Monitoring report form
(Version 03.1)

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	12/03/2013
Registration date of the project activity	01/04/2009
Monitoring period number and duration of this monitoring period	Monitoring period #3 is from 01/01/2011 to 31/12/2012 (including both days).
Project participant(s)	CELULOSA ARAUCO Y CONSTITUCIÓN S.A.
Host Party(ies)	Chile.
Sectoral scope(s) and applied methodology(ies)	Scope 1 Consolidated methodology for grid-connected electricity generation from renewable sources (ACM0002 ver.6). Consolidated methodology for generation from biomass residues (ACM0006 ver. 5).
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 2011 to 31 December of 2012: **399,556(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 monitored period from 01 January 2011 to 31 December 2012 is: **102,685(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[2] 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[3]. 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	Construction start date
February 2004	Commissioning start date
01/04/2009 to 31/12/2009 (both days are included"	The 1st monitoring period
01/01/2010 to 31/12/2010	The 2nd monitoring period.
01/01/2011 to 31/12/2012 (both days are included)	The 3rd monitoring period (this report)

ADt stands for "Air Dry ton".
y used for this project activity.

Total Net emission reductions

The total net emission reduction claimed in monitored periods 5 is **102,685(tCO_2eq)**

Where:

- From January 1st 2012 to December 31st 2012 the total net emission reductions is **104,768.6 (tCO_2eq).**
- From January 1st 2011 to December 31st 2011the total net emission reductions is **-2,082.7** (**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**
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

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:

From January 1st 2011 to December 31st 2011:

	Out of service day	Starting day	Number of hours	Comments
Shutdown				
Power boiler	07-03-2011	18-03-2011	231	Low level of the Cruces River
Recovery boiler	06-03-2011	20-03-2011	284	Low level of the Cruces River
	26-05-2011	29-05-2011	79	Low burning of NCL
	06-08-2011	23-08-2011	19	Recovery boiler trip
Tur**bo generator** 1	07-03-2011	19-03-2011	312	Low level of the Cruces River
	21-11-2011	25-11-2011	34	Recovery boiler trip
Turb**o generator** 2	01-01-2011	21-08-2011	5524	Out of service
	24-09-2011	30-09-2011	146	Turbine 2 trip
	23-11-2011	26-11-2011	39	Out of service
Maintenance Stoppage				
Power Boiler	07-11-2011	14-11-2011	167	No comment
Recovery boiler	05-11-2011	16-11-2011	261	No comment
Tur**bo generator** 1	05-11-2011	16-11-2011	249	No comment
Turb**o generator** 2	10-09-2011	23-09-2011	172	No comment
	07-11-2011	14-11-2011	173	No comment

Instrument replacements during 2011:

	Old serial number	New serial number	Date replaced
Temp. transmitter 352-TT-430	230921	0618823	23/11/2011

From January 1st 2012 to December 31st 2012)

	Out of service day	Starting day	Number of hours	Comments
Shutdown/Stoppage				
Power Boiler	08-11-2012	15-11-2012	157	No comment
Recovery boiler	06-11-2012	16-11-2012	235	No comment
Turbo generator 1	06-11-2012	16-11-2012	232	No comment
Turbo generator 2	08-11-2012	15-11-2012	173	No comment

Instrument replacements during 2012:

Instrument replacements CP1MP4	Old serial number	New serial number	Date replaced
Flow transmitter 352-FT- 433	0860203276	0339494	28/10/2012
Temp. transmitter 352-TT-430	0618823	0618822	23/03/2012
Flow transmitter 365-FT-914	6404025150	6410003178	11/11/2012
Flow transmitter 365-FT-924	5003010908	6410006727	10/11/2012

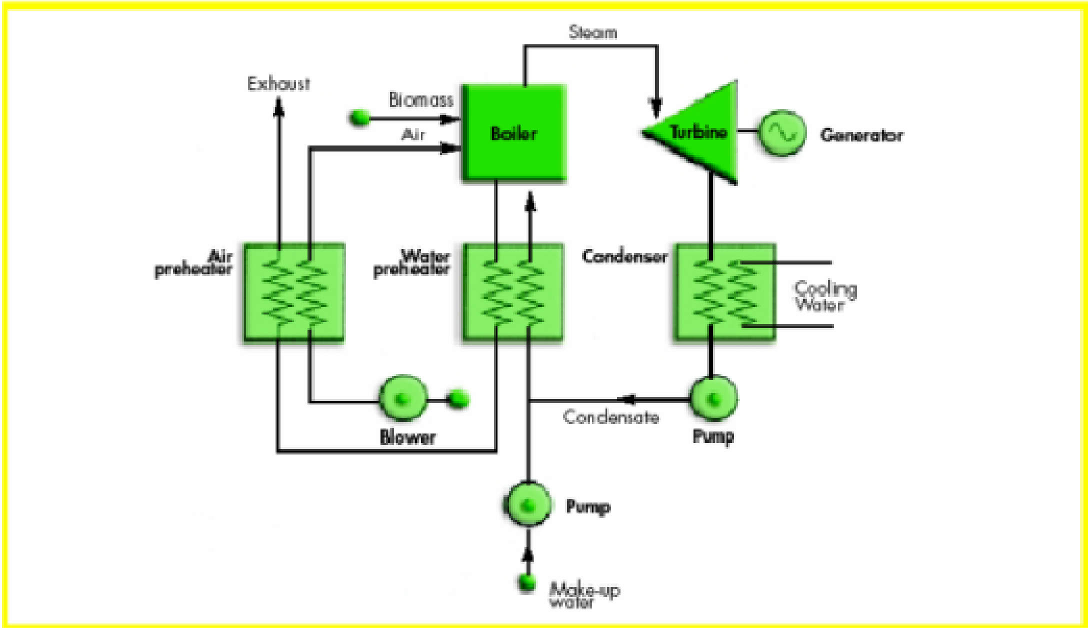
Description of the installed technology and equipment

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

During March and May of 2011 the Project Participants were temporarily unable to produce evidence related to monitored parameters of electricity generation and electricity consumption of this project activity. In this case monitored data was lost due some problems with the IP21 data system of the pulp mill losing partially of the monitored data used for emission reduction calculation of this project activity.

The extend and duration of the non-conforming monitoring during March and May of 2011 are presented in the following tables:

	Gross electricity generated by the power plant		Total internal electricity consumption					
	TG1	TG2	Fiber	Lycor	Wood	Machine	Filters	
	MJ	MJ	MJ	MJ	MJ	MJ	MJ	
01-03-11	5,009,211	0	1,419,564	1,654,320	101,856	957,804	7,338	
02-03-11	4,971,886	0	1,368,756	1,631,652	147,936	960,420	7,492	
03-03-11	4,967,782	0	1,410,168	1,602,732	145,740	948,048	7,108	
04-03-11	5,034,215	0	1,434,540	1,640,808	170,400	946,440	7,284	
05-03-11	4,990,268	0	1,412,040	1,625,616	144,072	943,104	7,364	
06-03-11	4,158,769	0	1,057,080	1,482,648	93,852	735,984	6,751	
07-03-11	0	0	0	0	0	0	0	General Stoppage of the pulp mill due to low level of river Cruces.
08-03-11	0	0	0	0	0	0	0	
09-03-11	0	0	0	0	0	0	0	
10-03-11	0	0	0	0	0	0	0	
11-03-11	0	0	0	0	0	0	0	
12-03-11	0	0	0	0	0	0	0	
13-03-11	0	0	0	0	0	0	0	
14-03-11	0	0	0	0	0	0	0	
15-03-11	0	0	0	0	0	0	0	
16-03-11	0	0	0	0	0	0	0	
17-03-11	0	0	0	0	0	0	0	
18-03-11	0	0	0	0	0	0	0	
19-03-11	0	0	0	0	0	0	0	
20-03-11	616,465	0	247,092	1,000,968	18,240	59,148	0	
21-03-11	3,795,821	0	767,148	1,402,116	83,124	606,768	4,074	
22-03-11	4,314,893	0	1,200,492	1,381,200	119,172	974,244	7,446	
23-03-11	4,632,349	0	1,257,276	1,422,612	116,868	991,992	7,734	
24-03-11	4,378,533	0	1,260,120	1,381,320	95,004	987,660	7,037	
25-03-11	4,479,432	0	1,280,400	1,400,256	101,076	996,144	7,335	
26-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	Period where the IP21 data system of the pulp mill failed.
27-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
28-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
29-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
30-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
31-03-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
TOTAL MJ	51,349,624	0	14,114,676	17,626,248	1,337,340	10,107,756	76,963	
TOTAL MWh	14,264	0	3,921	4,896	371	2,808	21	

	Gross electricity generated by the power plant		Total internal electricity consumption					
	TG1	TG2	Fiber	Lycor	Wood	Machine	Filters	
	MJ	MJ	MJ	MJ	MJ	MJ	MJ	
01-05-11	5,116,174	0	1,476,106	1,608,861	138,903	985,325	4,323	
02-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	IP21 Data system of the pulp mill failed.
03-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
04-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
05-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
06-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
07-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
08-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
09-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
10-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
11-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
12-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
13-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
14-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
15-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
16-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
17-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
18-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
19-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
20-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
21-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
22-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
23-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
24-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
25-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
26-05-11	*Data loss*	0	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
27-05-11	*Data loss*	*0*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	*Data loss*	
28-05-11	1,677,792	0	177,187	916,437	92,424	43,231	0	
29-05-11	3,503,902	0	915,220	1,270,505	165,956	501,778	0	
30-05-11	4,639,538	0	1,320,083	1,508,678	155,370	936,697	0	
31-05-11	4,792,862	0	1,288,385	1,533,371	97,352	935,988	0	
TOTAL MJ	19,730,268	0	5,176,981	6,837,852	650,005	3,403,020	4,323	
TOTAL MWh	5,481	0	1,438	1,899	181	945	1	

In order to address this problem in the most conservative possible way the Project Participant assumed zero to the monitored parameters gross electricity generated by the power plant and total internal electricity consumption rather than estimate values.

The applied the approach previously described instead of estimate data loss allowed the Project Participant to reasonable dissipate any possible risk of overestimating the total emission reductions claimed for the monitoring period between January 1st 2011 and December 31st 2011.

B.2.2. Corrections

Not applicable.

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 simultaneously 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, would be determined by following the indicatio ns of baseline scenario N°4, using formula N°14, wh ich is used with 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

Not applicable.

B.2.5. Changes to start date of crediting period

Not applicable.

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

Not applicable.

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[4]

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.

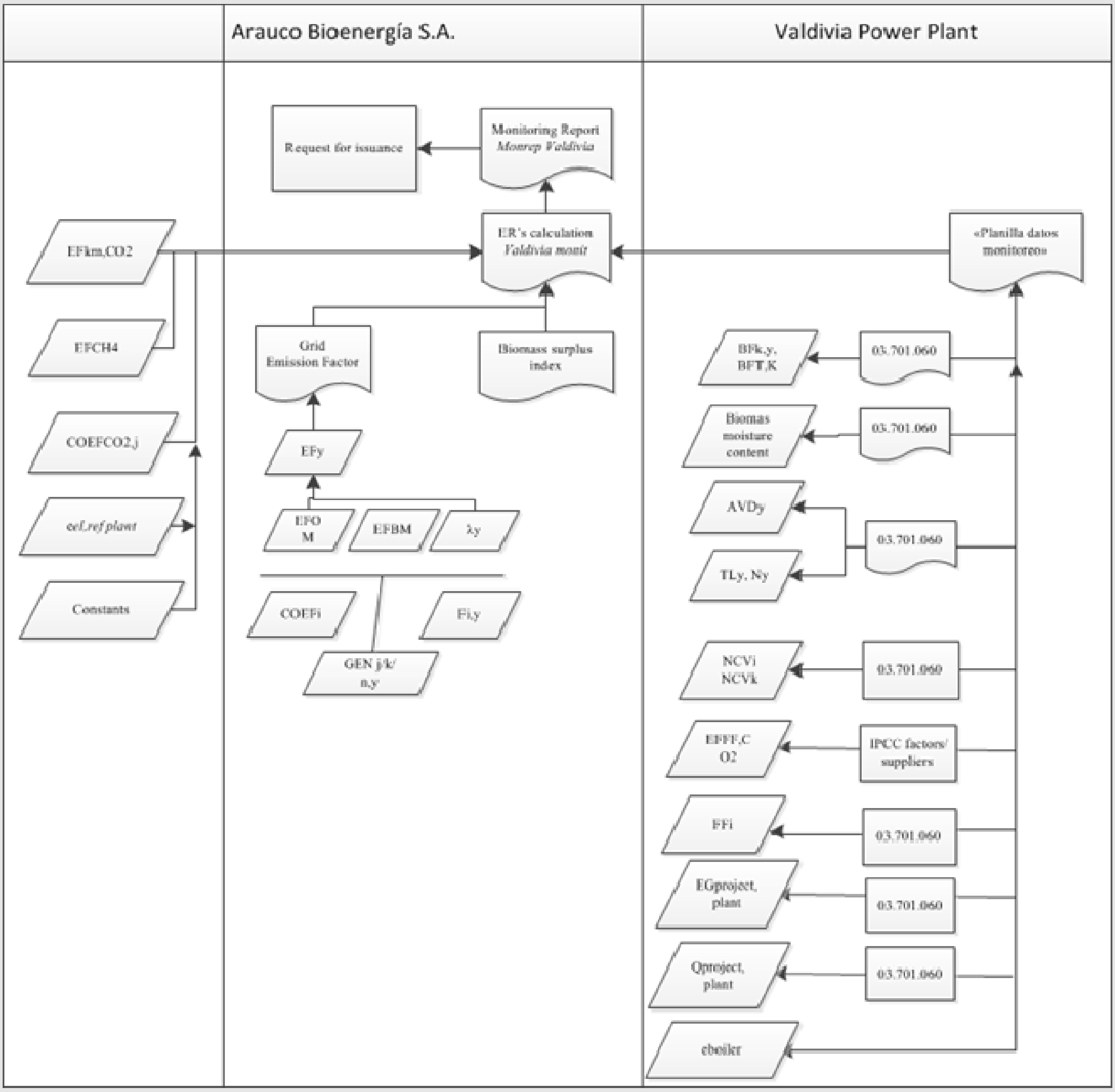
[4] Arauco Bioenergía S.A. is the new name of Arauco Generación S.A.

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.

<u>The following diagram describes the monitoring system:</u>



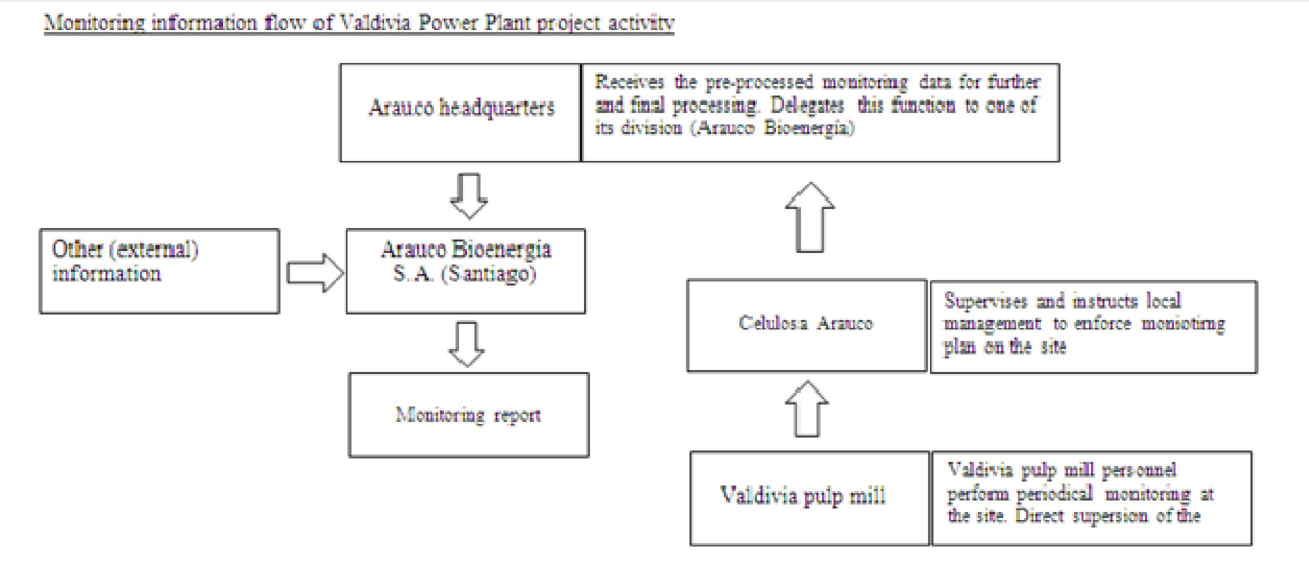
Note that the document of # 03.701.060 describes the proccedure of monitoring the CDM parameters used in the emission reduction calculations.

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:



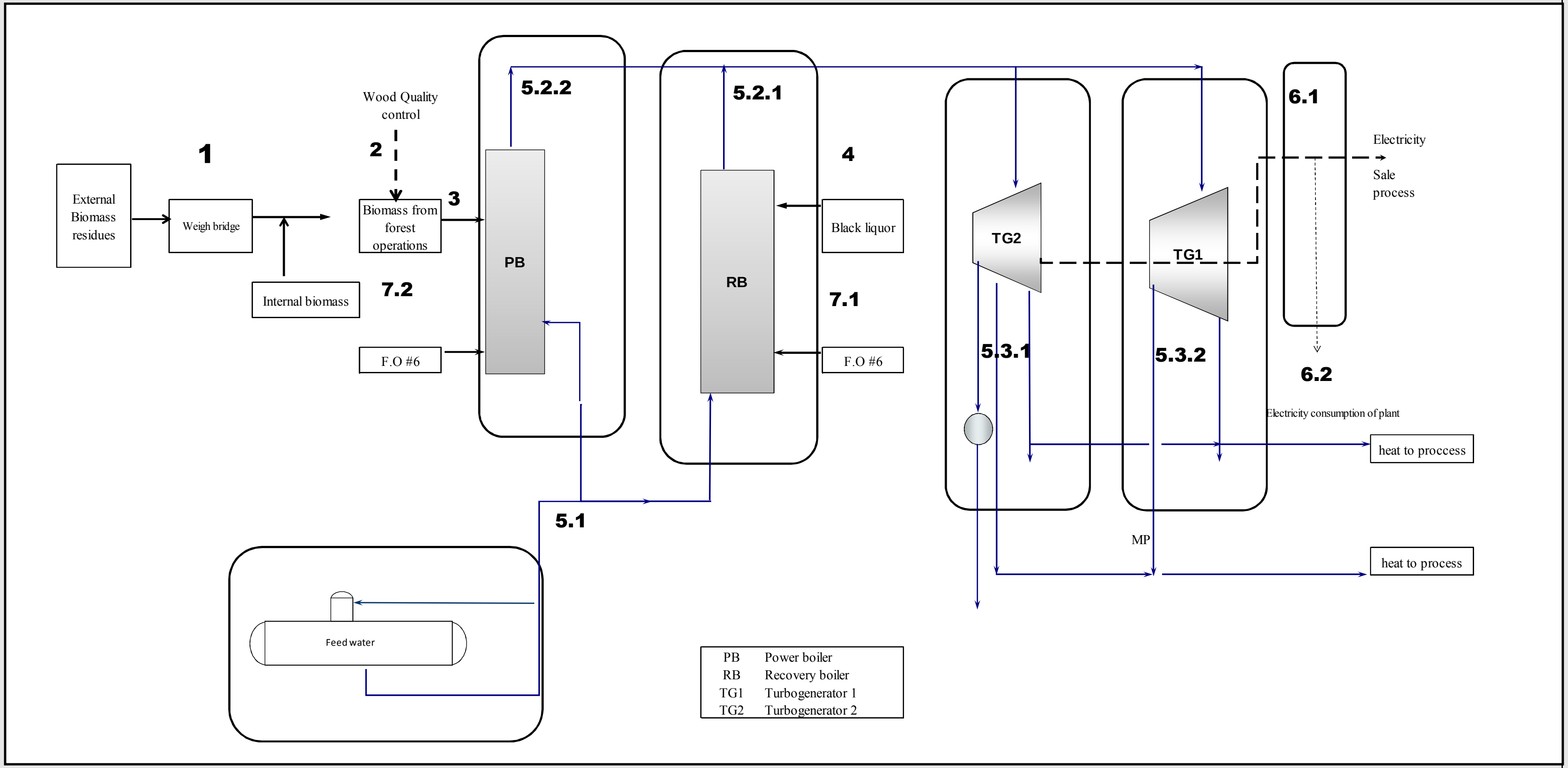
Calibration results of monitoring instruments for 2011 and 2012 is presented in the following table:

From January 1st 2011 to December 31st 2011:

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	ARE EQUAL	YES
	Weighbridge =2 Center	TL_y	330-WT-051	NO	NO
	Weighbridge =3 North	TL_y	330-WT-052	ARE EQUAL	NO
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	YES	YES
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1154	ARE EQUAL	YES
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1155	NO	YES
	Drying Oven ULE 700 (400 - 500 L)	Moisture content of $BF_{k,y}$	310-81-1156	NO	NO
3	Weightmeter	$BF_{k,y}$	331-WT-005	YES	YES
4	Magnetic Flow Transmitter	$BF_{k,y}$	352FT433	NO	NO
	Magnetic Flow Transmitter	$BF_{k,y}$	352FT445	NO	NO
	Refractometer	Moisture content of $BF_{k,y}$	352DT435A	YES	YES
	Refractometer	Moisture content of $BF_{k,y}$	352DT435B	YES	YES
5.1.	Pressure Transmitter	$Q_{project\ plant,y}$	362PT980	NO	YES
	Temperature Transmitter	$Q_{project\ plant,y}$	362TT965	YES	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	NO	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	NO	YES
	Differential Pressure Flow Transmitter	$Q_{project\ plant,y}$	365FT923	YES	YES
	Differential Pressure Flow Transmitter	$Q_{project\ plant,y}$	365FT924	YES	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	$FF_{project\ plant,i,y}$	352FT653	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT657	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT681	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT685	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT823	CALIB NOT REQUIRED	YES (zero adjusted)
7.2.	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT507	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT510	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT515	CALIB NOT REQUIRED	YES (zero adjusted)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT518	CALIB NOT REQUIRED	YES (zero adjusted)

From January 1st 2012 to December 31st 2012:

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	ARE EQUAL	YES
	Weighbridge #2 Center	TL_y	330-WT-051	YES	YES
	Weighbridge #3 North	TL_y	330-WT-052	ARE EQUAL	YES
2	Digital Scale	Moisture content of $BF_{k,y}$	310-81-1150	YES	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 $BF_{k,y}$	310-81-1156	NO	NO
3	Weightmeter	$BF_{k,y}$	331-WT-005	NO	NO
4	Magnetic Flow Transmitter	$BF_{k,y}$	352FT433	NO	NO
	Magnetic Flow Transmitter	$BF_{k,y}$	352FT445	NO	NO
	Refractometer	Moisture content of $BF_{k,y}$	352DT435A	NO	NO
	Refractometer	Moisture content of $BF_{k,y}$	352DT435B	NO	NO
5.1.	Pressure Transmitter	$Q_{project\ plant,y}$	362PT980	NO	YES
	Temperature Transmitter	$Q_{project\ plant,y}$	362TT965	YES	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	NO	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	YES	YES
5.3.2.	Differential Pressure Flow Transmitter	$Q_{project\ plant,y}$	365FT920	NO	YES
	Differential Pressure Flow Transmitter	$Q_{project\ plant,y}$	365FT923	NO	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	$FF_{project\ plant,i,y}$	352FT653	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT657	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT681	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT685	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	352FT823	CALIB NOT REQUIRED	YES(zero adjustment)
7.2.	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT507	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT510	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT515	CALIB NOT REQUIRED	YES(zero adjustment)
	Mass Flow Transmitter	$FF_{project\ plant,i,y}$	363FT518	CALIB NOT REQUIRED	YES(zero adjustment)


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

SECTION D. Data and parameters

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

Data/Parameter	**GWPCH4**
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[5]. – 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.

Data/Parameter	**Additional electric power consumption of the project mill**
Unit	(%)

[5] 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).

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. <u>Biomass residues of type : Black liquor</u> 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 the black liquor (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 (in the DCS) multiplied by the average concentration (%) of solids by using the equation 1 listed below. Black liquor (tDS[6]/s) = black liquor flow (l/s) * (%) solids*density of black liquor (tDS/l). The 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 the emission reductions of the project activity in Arauco Bioenergía S.A. <u>Biomass residues (mix of sawdust and bark) from forest operations</u> The biomass from forest operations (in wet tons) combusted in the power boiler was 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 the 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), the biomass residues ($BF_{T,k,y}$) used in equation Nº4 of the ACM0006 (Version 05) corresponds to the fraction of $BF_{k,y}$ attributable to the project activity that must be brought in trucks from outside of the plant which are utilized for project emission calculation due to transportation to the power plant. This amount was duly measured (weight and volume) at the entrance of the power plant.	

[6] tDS stands for "ton of dry solid".

Value(s) of monitored parameter	**Black liquor:** (2012): 954,537(tDS, tonnes dry solids) (2011): 937,426(tDS, tonnes dry solids). **From January 1st 2012 to December 31st 2012:** Biomass residues (mix of sawdust and bark): 137,738(BDt, bone dry ton) From 137,738 (BDt), 29,318(BDt) corresponds to biomass attributable to the project activity that was brought to the power plant by trucks It must be noted that the biomass from forest operations (sawdust and bark mix) is monitored on wet basis. The biomass is then adjusted to dry basis using the corresponding moisture content as per required by the baseline methodology. **From January 1st 2011 to December 31st 2011:** Biomass residues (mix of sawdust and bark): 123,651 (BDt, bone dry ton) From 123,651(BDt), 19,553(BDt) corresponds to biomass attributable to the project activity that was brought to the power plant by trucks
Monitoring equipment	Black liquor: 352FT433 Type: Magnetic Flow Transmitter. ROSEMOUNT 8732CR12N0M4T1L1 Accuracy class: +/- 0.25% Serial number: 0860203276 Calibration frequency: 1 year Calibration dates: 10/12/2010 Date of last calibration: 09/11/2011 Validity: 09/11/2012 *Replaced during CP1 MP4 (2012) by:* 352FT433 Type: Magnetic Flow Transmitter. ROSEMOUNT 8732E Accuracy class: +/- 0.25% Serial number: 0339494 Calibration frequency: 1 year Calibration dates: 28/10/2012 Date of last calibration: 10/11/2012 Validity: 10/11/2013 352FT445 Type: Magnetic Flow Transmitter. ROSEMOUNT 8732CR12N0M4T1L1 Accuracy class: +/- 0.25% Serial number: 0860145376 Calibration frequency: 1 year Calibration dates: 10/12/2010, 09/11/2011 Date of last calibration: 10/11/2012 Validity: 10/11/2013

		352TT430 Type: Temperature Transmitter. ROSEMOUNT 644HANAJ6C4Q4G5 Accuracy class: +/- 0.21℃ Serial number: 230921 Calibration frequency: 1 year Calibration dates: 30/11/2010 Date of last calibration: 09/11/2011 Validity: 09/11/2012 *Replaced during CP1 MP3 (2011) by:* 352TT430 Type: Temperature Transmitter. ROSEMOUNT 3144PD1A1N4B4MSF5C8C4Q4 Accuracy class: +/- 0.21℃ Serial number: 0618823 Calibration frequency: 1 year Calibration dates: 23/11/2011 Date of last calibration: 23/11/2011 Validity: 23/11/2012 Replaced again during CP1 MP4 (2012) by: 352TT430 Type: Temperature Transmitter. ROSEMOUNT 3144PD1A1N4B4MSF5C8C4Q4 Accuracy class: +/- 0.21℃ Serial number: 0618822 Calibration frequency: 1 year Calibration dates: 23/03/2012 Date of last calibration: 10/11/2012 Validity: 10/11/2013 352DT435A Type: Refractometer. K-PATENTS IT-RE-GP Accuracy class: +/- 0.1% Serial number: 2002-D42-5099 Calibration frequency: 2 Years Calibration dates: 19/10/2010, 28/04/2011, 08/11/2011, 30/04/2012 Date of last calibration: 10/11/2012 Validity: 10/11/2014 352DT435B Type: Refractometer. K-PATENTS IT-RE-GP Accuracy class: +/- 0.1% Serial number: 2002-D43-5100 Calibration frequency: 2 Years Calibration dates: 21/10/2010, 02/05/2011, 08/11/2011, 27/04/2012 Date of last calibration: 10/11/2012 Validity: 10/11/2014	

		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: 23/11/2010, 13/11/2011 Date of last calibration: 13/11/2012 Validity: 13/11/2013
	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 is continuously measured by proper instrument and data obtained fully integrated with the DCS. Data is the 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. **Biomass residues (mix of sawdust and bark) from forest operations.** (2012): 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 69.06%, 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 18% by weight was obtained for the monitored period. From January 1st 2011 to December 31st 2011: 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 67.72%, 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 9.7% by weight was obtained for the monitored period. This difference was deemed acceptable by the Project Participant.

	Differences between measured biomass residues and stock changes values were over 7% for both years. In this case, no adjustment was performed to the monitored (measured) biomass residues, since higher amounts of biomass leads to a more conservative net emission reduction In order to address this problem, the project participant should perform an adjustment to monitored (measured) values of biomass residues combusted in the power boiler. Since a higher amount of biomass leads to lower net emissions reductions, in a clear and conservative way, the PP will perform an adjustment the measured values in the case these result lower than the stock values.in this case, no adjustment was performed to the monitored values as these resulted to be lower than stock variations. **Black liquor** 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:
	From January 1st 2012 to December 31st 2012 With the monitored data, the efficiency obtained for the recovery boiler was 73.8%. This value is compared with the average efficiency value of 64.05% specified for this boiler by the manufacturer. A difference of 9.3% was obtained which is considered a reasonable deviation. Additionally, the Project Participant calculated an operational index of 1.74(tDS/ADT), which also compares very closely with the range of 2.0 +/- 0.5. From January 1st 2011 to December 31st 2011: With the monitored data, the efficiency obtained for the recovery boiler was 75.1% which is a reasonable value when compared with the average efficiency value of 64.05% specified for this boiler by the manufacturer. Additionally, the Project Participant calculated an operational index of 1.83 (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	--

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	Black liquor: On-site measurements. For more details, please refer to the $BF_{k,y}$ parameter. Biomass residues from forestry operations: On-site measurements.
Value(s) of monitored parameter	Black liquor: This biomass type is directly measured in dry-solid terms (tDS). **Biomass residues from forest operations:** (2012): 64.00% (weighted averaged for the monitored period, wet basis). (2011): 64.68% (weighted averaged for the monitored period, wet basis).
Monitoring equipment	Black liquor: The equipment used to measure this parameter was described in full under the 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: 31/10/2010, 18/01/2011, 15/04/2011, 19/07/2011, 17/10/2011, 16/04/2012, 04/07/2012, 04/10/2012 Date of last calibration: 04/10/2012 Validity: 04/04/2013 310-81-1151 Type: Digital Scale. METTLER TOLEDO PG12001 Accuracy class: +/- 0.1 g Serial number: 1122192802 Calibration frequency: 6 Months Calibration dates: 23/09/2010, 17/01/2011, 18/04/2011, 18/07/2011, 18/10/2011, 11/04/2012, 19/07/2012 Date of last calibration: 09/10/2012 Validity: 09/04/2013 310-81-1213 Type: Digital Scale. METTLER TOLEDO AB-204 Accuracy class: +/- 0.1 mg Serial number: 1126350159 Calibration frequency: 6 Months Calibration dates: 07/10/2010, 26/01/2011, 27/04/2011,08/08/2011, 28/11/2011, 27/02/2012, 25/05/2012, 21/08/2012 Date of last calibration: 28/11/2012 Validity: 28/05/2013 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 for the moisture content measurement. 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 used to measure moisture content and all of them received periodic maintenance and calibration, according to manufacturer's recommendation. For more details about the calibration of these instruments, please refer to the 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 table below, a deviation of 1.04% and 0.3% was obtained for 2012 and 2011, respectively, which results in a reasonable value. (see table below) 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 the biomass residues from forestry operations moisture content was duly performed during the monitored period. Please refer to page 12 of this Monitoring Report that presents a table with the corresponding calibration results.
Purpose of data	Baseline emissions and project emissions calculations.
Additional comment	--

Monitoring period	Parameter	Laboratory samples (%)	Measurements recorded in the DCS (%)	Deviation (%)
Jan-Dec (2012)	Annual average moisture content.	25.8	26.9	1.04
Jan-Dec (2011)	Annual average moisture content.	24.5	24.8	0.3

Data/Parameter	**$EF_{CH4,BF}$**

Unit	(tCH_4/GJ)
Description	CH4 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 1.02 conservativeness factor 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	(2012): 84.0 km (weighted average, round trip). For more details, please see the corresponding emission reduction calculation Excel spread sheet. (2011): 62.5 km (weighted average, 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 travel 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 distances in 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 extracts the number of trucks that arrived to the mill with biomass residues (mix of sawdust and bark) and reports this information to the person in charge of calculating the emissions reductions of the project activity in Arauco Bioenergía S.A.
Value(s) of monitored parameter	(2012): 3,212 truck trips (2011): 2,593 truck trips
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	All trucks that brought third party biomass residues were continuously recorded daily 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 month: 2012: 267 2011: 216 2010: 242 2009: 334 2008: 287 2007: 379 As can be seen in the table above, the average N° of trips during the monitored period (2012 and 2011) similarly compares to the average N° of trips of the previous years.
Purpose of data	Project emission calculations.
Additional comment	---

Year (Jan to Dec)	Average N° of trips per month
2012	267
2011	216
2010	242
2009	334
2008	287
2007	379

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	(2012): 25.4 (ton/truck). (2011): 21.3 (ton/truck). These are the average values considering truckload of the trucks and the amount of biomass from third party suppliers.

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: 30/11/2010, 30/04/2011 Date of last calibration: 20/12/2012 Validity: 20/12/2013 330-WT-051 Type: Weighbridge #2 Center METTLER TOLEDO JAGXTREME Accuracy class: +/- 30 kg Serial number: 5311767-5HD Calibration frequency: 1 Year Calibration dates: 30/11/2010, 30/04/2011 Date of last calibration: 20/12/2012 Validity: 20/12/2013 330-WT-052 Type: Weighbridge #3 North METTLER TOLEDO JAGXTREME Accuracy class: +/- 30 kg Serial number: 5311771-5HD Calibration frequency: 1 Year Calibration dates: 30/11/2010, 30/04/2011 Date of last calibration: 20/12/2012 Validity: 20/12/2013
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 9 of this Monitoring Report that 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	(tCO2/km)
Description	Average CO2 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): 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	<u>(2012):</u> 1.320 ($kgCO_2$/km). <u>(2011):</u> 1.251 ($kgCO_2$/km).
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)	$EF_{km,Diesel}$ = [[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: $EF_{CO2,FF,Diesel}$ (tCO_2/GJ): Carbon content of diesel (tC/TJ) * Fraction of carbon oxidized* CO_2 / C conversion factor (tCO_2/tC) *(1TJ/1000GJ). $EF_{km,Diesel}$ = [(1/2.1km/l) * 0.84 (kg/l)/1,000] * [0.07407 (tCO_2/GJ).* 42.90 (GJ(ton)]

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
2012	1.320	---	---
2011	1.251	---	---
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 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
2012	2.13	---	---
2011	2.13	-	-
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 values used of NCV_{Diesel} with the 2006 IPCC values.

	NCV_{Diesel} (GJ/ton)	
Year	Valdivia Project Plant	2006 IPCC Values
2012	42.54	43.0 [Lower: 41.4 Upper: 43.3]
2011	42.80	
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 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	(2012): Diesel: 0.07407 (tCO_2/GJ). Fuel oil: 0.07737 (tCO_2/GJ). (2011): 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.

<table>
<tr><td>Source of data</td><td>
The Project Participant used the following information sources to determine this parameter:

Specific consumption factor of 3.43 (kg of fuel oil/m^{3}st of forestry biomass residues): Corresponds to the historic fossil fuel consumption per unit of biomass from forestry operation 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 the 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. This fossil fuel amount is directly monitored by the power plant operators in the Valdivia biomass power plant.
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.

</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<u>(2012):</u>
Fossil fuel consumption associated to additional biomass residues from forest operation: 1,557.7 (ton) of fuel oil.
Fossil fuel consumption in the power and recovery boilers related to additional surplus power generation to the grid:
<table>
<tr><th>Measured value (ton/year)</th><th>Parameter</th></tr>
<tr><td>3,530.6</td><td>Additional Fuel Oil consumption in the power boiler for power generation.</td></tr>
<tr><td>5,089</td><td>Additional Fuel Oil consumption in the recovery boiler for power generation.</td></tr>
</table>
<u>(2011):</u>
Fossil fuel consumption associated to additional biomass residues from forest operation: 1,210.0 (ton) of fuel oil.
Fossil fuel consumption in the power and recovery boilers related to additional surplus power generation to the grid:
<table>
<tr><th>Measured value (ton/year)</th><th>Parameter</th></tr>
<tr><td>10.4</td><td>Additional Fuel Oil consumption in the power boiler for power generation.</td></tr>
<tr><td>0.0</td><td>Additional Fuel Oil consumption in the recovery boiler for power generation.</td></tr>
</table>
</td></tr>
</table>

	Monitoring equipment	352FT653 Mass Flow Transmitter MICROMOTION 2700R11EBASZAZ Accuracy class: +/- 0.5% Serial number transmitter: 3010822 Serial number sensor: 723560 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. 728918 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: 728854 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 it was defined in the registered PDD, section B.6.1 page 46, the consideration of fossil fuel consumption for emission reduction calculation 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: <u>The additional fossil fuel consumption used to burn additional biomass consumption related to the project activity:</u> According to the registered PDD, page 46, the Project Participant used the specific consumption factor (i.e. 3.43 kg fuel/m^3st)[7] 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. <u>The additional fossil fuel consumption in the power and recovery boilers used to enhance surplus power generation to the grid:</u> 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. 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.

[7] (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 fuels stocks variations and purchased amounts. Energy/mass balance consistency check (2012): The resulting average efficiency of the recovery boiler was 73.8% with a deviation of 9.75%, which resulted in a reasonable value when compared with the average efficiency value of 64.05 % specified for this boiler by the manufacturer. The efficiency obtained of the power boiler during the monitoring period was 69.06%, which resulted in a reasonable value when compared with the manufacturer's range [61.99% - 87.31%] and therefore, consistency of fossil fuel measurements was confirmed. (2011): The resulting average efficiency of the recovery boiler was 75.1% with a deviation of 11.05%, which resulted in a reasonable value when compared with the average efficiency value of 64.05 % specified for this boiler by the manufacturer. The efficiency obtained of the power boiler during the monitoring period was 67.72 %, which resulted in a reasonable value when compared with the manufacturer's range [61.99% - 87.31%] and therefore, consistency of fossil fuel measurements was confirmed. Purchase and stock variations check (2012): The total measurements of Fuel Oil in the plant were cross-checked with purchases and stock variations. A difference of 0.2% was obtained which is considered a reasonable deviation. (2011): The total measurements of Fuel Oil in the plant were cross-checked with purchases and stock variations. A difference of 0.95% was obtained which is considered 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 the front loaders operators (biomass transportation subcontractors) of the Valdivia biomass power plant.
Value(s) of monitored parameter	(2012): 52.8 (ton) of Diesel. (2011): 49.4 (ton) of Diesel.
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 2010 was compared against historical operational indices which resulted in a reasonable value, as shown in table below: Year (Jan-Dec) – Index (lt/hrs-year): 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	---

Table within QA/QC procedures:

Year (Jan-Dec)	Index (lt/hrs-year)
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	(2012): 654,405 (MWh/y). (2011): 435,577(MWh/y).
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 that allows 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 manufacture recommendation and/or proper industry standards. According to methodology ACM0006 (Version 5), page 56/63 the consistency of the 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 year. • Black liquor index: Electricity generation associated to black liquor/black liquor (dry basis) (MWh/tDS) (2012): The black liquor index was 0.585 (MWh/tDS), which resulted in a reasonable value when compared with the historical acceptance range of [0.49 +/- 0.1] (MWh/tDS) of the recovery boiler. (2011): The black liquor index was 0.451 (MWh/tDS), which resulted in a reasonable value when compared with the historical acceptance range of [0.49 +/- 0.1] (MWh/tDS) of the recovery boiler. • Biomass residues from forestry operations index: Electricity generation associated to forestry biomass residues/Biomass residues from forestry operations (dry basis) (MWh/BDt) (2012): The biomass residues index was 0.709 (MWh/BDt) which resulted in a reasonable value when compared with the historical acceptance range of [0.83 +/- 0.1] (MWh/BDt) of the power boiler. (2011): The biomass residues index was 0.542 (MWh/BDt) which resulted in a reasonable value when compared with the historical acceptance range of [0.83 +/- 0.1] (MWh/BDt) of the power boiler. According to page 85 of the registered PDD, the Project Participant must also perform a consistency check considering the total electricity generation and the steam passing through the turbines. This check is shown below for each of the two turbines of the Valdivia power plant: (2012): • 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 0.227 (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.	

	(2011): • TG1: The average annual index of 0.144 (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 0.239 (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. (2012): 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 1.36 % was obtained, which resulted in an acceptable deviation. (2011): 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 2.94 % 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 describ ed in the PDD.

Data/Parameter	$\mathbf{Q_{project\ plant,y}}$
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 case of superheated steam).

Value(s) of monitored parameter	<u>(2012):</u> 1,297,666 (GJ) of heat generated in the power boiler. <u>(2011):</u> 1,105,400 (GJ) of 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: 01/12/2010, 09/11/2011 Date of last calibration: 10/11/2012 Validity: 10/11/2015 365FT902 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010902 Calibration frequency: 3 Years Calibration dates: 30/11/2010, 11/11/2011 Date of last calibration: 10/11/2012 Validity:10/11/2015 365FT910 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010903 Calibration frequency: 3 Years Calibration dates: 30/11/2010, 07/11/2011 Date of last calibration: 11/11/2012 Validity:11/11/2015 365FT913 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010904 Calibration frequency: 3 Years Calibration dates: 30/11/2010, 07/11/2011 Date of last calibration: 11/11/2012 Validity:11/11/2015 365FT914 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 6404025150 Calibration frequency: 3 Years Calibration dates: 30/11/2010 Date of last calibration: 30/11/2010 Validity: 29/11/2013 <u>*Replaced during 2012 by:*</u> 365FT914 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 6410003178 Calibration frequency: 3 Years Calibration dates: 07/11/2011

		Date of last calibration: 11/11/2012 Validity: 11/11/2015 365FT920 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010906 Calibration dates: 30/11/2010, 09/11/2011 Date of last calibration: 11/11/2012 Validity:11/11/2015 365FT923 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010907 Calibration frequency: 3 Years Calibration dates: 30/11/2010, 09/11/2011 Date of last calibration: 11/11/2012 Validity:11/11/2015 365FT924 Type: Differential Pressure Flow Transmitter ABB 2600T Accuracy class: +/- 0.075% Serial number: 5003010908 Calibration frequency: 3 Years Calibration dates: 30/11/2010 Date of last calibration: 30/11/2010 Validity: 30/11/2013 *Replaced during 2012 by:* 365FT924 Type: Differential Pressure Flow Transmitter ABB 264DSGSSB2A3 Accuracy class: +/- 0.075% Serial number: 6410006727 Calibration frequency: 3 Years Calibration dates: 09/11/2011, 05/07/2012 Date of last calibration: 10/11/2012 Validity: 10/11/2015 362PT980 Type: Pressure Transmitter ROSEMOUNT 3051S2TG4A2E11F1AAO1B4 Accuracy class: +/- 0.025% of span Serial number: 0075788 Calibration frequency: 5 Years Calibration dates: 30/11/2010, 11/11/2011 Date of last calibration: 10/11/2012 Validity:10/11/2017 362TT965 Type: Temperature Transmitter ROSEMOUNT 3244MV Accuracy class: +/- 0.10 °C Serial number: 430676 Calibration frequency: 1 Year Date of penultimate calibration: 09/06/2010, 29/06/2011, 14/07/2011 Date of last calibration: 07/06/2012 Validity: 07/06/2013
	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 in 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 fuel 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 project power and recovery boiler plant. (2012): The efficiency obtained for the power boiler during the monitored period was 69.06 %, which resulted in a reasonable value when compared with the manufacture´s acceptance range [61.99% - 87.31%]. The resulting average efficiency of the recovery boiler was 73.8% with a deviation of 9.75%, which resulted in a reasonable value when compared with the average efficiency value of 64.05 % specified for this boiler by the manufacturer. Considering the results obtained above, the monitored variables used for the calculation of the parameter were considered acceptable by the Project Participant. (2011): The efficiency obtained for the power boiler during the monitored period was 67.72 %, which resulted in a reasonable value when compared with the manufacture´s acceptance range [61.99% - 87.31%]. The resulting average efficiency of the recovery boiler was 75.1% with a deviation of 11.05%, which resulted in a reasonable value when compared with the average efficiency value of 64.05 % specified for this boiler by the manufacturer. Considering the results obtained above, the monitored variables used for the calculation of the parameter were considered 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 below: (2012): Operational index of the recovery boiler: (ton of steam/ tDS) The annual operational index was 3.57 (tons of steam/tDS) which resulted in reasonable value when compared with the historical acceptance range value of [3.5 +/- 0.5](ton of steam/tDS)] of the recovery boiler. Operation index of the power boiler: (ton of steam/ BDt) The annual operational index was 4.33 (tons of steam/BDt), which resulted in a reasonable value compared with the historical acceptance range of [4.0 +/-0.5] (ton of steam/BDt) of 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. (2011): Operational index of the recovery boiler: (ton of steam/ tDS) The annual operational index was 3.23 (tons of steam/tDS) which resulted in reasonable value when compared with the historical acceptance range value of [3.5 +/- 0.5](ton of steam/tDS)] of the recovery boiler. Operation index of the power boiler: (ton of steam/ BDt) The annual operational index was 3.88 (tons of steam/BDt), which resulted in a reasonable value compared with the historical acceptance range of [4.0 +/-0.5] (ton of steam/BDt) of 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). Year (Jan-Dec): Index (GJ/BDt) 2012: 9.45 2011: 9.03 2010: 9.46 2009: 9.22
Purpose of data	Baseline and Project emission calculations.
Additional comment	---

Data/Parameter	**NCV_i**
Unit	(GJ/ton)
Description	Net calorific value of the fossil fuel type i.
Measured/Calculated /Default	Measured.
Source of data	The Project Participant used the following information sources to determine this parameter: • Net calorific measurements carried out by reputed laboratories.
Value(s) of monitored parameter	See below

First semester (Jan-June 2012) measurements:

Date of Samples	Diesel (Kcal/kg)	FO #6 (Kcal/kg)
Apr 13, 2012	10,170	9,614
Apr 13, 2012	10,171	9,611
Apr 13, 2012	10,199	9,611
Average (Kcal/kg)	10,180	9,612
Average (GJ/ton)	42.59	40.22

Second semester (July-Dec 2012) measurements:

Date of Samples	Diesel (Kcal/kg)	FO #6 (Kcal/kg)
Oct 10, 2011	10,223	9,646
Oct 10, 2011	10,012	9,629
Oct 10, 2011	10,192	9,628
Average (Kcal/kg)	10,142	9,634
Average (GJ/ton)	42.44	40.31

First semester (Jan-June 2011) measurements:

Date of Samples	Diesel (Kcal/kg)	FO #6 (Kcal/kg)
Apr 04, 2011	10,227	9,721
Apr 04, 2011	10,226	9,721
Apr 04, 2011	10,241	9,720
Average (Kcal/kg)	10,231	9,721
Average (GJ/ton)	42.81	40.67

Second semester (July-Dec 2011) measurements:

Date of Samples	Diesel (Kcal/kg)	FO #6 (Kcal/kg)
Oct 10, 2011	10,185	9,675
Oct 10, 2011	10,236	9,672
Oct 10, 2011	10,224	9,682
Average (Kcal/kg)	10,215	9,676
Average (GJ/ton)	42.74	40.49

Monitoring equipment	Not applicable.

Measuring/Reading/ Recording frequency	Every six months, taking at least three samples for each measurement.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The measured net calorific values were found consistent with the corresponding IPCC default values.
Purpose of data	Project emission calculations.
Additional comment	---

Data/Parameter	**NCV_k**
Unit	(GJ/ton)
Description	Net calorific value of biomass residue type k.
Measured/Calculated /Default	Measured.
Source of data	The Project Participant used the following information sources to determine this parameter: • Net calorific measurements carried out by reputed laboratories.
Value(s) of monitored parameter	First semester (Jan-June 2012) measurements: Black liquor: 12.06 (GJ/ton) Sawdust & bark mix: 18.65 (GJ/ton) Second semester (July-Dec 2012) measurements: Black liquor: 13.25 (GJ/ton) Sawdust & bark mix: 17.87 (GJ/ton) First semester (Jan-June 2011) measurements: Black liquor: 11.96 (GJ/ton) Sawdust & bark mix: 18.64 (GJ/ton) Second semester (July-Dec 2011) measurements: Black liquor: 12.24 (GJ/ton) Sawdust & bark mix: 16.94 (GJ/ton)
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Every six months, taking at least three samples for each measurement. All NCVs were determined on dry basis of biomass.

Calculation method (if applicable)	**Black liquor**

In accordance with the methodology, the required black liquor samples were collected with the purpose of measuring their Net Calorific Value in the laboratory. Results are presented below:

(2012):

First period (Jan-June 2012): Black liquor Net Calorific Value

Date of Samples	NCV(pine) (GJ/ton)	Date of Samples	NCV(euca) (GJ/ton)
Apr 13,2012	12.07	Apr 18,2012	11.76
Apr 13,2012	12.30	Apr 18,2012	11.93
Apr 13,2012	12.07	Apr 18,2012	12.02
Average	12.14	Average	11.90

Second period (July-Dec 2012): Black liquor Net Calorific Value

Date of Samples	NCV(pine) (GJ/ton)	Date of Samples	NCV(euca) (GJ/ton)
Aug 13,2012	12.95	Aug 14,2012	13.71
Aug 13,2012	13.09	Aug 14,2012	13.58
Aug 13,2012	13.05	Aug 14,2012	13.45
Average	13.03	Average	13.58

A weight average considering percentage of pulp mill production (ADT) and the average net calorific value from pine and eucalyptus was calculated to determine the most representative net calorific value for black liquor. Results of this calculations is presented as follows:

Parameter	First period (Jan-June 2012)	Second period (July-Dec 2012):
NCV (Black liquor)	12.06(GJ/ton)	13,25(GJ/ton)

The representativeness of black liquor net calorific value is assured as follows:

A description of the weight average calculations performed to ensure the representativeness of the net calorific value of black liquor is presented as follows:

First period (Jan-June 2012):

NCV (Black liquor) = [64.85% * 12.14 (GJ/ton) + 35.15% * 11.90(GJ/ton)] = 12.06(GJ/ton)

Second period (July-Dec 2012):

NCV (Black liquor) = [59.21% * 13.03 (GJ/ton) + 40.79% * 13.58(GJ/ton)] = 13.25(GJ/ton)

(2011):

First period (Jan-June 2011): Black liquor Net Calorific Value

Date of Samples	NCV (pine) (GJ/ton)	Date of Samples	NCV (euca) (GJ/ton)
Apr 19, 2011	11.83	n/a	n/a
Apr 19, 2011	12.39	n/a	n/a
Apr 19, 2011	11.65	n/a	n/a
Average	11.96	Average	n/a

Second period (July-Dec 2011): Black liquor Net Calorific Value

Date of Samples	NCV (pine) (GJ/ton)	Date of Samples	NCV (euca) (GJ/ton)
Nov 21, 2011	12.51	Nov 07, 2011	12.39
Nov 21, 2011	12.16	Nov 07, 2011	12.30
Nov 21, 2011	12.14	Nov 07, 2011	11.90
Average	12.27	Average	12.20

The representativeness of black liquor net calorific value is assured as follows:

Most of the 1st semester pulp production was from pine. Therefore, black liquor samples were all from pine and the net calorific value obtained was considered conservative for the first semester.

In the case of the 2nd semester pulp production was 56.96% from pine and 43.04% from eucalyptus. A weight average considering percentage of pulp mill production and the average net calorific values from pine and eucalyptus was calculated to determine the most representative net calorific value from black liquor in the second semester. A description of the calculation performed to ensure the representativeness of the net calorific value of black liquor is presented below:

NCV (black liquor) = 56.96% * 12.27 + 43.04% * 12.20 = 12.24 (GJ/ton)

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

(2012):

In accordance with the methodology, the required residual biomass samples were collected with the purpose of measuring their net calorific value in the laboratory. Results are presented below:

	Date of samples	Biomass residues	NCV (kcal/kg)	(GJ/ton)
1st Period	Apr 13, 2012	mix of sawdust and bark.	4,454	18.64
1st Period	Apr 13, 2012	mix of sawdust and bark.	4,463	18.67
1st Period	Apr 13, 2012	mix of sawdust and bark.	4,454	18.64
Net calorific value (dry basis)				18.65

	Date of samples	Biomass residues	NCV (kcal/kg)	(GJ/ton)
2nd Period	Aug 08, 2012	mix of sawdust and bark.	4,302	18.00
2nd Period	Aug 08, 2012	mix of sawdust and bark.	4,260	17.82
2nd Period	Aug 08, 2012	mix of sawdust and bark.	4,251	17.79
Net calorific value (dry basis)				17.87

The representativeness of the NCV measurements above is based on the fact that each measurement was taken in a month in which the Valdivia pulp mill was producing similar pulp mix as the one that was produced during each semester.

	Pulp mix(%pine, %euca)
First period(Jan-June 2011):	(65%,35%)
Apr 13,2012	(44%,56%)
Second period(July-Dec 2012):	(59%.41%)
Aug 08,2012	(45%,55%)

(2011):

	Date of samples	Biomass residues	NCV (kcal/kg)	(GJ/ton)
1st Semester	Apr 04, 2011	mix of sawdust and bark.	4,435	18.56
1st Semester	Apr 04, 2011	mix of sawdust and bark.	4,464	18.68
1st Semester	Apr 04, 2011	mix of sawdust and bark.	4,454	18.64
Net calorific value (dry basis)				18.62

	Date of samples	Biomass residues	NCV (kcal/kg)	(GJ/ton)
2nd Semester	Oct 21, 2011	mix of sawdust and bark.	4,041	16.91
2nd Semester	Oct 21, 2011	mix of sawdust and bark.	4,043	16.92
2nd Semester	Oct 21, 2011	mix of sawdust and bark.	4,057	16.97
Net calorific value (dry basis)				16.93

The Project Participant cross-checked the consistency of the measured values with the default values by the IPCC and other similar biomass power plants by Arauco located in the South part of the country. The values were found consistent.

QA/QC procedures	Biomass type: Black liquor:

Source	NCV (GJ/Kg)
Values applied	(2012): 12.06 (1st semester) 13.25 (2nd semester) (2011): 11.96(1st semester) 12.24(2nd semester)
Default values IPCC 2006,Chapter 1, Volume 2	Average: 11.8 Range [5.9 – 23.0]
Historical value 2010 of Valdivia Biomass Power Plant Ref: 1787	12.01(1st semester) 12.22(2nd semester)
Historical value 2010 (other registered CDM project Nueva Aldea Biomass Power plant Phase 2, Ref:0356)	10.29
Historical value 2009 (other registered CDM project Nueva Aldea Biomass Power plant Phase 2, Ref:0356)	10.35

Biomass type mix of sawdust and bark from forest operations

Source	NCV (GJ/Kg)
Values applied	(2012: 18.65 (1st semester) 17.87 (2nd semester) (2011): 18.64 (1st semester) 16.94 (2nd semester)
Default values IPCC 2006, Chapter 1, Volume 2.	Average: 15.6 Range [7.9 – 31]
Historical value 2010 of Valdivia Biomass Power Plant. Ref: 1787	16.53(1st semester) 18.83(2nd semester)
Historical value 2010 (other registered CDM project: Nueva Aldea Biomass Power Plant Phase 1, Ref: 0258)	16.95
Historical value 2009 (other registered CDM project: Nueva Aldea Biomass Power Plant Phase 1, Ref: 0258)	17.98
Historical value 2008 (other registered CDM project Nueva Aldea Biomass Power Plant Phase 1, Ref.0258)	17.97
Historical value 2010 (other registered CDM project: Trupan Biomass Power Plant in Chile, Ref: 0259)	17.86
Historical value 2009 (other registered CDM project: Trupan Biomass Power Plant in Chile, Ref: 0259)	17.93
Historical value 2008 (other registered CDM project: Trupan Biomass Power Plant in Chile,	18.59

	Ref: 0259)
	According to the values above, the Project Participant deemed the monitored NCV values within the acceptable ranges.
Purpose of data	Baseline and Project emission calculations.
Additional comment	---

Data/Parameter	**$EF_{burning,CH4,k,y}$**
Unit	(tCH_4/GJ)
Description	CH_4 emission factor for uncontrolled burning of the biomass residue type k during year y.
Measured/Calculated /Default	Measured once at the start of the project activity.
Source of data	The Project Participant used the following information sources to determine this parameter: • Measurement report from U.S. Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, Montana, USA: "Methane Emissions from Burning Sawmill Residues in South Central Chile". It must be noted that in this case, the Project Participant used a measured value for this parameter rather than the default methane emission factor provided by the baseline methodology. This was clearly stated in page 87 of the registered PDD. The Project Participant did not use the measured value in the registered PDD, since it was not available when the PDD of the Valdivia CDM project activity was written.
Value(s) of monitored parameter	Biomass residues from forest operations (sawdust and bark mix from sawmills, pulp mills, etc.): 0.0008742 (tCH_4/GJ) or 874.2 (Kg CH_4/TJ). This value includes the adjustment of a conservativeness factor of 0.94.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	The measured CH_4 emission factor for uncontrolled burning of biomass residues was compared with IPCC default values as presented in the table: (table below) As can be seen, the measured value is considerably higher than the IPCC default value. However, as explained below, this comparison is not relevant in this case, since the default emission factor does not reflect the real methane emissions that occur in this case when the biomass residues are burned in the open air, under very low oxygen presence, in the south part of the country. The Project Participant hired a highly reputed US institution to carry out two measurements for this emission factor: one in September of 2006 and another one in March, 2009. The 2009 measurement was carried out at the end of the dry season (summer), in which the piled biomass residues are drier. This facilitates the combustion of the biomass residues, which leads to a lower methane emission factor (there is less smouldering in the combustion of the biomass residues) than if the biomass residues were more humid (as it happened with the 2006 measurement). The following table shows the 2006 and 2009 measurements for the CH_4 emission factor: (table below) Considering the results of the two measurements and the fact that the 2009 measurement (used in the Valdivia emission reduction calculation) was carried out under the <u>most conservative conditions possible</u>, the Project Participant deemed the 2009 measured value representative and appropriate in this case.

		2009 measured value.[1]	IPCC default value.[2]
CH_4 factor for biomass uncontrolled burning.	(tCH_4/BDt)	0.0172	0.0027
CH_4 factor for biomass uncontrolled burning.	(tCH_4/GJ)	0.000930	0.000150

[1] Measurement report issued by ISDA Forest Service, Rocky Mountain Research.
[2] Default value provided in page 42/63 of the ACM0006 (Version 5).

		2009 measured value	2006 measured value.
CH_4 factor for biomass uncontrolled burning.	(tCH_4/BDt)	0.0172	0.0137
CH_4 factor for biomass uncontrolled burning.	(tCH_4/GJ)	0.000930	0.0007405

Purpose of data	Baseline emission calculations.
Additional comment	--

Data/Parameter	e_{boiler}
Unit	(%)
Description	Average net energy efficiency of heat generation in the boiler that would generate heat in the absence of the project activity.
Measured/Calculated /Default	In this case, the Project Participant used the ASME PTC 4.1 standard for determining the boiler efficiency that would have been used in the baseline scenario.

Source of data	The boiler efficiency was determined based on a similar and comparable plant owned by Arauco according to the ASME PTC 4.1 standard.
Value(s) of monitored parameter	85%
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Once at the beginning of the project activity.
Calculation method (if applicable)	As per the ASME PTC 4.1 standard.
QA/QC procedures	According to worldwide reputed consultants and equipment supplier in the Energy sector, the efficiency values for these types of boilers are: • Andritz: Efficiency range for a biomass residues boiler (85% - 90%). • Metso: Average efficiency for a biomass residue boiler: 88%. The efficiency value used for the biomass boiler that would have been used in the baseline is similar to the efficiency values presented above. Furthermore and as indicated in the “Comment section below”, the 85% efficiency value used by the Project Participant in this emission reduction calculation is the most conservative efficiency value among the values suggested by the consulting companies above that can be used for the Valdivia project in this case.
Purpose of data	Baseline emission calculations.
Additional comment	It must be noted that the registered PDD used 100% efficiency of this boiler but only for the purpose of estimating the Valdivia CDM project emission reduction calculation ex-ante. However, the 100% default efficiency value is not conservative in this case (this project does not claim emission reductions due to heat displacement); therefore, the Project Participant decided to use a more realistic efficiency value, which in this particular case is based on a real (existing) saturated steam boiler for forestry biomass residues and is much more conservative than the original 100% value used in the PDD.

Data/Parameter	--
Unit	(m^3st)
Description	Quantity of biomass residues of type k that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region.
Measured/Calculated /Default	--
Source of data	This parameter was determined based on official data and statistics from: • Various reports from INFOR “National Forestry Institute”, • Environmental Impact Assessment reports from the Environmental National Authority (CONAMA), • The Instituto Nacional de Estadísticas INE (in English: National Institute of Statistics). • Arauco internal information.
Value(s) of monitored parameter	See table in the leakage section of this Monitoring Report.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	---

Purpose of data	Leakage emission calculations.
Additional comment	---

Data/Parameter	**---**
Unit	(m^3st)
Description	Quantity of available biomass residues of type k in the region.
Measured/Calculated /Default	---
Source of data	This parameter was determined based on official data and statistics from: • Various reports from INFOR "National Forestry Institute", • Environmental Impact Assessment reports from the Environmental National Authority (CONAMA), • The Instituto Nacional de Estadísticas INE (in English: National Institute of Statistics). • Arauco internal information.
Value(s) of monitored parameter	See table in the leakage section of this Monitoring Report.
Monitoring equipment	Not applicable
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	---
Purpose of data	Leakage emission calculations.
Additional comment	---

Data/Parameter	**$EC_{PJ,y}$**
Unit	(MWh)
Description	On-site electricity consumption attributable to the project activity during the year y.
Measured/Calculated /Default	Measured.
Source of data	There was no on-site electricity consumption attributable to the project activity during the monitored period.
Value(s) of monitored parameter	0 (MWh/yr)
Monitoring equipment	Not applicable since there were no such type of electricity consumptions in this case. Please see clarification below in the "Additional comment" section.
Measuring/Reading/ Recording frequency	Continuously.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	There was no on-site electricity consumption attributable to the project activity during the monitored period.
Purpose of data	Project emission calculations.
Additional comment	It must be noted that according to the ACM0006 (Version 5), this parameter refers to the on-site electricity consumption in addition to the auxiliary electricity consumption of the biomass power plant that are attributable to the CDM project activity.

Data/Parameter	**$EF_{grid,y}$**
Unit	(tCO_2/MWh)

Description	CO2 emission factor for grid electricity during the year y.
Measured/Calculated /Default	Calculated.
Source of data	The Project Participant used the following information sources to determine this parameter: • CDEC SIC dispatch centre reports. • Ministry of Energy reports. • 2006 IPCC lower values.
Value(s) of monitored parameter	(2012): 0.7268(tCO_2/MWh) (2011): 0.7186(tCO_2/MWh)
Monitoring equipment	Not Applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	The grid emission factor corresponds to the Combined Margin of the SIC grid for the monitored period (full year data). The equation used for this calculation is equation N°10 of the ACM0002 (Versi on 06). Arauco Bioenergía S.A. is responsible for performing the calculations to determine the grid emission factor according to the last version of the ACM0002. Official and publicly available information is used for that purpose. The calculation of this emission factor is in the Annex of this Monitoring Report.
QA/QC procedures	The data and results were found consistent with other official statistics and reports (i.e. Ministry of Energy, CDEC SIC dispatch reports).
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	$\mathbf{EF_{OM,y}}$
Unit	(tCO_2/MWh)
Description	CO_2 Operating Margin emission factor of the grid.
Measured/Calculated /Default	Calculated.
Source of data	The Project Participant used the following information sources to determine this parameter: • CDEC SIC Dispatch Centre reports. • Ministry of Energy reports. • 2006 IPCC lower values.
Value(s) of monitored parameter	(2012): 0.6950(tCO_2/MWh) (2011): 0.7324(tCO_2/MWh)
Monitoring equipment	Not Applicable.
Measuring/Reading/ Recording frequency	Annually.

Calculation method (if applicable)	In this case, the OM emission factor is calculated using the simple/adjusted method equation, N° 4 of the ACM0002 (Version 06). The justification for the chosen OM calculation method is presented in detail in page 48 of the registered PDD. All the information required for the calculation of this emission factor is provided in the Annex of this Monitoring Report.
QA/QC procedures	The data and results were found consistent with other official statistics and reports (i.e. Ministry of Energy, CDEC SIC Dispatch Centre reports).
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$EF_{BM,y}$**
Unit	(tCO_2/MWh)
Description	CO2 Build Margin emission factor of the grid.
Measured/Calculated /Default	Calculated.
Source of data	The Project Participant used the following information sources to determine this parameter: • CDEC SIC Dispatch Centre reports. • Ministry of Energy reports. • 2006 IPCC lower values.
Value(s) of monitored parameter	(2012): 0.7585(tCO_2/MWh) (2011): 0.7048(tCO_2/MWh)
Monitoring equipment	Not Applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	This variable is calculated according to equation N° 9 of the ACM0002 (Version 06). All the information required for the calculation of this emission factor is provided in the Annex of this Monitoring Report.
QA/QC procedures	The data and results were found consistent with other official statistics and reports (i.e. Ministry of Energy, CDEC SIC Dispatch Centre reports).
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$F_{i,y}$**
Unit	See tables in the Annex, at the end of this Monitoring Report.
Description	Amount of each fossil fuel consumed by each power source/plant.
Measured/Calculated /Default	Measured.
Source of data	The Project Participant used the following information sources to determine this parameter: • CDEC SIC Dispatch Centre reports. • Ministry of Energy reports.

Value(s) of monitored parameter	See tables in the Annex, at the end of this Monitoring Report.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable. This information comes from official sources.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$COEF_i$**
Unit	Units in (tCO_2/000ton) except Natural Gas (tCO_2/MMm^3).
Description	Emission factor coefficient of each fossil fuel type consumed by each power plant/source in the relevant grid.
Measured/Calculated /Default	Calculated.
Source of data	This factor was calculated using IPCC default values (Carbon content and fraction of carbon oxidized) and local national data (Net calorific values of the corresponding fossil fuels).
Value(s) of monitored parameter	Coal: 2,814 (tCO_2/000ton) Petcoke: 2,857 (tCO_2/000ton) Diesel: 3,378 (tCO_2/000ton) Nat. Gas: 2,193 (tCO_2/MMm^3) IFO 180: 3,401 (tCO_2/000ton)
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	$COEF_{CO2,i}$ (tCO_2/000ton)= NCV_i (TJ/000ton) * Carbon content of fuel type i (tC/TJ)*Fraction of carbon oxidized * CO_2 / C conversion factor (tCO_2/tC) Where: – $COEF_{CO2,coal}$ (tCO_2/000ton) = 29.3 (TJ/000ton) * 26.2 * (44/12) – $COEF_{CO2,Petcoke}$ (tCO_2/000ton) = 29.3 (TJ/000ton) * 26.6 * (44/12) – $COEF_{CO2,Diesel}$ (tCO_2/000ton) = 45.6 (TJ/000ton) * 20.2 * (44/12) – $COEF_{CO2,Nat\ Gas}$ (tCO_2/000ton) = 39.1 (TJ/MMm^3) * 15.3 * (44/12) – $COEF_{CO2,IFO\ 180}$ (tCO_2/000ton) = 44.0 (TJ/000ton) * 21.1 * (44/12) Note that the Project Participant presents local measurements of Net calorific values in Terajoules per thousand tons (TJ/000tons) in order to results with IPCC values published in units of (TJ/Gg) equivalent to (TJ/000 tons). This explain why the Project Participant presents the parameter $COEF_{CO2,i}$ in units of tons of CO_2 per thousand tons (tCO2/000ton), as it is shown in equation presented above.
QA/QC procedures	Local NCV values were duly compared with IPCC default and/or lower values. Local values were found consistent. Carbon content and % of carbon oxidized were taken from the IPCC.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$GEN_{j/k/n,y}$**
Unit	(MWh) See tables in the Annex, at the end of this Monitoring Report.
Description	Electricity generation of each power source/plant j, k or n.
Measured/Calculated /Default	Measured.

Source of data	This information was directly obtained by the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	See tables in the Annex, at the end of this Monitoring Report.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The Project Participant used official data from the CDEC-SIC Dispatch Centre. The data was found to be consistent with official studies (e.g. CDEC-SIC Yearbook.).
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**--**
Unit	(Text)
Description	Identification of power source/plant for the OM.
Measured/Calculated /Default	Determined based on official data.
Source of data	This information was directly obtained by the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	Please see the tables for the OM calculation provided in the Annex, at the end of this Monitoring Report.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable. This information comes from official sources.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**--**
Unit	Text.
Description	Identification of power source/plant for the BM.
Measured/Calculated /Default	Determined based on official data.
Source of data	This information was directly obtained by the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	Please see the tables for the BM calculation provided in the Annex, at the end of this Monitoring Report.
Monitoring equipment	Not Applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable. This information comes from official sources.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	λ_y
Unit	(Number)
Description	Fraction of time during which low-cost/must-run sources are on the margin.

Measured/Calculated /Default	Calculated.
Source of data	This factor was calculated from information directly obtained from the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	(2012): λ_{2012} = 0.000000000 (2011): λ_{2011} =0.0001141553
Monitoring equipment	Not Applicable.
Measuring/Reading/ Recording frequency	Annually.
Calculation method (if applicable)	As per the corresponding methodology ACM0002 (Version 06)
QA/QC procedures	The data used for the calculation of this parameter comes from official sources. The calculation was double-checked in this case.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$GEN_{j/k/l,y\ IMPORTS}$**
Unit	(KWh)
Description	Electricity imports to the project electricity system.
Measured/Calculated /Default	Not applicable.
Source of data	This information was directly obtained by the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	0 (KWh). To date, the SIC system is not interconnected with any other transmission system, either of Chile or of any other country.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	To date, the SIC system is not interconnected with any other transmission system, either of Chile or of any other country.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$COEF_{j/k/l,y\ IMPORTS}$**
Unit	(tCO_2/ton) or (tCO_2/m^3)
Description	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur).
Measured/Calculated /Default	Not applicable.
Source of data	This information was directly obtained by the CDEC-SIC Dispatch Centre.
Value(s) of monitored parameter	0 (tCO_2/ton) or 0 (tCO_2/m^3). Since there are no imports in the SIC, this variable is currently not used in the emission reduction calculation.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Not applicable.

Calculation method (if applicable)	Not applicable.
QA/QC procedures	To date, the SIC system is not interconnected with any other transmission system, either of Chile or of any other country.
Purpose of data	Baseline emission calculations.
Additional comment	---

Data/Parameter	**$EF_{CO2,LE}$**
Unit	(tCO_2/GJ)
Description	CO_2 emission factor of the most carbon intensive fuel used in the country.
Measured/Calculated /Default	Default value.
Source of data	The most carbon intensive fuel type can be obtained from official national communication sources (e.g. CNE, CDEC-SIC). In case such information is not available, IPCC default values will be used instead.
Value(s) of monitored parameter	Since leakage was 0 during the monitored period, this parameter was not used in the corresponding emission reduction calculation.
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The Project Participant had no need to use this variable, since it was possible to show that the project activity did not cause leakage in the influence area of the power plant.
Purpose of data	Leakage emission calculations.
Additional comment	---

D.3. Implementation of sampling plan

Not applicable.

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 (Version 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 (increm baseline generation) during year y (MWh). In this case, the project plant would incorpo net quantity of increased electric generation capacity derived from implementing CDM initiatives N°1 and N°2, simultaneously.
$EG_{project\ plant}$:	Net quantity of electricity generated in the project plant during year (MWh). In this ca project plant would incorporate the net quantity of increased electric generation derived from implementing CDM project initiatives N°1 and N°2, simultaneously.
$\varepsilon_{el,\ other\ plant(s)}$:	Average net energy efficiency of electricity generation in (the) other power plant(s) tha use the biomass residues fired in the project plant in the absence of the project ($MWh_{el}/MWh_{biomass}$). In this case, the baseline power plant electric efficiency cal considers a business-as-usual pulp mill (reference plant), in which the project initiati and N°2 are not implemented. For more details pleas e see pages 10 and 11 of the re PDD.
$BF_{k,y}$:	Quantity of biomass residue type k combusted in the project plant during the year y dry matter or litter). In this case, the project plant would combust a higher amount of b from forest operations (CDM project initiative Nº1) but the same amount of black liquo project initiative Nº2) than the baseline plant (reference plant). This variable includ 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 th the NCV for each type of biomass would be monitored and considered in the calcula NCV of biomass from forest operations (CDM project initiative Nº1) and the NCV liquor (CDM project initiative Nº2).

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

Data:

	2011	2012
(1) Gross electricity generated in the project plant	450,592(MWh/y)	672,313(MWh/y)
(2) Total internal electricity consumption	355,807(MWh/y)	424,362(MWh/y)
(3) Additional power consumption percentage due to the project activity	4.22(%)	4.22%
(4) Average net energy efficiency of electricity generation in the baseline plant	12.09(%)	12.09%
(5) Quantity of black liquor combusted in the project plant (dry basis)	937,426(tDS/y)	954,537(tDS/y)
(6) Quantity of biomass from forest ops. combusted in the project plant (dry basis)	123,651(BDt/y)	137,738(BDt/y)
(7) Net calorific value of black liquor (dry basis) (See note)	12.10(GJ/ton)	12.65
(8) Net calorific value of biomass from forest operations (dry basis) (See note)	17.79(GJ/ton)	18.26

Note: Net calorific values of biomass must be monitored twice a year. For simplicity, a weighted average (considering net calorific values and the amount of biomass) was used here.

Calculations:

	2011	2012

(9) Net quantity of electricity generated in the project plant	(1)-(2)*(3)	435,577(MWh/y)	654,405(MWh/y)
(10) Electric power generated in the baseline mill	(4)*((5)*(7)+(6)*(8))*(1/3,600)	454,794(MWh/y)	489,998(MWh/y)
(11) Net quantity of increased electricity	(9)-(10)	-19,217(MWh/y)	164,407(MWh/y)

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 years 2011 and 2012 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:

	2011	2012
(1) Combined margin for the SIC grid	0.7187(tCO_2/MWh)	0.7268(tCO_2/MWh)
(2) Electricity displaced by the project activity	-19,217(MWh/y)	164,407(MWh/y)

Calculations:

		2011	**2012**
(3) Total grid emission savings	**(1)*(2)**	**-13,811(tCO_2/y)**	**119,492(tCO_2/y)**

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 year in which the project generation occurs, in this case corresponds to years 2011 and 2012.

The Project Participant used data from 2011 and 2012 to determine the lambda factors that express the percentage of the time when low-cost/must-run sources were on the margin for 2011 and 2012:

$$\lambda_y = \lambda_{2011} = 0.000114153$$
$$\lambda_y = \lambda_{2012} = 0.000000000$$

The rest of the parameters used to calculate the EF_{grid} for 2011 and 2012 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 for 2011 and for 2012

$$\sum_{i,j} F_{i,j,2011} \cdot COEF_{i,j} = 17{,}542{,}292(tCO_2 / y)$$
$$\sum_{i,j} F_{i,j,2012} \cdot COEF_{i,j} = 18{,}074{,}532(tCO_2 / y)$$

- The total power generation in the SIC by non-low-cost/must-run power sources in 2011 and 2012:

$$\sum_{j} GEN_{j,2011} = 23{,}947(GWh / y)$$
$$\sum_{j} GEN_{j,2012} = 26{,}006(GWh / y)$$

- The CO_2 emissions of low-cost/must run power sources in 2011 and 2012. 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 low:

$$\sum_{i,k} F_{i,k,2011} \cdot COEF_{i,k} = 380{,}576(tCO_2 / y)$$
$$\sum_{i,k} F_{i,k,2012} \cdot COEF_{i,k} = 528{,}905(tCO_2 / y)$$

- Total power generation in the SIC by low-cost/must-run resources for 2011 and 2012

$$\sum_{k} GEN_{k,2011} = 22{,}166(GWh / y)$$
$$\sum_{k} GEN_{k,2012} = 22{,}852(GWh / y)$$

Replacing the above values in the equation used to calculate the EF for the year 2011 and 2012, the operating margin results:

$$EF_{\mathrm{OM},2011} = (1 - 0.00011415) \cdot \frac{17{,}542{,}292}{23{,}947} + 0.00011415 \cdot \frac{380{,}576}{22{,}166} = 732.48(\mathrm{tCO_2/GWh})$$
$$EF_{OM,2011} = EF_{OM,simpleadjusted,2011} = 0.732(tCO_2 / GWh)$$

$$EF_{OM,2012} = (1 - 0.00000000) \cdot \frac{18{,}074{,}532}{26{,}006} + 0.00000000 \cdot \frac{528{,}295}{22{,}852}(tCO_2 / GWh)$$
$$EF_{OM,2012} = EF_{OM,simpleadjusted,2012} = 0.695(tCO_2 / GWh)$$

b) Build Margin calculation

According to 2011 and 2012 SIC data, the group of plants that accounts for the largest generation in each year are the ones responsible for the 20% of the total generation in 2011 and 2012, respectively. These plants are considered to calculate the Build Margin for 2011 and 2012:

$$EF_{BM,2011} = 0.704(tCO_2 / MWh)$$
$$EF_{BM,2012} = 0.758(tCO_2 / MWh)$$

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 2011 and 2012, and assuming the default value of (0.5) for the weights W_{OM} and (0.5) for the W_{BM}, it is possible to calculate $EF_{grid\ CM,y}$ for the year 2011 and 2012:

$$EF_{electricity,2011} = 0.5*0.732 + 0.5*0.704 = 0.7186 (tCO_2/MWh)$$

$$EF_{electricity,2012} = 0.5*0.695 + 0.5*758 = 0.7268 (tCO_2/MWh)$$

<u>2. Baseline emissions due to uncontrolled burning of anthropogenic sources of biomass residues</u>

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 (Versio n 05). As mentioned before, the proposed project activity only involves additional use of biomass from forest operations in the power boiler.

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

Where:

BFPJ,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).
BFk,y :	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter).
Qproject 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.

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

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:

	2011	2012
(1) Total high-pressure steam generated by the recovery boiler	3,201,883(ton/y)	3,619,514(ton/y)
(2) Total high-pressure steam generated by the power boiler	646,884(ton/y)	752,543(ton/y)
(3) Total biomass residues from forest operations combusted in the power boiler.	123,651(BDt/y)	137,738(BDt/y)
(4) Net calorific value of biomass from forest operations (dry basis) (See note).	17.79(GJ/ton)	18.26(GJ/ton)
(5) Quantity of process heat generated in the cogeneration project plant.	6,576,806(GJ/y)	7,539,064(GJ/y)
(6) Energy efficiency of the boiler used in the absence of the project activity.	85%	85%

Note: Net calorific values of biomass must be monitored twice a year. For simplicity, a weighted average (considering net calorific values and the amount of biomass) was used here.

Calculations:

		2011	2012
(7) Process heat attributable to the power boiler	[(2)/(1)+(2)]*(5)	1,105,400(GJ/y)	1,297,666(GJ/y)
(8) Biomass used to generate heat	(7)/((4)*(6))	73,120(BDt/y)	83,586(BDt/y)
(9) Incremental biomass use	**(3)-(8)**	50,531(BDt/y)	54,152(BDt/y)

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

BEbiomass,y :	Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_{2e}/yr).
GWPCH4 :	Global Warming Potential of methane valid for the commitment period (tCO_{2e}/tCH_4).
BFPJ,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).
NCVk :	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:

	2011	2012
(1) Additional biomass from forest operations due to the project activity	50,531(BDt/y)	54,152(BDt/y)
(2) Adjusted CH_4 emission factor for uncontrolled burning of biomass from forest ops. (See note)	327(tCO_2eq/000ton)	335(tCO_2eq/000ton)

Note: The Project Participant used an adjustment factor of 0.94 for the measured CH_4 emission factor. The adjustment factor was chosen following the indication of Table N° 6 of th e 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.

Calculations:

		2011	2012
(6) Emissions	**(1)*(2)* (ton/1000 kg)**	**16,499(tCO_2eq)**	**18,158(tCO_2eq)**

Total baseline emissions

	2011	2012
Emission sources	**(tCO_2eq)**	**(tCO_2eq)**
Carbon dioxide emissions due to electricity displacement.	-13,811	119,492
Methane emissions due to uncontrolled biomass burning avoidance	16,499	18,158
Total	**2,688**	**137,650**

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/yr).
$PEFF_y$:	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/yr).
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/yr).
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/yr).

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:

	2011	2012
(1) Biomass bought from 3rd parties (dry)	19,533(BDt/y)	29,318(BDt/y)
(2) Biomass average humidity (wet basis)	64.68 %	64.00%
(3) Average load for 1 trip	21.3(ton/truck)	25.4(ton/truck)
(4) Average round trip distance between the biomass supply sites and the plant	62.5(km)	84.0(km)
(5) Emission factor for heavy truck transportation (See note)	1.251($kgCO_2$/km)	1.320($kgCO_2$/km)

Note: This parameter was calculated using the Diesel CO_2 emission factor and the monitored performance index of the trucks (2.1 Km/lt), provided by the transportation subcontractors.

Calculations:

		2011	2012
(6) Biomass transported (wet)	(1)/[1 – (2)]	55,359(wet ton)	81,438(wet ton)
(7) Number of trips needed for the Plant per year	(6) / (3)	2,593(trips)	3,212(trips)
(8) Total distance travelled, considering round trip	(4)*(7)	162,055(km)	269,733(km)
(9) Total emissions	**(5)*(8)* (1ton/1,000kg)**	**203(tCO_2)**	**356(tCO_2)**

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

This emission source is calculated using equation N°6 of the ACM0006 (Version 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 fossil fuel consumption associated to the project activity is related to additional electric power generation of the power plant.

Data:

	2011	2012
(1) Fossil fuel used in the recovery boiler attributable to the project activity[(1)]	0(ton)	5,089(ton)
(2) Fossil fuel net calorific value (average)	40.61(GJ/ton)	40.29(GJ/ton)
(3) Fossil fuel CO_2 emission factor	0.07737(tCO_2/GJ)	0.07737(tCO_2/GJ)

[(1)]Fuel oil consumption due to power generation reasons.

Calculations:

		2011	**2012**
(4) Total emissions	**(1)*(2)*(3)**	**0(tCO_2)**	**15,862(tCO_2)**

– 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:

	2011	**2012**
(5) Fuel oil used due to operational reasons	1,210(ton)	1,557.7(ton)
(6) Fuel oil consumption due to power generation reasons	10.4(ton)	3,530.6(ton)
(7) Fossil fuel used in the power boiler attributable to the project activity [(5)+(6)]	1,220.3(ton)	5,088.3(ton)
(8) Fossil fuel net calorific value (average)	40.61(GJ/ton)	40.29(GJ/ton)
(9) Fossil fuel CO_2 emission factor	0.07737(tCO_2/GJ)	0.07737(tCO_2/GJ)

Calculations:

		2011	2012
(10) Total emissions	**[(5)+(6)]*(8)*(9)**	**3,834(tCO_2)**	**15,861(tCO_2)**

- 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 operation (mix of sawdust and bark) that is attributed to the project activity (e.g. generation of additional power).

Data:

	2011	2012
(10) Fossil fuel (Diesel) used for on-site biomass transportation due to the project activity.	49.4(ton)	52.8(ton)
(11) Fossil fuel net calorific value (average).	42.80(TJ/000ton) 42.80(GJ/ton)	42.54(TJ/000ton) 42.54(GJ/ton)
(12) Fossil fuel CO_2 emission factor.	0.07407(tCO_2/GJ)	0.07407(tCO_2/GJ)

Calculations:

		2011	2012
(13) Total emissions	**(10)*(11)*(12)**	**157(tCO_2)**	**166(tCO_2)**

- 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:

	2011	**2012**
Carbon dioxide emissions from on-site consumption of fossil fuels	**(tCO_2)**	**(tCO_2)**
Fossil fuel consumption in the recovery boiler	0	15,862
Fossil fuel consumption in the power boiler	3,834	15,861
Fossil fuel consumption due to on-site biomass from forest operations transportation	157	166
Fossil fuel consumption due to on-site biomass from forest operations preparation	0	0
Total emissions	**3,990**	**31,890**

3. Carbon dioxide emissions from electricity consumption

This emission source is calculated using equation N° 7 of the ACM0006 (Version 05). However, during the 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:

	2011	2012
(1) Biomass related to the project activity burned in the power boiler.	50,531(BDt)	54,152(BDt)
(2) Net calorific value of biomass from forest operations (dry basis) (See note).	17.79(GJ/ton)	18.26(GJ/ton)
(3) Biomass methane emission factor under controlled burning conditions	30.0(KgCH$_4$/TJ)	30.0(KgCH4/TJ)
(4) Conservativeness factor	1.02	1.02
(5) Global Warming Potential of CH_4	21	21

Note: Net calorific values of biomass must be monitored twice a year. For simplicity, an average was used here.

Calculations:

		2011	2012
(6) Total emissions	**(1)*(2)*(1TJ/1,000GJ)*(3)*(4)*(5) *(1 ton/1,000kg)**	**578(tCO_2eq)**	**636(tCO_2eq)**

Total project emissions:

	2011	2012
Emission sources	**(tCO_2eq)**	**(tCO_2eq)**
Carbon dioxide emissions from biomass residues transportation	203	356

to the power plant		
Carbon dioxide emissions from on-site consumption of fossil fuels.	3,990	31,890
Carbon dioxide emissions from electricity consumption	0	0
Methane emissions from combustion of biomass residues	578	636
TOTAL PROJECT EMISSIONS	**4,771**	**32,881**

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

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

Arauco performed a biomass availability study for 2011 and 2012, using official bulletins from INFOR[8] as well as other (whenever available) official sources to calculate the biomass supply and demand in the Valdivia power plant influence area[9]. This study is part of the monitoring plan of the Valdivia project activity and was carried out according 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 TABLE

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[10].

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

[8] INFOR stands for "Instituto Nacional Forestal" or "National Forestry Institute" in English.
[9] The Valdivia project influence area is defined in page 129 of the registered PDD.
[10] 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)
3rd Verification (01Jan 2011-31Dec 2012)	140,337.6	37,651.7	0	102,685.9

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

From January 1st 2011 to December 31st 2012

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)	Total: 399,556(tCO_{2eq}) (2012): 215,357 (tCO_{2eq}) (2011):184,199(tCO_{2eq})	Total:102,685.9(tCO_{2eq}) (2012):104,768.6(tCO_{2eq}) (2011): -2,082.7(tCO_{2eq})

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

From January 1st 2011 to December 31st 2011:

According to the PDD the estimated emission reductions for the period covered between 01/01/2011 and 31/12/2011 (both days included) should have been 184,199(tCO_{2eq}). The monitored emissions obtained are -2,083(tCO_{2eq}). This results can be explained by the following reasons:

- The monitored net quantity of electricity generated at the project plant is 36.54% lower than the amount of electricity estimated in the PDD. This difference can be explained by the following reasons:

  - According to the PDD, the estimated Gross electricity generated in the project plant for this period should have been 704,000 (MWh). The monitored Gross electricity generated is 36.02% (%) lower than the estimated in the PDD.

  The reason described above can partially be explained because the power plant faced an abnormal operation during 2011 suffering from irregular stoppages, operating lower than its normal production meaning less electricity was generated. The Project Participant presents the most relevant operational in table of section B.1 of this monitoring report.

- The grid emission factor obtained for year 2011 was 0.7186(tCO_2/MWh), while the grid emission factor estimated in the PDD was 0.911(tCO_2/MWh)[11].

[11] Estimate value during validation stage of this Project activity.

- The third reasons that contributed to explain the result presented above was related to monitored data loss during the months of March and May of 2011. This problem has been addressed by the Project Participant in detail in section B.2.1 of this monitoring report, as a temporary deviation to the monitoring plan. Note that in order to address this problem in the most conservative possible way the Project Participant assumed zero to the monitored parameters gross electricity generated by the power plant and total internal electricity consumption rather than estimate values.

Since for the period between January 1st 2011 and December 31st 2011, the total emission reductions obtained are -2,083(tCO_{2eq}) the Project Participant will discount this due amount from the emission reductions obtained from January 1st 2012 to December 31st 2012.

From January 1st 2012 to December 31st 2012

According to the PDD, the estimated emission reductions for the period covered between 01/01/2012 and 31/12/2012 should have been 215,357 CERs. The monitored emissions are 52.3% lower than the estimate in the PDD. This difference can be explained by the following reasons:

- The monitored Net quantity of electricity generated is 4.66 (%) lower than the amount estimated in the PDD. This difference can be explained by the following reasons:

  - According to the PDD, the estimated Gross electricity generated in the project plant for the period covered by this monitoring period should have been 704,000 (MWh). The monitored Gross electricity generated is 4.5 (%) lower than the Value estimated in the PDD.

  - According to the PDD, the estimated Electric power generation in the baseline mill for the period covered by this monitoring period should have been 417,520(MWh). The monitored amount is 17.46 (%) higher than the estimated in the PDD.

- The grid emission factor obtained for year 2012 was 0.7268(tCO_2/MWh), while the grid emission factor estimated in the PDD was 1.058(tCO_2/MWh)[12].

The reasons previously described can partially explain the low emissions compared to the estimate in the PDD.

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 ($t\ CO_2e$)	102,685(tCO_{2e})	Not applicable.

Note: the emission reductions claimed are from the monitoring period from January 1st 2010 to December 31st 2010

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[12] Estimate value during validation stage of this Project activity.

Document information

Version	*Date*	*Description*
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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