CONTENTS

A. General description of the small-scale project activity

A.1 Title of the small-scale project activity:

- Russfin Biomass CHP Plant Project.
- Version number: Version 008
- Date: 09-23-2005

A.2 Description of the small-scale project activity:

The purpose of the proposed project activity is to use biomass for combined heat and electric power generation, than otherwise would be left to decay in open air. The project is presented by **Forestal Russfin Ltda.**[1]**,** a leading *lenga* [2] lumber producing company in Chile.

Forestal Russfin Ltda.is a private company which main activity is the lenga management and production in Chile. They produce annually 9,300 MBF/y [3] (22,000 m^3/y) of lenga (*nothofagus pumilio*) lumber for export and domestic consumption. Lenga, which is also known as Fireland Cherry, is a tree which habitat is located in the Chilean's XI and XII regions, specifically in the Patagonia and in the Fireland territory. It has a sapwood of white to yellowish color and a heartwood of a pale to dark pink. It's a beautiful wood that offers excellent conditions for drying, being easily machined and stained.

The project involves the construction and operation of a new CHP plant of 1.2 MW net generating electric power capacity located inside the Forestal Russfin Sawmill facility. No Surplus electric power will be sold to third parties due no public electrical grid is available. The surplus heat after power generation will be delivered to the wood drying kilns and to the mill's central heating system .

The proposed project would also assit Chile's sustainable development by reducing greenhouse gases (GHG) emissions by switching Diesel for biomass to generate electricity and steam which will be used on site by **Forestal Russfin Ltda. Without the CERs additional income, they would continue using diesel fuel for electricity generation as they have done during the last 13 years**. In addition, this project will accomplish an additional greenhouse effect reduction benefit derived from a biomass controlled disposal, which results into lower methane emissions.

The Forestal Russfin project activity participants believe that biomass power cogeneration constitute a sustainable source of power generation that brings advantages for mitigating global warming. Using the available natural resources in a more rational way, this project activity may help to enhance the development of renewable energy sources, in particular the use of biomass generated as a by-product of the forestry industry, which has a significant potential in Chile. The proposed project is a good example to demonstrate the viability of sustainable electricity generation to all forest-related industries. It is

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[1] www.ignisterra.com

[2] The Lenga Beech or lenga (*Nothofagus pumilio*) is a deciduous tree or shrub native to the centre area of the Andes range, in the temperate forests of Chile and Argentina down to Tierra del Fuego. It grows to a height of up to 30 m, and a trunk diameter of 1.5 m. The leaves are 2-4 cm long, with irregularly lobed margin, and turn to yellow and reddish tones in autumn. The fruit is a small nut 4-7 mm long. It can be found in the Valdivian temperate rain forests, the Torres del Paine National Park, the Los Alerces National Park and the Nahuel Huapi National Park among other places. It belongs to the same genus as the coihue.

[3] One board foot is the nominal quantity of lumber derived from a piece of rough green lumber 1 inch thick and 1 foot wide by 1 foot long the abbreviation M is used to represent 1,000. So, 6 MBF is 6,000 BF; 4 MMBF is 4 million BF- www.cwc.ca/design/tools/calcs/board_feet

important to highlight that although this technological improvement is consistent with the internal policies of efficient energy usage and Forestal Russfin's environmental conscience, it must be recognized as an activity that goes far beyond the common practice of the Lumber industry in Chile, thus it will serve as example for other forest-related industries.

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)	Forestal Russfin Ltda..	NO

A.4 Technical description of the small-scale project activity:

A.4.1 Location of the small-scale project activity:

A.4.1.1 Host country Party(ies): Chile

A.4.1.2 Region/State/Province: Region XII, "Región de Magallanes y de la Antártica Chilena"

A.4.1.3 City/Town/Community: "Tierra del Fuego", Fireland Territory.

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this small-scale project activity *(max one page)*:

The proposed project takes places in the Forestal Russfin Ltda. Mill, Timaukel county , (latitude 53° 45' 59" S; longitude 69° 11' 42" W; 218 m.a.s.l.), 380 km away from Punta Arenas City, located in Region XII, where Forestal Russfin's Lenga *(Nothofagus pumilio)* forests are. Region XII or "Región de Magallanes y de la Antártica Chilena" is located in the southern area of Chile. Its limits are, by the north, Region XI or "Región de Aysén" (48º 36'); by the south, the international waters of the Drake Sea (56º 30'); by the east, Argentina and by the west, the Pacific Ocean.

It is divided in four provinces, "Antártica Chilena" which capital city is "Puerto Williams", "Tierra del Fuego" which capital city is "Porvenir", "Última Esperanza" which capital city is "Puerto Natales" and "Magallanes" which capital city is "Punta Arenas". These four provinces are divided in ten counties but, out of them, only three, "Punta Arenas", "Natales" and "Porvenir"have urban characteristics. The rest are rural areas with very few inhabitants.

In 1999, the total population in this region was 150,000 inhabitants. 73% of the total population lives in Punta Arenas and 11% in Puerto Natales. The total surface of the region is 132,033 km^2. Thus, the population density is just 1.2 inhabitant per km^2.

One of the main characteristics of this region is its isolation from the rest of the country. There are no roads on land excepts from the Argentinean side. Another characteristic is the difference between the women (74,000) and men (83,000) population.

Figure 1. Map of South America showing Patagonia.

Figure 2. Map of "Región de Magallanes" showing the provinces cities. [4]

According to Donoso[5], there are five forest types dominated by *Nothofagus* species, Roble - Hualo (*n. oblicua - n. glauca*), Roble - Raulí - Coïgue (*n. oblicua - n. alpina - n.donbeyi*), Coïgue - Raulí - Tepa (*n. donbeyi - n. alpina - laurelia philippiana*), Lenga (*n. pumilio*). Lenga is associated with roble (*n. oblicua*) and coïgue (*n. dombeyi*) in the extreme northern portion of the range, and with araucaria (Araucaria araucana) and coïgue de Magallanes (*n. betuloides*) in the southern portion and Coïgue de Magallanes (*n. betuloides*).

The Chilean government, through its National Forestry Corporation (CONAF[6]) approves and controls the harvest and management plans that assure the regeneration, permanence and improvement of the forest areas.

The national Forestry Corporation (CONAF) granted the following harvest permits to Forestal Rusffin Ltda.:

YEAR					
2.005		2.004		2.003	
hectares	authorization	hectares	authorization	hectares	authorization
562	24/37-120/04	1.517	1.203.134	1.760	1.203.104
139	20/37-120/04	182	1.203.146	486	1.203.103
958	21/37-120/04	958	1.203.130	230	1.203.105
56	23/37-120/04	105	1.203.132	40	1.203.125
230	22/37-120/04	230	1.203.133		

[4] Modified from www.mapasdechile.com

[5] Donoso, C. 1995. Temperate Rainforests of Chile and Argentina. Structural variation and dynamics. Editorial Universitaria. Santiago, Chile. 483 pp. Donoso, C., Lara, A. 1999. Silviculture of the Chile's native forests. Editorial Universitaria. Chapter 10. Evergreen forests. pp. 297- 339.

[6] www.conaf.cl

According to CONAF's 1997 land survey, *nothofagus* forests cover an area of approximately 7,397,000 hectares, accounting for 55% of all of Chile's native forests. Of this area, the native Lenga forests reach a surface of 3,400,000 hectares, out of which the Chilean legislation allows only 30% for commercialization, leaving the rest of the surfaces for national parks. This is carried out to protect the wildlife areas, to ensure the existence of the forest's ecosystems and to preserve the water courses and soils.

The Lenga forests are noted for their simple composition and structure. The most conspicuous features of these trees are the abundant boles of live mature and old trees, recent gaps filled with dense patches of seedlings, and abundant logs and other woody debris on the forest floor. A low ground layer dominated by herbs, grasses, and lenga seedlings is typically the only plant understory.

A.4.2 Type and category(ies) and technology of the small-scale project activity

According to the categorization of Appendix B to the simplified M&P for small–scale CDM project activities this project conforms with the following three types and categories,

TYPE III. OTHER PROJECT ACTIVITIES
III.E. Avoidance of methane production from biomass decay through controlled combustion

TYPE I. RENEWABLE ENERGY PROJECTS
I.A. Electricity generation by the user
I.C Thermal energy for the user

The following project activity should obey the following characteristics,

- For type III, the project emissions per year over the crediting period will not go beyond the limits of 15 kilotonnes of CO_2e per year as it is shown in section A.4.3.1 of this document.
- For type I, category A and C, the Biomass Power Plant should not exceed a capacity of 15 MW. As said before, in the case of this project activity, the Biomass CHP Plant would have a net capacity of 1.2 MW.

The technology to be employed in this project activity is the Biomass fired Combined Heat and Power (CHP) Plant or cogeneration system. Cogeneration is the sequential generation of two different forms of useful energy, generally electrical and thermal, from a single primary energy source. Hence, cogeneration produces much lower emissions for each unit of energy produced. Combined Heat and Power (CHP) systems make efficient use of heat that would otherwise be wasted.

The predominant technology around 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 involved 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.

Thus, this project activity takes into account GHG emission mitigation due to the replacement of diesel to generate electricity and LPG to generate heat, for a much cleaner fuel, biomass, and due to non open-decaying of the biomass residues. It compares the emission of GHG between the current scenario (electricity generation with six old Diesel generation units, heat generated by biomass and LPG combustion and biomass decayment in open air) and the project activity scenario (biomass fired combined heat and power plant, with a net capacity of 1.2 MW and no biomass decayment in open air).

The combustion of fossil fuels gives rise to emissions, such as carbon dioxide, nitrous oxides, sulphur oxides, carbon monoxide, particulates, organic compounds, trace metals, etc. Aside from its local effects, the global issues are the greenhouse effect and the acid rain phenomenon. Biomass, on the other hand, acts as a sink for atmospheric carbon dioxide. If biomass is being regrown at the same rate as it is being harvested, the net flux of CO_2 to the atmosphere is zero. Biomass is a low sulphur fuel - contributing much less than fossil fuels to the acid rain phenomenon. The use of biomass wastes in modern boiler also reduces the environmental hazards associated with open-burning or open-dumping.

It makes sense to use biomass in place of conventional, nonrenewable fuels for several good reasons:

- **Biomass fuel is a local product**. In contrast to fossil fuels, biomass is grown and harvested on the same place it is needed. The fossil fuels that are needed to generate heat and electricity at the Forestal Russfin sawmill have to be taken from places far away from Fireland Territory. This does not only generate pollution from the transportation but also makes the fossil fuel more expensive.

- **Biomass energy is enviromentally friendly**. Using biomass in place of fossil fuel, reduces the atmospheric buildup of greenhouse gases, which cause climate change. This can also reduce the levels of gases that cause acid rain. Biomass energy systems also help keep forests healthy by providing a market for low-grade "cull" wood, whose removal improves the well-being of the forest and the value of commercial trees.

- **Biomass is a renewable resource**. Biomass is a renewable fuel that can be sustainably produced. **Forestal Russfin Ltda.** takes care along with CONAF to ensure the sustainable management of the Lenga Forests in Chile. The use of biomass as a fuel also produces a less demand on the Earth's resources.

In Chile, the majority of the electricity is generated by hydroelectric plants (60%) and in a lower proportion by thermoelectric plants (40%), which mostly use fossil fuels for the generation (aproximately 99%)[7]. Out of all the energy generated by renewable energies in Chile, Biomass account only for the 0.3%, as shown in the following figure,

[7] Load Economic Dispatch Center Central Interconnected System (CDEC-SIC), Operation Statistics 1995-2004

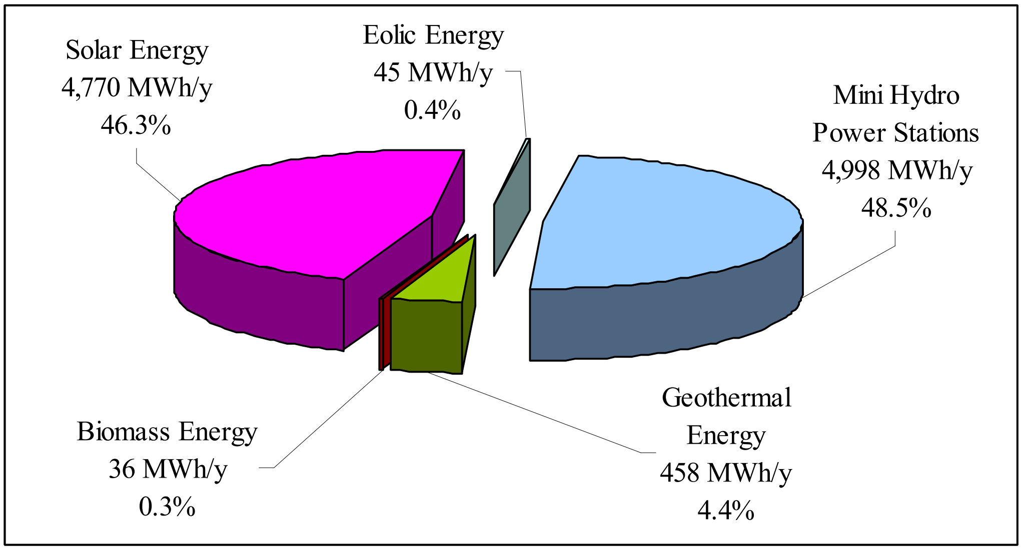

Figure 3. Proportion of the renewable energies used in Chile. [8]

However, biomass technology could be more used in Chile since there are abundant biomass resources and the forestry industry has shown a significant growth in the last years. In addition, biomass's efficient use can contribute significantly to the Chilean sustainable development and can support as well the local and global environment conservation.

Thus, this project activity would definitively bring environmental benefits to Chile and the World. It would also bring to a developing country clean and environmentally safe technology not widely used, except in developed countries.

Forestal Russfin Ltda. does not need to build the biomass CHP plant since they could satisfy theirs power needs using diesel generators as it were theirs - *business as usual* - practice during last the 13 years.

National regulations and laws do not force them to use a renewable source of energy and/or to avoid the methane generation by the sawmill residues dumping in open air. As said before, a biomass combined heat and power plant is not a common practice in Chile.

A.4.3 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The Project will reduce anthropogenic GHG emissions by replacing Diesel-based electricity and LPG-based heat with GHG-free biomass combined heat and power generation. Forestal Russfin actually satisfies some of their heat requirements by using biomass as a fuel, but an important part of the heat required is provided by the combustion of LPG. In addition, the Project will assist Chile with greenhouse gas (GHG) reduction by curbing methane emissions from open-air decay of biomass derived from the sawmill.

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[8] According to the data taken from the Chilean National Energy Comission. CNE, "Comisión Nacional de Energía". www.cne.cl

There are three sources of GHG emissions in the absence of the project activity. The first is due to the generation of electricity with fossil fuel, specifically with Diesel engine generators. The second one is due to leaving the sawmill residues to decay in the open air. The third one is due to the combustion of biomass and LPG to generate heat.

The decomposition of the sawmill residues in the absence of oxygen (anaerobic digestion), as it is in the piles left to decay in open air, generate methane (CH_4), which is a powerfull GHG. Thus, the second source of emissions are the amount of methane associated to the decay of the biomass.

In project scenario, no biomass is left to decay in the open air, thus no methane (CH_4) is liberated to the atmosphere. Then if the project goes ahead, the biomass is combusted instead of diesel to generate heat and power to satisfy the needs of the Sawmill facility. Thus, the GHG emissions due to the project are much smaller since the combustion of biomass is cleaner than the combustion of any fossil fuel.

Table 1.
GHG emissions sources

	Baseline scenario		**Project scenario**	
	GHG	**Emissions due**	**GHG**	**Emissions due**
Heat requirements	CO_2	Biomass and LPG fuel use	CO_2	Biomass fuel use
Power requirements	CO_2	Diesel fuel use	CO_2	Biomass fuel use
Biomass	CH_4	Biomass anaerobic decomposition	-	-

The Project does not quantify any leakage effect related to biomass availability, because there is enough biomass available to satisfy all the requirements of the on site consumer in the influence area of the Forestal Russfin Biomass CHP Plant. As well, no leakage calculation is needed, as explained in the methodology, AMS-I.A., due to the Diesel generation units since these are to be removed and not use anymore.

An incentive to **Forestal Russfin Ltda.,** the investor, to pursue this energy sourcing development path is the higher status associated with CDM designation. The Project will publicly highlight its participant's environmental commitment, in a moment in which the Chilean authorities concern for the environment has become evident. Project participant, **Forestal Russfin Ltda.**, will also benefit from 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.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	**Annual estimation of project emissions (tonnes CO_2equ)**	**Annual estimation of emission reductions (tonnes CO_2equ)**
2006	2,853	37,405
2007	2,853	37,405
2008	2,853	37,405
2009	2,853	37,405
2010	2,853	37,405
2011	2,853	37,405
2012	2,853	37,405
Total estimated (tonnes of CO_2equ)	19,974	261,837
Total numbers of	7 y	7 y

crediting years		
Annual average over the crediting period (tonnes CO_2equ)	2,853	37,405

A.4.4 Public funding of the small-scale project activity:

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

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

Debundling is defined as the fragmentation of a large project activity into smaller parts. The proposed Project Activity is not a debundled component of any other larger project. At present time **Forestal Russfin Ltda.** only would like to submit this project activity, a biomass combined heat and electric power plant with the residues from their Fireland Territory's Sawmill Facility.

This project activity is submitted by **Forestal Russfin Ltda.** and no other project will be submitted by them at this location. Forestal Russfin will use the residues from their sawmill to generate power and heat for themselves.

B. Application of a baseline methodology

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

<u>TYPE III. OTHER PROJECT ACTIVITIES</u>
III.E. Avoidance of methane production from biomass decay through controlled combustion

<u>TYPE I. RENEWABLE ENERGY PROJECTS</u>
I.A. Electricity generation by the user
I.C. Thermal energy for the user

B.2 Project category applicable to the small-scale project activity:

As seen in *B.1* there are three categories applicable for this project activity. The reason for this is that there are three relevant sources of GHG reduction.

The first one, avoidance of methane production from biomass decay through controlled combustion, comprises project activities that avoid the production of methane from biomass that would otherwise have been left to decay as a result of anthropogenic activity. Due to the project activity, decay is prevented through controlled combustion and less methane is produced and emitted to the atmosphere. This is the case of the Forestal Russfin Biomass CHP Plant. With the contruction of this power plant <u>all</u> the biomass that usually was dumped and stored in stockpiles would now be used as a fuel, emitting no methane to the atmosphere.

The other two, electricity generation by the user and thermal energy for the user, comprises renewable energy generation unit that supply users with electricity and heat. The renewable energy generating unit, in this case, biomass fired heat and power plant, replace existing Diesel fired generation units and Biomass and LPG fueled heat generation units.

These project categories are applicable to the small-scale project activity since the project characteristics are,

- Renewable energy technology that supply the user with electricity and thermal energy.
- By using the biomass as a renewable energy technology to generate electricity and thermal energy the production of methane is avoided by not leaving biomass to decay in the open air.

In order to apply these methodologies in the context of the project activity several assumptions have to be made. Then, the first methodology, avoidance of methane production from biomass decay trough controlled combustion, is developed as follows,

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

$CH_4\_IPCC_{decay}$	IPCC CH_4 emission factor for decaying biomass in the region of the project activity (tonnes of CH_4/tonne of biomass)
MCF	Methane Correction Factor (fraction) (default is 0.4)
DOC	Degradable organic carbon (fraction, see equation below or default is 0.3)
DOC_F	Fraction DOC dissimilated to landfill gas (default is 0.77)
F	Fraction of CH_4 in landfill gas (default is 0.5)

For DOC, the following equation may be used instead of the default:

$$DOC = 0.4 (A) + 0.17 (B) + 0.15 (C) + 0.30 (D)$$

where,

A	Per cent waste that is paper and textiles
B	Per cent waste that is garden waste, park waste or other non-food organic putrescibles
C	Per cent waste that is food waste
D	Per cent waste that is wood or straw

In the case of this project activity, considering that the only waste that is being dumped and left to decay is the sawmill residues, then the per cent waste that would only be accounted for the calculation of the DOC is D.

Thus, DOC would result as,

$$DOC = 0.30 (D)$$

Finally the baseline emissions would be calculated as,

$$BE_{y\,1} = Q_{biomass} * CH_4\_IPCC_{decay} * GWP\_CH_4$$

where,

$BE_{y\,1}$	Baseline emissions from biomass decay (tonnes of CO_2 equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tonnes)
$CH_4\_IPCC_{decay}$	IPCC CH4 emission factor for decaying biomass in the region of the project activity (tonnes of CH_4/tonne of biomass)
GWP_CH_4	Is the approved Global Warming Potential value for methane for the first commitment period, 21 (tonnes of CO_2 equivalent / tonnes of CH_4)

In the case of the second source of GHG emissions in the baseline scenario, the methodology, electricity generation by the user, offers two formulae as shown below,

a) Option 1:

$$Eb = \frac{\sum_i (n_i \cdot c_i)}{(1-l)}$$

where,

Eb	annual energy baseline in kWh per year.
$\sum_i$	the sum over the group of "i" renewable energy technologies (e.g. residential, rural health center, rural school, mills, water pump for irrigation, etc.) implemented as part of the project.
n_i	number of consumers supplied by installations of the renewable energy technology belonging to the group of "i" renewable energy technologies during the year.
c_i	estimate of average annual individual consumption (in kWh per year) observed in closest grid electricity systems among rural grid connected consumers belonging to the same group of "i" renewable energy technologies. If energy consumption is metered, ci is the average energy consumed[9] by consumers belonging to the group of "i" renewable energy technologies.
l	average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction[10].

b) Option 2:

$$Eb = \frac{\sum_i O_i}{(1-l)}$$

where,

Eb	annual energy baseline in kWh per year.
$\sum_i$	the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project.
O_i	the estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (in kWh per year)
l	average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction.

The emissions baseline is the energy baseline calculated in accordance with Option 1 or 2 times the CO_2 emission coefficient for the fuel displaced. A conservative IPCC default value of 0.9 kg CO_2equ/kWh, which is derived from diesel generation units, may be used.

In the case of this project activity the option that best fits would be option 2. Due there is only one renewable energy technology implemented as part of this project activity.

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[9] Potential oversizing of the power capacity installed or energy generated by the CDM project activity shall not be reflected in the baseline and emissions reduction calculation. For this reason, the energy value taken into account shall be the energy consumed. It cannot be the electricity output, except if the project participant justifies that it represent a reasonable estimate of the energy that would have been generated by a diesel generator larger than 35 kW and operating with a load factor of at least 50% to provide similar electricity services.

[10] A reasonable default value for generation losses could be 20%.

In the case of heat generation, the simplified baseline is the fuel consumption of the technologies, in this case biomass and LPG, times an emission coefficient for the fuel displaced. IPCC default values for emission coefficients may be used. The formulae used to calculate the baseline emissions for the combustion of biomass is explained above:

$$BE_{y3}= Q_{biomass}* E_{biomass} (CH_{4\ bio\_comb}*CH4\_GWP + N_2O_{\ bio\_comb}*N_2O\_GWP)/10^{\wedge}6$$

where,

BE_{y3}	Baseline emissions due to biomass combustion (tonnes of CO_2 equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tonnes/year)
$E_{biomass}$	Energy content of biomass (TJ/tonne)
$CH_{4\ bio\_comb}$	CH_4 emission factor for biomass (kg of CH_4/TJ, default value is 300)
CH_4 GWP	Is the approved Global Warming Potential value for methane for the first commitment period, 21 (tonnes of CO_2 equivalent / tonnes of CH_4)
$N_2O_{\ bio\_comb}$	N_2O emission factor for biomass combustion (kg/TJ, default value is 4)
N_2O GWP	Is the Global Warming Potential for N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period. (tonnes of CO_2 equivalent / tonnes of N_2O)

For the combustion of LPG, the emission are calculated as it follows:

$$BE_{y4} = O*(CO_{2\ bio\_comb} + CH_{4\ bio\_comb}*CH4\_GWP + N_2O_{\ bio\_comb}*N_2O\_GWP)$$

where,

BE_{y4}	Baseline emissions due to LPG combustion (tonnes of CO_2 equivalent)
O	Annual energy output (TJ/year)
$CO_{2\ bio\_comb}$	CO_2 emission factor for LPG (tonnes of CO_2/TJ)
$CH_{4\ bio\_comb}$	CH_4 emission factor for biomass (tonnes of CH_4/TJ, default value is 300)
CH_4 GWP	Is the approved Global Warming Potential value for methane for the first commitment period, 21 (tonnes of CO_2 equivalent / tonnes of CH_4)
$N_2O_{\ bio\_comb}$	N_2O emission factor for biomass combustion (tonnes of N_2O/TJ, default value is 4)
N_2O GWP	Is the Global Warming Potential for N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period. (tonnes of CO_2 equivalent / tonnes of N_2O)

In the following table, the biomass plant installed parameters are shown.

Table 2. Biomass Power Plant parameters.

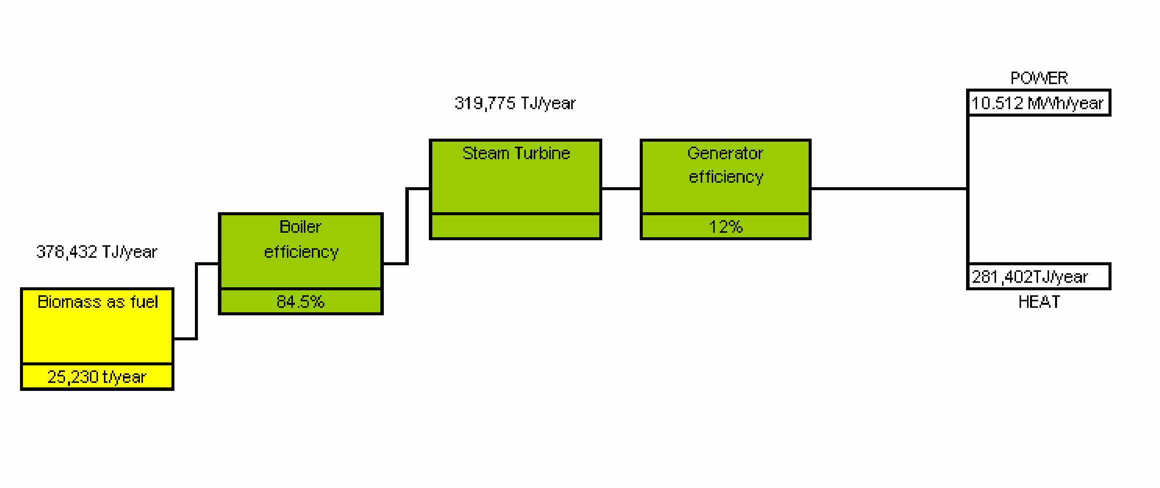
Plant capacity (net)	1,200 kW
Working hours per year (net)	7,008 hours/year [11]

Thus, the estimated annual output of the biomass plant installed in kWh per year is,

Annual Net Output [12] (kWh per year)
10,512,000

[11] (24 h/d x 365 d/y) x 0.8

[12] Represent a reasonable estimate of the average yearly energy that would have been generated by Forestal Russfin´s diesel generators during the last years.



B.2 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The most likely future scenario for the Forestal Russfin Sawmill is the continuation of electricity generation using on site diesel generators units and thus, open air biomass dumping.

However, the project activity consists of replacing Diesel-based electricity and biomass-based heat with GHG-free biomass combined heat and power generation. In addition, the project will assist Chile with greenhouse gas (GHG) reduction by curbing methane emissions from open-air dumping of biomass derived from sawmills. Thus, anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the project activity.

To test whether the project is additional or not, the baseline methodology includes the proposed additionality test below[13]. It is clear that the economic benefits of the project without the sales of CERs are not sufficient to overcome all the technical, institutional and financial barriers to biomass (co)generation and further changes are still needed in all of these fronts to unlock the considerable potential of biomass (co)generation in Chile.

The test is applied as follows:

Step 0: Preliminary screening of projects started after 01.01.00 and prior 12.31.05

Since the beginning of this year Forestal Russfin biomass CHP biomass project are on – *equipment commissioning stage* -. However, there is sufficient evidence that Forestal Russfin Ltda. have been involved in theirs sustainable development plan, the CDM and its potential benefits since the very beginning of this project's development.

Forestal Russfin included in this project's planning the CDM - CERs potential incomes as the unique real - *reason why* - that justifies the implementation of a CHP biomass plant at theirs sawmill in southern Chile.

[13] The test to assess project additionality corresponds to the "Consolidated tools for demonstration of additionality" proposed by the Meth Panel.

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

Sub step 1a. Define alternatives to the project activity

There are three alternatives to the project activity as shown below,

> **Alternative 1:** Current situation (baseline scenario): To continue to use diesel-based electricity generation and LPG and biomass to generate heat at the sawmill facility . In consequence, most of the biomass, sawmill residues, would be dumped in the open air.
> **Alternative 2:** To use another source of energy. In this part of "Región XII", specifically around Forestal Russfin Sawmill facility, the Chilean SIC grid does not have coverage. In addition, the population growth does not show a significant increase[14], thus it is common to use fossil fuel on site generators to satisfy the power and heat needs. In consequence, another possible alternative would be to use a different fossil fuel, like LPG. This alternative would not make a big difference from the current situation.
> **Alternative 3:** Project activity: Generate power and heat with the sawmill residues, biomass. This would impede the biomass dumping in open air and there would not be the need to buy and combust dieselor any fossil fuel.

In this case, there is almost only one obvious project alternative to the Forestal Russfin Biomass CHP Plant project activity, which is here presented as the baseline case scenario, alternative 1.

Sub-step 1b. Compliance with applicable laws and regulations

The baseline scenario or the alternative situation, which are very similar, would comply with all the National regulations and laws, since the current situation currently does. At the moment in the Chilean national regulations and laws there are no regulations against dumping sawmill residues in the open air, neither the use of any fossil fuel to generate electricity.

In addition, according to the "Decreto 95" of the Ministry of the General Secretary of the Presidency[15], of date August 21st, 2001, the Forestal Russfin Biomass Power Plant does not need to enter the environmental impact evaluation system. This is due to the article 3.c, which states that power plants with a capacity lower than 3 MW do not cause a significant environmental impact to be evaluated by the designed environmental authorities.

Step 2: Investment Analysis

Sub Step 2a. Determine appropriate analysis method

According to the methodology for determination of additionally, option I should be used if the CDM project activity generates no financial or economic benefits other than CDM related income. Since this is the case for the Forestal Russfin Biomass CHP Plant, an incremental cost analysis will be used.

Sub-step 2b – Option I. Apply incremental cost analysis

Alternative 3 (the proposed project activity) represents extra investment for the biomass fired combined heat and power plant equipment.

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[14] According to the National Statistics (INE "Instituto Nacional de Estadísticas"), the population in Región XII in 1992 was 143,198 inhabitants and in 2002 was 150,826 inhabitants. www.ine.cl

[15] http://www.segpres.cl/inicio.asp

The total extra investment[16] is expected to be US$ 2,800,000 and the costs for operation and maintenance are expected to be reduced at a rate of US$ 431,340 annually, but yet, is not an attractive project to take place without the CERs income.

Investing in a Biomass CHP Plant, **Forestal Russfin Ltda.** will not generate any revenues in the absence of CDM.

The table 3 below shows the financial analysis for Alternative 3, considering a 21-year horizon. As shown, the project Internal Rate of Return (IRR) without carbon income is 11.11%. As the project IRR is lower than the discount rate [17], the Net Present Value (NPV)[18] will be negative.

Though there is no connection to the grid at the location of the project, the possibility of selling electricity to the Chilean grid is not considered within the project activity.

Table 3
Project without CERs income

Net Present Value (US$)	-406,720
IRR (%)	11.11
Discount rate (%)	14

Alternative 3 without CERs income is therefore not an economically attractive and realistic scenario due on the economical point of view:

Alternative 1 is not viable option without CERs income.

Sub-step 2d. Sensitivity Analysis

It seems neccesary to apply a sensitivity analysis to the project activity by changing the following parameters in the financial analysis,

1. Increase in project revenues (CDM related income)
2. Reduction in project capital and running costs (operational and maintenance costs)

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 15%, and assessing what the impact on the project IRR would be (see table below). As can be seen, the project IRR remains very low, even in the case where these parameters change in favour of the project.

Table 4.
Project with CERs income

[16] At beginning of this year, Russfin CHP biomass project was at - *equipment's commissioning stage* - therefore the total balance between real investment vs projected budget is not totally closed.

[17] Discount rate for this project was considered at 14%

[18] Net Present Value is the difference, if any, between the cost of an investment and the discounted present value of all anticipated future cash flows (positive and negative) to that investment. Generally, where NPV is positive, the investment is acceptable; where NPV is zero, the investment is marginal; and where NPV is negative, the investment is unacceptable.

Net Present Value (US$)	IRR (%)	NPV(US$)
Original	**17.26**	**481,890**
Increase in project revenues	**18.14**	**615,180**
Reduction in project costs	**18.22**	**628,390**

Step 3: Barrier Analysis

There are two types of barriers that make the Forestal Russfin project activity additional and thus, not the baseline case scenario:

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

The Forestal Russfin Biomass Power Plant clearly represents a technological breakthrough and therefore presents new risks not only from a financial perspective, but also from an operational point of view.

Technological barriers: Despite the technology is available and proven, it clearly implies facing a higher complexity at the construction level and at the operational level due the sawmill is located in a very remote area. It demands specialized and qualified labor to design, integrate and build the electric power generating unit inside Forestal Russfin and demands (additional) qualified personnel to operate the CHP plant to provide electric power and heat to the the sawmill.
It must be noted that much of the engineering used to build these type of plants is subcontracted abroad, usually from northern European countries, which are leaders in energy efficiency and clean energy generation technologies. That is clearly in line with the CDM postulates.

In addition, Forestal Russfin core business is the production of forestry-related products for exports and not the generation of electric and heat energy.

Being Chile one of the most important forestry-products producing countries in the world, few other companies apart from Forestal Russfin is currently generating electric power from biomass sources, but they have been doing it for not so long and using large and more efficient power units connected to the public grid.

Barriers due to the prevailing practice: As previously stated above, the Forestal Russfin Biomass CHP Plant uses a proved technology to generate electric power, however the implementation of such technology within a lumber mill complex clearly departs from the conventional approach in the wood industry. For that reason, the project is one of the first of its kind in Chile, and one of the few of its kind at least in South America.

Finally, at a more macro level, despite regulatory authorities have taken some measures to promote the use of non-conventional renewable energy sources, these efforts have proved to be clearly insufficient:

- There is a lack of awareness of the multiple benefits of Decentralized Energy. The great potential to develop micro power plants in the south of the country remains to be exploited.
- Regulations for the electric sector are oriented around central generation.
- There are no clear national promotion for cogeneration or renewable energy promotion policies.

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

Since the proposed baseline scenario would use the conventional (*business as usual*) fossil fuel on site generators, there would be no risks either from a financial or operational perspective since this is the current scenario.

It can be easily shown that none of the above barriers would prevent the wide implementation of the proposed or any alternative baseline project scenario:

Technological barriers: As said before, baseline scenario or alternative conventional power generation do not represent technological barriers. **Forestal Russfin Ltda.**has been satisfying their power needs with Diesel for a very long time (**last 13 years**). To continue to use Diesel or to replace the Diesel on site generators by any other fossil fuel on site generators do not represent a technological barrier for them.

Barriers due to the prevailing practice: The same argument used above applies in this case. The proposed baseline case scenario constitutes the prevailing practice in this case.

There are no barriers in the wood industry that would prevent the utilization of alternative fossil fuel power units for electric or thermal power generation other than the ones that could be found in any other industry.

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

As was said in the Step 3, the Forestal Russfin Biomass CHP Plant is one of the first small plants of this type in Chile and one of the very few of its type in South America. Therefore, there are few other examples of similar mill plants with this type of CHP generating capacity in operation or under construction at present.

4.2. Similar options to the proposed project activity that are currently occurring in Chile

Thanks to the more real option of getting funding from the carbon credits, more companies are rethinking the possibility of developing biomass projects. Unfortunately, due to lack of important incentives, no other company has gone as far as Forestal Russfin Ltda. in developing real biomass cogeneration projects.

Step 5: Impact of CDM Registration

The approval and registration of the Forestal Russfin Biomass CHP Plant as a CDM activity will report significant benefits to the **Forestal Russfin Ltda.** However, these benefits will not only circumscribe to the project activity itself, but also to Forestal Russfin overcoming the associated barriers to carry the proposed project to final completion, and any other company in Chile that decides to follow Forestal Russfin's lead in small 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 and thermal energy via a clean energy source. This demonstrates the constant environmental improvement policy of **Forestal Russfin Ltda.**, and positions the company as an "environmental friendly" company not only in the Chilean context, but most importantly in the worldwide context. This point is extremely sensitive to **Forestal Russfin Ltda.**given that over 90% 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 recognize the effort **Forestal Russfin Ltda.** is doing by using high-end and environmental-friendly technology by placing the company ahead from other industry players in this field.

- The financial benefits derived from the sale of CERs to Annex I countries is also a strong incentive to develop this CDM project activity for **Forestal Russfin Ltda.** As was shown in the barrier analysis, the additional investment related to the project activity is not minor and the barriers that must be overcome to implement the project activity are not minor either, translating sometimes in significant delays and costs that would not have occurred if the baseline case scenario would have been continued to implement instead. The revenue that would come from the sale of the CERs would contribute to mitigate these extra costs and make future CDM projects more interesting not only for Forestal Russfin Ltda., but also for companies that could benefit from these clean technologies in the future.
- 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. The CDM registration of the proposed project activity would open a new funding possibility for renewable energy projects, that 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.
- Finally, Chile has shown a sound management of its economic policy in the last 20 years, a fact for which 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 economy which relies heavily in its exports (40% of its GNP). That makes the country 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.3 Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary for the project activity is where the treatment of biomass takes place. In concern with this project activity, the project boundary is the Forestal Russfin Sawmill facility. The characteristics of the site are explained in a deeper manner in the section A.4.1 of this document. It is important to quote that the zone around the sawmill is almost depopulated by houses or industries.

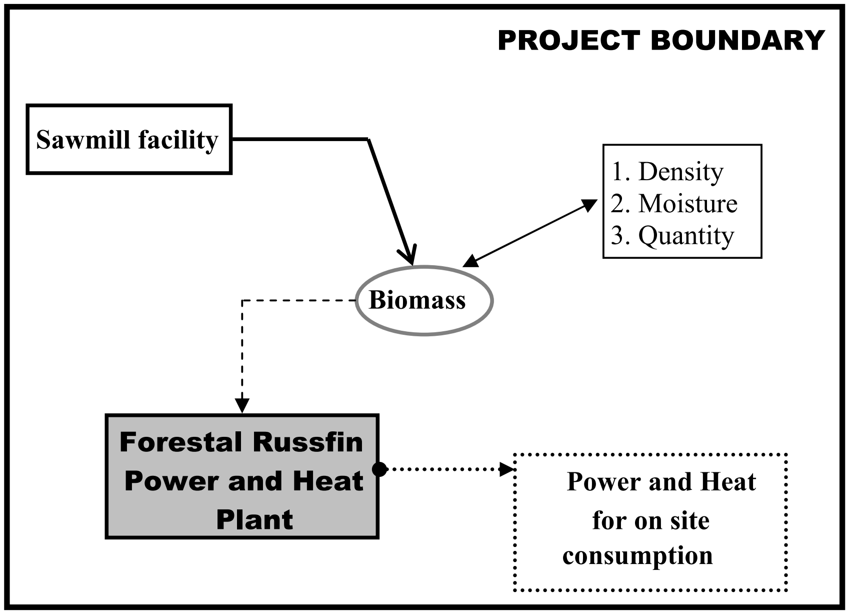

Figure 5. Project Boundary with the monitoring variables.

Table 5. GHG gases with their respective source accounted for each scenario, baseline and project activity.

	Source	Gas	Comment
Baseline Scenario	Biomass open air decay	CH_4	The anaerobic conditions at the open air provide the properties for methane generation and its released to the atmosphere.
	Diesel and LPG combustion	CO_2equ.	GHG emissions due to the combustion of diesel to generate electricity.
	Biomass combustion	CO_2	CO_2 emissions due to the combustion of Biomass to generate heat
Project Scenario	Biomass combustion	CH_4	CH_4 emissions due to the combustion of biomass to generate power and heat.
	Biomass combustion	N_2O	N_2O emissions due to the combustion of biomass to generate power and heat.
	Biomass combustion	CO_2	CO_2 emissions due to biogenic sources are considered to be carbon-neutral.

B.4 Details of the baseline and its development:

The methodologies to use are the following,

AMS.-III.E, Avoidance *of methane production from biomass decay through controlled combustion,*
AMS.- I.A, *Electricicty generation by the user*
AMS.- I.C *Thermal Energy for the user*

As said before, the baseline scenario is the situation where, in the absence of the project activity, biomass is left to decay within the project boundary and methane is emitted to the atmosphere. In this scenario Diesel, LPG and Biomass are needed to generate electricity and thermal energy for the sawmill facility. Thus, the baseline emissions are the amount of methane from the decay of the biomass treated in the project activity and the emissions due to the combustion of Diesel, LPG and Biomass.

B.5.1 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

30/06/2005

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

Mr. Francisco Acuña./ Ms. Valentina Villoria / Mr. Germán Richter
Eratech Ltda. Chile (NOT A PROJECT PARTICIPANT)
Angamos 185. Oficina 34.
Reñaca, Viña del Mar.
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C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

01/01/2005

C.1.2 Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

21 y

C.2 Choice of the crediting period and related information: *(Please underline the selected option (C.2.1 or C.2.2) and provide the necessary information for that option.)*

C.2.1 Renewable crediting period *(at most seven (7) years per crediting period)*

C.2.1.1 Starting date of the first crediting period *(DD/MM/YYYY)*:

01/01/2006

C.2.1.2 Length of the first crediting period *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*:

7 y

C.2.2 Fixed crediting period *(at most ten (10) years)*: NOT APPLICABLE

C.2.2.1 Starting date *(DD/MM/YYYY)*: NOT APPLICABLE

C.2.2.2 Length (max 10 years): *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)* **NOT APPLICABLE**

D. Application of a monitoring methodology and plan

D.1 Name and reference of approved methodology applied to the´small-scale project activity:

There are three approved methodologies applied to this project activity. These are the following,

AMS-I.A Electricity generation by the user

AMS-I.C Thermal energy for the user

AMS-III.E. Avoidance of methane production from biomass decay through controlled combustion

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

Monitoring has been chosen as it is suggested in the last proposal on "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".

In the case of the avoidance of biomass decay's methodology, the most important and unique value to be monitored is the amount of biomass combusted previous and after the project implementation. For this, it is neccesary to monitor as well the moisture and density of the biomass combusted in the project activity or left to decay in the case of the baseline scenario. Thus, this parameter, $Q_{biomass}$, is used for baseline and project activity emission calculations.

In the case of thermal and electricity generation by the user the only parameters that need to be monitored are, the annual output of the renewable energy, calculated as the biomass fired CHP plant capacity times the other parameter to be monitored, the operation working hours of the biomass CHP plant. This is to calculate the project activity emissions in the case of thermal and electricity generation by the user methodologies.

Data collection is compatible with the baseline methodology described in Section E.

D.3 Data to be monitored:

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1.	Amount of biomass combusted in cubic meters.	$Q_{biomass}m^3$	m^3	c	Daily calculation and monthly recording	100%	Electronic	Two years after the end of the crediting period.	$Q_{biomass}$ is the total biomass used for power generation due to the project activity. PROJECT/BASELINE SCENARIO EMISSIONS
2.	Amount of biomass combusted in tonnes.	$Q_{biomass}$	tonnes	c	Daily calculation and monthly recording	100%	Electronic	Two years after the end of the crediting period.	$Q_{biomass}$ is calculated as, $Q_{biomass}= (Q_{biomass}\ m^3 \times \rho_{biomass})/1000$ Baseline and project activity emissions calculations. PROJECT/BASELINE SCENARIO EMISSIONS
3.	Density of the biomass.	$\rho_{biomass}$	kg/m^3	m	Montly measurement	100%	Electronic	Two years after the end of the crediting period.	Measured to calculate ID number 1 and 2.
4.	Moisture of the biomass.	$M_{biomass}$	%	m	Montly measurement	100%	Electronic	Two years after the end of the crediting period.	Measured to calculate ID number 1 and 2.
5.	Output of the Biomass Power Plant.	O_i	kWh	m	Monthly measurement and annualy recording.	100%	Electronic	Two years after the end of the crediting period.	Calculated as, the plant capacity times the working hours of it. PROJECT/BASELINE SCENARIO EMISSIONS
6.	Working hours per year	h	h	m	Monthly measurement and annualy recording.	100%	Electronic	Two years after the end of the crediting period.	PROJECT/BASELINE SCENARIO EMISSIONS

Forestal Russfin Ltda. is certified under the ISO 9001 scheme, certification number CL05/0250, so the monitoring of the project activity will be done under the strict parameters of QA/QC.

D.4 Name of person/entity determining the monitoring methodology:

The project monitoring will be done by Ing. Rodolfo Tirado, General Manager of Forestal Russfin and other 2 professionals at Forestal Russfin's Sawmill facility.

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E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Since there are three sources of GHG emission reductions and thus three methodologies from appendix B of the simplified modalities and procedures for small-scale CDM project activities used, then it seems neccesary to described the formulae for baseline and project activity emissions as shown in section E.1.2.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

The anthropogenic emissions by sources of GHGs due to the project activity within the project boundary are those due to,

1. The amount of biomass combusted

The formulae used to estimate them, according to the methodology for the type of projects *III. Other project activities*, category, *III.E, Avoidance of methane production from biomass decay through controlled combustion* are,

$$PE_y = Q_{biomass} * E_{biomass} (CH_{4\ bio\_comb} * CH_4\_GWP + N_2O_{\ bio\_comb} * N_2O\_GWP)/10\text{^}6$$

$$PE_y\text{=}25{,}229(tonne/year)\text{*}0.015(TJ/tonne)[(300(kgCH_4/TJ)\text{*}21(kgCO_2/kgCH_4))+(4(kgNO_2/TJ)\text{*}310\ (kgCO_2e/\ kgNO_2\ ))]/1000$$

$$PEy = 2{,}853\ tCO_e/year$$

where,

PE_y	Project activity emissions (kilotonnes of CO_2 equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tonnes)
$E_{biomass}$	Energy content of biomass (TJ/tonne)
$CH_{4\ bio\_comb}$	CH_4 emission factor for biomass (kg of CH_4/TJ, default value is 300)
CH_4 GWP	Is the approved Global Warming Potential value for methane for the first

	commitment period, 21 (tonnes of CO_2 equivalent / tonnes of CH_4)
$N_2O_{bio\_comb}$	N_2O emission factor for biomass combustion (kg/TJ, default value is 4)
N_2O GWP	Is the Global Warming Potential for N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period. (tonnes of CO_2 equivalent / tonnes of N_2O)

The value for the energy content of biomass was taken from the TABLE 1-13 ENERGY CONTENT OF BIOMASS FUELS: DEFAULT NET CALORIFIC VALUES of the "Revised 1996 IPCC Guidelines for Nacional Greenhouse Gas Inventories: Reference Manual", Page 1.45. According to this conservative and transparent source of information, the value for $E_{biomass}$ is 15 MJ/kg (0.015 TJ/tonnes).

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

No leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Since no leakage calculation is required then the project actvity emissions are those calculated in E.1.2.1.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulea/algorithm, emissions in units of CO_2 equivalent)*

The anthropogenic emissions by sources of GHGs in the baseline within the project boundary are those due to,

1. **Biomass left to decay in open air.**

The first source of emissions are calculated using the methodology in the type of project *III. Other project activity*, category, *D*, *Avoidance of methane production from biomass decay through controlled combustion* as follows,

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$
$$CH_4\_IPCC_{decay} = (0.4*0.3*0.77*0.5*16/12)$$
$$CH_4\_IPCC_{decay} = 0.0616$$

where,

$CH_4\_IPCC_{decay}$	IPCC CH_4 emission factor for decaying biomass in the region of the project activity (tonnes of CH_4/tonne of biomass)
MCF	Methane Correction Factor (fraction) (default is 0.4)
DOC	Degradable organic carbon (fraction, see equation below or default is 0.3)
DOC_F	Fraction DOC dissimilated to landfill gas (default is 0.77)
F	Fraction of CH_4 in landfill gas (default is 0.5)

As explained in section B.2 of this document the Degradable Organic Carbon, DOC, would be remains as DOC = 0.30 (D) since the biomass left to decay is only the rest of the sawmill operations.

Thus, the baseline emissions would be calculated as,

$$BE_{y\,1} = Q_{biomass} * CH_4\_IPCC_{decay} * GWP\_CH_4$$
$$BE_{y\,1} = 23{,}529 \text{ (tonne/year)}*0.0616 \text{ (tonne}CH_4\text{/tonne biomass)}*21 \text{ (tonne}CO_{2e}\text{/tonne }CH_4)$$
$$BE_{y\,1} = 30{,}437 \text{ tonne } (CO_{2e}\text{/year})$$

where,

$BE_{y\,1}$	Baseline methane emissions from biomass decay (tonnes of CO_2 equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity less quantity of biomass used to generate heat in the baseline (tonnes)
$CH_4\_IPCC_{decay}$	IPCC CH_4 emission factor for decaying biomass in the region of the project activity (tonnes of CH_4/tonne of biomass)
GWP_CH_4	Is the approved Global Warming Potential value for methane for the first commitment period, 21 (tonnes of CO_2 equivalent / tonnes of CH_4)

2. **Diesel generation units.**

The second source of emissions are calculated using the methodology in the type of project *I. Renewable Energy Projects* , category, *A, Electricity generation by the user*, as follows*,*

$$Eb = \frac{\sum_i O_i}{(1-l)}$$

Eb = 10,512,000 (kWh/year)

Eb	annual energy baseline in kWh per year.
$\sum_i$	the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project.
O_i	the estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (in kWh per year)
l	average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction.

The emissions baseline is the energy baseline calculated times the CO_2 emission coefficient for the fuel displaced. A IPCC default value of 0.9 kg CO_2equ/kWh, which is derived from diesel generation units, is used. The baseline emissions per year due to the use of diesel are then calculated as,

$$BE_{y\,2} = Eb * 0.0009$$
$$BE_{y\,2} = 9{,}461 \text{ tonne } CO_{2e}\text{/year}$$

where,

$BE_{y\,2}$	Baseline methane emissions from diesel fired electricity generation (tonnes of CO_2 equivalent per year)
Eb	Annual energy baseline in kWh per year.
0.0009	CO_2 emission coefficient for the fuel displaced in tonnes of CO_2equ per kWh.

3. **Biomass heat generation units.**

$$BE_{y3} = Q_{biomass} * E_{biomass} (CH4_{\,bio\_comb}*CH4\_GWP + N_2O_{\,bio\_comb}*N_2O\_GWP)/10\text{^}6$$

$$BE_{y3}=1{,}700(tonne/year)*0.015(TJ/tonne)[(300(kgCH_4/TJ)*21(kgCO_2/kgCH_4))+(4(kgNO_2/TJ)*310\ (kgCO_2e/\ kgNO_2\ ))]/1000$$

$$PEy = 192\ tCO_e/year$$

where,

BE_{y3}	Baseline emissions due to biomass combustion (tonnes of CO_2 equivalent)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tonnes/year)
$E_{biomass}$	Energy content of biomass (TJ/tonne)
$CH_{4\ bio\_comb}$	CH_4 emission factor for biomass (kg of CH_4/TJ, default value is 300)
CH_4 GWP	Is the approved Global Warming Potential value for methane for the first commitment period, 21 (tonnes of CO_2 equivalent / kg of CH_4)
N_2O $_{bio\_comb}$	N_2O emission factor for biomass combustion (kg/TJ, default value is 4)
N_2O GWP	Is the Global Warming Potential for N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period. (kg of CO_2 equivalent / kg of N_2O)

4. LPG heat generation units.

$$BE_{y4} = O*(CO_{2\ LPG\_comb} + CH_{4\ LPG\_comb}*CH4\_GWP + N_2O\ _{LPG\_comb}*N_2O\_GWP)$$

$$BE_{y4} = 3(TJ/year)*(63.07\ (tCO_2/TJ) + 0.0011\ (tCH_4/TJ)*21\ (kgCO_2e/kgCH_4) + 0.004\ (tCH_4/TJ)*310\ (kgCO_2e/kgCH_4))$$

From the sum of these three sources of baseline emissions result the total baseline emissions as follows,

$$BE_y t = BE_{y\ 1} + BE_{y\ 2} + BE_{y\ 3} + BE_{y4}$$

$$BE_y t = 40{,}259\ tonne\ CO_{2e}/year$$

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

The emission reductions due to the project are those given by,

$$ER_y = BE_y t - PE_y$$

$$ER_y = 37{,}405\ tCO_2e$$

E.2 Table providing values obtained when applying formulae above:

Baseline

Fuel	Unit	tCO2e/year Combustion	Left to Decay	Total
Diesel	1.2 MWh/year	9.461	0	9.461
LPG	0.06 Kt/year	169	0	169
Biomass	25.229 kt/year	192	30.437	30.629
			Total	40.259

Project Activity

Fuel	Unit	tCO2e/year Combustion	Left to Decay	Total
Diesel	1.2 MWh/year	0	0	0
LPG	0.06 Kt/year	0	0	0
Biomass	25.229 kt/year	2.853	0	2.853
			Total	2.853

Net Emission Reductions	37.405

Year	Baseline Emissions due to Biomass decay tCO_2equ	Baseline Emissions due to Diesel Electricity generation tCO_2equ	Baseline Emissions due to Biomass Heat Generation tCO_2equ	Baseline Emissions due to LPG Heat Generation tCO_2equ	Project activity emissions tCO_2equ	Emission reductions tCO_2equ

2006	30.437	9.461	192	169	2.853	37.405
2007	30.437	9.461	192	169	2.853	37.405
2008	30.437	9.461	192	169	2.853	37.405
2009	30.437	9.461	192	169	2.853	37.405
2010	30.437	9.461	192	169	2.853	37.405
2011	30.437	9.461	192	169	2.853	37.405
2012	30.437	9.461	192	169	2.853	37.405
2013	30.437	9.461	192	169	2.853	37.405
2014	30.437	9.461	192	169	2.853	37.405
2015	30.437	9.461	192	169	2.853	37.405
2016	30.437	9.461	192	169	2.853	37.405
2017	30.437	9.461	192	169	2.853	37.405
2018	30.437	9.461	192	169	2.853	37.405
2019	30.437	9.461	192	169	2.853	37.405
2020	30.437	9.461	192	169	2.853	37.405
2021	30.437	9.461	192	169	2.853	37.405
2022	30.437	9.461	192	169	2.853	37.405
2023	30.437	9.461	192	169	2.853	37.405
2024	30.437	9.461	192	169	2.853	37.405
2025	30.437	9.461	192	169	2.853	37.405
2026	30.437	9.461	192	169	2.853	37.405
					Total (tCO_2 21 years)	785.510
					Total (tCO_2 7 years)	261.837

F. Environmental impacts

F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity: *(if applicable, please provide a short summary and attach documentation)*

NOT APPLICABLE.

According to the "Decreto 95" of the Ministery of the General Secretary of the Presidence[19], of date August 21st, 2001, the Forestal Russfin Plant does not need to enter the environmental impact evaluation system. This is due to the article 3.c, which states that power plants with capacity lower than 3 MW do not cause a significant environmental impact to be evaluated by the designed environmental authorities.

[19] http://www.segpres.cl/inicio.asp

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

Under the existing Chilean environmental legislation, the local DNA (CONAMA) calls for a Public Consultation Process (PCP) to identify concerns of the local stakeholders and response of the developer, as part of the EIA.

However, due to the technical & legal characteristics of the proposed CDM project activity (see section F.1) an open public consultation is not required by Law. In this case, what the common sense recommended, and it was done that way, was a focused public consultation, surveying the neighbors in the area of direct influence of the project and leaders or organized local groups in that same area.

Therefore the following independent PCP's activities was performed by the project developer:

a) 02 public announcements were performed in a regional newspaper.
b) Letters to all the public authorities and neighbors was sent explaining the project.

The PCP has been developed following crystal-clear procedures and tried to cover the interested parties and/or by those affected by the project.

Only the Chilean service of agriculture and stockbreeding (Servicio Agricola y Ganadero, SAG) submit a concrete positive opinion about the project through letter number 11772 dated September 12 th 2005, signed by the Regional Director of SAG in the "Region XII", Mr. Carlos Rowland Ovando (letter's copy available upon request).

G.2 Summary of the comments received:

In general, the perception of the project is positive and related benefits regarding the use of clean mechanisms for electricity generation are well recognized by local stakeholders. Other concerns about the local permits and operation are seen as solvable and not as key within their general concerns about the mill itself.

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

The project developer will take the suggestions up and will inform the stakeholders regularly on the progress of the project at Forestal Russfin Ltda. Mill site.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

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