriers will be presented and analyzed below.

3.1. Barriers that prevent a wide spread implementation of this activity

Investment barriers: In Chile there is a higher risk exposure for being a big (visible) player in the electric power generation industry. As a member of the CDEC-SIC dispatch center, Arauco is exposed to fines applied to power generators applied by the national authority. According to the law, these fines are applied in proportion to the installed capacity of each electric power company. The problem is that many times (in reality, always), these fines are applied to ALL CDEC-SIC members, regardless of whether a particular company had or did not have anything to do with the system failure (i.e. black-out). In case of Arauco, the company has never been responsible for a system failure, nevertheless it had been finned by the national authority almost every time a system failure had occurred. This higher risk exposure prevent companies whose core business is not power generation, from investing in power cogeneration projects

The higher risk exposure mentioned above constitutes a significant barrier for the execution of the proposed project activity. Particularly considering that Arauco is part of the Angelini Group, a conservative conglomerate in Chile, whose core business is the production of forestry-related products for exports and not the generation and commercialization of electric power. In fact, in the last years the Angelini Group had taken steps oriented more towards a divestiture in the electric power sector. During 2001, the Angelini Group sold Saesa and Frontel, two electric power distribution companies in the IX and X Regions of Chile respectively.

Technological barriers: Though Arauco is a relevant player in the pulp industry in Chile, the Nueva Aldea pulp mill does present some particular features that make the plant special and different from the BAU pulp mill. This is due to the fact that the Nueva Aldea pulp mill was specially designed to generate additional electric power, which implies some modifications and technology improvements over the conventional mill that are not standard in the pulp mill industry.

It must also be noted that much of the engineering and innovations required to build these type of mills must be subcontracted abroad, usually from northern European countries (Finland and Sweden), which are leaders in energy efficiency and renewable (biomass) energy generation technologies. That is clearly in line with the CDM postulates.

Barriers due to the prevailing practice: As previously stated, big-scale surplus electric power generation in a pulp mill does not constitute the normal practice in the Pulp mill industry. As a result, the operation of such a plant requires (additional) qualified personnel, who must know how to respond to both internal electric power demands of the mill and to the daily CDEC-SIC dispatch center programs. This last point is relevant, given that there are very few trained and experienced operators who know how to run a big-scale biomass cogeneration facility and at the same time, are familiar with electric power generation in the SIC in Chile.

Cultural barriers: Arauco's culture in the forestry-related industries is very much influenced by the commodities: wood-products and pulp markets, which differs from the culture in the electric power sector. Unlike forestry products, electric power cannot be stored in order to speculate on price. The Power Purchase Agreements require different negotiation skills, which are not the core competences of Arauco management. For instance, when signing a long-term electricity contract, the PPA, the seller must be confident enough that it will be able to supply the contracted power at a reasonable cost.

Barriers to entry to the electric power industry: Most of the above paragraphs have dealt with barriers related to the Pulp mill industry. However, the proposed project also faces significant barriers in the electric power industry, some of which are mentioned and discussed below:

Unlike some developed countries in which biomass cogeneration receives favorable treatment and incentives (i.e. Finland, Germany, Sweden, etc.), in Chile, when a cogeneration system is not operational due to maintenance, the developer of cogenerated electricity needs to purchase electricity from the grid. A similar situation happens in case of a technical problem, even if it means stopping the cogeneration plant for just 15 minutes (the minimum period in which the electric distributors measure the peak power consumption). In that case, if the cogeneration plant registers peek power consumption during peek power time, the consuming plant not only has to pay for the electricity (MWh) consumed during these periods, but also for the maximum power demand (MW) for the entire billing period. Moreover, while the billing period is monthly, the billing peak demand remains at the maximum demand for 12 months at a time. Thus, if the cogeneration system is not operational even for a short period of time a year, the industrial customer must pay the demand charge all year long.

The coordination with other generating / distribution / transmission companies also constitute another barrier for cogeneration power plants such as the Nueva Aldea Power Plant Phase 2. To be able to sell electric power to the SIC grid and obtain the benefits of a power generating company, Arauco must be part of the CDEC-SIC, the dispatch center for the SIC grid. This constitute an operational barrier, since the cogeneration power plant needs to comply with both internal and external energy requirements, compared to pure power plants units in the system, which only need to coordinate with external CDEC instructions. This duality represents a higher operational complexity for the owner of the cogeneration facility, who cannot tune the power plant to exclusively maximize the return on electric power generation assets.

An argument that reinforces and complements the barrier mentioned above, refers to the fact that in the SIC system, the non-conventional renewable energy technologies represent less than 5% of the total energy generated in the system. In addition, the electric power industry is highly concentrated, with mainly four power companies concentrating over 60% of the total energy generated in the SIC grid. The low share of non-conventional renewable energy technologies, the high leverage of conventional power generators and the insufficient incentives for renewable sources in the electric law make these barriers structural and relatively permanent for prospective non-conventional energy producers and current players such as Arauco.

The coordination with sub-distribution, distribution and transmission companies also becomes more complicated when an industrial facility must not only consumes power from the grid but injects power to the grid. Sometimes the systems to which the cogeneration plant must connect is not capable of handling the additional power injected by the power plant. This implies additional investments (reinforcement of sub-transmission lines and new protection systems), which in some occasions can translate into additional (and costly) startups delays[8].

Despite the regulatory authorities have recently incorporated[9] some measures to promote the use of non-conventional renewable energy sources, the RM17 of 2004 introduced a new algorithm for the firm power calculation for self-power generating companies. This new algorithm introduced a new penalization factor that lowered the firm power for these power producers, which is not present in the calculation of the firm power of conventional power producers. This measure negatively affects biomass cogeneration facilities such as the Nueva Aldea Power Plant Phase 2, given that the cogeneration facility falls under this power plant category.

Finally, at a more macro level, the current regulatory incentives are not enough to make the use of renewable sources more prevalent in Chile. As a result:

- There is a lack of awareness of the multiple benefits of decentralized energy and therefore, the considerable potential to develop micro power plants in the south of the country remains to be exploited. According to several studies, Chile has considerable electric power generation potential in small-hydraulic, wind and biomass renewable sources.
- Regulations for the electric sector are mostly oriented around centralized large-scale and conventional power generation.
- Relatively low price for electricity (node price) does not make the development of non-conventional energy sources economically feasible.

[8] Given that it these additional costs are very hard to anticipate and estimate, they are seldom considered as part of the investment and accounted for in the financial evaluation ex-ante.

[9] Short Law I in March 2004 and Short Law II in May 2005.

- Unlike some European countries who favor this type of power generation technology, there are no national objectives or tax incentives for cogeneration or renewable energy promotion policies in Chile. The current initiatives that have been implemented to give non-conventional renewable power generation a more favorable treatment, still do not reflect all the positive externalities related to these type of technologies, and therefore do not make them financially attractive.

3.2. Barriers that do not prevent a wide spread implementation of at least one baseline scenario alternative

It can be easily shown that none of the barriers mentioned above would prevent the wide implementation of most of the conventional project alternatives mentioned in Step 1, and particularly, of the proposed baseline project scenario.

Investment barriers: Since the proposed baseline scenario for the Nueva Aldea Phase 2 project activity would have used a conventional (business as usual) pulp mill configuration, the facility would have been self-sufficient in thermal and electric power generation and would have not generated additional electric power to the grid. Therefore, there would have been no additional operational risks and the project risk would have not differed from that of the conventional mill in the corresponding industry.

Investment barriers would not prevent other conventional baseline case scenarios either, such as to generate electric power through fossil-fuel power. As was mentioned before, these solutions have actually been implemented by Arauco in other pulp mills.

Technological barriers: The same argument mentioned above applies in this case, since in a conventional pulp mill, there are no additional technological barriers other than the ones normally found in the corresponding industries.

The technological barriers for a conventional power generation alternative would also be minor, since there are plenty of companies and brokers that provide new / used power generation equipment, spares and technical support at competitive prices today.

Barriers due to the prevailing practice: The proposed baseline case scenario, as well as the conventional power generation alternatives presented in Step 1 constitute the common practice in the corresponding industries.

Cultural barriers: There would be no cultural issues with the proposed baseline project scenario or with any of the BAU / conventional alternatives presented in Step 1. There are no barriers in the pulp mill industry that would prevent the utilization of alternative fossil fuel power units for electric power generation other than the ones that could be found in the corresponding industry.

Barriers to entry to the electric power industry: Given that the proposed baseline scenario would not contemplate additional electric power generation capacity, the coordination for power injection with the CDEC-SIC and the transmission, distribution and power companies would not be required, so none of the barriers mentioned before for the project activity would apply. The only coordination the Power Plant would require would be that of any normal client with the electric system, which would be part of the business as usual practice. As for the conventional power generation baseline options, these barriers would exist, however given the nature of the more conventional power generation technology, they would be less restrictive.

Most of the barriers and low incentives for renewable energy sources presented in this section have been addressed by the OECD Environmental Performance Review study for Chile, published early in 2005[10].

Given that the identified barriers do compromise the viability of the proposed project activity and do not affect in any particular way the baseline case scenario, the proposed project activity presents a clear case for additionality from a barrier perspective analysis.

Step 4: Common practice analysis,

4.1 Other activities similar to the proposed project activity in Chile

4.1.1 Arauco initiatives:

Arauco is the only company who has developed biomass cogeneration to the point to become a net energy generator in the SIC. Though Arauco has implemented some previous biomass cogeneration initiatives, the only biomass cogeneration initiative that is relatively comparable to the Nueva Aldea Phase 2 proposed project activity is the Constitución mill. Nevertheless, as will be shown, there are clear distinctions that make the proposed project activity different from the Constitución mill cogeneration initiative.

The Constitución mill: The Constitución mill is a small mill that was designed to produce unbleached Kraft pulp from radiata pine. The mill was originally designed to add a bleaching stage and a paper manufacturing department in the future, so the pulp mill was dimensioned to generate additional power to support these areas. Since these initiatives never materialized, it was decided to use the extra energy generation capacity of the Constitución mill to generate additional electric power to the grid. Despite the concept is similar to the one used by the proposed project activity, the following differences must be noted:

- The scale of the additional power generation capacity is smaller compared to the one of the proposed project activity. In fact, the Constitución mill configuration (recovery boilers, turbogenerators, etc.) did not contemplate additional power generation capacity to the grid.

- The surplus power generation capacity of the Constitución mill is a result of a change in the type of product the mill was supposed to produce (from a more power intensive to a less power intensive product type) rather than a deliberate purpose to generate power to the grid. For this reason, the Constitución mill does not reflect the common practice of the pulp mill industry in terms of energy generation.

[10] Please see pages 19, 59, 63 and 65.

Other Arauco cogeneration initiatives are significantly smaller in scale and rely on a different biomass fuel type making these initiatives not comparable with the proposed project activity.

4.1.2 Other company's initiatives:

There are no other pulp mills in Chile that have been specifically designed to generate surplus electric power to the grid without considering the benefits of the CDM.

A similar cogeneration initiative by another relevant player in the pulp mill industry in Chile includes a biomass (bark) power boiler (150 tvap/hr at 60 bar) that is currently being installed inside a pulp mill facility site. This initiative is mainly oriented towards the generation of steam for a future wood products mill that will be installed near the pulp mill area. It will also provide additional steam to increase the electric generation capacity inside the pulp mill to make it (and other company's interconnected pulp mills in the region) self-sufficient in electric power generation.

As was previously mentioned, today it is a common practice in the pulp industry not to rely in external electric power sources, but to generate all power internally. Older pulp mills were less energy efficient (both in energy consumption and generation capacity) so they were not necessarily self-sufficient in electric power generation.

The rest of the biomass cogeneration initiatives in Chile are definitely not comparable to the proposed project activity, since they are significantly smaller scale than the Nueva Aldea Power Plant Phase 2 (i.e. <50 tvap/hr, saturated or near saturated steam at 45 bar, <10 MW, etc.).

4.2. Analysis of similar options observed in Chile

Other biomass cogeneration initiatives have been presented and discussed in the preceding section. From the project proponent's point of view, these initiatives present clear differences that make the proposed project activity particular and unique in its type. However, even in the case these cogeneration initiatives were considered similar to the proposed project activity, biomass cogeneration would still not be the common practice in any of the industries in which the proposed project activity is involved in:

Electric power industry: The following table shows the biomass power generation situation in the SIC:

		2000	2001	2002	2003	2004
Total power generation (Chile)	(GWh)	39,586	41,286	42,353	45,239	48,871
Biomass power generation in Chile	(GWh)	612	387	374	429	649
Biomass / total generation in Chile	(%)	1.5%	0.9%	0.9%	0.9%	1.3%
Nº of biomass power plants (SIC and in Chile)	(Number)	4	4	4	5	7
Total Number of power plants in the SIC	(Number)	53	50	52	53	63

Source: CDEC-SIC Annual Reports and INE 2003 Energy Annual Report.
Note: Biomass power generation include all type of biomass. 2003 and 2004 include 2 Arauco CDM biomass cogeneration project activities.

From the table above, it is possible to see the low participation of biomass in the total electric power generation in Chile. To reinforce this argument, the last node price report issued by the CNE considered renewable energy sources in new power plants developments for the next 10 years. The proposed plan considered geothermal and new run of the river generating units, but no new biomass capacity whatsoever. This clearly shows that biomass cogeneration capacity is not the common practice in the electric power generation sector in Chile. Unlike developed countries in northern Europe, there is no National Plan in Chile to promote the use of biomass power plants.

Pulp mill industry: Though cogeneration is widely used in the pulp mill industry, and therefore part of the business as usual practice, only modern pulp mills tend to be self-sufficient in thermal and electric power generation. In these mills, all internal thermal and electric power requirements are served by burning black liquor in the recovery boiler (not biomass from forestry operations), which is part of the Kraft process. In some cases, a biomass (bark) power boiler to supplement internal thermal and electric power generation is also considered a normal practice. However, it is not the common practice in Chile (or in the world) that a pulp mill be a net electric power exporter to the grid to which it is connected. Even today there are examples of new pulp mill projects in Chile currently under way that are not self sufficient in electric power generation, and that have to import electric power from the grid.

Other related industries: Sawmills, plywood mills and MDF panel board industry: In all of these industries only low pressure and/or saturated steam is required for their internal processes. These plants are not designed to operate with high pressure steam, so on-site power generation is not considered a normal practice, even for internal power consumption.

According to the analysis above, the following conclusions can be drawn:

- The Nueva Aldea Power Plant Phase 2cogeneration project is one of the first of its type in Chile. Similar cogeneration projects are not observed as conventional initiatives in other pulp mill facilities in Chile.

- Similar biomass cogeneration projects in related industries (i.e. Sawmills, plywood mills and MDF wood panel mills) are equally unique, and therefore, not observed as conventional initiatives either.

For these reasons, the Nueva Aldea Power Plant Phase 2 project activity is not considered to be part of the common practice in the relevant (and comparable) industry (ies), and therefore considered additional from a common practice perspective analysis.

Step 5: Impact of CDM Registration

The approval and registration of the Nueva Aldea Power Plant Phase 2 as a CDM activity will report significant benefits to the Nueva Aldea Industrial Complex. However, these benefits will not only circumscribe to the project activity itself, but also to Arauco for overcoming the associated barriers to carry the proposed project to final completion, and any other company in Chile that decides to follow Arauco's lead in biomass cogeneration in the future.

There are multiple benefits and incentives derived from having this project approved by the CDM Executive Board:

- The project will unquestionably reduce anthropogenic greenhouse emissions by generating electric power via a clean energy source. This demonstrates the constant environmental improvement policy of Arauco, and positions the company as an "environmental friendly" company not only in the Chilean context, but most importantly in the international context. This point is extremely sensitive to Arauco, given that approximately 85% of the company's consolidated annual sales come from exports to countries that have a high consciousness about the environment and the usage of sustainable technologies. The registration of a project by the CDM would acknowledge the effort Arauco is doing by using high-end environmental-friendly technology and would give the company a competitive edge in this field.

- The financial benefit derived from the sale of CERs to Annex I countries is also a strong incentive to develop CDM project activities for Arauco. The additional investment related to a biomass electric power generation capacity is about MMUS$ 15 to MMUS$ 20 (depending on the project context), which is significant. The barriers that must be overcome to implement such project are not minor either and in the long run would translate into a higher operational exposure and ultimately into additional costs. The revenue that would come from the sale of the CERs would contribute to mitigate these extra costs and make CDM projects more attractive not only for Arauco, but also for companies that could benefit from these clean technologies in the future.

- The CDM is a new mechanism that has the potential to promote in an economically efficient way the usage of clean technology. However, given that the system is still at its early beginnings, the transaction costs for developing new project activities are still very high. This makes it very difficult for small companies to use the mechanism to develop new CDM projects. By registering the proposed project activity, it will become easier for other grid-connected renewable energy project to be implemented in the country as they will benefit from Arauco's CDM experience. As was mentioned in a previous section of this PDD, the investment in new power units has been low in the last 5 years. In particular, the investment in new hydro and other renewable units has become less attractive compared to other fossil-fuel options under the current electric industry perspectives. The CDM registration of the proposed project activity would open a new funding possibility for grid-connected renewable energy projects, which are not economically viable under the currently prevailing conditions. Chile has considerable renewable energy potential. It has a world-class forest industry, which can provide abundant biomass fuel for energy generation; it has abundant undeveloped hydroelectric resources in the south and has significant (not yet dimensioned) geothermal resources in the central and south part of the country, which have not been exploited at all. From this perspective, the CDM registration of Nueva Aldea Power Plant Phase 2 would be a positive and powerful signal to potential investors of renewable energy sources in the country.

- Finally, Chile has shown a sound management of its economic policy in the last 20 years, a fact for which it is now recognized as one of the most attractive countries to do business with in Latin America. With the recent approval of free-trade agreements with USA and the European Union, Chile has a very open and world-integrated economy which relies heavily on its exports (40% of its GNP). That makes the Chilean economy very sensitive to external shocks and currency fluctuations. Because of this, the CDM provides an interesting way to mitigate the effects of inflation and exchange rate fluctuation, by opening a new hard-currency cash flow stream possibility that can be used to finance new investment possibilities and to improve their financial performance by curbing the financial risk exposure.

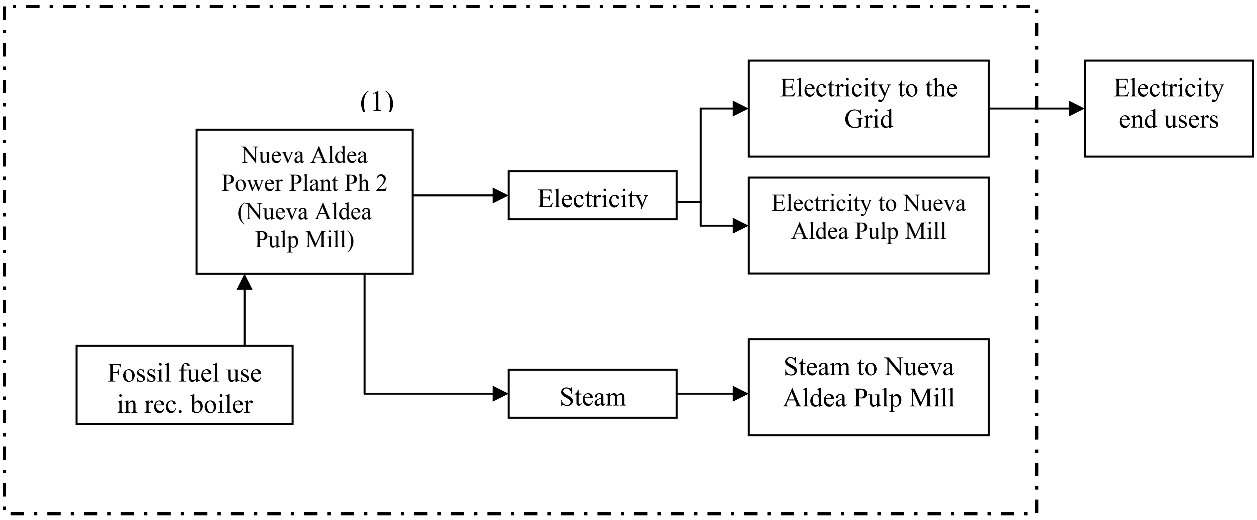
B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The definition of the project boundary related to the baseline methodology is applied to the project activity in the following way:

Baseline energy grid: For the Nueva Aldea Power Plant Phase 2, the SIC grid system in Chile is considered as a boundary, since it is the system to which the new power plant is connected and therefore the one that receives all the biomass-based produced electricity.

Biomass cogeneration plant: The Nueva Aldea Power Plant Phase 2 located in the Nueva Aldea Industrial Complex site is considered as boundary, since it comprises the whole site where the cogeneration facility is located.

For more clarity, the following picture represents the project boundary of the project activity:



Notes:

(1) The dotted lines indicate the Project's boundaries.

Direct on-site emissions for the project activity are:

- CO_2 emissions from fossil fuel co-firing in case surplus power is generated in the pulp mill.

Direct off-site emissions for the project activity are:

- None.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

B.5.1 Date of baseline completion:

24/10/2005.

B.5.2 Name of person / entity determining the baseline:

As stated before, Arauco is the project participant responsible for the technical services related to GHG emission reductions, and is therefore, the entity that determined the baseline.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/07/2004.

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

Minimum of 25 years.

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

C.2.1. Renewable crediting period

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

01/08/2006.

The starting date of the crediting period is defined as the first day of operation of the Nueva Aldea Power Plant Phase 2.

C.2.1.2. Length of the first crediting period:

Seven (7) years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not chosen.

C.2.2.2. Length:

Not chosen.

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

The monitoring methodology applied for this project activity corresponds to the one of the approved baseline methodology for biomass cogeneration plants ACM0006. The name of the applied monitoring methodology is:

"Consolidated monitoring methodology for grid-connected electricity generation from biomass residues"

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

The monitoring methodology, as well as the baseline methodology used for this project activity was originally developed by Arauco for the Trupan Power Plant project activity. The methodology was then consolidated by the Meth Panel into a broader and more flexible methodology, which is now presented as the methodology applied for the proposed project activity.

The chosen monitoring methodology involves, where possible, direct measurements of the variables required to monitor baseline and project emissions. Commercial data is collected and saved for the purpose of verifying the measured data. Where direct measurements are not possible, commercial data is used as the primary data, with an appropriate quality control measure.

The methodology is straightforward and accurate in its approach. By obtaining actual data pertinent to the project activity and by ensuring an appropriate quality control measure for every piece of data collected, it allows for the most accurate calculation of GHG emission reductions associated with the project activity. Where the collection of the relevant data is possible, as is the case for this Project, this approach is the most appropriate.

All data collected as part of the monitoring (baseline, project and leakage emissions), will be archived electronically and be kept at least for 2 years after the end of the last crediting period.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number.	Data variable.	Source of data.	Data unit.	Measured (m), calculated (c) or estimated (e).	Recording Frequency.	Proportion of data to be monitored.	How will the data be archived? (electronic/ paper).	Comment.
1. FF_y	Fossil fuel used in Recovery Boiler.	Pulp Mill's procurement department.	kg	Measured and calculated.	Continuously.	100%	Electronic.	Though fossil fuel consumption in pulp mill recovery boilers is not common, the amount of fossil fuel used in the Recovery Boiler of the Nueva Aldea Pulp Mill will be monitored and the CO_2 emissions from fossil fuel usage will be discounted whenever the mill is generating surplus power to the grid. Otherwise, the consumption of fossil fuel is considered part of the baseline scenario, since it would have been used with or without the implementation of the project activity to back the power generation of the mill.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The anthropogenic emissions by sources of GHGs of the project activity in year *y* ($EM_{P,y}$) can be determined as follows:

$$EM_{P,y} = P_{E1,y}$$

Where:

$EM_{P,y}$: Total project activity emissions (tCO_2/yr).
$P_{E1,y}$: Project emissions from fossil fuel consumption in the Plant's recovery boiler (tCO_2/yr).

D.2.1.2.1 Emissions from fossil fuel consumption in the Power Plant's recovery boiler:

Though the usage of fossil fuels in the Nueva Aldea Pulp Mill recovery boiler is contemplated as a back-up, it is not a common practice since the fossil fuel residues may contaminate the recovery process of the inorganic compounds required in the Kraft cycle. Nevertheless, and to ensure that additional electric power generated at the mill will exclusively correspond to biomass from sustainable forestry operations, the project proponent will monitor the amount of fossil fuel used in the recovery boiler and calculate the emissions derived from fossil fuel usage whenever the pulp mill generates electric power surplus to the grid.

However, if the Pulp Mill is not generating surplus power to the grid, emissions derived from fossil fuel usage in the recovery boiler will not be accounted for, since such emissions would have occurred with or without the implementation of the project activity.

$$P_{E1,y} = \sum_i FF_{i,y} \cdot COEF_{CO2,i}$$

Where:

$P_{E1,y}$: Project emissions from fossil fuel consumption in the Pulp Mill's recovery boiler (tCO_2/yr).
$FF_{i,y}$: Fossil fuel of type *i* used in the recovery boiler related to the project activity (kg/yr).
$COEF_{CO2,i}$: CO_2 emission factor for the fossil fuel of type *i* used in the recovery boiler (tCO_2/kg).

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number.	Data variable.	Source of data.	Data unit.	Measured (m), calculated (c), estimated (e).	Recording Frequency.	Proportion of data to be monitored.	How will the data be archived? (electronic/ paper).	Comment.
2. EG_y (EG_h if dispatch data OM is used)	Net quantity of electricity displaced by the project activity from the grid.	Project proponent (Power plant meters).	MWh	Measured.	Continuously.	100%	Electronic.	EG_y is the net electricity generated by the project activity displaced from the grid. This variable will be checked with the injection to the grid and the internal electric power consumption of the Industrial Complex. These variables will be also monitored and backed with commercial invoices whenever possible.
3. EF_y	CO_2 emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	tCO_2/MWh	Calculated.	Yearly.	100%	Electronic.	Calculated as a weighted sum of the OM and BM emission factors.
4. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	tCO_2/MWh	Calculated.	Yearly.	100%	Electronic.	Calculated as indicated in the chosen baseline methodology.

5. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	tCO_2/MWh	Calculated.	Yearly.	100%	Electronic.	Calculated as indicated in the chosen baseline methodology.
6. $F_{i,y}$	Amount of each fossil fuel consumed by each power source / plant.	Relevant dispatch center, electric power companies' public information and host country official information.	Mass or volume.	Measured.	Yearly.	100%	Electronic.	This information will not be directly measured. It will be obtained from the relevant dispatch center, electric power companies or the latest official statistics publicly available.
7. $COEF_i$	CO_2 emission coefficient of each fuel type i consumed by the electric power generators in the relevant grid.	Relevant dispatch center, electric power companies' public information and host country official information.	tCO_2/ (mass or volume unit).	Measured or calculated.	Yearly.	100%	Electronic.	Plant or country-specific values to calculate $COEF_i$ are preferred to IPCC default values.
8. $GEN_{j/k/n,y}$	Electricity generation of each power source / plant j/k or n.	Relevant dispatch center, electric power companies' public information and host country official information.	MWh/yr	Measured.	Yearly.	100%	Electronic.	This information will not be directly measured. It will be obtained from the relevant dispatch center, electric power companies or the latest official statistics publicly available.

9.	Identification of power source / plant for the OM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text.	Estimated.	Yearly.	100% of set of plants.	Electronic.	Identification of plants (j, k, or n) to calculate the Operating Margin emission factors.
10.	Identification of power source / plant for the BM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text.	Estimated.	Yearly.	100% of set of plants.	Electronic.	Identification of plants (m) to calculate the Build Margin emission factors.
11. λ_y	Fraction of time during which low-cost / must-run sources are on the margin.	Relevant dispatch center, electric power companies' public information and host country official information.	Number.	Calculated.	Yearly.	100%	Electronic.	Factor accounting for number of hours per year during which low-cost / must-run sources are on the margin.
12.a $GEN_{j/k/ll,y\ IMPORTS}$	Electricity imports to the project electricity system.	Relevant dispatch center and host country official information.	KWh	Calculated.	Yearly.	100%	Electronic.	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports. If there are no imports in the relevant system, the monitoring of this variable does not apply.
12.b $COEF_{i,jy\ IMPORTS}$	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur).	Relevant dispatch center, electric power companies' public information and host country official information.	tCO_2/ (mass or volume unit).	Calculated.	Yearly.	100%	Electronic.	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate the coefficients. If there are no imports in the relevant system, the monitoring of this variable does not apply.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Since the baseline scenario is that the current practice continues, i.e., the biomass is burned just to serve the power needs of the Pulp Mill, and not to generate additional electric power to the grid, emission reductions result from the displacement of electric power generated with fossil fuels in the grid. According to this, the baseline emissions for year *y* can be calculated according to the following formula:

$$BL_{E,y} = BL_{E1,y}$$

Where:

$BL_{E,y}$: Total baseline emissions (tCO_2/yr).
$BL_{E1,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).

D.2.1.4.1 Baseline emissions from grid-electricity displacement:

Emission reductions from grid-electricity displacement are achieved through the displacement of electricity generated by the power plants connected to the relevant grid system. The formulae presented here are taken directly from the Consolidated baseline methodology for grid-connected electricity generation from biomass residues, therefore only the basic formulae and algorithms are presented here.

The emission factor for the displaced energy, ($EF_{electricity,y}$), is calculated as a function of the build margin ($EF_{BM,y}$) and the operating margin ($EF_{OM,y}$) emission factor of the corresponding grid system:

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

For the purpose of determining the build margin (BM) and operating margin (OM) emission factors, as described below, a (regional) **project electricity system** is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly, a **connected electricity system**, e.g. national or international, is defined as a (regional) electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

The details for calculating the Operating and Build margins ($EF_{OM,y}$, $EF_{BM,y}$) can be found in the baseline methodology chosen for the proposed project activity.

<u>Calculation of baseline emissions due to displacement of electricity</u>

Baseline emissions due to displacement of electricity are calculated by multiplying the electricity baseline emissions factor ($EF_{electricity,y}$) with the net electricity generation of the project activity.

$$BE_{electricity,y} = EF_{electricity,y} * EG_y$$

Where:

$BE_{electricity,y}$: Baseline emissions due to displacement of electricity during the year y (tCO_2/yr).
$EF_{electricity,y}$: CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year *y* (tCO_2/MWh).
EG_y: Net quantity of electricity generated in the power plant during the year *y* (MWh/yr).

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

This option was not chosen.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

This option was not chosen.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The proposed project activity contemplates the use of the same amount of biomass that would have been used in the baseline scenario. For this reason, the project proponent does not foresee any potential leakage related to the proposed project activity.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

From the equations in sections D.2.1.2, D.2.1.4 and D.2.3.2, the total net emission reductions from the project activity during a given year *y* can be calculated as follows:

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

or

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

or

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

Where:

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

$P_{E4,y}$: Project emissions from fossil fuel consumption in the Recovery Boiler (tCO_2/yr).

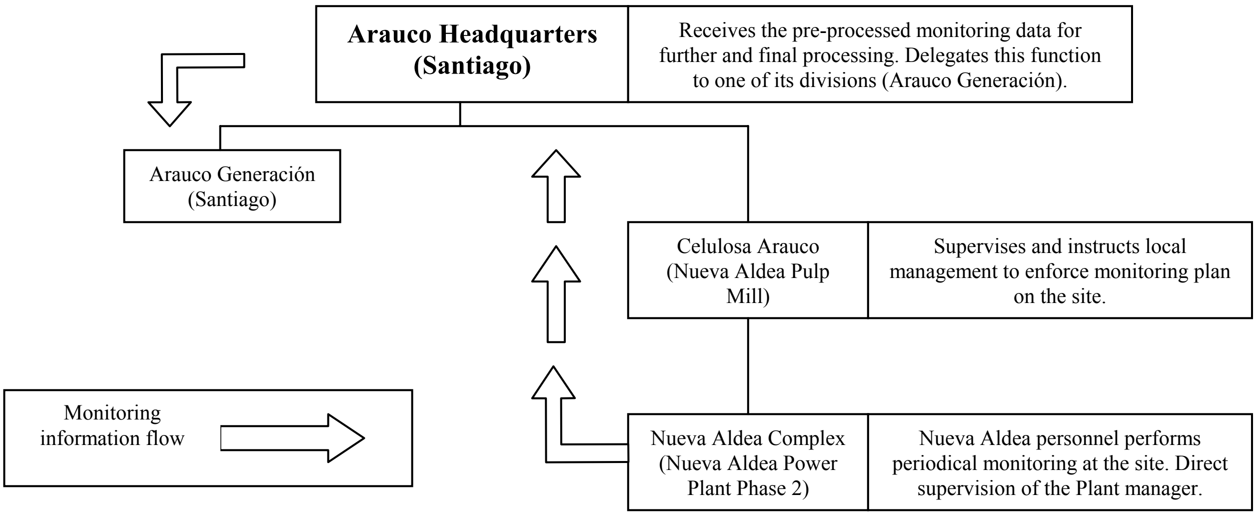
D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	The consistency of metered fuel consumption should be checked with purchase receipts.
2	Low	The electricity meters will undergo maintenance / calibration subject to appropriate industry standards. The accuracy of the meter readings for electricity sold to the grid will be verified by receipts issued by the purchasing power company and / or the corresponding dispatch center. The consistency of metered net electricity generation should be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years).
3,4,5,6,7,8,9,10,11, 12a, 12b	Low	Calculation of the CO_2 emission coefficient for grid electricity involves the use of official data released by the power generating company and / or indirectly by the corresponding dispatch center (if available and possible). Quality control of this data is beyond the control of the project operators. However, if the data are considered unreasonable, they may be replaced by more accurate data according to methods verified by the DOE:

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The project proponent, Arauco, will implement monitoring procedures according to the monitoring methodology chosen for this project activity. This monitoring methodology will account for emission reductions in an accurate and conservative manner.

Arauco counts with on-site personnel (at the project activity site), who will be in charge of gathering and registering all the required information described in the monitoring plan. Such duties will be incorporated to the personnel's everyday activities to ensure continuity and high-quality standards. The information will be partially processed and stored there, and will be sent periodically (monthly) to Arauco Generación S.A. in Santiago for further and final processing (table formats, reports, etc.). With the information at this level, Arauco will be in condition to certify the emission reduction of the Nueva Aldea Power Plant Phase 2 project activity periodically (i.e. once every year).

Monitoring information flow of Nueva Aldea Power Plant Phase 2 project activity



D.5 Name of person/entity determining the monitoring methodology:

Arauco is the project participant responsible for the technical services related to GHG emission reductions, and is therefore, on behalf of Celulosa Arauco, the author of this document, and all its contents. Arauco is, therefore, the entity that determined the methodology proposed in section D of this document.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

According to section D.2.1.2, the anthropogenic emission by sources of GHG of the Nueva Aldea Power Plant Phase 2 project activity in a year *y*, can be determined as follows:

$$EM_{P,y} = P_{E1,y} \qquad (1)$$

Where:

$EM_{P,y}$: Total project activity emissions (tCO_2/yr).
$P_{E1,y}$: Project emissions from fossil fuel consumption in the Pulp Mill's recovery boiler (tCO_2/yr).

As previously indicated in this PDD, fossil fuel will only be used for start-up operations. That is, when the recovery boiler is cold, fossil fuel (diesel or natural gas) is used to reach the steady state combustion temperature. Once this condition is obtained, fossil fuel is totally replaced by black liquor. It is not foreseen that fossil fuel will be used in the recovery boiler on a normal basis to increase electric power output and much less for external power generation. The following considerations can be mentioned to confirm this argument:

- Recovery boilers are especially designed and optimised to operate on black liquor. If fossil fuel is used instead, the boiler efficiency-drop is considerable (i.e. 90% to 20%). This makes it highly uneconomical and inconvenient to generate electric power by means of supplementing and / or replacing biomass with fossil fuels in these type of boilers.

- If fossil fuel is co-fired, the combustion dynamic changes in such a way that a considerable portion of the black liquor residues (which need to be recycled) are expelled with the flue gases. This represents an additional load to the electrostatic precipitators and is uneconomical in terms of the inorganic compounds recovery process.

For these reasons, fossil fuel consumption in the recovery boiler is expected to be zero. Nevertheless and given that fossil fuels can be co-fired with the biomass, they will be monitored and their emissions calculated whenever:

- The pulp mill generates surplus power to the grid and fossil fuel is being co-fired.

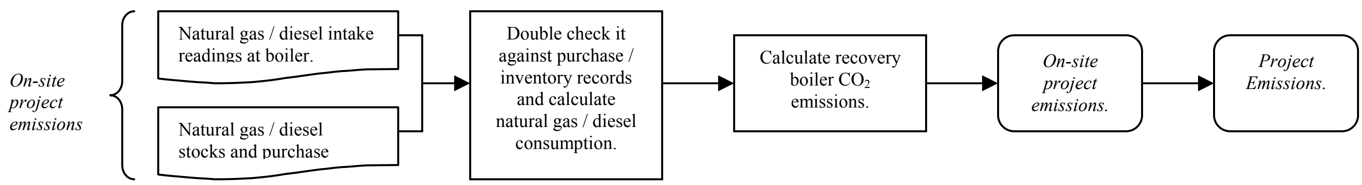
- The fossil fuel co-firing does not correspond to start-up operations.

This calculation will only consider the additional fossil fuel of each type used in the recovery boiler due to the implementation of the project activity. The additional fossil fuel will be determined in the following way:

- All fossil fuel burned in the recovery boiler, whenever the pulp mill is generating surplus electric power. This is conservative, since in some special cases, a fraction of the fossil fuel consumed might be required to supply internal power needs of the pulp mill.
- 0, if the pulp mill is not generating surplus electric power to the grid. Under this condition, the mill would have had to burn fossil fuel with or without the implementation of the project activity to maintain the its operation.

Fossil fuels used for start-up operations of the pulp mill will be considered part of the baseline scenario and thus will not be considered for project emissions. Considering the higher concentration of the black liquor due to the implementation of the project activity, this assumption is conservative.

Summary of estimation process of Nueva Aldea Power Plant Phase 2 project emissions:



E.2. Estimated leakage:

No leakage is anticipated from the implementation of the project activity.

$$L_{Py} = 0 \qquad (2)$$

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Given that no leakage of significance is anticipated, E.3 equals E.1.:

$$Project\ Activity\ Emissions_{\ y} = EM_{P,y} + L_{Py}$$

But from (2):

$$L_{Py} = 0$$

Therefore:

$$Project\ Activity\ Emissions_{\ y} = EM_{P,y}$$

And since:

$$P_{E1,y} = 0$$

Then:

$$Project\ Activity\ Emissions_{\ y} = EM_{P,y} = 0 \qquad (3)$$

The expected emissions from the project activity for each of the three crediting period are zero.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Electricity generation baseline emissions

The proposed baseline methodology considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. In this case, the Nueva Aldea Power Plant Phase 2 is connected to the SIC Chilean grid.

The Central Interconnected System of the Republic of Chile (SIC), is comprised by the transmission systems and the generating Power Plants that operate interconnected from Rada de Paposo in the north (II Region), to Isla Grande de Chiloé in the south (X Region). This system is the largest of the four electric systems that supply energy to the Chilean territory, accounting for about 75% of the power generation capacity in Chile and supplying to approximately 93% of the Chilean population. Despite its long extension (the system is basically a long 220KV double / simple circuit transmission line with some higher capacity and alternative circuits in some segments) the SIC does not present important transmission limitations. This has been further reassured by the "Short Law", which mandates transmission companies to make all necessary investments in transmission every 4 years to ensure and maintain the quality and safety of the transmission service within the system. It must also be said that the SIC has no interconnection with any other interconnected system within Chile or with any other country[11] in the region.

Emission reductions of the proposed project activity are achieved through the displacement of a fossil-fuelled plant at the margin of the SIC grid, with the same capacity of the Nueva Aldea Power Plant Phase 2, and producing electricity with the emissions factor calculated as the chosen methodology describes as the electricity baseline emission factor $EF_{electricity,y}$.:

$$EF_{electricity,y} = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y} \qquad (4)$$

[11] The interconnection between the SIC (center and south of Chile) and the SING (north of Chile) has been a largely debated project, which up to now has proven to be unprofitable and therefore, not viable.

It is therefore necessary to calculate electricity baseline emission factor $EF_{electricity,y}$ of the SIC Chilean grid, which operates independently in Chile, in order to determine the emission reductions to be achieved by the Nueva Aldea Power Plant Phase 2. This implies to calculate the corresponding Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) for the SIC grid to which the Nueva Aldea Power Plant Phase 2 is connected.

Operating Margin emission factor calculation ($EF_{OM,y}$)

The new proposed baseline methodology offers four methods to calculate the Operating Margin emission factor:

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

The chosen methodology suggests that option (c) should be the first choice, however, this PDD will select option (b) for determining the Operating Margin. The reasons for choosing option (b) instead of option (c) are presented below:

- The Dispatch data analysis method requires to monitor the top 10% dispatched plants every hour. Despite the fact that the CDEC-SIC makes a lot of information public, hourly dispatched data is not easily and readily available to third parties (even CDEC members). The information is dispersed, requires considerable processing and has a delay of at least 1 week.

- The dispatch policy of the CDEC-SIC is so dynamic (the top 10% plants changes every minute) that to be accurate enough in the calculation, it would be necessary to monitor the top 10% of dispatched plants in real time instead of in an hourly basis. This introduces uncertainty and complexity to the monitoring procedure and compromises transparency in the OM calculation process.

- To have a better idea of what Dispatch data analysis would imply, the Project Developer decided to simulate the monitoring procedure for one week. The conclusion was that with the current quality of information available, the cost (in man-hours and / or specialized software development) to gather and process all the information required, the viability of the project would be compromised.

- Finally, a simplified dispatch data analysis was simulated (monthly instead of hourly) for an entire year and the results obtained were similar to the results obtained using the simple adjusted OM[12] method. Considering that similar results were obtained with a much more simple, transparent and easy to implement method, it was decided to choose option (b), the Simple adjusted method, to calculate the OM.

[12] The Simple OM method was discarded since the low operating cost / must run resources constitute more than 50% (actually 62% with 2004 figures) of the total grid generation, and the proposed methodology establishes a limit of less than 50% to use the Simple OM.

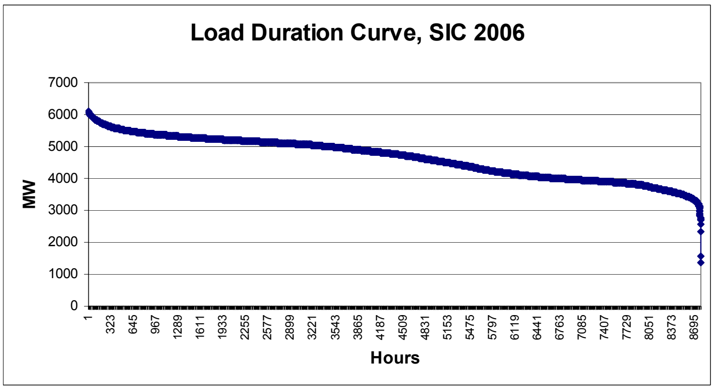
The Simple Adjusted OM method requires to identify low cost must run resources (k) from other power sources (j):

$$EF_{OM,simpleadjusted,y} = (1-\lambda_y)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y\cdot\frac{\sum_{i,k} F_{i,k,y}\cdot COEF_{i,k}}{\sum_k GEN_{k,y}} \quad (5)$$

According to the baseline methodology, it is possible to calculate the Operating Margin using data vintages for year(s) y:

- A 3-year average, based on the most recent statistics available at the time of PDD submission, or
- The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring.

The project proponent will use the second option to calculate the OM; that is, the OM will be calculated the year in which the project generation occurs. For the OM calculation in this PDD, the project proponent will estimate the OM in 2006, based on a realistic estimate of the electric power generation situation for 2006.



Note: The load duration curve for 2006 was estimated from the real 2004 load duration curve.

From the curve above, it is possible to determine the fraction of the year in which low-cost / must-run sources are on the margin for the year 2006:

$$\lambda_y = \lambda_{2006} = 0.001$$

$$\lambda_{2006} = 0.001$$

The rest of the parameters of equation (5), were calculated as follows for the year 2006:

$$\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j} = 10{,}838{,}120 (tCO_2 / yr)$$

- The Plant emission factors for the operating units in the SIC was calculated using information obtained directly from the CDEC-SIC (official and public information) and the Power Plants themselves (the power plant owner's web page). In the few cases the information was not available, the calculation used the default IPCC values from the IPCC 1996 Revised Guidelines and the IPCC Good Practice Guidance.

- The calculation corresponds to the emissions of power sources (not including low-cost / must-run resources) estimated for year 2006.

$$\sum_{j} GEN_{j,y} = 15{,}722 (GWh / yr)$$

- The information was obtained directly from the CDEC-SIC (official and public information).

- The calculation corresponds to the total energy generated in the SIC grid minus low-cost / must-run resources estimated for the year 2006.

$$\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k} = 0 (tCO_2 / yr)$$

- Since in Chile low operating cost and must-run resources include only hydraulic energy and very few biomass plants, the total emissions for this part of the equation are zero.

$$\sum_{k} GEN_{k,y} = 24{,}398 (GWh / yr)$$

- The information was obtained directly from the CDEC-SIC (official and public information).

- The calculation corresponds to the energy generated in the SIC grid of low-cost / must-run resources estimated for the year 2006.

Replacing the above values in equation (5), the operating margin results:

$$EF_{OM,simpleadjusted,y} = (1-0.001)\cdot\frac{10,838,120}{15,722} + 0.001\cdot\frac{0}{24,398} = 688.68(tCO_2 / GWh)$$

$$EF_{OM,simpleadjusted,y} = 688.68(tCO_2 / GWh)$$

Build Margin emission factor calculation ($EF_{BM,y}$)

According to the methodology, there are two options to calculate the Build Margin. Option 1, in which the Build Margin is calculated ex-ante for the first crediting period and Option 2, in which the Build Margin is calculated ex-post during the first crediting period. For subsequent periods, the project proponent must calculate the Build Margin ex-ante, as stated in Option 1.

In each of these options, the Project Proponent must select a sample group of m power plant that comprises the larger annual generation from either:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise the 20% of the system generation (in MWh) and that have been built most recently.

For this project activity, the project proponent will choose Option 2; that is, the project proponent will monitor the Build Margin ex-post for the first crediting period. For subsequent periods, the Build Margin will be calculated ex-ante.

According to 2006 projections in the power sector, the most likely group of plants that will account for the largest generation in 2006 will be the last ones built and responsible for the 20% of the (projected) total generation in 2006. These plants will then be considered to calculate (estimate) the Build Margin for 2006:

$$EF_{BM,y} = 248.76(tCO_2 / GWh)$$

As in the Operating Margin calculation case, the Build Margin calculation also considered official CDEC-SIC data and / or other official data if available. In cases data was not available, IPCC default factors were used.

Having obtained both $EF_{OM,y}$ and $EF_{BM,y}$, and assuming the default values (0.5) for the weights w_{OM} and w_{BM} established in the proposed methodology, it is possible to calculate $EF_{electricity,y}$ from the equation (4):

$$EF_{electricity,y} = 0.5*688.68 + 0.5*248.76 = 468.72\ (tCO_2/GWh)$$

Using the value of the electricity baseline emission factor $EF_{electricity,y}$ calculated above and the expected electric energy to be produced by the Nueva Aldea Power Plant Phase 2, the total grid emission reductions can be calculated as follows:

Data/estimates:

(1) Combined margin for the SIC grid	468.72 (tCO_2/GWh)
(2) Net electric power output	37.5 (MW)
(3) Average load factor for energy export to the grid[13]	80.0%

Calculations:

(4) Total energy displaced from the grid	(2)*(3)*8,760 (hr/yr)/1,000 (GWh/MWh)	262.8 GWh/yr
(5) Total grid emission savings	**(1)*(4)**	**123,179 tCO_2/yr**

Baseline emission summary

The following flowchart summarizes the process of baseline emissions estimation, while the table below shows the total baseline emission savings.

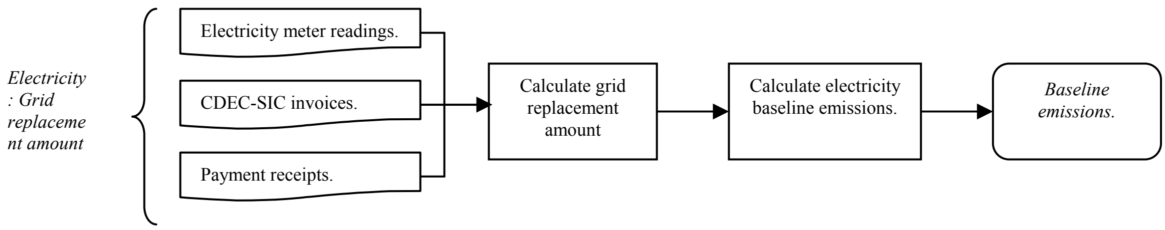


Table Nº 4: Nueva Aldea Phase 2 project activity total baseline emission savings

		Year $_y$
Grid emission savings	(tCO_2/yr)	123,179
Total baseline emission savings	**(tCO_2/yr)**	**123,179**

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The proposed project activity is expected to achieve 878,000[14] tCO_2eq of net emission reductions during the first 7-year crediting period.

[13] Average load factors were calculated using official CDEC-SIC data and Nueva Aldea data.

Table Nº 5: Nueva Aldea Phase 2 project activity net emission savings

		Year $_y$
Total baseline emissions savings	(tCO_2/yr)	123,179
Total project emissions	(tCO_2/yr)	0
NET EMISSION SAVINGS PER YEAR	**(tCO_2/yr)**	**123,179**

Note: In this case, year *y* corresponds to 2006 emission reduction savings, assuming steady-state operation parameters.

E.6. Table providing values obtained when applying formulae above:

Table Nº 6: GHG emission reductions by sources of Nueva Aldea Phase 2 project activity

Years	Estimation of project activity emission reductions in tons of CO_2 eq	Estimation of baseline emission reductions in tons of CO_2 eq	Estimation of leakage in tons of CO_2 eq	Estimation of project activity emissions in tons of CO_2 eq
2006	92,384	92,384	0	0
2007	100,721	100,721	0	0
2008	138,803	138,803	0	0
2009	167,627	167,627	0	0
2010	126,144	126,144	0	0
2011	126,144	126,144	0	0
2012	126,144	126,144	0	0
2013	125,424	125,424	0	0
2014	125,424	125,424	0	0
2015	125,424	125,424	0	0
2016	125,424	125,424	0	0
2017	125,424	125,424	0	0
2018	125,424	125,424	0	0
2019	125,424	125,424	0	0
2020	125,424	125,424	0	0
2021	125,424	125,424	0	0
2022	125,424	125,424	0	0
2023	125,424	125,424	0	0
2024	125,424	125,424	0	0
2025	125,424	125,424	0	0
2026	125,424	125,424	0	0
Total 3 cred. periods	**2,633,902**	**2,633,902**	**0**	**0**
Total 1st cred. period	**877,967**	**877,967**	**0**	**0**

SECTION F. Environmental impacts

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

The impacts of the project that were identified in the EIS are the following:

- **Solid and Liquid Wastes:** The operation of the Plant will generate sewage water that will be treated in a Sewage treatment Plant in accordance with the Chilean regulations. The Project will consume all the biomass that will be generated by the Plant. Very low amounts of residues, like

[14] This estimation considers an OM and BM projection for the first 7-year crediting period.

ashes, plastics and other industrial waste will be send to a landfill, also according with the Chilean regulations. Pulp mill effluents will receive tertiary treatment, which is the most thorough and effective treatment for pulp mill effluents in the world today.

- **Atmospheric emissions:** The emissions are related to noise and particulate material. Both of them are treated with state of art technology that put them below the emission limit factor required by the Chilean regulations.

All those impacts were mentioned and resolved during the environmental impact assessment procedure.

All these statements are confirmed by the endorsement of the project given by the Designated National Authority (CONAMA), in its Host country approval process. In that instance the DNA reviewed all the different environmental permits related to the project and found them to be in accordance with all national environmental regulations.

No transboundary impacts are considered for this Project.

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

The project complies with the specific applicable regulations of the host country in regard to Environment Impact Assessment (EIA). The EIA follows the regulations for EIA System set in Chile by the Supreme Decree N 30/97 of the Ministry General Secretariat of the Presidency, Regulation for the Environmental Impact Assessment System and its modifications set in Supreme Decree N 95/2001, and the Act N 19300 on the Environmental Framework.

The Plant in which the project is located submitted and Environmental Impact Study (EIS) in order to comply with the Chilean regulation.

The EIS was presented originally in March 17, 1999 and approved in January 26, 2001 by Resolution N° 9/2001. Due to some changes in the Project concept, the Plant submitted a new EIA in August 30, 2004 which was approved in March 10, 2005 by Resolution N° 76/2005.

As stated previously, the Plant were the CDM Project activity is located went through the Environmental Impact Assessment procedure successfully receiving all the corresponding authorizations in order to operate in accordance with the environmental legislation.

SECTION G. Stakeholders' comments

Apart from the legal requirements imposed by the Environmental Impact System procedure, such as, publications in local newspapers and community meetings, the company decided to invest a lot of effort, money and hours in order to explain to the local authorities and to the local community the characteristics of the Project.

The Stakeholders involvement was organized through the following channels:

1. Technical staff of the Company met with local community and authorities in order to discuss all the technical aspects of the Project: this was done with the community of Coelemu and Ranquil. The conclusions of those meetings were compiled in a document that were distributed to the communities and local authorities.

2. Meetings with the communities of Ranquil, Coelemu, Trehuaco and Quillon and the management of the Company: the meetings were announced through leaflets send to each house and announcements in local radios. Again the conclusions of those meetings were distributed to all stakeholders.

3. Visits to the Construction site: representatives of the different communities and local authorities were invited to visit the construction site.

4. The Project was also announced in different CDM seminars in Chile.

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

As stated above all comments were compiled in documents that were distributed back to all stakeholders. All those comments were taken into account and accommodated in accordance with the characteristics of the project and the local authorities requests.

G.2. Summary of the comments received:

The comments related to the project activity were related to the emissions of the project and waste management.

For the emissions issue, the company emphasized their commitments to comply with all the requirements imposed by the local authorities.

All other technical and environmental aspects were resolved at the EIS and approved by the environmental authorities.

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

All clarifications done by the authorities were clarified and incorporated in due time. This allowed the environmental approval of the project, as stated in Section F and G.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	CELULOSA ARAUCO Y CONSTITUCIÓN S.A.
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Represented by:	
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Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Public Funding:

The financial plans for the Project do not involve public funding.

Annex 3

BASELINE INFORMATION

BASELINE DATA OF NUEVA ALDEA POWER PLANT PHASE 2

BASELINE SIC-GRID DATA

(SOURCES: CDEC-SIC/CNE)

POWER PLANT	POWER OUTPUT (MW)	PLANT TYPE	(ENERGY IN GWh) 2005	2006
Abanico	136.0	Run of the river	324.0	338.8
Aconcagua	72.9	Run of the river	424.0	438.9
Alfalfal	178.0	Run of the river	854.3	895.2
Antilhue	100.0	Open cycle	0.0	0.0
Antilhue new	47.0	Open cycle	15.5	29.5
Antuco	320.0	Reservoir	1,711.0	1,529.4
Arauco	33.0	Biomass / Steam	63.5	85.9
Bocamina	128.0	Coal / Steam	710.7	681.1
Bocamina TG	23.6	Open cycle	0.0	0.0
Cabrero	260.0	Open cycle	0.0	0.0
Candelaria (Open cycle)	250.0	Open cycle	5.4	66.6
Canutillar	172.0	Reservoir	1,002.5	1,076.6
Capullo	12.0	Run of the river	64.9	61.4
Celco	20.0	Biomass / Steam	90.2	98.8
Chacabuquito	25.0	Run of the river	164.1	168.4
Cholguán	13.0	Biomass / Steam	83.7	86.2
Cipreses	105.9	Reservoir	421.5	462.2
Colbún+Mach	569.0	Reservoir	2,733.6	3,039.5
Constitución	8.7	Biomass / Steam	59.0	59.4
Curillinque	89.0	Run of the river	565.9	591.0
D. de Almagro	23.8	Open cycle	0.5	1.2
El Indio TG	12.0	Open cycle	0.0	0.0
El Toro	450.0	Reservoir	1,743.4	994.1
Florida	28.0	Run of the river	120.2	121.0
Guacolda I	152.0	Coal / Steam	1,154.1	1,079.0
Guacolda II	152.0	Coal / Steam	1,154.9	1,072.0
Horcones TG	24.3	Open cycle	47.3	69.7
Huasco TG Diesel	58.0	Open cycle	0.0	0.0
Huasco TG IFO	58.0	Open cycle	0.9	0.8
Huasco TV	16.0	Coal / Steam	1.7	7.4
Isla	68.0	Run of the river	449.9	473.9
Itata	13.0	Biomass / Steam	67.7	90.2
L. Verde TG	17.0	Open cycle	2.3	9.2
L. Verde TV	49.0	Coal / Steam	47.0	32.2
Laja	8.7	Biomass / Steam	52.4	59.4
Licantén	5.5	Biomass / Steam	22.6	24.0
Loma Alta	40.0	Run of the river	251.0	263.3
Los Molles	18.0	Run of the river	46.3	53.8
Los Quilos	39.3	Run of the river	256.1	260.3
Los Robles	72.0	Open cycle	0.0	0.0
Maitenes	29.0	Run of the river	126.1	127.0
Mampil	49.0	Run of the river	172.1	194.9
Nehuenco	368.4	Combined cycle	453.5	661.2
Nehuenco (Open cycle)	250.0	Open cycle	15.7	86.6
Nehuenco 9B	108.0	Open cycle	9.5	13.8
Nehuenco 9B Diesel	108.0	Open cycle	0.0	0.3
Nehuenco Diesel	368.4	Combined cycle	108.4	188.6
Nehuenco II	390.4	Combined cycle	2,998.9	3,014.0
Nehuenco II (Open cycle)	250.0	Open cycle	0.0	0.0
Nueva Renca	379.0	Combined cycle	2,165.8	2,464.7
Nueva Renca Diesel	379.0	Combined cycle	415.3	518.8
P. de Azúcar	156.0	Open cycle	0.0	0.0
Pangue	467.0	Reservoir	1,937.3	2,211.9
Pehuenche	566.0	Reservoir	2,624.1	2,873.1
Petropower	75.0	Petcoke / Steam	426.9	450.3
Peuchén	77.0	Run of the river	290.8	331.9
Pilmaiquén	39.0	Run of the river	260.1	260.6
Pullinque	48.0	Run of the river	229.7	232.3
Puntilla	14.0	Run of the river	115.8	116.1
Ralco	690.0	Reservoir	2,703.6	3,085.8
Rapel	378.0	Reservoir	943.7	1,079.8
Renca	97.0	Diesel / Steam	0.0	5.6
Rucúe	178.4	Run of the river	1,033.3	944.4
S. Fco. Mostazal	25.7	Open cycle	1.9	11.1
Saesa TG	50.0	Open cycle	264.3	357.5
San Antonio	156.0	Open cycle	0.0	0.0
San Ignacio	37.0	Run of the river	204.5	230.1
San Isidro	379.0	Combined cycle	951.2	764.6
San Isidro Diesel	379.0	Combined cycle	356.0	467.6
San Pedro	68.0	Open cycle	0.0	0.0
Sauz+Szito	88.8	Run of the river	521.0	520.9
Taltal (I and II)	244.9	Open cycle	930.6	1,020.5
Taltal II Diesel	120.0	Open cycle	0.0	0.0
Valdivia	61.0	Biomass / Steam	269.7	349.0
Ventanas 1	120.0	Coal / Steam	482.1	542.9
Ventanas 2	220.0	Coal / Steam	1,237.5	1,084.9
Volcán+Queltehues	62.6	Run of the river	447.9	454.1
Others	4.1	N.A.	12.8	16.9
COYA	25.0	Run of the river	0.0	97.2
SAN IGNACIO TG	18.0	Open cycle	0.0	6.7
CAMPANARIO CA	260.0	Open cycle	0.0	0.0
CAMPANARIO DIESEL	260.0	Open cycle	643.5	1,013.5
TOTAL			**38,065.8**	**40,119.6**

SIC GRID FOSSIL FUEL CO_2 EMISSION DATA

COAL, BOCAMINA

Net calorific value	(TJ / 000 ton)	26.0
Carbon content	(tC / TJ)	25.8

COAL, HUASCO

Net calorific value	(TJ / 000 ton)	25.2
Carbon content	(tC / TJ)	25.8

COAL, VENTANAS, RENCA AND L.VERDE

Net calorific value	(TJ / 000 ton)	25.7
Carbon content	(tC / TJ)	25.8

COAL, GUACOLDA

Net calorific value	(TJ / 000 ton)	25.3
Carbon content	(tC / TJ)	26.0

PETCOKE, GUACOLDA AND PETROPOWER

Net calorific value	(TJ / 000 ton)	31.2
Carbon content	(tC / TJ)	27.5

DIESEL

Net calorific value	(TJ / 000 ton)	42.7
Carbon content	(tC / TJ)	20.2

IFO 180 (RESIDUAL OIL)

Net calorific value	(TJ / 000 ton)	40.2
Carbon content	(tC / TJ)	21.1

NATURAL GAS

Net calorific value	(TJ / MM m3)	35.8
Carbon content	(tC / TJ)	15.3

Sources:
- Direct company information.
- Revised 1996 IPCC Guidelines for national greenhouse gases.
- CNE node price reports.
- Arauco Generación
- Local fuel distribution companies.

OPERATING MARGIN CALCULATION

		2005	2006
Total emissions from non-low cost / must run power plant:	(tCO_2/yr)	10,072,207	10,838,120
Total emissions from low-cost / must-run power plants	(tCO_2/yr)	0	0
Total energy generated in the SIC	(GWh/yr)	38,066	40,120
Total energy by non-Low cost / must run power plants	(GWh/yr)	14,601	15,722
Total energy by low cost / must run power plants	(GWh/yr)	23,464	24,398
Factor λ	(number)	0.0010	0.0010
Operating Margin	**(tCO_2/GWh)**	**689.12**	**688.68**

Notes:
- Low cost / must run units present no GHG emissions, since they are basically hydro plants and very few biomass pl:
- Lambda factor is almost 0 for these years.

BUILD MARGIN CALCULATION THE YEAR THE EMISSION ABATEMENT OCCUR FOR THE 1st CREDITING PERIOD

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

	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	START OPERATION	TOTAL GEN IN 2005 (GWh)	TOTAL GEN IN 2006 (GWh)	(tCO_2/GWh)	LOAD FACTOR
QUILLECO	70.0	Run of the river	Hydro	Abr-07	0.0	0.0	0.0	58.8%
CAMPANARIO CA	260.0	Open cycle	Natural Gas	Abr-07	0.0	0.0	**745.0**	23.1%
SAN IGNACIO TG	18.0	Open cycle	Diesel	May-06	0.0	6.7	929.1	9.9%
COYA	25.0	Run of the river	Hydro	Abr-06	0.0	97.2	0.0	58.8%
Candelaria (Open cycle)	250.0	Open cycle	Diesel	Jul-05	5.4	66.6	929.1	9.9%
Saesa TG	50.0	Open cycle	Natural Gas	May-05	264.3	357.5	519.4	23.1%
Itata	13.0	Biomass / Steam	Biomass	Abr-05	67.7	90.2	0.0	62.3%
Antilhue new	47.0	Open cycle	Diesel	Ene-05	15.5	29.5	929.1	9.9%
Horcones TG	24.3	Open cycle	Natural Gas	Sep-04	47.3	69.7	707.2	23.1%
Ralco	690.0	Reservoir	Hydro	Sep-04	2,703.6	3,085.8	0.0	46.6%
Valdivia	61.0	Biomass / Steam	Biomass	May-04	269.7	349.0	0.0	62.3%
Licantén	5.5	Biomass / Steam	Biomass	Abr-04	22.6	24.0	0.0	62.3%
Nehuenco II	390.4	Combined cycle	Natural Gas	Abr-04	2,998.9	3,014.0	402.3	62.1%
Nehuenco II (Open cycle)	250.0	Open cycle	Natural Gas	May-03	0.0	0.0	633.4	23.1%
Cholguán	13.0	Biomass / Steam	Biomass	Jun-03	83.7	86.2	0.0	62.3%
S. Fco. Mostazal	25.7	Open cycle	Diesel	Jul-02	1.9	11.1	967.0	9.9%
Chacabuquito	25.0	Run of the river	Hydro	Jul-02	164.1	168.4	0.0	58.8%
Nehuenco 9B	108.0	Open cycle	Natural Gas	Jun-02	9.5	13.8	**670.8**	23.1%
Mampil	49.0	Run of the river	Hydro	Abr-00	172.1	194.9	0.0	41.0%
Taltal (I and II)	244.9	Open cycle	Natural Gas	Feb-00	930.6	1,020.5	**585.6**	27.1%
Peuchén	77.0	Run of the river	Hydro	Ene-00	290.8	331.9	0.0	40.5%
Nehuenco	368.4	Combined cycle	Natural Gas	Ene-99	453.5	661.2	**609.7**	55.3%

TOTAL GEN. PER YEAR	**(GWh / yr)**		**38,065.8**	**40,119.6**
20% OF GEN. PER YEAR	**(GWh / yr)**		**7,613.2**	**8,023.9**
5 MOST RECENT PLANT GEN	**(GWh / yr)**		**400.3**	**618.2**

EMISSION FACTOR 5 PLANTS	**(tCO_2/GWh)**		**475.1**	**410.5**
EMISSION FACTOR 20% GEN	**(tCO_2/GWh)**		**251.4**	**248.8**

BUILD MARGIN	**(tCO_2/GWh)**		**251.4**	**248.8**

Note:
-These emission factors are estimations based on the CNE future expansion plan for the SIC grid.

COMBINED MARGIN CALCULATION

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)

		2005	2006
Operating Margin	(tCO_2/GWh)	689.12	688.68
Build Margin	(tCO_2/GWh)	251.35	248.76
Combined Margin	**(tCO_2/GWh)**	**470.23**	**468.72**

Annex 4

MONITORING PLAN

Please refer to section D of this PDD.

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