Revised Monitoring Plan

Project name: Trupan Biomass Power Plant in Chile
Project ref. no: 0259
Dated: 23 June 2008
Version: 1

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 monitoring methodology of the ACM0006 (Version 01). The name of the applied monitoring methodology is:

"Consolidated monitoring methodology for grid-connected electricity generation from biomass residues (Version 01)"

This project activity also relies on the monitoring methodology of the following baseline methodology:

ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 06)".

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

As mentioned in B.1, the baseline and monitoring methodology that is applied to the Trupan Power Plant project activity is the consolidation of several methodologies for grid-connected biomass cogenerations projects, of which the one of them was a methodology developed by Arauco specifically for the proposed project activity. Being the consolidated methodology broader in scope and more widely applicable for grid-connected biomass cogeneration projects, such methodology is deemed appropriate and fully applicable to the proposed project activity.

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

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

All data collected as part of the monitoring (baseline, project and leakage emissions), will be archived electronically and kept for at least 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 combusted in the project plant during the year y.	Power Plant's procurement department.	Mass or volume unit (BDt[1] or cubic meters).	Measured.	Continuously, prepare annually an energy balance.	100%	Electronic.	The quantity of biomass combusted will be collected separately for each type of biomass and will be determined based on measured data. Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary or if biomass is transported to the project site and corresponding CO_2 emissions are calculated with equation (3) in the baseline methodology. Data will be archived 2 years following the end of the crediting period.
2. NCVi	Net calorific value of biomass or fossil fuel	Power Plant's procurement department and	GJ/mass or volume unit.	Measured or calculated.	Annually.	100%	Electronic.	The net calorific value should be determined separately for all types of biomass and fossil fuels. Net calorific values should be based on measurements

[1] BDt stands for "Bone dry ton" or "Dry ton".

	type i.	authorized laboratories.						or reliable local or national data. Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Data will be archived 2 years following the end of the crediting period.
3. EF_{CH4}	Methane emission factor for combustion of biomass in the project plant.	Measurements by project proponent or IPCC default factors.	Kg CH_4/TJ	Measured or estimated.	Annually.	100%	Electronic.	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary and if measurements are undertaken to determine the emission factor. Data will be archived 2 years following the end of the crediting period.
4. AVD_y	Average return trip distance between biomass fuel supply sites and the project site.	Power Plant's procurement department.	Km	Measured.	Continuously.	100%	Electronic.	If biomass is supplied from different sites, this parameter should correspond to the mean value of km traveled by trucks that supply the biomass plant. Data will be archived 2 years following the end of the crediting period.
5. TL_y	Average truck load of the trucks used for	Power Plant's procurement department.	Mass or volume unit (BDt or	Measured.	Regularly.	100%	Electronic.	Project participants have to monitor either the number of truck trips N_y or this parameter.

	transportation of biomass.		cubic meters).					Data will be archived 2 years following the end of the crediting period.
6. $EF_{km,CO2}$	Average CO_2 emission factor for transportation of biomass with trucks.	Project site or default values from the IPCC.	tCO_2/km	Calculated.	Annually.	100%	Electronic.	Local or national data should be preferred. Default values from the IPCC may be used alternatively and should be chosen in a conservative manner. Data will be archived 2 years following the end of the crediting period.
7. $F_{Trans,i,y}$ (in the PDD, this variable appears as $OF_{i,y}$)	Fuel consumption of fuel type i used for transportation of biomass.	Power Plant's procurement department.	Mass or volume unit	Measured.	Continuously.	100%	Electronic.	Data will be archived 2 years following the end of the crediting period.
8. $COEF_{CO2,i}$	CO_2 emission factor for the fuel type i.	Power Plant's procurement department and / or default factors from the IPCC.	tCO_2 / mass or volume unit.	Measured or calculated.	Annually.	100%	Electronic.	These emission factors will be applied to fuel consumption for transportation (7) and on-site fuel consumption (9). Measurements or local / national data should be preferred. Default values from the IPCC may be used alternatively. Data will be archived 2 years following the end of the crediting period.
9. $FF_{project\ plant,i,y}$ (in the PDD,	On-site fossil fuel consumption	Power Plant's procurement department.	Mass or volume unit.	Measured.	Continuously.	100%	Electronic.	Any type of fossil fuel consumption in the Power Plant will be continuously monitored and recorded. The data will be

this variable appears as FF_y)	of fuel type i for co-firing in the project plant.							checked with purchase receipts, whenever possible and available. Data will be archived 2 years following the end of the crediting period.

Note: Only additional quantities of biomass and fossil fuels due to the CDM project activity will be used to calculate baseline and project emissions.

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

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

$$EM_{P,y} = P_{E1,y} + P_{E2,y} + P_{E3,y} + P_{E4,y}$$

Where:

$EM_{P,y}$: Total project activity emissions (tCO_2eq/yr).
$P_{E1,y}$: Project emissions from biomass controlled burning in the Power Plant (tCO_2eq/yr).
$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO_2/yr).
$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Plant's power boiler (tCO_2/yr).

D.2.1.2.1 Emissions from biomass controlled burning in the Power Plant's power boiler:

Consistent with IPCC Guidelines[2], CO_2 emission from biomass combustion at the Trupan Power Plant, being the release of the CO_2 absorbed on a sustainable basis by forest that is replanted every year (forest companies replant the surfaces they harvest[3]). The same treatment is not extended to methane emissions. When biomass is combusted in a well-controlled environment at the Trupan Power Plant, methane emissions are small in quantity but still not zero.

$$P_{E1,y} = GWP_{CH4} \cdot EF_{Biomass,CH4} \cdot \sum_i BF_{i,y} \cdot NCV_{Biomass,i}$$

Where:

P_{E1} : Project emissions from biomass controlled burning (tCO_2eq/yr).
GWP_{CH4} : Global Warming Potential of methane (21 tCO_2eq/tCH_4).
$EF_{Biomass,CH4}$: Biomass methane emission factor (tCH_4/TJ).
$BF_{i,y}$: Biomass of type *i* used by the project activity (BDt/yr).
$NCV_{Biomass,i}$: Net calorific value of biomass of type *i* (TJ/BDt).

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[2] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, p.6.1 Please also see Revised 1996 IPCC Guidelines for National Greenhouse Inventories, Workbook and IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, P.5.5

[3] Chilean Law D.L. 701 obliges forest companies to reforest the areas that have been harvested, unless the area is not suitable for forest activity. Such cases constitute less than 1% of cases.

D.2.1.2.2 Emissions from biomass transportation to the Power Plant:

Transporting biomass from the suppliers to the Trupan Power Plant is normally done by trucks, which results in direct off-site GHG emissions. The emissions related to biomass transportation to the Power Plant in year *y* can be calculated as follows:

$$P_{E2,y} = \frac{\sum_i BF_{T,i,y}}{TL_y} * AVD_y * EF_{km,CO2}$$

Where:

$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO_2/yr).
$BF_{T,i,y}$: Biomass of type *i* (wet) transported by trucks used by the project activity (wet ton/yr).
TL_y : Average truck load of the trucks used (ton).
AVD_y : Average return trip distance between the biomass fuel supply sites and the site of the project plant (km).
$EF_{km,CO2}$: Average CO_2 emission factor for the transportation fuel (tCO_2/km).

D.2.1.2.3 Emissions from biomass transportation within the Trupan Power Plant site:

Within the Trupan Power Plant site, diesel-fuelled trucks and bulldozers will transport the biomass to the power boiler area. As in the previous case, such transportation also generates project-related GHG emissions, which for year *y* can be estimated as follows:

$$P_{E3,y} = \sum_i OF_{i,y} \cdot COEF_{CO2,i}$$

Where:

$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO_2/yr).
$OF_{i,y}$: Fossil fuel of type *i* used for on-site transportation of biomass (kg/yr).
$COEF_{CO2,i}$: CO_2 emission factor for the transportation fuel of type *i* (tCO_2/kg).

D.2.1.2.4 Emissions from fossil fuel consumption in the Power Plant's power boiler:

Having a larger power boiler, with higher biomass combustion capacity and higher steam pressure generation capacity than the baseline case boiler implies a higher consumption of fossil fuel for start-ups and for maintaining the power boiler temperature, especially in winter time, when the biomass has a higher humidity. This additional consumption of fossil fuels in the power boiler generates GHG emissions, which for a year *y* can be estimated as follows:

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

Where:

$P_{E4,y}$: Project emissions from fossil fuel consumption in the Plant's power boiler (tCO_2/yr).
$FF_{i,y}$: On-site fossil fuel consumption of type *i* for co-firing in the project plant (kg/yr).
$COEF_{CO2,i}$: CO_2 emission factor for the fossil fuel of type *i* used in the power boiler (tCO_2/kg).

For the Trupan Power Plant project activity, the following considerations must be taken:

- According to the chosen baseline methodology, the project proponent will monitor the consumption and net calorific values of each type of biomass consumed in the power plant. For simplicity, this PDD will consider the total biomass consumption and the corresponding weighted average net calorific value of the biomass mix for emission reduction calculations.

- As mentioned in D.2.1.1, only additional quantities of biomass and fossil fuels attributed to the project activity will be considered to calculate the baseline and project emissions. This is indicated for biomass in page 32 of the ACM0006 (Version 01) and for fossil fuels, in page 18 of the ACM0006 (Version 01).

  According to the above, the biomass related to the CDM project activity will be determined in accordance with equation 24 of the ACM0006 (Version 01). On-site fossil fuel consumption will be determined assuming a relation of direct proportionality between the amount of on-site fossil fuel consumption (for on-site transportation and for co-firing in the power boiler) and the biomass consumption in the power boiler. This relation of direct proportionality was confirmed using data from other power boilers of different size of Arauco, and therefore, was considered appropriate to determine the amount of fossil fuel associated to the CDM project activity.

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.
10. $EG_{project\ plant,y}$	Net quantity of electricity generated in the project plant during the year y.	Power Plant electric meters.	MWh	Measured.	Continuously.	100%	Electronic.	$EG_{project\ plant,y}$ is the net electricity generated by the project activity displaced from the grid. Data will be archived 2 years following the end of the crediting period.

11. Q_y	Net quantity of heat generated from firing biomass in the project plant.	Project proponent (Power plant meters)	GJ	Measured.	Continuously.	100%	Electronic	Only relevant for cogeneration project activities. Project participants should calculate the net heat generation and subtract any condensate return. In case of scenario 3, monitoring of this parameter for project emissions is only required, if CH_4 emissions due to natural decay or uncontrolled burning are included in the project boundary. Data will be archived 2 years following the end of the crediting period.
12. 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.	Annually.	100%	Electronic.	Calculated as a weighted sum of the OM and BM emission factors, as indicated in the ACM0002. Data will be archived 2 years following the end of the crediting period.

13. $EF_{OM,y}$	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.	Annually.	100%	Electronic.	Calculated as indicated in the ACM0002 baseline methodology. Data will be archived 2 years following the end of the crediting period.
14. $EF_{BM,y}$	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.	Annually.	100%	Electronic.	Calculated as indicated in the ACM0002 baseline methodology. Data will be archived 2 years following the end of the crediting period.
15. $F_{i,y}$	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.	Annually.	100%	Electronic.	This information will be obtained from the relevant dispatch center, electric power companies or the latest official statistics publicly available. Data will be archived 2 years following the end of the crediting period.
16. $COEF_i$	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.	Annually.	100%	Electronic.	Plant or country-specific values to calculate $COEF_i$ are preferred to IPCC default values. Data will be archived 2 years following the end of the crediting period.

17. $GEN_{j/k/n,y}$	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.	Annually.	100%	Electronic.	This information will be obtained from the relevant dispatch center, electric power companies or the latest official statistics publicly available. Data will be archived 2 years following the end of the crediting period.
18.	Identification of power source / plant for the OM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text.	Estimated.	Annually.	100% of set of plants.	Electronic.	Identification of plants (j, k, or n) to calculate the Operating Margin emission factors. Data will be archived 2 years following the end of the crediting period.
19.	Identification of power source / plant for the BM calculation.	Relevant dispatch center, electric power companies' public information and host country official information.	Text.	Estimated.	Annually.	100% of set of plants.	Electronic.	Identification of plants (m) to calculate the Build Margin emission factors. Data will be archived 2 years following the end of the crediting period.

20. 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.	Annually.	100%	Electronic.	Factor accounting for number of hours per year during which low-cost / must-run sources are on the margin. Data will be archived 2 years following the end of the crediting period.
21.a $GEN_{j/k/ll,y}$ IMPORTS	Electricity imports to the project electricity system.	Relevant dispatch center and host country official information.	KWh	Calculated.	Annually.	100%	Electronic.	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports. If there are no imports in the relevant system, the monitoring of this variable does not apply. Data will be archived 2 years following the end of the crediting period.

21.b $COEF_{i,j,y}$ 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.	Annually.	100%	Electronic.	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate the coefficients. If there are no imports in the relevant system, the monitoring of this variable does not apply. Data will be archived 2 years following the end of the crediting period.

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 related to the project activity would be disposed and not utilized for electric power generation. The emission reductions then, result from the avoidance of biomass open-air burning and the displacement of electric power generated with fossil fuels. According to this, the baseline emissions for year *y* can be calculated according to the following formula:

$$BL_{E,y} = BL_{E1,y} + BL_{E2,y}$$

Where:

$BL_{E,y}$: Total baseline emissions (tCO_2eq/yr).
$BL_{E1,y}$: Baseline emissions from avoided biomass disposal (tCO_2eq/yr).
$BL_{E2,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).

D.2.1.4.1 Baseline emissions from avoided biomass disposal:

The emissions from avoided biomass disposal are calculated assuming a conservative baseline scenario; that is, that the biomass is burned in the open-air. According to this, the emissions from avoided biomass disposal used by the project activity in year *y* can be calculated using equation 24 of the ACM0006 (Version 01):

$$BL_{E1,y} = GWP_{CH4} \cdot \left[\sum_i BF_{i,y} * NCV_{Biomass,i} - \frac{Q_y}{\varepsilon_{Boiler}} \right] \cdot EF_{burning,CH4,i}$$

Where:

$BL_{E1,y}$: Emissions due to natural decay or burning of anthropogenic sources of biomass during the year y (tCO_2eq/yr).
GWP_{CH4} : Global Warming Potential of methane (21 tCO_2eq/tCH_4).
$BF_{i,y}$: Biomass of type *i* used by the project activity (BDt/yr).
$NCV_{Biomass,i}$: Net calorific value of biomass fuel type i (GJ/mass or volume of biomass).
Q_y : Net quantity of heat generated in the cogeneration project plant during the year y (GJ).
ε_{Boiler} : Energy efficiency of the boiler that would be used in the absence of the project activity.
$EF_{CH4burning,i}$: CH_4 emission factor for uncontrolled burning of biomass type i (tCH_4/GJ).

Consistent with D.2.1.2 , only the biomass related to the CDM project activity will be considered for the emission reduction calculation.

D.2.1.4.2 Baseline emissions from grid-electricity displacement:

Emission reductions from grid-electricity displacement are achieved through the displacement of electricity generated by the power plants connected to the relevant grid system. The formulae presented here are taken directly from the ACM0002 (Version 06), therefore only the basic formulae and algorithms are presented here.

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

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

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

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

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

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

$$BL_{E2,y} = BE_{electricity,y} = EF_{electricity,y} * EG_y$$

Where:

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

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

This option was not chosen.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

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

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

This option was not chosen.

D.2.3. Treatment of leakage in the monitoring plan

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

ID number	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
22. $BF_{i,y}$	Amount of biomass type i for which leakage could not ruled out using one of the approaches in the baseline methodology.	Power Plant's procurement department.	Mass or volume unit.	Measured.	Annually	100%	Electronic.	The amount of biomass combusted will be collected separately for each type of biomass and will be determined based on measured data. Data will be archived 2 years following the end of the crediting period.
23.	Amount of biomass of type i fired in all grid-connected power plants in the region / country.	Host country official data (Dispatch center, statistics, relevant industry official publications, etc.).	Mass or volume unit.	Measured or calculated.	Annually.	100%	Electronic.	This parameter will be obtained from official information. If not available, the parameter will be calculated or estimated using official data. Data will be archived 2 years following the end of the crediting period.
24.	Amount of biomass of type i that is available in surplus in the	Host country official data (Dispatch center, statistics, relevant industry official	Mass or volume unit.	Measured or calculated.	Annually.	100%	Electronic.	This parameter will be obtained from official information. If not available, the parameter will be calculated or estimated using official information. The quantity of surplus

	region / country.	publications, etc.).						supply is the difference between available biomass and biomass used for other purposes than grid-connected electricity generation. Data will be archived 2 years following the end of the crediting period.
25. $COEF_{CO2,j}$	CO_2 emission factor of the most carbon intensive fuel in the calculation of the combined margin with methodology ACM0002.	Relevant dispatch center, electric power companies' public information and host country official information.	tCO_2 / mass or volume unit.	Measured or calculated	Annually.	100%	Electronic	Measured or local / national data should be preferred. Default values from the IPCC may be used alternatively. Data will be archived 2 years following the end of the crediting period.

Note: As stated in the chosen baseline and monitoring methodology for the proposed project activity, leakage emissions will be calculated and deducted only if the Trupan project activity causes other biomass-fuel consumers change to fossil fuels because of insufficient biomass supply. To do so, a "biomass surplus index" indicator will be annually calculated and monitored. If the indicator shows enough quantity of biomass available, leakage will be assumed to be zero. Other leakage emissions are not apparent from the project activity, since all detectable GHG emission sources have been included inside the project activity boundary, and are therefore, considered as project emissions.

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

The main source of potential leakage is that the project diverts biomass from other users and thereby increases fossil fuel use in the surrounding area. According to the baseline methodology applied to this project activity, there are two alternatives to estimate leakage emissions:

Alternative A: Demonstrate that the biomass consumption of the power plant will not result in increased fossil fuel consumption elsewhere. To do so, the baseline methodology presents three options:

1. Option L_1 : Show that biomass is not used at all, but burned or left for decay and that this situation would continue without the implementation of the project activity.
2. Option L_2 : Show that there is a considerable surplus of biomass in the area, which is not utilized.
3. Option L_3 : Show that biomass suppliers in the area are not able to sell all their biomass in the project area.

If the project proponent can prove the abundance of biomass through any of these options, leakage is assumed to be zero.

$$L_y = 0$$

It will be shown in subsequent sections of this PDD that the Trupan project activity does not increase the consumption of fossil fuels due to the diversion of biomass from other users in the power plant area and therefore, leakage can be assumed to be zero.

Alternative B: If the project proponent is not able to demonstrate that the biomass consumption of the power plant will not result in increased fossil fuel consumption elsewhere, then leakage must be monitored and deducted from the net project emissions. Leakage effects in year *y* are given by equation 26 of the ACM0006 (Version 01):

$$L_y = COEF_{CO2,j} \cdot \sum_i BF_{i,y} \cdot NCV_i - \frac{Q_y}{\varepsilon_{boiler}}$$

Where:

L_y : Are the leakage emissions during the year *y* in tons of CO_2.
$COEF_{CO2,j}$: Is the CO_2 emission coefficient (per an energy unit) of the most carbon intensive fuel used in the country.
$BF_{i,y}$: Is the quantity of biomass type *i* used as fuel in the project plant during the year y in a volume or mass unit.
i : Are the types of biomass for which leakage effects could not be ruled out with one of the approaches L_1, L_2 or L_3 above.
NCV_i : Net calorific value of the biomass type *i* (per volume or mass).
Q_y : Is the net quantity of heat generated in the cogeneration project plant during the year *y* in GJ.
ε_{boiler} : Is the energy efficiency of the boiler that would be used in the absence of the project

activity.

Leakage emissions are calculated for each type of biomass. For further details, please refer to the leakage section of the Consolidated Baseline Methodology for grid-connected electricity generation from biomass residues, applied to this project activity.

Other monitored data:

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
26.	Biomass moisture	Trupan biomass power plant.	%	Measured.	Continuously.	100%	Electronic.	Data will be archived 2 years following the end of the crediting period.
27.	Biomass source identification	Trupan's reception bills and CONAF dispatch bills.	N.A.	Measured.	Continuously.	100%	Electronic.	The Trupan plant only receives biomass from suppliers who declare to fully comply with the forest Chilean Law (please refer to Annex 4 of this PDD for the rationale behind proposed monitoring procedure). Data will be archived 2 years following the end of the crediting period.

Note: Variable 26 needs to be monitored in order to determine the dry biomass used in the Trupan power plant. Variable 27 must be monitored due to an indication of the Executive Board in its 24th meeting (EB24) related to the Trupan project activity.

Additional data, not monitored

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Data value	Comment
28. ε_{Boiler}	Boiler energy efficiency in the absence of the project activity.	Project proponent information, relevant publications, expert opinion in the relevant industry.	%	Estimated.	Determined once, at the beginning of the crediting period.	85%	This efficiency value was determined based on the efficiency calculation of a real low-pressure boiler installed in one of the Arauco industrial facilities. The efficiency was calculated in accordance with the ASME PTC 4.1 Norm and was further validated with an expert opinion from a highly reputed consulting company, in the field of heat and power generation.

Note: Variable 28 was incorporated due to an indication of the Executive Board in its 38th meeting (EB38).

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

$$PNE_y = (BL_{E1,y} + BL_{E2,y}) - (P_{E1,y} + P_{E2,y} + P_{E3,y} + P_{E4,y}) - L_y$$

Where:

$BL_{E1,y}$: Baseline emissions from avoided biomass disposal (tCO_2eq/yr).
$BL_{E2,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).

$P_{E1,y}$: Project emissions from biomass controlled burning in the Power Plant (tCO_2eq/yr).
$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO_2/yr).
$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Power Plant (tCO_2/yr).

L_y : Are the leakage emissions (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, 22	Low	Any direct measurements with mass or volume meters at the plant site should be cross-checked with an annual energy balance that is based in purchased quantities and stock changes.
2	Low	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
3, 6, 8, 16, 21.b, 25	Low (CO_2) / Medium (CH_4)	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
4	Low	Check consistency of the monitored data with information provided by the transportation companies, road maps and / or other sources.
5	Low	Equipment used to measure the truck's capacities will receive calibration and maintenance according to proper industry standards.
7, 9	Low	Total quantities of fossil fuel consumption will be checked with purchase receipts whenever possible and available. Flow meters will receive proper maintenance and calibration. Front loaders fuel consumption will be crosschecked against hourly fuel consumption rates.
10	Low	The electricity meters will undergo maintenance / calibration according to proper industry standards. The accuracy of the meter readings for electricity sold to the grid will be verified by receipts issued by the purchasing power company and / or the corresponding dispatch center. The consistency of metered net electricity generation should be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years).
11	Low	All instruments used to determine the amount of heat generated by the cogeneration plant will receive maintenance and calibration according to proper industry standards. The consistency of metered net heat generation should be crosschecked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the net heat generation divided by the quantity of biomass fired results in a reasonable thermal efficiency that is comparable to previous years).
12, 13, 14, 15, 17, 18, 19, 20, 21.a	Low	Default data (for emission factors) and IEA statistics (for energy statistics) are used to check the local data.
23, 24	Medium	Where possible, supplementary data sources and expert judgment should be used to support findings.
26	Low	Scales used to determine the biomass moisture will receive proper maintenance and calibration according to the user manual.
27	Low	Quality control and assurance of this variable relies on the enforcement of the outstanding law pertinent to the forestry sector in Chile. Please refer to Annex Nº4 of this PDD for further explanations and details.

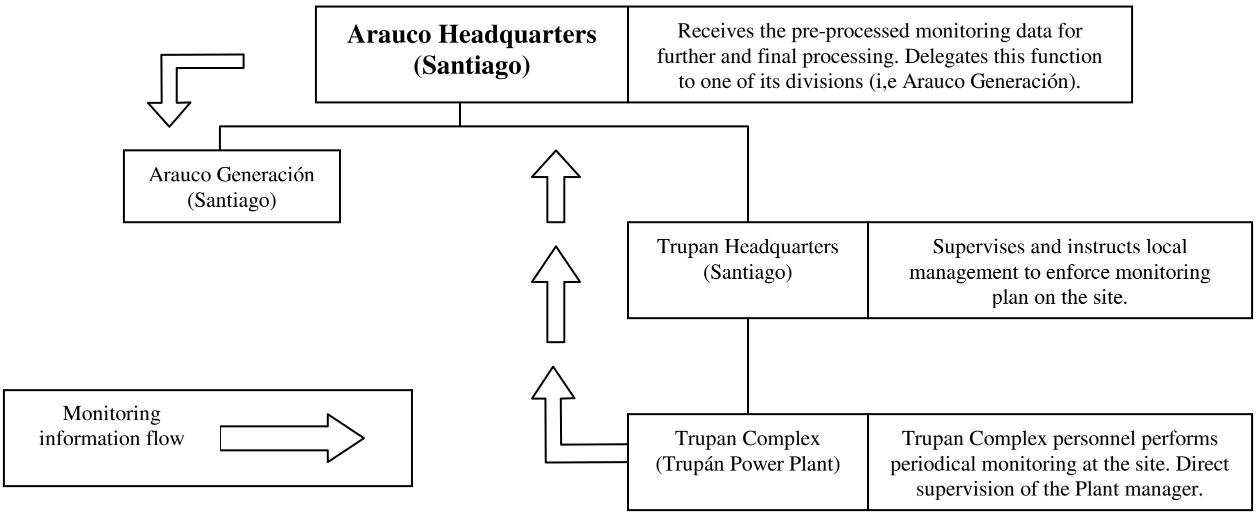
28	Low	The selected efficiency value will be checked with an expert opinion in the corresponding industry. This factor, however, will be determined at the beginning of the first crediting period.

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 and leakage effects 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 Trupan project activity periodically (i.e. once every year).

Monitoring information flow of Trupan Project activity



It must be noted that the above structure is subject to minor modifications, once monitoring procedure is implemented.

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 Trupan, 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.