Monitoring report form
(Version 03.2)

Monitoring report

Title of the project activity	VALDIVIA BIOMASS POWER PLANT
Reference number of the project activity	UNFCCC REF. Nº: 1787
Version number of the monitoring report	1
Completion date of the monitoring report	11/04/2014
Registration date of the project activity	01/04/2009
Monitoring period number and duration of this monitoring period	Monitoring period #4 is from 01/01/2013 to 31/12/2013 (both days included).
Project participant(s)	CELULOSA ARAUCO Y CONSTITUCIÓN S.A.
Host Party(ies)	Chile.
Sectoral scope(s) and applied methodology(ies)	Scope 1 (ACM0002 ver.6) "Consolidated baseline methodology for grid-connected electricity generation from renewable sources". (ACM0006 ver. 5) "Consolidated methodology for generation from biomass residues".
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	Estimated amount of GHG emission reductions from 01 January of 2013 to 31 December of 2013: **181,654 (tCO_{2eq}).**
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	The total net emission reduction claimed in the monitored period from 01 January 2013 to 31 December 2013 is: **94,762 (tCO_2eq).**
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012 (if applicable)	N/A
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	94,762 (tCO_2eq)

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project activity consists in a 550,000 (ADt/year)[1] pulp mill with a 61 MW of surplus power capacity to the grid. This surplus capacity allows the pulp mill to operate as a grid-connected power plant. The mill is located in the X Region of Chile.

The surplus electric power capacity of the mill is a result of the following initiatives:

- The installation of a high capacity biomass power boiler, designed for electric power generation.
- The construction of a more efficient pulp mill, capable of generating surplus electric power to the grid.

The project activity is designed to use black liquor and additional biomass from forest operations (bark and sawdust) for power cogeneration in the new pulp mill facility. The project activity is presented by Celulosa Arauco y Constitución S.A. (from now on, Arauco), a leading forestry and pulp-producing company in Chile.

Though modern pulp mills tend to be self-sufficient in heat and electric power generation, the Valdivia pulp mill was deliberately designed to generate a considerable amount of surplus power to the grid. This surplus is generated by burning black liquor in the recovery boiler and biomass from forest operations (from own and third party sources) in a power boiler, both inside the pulp mill facility. All the biomass consumed by the project activity is generated from sustainable forest operations. The additional electric power generation capacity of the pulp mill is a result of particular modifications of the mill that enable it to generate additional power to the grid. Such capacity would have not been available to the grid with a more conventional business as usual pulp mill design.

The reduction in greenhouse gas emissions is therefore accomplished through the displacement of grid electricity by carbon neutral surplus electricity generated by the pulp mill. An additional reduction of greenhouse gases is accomplished by the additional consumption of biomass from forest operations (a mix of sawdust and bark) to increase the surplus power generation of the mill. In a baseline scenario, this additional amount of biomass would not be used for energy purposes and would be dumped in piles for natural decay or burned in the open air in an uncontrolled manner.

Considering the higher cost of building a pulp mill with surplus power capacity, the decision of building such power plant relied on the possibility of not relying on the SIC grid for electric power, on selling excess power to the grid and on the potential benefits from being a CDM project activity.

The Valdivia project activity assists Chile's sustainable growth by providing electricity to the SIC grid through biomass power generation, which is a clean and renewable energy source. The Project Participant believes that biomass power generation constitutes a sustainable source of power generation that brings clear advantages to mitigate global warming. By using the available natural resources in a more efficient way, the Valdivia CDM project activity helps promoting 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 Valdivia CDM project is a good example to demonstrate the viability of electricity generation as a source of revenue not only to the pulp industry, but also to all forest-related industries. It is worthy to highlight, however, that very few pulp mills in Chile have this additional power generation capacity. This makes the Valdivia pulp mill quite unique and particular in its type.

Relevant dates for the project activity:

Date	Key events
September 2001	Start date
February 2004	Commissioning date
01/04/2009 to 31/12/2009.	The 1st monitoring period
01/01/2010 to 31/12/2010.	The 2nd monitoring period
01/01/2011 to 31/12/2012	The 3rd monitoring period
01/01/2013 to 31/12/2013 (both days are included)	The 4th monitoring period (this report)

[1] ADt stands for "Air Dry ton".

Total Net emission reductions

From Jan 1st 2013 to Dec 31st 2013: 94,762 (tCO_2eq)

A.2. Location of project activity

The project activity is located in Chile, X Region of Valdivia, commune of San José de la Mariquina, in the province of Valdivia. It is located in km 788 of the 5-Sur highway in the Rucao sector. The Valdivia Region can be directly accessed from Santiago through the 5-Sur or Panamericana Sur highway. The project site is located in the following geographical coordinates 39°33'51'' S and 72°53'41''W.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (Host)	**Celulosa Arauco y Constitución S.A.**	**No**

A.4. Reference of applied methodology

The name of the approved baseline methodology applied to the proposed project activity is:

- ACM0006 (Version 05), "Consolidated methodology for generation from biomass residues".

The project activity also relies on the following methodologies and tools:

- ACM0002 (Version 06), "Consolidated methodology for grid-connected electricity generation from renewable sources".
- "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 02.2)
- "Tool for the demonstration and assessment of additionality" (Version 04).

A.5. Crediting period of project activity

Starting date of the first crediting period	01/04/2009
End date of the first crediting period	31/03/2016
Length of the first crediting period	Seven (7) years
Maximum length of the crediting period	3 x Seven (7) years

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The project activity has been completed as planned and described in the Project Design Document (PDD). The starting date of the operation of the project activity was in 01/04/2009 and it has operated as described in the CDM PDD.

Information on the operation of the project activity during the monitoring period is presented in table below:

	Out of service day	Starting day	Number of hours	Comments
Shutdown				
Turbo generator 2	29/9/2013	01/10/2013	49,7	Maintenance work in high voltage areas of the power plant. Also the rotor jammed.
Maintenance Stoppage				
Power Boiler	25/11/2013	01/12/2013	156,3	Annual programmed stoppage
Recovery boiler	23/11/2013	07/12/2013	337,0	Annual programmed stoppage
Turbo generator 1	11/11/2013	31/12/2013	1213	Overhaul
Turbo generator 2	25/11/2013	02/12/2013	157,9	Annual programmed stoppage

<u>During the monitored period the following instruments were replaced:</u>

	Old serial number	New serial number	Date replaced
365-FT-923	5003010907	5003009136	February 2, 2013
352-DT-435B	2002-D43-5100	2002-D42-5100	February 5, 2013
352-DT-435B	2002-D42-5100	2002-D43-5100	November 5, 2013

This steam flow meter (365-FT-923) was replaced on the same day its failure was detected. Failure was due to a faulty low pressure chamber.

Instruments with delayed calibration during the monitored period:

TAG	Calibration due date	Actual calibration date
331-WT-005	13/11/2013	---
352-FT-461	11/11/2013	03/12/2013
352-FT-462	11/11/2013	03/12/2013
352-FT-463	11/11/2013	03/12/2013
352-FT-464	11/11/2013	03/12/2013
352-TT-430	10/11/2013	27/11/2013

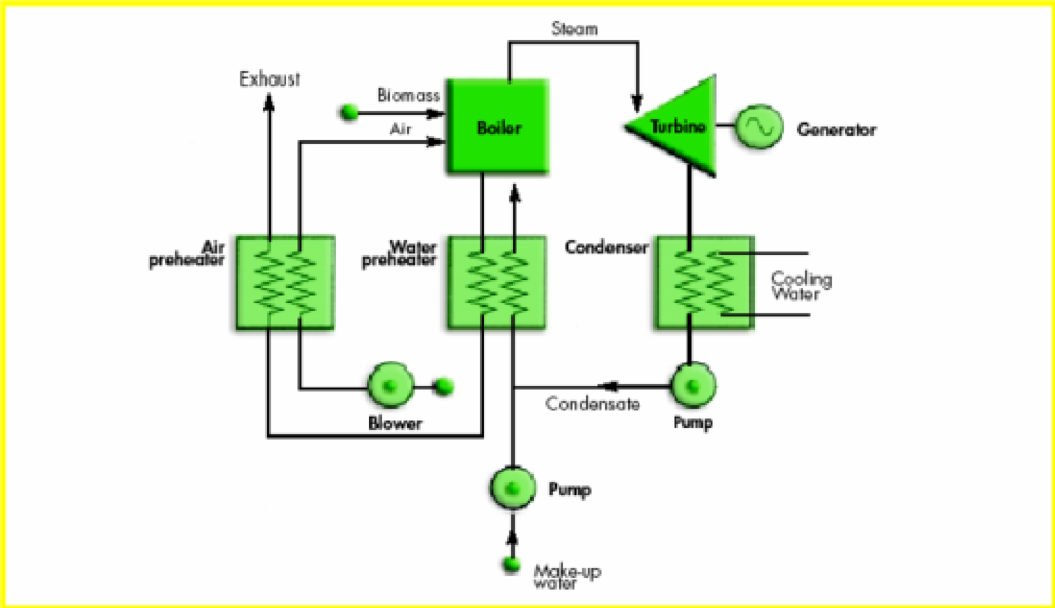
Description of the installed technology and equipment

The technology used in this project (which is also the predominant technology everywhere in 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 vapour 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 1). 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.

Figure 1: Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine.



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

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

Delays in the net calorific value measurements of fossil fuels (i.e. Diesel and Fuel Oil) and biomass residues (i.e. black liquor and biomass residues from forest operations) consumed in the project activity:

According to the monitoring plan, the Project Participant shall determine the net calorific value of the following fuel types: Fossil fuels (i.e. Fuel Oil and Diesel), black liquor and biomass residues from forest operations, at least every six months, taking three samples per measurement. In this case, during the monitored period [Jan 01st of 2013 -- 31st of 2013] delays occurred in the sampling of these fuels.

In order to address these delays in the most conservative possible way, the Project Participant has performed adjustments to the fuels' net calorific value measurements. The adjustments are described in detail in the following paragraphs:

Adjustment to fossil fuel (i.e. Diesel and Fuel Oil) net calorific values:

There was a delay of 14 days as shown in the table below:

	1st semester	2nd semester
Sampling dates	Jan 09, 2013	July 23rd, 2013
Delay	----	14 days

– Carbon dioxide emissions from on-site consumption of fossil fuels, in this case Fuel Oil and Diesel:

According to the last version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", the Project Participant used the following approach for determine CO_2 emissions:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \ x \ COEF_{i,y}$$

Where:

$PE_{FC,i,y}$	= CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr).
$FC_{i,j,y}$	= Quantity of fuel type i combusted in process j during the year y (mass or volume unit/y).
COEFi,y	=CO_2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit);
i	=are the fuel types combusted in process j during the year y.

The CO_2 emission coefficient $COEF_{i,y}$ is calculated using approach B of the Tool presented above, which consists in calculating the coefficient based on the net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,y,y}$$

Where:

$COEF_{i,y}$	= CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit);
$NCV_{i,y}$	= Weighted average net calorific value of the fuel type i in year y (tCO_2/GJ);
$EF_{CO2,i,y}$	= Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ);
i	= Fuel types combusted in process j during the year y.

According to the Tool, a high NCV of fossil fuels results in a high $COEF_{i,y}$ which leads to high project emissions due to on-site consumption of fossil fuels. Therefore, the Project Participant has conducted the most conservative adjustment to these fossil fuels measurements considering the upper IPCC values of 41.70(GJ/ton) for Fuel Oil and 43.30(GJ/ton) for Diesel. Results of these adjustment for 2013 are presented in table below:

Fossil fuel type	NCV (original) [(a)] (GJ/BDt)	NCV (adjusted) [(b)] (GJ/BDt)
Fuel Oil	40.663	40.801
Diesel	43.005	43.017

The Project Participant would like to note the following:

(a) These values correspond to the average net caloric values obtained from the original measurements ofr Fuel oil and Diesel conducted per semester during 2013.

(b) The NCV was adjusted using the upper 2006 IPCC values for Fuel oil and Diesel for the period from July 1st to July 22, 2013. The rationale behind this adjustment is that the first sample, taken on January 9th, is valid for the first semester from January 1st to June 30th and the second sample, taken on July 23rd, is valid for the second semester from the sampling date onwards.

Detailed calculations are provided in the emission reduction calculation spread sheet named Valdivia CP1MP4 140210 adjustment.xls.

- Carbon dioxide emissions from fossil fuel consumption, in this case Diesel, from biomass residues transportation to the power plant.

Equation 4 of the ACM0006 (Version 05): Project emissions due to biomass transportation.

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} * AVD_y * EF_{km,CO2,y}$$

Where:

PET_y =	CO_2 emissions during year y due to transport of the biomass residues to the project plant (tCO_2/yr).
Ny =	Number of truck trips during the year y.
AVD_y =	Average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during year y (km).
$EF_{km,CO2,y}$ =	Average CO_2 emission factor for the trucks measured during the year y (tCO_2/km).
BFk,y =	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter).
TL_y =	Truck average biomass transportation capacity (ton).

In equation 4 of the ACM0006 (Version 05) a higher net calorific value results in a higher $COEF_{i,y}$ and thus a higher $EF_{km,CO2,y}$, thereby increasing project emissions. The Project Participant has conducted the most conservative adjustment, in this case to Diesel consumption, considering the upper IPCC value of 43.30 (GJ/ton) for Diesel consumed due to biomass transportation for the period from July 1st to July 22nd 2013. As a result, the emission factor for heavy truck transportation increased from 1.2576 to 1.2579 (kgCO2/km), consequently increasing project emissions from biomass residues transportation to the power plant.

Adjustment to the net calorific value of biomass residues from forest operations:

There was a delay of 16 days as shown in the table below:

	1st semester	2nd semester
Sampling dates	Jan 09, 2013	July 25th, 2013
Delay	----	16 days

- Methane emissions from controlled combustion of biomass residues:

Equation 8 of the ACM0006 (Version 05) is used to calculate methane emissions due to combustion of biomass residues in the project plant.

$$PE_{Biomass,CH4,y} = EF_{CH4,y} * \sum_k BF_{k,y} * NCV_k$$

Where:

$BF_{k,y}$ =	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter).
NCV_k =	Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter).
$EF_{CH4,BF}$ =	CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ).

The controlled biomass burning factor affects project emissions. According to equation 8, a higher net calorific value of biomass residues results in a higher controlled biomass burning factor. For conservativeness reasons, the Project Participant applied the upper 2006 IPCC net calorific value of 31(GJ/BDt) for biomass residues from forest operations for the period from July 1st to July 24th, 2013. This was done considering that the net calorific value of the samples taken on January 9th was valid for the first semester, from January 1st to June 30th and the net calorific value of samples taken on July 25th was valid from July 25th until December 31st. The average net calorific value that results from this adjustment is higher than the original one. This, in turn, leads to a higher controlled biomass burning factor and therefore, higher

project emissions. The values obtained can be seen in the following table:

Biomass from forest operations	Original	Adjusted
NCV (GJ/BDt)	17.823	18.666
Controlled biomass burning factor (tCO_{2eq}/000ton)	11.45	11.99
Emissions from controlled burning of biomass residues in the power boiler (tCO_2/y)	668	700

Please note that the emissions value referred to as "Original" includes another adjustment related to the late calibration of the power boiler's weight meter. See "CP1MP4 140210 adjustments.xls."

Detailed calculations are provided in the emission reduction calculation spread sheet named Valdivia CP1MP4 140210 adjustments.xls.

- Methane emissions due to uncontrolled biomass burning avoidance

Equation 46 of the ACM0006 (Version 05) is used to calculate the baseline methane emissions associated to the additional biomass consumed due to the project activity.

$$BE_{biomass,y} = GWP_{CH4} * \sum_{k} BF_{PJ,k,y} * NCV_k * EF_{burning,CH4,y}$$

Where:

$BE_{biomass,y}$ = Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_2e/yr).
GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4).
$BF_{PJ,k,y}$ = Incremental quantity of biomass residue type k used as a result of the project activity in the project plant during the year y (tons of dry matter or liter).
NCV_k = Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter)
$EF_{burning,CH4,k,y}$ = CH_4 emission factor for uncontrolled burning of the biomass residue type k during the year y (tCH_4/GJ).

In this case, the emission factor affects the baseline emissions of the project activity. As can be seen from above equation, a lower net calorific value results in lower baseline emissions. Therefore, the Project Participant considered the lower limit 2006 IPCC value of 7.9 (GJ/BDt) for biomass residues when calculating the methane emission factor for uncontrolled burning of biomass residues from forest operations. This lower limit IPCC value was applied from July 1st to July 24th, 2013.

Results in term of emission reductions are presented as follows:

Biomass from forest operations	Original	Adjusted
NCV (GJ/BDt)	17.823	17.167
CH_4 emission factor for uncontrolled burning of biomass from forest opserations (tCO_{2eq}/000ton)	327	315
Emissions reductions due to uncontrolled biomass burning avoidance (tCO_{2eq}/y)	19,086	18,383

Please note that the emissions value referred to as "Original" includes another adjustment related to the late calibration of the power boiler's weight meter. See "CP1MP4 140210 adjustments.xls."

Detailed calculations are provided in the emission reduction calculation spread sheet named Valdivia CP1MP4 140210 adjustment.xls.

- Emission reductions due to displacement of electricity
(adjustment performed to black liquor net calorific value due to a sampling delay)

The Project Participant informs that there was a delay of 14 days in the sampling of pine black liquor during the second semester.

	Pine campaign	
Sampling dates	January 9th, 2013	July 23rd, 2013
Delay	---	14 days
	Euca campaign	
Sampling dates	January 18th, 2013	July 7th, 2013
Delay	---	no delay

Equation 14 of the ACM0006 (Version 05) is used to calculate the emission reductions due to the displacement of electricity as a result of the project activity.

$$EG_y = EG_{project\ plant,y} = \varepsilon_{el,other\ plant(s)} \cdot \frac{1}{3.6} \sum_k BF_{k,y} \cdot NCV_k$$

Where:

EG_y = Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during year y (MWh). In this case, the calculation would include the net quantity of increased electricity generation derived from implementing CDM project initiatives Nº1 and Nº2, simultaneously.

$EG_{project\ plant}$ = Net quantity of electricity generated in the project plant during year y (MWh). In this case, the project plant would incorporate the net quantity of increased electric generation capacity derived from implementing CDM project initiatives Nº1 and Nº2.

$\varepsilon_{el,\ other\ plant(s)}$ = Average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass residues fired in the project plant in the absence of the project activity ($MWh_{el}/MWh_{biomass}$). In this case, the baseline power plant electric efficiency calculation considers a business-as-usual pulp mill (reference plant), in which project initiatives Nº1 and Nº2 are not implemented. For more details please see pages 10 and 11 of the PDD.

$BF_{k,y}$ = Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or litter). In this case, the project plant would combust a higher amount of biomass from forest operations (CDM project initiative Nº1) but the same amount of black liquor (CDM project initiative Nº2) than the baseline plant (reference plant). This variable includes both types of biomass fired in the project plant.

NCV_k = Net calorific value of the biomass residue type k (GJ/ton of dry matter of GJ/liter). In this case, the NCV for each type of biomass would be monitored and considered in the calculation: the NCV of biomass from forest operations (CDM project initiative Nº1) and the NCV of black liquor (CDM project initiative Nº2).

Adjustment performed to black liquor net calorific value:

In equation 14 of ACM0006 (version 05) a higher black liquor net calorific value results in a lower amount of net increased electricity generation as a result of the project activity, and therefore less emission reductions.

For eucalyptus (no sampling delay), the Project Participant applied the net calorific value obtained on January 18th to black liquor combusted from January 1st to June 30th, 2013.

For pine, the Project Participant applied the net calorific value obtained on January 9th to black liquor

combusted from January 1st to June 30th, 2013. Pine black liquor combusted between July 1st and July 22nd was assigned a net calorific value of 23.0 (GJ/tDS), which corresponds to the 2006 IPPC upper limit value. For pine black liquor combusted from July 23rd to December 31st, the net calorific value obtained in the second semester was applied.

Results were as follows:

	Jan 1st to June 30th	July 1st to July 22nd	July 23rd to Dec 30th
Pine black liquor (tDS)	217,047	31,192	157,311
NCV pine black liquor (GJ/tDS)	11.85	11.84	11.84
NCV pine black liquor (GJ/tDS) **ADJUSTED**	11.85	**23.0**	11.84
Euca black liquor (tDS)	73,646	16,885	53,919
NCV euca black liquor (GJ/tDS)	11.46	11.88	11.88
Weighted average NCV (GJ/tDS) **ADJUSTED**	11.75	**19.09**	11.85

As a result of the weighted average calculation of the NCV for 2013 using data presented in table above, the value increased from 11.80 (GJ/tDS) to 12.25 (GJ/tDS).

As a consequence, emission reductions were modified in the following way:

According to equation 14 of the ACM0006 (Version 05) the net quantity of increased electricity decreased from 150,990 (MWh/y) to 130,198 (MWh/y). Therefore, associated grid emissions also decreased from 116,802 (tCO_2/y) to 100,717 (tCO_2/y).

Detailed calculations are provided in the emission reduction calculation spread sheet named Valdivia CP1MP4 140210 adjustment.xls.

Considering all adjustments described previously, the total emission reductions claimed for the monitored period have changed as shown below:

PROJECT EMISSIONS		Total (original)	Total (adjusted)
Methane emissions from combustion of biomass residues	(tCO_2eq/y)	668	700
Carbon dioxide emissions from biomass residues transportation to the power plant	(tCO_2/y)	412.2	412.3
Carbon dioxide emissions from on-site consumption of FF:			
Fossil fuel consumption due to on-site biomass from forest operations transportation	(tCO_2/y)	145.59	145.64
Fossil fuel consumption in the power boiler:	(tCO_2/y)	15,426	15,478
Fossil fuel consumption in the recovery boiler	(tCO_2/y)	7,575	7,601
TOTAL PROJECT EMISSIONS	(tCO_2eq/y)	24,228	24,338

Please note that emission values referred to as “Original” include another adjustment related to the late calibration of the power boiler’s weight meter. See “CP1MP4 140210 adjustments.xls.”

Total project emissions during 2013 increased 0.5% to 24,338 (tCO_2eq/y) after applying the most conservative adjustments described above.

		Total (original)	Total (adjusted)
Carbon dioxide emissions due to electricity displacement	(tCO_2/yr)	116,082	100,717
Methane emissions due to uncontrolled biomass burning avoidance	(tCO_2eq/yr)	19,086	18,383
TOTAL BASELINE EMISSIONS	(tCO_2eq/yr)	135,888	119,100

Please note that the emissions value referred to as "Original" includes another adjustment related to the late calibration of the power boiler's weight meter. See "CP1MP4 140210 adjustments.xls."

Total baseline emissions during 2013 decreased 12% to 119,100 (tCO_2eq/y) after applying the most conservative adjustments described above.

Detailed calculations are provided in the emission reduction calculation spread sheet named Valdivia CP1MP4 140210 adjustment.xls.

Net emission reductions

		Baseline emissions		Project activity emissions					
	Net emission reductions	Grid emissions	Methane emissions	Methane in P.B.	Fossil fuel in P.B.	Fossil fuel in R.B.	Transport onsite	Transport to P. Plant	Leakage
	(tCO_2eq)	(tCO_2)	(tCO_2eq)	(tCO_2eq)	(tCO_2)	(tCO_2)	(tCO_2)	(tCO_2)	(tCO_2)
4th verif (01 Jan 2013 - 31 Dec 2013)	111.659.9	116.801.9	19.085.8	668.1	15.425.6	7.575.3	145.9	413.2	0
NET EMISSION REDUCTIONS	**111.659**	**116.802**	**19.086**	**668**	**15.426**	**7.576**	**146**	**413**	**0**

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

Net emission reductions (with adjustment)

		Baseline emissions		Project activity emissions					
	Net emission reductions	Grid emissions	Methane emissions	Methane in P.B.	Fossil fuel in P.B.	Fossil fuel in R.B.	Transport onsite	Transport to P. Plant	Leakage
	(tCO_2eq)	(tCO_2)	(tCO_2eq)	(tCO_2eq)	(tCO_2)	(tCO_2)	(tCO_2)	(tCO_2)	(tCO_2)
4th verif (01 Jan 2013 - 31 Dec 2013)	94.762.6	100.717.4	18.382.7	699.6	15.478.0	7.600.9	145.6	413.3	0
NET EMISSION REDUCTIONS (with adjustment)	94.762	100.717	18.383	700	15.478	7.601	146	413	0

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

As can be seen from the tables above, the adjustments performed due to delays in sampling for net calorific value analysis are translated into a decrease of 15% to 94,763 (tCO_2) in the total amount of emission reductions claimed for the monitored period.

B.2.2. Corrections

None.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

The Project Participant presented a request for deviation of the baseline methodology during Validation process, so that two compatible baseline scenarios (N°3 and N°4) could be s imultaneously applied to the proposed project activity. In this case, the additional net electric power generation of the project activity involving simultaneously scenarios N°3 and N°4, wou ld be determined by following the indications of baseline scenario N°4, using formula N°14, which is used wit h some minors modifications included in page 120, Annex 3 of the registered PDD.

The approval date of the request for deviation was on December 13, 2007, and details of this approval are included in page 111, Annex 3 of the registered PDD.

B.2.4. Changes to project design of registered project activity

None

B.2.5. Changes to start date of crediting period

None

B.2.6. Types of changes specific to afforestation or reforestation project activity

None

SECTION C. Description of monitoring system

The Project Participant, Arauco, has implemented monitoring procedures according to the monitoring methodology chosen for this project activity. This monitoring methodology accounts for emission reductions in an accurate and conservative manner.

Arauco is responsible for the operation and the monitoring of the project activity. Arauco counts with on-site personnel (at the project activity site), who are in charge of gathering and registering all the required information described in the monitoring plan. Such duties are incorporated to the personnel's everyday activities to ensure continuity and high-quality standards. Support and consultancy regarding the CDM obligations is provided by Arauco Bioenergía S.A[2]

Data collection procedures:

The highest attention is demanded by the parameters that should be continuously monitored by the Project Participant. These parameters are the most important data for the calculation of the achieved emission reduction.

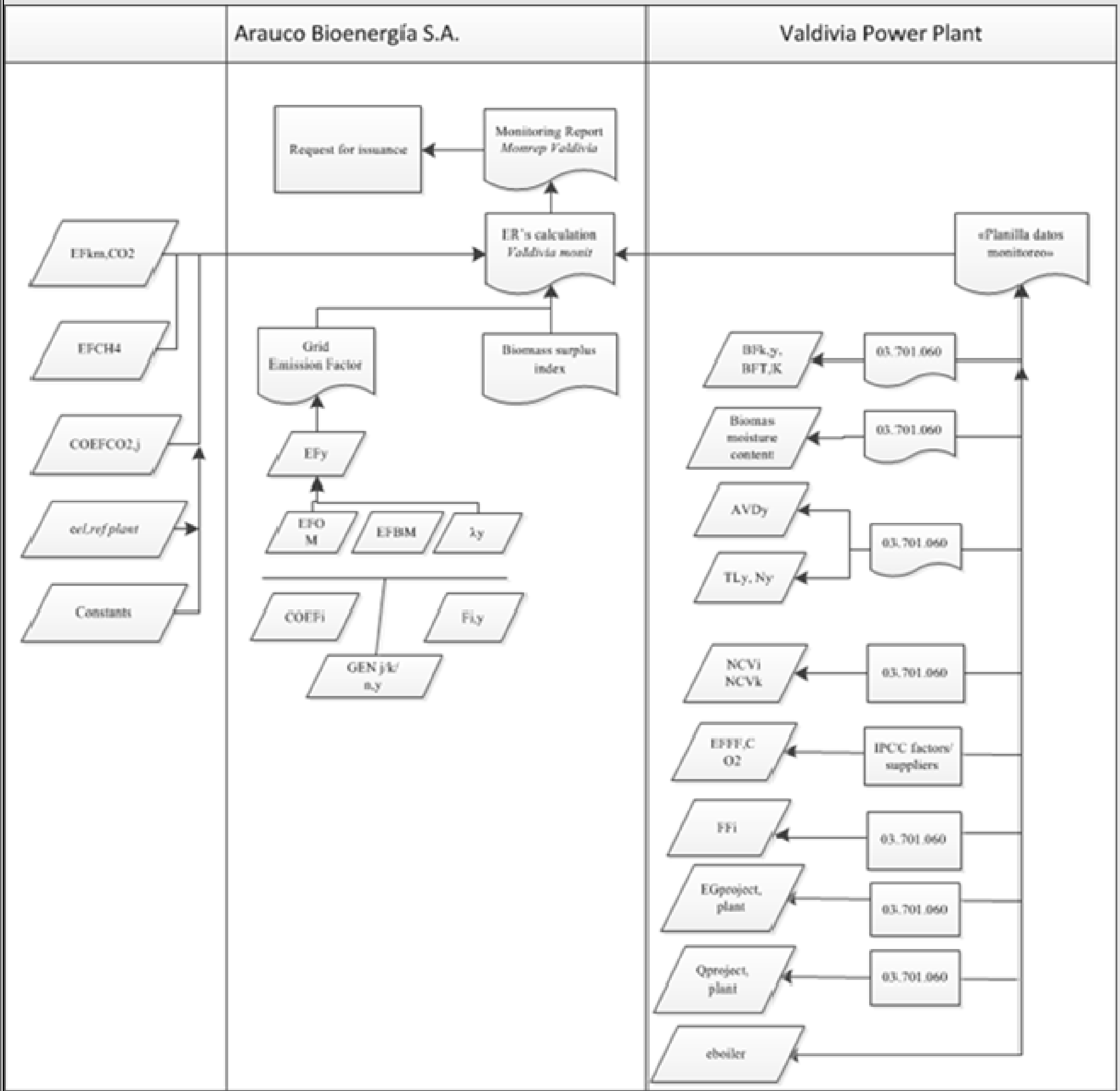
The parameters such as the quantity of biomass residue used ($BF_{k,y}$, $BF_{T,k}$), fossil fuel consumption (FF_i), quantity of heat generated ($Q_{projectplant}$) and net quantity of electricity generated data ($EG_{projectplant}$) are monitored continuously, online and fully integrated with the Distributed Control System (DCS) of the Valdivia pulp mill. The data is downloaded by the IP system and inserted automatically in an Excel spread sheet, and finally data is aggregated and reported monthly in the emission reduction calculation sheet.

Biomass truckloads transported to the power plant are weighed by weighbridges installed at the Valdivia plant entrance. Data about return trip distance between biomass fuel supply sites and the project site and data about on-site use of transport fuel are informed by third parties.

The information is partially processed and stored on-site, and is sent to Arauco Bioenergía S.A. in Santiago for further and final processing (table formats, reports, etc.) that allow calculating the resulting emission reductions.

[2] Arauco Bioenergía S.A. is the new name of Arauco Generación S.A.

The following diagram describes the monitoring system:



The Project Participant informs that in document of # 03.701.060 is described the proccedure of monitoring the CDM parameters used in the emission reduction calculations.

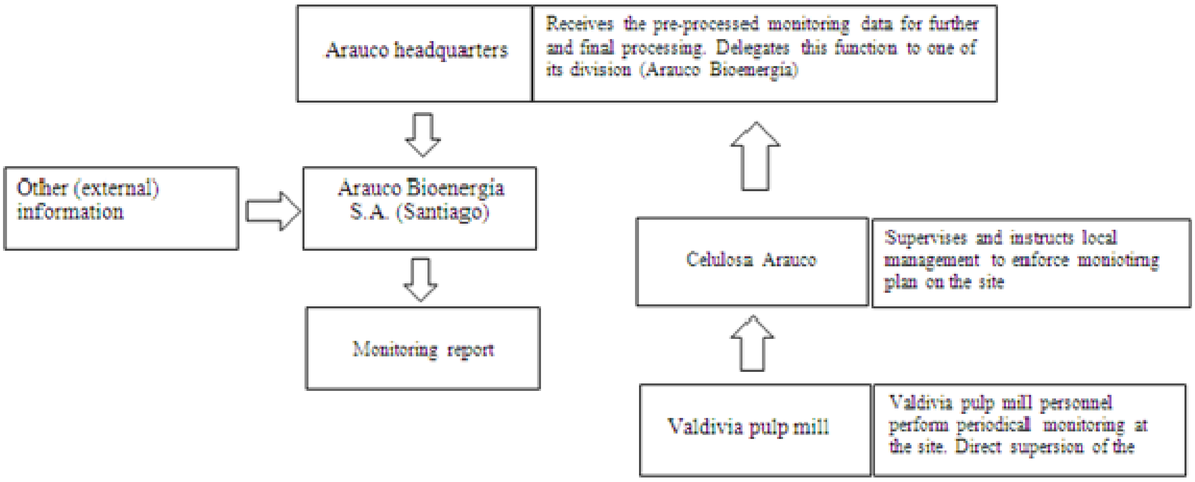
Procedure for emergency case:

In case of unforeseen problems or failures of the data recording system the operating staffs informs the responsible person for the monitoring. In cases where no data are available due to failures of the monitoring equipment the responsible person for the monitoring decides as soon as possible which actions will be undertaken to minimise the amount of not registered GHG emission reduction. Furthermore, procedures in case of failures of monitoring equipment/instruments and IT systems, such as IP21, Lab21, and SRR are described in procedure 03.701.060.

As mentioned in the registered PDD, Arauco Bioenergía S.A. is responsible for gathering and processing all the monitored data for the emission reduction calculation for the monitored period which is normally carried out every year.

The monitoring information flow implemented by Arauco Bioenergia S.A. for the Valdivia CDM project activity is presents as follows:

Monitoring information flow of Valdivia Power Plant project activity



Calibration results of monitoring instruments for 2013 are presented in the following table:

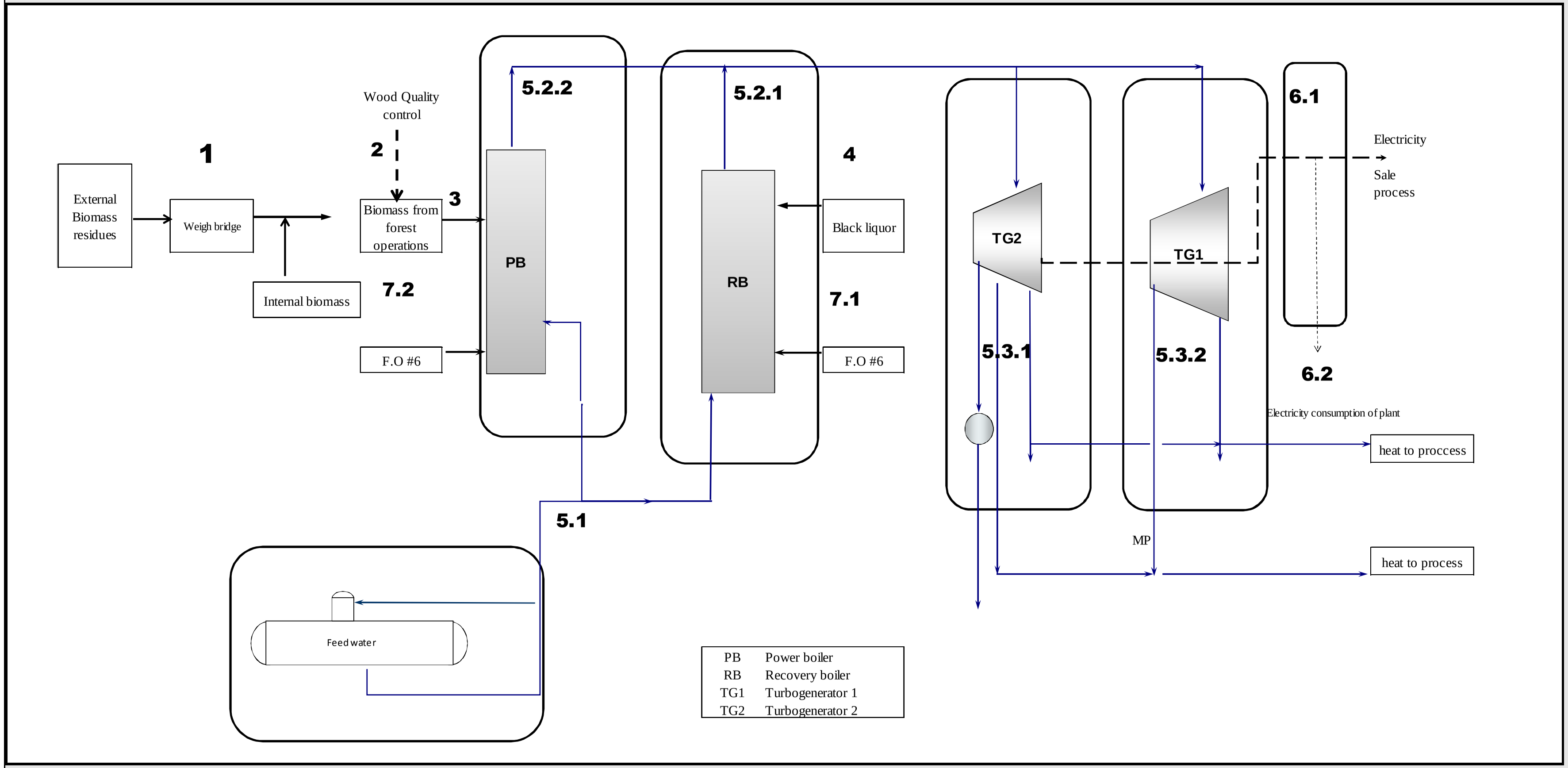
ITEM	INSTRUMENT	VARIABLE	ITEM	MEASURED ERROR GREATER THAN ADMISSIBLE ERROR (YES/NO)	ADJUSTMENT MADE (YES / NO)	
1	Weighbridge #1 South	TL_y	330-WT-050	YES	YES	
	Weighbridge #2 Center	TL_y	330-WT-051	YES	YES	
	Weighbridge #3 North	TL_y	330-WT-052	YES	YES	
2	Digital Scale	Moisture content of $BF_{k,y}$	310-81-1150	ARE EQUAL	YES	
	Digital Scale	Moisture content of $BF_{k,y}$	310-81-1151	ARE EQUAL	YES	
	Digital Scale	Moisture content of $BF_{k,y}$	310-81-1213	ARE EQUAL	YES	
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1154	NO	NO	
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1155	NO	NO	
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1155	ARE EQUAL	YES	
3	Weightmeter	$BF_{k,y}$	331-WT-005	NO	NO	Note 1
4	Magnetic Flow Transmitter	$BF_{k,y}$	352-FT-461	NO	NO	
	Magnetic Flow Transmitter	$BF_{k,y}$	352-FT-462	NO	NO	
	Magnetic Flow Transmitter	$BF_{k,y}$	352-FT-463	NO	NO	
	Magnetic Flow Transmitter	$BF_{k,y}$	352-FT-464	NO	NO	
	Refractometer	Moisture content of $BF_{k,y}$	352DT435A	NO	NO	
	Refractometer	Moisture content of $BF_{k,y}$	352DT435B	YES	NO	Note 2
	Temperature Transmitter	Temperature of $BF_{k,y}$	352TT430	NO	NO	
5.1.	Pressure Transmitter	$Q_{project plant,y}$	362FT980	NO	YES	
	Temperature Transmitter	$Q_{project plant,y}$	362TT965	NO	YES	
5.2.1.	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT901	NO	YES	
5.2.2.	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT902	YES	YES	
5.3.1.	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT910	NO	YES	
	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT913	NO	YES	
	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT914	NO	YES	
5.3.2.	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT920	YES	YES	
	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT923	YES	YES	
	Differential Pressure Flow Transmitter	$Q_{project plant,y}$	365FT924	NO	YES	
6.1.	Energy Meter	$EG_{project plant,y}$	368JI203	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI104	NO	NO	
6.2.	Energy Meter	$EG_{project plant,y}$	368JI105	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI101	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI102	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI107	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI201	NO	NO	
	Energy Meter	$EG_{project plant,y}$	368JI205	NO	NO	
7.1.	Mass Flow Transmitter	$FF_{project plant,y}$	352FT653	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	352FT657	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	352FT681	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	352FT685	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	352FT823	CALIB NOT REQUIRED	YES(zero adjustment)	
7.2.	Mass Flow Transmitter	$FF_{project plant,y}$	363FT507	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	363FT510	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	363FT515	CALIB NOT REQUIRED	YES(zero adjustment)	
	Mass Flow Transmitter	$FF_{project plant,y}$	363FT518	CALIB NOT REQUIRED	YES(zero adjustment)	

The Project Participant would like to note the following:

– Adjustments were conducted in cases where the error found exceeded the maximum permissible error stated by the manufacturer, except for:

Note 1 – Calibration of 331-WT-005 was not performed on the date it was due, but the measured error during the last calibration did not exceed maximum permissible error.

Note 2 – The sensor of 352-DT-435B was found twice out of calibration, so it was replaced by a calibrated one both times.


External Biomass residues
Weigh bridge
Internal biomass
1
2
3
4
Wood Quality control
Biomass from forest operations
7.2
F.O #6
PB
5.2.2
RB
5.2.1
Black liquor
7.1
F.O #6
5.1
Feed water
PB Power boiler
RB Recovery boiler
TG1 Turbogenerator 1
TG2 Turbogenerator 2
TG2
TG1
5.3.1
5.3.2
6.1
6.2
Electricity
Sale
process
Electricity consumption of plant
heat to proccess
MP
heat to process

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	**GWP_{CH4}**
Unit:	(tCO2e/tCH4)
Description:	Global Warming Potential for CH4.
Source of data:	IPCC
Value(s) applied):	21 (tCO2e/tCH4)
Purpose of data:	Calculation of baseline emissions.
Additional comment:	--

Data / Parameter:	$\varepsilon_{el,reference\ plant}$
Unit:	(%)
Description:	Average net energy efficiency of power in the reference power cogeneration plant that would use the biomass residues fired in the project plant in the absence of the project activity.
Source of data:	The electric efficiency of the Valdivia baseline mill was calculated from the AF Celpap energy / mass balances (Please see section A.4.3 of this PDD). The calculation itself can be found in Annex 3 of this PDD.
Value(s) applied):	12.09 %
Purpose of data:	Calculation of baseline emissions.
Additional comment:	The reference pulp mill's electric efficiency of 12.09% was established taking into account the following considerations: – The chosen baseline scenario for the Valdivia biomass power plant project activity that states that the reference pulp mill would be self-sufficient in electric and thermal power generation. Therefore, the baseline efficiency of 12.09% was calculated from the baseline pulp mill design energy / mass balances. – The baseline scenario applied to the Valdivia CDM project (self-sufficiency in heat and electric power generation) is consistent with the current BAT (Best Available Technology) for non-integrated bleached pulp mills, like the Valdivia pulp mill[3]. – The electric efficiencies of other (modern and recently built) pulp mills in the country. The electric efficiencies of these pulp mills were in the range of 8.0% to 10.5%, therefore the selection of an efficiency of 12.09% (20% higher than the higher end of the range) ensures a conservative baseline. According to the above, the chosen efficiency of 12.09% was deemed conservative and appropriate.

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

Data / Parameter:	**Additional electric power consumption of the project mill**
Unit:	(%)
Description:	This is the additional electric power consumption of the project pulp mill with surplus power capacity generation to the grid with respect to a baseline pulp mill, which does not have surplus electric power capacity to the grid. This marginal higher power consumption is derived from the installation of the equipment that enables the project pulp mill to generate additional power (for example: the installation of a higher biomass capacity power boiler in the project mill, compared to the one that would have been installed in a baseline pulp mill).
Source of data:	Energy / mass balances of AF Celpap study for the Valdivia mill.
Value(s) applied):	Constant 4.22% of the total energy consumed by the pulp mill in the project scenario.
Purpose of data:	Calculation of baseline emissions.
Additional comment:	This variable is used to determine the net quantity of electricity generated in the project plant during the year.

Data / Parameter:	**Fuel oil consumption per unit of combusted biomass in the Valdivia mill power boiler**
Unit:	(kg of fuel oil/m^3st)
Description:	This parameter refers to the amount of fuel oil that is normally co-fired in a fluidized bed biomass boiler. It considers normal operational reasons such as start-up operations and the wet condition of biomass in winter.
Source of data:	Historic fossil fuel and biomass consumption data from the Valdivia biomass power plant.
Value(s) applied):	3.43 (kg of fuel oil/m^3st)
Purpose of data:	Calculation of project emissions.
Additional comment:	In this case it is used to determine the fossil fuel consumption due to additional consumption of biomass from forest operations (sawdust and bark) in the power boiler.

D.2. Data and parameters monitored

Data / Parameter:	**$BF_{k,y}$ (and $BF_{T,k,y}$)**
Unit:	Tons of dry mater.
Description:	Quantity of biomass residue type k combusted in the project plant during the year y.
Measured/ Calculated / Default:	Measured.

	Source of data:	The project activity combusts two types of biomass residues: Black liquor from the pulping operation and a mix of sawdust and bark from forest operations. Biomass residues of type: Black liquor This variable was monitored continuously (online, each five seconds) and fully integrated with the Distributed Control System (DCS) using dedicated flow meters for measuring continuously black liquor flow (l/s) in combination with two (2) refract meters to measure the average concentration (%) of solids, and one (1) transmitter to measure the temperature (°C) of the black liquor flow. To determine the dry biomass flow (tons of Dry Solids (tDS)), the total wet flow is automatically multiplied by the average concentration (%) of solids (in the DCS) by using equation 1 listed below. Black liquor (tDS[4]/s) = black liquor flow (l/s) * (%) solids*density of black liquor (tDS/l). Black liquor flow (tDS/s) to the recovery boiler is transmitted to the pulp mill's DCS. This information is stored in the pulp mill's databases. The Operation Manager collects checks and informs the monitored integrated flow values to the person in charge of calculating emission reductions of the project activity in Arauco Bioenergía S.A. Biomass residues (mix of sawdust and bark) from forest operations Biomass from forest operations (in wet tons) combusted in the power boiler is directly monitored via an on-line weight meter located at the entrance of the power boiler. This instrument transmits the monitored data to the pulp mill Distributed Control System (DCS). As in the previous case, the registered values are integrated collected and informed by the Operation Manager to the person in charge of calculating emission reductions of the project activity in Arauco Bioenergía S.A. Please note that according to the approved monitoring plan of the registered PDD (page 79), biomass residues ($BF_{T,k,y}$) used in equation Nº4 of the ACM0006 (Version 05) correspond to the fraction of $BF_{k,y}$ attributable to the project activity that must be brought by truck from outside the plant. This fraction of $BF_{k,y}$ is also utilized for the calculation of project emissions due to transportation of biomass residues to the power plant. This amount is duly measured (weight and volume) at the entrance of the power plant.	

[4] tDS stands for "ton of dry solids".

Value(s) of monitored parameter:	<u>Black liquor</u>: 1.080.228 tDS Note: This value corresponds to the original measurement. However, the Project Participant, following a conservative approach, has carried out an adjustment to measurements of black liquor in the period the meters were out of calibration. (For detailed information refer to section “Additional Comments” under this parameter). <u>Biomass residues (mix of sawdust and bark)</u>: 163,327 (BDt, bone dry tons) Of 162,327 (BDt), only 62,395 (BDt) correspond to biomass attributable to the project activity that was brought to the power plant by trucks. As in the case of black liquor, these values correspond to the original measurements. However, an adjustment has been carried out following a conservative approach, for the period during which the weight meter was out of calibration. (For detailed information refer to section “Additional Comments” under this parameter). The Project Participant would like to note that the biomass from forest operations (mix of sawdust and bark) is monitored on a wet basis. Then biomass is adjusted to dry basis using the corresponding moisture content as per required by the baseline methodology.
Monitoring equipment:	<u>Black liquor</u>: 352FT461 Type: Magnetic flow transmitter Rosemount 8742C Accuracy class: +/-0.25% Serial numbers:0860144486 Calibration frequency: 12 months Calibration dates: 11/11/2012 Date of last calibration: 03/12/2013 Validity: 02/12/2014 352FT462 Type: Magnetic flow transmitter Rosemount 8732E Accuracy class: +/-0.25% Serial numbers:0312404 Calibration frequency: 12 months Calibration dates: 11/11/2012 Date of last calibration: 03/12/2013 Validity: 02/12/2014 352FT463 Type: Magnetic flow transmitter Rosemount 8732E Accuracy class: +/-0.25% Serial numbers:0312403 Calibration frequency: 12 months Calibration dates: 11/11/2012 Date of last calibration: 03/12/2013 Validity: 02/12/2014 352FT464 Type: Magnetic flow transmitter Rosemount 8732E Accuracy class: +/-0.25% Serial numbers:0312399 Calibration frequency: 12 months Calibration dates: 11/11/2012

Date of last calibration: 03/12/2013
Validity: 02/12/2014

352TT430
Type: Temperature Transmitter. ROSEMOUNT 3144PD1A1NAB4M5F5C8C4Q4
Accuracy class: +/- 0.21℃
Serial number: 0618822
Calibration frequency: 1 year
Calibration dates: 10/11/2012
Date of last calibration: 27/11/2013
Validity: 26/11/2014

352DT435A
Type: Refract meter. K-PATENTS IT-RE-GP
Accuracy class: +/- 0.1%
Serial number: 2002-D42-5099
Calibration frequency: 2 Years
Calibration dates: 10/11/2012, 30/04/2013
Date of last calibration: 04/11/2013
Validity: 03/11/2015

352DT435B
Type: Refract meter. K-PATENTS IT-RE-GP
Accuracy class: +/- 0.1%
Serial number: 2002-D43-5100
Calibration frequency: 2 Years
Calibration dates: 10/11/2012
Date of last calibration: 10/11/2012
Validity: 09/11/2014

Sensor replaced on 02/05/2013 by:

352DT435B
Type: Refract meter. K-PATENTS IT-RE-GP
Accuracy class: +/- 0.1%
Serial number: 2002-D42-5100
Calibration frequency: 2 Years
Calibration dates: 02/05/13
Date of last calibration: 02/05/13
Validity: 01/05/15

Sensor replaced again on 05/11/2013 by:

352DT435B
Type: Refract meter. K-PATENTS IT-RE-GP
Accuracy class: +/- 0.1%
Serial number: 2002-D43-5100
Calibration frequency: 2 Years
Calibration dates: 05/11/2013
Date of last calibration: 05/11/2013
Validity: 04/11/2015

Biomass residues (mix of sawdust and bark) from forest operations

331-WT-005
Type: Weight meter. RAUTE PRECISION WB910
Accuracy class: +/- 0.6kg

	Serial number: 2472377 Calibration frequency: 1 year Calibration dates: 13/11/2012 Date of last calibration: 13/11/2012 Validity: 12/11/2013
Measuring/ Reading/ Recording frequency:	The measurements of biomass residues of type black liquor are taken continuously (each five seconds) online and fully integrated with the Distributed Control System (DCS). Data of biomass consumption is aggregated and reported monthly in the emission reduction calculation sheet. Biomass residues from forestry operations are continuously measured by a proper instrument and data obtained fully integrated with the DCS. Data are recorded and aggregated monthly in the emission reduction calculation sheet.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Both biomass types (black liquor and biomass from forest operations) quantities were measured by proper and dedicated meters. All meters were duly calibrated and maintained according to the manufacturer's specifications and/or according to proper industry standards. Maintenances and calibrations were planned according to a specific schedule, which is part of the quality system implemented in the pulp mill. <u>Biomass residues (mix of sawdust and bark) from forest operations.</u> The mix of biomass residues measured by a dedicated weight meter was cross-checked against the energy/mass balance. Using the monitored data, the energy/mass balance indicated a power boiler efficiency of 72.58%, which is well within the range specified in the power boiler manual [61.99% - 87.31%]. According to this, the monitored value of the biomass residues combusted in the power boiler is acceptable. In addition to the above, the measured value of biomass combusted was monthly cross-checked against purchase records, internal biomass production and stock changes (topographic studies). A difference of 5.2% by weight was obtained for the monitored period. <u>Black liquor</u> The black liquor consumption measurements (tDS) were cross-checked against the total pulp production in the pulp mill (ADT) and the energy/mass balance of the recovery boiler. Results of this comparison are presented below: With the monitored data, the efficiency obtained for the recovery boiler was 63.99%. This value is compared with the average efficiency value of 64.05% specified for this boiler by the manufacturer. The difference is considered a reasonable deviation. Additionally, the Project Participant calculated an operational index of 1.96(tDS/ADT), which also compares very closely with the range of 2.0 +/-0.5.

Purpose of data:	Baseline and project emissions calculations.
Additional comment:	According to VVS v. 5.0, paragraph 238, the maximum permissible error of the meters, in this case of the magnetic flow meters and temperature meter, was applied to the period of measurement in which these meters were not certified as calibrated (i.e. for the temperature meter, from 10/11/2013 to 23/11/2013 and for the flow meters, from 11/11/2013 to 23/11/2013). Although calibration took place after 23/11/2013, the meters stopped operating on this date due to the annual maintenance stoppage. Considering the above, the Project Participant has applied the instruments' maximum permitted error of 1% to adjust black liquor flow and temperature measurements in the most conservative way in the period the meters were out of calibration. In the same way, the amount of biomass residues was adjusted according to the weight meter's maximum permissible error (1%). Calibration of this instrument expired on 12/11/2013. Therefore, adjustments were made from 13/11/2013 until 31/12/2013, excluding the period when the meter was not in operation due to the annual programmed maintenance stoppage (26/11/2013 to 30/11/2013).

Data / Parameter:	**Moisture content of the biomass residues**
Unit:	(%) of water content (humid basis).
Description:	Moisture content of each biomass residue type k.
Measured/ Calculated / Default:	Measured.
Source of data:	<u>Black liquor:</u> On-site measurements. For more details, please refer to the $BF_{k,y}$ parameter. <u>Biomass residues from forestry operations:</u> On-site measurements.
Value(s) of monitored parameter:	<u>Black liquor</u>: This biomass type is directly measured in dry-solid terms (tDS). <u>Biomass residues from forest operations</u>: 61.2% The Project Participant informs that applied values are weight averaged for the monitoring period.

Monitoring equipment:	Black liquor: The equipment used to measure this parameter was described in full under parameter $BF_{k,y}$. Biomass residues (mix of sawdust and bark) from forest operations 310-81-1150 Type: Digital Scale. METTLER TOLEDO PG12001 Accuracy class: +/- 0.1 g Serial number: 1122192799 Calibration frequency: 6 Months Calibration dates: 04/10/2012, 10/01/2013, 05/04/2013, 11/07/2013 Date of last calibration: 09/10/2013 Validity: 08/04/2014 310-81-1151 Type: Digital Scale. METTLER TOLEDO PG12001 Accuracy class: +/- 0.1 g Serial number: 1122192802 Calibration frequency: 6 Months Calibration dates: 09/10/2012, 14/01/2013, 15/04/2013, 11/07/2013 Date of last calibration: 10/10/2013 Validity: 09/04/2014 310-81-1154 Type: Drying Oven. MEMMERT ULE700 Accuracy class: +/- 1 ℃ Serial number: G703.0095 Calibration frequency: Calibration is not required according to the manufacturer. 310-81-1155 Type: Drying Oven MEMMERT ULE700 Accuracy class: +/- 1 ℃ Serial number: G703.0096 Calibration frequency: Calibration is not required according to the manufacturer. 310-81-1156 Type: Drying Oven. MEMMERT ULE700 Accuracy class: +/- 1 ℃ Serial number: G703.0098 Calibration frequency: Calibration is not required according to the manufacturer.	
Measuring/ Reading/ Recording frequency:	As stated before, black liquor is directly monitored in dry basis. Daily samples of biomass residues from forestry operations (mix of sawdust and bark) are taken to determine their moisture content. Moisture content analysis is performed in Valdivia's own laboratory with calibrated digital scales and drying ovens.	
Calculation method (if applicable):	Not applicable.	

QA/QC procedures:	Black liquor: Proper instruments were used to measure moisture content. All of them received periodic maintenance and calibration, according to the manufacturer's recommendation. For more details about the calibration of these instruments, please refer to parameter $BF_{k,y}$, QA/QC procedure section. In addition to the above, the Project Participant carried out moisture content measurements in the Valdivia laboratory in order to cross-check the dry black liquor flows recorded in the DCS. As shown in the table below, a deviation of 0.78% was obtained for 2013 which is deemed a reasonable value. Parameter: Annual average moisture content; Laboratory samples (%): 26.3; Measurements recorded in the DCS (%): 26.1; Deviation (%): 0.78% Biomass residues (mix of sawdust and bark) from forest operations In this case, proper calibration according to the manufacturer of all instruments used to determine moisture content of biomass residues from forestry operations was duly performed during the monitored period. Please refer to page 16 of this Monitoring Report, which presents a table with the corresponding calibration results.
Purpose of data:	Baseline emission and project emission calculations.
Additional comment:	--

Parameter	Laboratory samples (%)	Measurements recorded in the DCS (%)	Deviation (%)
Annual average moisture content	26.3	26.1	0.78%

Data / Parameter:	**$EF_{CH4,BF}$**
Unit:	(tCH_4/GJ)
Description:	CH_4 emission factor for the combustion of biomass residues in the project plant.
Measured/ Calculated / Default:	Default.
Source of data:	ACM0006 (Version 5), page 25/63, Table 4: "Default CH_4 emission factors for combustion of biomass residues". According to the baseline methodology, the chosen factor is corrected for uncertainty using Table 5 in page 26/63 of the ACM0006 (Version 5).
Value(s) of monitored parameter:	30.0 (Kg CH_4/TJ) or 0.00003 (tCH_4/GJ) for biomass from forest operations, with an associated conservativeness factor of 1.02. This results in an adjusted default emission factor of 30.6 (Kg CH_4/TJ) or 0.0000306 (tCH_4/GJ). The reason for which the conservativeness factor 1.02 was chosen in this case can be found in section B.6, page 54 of the registered PDD.
Monitoring equipment:	Not applicable.

Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	In this case, the project participant used the default factor provided by the ACM0006 (Version 05).
Purpose of data:	Project emissions calculations.
Additional comment:	---

Data / Parameter:	**AVD_y**
Unit:	(Km)
Description:	Average round-trip distance between biomass fuel supply sites and the project site.
Measured/ Calculated / Default:	Measured.
Source of data:	Calculations based on records provided by the Valdivia Pulp mill Procurement Department. The information used to perform the corresponding calculations comes from Forestal Valdivia (an Arauco subsidiary) and the Valdivia pulp mill Procurement Department R-Maderas database.
Value(s) of monitored parameter:	<table><tr><td>Monitored parameter</td><td>2013</td></tr><tr><td>AVD_y</td><td>65.7 km</td></tr></table> The Project Participant would like to note that the value applied is a weighted average calculation for the round trip. For more details, please see the corresponding emission reduction calculation Excel spread sheet.
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	The distance traveled by each truck transporting biomass from forestry operations residues was continuously recorded at the entrance of the Valdivia plant and registered in the R-Maderas database.
Calculation method (if applicable):	This parameter is determined for the monitored period by calculating a weighted average distance, which considers the transported biomass amounts and the corresponding distances of each supply center to the Valdivia biomass power plant. This weighted average is multiplied by two in order to determine the weighted average distance, round trip.

QA/QC procedures:	Biomass residues from forest operations were brought from known suppliers which have known locations (e.g. road distances to the plant are also known). The QA/QC procedure in this case is carried out at the entrance of the Valdivia power plant and is applied in such a way that no truck with biomass residues from forestry operations is allowed if it does not come from a known and registered supplier (for which the road distance is also known). During the monitored period, no trucks from unspecified/unregistered sites were allowed, so no discrepancies were detected in this case.
Purpose of data:	Project emission calculations.
Additional comment:	--

Data / Parameter:	**N_y**
Unit:	---
Description:	Number of truck trips for the transportation of biomass.
Measured/ Calculated / Default:	Calculated.
Source of data:	The Superintendence of Fiber monitored and recorded each type of raw material (including biomass residues from forestry operations) dispatched to the mill. This information was stored in the mill's information system and the person in charge of reporting this information extracted the number of trucks that arrived at the mill with biomass residues (mix of sawdust and bark) and reported this information to the person in charge of calculating the emission reductions of the project activity in Arauco Bioenergía S.A.
Value(s) of monitored parameter:	4702 trips Note: This is the original monitored value. However, because this value is calculated based on the amount of biomass from forest operations that feeds the power boiler and there was a delay in the calibration of the power boiler's weight meter, the value used for emission reduction calculations is slightly higher. Please refer to section "Additional comment" under parameter $BF_{k,y}$.
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	All trucks that brought third party biomass residues were continuously recorded each day at the entrance of the plant in the R-Maderas database system.
Calculation method (if applicable):	This parameter is calculated as a ratio between the total wet biomass transported to the Valdivia biomass power plant and the average truck load used for the transportation of the biomass to the power plant.

QA/QC procedures:	The Project Participant verified the consistency of this variable with the quantity of biomass combusted (e.g. by the relation with previous years). Historical consumption records have been checked by the project participant, as shown in table below:

Year (Jan to Dec)	Average N° of trips Per year
2013	4.702
2012	2.971
2011	2.593
2010	2.904
2009	4.008
2008	3.444

	As can be seen in the table above, the average N° of trips during the monitored period (2013) similarly compares to the average number of trips of the previous years.
Purpose of data:	Project emission calculations.
Additional comment:	---

Data / Parameter:	**TL_y**
Unit:	(ton/truck)
Description:	Average truckload of the trucks used for the transportation of biomass from forest operations to the pulp mill.
Measured/ Calculated / Default:	Measured.
Source of data:	The Superintendence of Fiber monitored this parameter by measuring the truckloads at the project mill's weighbridges. The value was determined by calculating the average of the truckloads in tons for the trucks that delivered the biomass residues from forest operations to the power plant.
Value(s) of monitored parameter:	29.6 The Project Participant would like to note that the applied value is an average considering truck load and the amount of biomass from third party suppliers. Also, please note that the value reported here is the original one. Due to the delayed calibration of the power boiler's weight meter, the value applied to emission reduction calculations is slightly different. See section "Additional comment" under parameter $BF_{k,y}$.

Monitoring equipment:	330-WT-050 Type: Weighbridge #1 South METTLER TOLEDO JAGXTREME Accuracy class: +/- 30 kg Serial number: 5311768-5HD Calibration frequency: 1 Year Calibration dates: 11/11/2012, 12/05/2013 Date of last calibration: 24/11/2013 Validity: 23/11/2014 330-WT-051 Type: Weighbridge #2 Center METTLER TOLEDO JAGXTREME Accuracy class: +/- 30 kg Serial number: 5311767-5HD Calibration frequency: 1 Year Calibration dates: 11/11/2012, 12/05/2013 Date of last calibration: 24/11/2013 Validity: 23/11/2014 330-WT-052 Type: Weighbridge #3 North METTLER TOLEDO JAGXTREME Accuracy class: +/- 30 kg Serial number: 5311771-5HD Calibration frequency: 1 Year Calibration dates: 11/11/2012, 12/05/2013 Date of last calibration: 24/11/2013 Validity: 23/11/2014
Measuring/ Reading/ Recording frequency:	All trucks that carried third party biomass residues to the Valdivia mill were continuously recorded at the entrance of the plant in the R-Maderas database system and truck loads were reported on a monthly basis for emission reduction calculation purposes.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	The weighbridges at the pulp mill received periodic maintenance and calibration according to proper industry standards. All data was found correct and consistent. Please refer to page 16 of this Monitoring Report, which presents a table with the corresponding calibration results.
Purpose of data:	Project emission calculations.
Additional comment:	Option 1 was used to estimate CO_2 emissions from transportation of biomass to the Valdivia power plant.

Data / Parameter:	**$EF_{km,CO2,y}$**
Unit:	(tCO_2/km)
Description:	Average CO_2 emission factor for the trucks during year y.
Measured/ Calculated / Default:	Calculated.

Source of data:	The Project Participant used the following sources to determine this parameter: – Truck performance (Km/lt) from transportation subcontractors for each truck during the monitored period. – Fossil fuel density: Fossil fuel laboratory analysis. – Fossil fuel net calorific value: Fossil fuel laboratory analysis. – Fossil fuel carbon content: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1-4. – Fossil fuel fraction of carbon oxidized: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1-4.
Value(s) of monitored parameter:	0.0012576 (tCO_2/km) <u>Note:</u> The Project Participant informs that the above value is the original monitored value. However, the Project Participant carried out a conservative adjustment to the value informed due to the temporary deviation caused by delayed sampling for the analysis of fossil fuel net calorific values. The net calorific value of Diesel had an impact on the average CO_2 emission factor for trucks. For additional information refer to section B.2.1 of this Monitoring report and the emission reduction calculation spread sheet.xls
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	This parameter is calculated and recorded annually. Please note the following detail below: – Truck performance (Km/lt): Monitored and recorded monthly during the monitored period. – Fossil fuel density: Monitored twice a year (taking three samples each time) and recorded annually. – Fossil fuel net calorific value: Monitored twice a year (taking three samples each time) and recorded annually. – Fossil fuel carbon content: Default value from IPCC. – Fossil fuel fraction of carbon oxidized: Default value from IPCC.
Calculation method (if applicable):	The calculation method is as follows: $EF_{km,FF}$ = [[1/(average fuel performance of trucks (km/l)] * Diesel fuel density (kg/l)/1,000] * [$EF_{CO2,FF,Diesel}$ (tCO_2/GJ) * NCV_{Diesel} (GJ/ton)] Where: $EF_{CO2,FF}$ (tCO_2/GJ): Carbon content of diesel (tC/TJ) * Fraction of carbon oxidized* CO_2 / C conversion factor (tCO_2/tC) *(1TJ/1000GJ).

QA/QC procedures:	In this case, it was not possible to compare the monitored parameter $EF_{km,CO2,y}$ with the corresponding 2006 IPCC default factor for heavy truck transportation, since the corresponding CO_2 emission factor for heavy truck transportation is not available in the 2006 IPCC manual. However, the Project Participant compared this monitored parameter with the CO_2 emission factor of trucks observed in other biomass power plants by Arauco, also registered in the CDM.

	CO_2 emission factor of trucks (kg CO_2/km).		
Year	Valdivia Project Plant	Nueva Aldea Biomass Power Plant Phase 1, Ref:0258	Trupan Biomass Power Plant, Ref:0259
2013	1.258	---	---
2012	1.319	---	1.044
2011	1.250	1.351	1.170
2010	1.271	1.347	1.130
2009	1.260	1.351	1.348
2008	---	1.451	1.397

As can be seen in the table above, the monitored value is consistent with the truck emission factors observed in the other biomass power plants and therefore it was deemed acceptable in this case.

Additionally, the Project Participant compared the average truck fuel performance with the ones observed in other biomass power plants by Arauco. Result of this comparison was deemed acceptable, as shown in the table below.

	Average truck´s fuel performance (km/l)		
Year	Valdivia Project Plant	Nueva Aldea Biomass Power Plant Phase 1, Ref:0258	Trupan Biomass Power Plant, Ref:0259
2013	2.11	---	---
2012	2.13	---	2.60
2011	2.13	1.98	2.34
2010	2.10	1.98	2.36
2009	2.10	1.95	1.98
2008	---	1.84	1.91

Additionally, the Project Participant compared local NCV_{Diesel} values used with the ones provided by the 2006 IPCC.

	NCV_{Diesel} (GJ/ton)	
Year	Valdivia Project Plant	2006 IPCC Values
2013	43.01	43.0 [Lower: 41.4 Upper: 43.3]
2012	42.51	
2011	42.77	
2010	42.90	

According to the value above, the Project Participant deemed the monitored NCV within the acceptable range.

Purpose of data:	Project emission calculations.
Additional comment:	---

Data / Parameter:	$EF_{CO2,FF,i}$
Unit:	(tCO_2/GJ)
Description:	CO_2 emission factor for fossil fuel type i.
Measured/ Calculated / Default:	Calculated.
Source of data:	The Project Participant used the following sources to determine this parameter: • Fossil fuel carbon content: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1-4. • Fossil fuel fraction of carbon oxidized: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1-4.
Value(s) of monitored parameter:	Diesel: 0.07407 (tCO_2/GJ) Fuel oil: 0.07737 (tCO_2/GJ)
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	$EF_{CO2,FF,Diesel}$ (tCO_2/GJ): Carbon content of diesel (tC/TJ) * Fraction of carbon oxidized* CO_2 / C conversion factor (tCO_2/tC) * (1TJ/1000GJ) where: $EF_{CO2,FF,Diesel}$ (tCO_2/GJ) = 20.2 (tC/TJ) * 100% * 44/12 (tCO_2/tC) * (1GJ/1000TJ). $EF_{CO2,FF,FO}$ (tCO_2/GJ): Carbon content of FO (tC/TJ) * Fraction of carbon oxidized* CO_2 / C conversion factor (tCO_2/tC) * (1TJ/1000GJ) where: $EF_{CO2,FF,FO}$ (tCO_2/GJ) = 21.1 (tC/TJ) * 100% * 44/12 (tCO_2/tC) * (1TJ/1000GJ).
QA/QC procedures:	The Project Participant used the most updated IPCC default factors to calculate the fossil fuel coefficients. In this case, values were obtained from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1-4.
Purpose of data:	Project emission calculations.
Additional comment:	---

Data / Parameter:	$FF_{project\ plant,i,y}$
Unit:	(ton/year)
Description:	Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y.
Measured/ Calculated / Default:	Measured.
Source of data:	The Project Participant used the following information sources to determine this parameter: – Specific consumption factor of 3.43 (kg of fuel oil/m^3st of forestry biomass residues): Corresponds to the historic fossil fuel consumption per unit of biomass from forestry operations used in the power boiler of the Valdivia biomass power plant. This variable is obtained for the registered PDD (page 56). – Biomass residues from forestry operations related to the implementation of the CDM project activity: This biomass amount is calculated using the total biomass consumption in the power boiler and the equations derived from the approved methodology deviation of the ACM0006 (Version 5) presented in Annex 3 of the registered PDD (starting on page 111). – Fuel oil used in the power boiler attributable to the project activity: This corresponds to the amount of fossil fuel used in the power boiler to enhance the surplus power generation to the grid. – Fuel oil used in the recovery boiler attributable to the project activity: This corresponds to the amount of fossil fuel used in the recovery boiler to enhance the surplus power generation to the grid. This fossil fuel amount is directly monitored by the power plant operators in the Valdivia biomass power plant.
Value(s) of monitored parameter:	Fossil fuel consumption associated to additional biomass residues from forestry operations: 1,530.6 ton Note: The above value corresponds to the original calculation, before adjustments to net calorific value of biomass residues and total biomass combusted in the power boiler were made. For an explanation of these adjustments please refer to section B.2.1 and the "Additional comment" section under parameter $BF_{k,y}$ in this report. Fossil fuel consumption in the power and recovery boilers related to additional surplus power generation to the grid: <table><tr><td>2013</td><td>Description</td></tr><tr><td>Measured value (ton/year)</td><td>Parameter</td></tr><tr><td>3,367.9</td><td>Additional Fuel Oil consumption in the power boiler for power generation.</td></tr><tr><td>2,407.9</td><td>Additional Fuel Oil consumption in the recovery boiler for power generation.</td></tr></table>
Monitoring equipment:	352FT653 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ

		Accuracy class: +/- 0.5% Serial number transmitter: 3010822 Serial number sensor: 723360 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 352FT657 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010807 Serial number sensor: 728932 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 352FT681 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010892 Serial number sensor: 723912 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 352FT685 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3012133 Serial number sensor. 729075 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 352FT823 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3011047 Serial number sensor. 728916 Calibration frequency: According to manufacturer, calibration is not required for this instrument.. 363FT507 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010656 Serial number sensor: 728840 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 363FT510 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010755 Serial number sensor. 728933 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 363FT515 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3012292	

		Serial number sensor. 728929 Calibration frequency: According to manufacturer, calibration is not required for this instrument. 363FT518 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010764 Serial number sensor: 728954 Calibration frequency: According to manufacturer, calibration is not required for this instrument.	
	Measuring/ Reading/ Recording frequency:	Fossil fuel consumption amounts were continuously measured and recorded on-line by the pulp mill's DCS. The recorded data was aggregated monthly and yearly for emission reduction calculations.	

	Calculation method (if applicable):	Fossil fuel consumption in the power and recovery boilers was measured using on-line Coriolis mass flow meters. Data obtained was registered on-line by the pulp mill's DCS and recorded in databases. As defined in the registered PDD, section B.6.1 page 46, the consideration of fossil fuel consumption for emission reduction calculations is limited only to the additional fossil fuel consumption associated to the implementation of the CDM project activity. As previously mentioned, this includes additional fossil fuel consumption due to additional biomass consumption in the power boiler and additional fuel oil consumption in the power and recovery boilers for surplus power generation to the grid: Additional fossil fuel consumption used to burn additional biomass consumption related to the project activity: According to the registered PDD, page 46, the Project Participant used the specific consumption factor (i.e. 3.43 kg fuel/m^3st) [5] which contemplates historic fossil fuel consumption per unit of biomass consumed in the Valdivia plant. Hence, the additional fossil fuel was determined by multiplying the specific consumption factor by the additional biomass residues from forestry operations associated to the implementation of the CDM project activity. The additional biomass residue amount was calculated using the equations of the approved ACM0006 (Version 5) deviation. The additional fossil fuel consumption in the power and recovery boilers used to enhance surplus power generation to the grid: The corresponding shift operator registered the accumulated Fuel Oil consumption given by the Delta V system at every hour (o'clock time) for the two boilers. In the case of the recovery boiler, the Fuel Oil consumption for the hour where extra fuel was used to enhance surplus power generation to the grid was determined by the difference of two consecutive records taken at o'clock time. In the case of the power boiler, empirical curves were used to calculate the amount of Fuel Oil consumed for surplus power generation.	

[5] (m^3st) Volume unit commonly used in the Chilean forestry industry to express a cubic meter of biomass like sawdust, bark or chips that also contain a certain % of air and moisture that are not previously determined or quantified.

QA/QC procedures:	The Project Participant performed consistency checks of the fossil fuel consumption amounts against the energy/mass balance in the recovery and power boilers. Additionally, the measured value was compared with fossil fuel stock variations and purchased amounts. Energy/mass balance consistency check The resulting average efficiency of the recovery boiler was 63.99% which is almost identical with the average efficiency value of 64.05 % specified for this boiler by the manufacturer. Therefore, the calculated efficiency is considered reasonable. The efficiency obtained of the power boiler during the monitoring period was 72.58%, which is a reasonable value when compared with the manufacturer's range [61.99% - 87.31%]. In this way, consistency of fossil fuel measurements was confirmed. Purchase and stock variations check The total measurements of Fuel Oil in the plant were cross-checked with purchases and stock variations. A difference of 1% was obtained which is deemed a reasonable deviation.
Purpose of data:	Project emission calculations.
Additional comment:	---

Data / Parameter:	$FF_{project\ site,i,y}$
Unit:	(ton)
Description:	Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y.
Measured/ Calculated / Default:	Measured.
Source of data:	The Project Participant used the following information source to determine this parameter: – Data supplied by front loader operators (biomass transportation subcontractors) of the Valdivia biomass power plant.
Value(s) of monitored parameter:	Diesel: 45.7 ton
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	This parameter is monitored daily. The subcontractors aggregate and record this parameter on a monthly basis.

Calculation method (if applicable):	External subcontractors provide the service for the transportation of the biomass residues from forestry operations in the Valdivia biomass power plant site. Every month this entity provides the total amount of fossil fuel consumed as well as the operational hours of the front loader and/or bulldozers used to transport the biomass residues to the power boiler. The Project Participant then uses this total amount of fossil fuel used for the transportation of biomass residues and scales it down to the transportation of the biomass residues attributable to the implementation of the CDM project activity. This adjustment is performed using the total amount of biomass residues from forestry operations and the fraction of this biomass amount that is attributable to the CDM project activity. This biomass amount is determined using the equations of the approved deviation of the ACM0006 (Version 5). The calculation is performed as follows: Biomass residues Diesel on-site transportation consumption associated to the CDM project activity = Total Diesel consumption used for biomass residues on-site transportation * (Biomass residues from forestry operations associated to the implementation of the CDM project activity/Total biomass residues combusted in the power boiler).
QA/QC procedures:	The Project Participant carried out consistency checks based on monthly and annual operational indices (e.g. check whether front loader fossil fuel consumption divided by the operation hours resulted in a reasonable index, comparable to the ones observed in previous years). The operational index obtained for 2013 was compared against historical operational indices which resulted in a reasonable value, as shown in table below: Year (Jan-Dec) / Index (lt/hrs-year): 2013: 13.44 2012: 11.86 2011: 12.07 2010: 12.15 2009: 12.24 2008: 13.94 2007: 13.94
Purpose of data:	Project emission calculations.
Additional comment:	---

Year (Jan-Dec)	Index (lt/hrs-year)
2013	13.44
2012	11.86
2011	12.07
2010	12.15
2009	12.24
2008	13.94
2007	13.94

Data / Parameter:	$EG_{project\ plant,y}$
Unit:	(MWh/yr)
Description:	Net quantity of electricity generated in the project plant during the year y.
Measured/ Calculated / Default:	Measured and calculated.

Source of data:	The Project Participant used the following information source to determine this parameter: – Valdivia power plant on-line direct measurements of the gross electric power generated in the Valdivia biomass power plant. Measurements are continuously stored in the DCS database system. – Additional electric power consumption of the project mill: 4.22% of the total electricity consumption of the project pulp mill. This value comes from the registered PDD, page 55 and is used to calculate the net quantity of electricity generated in the project plant. – Total power consumption of the project pulp mill: On-line direct measurements which are continuously stored in the DCS database system of the Valdivia biomass power plant.
Value(s) of monitored parameter:	667,230 Mwh/yr
Monitoring equipment:	368JI101 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0211A-633-11 Calibration frequency: 7 Years Date of penultimate calibration: 27/11/2002 Date of last calibration: 24/04/2009 Validity: 23/04/2016 368JI102 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0211A-626-11 Calibration frequency: 7 Years Date of penultimate calibration: 27/11/2002 Date of last calibration: 23/04/2009 Validity: 22/04/2016 368JI104 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0211A-632-11 Calibration frequency: 7 Years Date of penultimate calibration: 28/11/2002 Date of last calibration: 21/04/2009 Validity: 20/04/2016 368JI105 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0212A-006-11 Calibration frequency: 7 Years Date of penultimate calibration: 02/12/2002 Date of last calibration: 21/04/2009 Validity: 20/04/2016 368JI107 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0211A-611-11

		Calibration frequency: 7 Years Date of penultimate calibration: 27/11/2002 Date of last calibration: 22/04/2009 Validity: 21/04/2016 368JI201 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0212A-205-11 Calibration frequency: 7 Years Date of penultimate calibration: 04/12/2002 Date of last calibration: 24/04/2009 Validity: 23/04/2016 368JI203 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0212A-044-11 Calibration frequency: 7 Years Date of penultimate calibration: 04/12/2002 Date of last calibration: 24/04/2009 Validity: 23/04/2016 368JI205 Type: Energy Meter POWER MEASUREMENT ION7300 Accuracy class: +/- 0.5% Serial number: PA-0212A-045-11 Calibration frequency: 7 Years Date of penultimate calibration: 04/12/2002 Date of last calibration: 23/04/2009 Validity: 22/04/2016		
	Measuring/ Reading/ Recording frequency:	The electric power generation and total internal electricity consumption of the project pulp plant were continuously measured using dedicated energy meters. Measurements were recorded in the DCS database system every two minutes and aggregated and registered monthly for the emission reduction calculation of the monitored period.		
	Calculation method (if applicable):	The net quantity of electricity generated in the project plant was determined using the following equation: $EG_{project\ plant}$ (MWh)= Gross electric power generation (MWh) – [Total internal electricity consumption of the project plant * (4.22%)] (MWh). As defined in the registered PDD, page 55, and stated in the approved methodology deviation, the additional energy consumption (attributable to the project activity) was determined by multiplying the total internal electricity consumption measured by the Project Participant with a factor of 4.22%. The resulting value (second term of the right side of the equation above) is subtracted from the gross electricity generation of the Valdivia biomass power plant, thus allowing to determine the net quantity of electricity generated in the project plant.		
	QA/QC procedures:	All electricity meters received maintenance and calibration according to the manufacturer's recommendation and/or proper industry standards. According to methodology ACM0006 (Version 5), page 56/63 the consistency of metered net electricity generation shall be cross-checked		

	with the quantity of fuel fired in the project plant. This means, check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years. • Black liquor index: Electricity generation associated to black liquor/black liquor (dry basis) (MWh/tDS) = 0.55 (MWh/tDS). The result is deemed reasonable. • Biomass residues from forest operations index: Electricity generation associated to forest biomass residues/Biomass residues from forestry operations (dry basis) (MWh/BDt) = 0.77 (MWh/BDt). The result is deemed reasonable. According to page 85 of the registered PDD, the Project Participant must also perform the consistency check considering the total power generation and the monitored amount of steam passing through the turbines. This is shown below for each of the two turbines of the Valdivia power plant: TG1: The average annual index of 0.145 (MWh/t steam) is within the historical range of [0.13 - 0.15] (MWh/t steam). As a result, the observed index calculated during the monitoring period is deemed acceptable. TG2: The average annual index of 0.226 (MWh/t steam) is within the historical range of [0.18 - 0.27] (MWh/t steam). As a result, the observed index calculated during the monitoring period is also deemed acceptable. Finally, according to the registered PDD, page 85, the consistency of metered net electricity generation shall also be cross-checked with receipts from electricity sales of the Valdivia power plant. The consistency of metered net electricity generation sold to the grid was cross-checked comparing the amount of electricity obtained from the energy bus balance with receipts from electricity sales and consumption. A deviation of 1.6 % was obtained, which resulted in an acceptable deviation.
Purpose of data:	Baseline emission calculations.
Additional comment:	It must be noted that the net electricity generation of the project plant calculated from the equation above is used to determine the net increased electricity generation of the Valdivia biomass power plant derived from implementing CDM initiatives N°1 and N°2 as described in the PDD.

Data / Parameter:	$Q_{project\ plant,y}$
Unit:	(GJ)
Description:	Net quantity of heat generated from firing biomass in the project mill.
Measured/ Calculated / Default:	Measured.

Source of data:	The Project Participant used the following information sources to determine this parameter: • High, medium and low pressure steam flows generated and used in the Valdivia biomass power plant: On-site measurements. • Steam thermodynamic conditions: Predefined set points (established in the pulping process) of steam temperature and pressure as required (i.e. in the case of superheated steam).
Value(s) of monitored parameter:	8,026,736 GJ Note that the monitored value corresponds to heat generated in the power boiler.
Monitoring equipment:	365FT901 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 6408030356 Calibration frequency: 3 Years Calibration dates: 10/11/2012 Date of last calibration: 27/11/2013 Validity: 26/11/2016 365FT902 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010902 Calibration frequency: 3 Years Calibration dates: 11/11/2012 Date of last calibration: 26/11/2013 Validity: 25/11/2016 365FT910 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010903 Calibration frequency: 3 Years Calibration dates: 11/11/2012 Date of last calibration: 27/11/2013 Validity:26/11/2016 365FT913 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010904 Calibration frequency: 3 Years Calibration dates: 11/11/2012 Date of last calibration: 27/11/2013 Validity: 26/11/2016 365FT914 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 6410003178 Calibration frequency: 3 Years

Calibration dates: 11/11/2012
Date of last calibration: 27/11/2013
Validity: 26/11/2016

365FT920
Type: Differential Pressure Flow Transmitter ABB 2600T
Accuracy class: +/- 0.075%
Serial number: 5003010906
Calibration dates: 11/11/2012
Date of last calibration: 28/11/2013
Validity: 27/11/2016

365FT923
Type: Differential Pressure Flow Transmitter ABB 2600T
Accuracy class: +/- 0.075%
Serial number: 5003010907
Calibration frequency: 3 Years
Calibration dates: 11/11/2012
Date of last calibration: 11/11/2012
Validity:10/11/2015

Replaced during 2013 by:

365FT923
Type: Differential Pressure Flow Transmitter ABB 2600T
Accuracy class: +/- 0.075%
Serial number: 5003009136
Calibration frequency: 3 Years
Calibration dates: 05/02/2013, 05/04/2013
Date of last calibration: 28/11/2013
Validity: 27/11/2016

365FT924
Type: Differential Pressure Flow Transmitter ABB 264DSGSSB2A3
Accuracy class: +/- 0.075%
Serial number: 6410006727
Calibration frequency: 3 Years
Calibration dates: 10/11/2012
Date of last calibration: 28/11/2013
Validity: 27/11/2016

362PT980
Type: Pressure Transmitter ROSEMOUNT 3051S2TG4A2E11F1AAO1B4
Accuracy class: +/- 0.025% of span
Serial number: 0075788
Calibration frequency: 5 Years
Calibration dates: 10/11/2012
Date of last calibration: 26/11/2013
Validity: 25/11/2018

362TT965
Type: Temperature Transmitter ROSEMOUNT 3244MV
Accuracy class: +/- 0.10 ℃
Serial number: 430676
Calibration frequency: 1 Year
Date of penultimate calibration: 07/06/2012, 01/04/2013
Date of last calibration: 18/06/2014

	Validity: 17/06/2015
Measuring/ Reading/ Recording frequency:	The variables used to determine this parameter were monitored continuously using proper instruments. The data obtained was recorded in the power plant DCS and was aggregated monthly for emission reduction calculation purposes.
Calculation method (if applicable):	The algorithm used is shown in the section E.1 Baseline emissions calculation of the Monitoring Report and in page 118 of the registered PDD. This algorithm was part of the methodology deviation presented for the Valdivia CDM project activity, which was approved by the Executive Board on December 13, 2007.

QA/QC procedures:	All relevant steam flow meters received maintenance and calibration according to proper industry standards. According to the registered PDD, page 86, the consistency of metered steam flows was compared with ad-hoc energy/mass balance and/or operational indices of the mill (e.g. for each of the boilers --recovery and power boiler-- check whether the amount of steam produced divided by the amount of fuels fired results in reasonable values compared to the ones observed in previous years). QA/QC 1: The Project Participant checked the consistency of metered steam flows against the annual energy balance of the power and recovery boiler. The efficiency obtained for the power boiler during the monitored period was 72.58 %, which resulted in a reasonable value when compared with the manufacturer’s acceptance range [61.99% - 87.31%]. The resulting average efficiency of the recovery boiler was 63.99% with minimal deviation from the 64.05% recommended by the manufacturer. Considering the results presented above, the monitored variables used for the calculation of the parameter were deemed acceptable by the Project Participant. QA/QC 2: The Project Participant checked consistency of metered heat flows against operational indices of the mill. Results are presented Operational index of the recovery boiler: (ton of steam/ tDS) The annual operational index was 3.28 (tons of steam/tDS) which is a reasonable value when compared with the historical acceptance range value of [3.5 +/- 0.5](ton of steam/tDS)] for the recovery boiler. Operational index of the power boiler: (ton of steam/ BDt) The annual operational index was 4.59 (tons of steam/BDt), which resulted in a reasonable value compared with the historical acceptance range of [4.7 +/-0.5] (ton of steam/BDt) fot the power boiler. Considering the results obtained above, the monitored variables used for the calculation of the parameter were considered acceptable by the Project Participant. QA/QC 3: In accordance with the methodology, the Project Participant shall check the consistency of metered net heat generation with the quantity of fuels fired (e.g. check whether the net heat generation divided by the quantity of fuels fired results in a reasonable thermal efficiency that is comparable to previous years).
Purpose of data:	Baseline and Project emission calculations.
Additional comment:	---

Year (Jan-Dec)	Index (GJ/BDt)
2013	9.29
2012	9.45
2011	9.03
2010	9.46
2009	9.22

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

Differences in baseline and project emission calculations included in tables below are due to the fact that all calculations are done directly in Excel spread sheets, which implies a decimal precision that is not carried over onto word formatted tables because decimals are truncated and rounded down. Exact resulting values can be viewed directly in emission reduction calculation Excel spread sheet.

1. Baseline emissions due to electricity displacement

In this case, the project participant used a modified version of equation N° 14 of the ACM0006 (Versio n 05), according to the PDD, page 120, to determine the net quantity of increased electricity as a result of the project activity. This modification was part of a request for deviation that pursued the simultaneous application of CDM project initiatives N° 1 and N° 2, which was approved by the Executive Board in December 13th, 2007.

$$EG_y = EG_{project\ plant} - \varepsilon_{el,\ other\ plant(s)} * (1/3.6) * \Sigma(BF_{k,y} * NCV_k)$$

Where:

EG_y : Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during year y (MWh). In this case, the project plant would incorporate the net quantity of increased electric generation capacity derived from implementing CDM project initiatives N°1 and N°2, simultaneously.

$EG_{project\ plant}$: Net quantity of electricity generated in the project plant during year (MWh). In this case, the project plant would incorporate the net quantity of increased electric generation capacity derived from implementing CDM project initiatives N°1 and N°2, simultaneously. Refer to the parameter in section D.2. Data and parameters monitored of this monitoring report.

$\varepsilon_{el,\ other\ plant(s)}$: Average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass residues fired in the project plant in the absence of the project activity ($MWh_{el}/MWh_{biomass}$). In this case, the baseline power plant electric efficiency calculation considers a business-as-usual pulp mill (reference plant), in which the project initiatives N°1 and N°2 are not implemented. For more details pleas e see pages 10 and 11 of the registered PDD.

$BF_{k,y}$: Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or litter). In this case, the project plant would combust a higher amount of biomass from forest operations (CDM project initiative Nº1) but the same amount of black liquor (CDM project initiative Nº2) than the baseline plant (reference plant). This variable includes both types of biomass fired in the project plant.

NCV_k : Net calorific value of the biomass residue type k (GJ/ton of dry matter of GJ/liter). In this case, the NCV for each type of biomass would be monitored and considered in the calculation: the NCV of biomass from forest operations (CDM project initiative Nº1) and the NCV of black liquor (CDM project initiative Nº2).

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

Data:

(1) Gross electricity generated in the project plant	(MWh/y)	695,232
(2) Total internal electricity consumption	(MWh/y)	426,580
(3) Additional power consumption percentage due to the project activity	%	4.22

(4) Average net energy efficiency of electricity generation baseline plant	%	12.09
(5) Quantity of black liquor combusted in the project plant (dry basis) (adjusted)	(tDS/y)	1,080,962 (a)
(6) Quantity of biomass from forest ops. combusted in the project plant (dry basis) (adjusted)	(BDt/y)	163,531 (b) 163,123 (c)
(7) Net calorific value of black liquor (dry basis) (adjusted)	(GJ/ton)	17.82 (d)
(8) Net calorific value of biomass from forest operations (dry basis) (adjusted)	(GJ/ton)	18.67 (e) 17.17 (f)

Notes:

a) Due to the late calibration of the black liquor flow meters and temperature meter, the amount of black liquor combusted in the recovery boiler was adjusted in a conservative manner: black liquor flow and temperature readings were increased according to the meters' maximum permissible error (1%) during the period when they were out of calibration. A higher amount of black liquor leads to a lower net quantity of increased electricity generation as a result of the project activity, and therefore less emission reductions (equation 14 of ACM0006 (version 05)).

b) Due to the late calibration of the biomass weigh meter, the amount of biomass from forest operations combusted in the power boiler was adjusted in a conservative manner: it was increased according to the meter's maximum permissible error (1%) during the period when the meter was out of calibration. A higher amount of biomass residues results in a lower net quantity of increased electricity generation as a result of the project activity, and therefore less emission reductions (equation 14 of ACM0006 (version 05)).

c) In this case, the amount of biomass from forest operations combusted in the power boiler was decreased by 1% during the period when the meter was out of calibration. A lower amount of biomass residues leads to lower baseline emissions, since CH_4 emissions from uncontrolled burning of biomass from forest operations decrease.

As part of the temporary deviations due to delays in sampling for fuel net calorific value analysis, the Project Participant carried out some adjustments to net calorific value measurements.

d) In equation 14 of ACM0006 (version 05) a higher net calorific value of black liquor results in a lower net quantity of increased electricity generation as a result of the project activity, and therefore less emission reductions. The Project Participant has adjusted the net calorific value using the upper IPCC value of 23.0 (GJ/tDS).

e) According to equation 8, a higher net calorific value of biomass residues results in a higher controlled biomass burning factor. For conservativeness reasons the Project Participant has adjusted net calorific value measurements using the upper 2006 IPCC value of 31(GJ/BDt) of biomass residues from forestry. This adjustment results in a higher controlled biomass burning factor and therefore, higher project emissions.

f) A lower net calorific value measurement results in lower baseline emissions since the adjusted CH_4 emission factor for uncontrolled burning of biomass residues from forest operations decreases. For conservative reasons, the Project Participant has adjusted the net calorific value using the lower limit 2006 IPCC value of 7.9 (GJ/BDt) for biomass residues. This adjustment results in lower methane emissions due to uncontrolled biomass burning avoidance.

For additional information about the adjustment refer to section B.2.1. Temporary deviations from registered monitoring plan or applied methodology

Calculations:

		Units	2013
(9) Net quantity of electricity generated in the project plant	(1)-(2)*(3)	(MWh/y)	677,230
(10) Electric power generated in the baseline mill (adjusted)	(4)*((5)*(7)+(6)*(8))*(1/3,600)	(MWh/y)	547,032
(11) Net quantity of increased electricity (adjusted)	(9)-(10)	(MWh/y)	130,198

Using the values of the net quantity of increased electricity generation and the CO_2 emission factor of the grid, it is possible to calculate the emission reductions due to displacement of electricity for the monitored period using equation N°9 of the ACM0006 (Version 05):

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

Where:

EG_y : Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh).

$ER_{electricity,y}$: Emission reductions due to displacement of electricity during the year y (tCO_2/yr).

$EF_{electricity,y}$: CO_2 emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh).

Data:

	Units	2013
(1) Combined margin for the SIC grid	(tCO_2/MWh)	0.774
(2) Electricity displaced by the project activity(adjusted)	(MWh/y)	130,198

Calculations:

		Units	2013
(3) Total grid emission savings (adjusted)	(1)*(2)	(tCO_2/y)	100,717

Determination of the emission factor of the grid electricity generation:

The parameter EF should be determined as the combined margin CO_2 emission factor for the grid to which the project activity is connected in year y, calculated according to the ACM0002 (version 06). This calculation is presented below:

a) Operating Margin calculations:

In this case the OM emission factor is calculated using the simple/adjusted method --equation N°4 of the ACM0002 (Version 06). The Project Participant used ex-post data to calculate this parameter, that is, the coefficient was calculated in the year in which the project generation occurs, which is 2013 in this case.

The Project Participant used data from that year to determine the lambda factor which represents the percentage of time when low-cost/must-run sources were on the margin for 2013:

$$\lambda_y = \lambda_{2013} = 0.00000$$

The rest of the parameters used to calculate the EF_{grid} for 2013 were obtained from the CDEC-SIC dispatch centre (official and public information). The calculation is as follows:

– CO_2 emission of non-low cost/must-run power sources:

$$\sum_{i,j} F_{i,j,2013} \cdot COEF_{i,j} = 20{,}739{,}492\ (tCO_2/y)$$

– The total power generation in the SIC by non-low-cost/must-run power sources in 2013:

$$\sum_{j} GEN_{j,2013} = 28{,}082{,}135\ (Mwh/y)$$

– The CO_2 emissions of low-cost/must run power sources in 2013. Note that since in Chile low-cost/must run power sources include mostly hydro energy, the total emissions for this part of the equation are

$$\sum_{i,k} F_{i,k}.COEF_{i,k} = 467{,}968\ (tCO_2/y)$$

– Total power generation in the SIC by low-cost/must-run resources for 2013:

$$\sum_{k} GEN_{k,2013} = 22{,}803{,}478\ (Mwh/y)$$

Replacing the above values in the equation used to calculate the EF for 2013, the operating margin results:

$$EF_{OM,2013} = (1 - 0.00000).\frac{20{,}739{,}492}{28{,}082{,}135}(tCO_2/Mwh) + 0.00000.\frac{467{,}968}{22{,}803{,}478}(tCO_2/Mwh)$$

$$EF_{OM,2013} = EF_{OM,simple\ adjusted,2013} = 0.739(tCO_2/Mwh)$$

b) Build Margin calculation

According to 2013 SIC data, the group of plants that accounts for the largest generation that year are the ones responsible for the 20% of the total generation. These plants are considered to calculate the Build Margin for 2013:

$$EF_{BM,2013} = 0.809(tCO_2/Mwh)$$

As in the previous case, the Build Margin calculation also considered official CDEC-SIC data and/or other official data publicly available.

Having obtained the Operating Margin $EF_{OM,y}$ and the Build Margin $EF_{BM,y}$, for 2013, and assuming the default value of 0.5 for the weights W_{OM} and W_{BM}, it is possible to calculate $EF_{grid\ CM,y}$ for the year 2013:

$$EF_{2013} = 0.5 \times 0.739 + 0.5 \times 0.809 = 0.774(tCO_2/Mwh)$$

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

To calculate this emission source, it is necessary first to calculate the quantity of biomass residues used as a result of the project activity. In this case, this is done using equation N° 30 of the ACM0006 (Vers ion 05). As mentioned before, the proposed project activity only involves additional use of biomass from forest operations in the power boiler.

$$BF_{PJ,k,y} = BF_{k,y} - \frac{Q_{projectplant,y}}{\varepsilon_{boiler} * NCV_k}$$

Where:

$BF_{PJ,k,y}$:	Incremental quantity of biomass residue type k used as a result of the project activity in the project plant during the year y (tons of dry matter or liter).
$BF_{k,y}$:	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter).
$Q_{project\ plant,y}$:	Quantity of heat generated in the cogeneration project plant from firing biomass residues during year y (GJ).
ε_{boiler} :	Energy efficiency of the boiler that would be used in the absence of the project activity.

Since in the project mill, the power boiler and the recovery boiler generate high-pressure steam at the same thermodynamic conditions, the best way to determine the heat that is attributable to the power boiler, is to multiply the total amount of heat generated in the mill by the fraction of high-pressure steam generated by the power boiler with respect to the total high-pressure steam generated in the mill by both boilers. This algorithm was part of the request for deviation approved by the Executive Board for the Valdivia project activity.

$$Q_{project\,plant,y} = [(\text{HP Steam PB})/(\text{HP Steam PB} + \text{HP Steam RB})] * \text{Process heat}$$

Where:

HP Steam PB :	Total high-pressure steam generated in the power boiler (tons/time unit).
HP Steam RB:	Total high-pressure steam generated in the recovery boiler (tons/time unit).
Process heat :	Total heat consumed in the pulping process (GJ/time unit).

Data:

	Units	2013
(1) Total high-pressure steam generated by the recovery boiler	(ton/y)	3,637,062
(2) Total high-pressure steam generated by the power boiler	(ton/y)	855,904
(3) Total biomass residues from forest operations combusted in the power boiler.	(BDt/y)	163,123
(4) Net calorific value of biomass from forest operations (dry basis) (See note).	(GJ/ton)	17.17
(5) Quantity of process heat generated in the cogeneration project plant.	(GJ/y)	8,026,736
(6) Energy efficiency of the boiler used in the absence of the project activity.		85%

Note:
As part of the temporary deviations due to delays in sampling for fuel net calorific value analysis, the Project Participant carried out some adjustments to net calorific value measurements. The adjustments are described in detail in section “B.2.1. Temporary deviations from registered monitoring plan” of this Monitoring report.

Calculations:

		Units	2013
(7) Process heat attributable to the power boiler	[(2)/(1)+(2)]*(5	(GJ/y)	1,529,083
(8) Biomass used to generate heat	(7)/((4)*(6))	(BDt/y)	104,792
(9) Incremental biomass use (adjusted)	**(3)-(8)**	(BDt/y)	58,331 (a)

Note:
a) The incremental biomass use decreased to 58,331 (BDt/y), which resulted in lower emission reductions due to uncontrolled biomass burning. This results from the adjustment of using a low net calorific value of 17.17 (GJ/BDt) in the emission reduction calculations. Detailed calculations can be seen in the emission reduction calculation spread sheet.xls

With the above calculation, it is possible to calculate the baseline emissions due to uncontrolled burning of anthropogenic sources of biomass residues using equation N°34 of the ACM0006 (Version 05):

$$BE_{Biomass,y} = GWP_{CH4} * \sum BF_{PJ,k,y} * NCV_k * EF_{burning,CH4,k,y}$$

Where

$BE_{biomass,y}$:	Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_{2e}/y).
GWP_{CH4} :	Global Warming Potential of methane valid for the commitment period (tCO_{2e}/tCH_4).
$BF_{PJ,k,y}$:	Incremental quantity of biomass residue type k used as a result of the project activity in the project plant during the year y (tons of dry matter or liter).
NCV_k :	Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter).
$EF_{burning,CH4,k,y}$:	CH_4 emission factor for uncontrolled burning of the biomass residue type k during the year y (tCH_4/GJ).

Data:

	Units	2013
(1) Additional biomass from forest operations due to the project activity (adjusted)	(BDt/y)	58,331 (a)
(2) Adjusted CH_4 emission factor for uncontrolled burning of biomass from forest ops. (See note)	(tCO_2eq/000ton)	315 (b)

Calculations:

		Units	2013
(3) Emissions (adjusted)	(1)*(2)* (ton/1000 kg)	(tCO_2eq)	18,383

Notes:
a) This results from the adjustment of using a low net calorific value of 17.17 (GJ/BDt) in the emission reduction calculations.
b) The Project Participant would like to note that an adjustment factor of 0.94 was chosen for the (original) measurement CH_4 emission factor following the indication of Table N°6 of the ACM0006 (Version 05). Since the emission factor must consider the NCV of the biomass which is measured twice a year, an average CH_4 emission factor was chosen here for simplicity.

Total baseline emissions

	2013
Emission sources	**(tCO_2eq)**
Carbon dioxide emissions due to electricity displacement	100.717
Methane emissions due to uncontrolled biomass burning avoidance (See note)	18.383
Total emissions (adjusted)	**119.100**

Note:

As part of the temporary deviations due to delays in sampling for fuel net calorific value analysis, the Project Participant carried out conservative adjustments to net calorific value measurements. The adjustments informed in the above table were considered in the preceding calculations. For further information refer to section "B.2.1. Temporary deviations from registered monitoring plan" of this Monitoring report and in the emission reduction calculation spread sheet.xls

E.2. Calculation of project emissions or actual net GHG removals by sinks

Project emissions are calculated through the following equation:

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} * PE_{Biomass,CH4,y}$$

Where:

PET_y :	CO_2 emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/y).
$PEFF_y$:	CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity (tCO_2/y).
PEEC,y :	CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity (tCO_2/y).
GWP_{CH4} :	Global Warming Potential for methane valid for the relevant commitment period.
$PE_{Biomass,CH4,y}$:	CH_4 emissions from the combustion of biomass residues during the year y (tCH_4/y).

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

This emission source is calculated using equation N°4 of the ACM0006 (Version 05).

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} * AVD_y * EF_{km,CO2,y}$$

Where:

PET_y :	CO_2 emissions during the year *y* due to transport of the biomass residues to the project plant (tCO_2/yr)
N_y :	Number of truck trips during the year *y*
AVD_y :	Average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year *y* (km)
$EF_{km,CO2,y}$:	Average CO_2 emission factor for the trucks measured during the year *y* (tCO_2/km)
$BF_{k,y}$:	Quantity of biomass residue type *k* combusted in the project plant during the year *y* (tons of dry matter or liter)
TL_y :	Average truck load of the trucks used (tons or liter)during the year y.

Data:

	Units	2013
(1) Biomass bought from 3rd parties (dry)	(BDt/y)	53,751

(2) Biomass average humidity (wet basis)	%	61.38
(3) Average load for 1 trip	(ton/truck)	29.5
(4) Average round trip distance between the biomass supply sites and the plant	(km)	69.7
(5) Emission factor for heavy truck transportation (see note below).	($kgCO_2$/km)	1.258 (a), (b)

Notes:

a) As part of the temporary deviations due to delays in sampling for fuel net calorific value analysis, the Project Participant carried out conservative adjustments to net calorific value measurements. In equation 4 of the ACM0006 (Version 05) a high net calorific value results in a high CO_2 conversion factor and therefore, a higher emission factor for heavy truck transportation, increasing project emissions. The PP has conducted the most conservative adjustment to the amount of Diesel consumed, by using the upper IPCC value of 43.30 (GJ/ton) for this fossil fuel type. For further information refer to section "B.2.1. Temporary deviations from registered monitoring plan" of this Monitoring report and to the emission reduction calculation spread sheet.xls.

b) The Project Participant would like to note that this parameter was calculated using the Diesel CO_2 emission factor and the monitored performance index of the trucks (2.11 Km/lt), provided by the transportation subcontractors.

Calculations:

		Units	2013
(6) Biomass transported (wet)	(1)/[1 – (2)]	(wet ton)	139,163
(7) Number of trips needed for the Plant per year	(6) / (3)	(trips)	4,711
(8) Total distance travelled, considering round trip	(4)*(7)	(km)	328,541
(9) Total emissions	(5)*(8)* (1ton/1,000kg)	(tCO_2)	**413**

Note:
This results from the previous adjustment of emission factor for heavy truck transportation described in preceding table,

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

This emission source is calculated using equation N°6 of the ACM0006 (Version 05).

$$PEFF_y = \sum (FF_{project\,plant,i,y} + FF_{project\,site,i,y}) * NCV_i * COEF_i$$

Where:

$FF_{project\ plant,i,y}$:	Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y (mass or volume unit per year).
$FF_{project\ site,\ i,y}$:	Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y (mass or volume unit per year).
NCV_i :	Net calorific value of fossil fuel type i (GJ / mass or volume unit).
$COEF_i$:	CO_2 emission factor for fossil fuel type i (tCO_2/GJ).

The proposed project activity implies additional fossil fuel consumption due to:

– Fossil fuel consumption in the recovery boiler: In this case, the Fuel Oil consumed associated to the project activity is related to additional electric power generation of the power plant.

Data:

	Units	2013
(1) Fossil fuel used in the recovery boiler attributable to the project activity	(ton)	2,408 (a)
(2) Fossil fuel net calorific value (average) (adjusted)	(GJ/ton)	40.80 (b)
(3) Fossil fuel CO_2 emission factor	(tCO_2/GJ)	0.07737

Notes:

a) The PP would like to note that Fuel oil consumption is due to power generation reasons.

b) As part of the temporary deviations due to sampling delays for fuel net calorific value analysis, the Project Participant carried out conservative adjustments to net calorific value measurements. Since a high NCV of fossil fuels results in a high $COEF_{i,y}$ which leads to higher project emissions due to on-site consumption of fossil fuels, the Project Participant has conducted the most conservative adjustment using the upper IPCC values of 41.70(GJ/ton) for Fuel Oil for the period of delay. For further information refer to section "B.2.1. Temporary deviations from registered monitoring plan" of this Monitoring report and to the emission reduction calculations spread sheet.xls.

Calculations:

		Units	2013
(4) Total emissions (adjusted)	(1)*(2)*(3)	(tCO_2)	**7,601**

– Fossil fuel consumption in the power boiler: In this case, there is fuel oil consumption associated to the project activity due to operational reasons and due to power generation reasons.

Data:

	Units	2013
(5) Fuel oil used due to operational reasons	(ton)	1,536
(6) Fuel oil consumption due to power generation reasons (adjusted)	(ton)	3,368 (a)
(7) Fuel oil used in the power boiler attributable to the project activity [(5)+(6)]	(ton)	4,903
(8) Fossil fuel net calorific value (average) (See note)	(GJ/ton)	40.80 (b)
(9) Fossil fuel CO_2 emission factor	(tCO_2/GJ)	0.07737

Note:

a) The Project Participant performed a conservative adjustment to the approach used to determine the FO consumed for power generation purposes. In this case, empirical curves were used to determine the amount of FO power generation and operational purposes. As a result the FO amount for power generation increased and therefore, project emissions.

b) Refer to note at the foot of the preceding table.

Calculations:

		Units	2013
(10) Total emissions (adjusted)	[(5)+(6)]*(8)*(9)	(tCO_2)	**15,478**

– Fossil fuel consumption due to on-site biomass residues from forest operations transportation: This fossil fuel consumption is related to the transportation of the additional biomass from forest operations (mix of sawdust and bark) that is attributed to the project activity (e.g. generation of

Data:

	Units	2013
(10) Diesel used for on-site biomass transportation due to the project activity.	(ton)	45.7
(11) Fossil fuel net calorific value (average). (See note below).	(TJ/000ton) or (GJ/ton)	43.02
(12) Fossil fuel CO_2 emission factor.	(tCO_2/GJ)	0.07407

Note: As part of the temporary deviations due to sampling delays for fuel net calorific value analysis, the Project Participant carried out conservative adjustments to net calorific value measurements. Since a high NCV of fossil fuels results in a high $COEF_{i,y}$ which leads to higher project emissions due to on-site consumption of fossil fuels, the Project Participant has conducted the most conservative adjustment

adjustment using the upper 2006 IPCC value of 43.30(GJ/ton) for Diesel. For further information refer to section “B.2.1. Temporary deviations from registered monitoring plan” of this Monitoring report and to the emission reduction calculations spread sheet.xls.

Calculations:

		Units	2013
(13) Total emissions (adjusted)	(10)*(11)*(12)	(tCO_2)	**145.6**

– Fossil fuel consumption due to on-site biomass residues from forest operations preparation: Since there was no mechanical preparation of biomass residues (sawdust and bark) during the monitored period, this emission source was zero.

According to the calculations above, the carbon dioxide emissions from on-site consumption of fossil fuels attributable to the implementation of the project activity can be summarized in the table below:

	2013
Carbon dioxide emissions from on-site consumption of fossil fuels (all values adjusted - see note below)	**(tCO_2)**
Fossil fuel consumption in the recovery boiler.	7,601
Fossil fuel consumption in the power boiler.	15,478
Fossil fuel consumption due to on-site biomass from forest operations transportation.	146
Fossil fuel consumption due to on-site biomass from forest operations preparation.	0
Total emissions.	**23.225**

Note: As described above, the Project Participant conducted the most conservative adjustments in terms of emission reduction calculations.

3. Carbon dioxide emissions from electricity consumption

This emission source is calculated using equation N° 7 of the ACM0006 (Version 05). However, during th e monitored period, there was no electricity consumption associated to the project activity, therefore the total emissions related to this source is zero.

$$PE_{EC,y} = 0$$

4. Methane emissions from combustion of biomass residues

This emission source is calculated using equation N°8 of the ACM0006 (Version 05).

$$PE_{Biomass,CH4,y} = EF_{CH4,BF} * \sum BF_{k,y} * NCV_k$$

Where:

$BF_{k,y}$: Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter).

NCV_k : Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter).

$EF_{CH4,BF}$: CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ).

Since the project activity implies additional biomass from forest operations consumption in the power boiler, the only source of methane emissions attributed to the project activity is the one related to this additional consumption under controlled burning conditions.

Data:

	Units	2013
(1) Biomass related to the project activity burned in the power boiler (adjusted).	(BDt)	58,331 (a)
(2) Net calorific value of biomass from forest operations (dry basis) (adjusted) (See note).	(GJ/ton)	18.67 (b)
(3) Biomass methane emission factor under controlled burning conditions	($KgCH_4$/TJ)	30.0
(4) Conservativeness factor	---	1.02
(5) Global Warming Potential of CH_4	---	21

Note:
According to equation 8, a high net calorific value of biomass residues results in a high controlled biomass burning factor. For conservativeness reasons and due to delays in the samples taken, the Project Participant has adjusted net calorific value measurements using the upper 2006 IPCC value of 31(GJ/BDt) of biomass residues from forestry. This adjustment results in a high controlled biomass burning factor and therefore, higher project emissions.

The Project Participant would like to note that net calorific values of biomass must be monitored twice a year. For simplicity, an average was used here.

Calculations:

		Units	2013
(6) Total emissions (adjusted)	(1)*(2)*(1TJ/1,000GJ)*(3)*(4)*(5) *(1 ton/1,000kg)	(tCO_2eq)	**700**

Note: The total emissions in 2013 increased to 700 tCO_2eq due to the adjustment performed in the net calorific value described in the preceding table.

Total project emissions:

	2013
Emission sources	**(tCO_2eq)**
Carbon dioxide emissions from biomass residues transportation to the power plant	413
Carbon dioxide emissions from on-site consumption of fossil fuels.	23.225
Carbon dioxide emissions from electricity consumption	0
Methane emissions from combustion of biomass residues	700
TOTAL PROJECT EMISSIONS	**24.338**

E.3. Calculation of leakage

Since the project activity contemplates the utilization of additional biomass from forest operations (sawdust and bark), it is required to assess if the project displaced the current use of biomass as a fuel. If the project actually drove current users of biomass to resort to more carbon-intensive fuels, the emission related to that fuel must be deducted from the project's emission reductions.

There are two sources of biomass that can be used in the Valdivia biomass power plant:

1. Biomass from industrial operations, consisting basically of biomass generated by local sawmills.

Currently, part of this biomass is used by the same sawmills for heat generation purposes, however, considerable surplus still remains.

2. Biomass from forestry operations, consisting basically of harvesting, pruning and thinning operations in managed forestlands. Currently this biomass has very little use.

Arauco performed a biomass availability study for 2012, using official bulletins from INFOR[6] as well as other (whenever available) official sources to calculate the biomass supply and demand in the Valdivia power plant influence area[7]. This study is part of the monitoring plan of the Valdivia project activity and was carried out according to approach L2 of the baseline methodology. A detailed Excel spread sheet with the monitored data and the calculation of the forest biomass supply/demand situation was provided to the DOE to establish the quality and validity of the data sources and the accuracy of the calculated numbers. The following table summarizes the results of this study:

Supply / Demand situation in Valdivia power plant influence area

(Estimation for year 2012)

Biomass residues generation

Biomass from industrial operations	(m^3st/yr)	3,655,101
Biomass from forestry operations	(m^3st/yr)	1,844,590

Biomass residues demand

Demand from industrial operations	**(m^3st/yr)**	2,650,025

Sources: Infor official bulletins and studies.

* Demand from forestry operations not available for year 2012

Valdivia power plant surplus index

(estimation for year 2012)

This index was calculated using criteria "L2" of the ACM0006

Industrial Biomass residues supply / Industrial Biomass residues consumption	1.3793

Biomass residues supply / Biomass residues consumption*	2.0753

* The Biomass residues supply considered the biomass residues from industrial and forestry operations

According to the table above, it is clear that the quantity of available biomass in the influence area of the project activity is greater than the 25% threshold established in option L2 of the consolidated baseline methodology. These results are consistent with the fact that in the last years the existing biomass power plants in the area/region continue to function without restriction and that new biomass based projects are being considered in the area[8].

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

$$L_y = 0$$

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

[6] INFOR stands for "Instituto Nacional Forestal" or "National Forestry Institute" in English.
[7] The Valdivia project influence area is defined in page 129 of the registered PDD.
[8] Including some prospective CDM biomass projects.

Item	Baseline emissions or baseline net GHG removals by sinks ($t\ CO_2e$)	Project emissions or actual net GHG removals by sinks ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions or net anthropogenic GHG removals by sinks ($t\ CO_2e$)
4th verification (1st Jan, 2013- 31st Dec, 2013)	119,100	24,337	0	94,762

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks ($t\ CO_2e$)	181,654	94,762

E.6. Remarks on difference from estimated value in registered PDD

According to the PDD, the estimated emission reductions for 2013 should have been 181,654 CERs. The monitored emissions were 48% lower than the estimate in the PDD. Reasons for this are:

- The monitored net quantity of electricity generated at the project plant was 677,230 (MWh/y), 1.3% lower than the electricity estimated in the PDD. According to the PDD, the estimated gross electricity generated in the project plant in 2013 was 704,000 (MWh), but the monitored gross electricity generated was 695,232 (Mwh), 1.2% lower.

- Also, and more importantly, the grid emission factor obtained for 2013 was 0.774 (tCO2/MWh), while that estimated in the PDD was 0.900 (tCO2/MWh). This alone accounts for a 14% reduction in grid emission savings.

- Added to this, the conservative adjustments that the PP made due to the temporary deviation derived from the late sampling of biomass from forest operations and black liquor for the determination of their net calorific value, led to an additional 14% decrease of total grid emission savings.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks ($t\ CO_2e$)	N/A	94,762 (tCO_2eq)

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Document information

Version	Date	Description
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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