SECTION D. Application of a monitoring methodology and plan

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

The monitoring methodology applied for this project activity corresponds to the one of the approved baseline methodology for biomass cogeneration plants ACM0006 (Version 02). The name of the applied monitoring methodology is:

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

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

According to the baseline methodology, the Nueva Aldea Power Plant Phase 2 fully complies with the applicability criteria. (See section B.1.1 of this PDD).

CDM project activity

The proposed project activity consists in the construction of a new pulp mill with a high electric efficiency to make it a power exporter to the grid. The higher efficiency is possible due to the installation of a high steam pressure of the recovery boiler and two high-capacity turbo generators. This allows the pulp mill to cogenerate surplus power to the grid, but in this case, without increasing the amount of biomass (black liquor, dry basis) that would be fired in the recovery boiler in a baseline scenario.

Baseline case scenario N°4 is applicable to the CDM project activity

- **"The proposed project activity involves the installation of a new biomass residue power generation plant at a site where no power was generation occurs".** Therefore it is a "power greenfield" project.

- "**In the absence of this project activity, a new biomass residue fired power plant would be installed instead of the project activity at the same site and with the same thermal firing capacity but with a lower efficiency of electricity generation as the project plant".** This is precisely the case with the project activity, since basically due to the higher steam production of the recovery boiler; the pulp mill is capable of generating surplus power to the grid while the baseline plant would only been able to generate the heat and power required by the pulp mill, but not surplus power to the grid.

- **"The same type and quantity of biomass residues as in the project plant would be used in the baseline plant".** The pulp mill has determined capacity and can process a certain amount of black liquor, which is used to produce energy inside the mill. The proposed project activity increases the energy efficiency of the mill and therefore allows it to generate surplus power to the grid but using the same amount of biomass (black liquor, dry basis) that would be used by the baseline pulp mill.

- The power generated by the project plant would in the absence of the project activity be generated:

(a) In the reference plant. Since pulp mills in Chile tend to be self-sufficient in electricity generation, the baseline plant considered would be a self-sufficient pulp mill in thermal and electricity generation. This is conservative.
(b) Partly in power plants in the grid. The proposed project activity would generate surplus power to the grid and therefore would displace electricity from the grid.

- **"The heat generated by the project plant would in the absence of the project activity be generated in the reference plant".** This is the norm with Kraft pulp mills in the world and the proposed baseline pulp mill design". Please see section A.4.3 of the PDD.

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

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

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

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

ID number.	Data variable.	Source of data.	Data unit.	Measured (m), calculated (c) or estimated (e).	Recording Frequency.	Proportion of data to be monitored.	How will the data be archived? (electronic/ paper).	Comment.
1. $BF_{i,y}$	Quantity of biomass type i used as fuel in the project plant during the year y in a volume or mass unit.	Power boiler black liquor meters	(tDS/day)	Measured	Continuously	100%	Electronic	<u>Source of data:</u> On-site measurements. <u>Description of the measurement method and procedures to be applied:</u> This variable is monitored using four (4) dedicated flow meters for measuring continuously the black liquor flow (l/s) in combination with two (2) refractometers to measure the average concentration (%) solids, and one (1) transmitter to measure the temperature (°C) of the black liquor flow. To determine the dry biomass flow (tDS), the total wet flow is multiplied by the average concentration (%) of solids using the following equation: **Black liquor (tDS) = black liquor flow (l/s) * (%) solids * density of black liquor**. – Black liquor flow: on-site measurement using proper and dedicated flow meters. – (%) solids: on-site measurement using proper and dedicated refractometers.

								– Density: obtained as a function of (%) solids and the temperature (°C) of the black liquor flow. The measurement is done continuously (each five seconds), online and fully integrated with the Distributed Control System (DCS) of the pulp mill. Data of biomass consumption is aggregated and reported monthly in the emission reduction calculation sheet. <u>Monitoring instruments (accuracy class, calibration frequency):</u> The accuracy class of this type of flow meter is +/- 0.5%, the accuracy class of this type of refractometers is +/- 0.1% DS, and the accuracy class of this type of temperature transmitter is +/- 0.1°C. This type of flow meters does not require calibration frequency. However, periodic verifications are done by Project owner. In the case of these refractometers, a biannual verification is done, and the temperature transmitter requires a five year calibration frequency. <u>Responsible to undertake the measurement/collecting data:</u> The Recovery Boiler department, as part of the Nueva Aldea Complex (Nueva Aldea Power Plant Phase 2), is responsible of measuring/collecting and aggregating the data (Refer to section D.4 of this PDD).
2. NCV_i	Net calorific value of	Biomass samples data at the power	(MWh/mass or volume	Measured	Annually	100%	Electronic	<u>Description of the measurement method and procedures to be applied:</u> This variable will be measured in specialized and reputed laboratories according to proper and relevant industry

	biomass type i per mass or volume of biomass.	plant.	unit)					standards. Measurement of NCV is on dry basis. Responsible to undertake the measurement/collecting data: The Recovery Boiler department is responsible of collecting and registered annually. (Refer to section D.4 of this PDD).
3. $COEF_{CO2,i}$	Emission factors	IPCC	(tCO_2/mass or volume unit)	Calculated	Annually	100%	Electronic	Source of data to be used: This parameter refers to the CO2 emission coefficient of the fossil fuel type i used in the project plant. This coefficient is calculated based on net calorific value and the weight average CO2 emission factor of the fuel type i, as follows: $\mathbf{\mathit{COEF}_{i,y} = NCV_{i,y} * EF_{CO2,i,y}}$ where: – $NCV_{i,y}$: weighted average net calorific value of the fuel type i in year y (tCO2/mass volume unit). – $EF_{CO2,i,y}$: weighted average CO2 emission factor of fuel type i in year y (tCO2/GJ) The selected source is the IPCC default factors for the parameters described above, in accordance to **Option B** of the “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”. Description of the measurement method and procedures to be applied: Any revision of the IPCC Guidelines should be taken into account. The appropriateness of the data will be reviewed annually. QA/QC procedures to be applied:

								Not applicable, since default factors will be used in this case. Responsible to undertake the measurement/collecting data: The Recovery Boiler department is responsible of collecting and registered the data. (Refer to section D.4 of this PDD)
4. $FF_{projectplant,i,y}$	On-site fossil fuel consumption of fuel type i for co-firing in the project plant.	Pulp Mill's procurement department.	(mass or volume unit)	Measured	Continuously	100%	Electronic	Source of data to be used: On-site measurements. Description of the measurement method and procedures to be applied: The total quantity of fossil fuel per type used in the recovery boiler is continuously monitored at the recovery boiler Plant by proper and dedicated instruments. Fossil fuel consumption (diesel): is determined as the sum of the measurement of flow meters measuring the fossil fuel entering to the recovery boiler burner ring, minus the sum of flow meters measuring the fossil fuel returned (not consumed by the recovery boiler) to the pipeline. Fossil fuel consumption (natural gas): is determined as the sum of the measurement of flow meters measuring the fuel entering to the start-up and load burners. The measurement of fossil fuel is online and fully integrated with the Distributed Control System (DCS) of the pulp mill. Consumption of fossil fuel is measured in tonnes and totalized three (3) times/day (one record per shift), and then aggregated and reported monthly in the emission reduction calculation sheet.

								Though fossil fuel consumption in pulp mill recovery boilers is not common, the amount of fossil fuel used in the Recovery Boiler of the Nueva Aldea Pulp Mill will be monitored and the CO_2 emissions from fossil fuel usage will be discounted whenever the mill is generating surplus power to the grid. Otherwise, the consumption of fossil fuel is considered part of the baseline scenario, since it would have been used with or without the implementation of the project activity to back the power generation of the mill. Monitoring instruments (accuracy class, calibration frequency): Fossil fuel of type Diesel. The accuracy level of the instruments that are used for the measurement of this parameter is +/- 0.1%. This type of fuel meters required a calibration frequency of 5 years. Fossil fuel of type Natural gas. The accuracy level of the instruments that are used for the measurement of this parameter is +/- 0.5%. This type of flow meters requires a calibration frequency of 5 years. Responsible to undertake the measurement/collecting data: The Recovery Boiler department is responsible of collecting and aggregating the data. (Refer to section D.4 of this PDD)

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

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

$$EM_{P,y} = P_{E4,y}$$

Where:

$EM_{P,y}$: Total project activity emissions (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Plant's recovery boiler (tCO_2/yr).

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

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

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

$$P_{E4,y} = \sum_i FF_{i,y} \cdot COEF_{CO2,i}$$

Where:

$P_{E4,y}$: Project emissions from fossil fuel consumption in the Pulp Mill's recovery boiler (tCO_2/yr).
$FF_{i,y}$: Fossil fuel of type i used in the recovery boiler related to the project activity (kg/yr).
$COEF_{CO2,i}$: CO_2 emission factor for the fossil fuel of type i used in the recovery boiler (tCO_2/kg).

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number.	Data variable.	Source of data.	Data unit.	Measured (m), calculated (c), estimated (e).	Recording Frequency.	Proportion of data to be monitored.	How will the data be archived? (electronic / paper).	Comment.

5. $EG_{project\ plant,y}$	Net quantity of electricity generated in the project plant during the year y.	Power plant electric meters	(MWh)	Calculated	Continuously	100%	Electronic	Description of the calculated method to be applied: The net electricity generation of the project plant will be obtained from the difference between the monitored amount of gross electricity generated and the monitored amount of electricity consumed by the auxiliary equipment using the following equation: $EG_{project\ plant} = EL_{PJ,gross,y} - EL_{PJ,aux,y}$ Where: – $EL_{PJ,gross,y}$:obtained from on-site measurement using proper and dedicated electricity meters. – $EL_{PJ,aux,y}$: obtained from on-site measurement using proper and dedicated electricity meters. The calculation is done automatically and fully integrated with the Distributed Control System (DCS) of the pulp mill. There is no manual record or manual calculation. Data of net electricity generation is recorded daily and aggregated and reported monthly in the emission reduction calculation sheet. Responsible to undertake the measurement/collecting data: The Recovery Boiler department is responsible of collecting and aggregating the data. (Refer to section D.4 of this PDD)

[1]$EL_{PJ,gross,y}$	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y.	On-site measurement.	(MWh)	Measured	Continuously	100%	Electronic	Source of data obtained: On-site measurements. Description of the measurement method and procedures to be applied: The measurement is online and fully integrated with the Distributed Control System (DCS) of the pulp mill. Data of gross electricity generation is recorded daily and aggregated and reported monthly in the emission reduction calculation sheet. Monitoring instruments (accuracy class, calibration frequency) All instruments will receive proper maintenance and calibration in accordance with the specifications of the manufacture and the best practices of the Pulp and Paper Industry. The level of accuracy of these meters is +/- 0.5%. This type of flow meter required a calibration frequency of seven (7) years. Responsible to undertake the measurement/collecting data: The Recovery Boiler department is responsible of collecting and aggregating the data. (Refer to section D.4 of this PDD)

[1] Gross electricity generation ($EL_{PJ,gross,y}$) and total auxiliary consumption ($EL_{PJ,aux,y}$) are defined using the nomenclature of ACM0006 (Version 11.1).

$EL_{PJ,aux,y}$	Total auxiliary electricity consumption in year y	On-site measurement.	(MWh)	Measured	Continuosly	100%	Electronic	<u>Source of data obtained:</u> On-site measurements. <u>Description of the measurement method and procedures to be applied:</u> This parameter shall include the electricity required for the operation of all power plants which are located at the project site and included in the project boundary (e.g. pumps, fans, instrumentation and control, etc.). The measurement is online and fully integrated with the Distributed Control System (DCS) of the pulp mill. Data of total auxiliary electricity consumption is recorded daily and aggregated and reported monthly in the emission reduction calculation sheet. <u>Monitoring instruments (accuracy class, calibration frequency)</u> All instruments will receive proper maintenance and calibration in accordance with the specifications of the manufacture and the best practices of the Pulp and Paper Industry. The level of accuracy of these meters is +/- 0.5%. This type of flow meter required a calibration frequency of seven (7) years. <u>Responsible to undertake the measurement/collecting data:</u> The Recovery Boiler department is responsible of collecting and aggregating the data (Refer to section D.4 of this PDD).

6. EF_y	CO_2 emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	(tCO_2/MWh)	Calculated	Yearly	100%	Electronic	Monitoring instruments (accuracy class, calibration frequency) Not applicable. Description of the calculated method to be applied: Calculated as a weighted sum of the OM and BM emission factors, according to equation 10 of the ACM0002 (Version 04). Responsible to undertake the measurement/collecting data: Arauco Generacion (Santiago) is responsible to collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).
7. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	(tCO_2/MWh)	Calculated	Yearly	100%	Electronic	Monitoring instruments (accuracy class, calibration frequency) Not applicable. Description of the calculated method to be applied: Calculated as indicated in the chosen baseline methodology. Equation 4 of the ACM0002 (Version 04), according to the simple adjusted OM method. Full year data is used to calculate each emission factor. Responsible to undertake the measurement/collecting data: Arauco Generación (Santiago) is responsible to collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

8. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	Relevant dispatch center, electric power companies' public information, host country government official information and IPCC values.	(tCO_2/MWh)	Calculated	Yearly	100%	Electronic	<u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable. <u>Description of the calculated method to be applied:</u> In this case, the BM is calculated for each year (ex-post), using equation 9 of the ACM0002 (Version 04). Full year data is used to calculate each emission factor. <u>Responsible:</u> Arauco Generacion (Santiago) is responsible to collecting and aggregating the data from official and publicly available information. . (Refer to section D.4 of this PDD)
9. $F_{i,y}$	Amount of each fossil fuel consumed by each power source / plant.	Relevant dispatch center, electric power companies' public information and host country official information.	(Mass or volume)	Measured	Yearly	100%	Electronic	<u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable. <u>Description of the calculated method to be applied</u> Not applicable. This information will not be directly measured. <u>Responsible to undertake the measurement/collecting data:</u> Arauco Generacion (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

10. $COEF_i$	CO_2 emission coefficient of each fuel type i consumed by the electric power generators in the relevant grid.	Relevant dispatch center, electric power companies' public information and host country official information.	(tCO_2/ mass or volume unit)	Measured or calculated	Yearly	100%	Electronic	<u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable. <u>Description of the calculated method to be applied</u> Plant or country-specific values to calculate $COEF_i$ are preferred to IPCC default values. In this case, this factor is calculated using IPCC default values of $EF_{CO2,i,y}$ (Carbon content of fuel type i and CO2/C conversion factor) and local national data (NCV). The equation used to obtain this parameter is: $\mathbf{COEF_{CO2,i} = NCV_i * EF_{CO2,i,y}}$ The selected source is the IPCC default factors for the parameters described above, in accordance to **Option B** of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". <u>Responsible to undertake the measurement/collecting data:</u> Arauco Generación (Santiago) is responsible for collecting the data from official and publicly available information (Refer to section D.4 of this PDD).

11. $GEN_{j/k/n,y}$	Electricity generation of each power source / plant j/k or n.	Relevant dispatch center, electric power companies' public information and host country official information.	(MWh/yr)	Measured	Yearly	100%	Electronic	<u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable. <u>Description of the calculated method to be applied</u> Not applicable. This information will not be directly measured. <u>Responsible to undertake the measurement/collecting data:</u> Arauco Generacion (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).
12.	Identification of power source / plant for the OM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text	Estimated	Yearly	100% of set of plants	Electronic	Identification of plants (j, k, or n) to calculate the Operating Margin emission factors. <u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable <u>Description of the calculated method to be applied</u> Not applicable. This information will not be directly measured. <u>Responsible to undertake the measurement/collecting data:</u> Arauco Generacion (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

13.	Identification of power source / plant for the BM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text	Estimated	Yearly	100% of set of plants	Electronic	Identification of plants (m) to calculate the Build Margin emission factors. <u>Monitoring instruments (accuracy class, calibration frequency)</u> Not applicable <u>Description of the calculated method to be applied</u> Not applicable. This information will not be directly measured. <u>Responsible to undertake the measurement/collecting data:</u> Arauco Generacion (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

14. λ_y	Fraction of time during which low-cost / must-run sources are on the margin.	Relevant dispatch center, electric power companies' public information and host country official information.	Number	Calculated	Yearly	100%	Electronic	Factor accounting for number of hours per year during which low-cost / must-run sources are on the margin. Monitoring instruments (accuracy class, calibration frequency) Not applicable Description of the calculated method to be applied Not applicable. This information will not be directly measured. Responsible to undertake the measurement/collecting data: Arauco Generacion (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

15.a $GEN_{j/k/ll,y}$ IMPORTS	Electricity imports to the project electricity system.	Relevant dispatch center and host country official information.	(KWh)	Calculated	Yearly	100%	Electronic	Monitoring instruments (accuracy class, calibration frequency) Not applicable. Description of the calculated method to be applied Not applicable. This information will not be directly measured. It is obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports. If there are no imports in the relevant system, the monitoring of this variable does not apply. Responsible to undertake the measurement/collecting data: Arauco Generación (Santiago) is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

15.b $COEF_{i,jy}$ IMPORTS	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur).	Relevant dispatch center, electric power companies' public information and host country official information.	(tCO_2/mass or volume unit)	Calculated	Yearly	100%	Electronic	Monitoring instruments (accuracy class, calibration frequency) Not applicable. Description of the calculated method to be applied Not applicable. This information will not be directly measured. It is obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate the coefficients. If there are no imports in the relevant system, the monitoring of this variable does not apply. Responsible to undertake the measurement/collecting data: Arauco Generacion is responsible for collecting and aggregating the data from official and publicly available information (Refer to section D.4 of this PDD).

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

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

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

Where:

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

According to the ACM0006 (Version 02), the baseline emissions from electricity displacement are calculated using equation 8:

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

Where:

$ER_{electricity,y}$: are the emission reductions due to displacement of electricity during the year y in tons of CO_2,
EG_y : is the net quantity of increased electricity generated as a result of the project activity (incremental to baseline generation) during the year y in MWh,
$EF_{electricity,y}$: is the CO_2 emission factor for the electricity displaced due to the project activity during the year y in tons CO_2/MWh.

Calculation of the electricity displaced from the grid EG_y:

EG_y, is calculated using equation 13 of the ACM0006 (Version 02):

$$EG_y = EG_{project\ plant,y} - \varepsilon_{el,other\ plant(s)} * \sum BF_{i,y} * NCV_i$$

Where:

EG_y : is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh,
$EG_{project\ plant,y}$: is the net quantity of electricity generated in the project plant during the year y in MWh,

$\varepsilon_{el,other\ plant(s)}$: is the average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass fired in the project plant in the absence of the project activity expressed in $MWh_{el}/MWh_{biomass}$.

$BF_{i,y}$: is the quantity of biomass type i used as fuel in the project plant during the year y in a volume or mass unit, and

NCV_i : is the net calorific value of the biomass type in MWh per mass or volume of biomass.

Calculation of the average net energy efficiency of electricity

The Project Participant has changed the gross electric efficiency of the reference plant (12.31%) to net electric efficiency, obtaining as a result an efficiency value of 10.839%.

The net electric efficiency established for the reference plant will remain fixed stable for all crediting period. This value (10.839%) is still more conservative than each of the gross electric efficiencies the Project Participant determined for other real cellulose pulp mills: Santa Fe existing line (8.38%), Santa Fe new line (9.33%), Alto Parana (10.48%). The comparison is done taking into consideration gross efficiencies since the required information to change gross efficiencies to net is not available (i.e. the information is not public). Nevertheless, the consideration of gross electric efficiencies to establish a net efficiency for the reference plant clearly leads to conservative electric efficiency estimation for the reference plant.

According to ACM0006 (Version 02), the net electric efficiency is calculated as follow:

Reference plant electric efficiency calculation		
Net electric power generation (a)	(GWh/yr)	586.0
Biomass combusted [2] (b)	(tDS/yr)	1,710,390
NCV of biomass [3] (c)	(GJ/tDS)	11.38
$\varepsilon_{el,other\ plant(s)}$ (a) / [(b)*(c)/3600]	**(MWh_{el}/MWh_{bio})**	10.839 %

Where:

The net electric power generation that would have been generated in the reference plant is determined by considering the gross electricity generated[4] by the reference plant minus the corresponding auxiliary consumption[5].

[2] Biomass amount combusted was obtained from the energy/mass balance stated in the registered PDD page 10. Please note that the amount of biomass burned in the recovery boiler is the same in both cases.

[3] Net Calorific value (NCV) is obtained from the Feasibility Report of the project.

[4] Result of the power generation capacity (76MW) informed in the registered PDD page 10.

[5] Baseline installed capacity of auxiliary electricity consumption (8.8 MW) corresponds to the value informed in the registered PDD, page 10.

Calculation of the grid electricity coefficient $EF_{electricity,y}$:

The formulae presented here are taken directly from the Consolidated baseline methodology for grid-connected electricity generation from biomass residues, therefore only the basic formulae and algorithms are presented here.

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

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

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

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

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

This option was not chosen.

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

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

This option was not chosen.

D.2.3. Treatment of leakage in the monitoring plan

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

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

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

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

$$L_y = 0$$

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

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

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

or

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

or

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

Where:

$BL_{E1,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Recovery Boiler (tCO_2/yr).

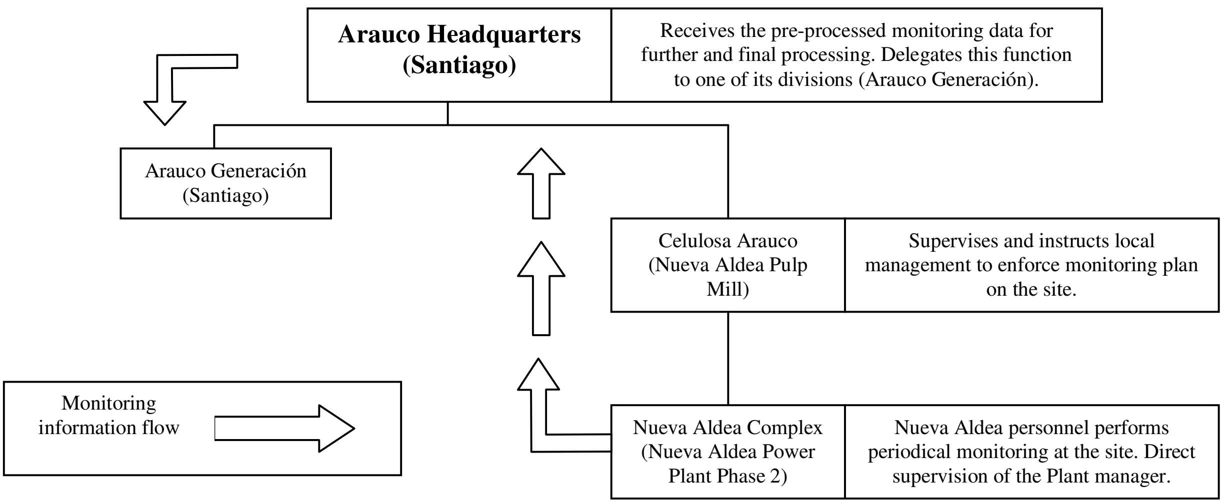
D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	Biomass flows will be crosschecked using an annual energy balance and stock changes.
2	Low	Net calorific values will be measured in specialized and reputed laboratories. In order to check the consistency of the measured value, the project proponent will compare the measured value with IPCC default values.
3	Low	IPCC default factors will be used in this case.
4	Low	Fossil fuel meters will receive periodic calibration and maintenance according to proper industry standards. The consistency of metered readings will be checked with purchase receipts, whenever possible and available.
5	Low	The consistency of metered net electricity generation will be cross-checked using an efficiency index (electricity generation divided by the quantity of biomass fired) comparable to previous years.
6,7,8,9,10,11,12,13,14,15a,15b	Low	Calculation of the CO_2 emission coefficient for grid electricity involves the use of official data released by the power generating company and / or indirectly by the corresponding dispatch center (if available and possible). Quality control of this data is beyond the control of the project operators. However, if the data are considered unreasonable, they may be replaced by more accurate data according to methods verified by the DOE:

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

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

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

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

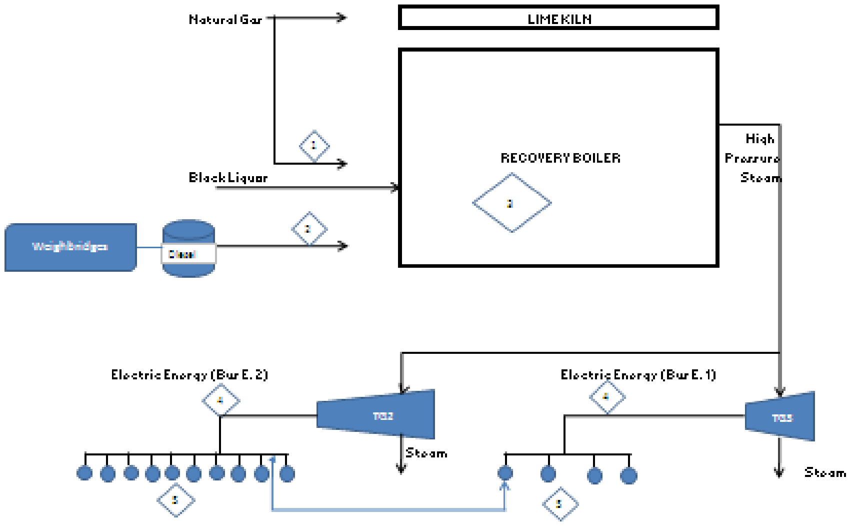


D.5 Name of person/entity determining the monitoring methodology:

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

Annex 4

Simplified version of the line Diagram of the Instruments



Item	Instrument
1	Natural Gas Meter (Start-up Burners) Natural Gas Meter (Load Burners)
2	Diesel Meter (Start-up Burners) Return Diesel Meter (Start-up Burners) Diesel Meter (Load Burners) Return Diesel Meter (Load Burners)
3	Black Liquor Flow Meter (Nozzle) 1-3 Black Liquor Flow Meter (Nozzle) 4-7 Black Liquor Flow Meter (Nozzle) 8-10 Black Liquor Flow Meter (Nozzle) 11-14 Refractometer Refractometer Black Liquor Temperature Transmitter
4	Energy Meter Switchgear 1-2 (Bus E.1) gross electric generation Energy Meter Switchgear 2-5 (Bus E.2) gross electric generation
5	Energy Meter Switchgear 5-1 Energy Meter Switchgear 5-2A Energy Meter Switchgear 5-2B Auxiliary consumption (*) Energy Meter Switchgear 6-1 Energy Meter Switchgear 6-2A

Note: See Line diagram for detailed information.