VIÑALES BIOMASS POWER PLANT

Document Prepared by Forestal Arauco S.A.

Project Title	Viñales biomass power plant
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Viñales power plant, located in the Viñales sawmill site of Celulosa Arauco y Constitución S.A. (from now on, Arauco)) consists of a 41 MW condensing-extracting turbo generator machine and a biomass fluidized-bed boiler of 210 ton/hr of high pressure steam capacity: The heat is used in the Viñales sawmill for wood-drying and part of the electric power is used in Viñales sawmill. The remaining electric power is injected in the SIC (Central interconnected system) grid for sale.

The project activity is designed to use own and third party biomass for steam and electric power generation. Biomass from industrial and forestry operations in Chile would be normally dumped in piles for natural decay.

The used technology for generating megawatt (MW) levels of electricity from biomass is the steam-Rankine cycle which involves heating pressurized water, with the resulting steam expanding to drive a turbine, 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 the flue gases to preheat combustion air, and a deaerator must be used to remove dissolved oxygen from water before it enters the boiler.

The project activity assists Chile's sustainable growth by providing electricity to the Viñales sawmill and to the SIC through biomass power generation, which is a clean and renewable energy source. Using the available natural resources in a rational way, the Viñales project activity helps promote 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 project activity is a good example to demonstrate the viability of electricity generation as a source of revenue not only in the Plywood and Sawmill industries, but in all forest-related industries.

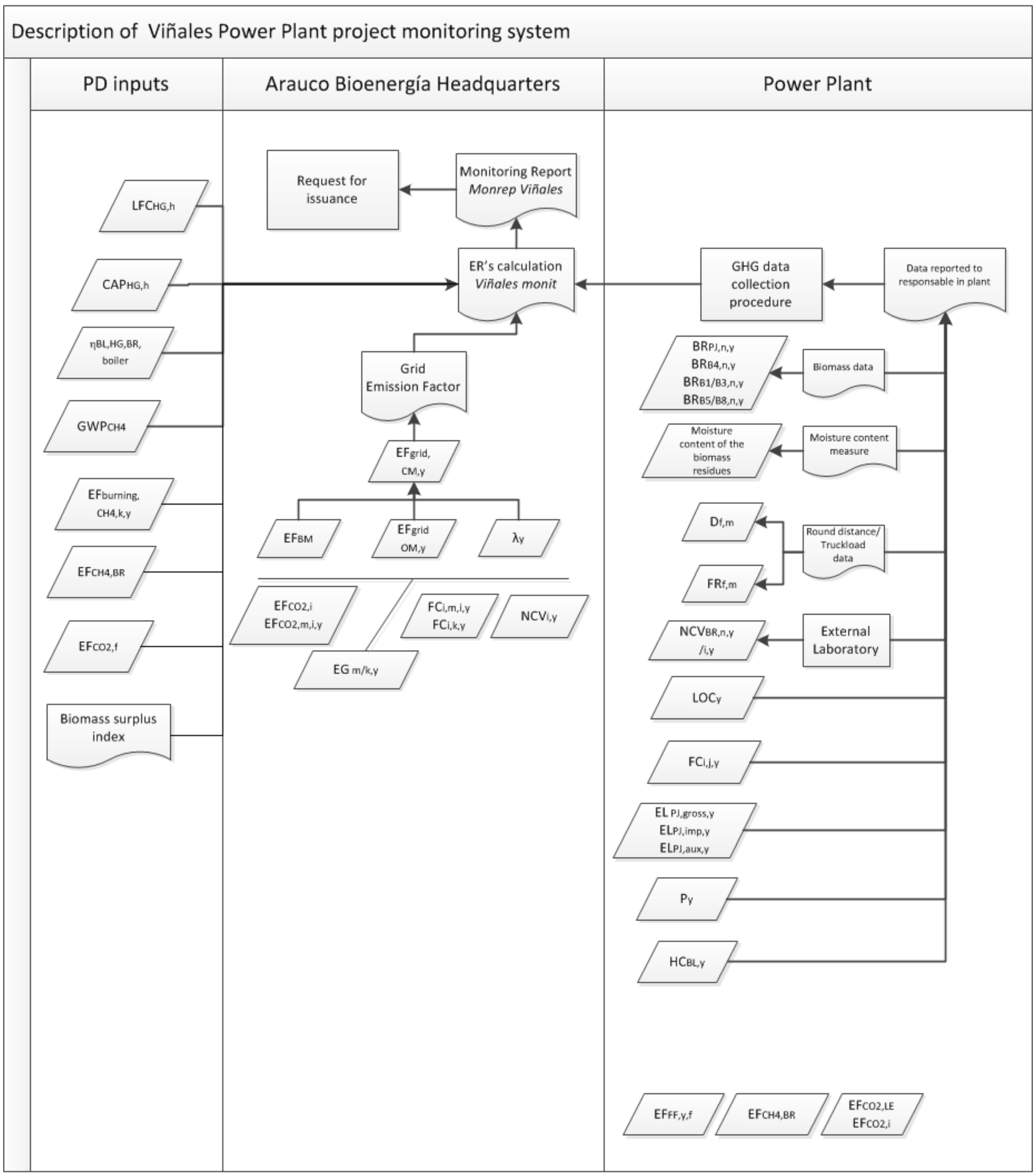
Relevant dates for the project activity:

Audit Type	Period	Program	VVB Name	Number of years
Validation	Date of issue 17 June 2013	VCS/VERRA	DNV Climate change Services AS	-
Verification	01/07/2014-31/12/2014	VCS/VERRA	LGAI TECHNOLOGICAL CENTER, S.A: (APPLUS)	6 months
Verification	01/01/2015-31/12/2016	VCS/VERRA	LGAI TECHNOLOGICAL CENTER, S.A: (APPLUS)	2 years
Verification	01/01/2017-31/12/2020	VCS/VERRA	ESPL	4 years

Date (DD/MM/YY)	Key events
January, 2010	Construction start date
July, 2012	Commissioning date

The total net emission reductions claimed in the 3rd monitoring period (from January 1st, 2017, to December 31st 2020) are 823,322 tCO2e.

The Project Participant has implemented monitoring procedures per the monitoring methodology chosen for this project activity. This monitoring methodology accounts for emission reductions in an accurate and conservative manner. The following diagram includes data collection procedure as: Data Parameters as HCBL,y, ELPJ,gross,y, ELPJ,imp,y, ELPJ,aux,y, Df,m, FCi,j,y, BRPJ,n,y, BRB4,n,y, BRB1/B3,n,y and BRB5/B8,n,y are aggregated in excel files to obtain a monthly value that is reported in the emission reductions calculation file. All data is recorded in electronic tapes and archived two years following the end of the crediting period as is specified in the defined monitoring plan.



Even though during this monitoring period there were no emergency situations, the monitoring data management system defined in all the procedures the possibility of emergency occurrences (for example, IT failure system). The on-site personnel were instructed to inform opportunely any inconvenient with the monitoring system or the monitoring instrument. Viñales power plant counts with a qualified electronic control area, which were the responsible of the continuity operation of the monitoring instruments.

1.2 Sectoral Scope and Project Type

The Viñales biomass power plant is a renewable energy supply side grid-connected project activity. It involves reduction of emission of greenhouse gases in the sector; more specifically, reduction of greenhouse gas emission sources from fuel combustion in energy industries, according to the list of sector/source categories indicated in Annex A of the Kyoto Protocol. The Viñales project activity is not a grouped project activity.

1.3 Project Proponent

Provide contact information for the project proponent(s). Copy and paste the table as needed.

Organization name	Celulosa Arauco y Constitución S.A.
Contact person	Mr. Christian Rodriguez
Title	Head of Climate Change.
Address	El Golf Ave. 150, 7th floor, Las Condes, Santiago, Chile.
Telephone	56-2-2462 3888
Email	christian.rodriguez@arauco.com

1.4 Other Entities Involved in the Project

Celulosa Arauco y Constitución S.A. is the project participant. The Maderas Arauco S.A." is the company responsible for signing contract and Arauco Bioenergia S.A. is responsible for the development of the project, lead annual Verifications and Validations preparing and updating all documents requested.

Organization name	Maderas Arauco SA..
Role in the Project	Project Participant
Contact person	Christian Rodríguez
Title	Head of Climate Change
Address	El Golf Ave. 150, 7th floor, Las Condes, Santiago, Chile.
Telephone	56-2-2462 3888

Email	christian.rodriguez@arauco.com

1.5 Project Start Date

19/05/2012

This is the date in which the Viñales power plant started generating electric power.

1.6 Project Crediting Period

The current PD indicates that the project crediting period start date is 01/01/2014. The first crediting period will last for 10 years, until 31/12/2023, and will be renewed 2 times, adding up to 30 years in total (3 x 10 years).

1.7 Project Location

The project activity is located in Km. 5 of the M-50 road to Chanco, commune of Constitución in Maule Region. The nearest city is Constitución, located 3 Km. away from the new power plant.

The project activity coordinates in decimals are provided the table below:

Latitude	Longitude
-35.371°	-72.412°

1.8 Title and Reference of Methodology

The name of the approved baseline methodology applied to the proposed project activity is: ACM0006 (Version 12.1.1): "Consolidated methodology for electricity and heat generation from biomass".

The baseline methodology of the project activity also relies on the following methodological tools:

- *"Tool05 to calculate the emission factor for an electricity factor for an electricity system (Version 03.0.0)"*
- *"Tool03 to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02)"*
- *"Tool09 to determine* the baseline efficiency of thermal or electric energy generation systems (Version 01)"
- "Tool01 for the demonstration and assessment of additionality (Version 7.0.0)".
- "Tool05 to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)"
- "Tool12 for project and leakage emissions from transportation of freight (Version 1.1)".

1.9 Participation under other GHG Programs

- Emissions Trading Programs and other Bindings Limits: The emission reductions associated to the Viñales project have not been used for compliance in any other emission trading program or to meet any kind of binding limits on GHG emissions during the current verification process.

- Participation under Other GHG Programs: The Viñales project participated in the ERNC market, created under the Law N°20.257, April, 2008 and therefore generated non-conventional energy certificates. Law N°20.257, to promote the non-conventional renewable energy in Chile, requires that from the beginning of the year 2010 the energy companies of our country with installed capacity of over 200 MW must certify that an amount of energy equivalent to 10% of their own consumption in each year has been injected by non-conventional renewable generation sources, these may be their own or contracted. The law allows an energy company to transfer its surplus to another energy company, and it may be even among companies of different electrical systems.

  As is possible to observe Law N°20.257 and the non-conventional energy certificates are referenced to energy consumption and transferences between energy companies is a non-GHG related environmental mechanism, so there are no double-counting issues involved with the VCS program in this case.

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

- Other Forms of Environmental Credit: The Viñales project is not involved to any other form of GHG-related environmental credit for GHG emission reductions or removals other than the VCS Program.

  The project consists of generating clean energy from residual biomass, generated by the manufacturing processes of forestry products.

  The project activity is cogeneration type, part of this energy feeds the Viñales manufacturing processes of forestry product, in this case melamine. The surplus of this clean electricity sold to the grid is eligible to claim emission reductions certificates, thereby displacing energy that would have been generated by the mix of generation sources connected to the grid.

1.11 Sustainable Development Contributions

The project activity is located in Km. 5 of the M-50 road to Chanco, commune of Constitución in the Maule Region. The nearest city is Constitución, located 3 Km away from the new power plant.

The Viñales power plant consists of a biomass fluidized-bed boiler of 210 ton/hr of high-pressure steam capacity and a 41 MW condensing-extracting turbo generator machine. The plant uses the Rankine cycle to cogenerate heat (steam) and electric power in the Viñales sawmill site. The heat is used in the Viñales sawmill for wood-drying while a fraction of the electric power is also used in the Viñales sawmill. The remaining electric power is injected in the SIC grid for sale.

The predominant technology in all parts of 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 project activity assists Chile's sustainable growth by providing electricity to the Viñales sawmill and to the local grid through renewable biomass power generation. Without the Viñales project activity, not only there would be no new clean energy injection to the local grid, but the Viñales sawmill would continue sourcing its electric power requirements from the grid. In addition, this project accomplishes an additional greenhouse (GHG) reduction benefit derived from a reduced disposal or uncontrolled burning of biomass residues, which results in lower methane emissions to the atmosphere.

As a result of the project activity, the main contributions to the SDGs are the reduction of GHG, as stated earlier, the total renewable electricity produced, the increase in the total number of jobs, and the number of employees who earn above the local minimum wage.

Table 1.11: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
Sequential row number	SDG Target number	Number and text of SDG indicator or, if no official SDG indicator is applicable, user-defined indicator	Indicate the project's contribution to the SDG Indicator (implemented activities to increase or decrease)	Brief description of the quantifiable impact of the project's activities related to the SDG indicator, during the monitoring period.	Brief description of the cumulative quantifiable impact of the project's activities related to the SDG indicator, over the project lifetime.
1)	13.0	Tones of greenhouse gas emissions avoided or removed	Implemented activities to increase	In previous monitoring periods the project avoided GHG emissions of 602,894 tCO2. The project avoided anthropogenic emissions of greenhouse gases (GHG) of 823,322 tCO_2 during the reporting period (01-Jan-2017 to 31-Dec-2020).	Over the project lifetime it has avoided anthropogenic greenhouse gases emissions (GHG) of 1,426,216 tCO_2e.

2)	7.2	User-defined indicator Total renewable energy produced	Implemented activities to increase	The project activity produced a total amount of electricity of 604,001 MWh from biomass during the previous reporting periods. The project activity produced 1,027,40 MWh from biomass during the reporting period (01-Jan-2017 to 31-Dec-2020').	Over the project lifetime it has contributed to the production of 1,631,409 MWh of renewable electricity
3)	8.5	User-defined indicator Total number of jobs	Implemented activities to increase	In the reporting period the project employed 92 (2017), 106 (2018), 103 (2019) and 96 (2020)	The project activity has increased the total number of jobs to 99 (*) collaborators during its lifetime (*) average number of collaborators in the reporting period.
4)	8.5	User-defined indicator Total number of employees earning above local minimum wage	Implemented activities to increase	The total number of employees involved in the project activity (100%) earn a wage above local minimum wage (in accordance with the Law 20.763).	Over the lifetime of the project activity provided wages above local minimum wage to all employees.

2 SAFEGUARDS

2.1 No Net Harm

We do not have any complaints or claims for a bioenergy plant in our records.
Complaints are always channeled through social networks (mainly Facebook) or also through goal calls to the direct numbers of Public Affairs.

In a biomass boiler, there is a low risk of unpleasant odors associated with handling mud, bark or field sweepings. However, measurements are taken to mitigate any potential risks. One mitigation measure is to consume the bark daily, rather than storing it in piles. Field sweepings should also be removed monthly.

There is a risk of failure in atmospheric emissions control systems such as filters, cyclones, and electrostatic precipitators. To mitigate this risk, the electrostatic precipitator should be maintained during the annual plant shutdown. In the event of a failure, the boiler should be shut down, and personnel should be instructed accordingly.

In the boiler diesel oil tank or diesel circuit, there is a risk of spills. To mitigate this risk, a spill battery is installed in the pond area with appropriate absorbent materials.

2.2 Local Stakeholder Consultation

Viñales has been actively engaging with the local communities and has received positive feedback regarding the benefits that the project has generated. The communities have been able to reap the rewards of the project through education, training, and infrastructure improvements, which have all contributed to a better quality of life. The project has continuously maintained open communication and active participation with the communities, which has further strengthened their relationship.

Community:

The purpose of the Company’s Local Development Strategy is to contribute to the development of local communities, developing iniciatives that generate mutual benefit through a model based on dialogue and participation. In Chile, areas of work for contributing to local development have been defined that cover a wide range of programs:

• Education and Training: Arauco firmly believe that education is a key factor in the development of a nation. In Chile, ARAUCO provides management and financial support for schools Arauco, Constitución and Cholguan, three educational institutions known at the national level for their excellent academic results. In addition, the company supports Fundación Belén Educa, an organization providing subsidized education for more than 8,000 students in their seven schools. Arauco also make a significant contribution through Arauco Educational Foundation, which for over 20 years has helped provide quality education to 94,700 students in public schools.

• Infrastructure and Improving the quality of life: At Arauco we are convinced that the home is where the family puts down roots and plans their future. Therefore, the Company has decided to promote access to housing for its employees, the collaborators who works for our service providers, and families in the Company's area of influence. This is achieved through technical support in the process of applying for public subsidies, financial support for hiring expert third parties to develop projects, locating and technically evaluating land for housing purposes, and cooperation and partnerships with diverse public and private bodies for the generation of quality housing solutions.
Through the program of improving life's quality the Company seeks to bring practical knowledge to the neighbouring communities around Arauco-managed forest areas that will allow them to improve their daily life.
• Participation and dialogue: Ongoing dialogue is required for Company-community relations over the long term. In Chile, an example of how these principles are reflected is the Participation and Community Consultation Guide, which discusses how to carry out participatory processes of recording and controlling the impact of our operations to forests. To maintain fluid communication with the Company's different public interest groups, facilitating the dissemination of information of interest and the timely receipt of queries and concerns, Arauco has actively developed and managed diverse channels, platforms and tools. Hotlines, websites, e-mail addresses and social media accounts on Facebook, YouTube, Flickr and Twitter are all available to the public.
• Corporate Policy on Mapuche Community Relations: Through this policy, Arauco is committed to learning about and respecting the Mapuche culture, establishing a complete program of training, recognition, dialogue and collaboration. The Mapuche culture is recognized as an ancient culture living in the present: relationship between the Mapuche people and land is a culture of nature. The Company has embraced the commitments of promoting mutual knowledge, maintaining channels of participation, identifying and preserving sites of cultural interest, and opening a dialogue with respect to land requirements.

Occupational Health and Safety:

At ARAUCO, the safety of our people always comes first. This commitment includes anticipating any and all actions that may be detrimental to the safety of our workers, in order to minimize the risk of accidents. Leadership means putting safety first in all decisions, thus mitigating risks from the start, incorporating lessons learned, simplifying and improving processes, and always giving recognition to people who show outstanding behavior in terms of safety. A Culture of Prevention means that our workers understand that a safe job is a job well done, and that their compliance with safety procedures and key rules is non-negotiable. Based on this solid foundation, ARAUCO is committed to providing its workers with a safe workplace environment, as well as all the tools, equipment and training necessary to perform their activities in a healthy and safe manner.

Corporate Commitments with Outside Initiatives:

Arauco recognizes the value of working in partnership with other actors, particularly when it comes to complex challenges with multiple points of view. The Company has a permanent relationship with academic institutions, NGO's and trade unions with which it seeks to expand its efforts in various networks and multi-sectoral cooperation, as:

- Santiago Climate Exchange
- Forest Footprint Disclosure (of the Global Canopy Project)
- Center for Business Sustainability (CBS) of Universidad Adolfo Ibañez
- UN Global Compact
- Prohumana
- AccionRSE
- Shared Value Initiative
- Unidos por la Primera Infancia

2.3 AFOLU-Specific Safeguards

n/a

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

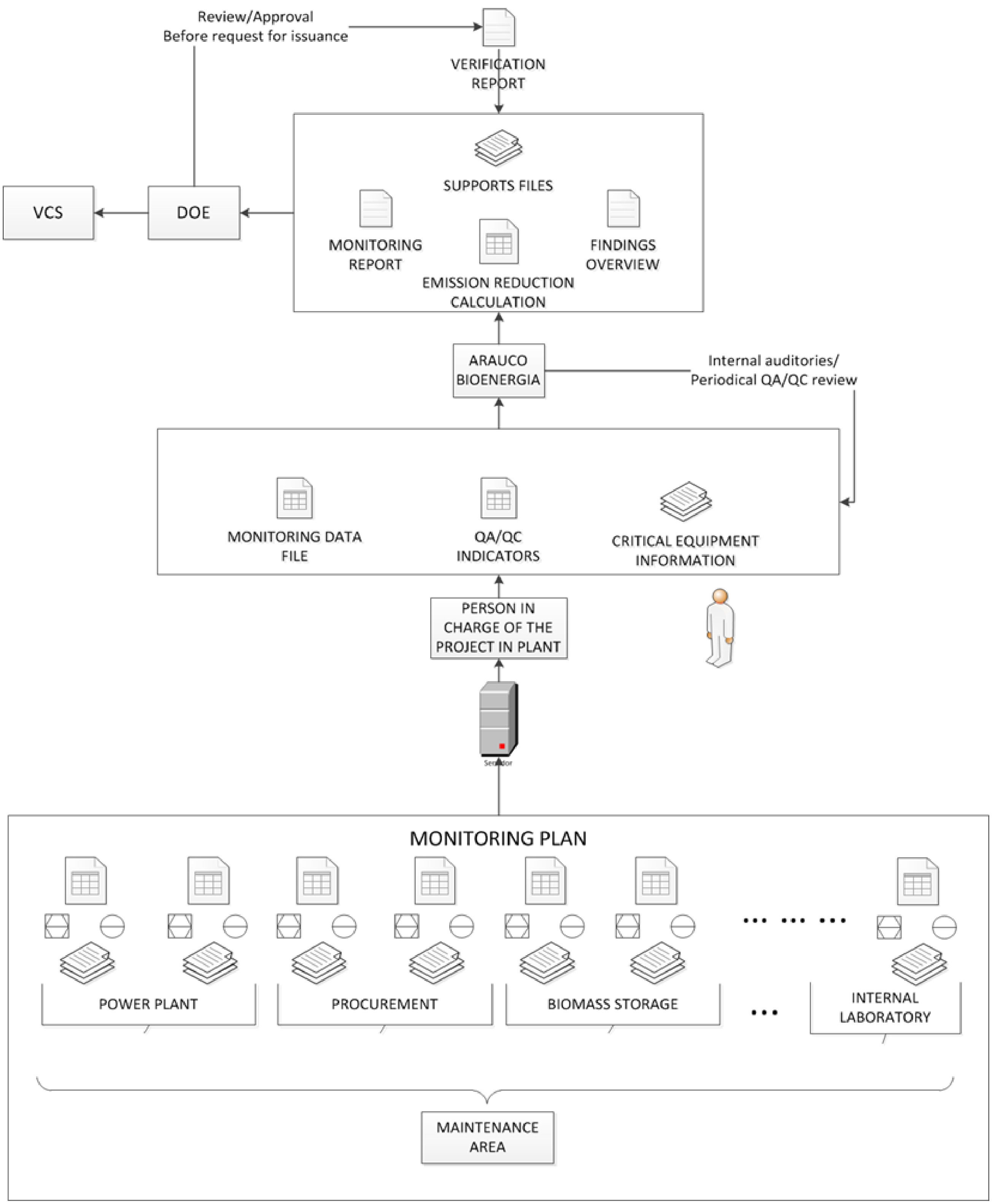
About the operation of the project activity(s) during this monitoring period, the Arauco cogeneration plant has been running smoothly and efficiently, with no major operational issues. We are grateful that it has not been affected by the fires that occurred during the summer. Although there have been some periods of residual forest biomass shortage, which is used to fuel the cogeneration boiler, we have been successfully managing the situation.

Regarding the data monitoring, the project team has been meticulously monitoring the plant's performance, and we are confident that the collected data is accurate and reliable. There have been no recorded events that have impacted the collection of monitoring data used in the project, and the primary parameters have been continuously recorded. With no significant gaps identified in instrument calibrations and a maintenance plan that has been thoroughly followed, we can assure you that the data reliability is unquestionable.

The project participant has followed the procedures implemented per the monitoring methodology chosen, ACM0006 Version 12.1.1. The project activity counted with on-site personnel (at the project activity site), who oversee gathering and registering all the required information described in the monitoring plan. Such duties were incorporated to the personnel’s everyday activities to ensure continuity and high-quality standards. Quantity of biomass used, fossil fuel consumption and net quantity of electricity generated data was monitored continuously and automatically by the Data Control System (DCS). The data was recorded daily and then was aggregated monthly.

The information was partially processed and stored on-site, and sent periodically (monthly) to Arauco Forestry S.A. in Santiago for further and final processing (table formats, reports, etc.). With the information at this level, Arauco carries out the external verifications to verify the emission reduction of the Viñales Power Plant project activity periodically (i.e. once every year). The following diagram shows the monitoring information flow implemented by Arauco Forestry S.A. for the project activity generation, calculation and reporting.

POWER PLANT



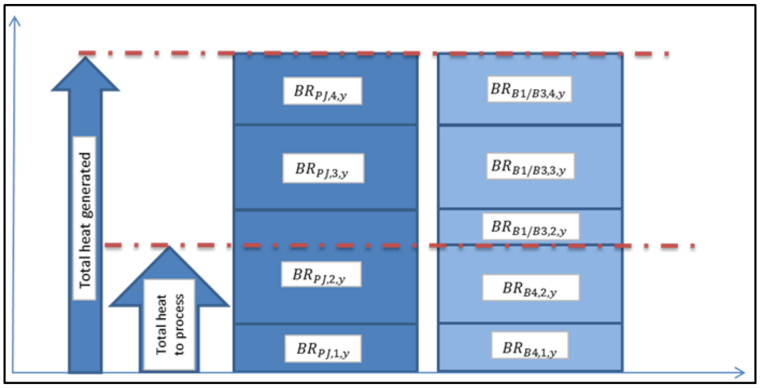
Review/Approval
Before request for issuance
VERIFICATION REPORT
SUPPORTS FILES
VCS
DOE
MONITORING REPORT
EMISSION REDUCTION CALCULATION
FINDINGS OVERVIEW
ARAUCO BIOENERGIA
Internal auditories/
Periodical QA/QC review
MONITORING DATA FILE
QA/QC INDICATORS
CRITICAL EQUIPMENT INFORMATION
PERSON IN CHARGE OF THE PROJECT IN PLANT
MONITORING PLAN
POWER PLANT
PROCUREMENT
BIOMASS STORAGE
INTERNAL LABORATORY
MAINTENANCE AREA

	N° days	Total hrs	Availability hrs	Trips hrs	Availability per month Power plant (%)
Jan-17	31	744	591.0	153.0	79.4%
Fen-17	28	672	627.8	44.2	93.4%
mar-17	31	744	722.3	21.7	97.1%
abr-17	30	720	720.0	0.0	100.0%
may-17	31	744	744.0	0.0	100.0%
jun-17	30	720	699.9	20.1	97.2%
jul-17	31	744	730.8	13.2	98.2%
ago-17	31	744	741.8	2.2	99.7%
sept-17	30	720	716.7	3.3	99.5%
oct-17	31	744	735.8	8.2	98.9%
nov-17	30	480	350.9	129.1	73.1%
dic-17	31	744	677.8	66.2	91.1%
ene-18	31	744	743.1	0.95	99.9%
feb-18	28	672	672.0	0	100.0%
mar-18	31	744	744.0	0	100.0%
abr-18	30	720	704.6	15.42	97.9%
may-18	31	744	717.0	26.99	96.4%
jun-18	30	720	719.2	0.8	99.9%
jul-18	31	744	728.7	15.27	97.9%
ago-18	31	744	741.2	2.82	99.6%
sept-18	30	720	718.2	1.8	99.8%
oct-18	31	744	744.0	0	100.0%
nov-18	30	480	410.8	69.22	85.6%
dic-18	31	744	695.3	48.73	93.5%
ene-19	31	744	737.1	6.92	99.1%
feb-19	28	672	664.8	7.25	98.9%
mar-19	31	744	744.0	0	100.0%
abr-19	30	720	704.9	15.1	97.9%
may-19	31	744	739.5	4.53	99.4%
jun-19	30	720	720.0	0	100.0%
jul-19	31	744	692.6	51.43	93.1%
ago-19	31	744	741.5	2.53	99.7%
sept-19	30	720	718.6	1.42	99.8%
oct-19	31	744	744.0	0	100.0%
nov-19	30	456	438.3	17.68	96.1%
dic-19	31	744	689.7	54.26	92.7%
ene-20	31	744	737.4	6.65	99.1%
feb-20	29	696	687.2	8.83	98.7%
mar-20	31	744	736.6	7.39	99.0%
abr-20	30	720	719.3	0.75	99.9%

may-20	31	744	744.0	0	100.0%
jun-20	30	720	720.0	0	100.0%
jul-20	31	744	723.3	20.7	97.2%
ago-20	31	744	744.0	0	100.0%
sept-20	30	720	720.0	0	100.0%
oct-20	31	744	735.3	8.75	98.8%
nov-20	30	456	452.3	3.7	99.2%
dic-20	31	744	735.9	8.15	98.9%

Biomass management was implemented according to description in 4.2 Data and Parameters Monitored . The use of biomass residues was always prioritized overuse of any fossil fuels. The saturated steam biomass boiler has run on the B4 baseline scenario biomass (sawdust and bark from industrial operations) as shows the following diagram:

Biomass consumption in priority order according PD.



First column represent the total quantity of biomass combusted category n to obtain the total heat generated ($BR_{PJ,n,y}$). Second column represent the total quantity of biomass combusted according defined scenarios.

The above diagram indicates the order to combust biomass in power boiler. First biomass to be combusted is used to generate heat to process. Once the heat to process is provided, the rest of the combusted biomass generates energy power: first for satisfied plants demand, then to export the surplus to the grid.

The Power Plant chief estimates and designs a yearly consumption plan for the power boiler. Then, Biomass Chief determines the yearly biomass requirements. As a first step, the Biomass Chief checks biomass residues provisions in Viñales, El Cruce and remanufacture Sawmills[1]. The quantity of biomass residues that cannot be provided by these sawmills is ordered from Forestal Arauco, a

[1] Viñales and Remanufacture sawmills are part of Viñales project's boundaries. El Cruce Sawmill is part of Celulosa Arauco but for project purpose is considered third party biomass.

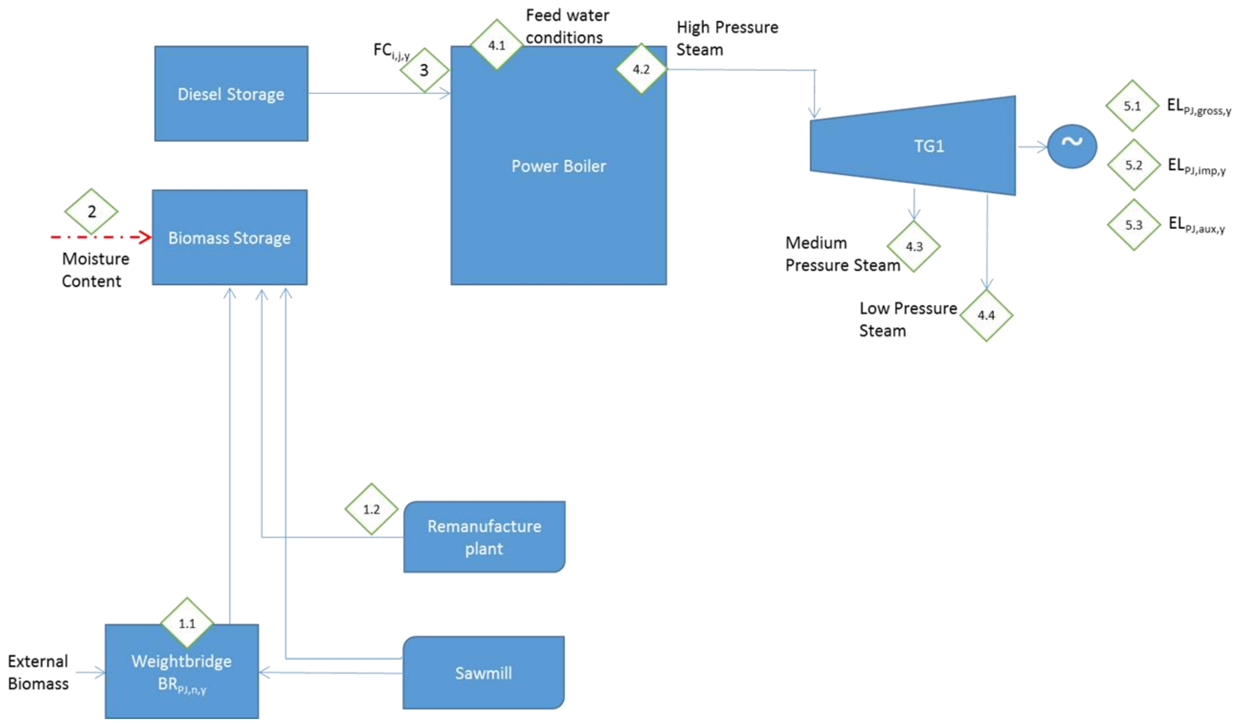
subsidiary of Celulosa Arauco in charge of biomass supply to mills. Forestal Arauco proposes a supply plan that is assessed by the Viñales Biomass Chief through an on-site inspection (checking biomass source and absence of chemical contamination). In this inspection, the Biomass Chief measures the distance between suppliers and the power plant. If the inspection yields a positive result, the third-party supplier is approved. Every biomass residue dispatch is checked at the Power Plant entrance from then on.

Project Participant was implemented a Monitoring plan per methodology ACM0006 version 12.1.1 and Project description document (PD) version 03. The following diagram below shows all the relevant monitoring points in Power plant, including the instruments used to measure the variables that are part of the monitoring plan

The Project Participant presents information about the operation of the project activity occurred during this monitoring period i.e. shutdowns/stoppages due to regular maintenance program and irregular stoppages. The events identified are listed below:

Changes in TAG between PD and installed equipment:

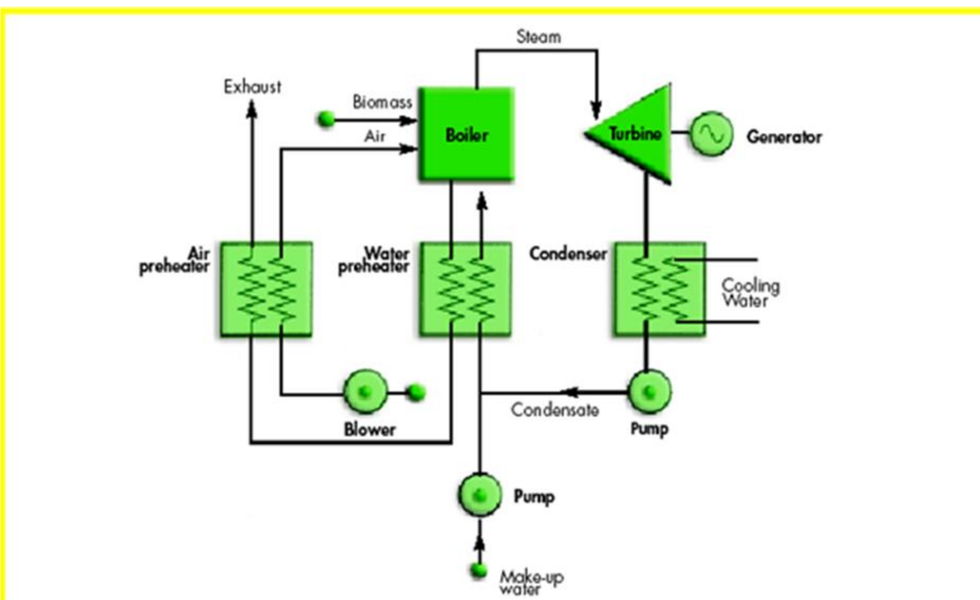
No changes registered.



The predominant technology in all parts of 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.

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 vapor 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. 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.

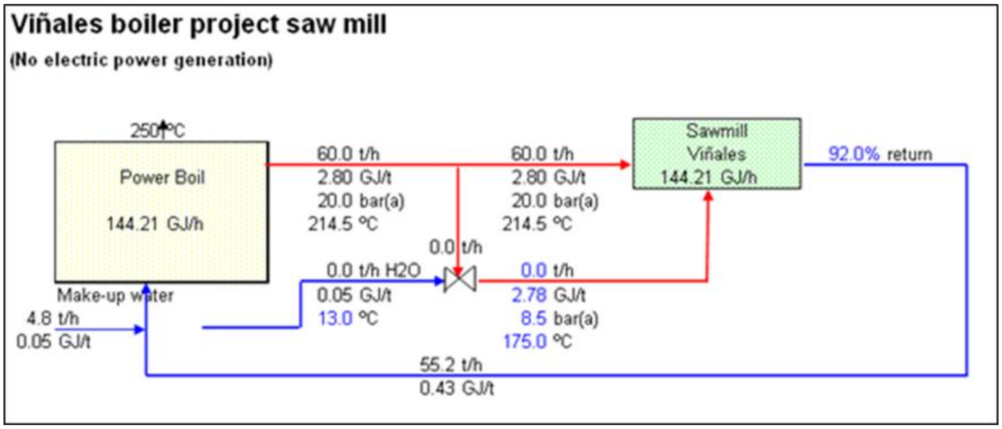
Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extracting steam turbine.



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

The following diagrams show the power generation situation under a BAU (Business-As-Usual) situation, without investment in additional power generation capacity.

The Viñales project without power cogeneration



3.2 Deviations

3.1.1 Methodology Deviations

Not applicable.

3.1.2 Project Description Deviations

Crediting period starting date:

The baseline methodology applied to the VCS Viñales project clearly states that moisture content of the biomass residues (directly associated with the calculation of biomass residues on a dry-basis) must be measured on-site and for each batch of biomass of homogeneous quality (page 67 of ACM0006/Version 12.1.1).

Due to logistic and administrative issues, Viñales Power plant took some time to implement a laboratory on-site to monitor the moisture content of the different biomass types, which started to measure from July 2014. Project Participant present a deviation to current PD and proposed a change in the starting date from 01/01/2014 to 01/07/2014. The reasons to delay the star date are:

1) The impossibility to measure directly all monitoring parameters would have compromised seriously the possibility of the project activity to generate CERs since this constitutes a direct non-compliance of the monitoring plan.

2) The impossibility to check the consistency of direct measurement of all monitored parameters as per procedure would have compromised the possibility of the project and generate a direct non-compliance of the standards of the monitoring plan.

Then, project start date was accepted by the VCS, and it change as follows:

	From	To
Star date 1st crediting period	01/01/2014	01/07/2014
Finish date 1st crediting period	31/12/2023	30/06/2024

Is important to emphasize that crediting period start date change does not affect the defined project initial conditions:

- Viñales power plant still is a Greenfield project, only biomass residues are used in the project plant, fossil fuels co-fired in the power boiler does not exceed the 80% of the total fuel, the implementation of the project does not result in an increase of the processing capacity, biomass residues used as fuel came from forestry or industrial operations and no chemical process is involved and biomass residues are not stored for more than one year. In conclusion, the applicability of the methodology ACM0006 Version 12.1.1 has not been modified.
- As was described in current PD Viñales biomass power plant project activity is not considered to be part of the common practice in the relevant and comparable industry (ies) in Chile and therefore, considered additional from a common practice analysis perspective. Additionality was not impacted by starting date change.

- Viñales project has not modified their project boundaries, then the definition of the baseline scenarios is the same defined in current PD. Appropriateness of the baseline scenario has not been impacted.

3.3 Grouped Projects

Not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Biomass residues categories and quantities used for the selection of the baseline scenario and assessment of additionality.
Data unit	(tCO2e/tCH4)
Description	The biomass quantities provided in the table below were determined ex-ante in accordance with the pulp mill project studies.
Source of data	On-site assessment of biomass residues categories and quantities.
Value applied	

Biomass residue category k	Biomass residue type	Biomass residue source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (dry tonnes/yr)
1	Sawdust and bark from industrial operations.	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	65,417
2	Sawdust and bark from industrial operations.	On-site production	Dumped and/or burned in the open air (B1: and/or B3:).	Heat and power generation on-site (biomass-only boiler)	83,786
3	Sawdust and bark from industrial operations.	Off-site production	Dumped and/or burned in the open air (B1:	Heat and power generation on-site (biomass-	128,052

				and/or B3:).	only boiler)	
	4	Biomass from forestry operations.	Off-site production	Dumped and/or burned in the open air (B1: and/or B3:).	Heat and power generation on-site (biomass-only boiler)	35,500
Justification of choice of data or description of measurement methods and procedures applied	The project Proponent hired reputed consultants for the development of the new power plant and the estimation ex-ante of the biomass types and quantities.					
Purpose of Data	• Baseline, project and leakage emissions.					
Comments	This parameter is related to the procedure for the selection of the baseline selection and assessment of additionality.					

Data / Parameter	Px
Data unit	cubic meters
Description	Quantity of the main product of the production process produced in year x from plants operated at the project site.
Source of data	On-site measurements.
Value applied	352,686 m3/yr of sawn timber from the sawmill
Justification of choice of data or description of measurement methods and procedures applied	88,203 m3/yr of processed wood products from the remanufacture plant.
Purpose of Data	Average between the productions of 2012 and 2013 is used respectively.
Comments	*Provide any additional comments*

Data / Parameter	$CAP_{HG,h}$
Data unit	(GJ/h)
Description	Baseline capacity of heat generator h (GJ/h)

Source of data	Reference plant design parameters.
Value applied	210 (GJ/h)
Justification of choice of data or description of measurement methods and procedures applied	This parameter reflects the design maximum heat generation capacity (in GJ/h) of the baseline heat generation h. This parameter was determined by Arauco based on its previous experience with saturated heat generators in other sawmills and on the Viñales sawmill heat requirements.
Purpose of Data	Calculation of baseline emissions
Comments	--

Data / Parameter	$LFC_{HG,h}$
Data unit	Ratio
Description	Baseline load factor of heat generator h (ratio).
Source of data	Reference plant design parameters.
Value applied	90%
Justification of choice of data or description of measurement methods and procedures applied	This parameter reflects the maximum load factor (i.e the ratio between the "actual heat generation" of the heat generator and its "design maximum heat generation" along one year of operation) of the baseline heat generator h, taking into account downtime due to maintenance, seasonal operational patterns and any other technical constraints. In this case, this parameter was determined from the baseline study carried out for the Viñales project and other similar/comparable projects in other Arauco sawmill facilities.
Purpose of Data	Calculation of baseline emissions
Comments	--

Data / Parameter	GWP_{CH4}
Data unit	(tCO2e/tCH4)
Description	Global Warming Potential of methane valid for the commitment period (tCO2/tCH4)
Source of data	IPCC Fourth Assessment Report (2007)
Value applied	25 for the second commitment period. Shall be updated according to any future update.
Justification of choice of data or description of	Until the next COP/MOP decision, it is the accepted value for emission reduction calculations.

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	---

Data / Parameter	EFburning, CH4,k,y
Data unit	(tCH4/GJ)
Description	CH4 emission factor for uncontrolled burning of the biomass residue type k during year y.
Source of data	Direct measurement before the start of the project activity.
Value applied	Biomass residues from industrial operations (mainly sawdust and bark from sawmills): 0.0008742 (tCH4/GJ) or 874.2 (Kg CH4/TJ). This value includes the adjustment of a conservativeness factor of 0.94. Biomass residues from forestry operations (mainly branches from harvesting, pruning and thinning operations): 0.00010146 (tCH4/GJ) or 101.46 (Kg CH4/TJ). This value includes the adjustment of a conservativeness factor of 0.89.
Justification of choice of data or description of measurement methods and procedures applied	The CH4 measurement was performed for the biomass types that will be used as a result of the implementation of the Viñales project activity. For a detailed description on the methods used, please see Annex 3, page 123, of the current Project Description Document.
Purpose of Data	Calculation of baseline emissions.
Comments	

Data / Parameter	$EF_{CH4,BR}$
Data unit	(tCH4/GJ)
Description	CH4 emission factor for the combustion of biomass residues in the project plant (tCH4/GJ)
Source of data	On-site measurements or default values, as provided in Table 4 and 5 of the ACM0006 (Version 12.1.1).
Value applied	30 kg CH4/TJ (unadjusted factor) 41.1 kg CH4/TJ using conservativeness factor of 1.37 from Table 5 (maximum uncertainty).
Justification of choice of data or description of	The measured CH4 emission factors are adjusted by a conservatism value, thus ensuring the appropriateness and conservativeness of the associated emission reduction calculation. Likewise, the default

measurement methods and procedures applied	emission factors provided by the methodology are conservative per se and are further adjusted using conservativeness factors provided by the methodology. This ensures the conservativeness of the emission reduction calculation.
Purpose of Data	Calculation of baseline emissions.
Comments	---

Data / Parameter	$hBL_{,HG,BR, boiler}$
Data unit	(%)
Description	Heat efficiency of the boiler (heat generator) that would have been installed in the baseline scenario.
Source of data	Baseline plant design parameter defined by Energy Industry consultant. The same value has been recently used by the Project Proponent in other similar emission reduction project activities under the CDM.
Value applied	85%
Justification of choice of data or description of measurement methods and procedures applied	As stated above, the proposed value has been used in other similar emission reduction project activities implemented in Chile and has been suggested by reputable engineering and technology companies such as Metso and Andritz. The value is realistic and furthermore, leads to a more conservative emission reduction calculation than the default value that is proposed in the "Tool to determine the baseline efficiency of thermal or electric energy generation systems".
Purpose of Data	Calculation of baseline emissions.
Comments	--

Data and parameters not monitored from the tool: "Project and leakage emissions from road transportation of freight" (Version 01.0.0).

Data / Parameter	EFCO2,f
Data unit	(g CO2/t km)
Description	Default CO2 emission factor for freight transportation activity f.
Source of data	Tool "Project and leakage emissions from road transportation of freight" (Version 01.0.0).
Value applied	Vehicle class / Emission factor (g CO_2/t km)

	Light vehicle: 245 Heavy vehicle: 129 In this case, the Project Participant used the emission factor for heavy vehicle according to the type of vehicle used in the transportation of the biomass residues to Viñales power plant
Justification of choice of data or description of measurement methods and procedures applied	The default value is proposed in the corresponding CDM tool and therefore are deemed conservative and appropriate in this case.
Purpose of Data	Calculation of Project emissions.
Comments	Applicable to Option B. The default CO2 emission factors take into account emissions generated by loaded outbound trips and empty return trips. The default emission factor used have been derived based on custom design transient speed-time-gradient drive cycle (adapted from the international FIGE cycle), vehicle dimensional data, mathematical analysis of loading scenarios, and dynamic modelling based on engine power profiles, which, in turn, are a function of gross vehicle mass (GVM), load factor, speed/acceleration profiles and road gradient. The following assumptions on key parameters have been made: an average driving speed of 30 km/h, an average gradient of 1% and a load factor attained when biomass is transported is assumed.

4.2 Data and Parameters Monitored

Data / Parameter	Biomass residues categories and quantities used in the project activity.
Data unit	Type Source Fate in the absence of the project activity Use in the project scenario Quantity (BDt)

Description	The biomass quantities were monitored continuously in the project plant, according to proper industry standards.
Source of data	On-site measurement and calculations.
Description of measurement methods and procedures to be applied	Most of the internal biomass residues were measured at the entrance of the biomass power plant, using dedicated weight bridges. The rest of the internal biomass residues that are transported by pneumatic transportation system was estimated by the internal supplier (Viñales Sawmill and Remanufacture Plant) according to Annex 1, page 113, current PD. The external biomass residues, from industrial and Forestry operations third parties, was measured using dedicated weight bridges. Dry weight of all biomass residues was subsequently determined using the biomass moisture content of the corresponding biomass type.
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
Value monitored	(see table below)

Biomass residues category k	Biomass residues type	Biomass residue source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (BDt/yr)
1	Sawdust and bark industrial operations	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass only boiler)	2020 23,461 2019: 26,268 2018: 26,502 2017: 24,721
2	Sawdust and bark industrial operations	On-site production	Dumped and/or burned in the open air (B1:/ B3:)	Heat and power generation on-site (biomass only boiler)	2020 78,430 2019: 74,239 2018: 73,139

						2017: 42,740
	3	Sawdust and bark industrial operations	Off-site from third parties facilities	Dumped and/or burned in the open air (B1:/ B3:)	Heat and power generation on-site (biomass only boiler)	2020: 138,086 adjusted 2019: 154,941 adjusted 2018: 176,262 adjusted 2017: 133,638adjusted
	4	Bark, branches, from harvest, prune or	Off-site from forestry operations	Dumped and/or burned in the open air (B1:/ B3:)	Heat and power generation on-site (biomass only boiler)	2020: 0 2019: 0 2018: 0 2017: 0
Monitoring equipment	Type: Weighbridge 1 GSE 460 Accuracy class: Class III (+/- 30 kg) Serial number: 152069 Calibration frequency: Biannual Dates of calibration: 15/02/2017 – 19/07/2017 – 21/01/2018 - 31/07/2018 – 28/01/2019 – 22/07/2019 – 27/02/2020 – 31/08/2020 Validity: 30/02/2021(As reference).					
QA/QC procedures to be applied	Project Participant crosschecked the measurement with an annual energy balance that is based on purchased quantities and stock changes. The result for QA/QC in the current period, January to December 2017-2018 - 2019 and 2020 were efficiencies of 87.11% - 67.88% - 74.62% - 84.77% respectively in the power boiler. According to provider information, power boiler efficiency could be between 66%-86%, then, yearly energy balance is in an acceptable range. Nevertheless, is important consider that the stoppages due to					

	failures or programmed affects the results of the monthly energy balance.
Purpose of the data	Calculation of baseline emissions and project emissions
Calculation method	For the biomass residues generated on-site that are transported by the pneumatic transportation system, consider equations described in Annex 1, page 113, current PD. $[1] BR\ Brushing\ process\ = a \cdot b \cdot Dr$ $[2]\ BR\ Logging\ process\ = c \cdot d \cdot Dr$ $[3] BR\ finger - joints = m \cdot q \cdot Dr$ $[4] BR\ band - sawing = e \cdot f \cdot g \cdot Dr$ $[5] BR\ molding\ process = (h - i) \cdot (1 - J) \cdot Dr + k \cdot l \cdot Dr$ $[6] BR\ squaring\ process = r \cdot s \cdot Dr$ $[7] BR\ Viñales\ sawmill\ plant = I \cdot \left(1 - \frac{S_o}{(S_i \cdot fc)}\right) \cdot Ds$ Where: Dr : Wood density (Kg/m3) a: Green wood volume consumption of the brushing machine (m3) b: Real (unadjusted) performance factor of the brushing machine (number). c: Logs volume consumption (m3) d: Performance factor for the production of wood-splinter. This parameter is determined based on empirical measurements (number). m: Sawdust volume generated from processing one wood-blank in the finger-joint process (m3) q: Amount of wood-blocks produced in the finger-joint process (number). e: Wood thickness that is being sawed (m) f: Linear meters of cuts along the thickness of the wood-blanks (m) g: Cut width (0.0022 m) h: Wood-blank volume consumed by the molding machine (m3) i: Sawdust volume generated from cutting the wood-blanks to the specified thickness (m3) j: Performance index from consuming wood-blanks and producing wood-moldings. This factor is calculated from the geometry of the wood molding (number for each type of molding). k: Molding volume production (m3) l: Process performance (number)

	r: Input volume moldings to the process (m3) s: Process performance (number. Empirical, determined for the process) l: Wood volume consumed by the shaving process (m3) So: Wood section that exists the shaving process (m2) Si: Wood section that enters the shaving process (m2) fc: Wood correction factor due to wood drying as a result of the shaving process (number).
Comments	N/A

Data / Parameter	For biomass residues categories for which scenarios B1: B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that is a realistic and credible alternative scenario.
Data unit	Tonnes
Description	Quantity of available biomass residues of type n in the region. Quantity of biomass residues of type n that are utilized in the defined geographical region. Availability of a surplus of biomass residues type n (which cannot be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region.
Source of data	Official national Survey and statistic.
Description of measurement methods and procedures to be applied	Not applicable in this case.
Frequency of monitoring/recording	At the validation stage for biomass residues categories identified ex-ante, and always that new biomass residues categories are included during the crediting period.
Value monitored	Not applicable in this case.
Monitoring equipment	Not applicable in this case.
QA/QC procedures to be applied	Not applicable in this case.
Purpose of the data	Leakage
Calculation method	Not applicable in this case.

Comments	

Data / Parameter	$BR_{PJ,n,y}$
Data unit	Tonnes
Description	Quantity of biomass residues of category n used in the project activity in year y.
Source of data	On-site measurements.
Description of measurement methods and procedures to be applied	Most of the internal biomass residues were measured at the entrance of the biomass power plant, using dedicated weight bridges. The rest of the internal biomass residues that are transported by pneumatic transportation system was estimated by the internal supplier according Annex 1, page 113, current PD. The external biomass residues were measured using dedicated weight bridges. Dry weight of all biomass residues was subsequently determined using the biomass moisture content of the corresponding biomass type.
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emission reductions.
Value monitored	

	Biomass residues type	Biomass residue source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (dry tonnes/yr)
$BR_{PJ,1,y}$	Sawdust and bark industrial operations	On-site	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass only boiler)	2020: 23,461 2019: 26,268 2018: 26,502 2017: 24,721
$BR_{PJ,2,y}$	Sawdust and bark industrial	On-site	Dumped and/or burned in	Heat and power generatio	2020: 78,430 2019:

	operations		the open air (B1 and or B3)	n on-site (biomass only boiler)	74,239 2018: 73,139 2017: 42,740
$BR_{PJ,3,y}$	Sawdust and bark industrial operations	Off-site	Dumped and/or burned in the open air (B1 and or B3)	Heat and power generation on-site (biomass only boiler)	2020: 138,086 adjusted 2019: 154,941 adjusted 2018: 176,262 adjusted 2017: 133,638 adjusted
$BR_{PJ,4,y}$	Biomass from forestry operations	Of-site	Dumped and/or burned in the open air (B1 and or B3)	Heat and power generation on-site (biomass only boiler)	2020: 0 2019: 0 2018: 0 2017: 0

Monitoring equipment	Type: Weighbridge 1 GSE 460 Accuracy class: Class III (+/- 30 kg) Serial number: 152069 Calibration frequency: Biannual Dates of calibration: 15/02/2017 – 19/07/2017 – 21/01/2018 - 31/07/2018 – 28/01/2019 – 22/07/2019 – 27/02/2020 – 31/08/2020 Validity: 30/02/2021(As reference).
QA/QC procedures to be applied	Project Participant crosschecked the measurement with an annual energy balance that is based on purchased quantities and stock changes. The result for QA/QC in the current period, January to December 2017-2018 - 2019 and 2020 were efficiencies of 87.11% - 67.88% - 74.62% - 84.77% respectively in the power boiler. According to provider information, power boiler efficiency could be between 66%-

	86%, then, yearly energy balance is in an acceptable range. Nevertheless, is important consider that the stoppages due to failures or programmed affects the results of the monthly energy balance.
Purpose of the data	Calculation of baseline emissions and project emissions.
Calculation method	BRPJ,1,y is obtained adding to the measured fraction transported by truck from Viñales sawmill and remanufacture plant, the calculated fraction of internal biomass transported by pneumatic system. Biomass residues by pneumatic transportation system are calculated by the internal suppliers according algorithms described in annex 1 of current PD.
Comments	The biomass residue quantities used should be monitored separately for each type of biomass residue and each source.

Data / Parameter	BRB4,n,y
Data unit	(Tonnes in dry basis /BDt)
Description	Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B4:
Source of data	On-site measurement.
Description of measurement methods and procedures to be applied	Internal and external biomass residues were measured at the entrance of the biomass power plant, using dedicated weight bridges. A fraction of the internal biomass residues that are transported by pneumatic transportation system was estimated according to Annex 1, page 113, current PD.
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emission reductions.
Value monitored	Biomass residues category | Biomass residues type | Biomass residue source | Biomass residues fate in the absence of the project activity | Biomass residues use in project scenario | Biomass residues quantity (dry tonnes/yr)

	$BR_{B4,1,y}$	Sawdust and bark industrial operations	On-site	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass only boiler)	2020: 23,461 2019: 26,268 2018 26,502 2017: 24,721

Monitoring equipment	Type: Weighbridge 1 GSE 460 Accuracy class: Class III (+/- 30 kg) Serial number: 152069 Calibration frequency: Biannual 15/02/2017 – 19/07/2017 – 21/01/2018 -31/07/2018 – 28/01/2019 – 22/07/2019 – 27/02/2020 – 31/08/2020 Validity: 30/02/2021(As reference).
QA/QC procedures to be applied	Project Participant crosschecked the measurement with an annual energy balance that is based on purchased quantities and stock changes. The result for QA/QC in the current period, January to December 2017-2018 - 2019 and 2020 were efficiencies of 87.11% - 67.88% - 74.62% - 84.77% respectively in the power boiler. According to provider information, power boiler efficiency could be between 66%-86%, then, yearly energy balance is in an acceptable range. Nevertheless, is important consider that the stoppages due to failures or programmed affects the results of the monthly energy balance.
Purpose of the data	Calculation of baseline emissions and project emissions.
Calculation method	According to methodology ACM0006 Version 12.1.1, step 3, pages 32 to 39.
Comments	According to Step 1.4 of methodology ACM0006 (Version 12.1.1) all these biomass residue types are used in the power boiler (heat generator) exclusively. As a result, the monitored quantities of biomass residues used in the project was directly allocated to that heat generator in the baseline scenario.

Data / Parameter	$BR_{B1/B3,n,y}$
Data unit	(Tonnes on dry basis)

<table>
<tr><td>Description</td><td>Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B1: or B3:</td></tr>
<tr><td>Source of data</td><td>On-site measurements.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Fraction of external biomass residues in baseline scenario B1: or B3: were measured at the entrance of the biomass power plant, using dedicated weight bridges.

Dry weight of all biomass residues was subsequently determined using the biomass moisture content of the corresponding biomass type.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Data monitored continuously and aggregated as appropriate, to calculate emission reductions.</td></tr>
<tr><td>Value monitored</td><td>
<table>
<tr><td></td><td>Biomass residues type</td><td>Biomass residue source</td><td>Biomass residues fate in the absence of the project activity</td><td>Biomass residues use in project scenario</td><td>Biomass residues quantity (dry tonnes/yr)</td></tr>
<tr><td>$BR_{B1/B3,2,y}$</td><td>Sawdust and bark industrial operations</td><td>On-site</td><td>Dumped and/or burned in the open air (B1 and or B3)</td><td>Heat and power generation on-site (biomass only boiler)</td><td>2020: 78,430
2019: 74,239

2018: 73,139

2017: 42,740</td></tr>
<tr><td>$BR_{B1/B3,3,y}$</td><td>Sawdust and bark industrial operations</td><td>Off-site</td><td>Dumped and/or burned in the open air (B1 and or B3)</td><td>Heat and power generation on-site (biomass only boiler)</td><td>2020: 138,086 adjusted
2019: 154,941 adjusted
2018: 176,262 adjusted</td></tr>
</table>
</td></tr>
</table>

						2017: 133,638 adjusted
	$BR_{B1/B3,4,y}$	Biomass from forestry operations	Off-site	Dumped and/or burned in the open air (B1 and or B3)	Heat and power generation on-site (biomass only boiler)	2020: 0 2019: 0 2018: 0 2017: 0
Monitoring equipment	Type: Weighbridge 1 GSE 460 Accuracy class: Class III (+/- 30 kg) Serial number: 152069 Calibration frequency: Biannual Dates of calibration: 15/02/2017 – 19/07/2017 – 21/01/2018 -31/07/2018 – 28/01/2019 – 22/07/2019 – 27/02/2020 – 31/08/2020 Validity: 30/02/2021(As reference).					
QA/QC procedures to be applied	Project Participant crosschecked the measurement with an annual energy balance that is based on purchased quantities and stock changes. The result for QA/QC in the current period, January to December 2017-2018 - 2019 and 2020 were efficiencies of 87.11% -67.88% - 74.62% - 84.77% respectively in the power boiler. According to provider information, power boiler efficiency could be between 66%-86%, then, yearly energy balance is in an acceptable range. Nevertheless, is important consider that the stoppages due to failures or programmed affects the results of the monthly energy balance.					
Purpose of the data	Calculation of baseline emissions and project emissions.					
Calculation method	According to methodology ACM0006 Version 12.1.1, step 5, pages 44 to 46.					
Comments	--					

Data / Parameter	$EF_{FF,y,f}$
Data unit	(tCO2/GJ)
Description	CO2 emission factor for fossil fuel type f in year y.

Source of data	Default value. 2006 IPCC Guidelines on National GHG Inventories. Table 1.4 Chapter 1 of Vol.2. In the upper limit of uncertainty at a 95% confidence interval.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	The Project Participant corroborate appropriateness the value for the current monitoring period.
Value monitored	0.0748 (tCO2/GJ) for Diesel. 0.0788 (tCO2/GJ) for Fuel Oil. 0.0656 (tCO2/GJ) LPG
Monitoring equipment	--
QA/QC procedures to be applied	--
Purpose of the data	Not applicable.
Calculation method	Calculation of baseline emissions and project emissions.
Comments	Not applicable.

Data / Parameter	$EF_{CH4,BR}$
Data unit	(tCH4/GJ)
Description	CH4 emission factor for the combustion of biomass residues in the project plant.
Source of data	Default values from the table 4 and 5 of ACM0006 (Version 12.1.1) methodology.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Not applicable.
Value monitored	30 (kg CH4/TJ) with an uncertainty conservativeness factor of 1.37 (corresponds to the maximum uncertainty of 300%).

Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable.
Purpose of the data	Calculation of baseline emissions and project emissions.
Calculation method	Not applicable.
Comments	Monitoring of this parameter for project emissions is required, since in this case CH4 emissions from biomass combustion are included in the project boundary. A conservative factor was applied, as specified in the baseline methodology.

Data / Parameter	EFCO2,LE
Data unit	(tCO2/GJ)
Description	CO2 emission factor of the most carbon intensive fossil fuel used in the country.
Source of data	Combustible use in Chile published by CNE: “Balance Nacional de Energia 2017-2020: Energía Global.” http://energiaabierta.cne.cl/balance-energetico/ and default CO2 emission factors for combustion in Table 1.4. 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Description of measurement methods and procedures to be applied	--
Frequency of monitoring/recording	Every re-validation processes.
Value monitored	Gas Coke and lignite Coke: 0.119 tCO2e/GJ
Monitoring equipment	Not used in this case, since leakage is assumed to be 0 for the present monitoring period.
QA/QC procedures to be applied	--
Purpose of the data	--
Calculation method	Calculation of leakage.
Comments	Not applicable.

Data / Parameter	HCBL,y
Data unit	(GJ)
Description	Baseline process heat generation in year y.
Source of data	On-site measurements and calculations.
Description of measurement methods and procedures to be applied	This parameter was determined as the difference of the enthalpy of the process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. The respective enthalpies were determined based on the mass flows, the temperatures and, in case of superheated steam, the pressure. An appropriate thermodynamic equation may be used to calculate the enthalpy as a function of temperature and pressure.
Frequency of monitoring/recording	Calculation based on continuously monitored data an aggregated as appropriate.
Value monitored	2020: 372,067 (GJ) 2019: 403,139(GJ) 2018: 407,559(GJ) 2017: 391,052(GJ)
Monitoring equipment	663-PT-0155 Type: Pressure gauge transmitter for Power Boiler Endress & Hauser Cerebar S//PMP75-ACC1WB1UBGAU Accuracy class: +/- 0.075% Serial number: D500C90109C Calibration frequency: 18 months Date of calibration: 10/11/2016 – 14/11/2017 – 19/11/2018 - 12/11/2019 – 04/12/2020 Validity: 03/06/2022 663-FT-0156 Type: Flow transmitter for Power Boiler Endress & Hauser Cerebar S//PMP75-ACC7FB1DAVUDA63M-AB2BBD. Accuracy class: +/- 0.075% Serial number: D501F50109D Calibration frequency: 18 months Date of calibration: 10/11/2016 – 14/11/2017 – 19/11/2018 – 18/11/2019 – 30/11/2020 Validity: 29/05/2022

	663-TT-0157 Type: Temperature sensor for the Power Boiler Endress & Hauser TH53-8A23E2E2B31AK. Accuracy class: ≤ ±0.5% Serial number: 266161 Calibration frequency: 2 years by PP's protocol. Measurement range: 0 – 600 °C Assembling and calibration date: 10/11/2016 – 11/11/2017 – 16/11/2018 – 15/11/2019 Validity: 14/11/2021 665-PT-9040-A / 665-PT-9040-B Type: Pressure gauge transmitter High pressure line Rosemount 2051TG4A2B21AB4Q4. Accuracy class: ±0.05% Serial number: 32601 (A) – 32602 (B) Calibration frequency: 18 months. Date of calibration: 08/11/2016 – 14/11/2017 – 19/11/2018 – 14/11/2019 -03/12/2020 Validity: 02/06/2022 665-FT-9030 Type: Flow transmitter high pressure line Rosemount 2051CD2F02A1A55Q4. Accuracy class: ±0.05%. Serial number: 33712 Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-15/11/2019 – 01/12/2020 Validity: 31//05/2022 665-TT-9043-A / 665-TT-9043-B Type: Steam Temperature transmitter high pressure line Rosemount 644HANAJ6Q4. Accuracy class: ±0.05% Serial number: 0271902 (A) / 0219846 (B)

	Calibration frequency: 2 years. Date of calibration: 11/11/2011-16/11/2018-15/11/2019 – 04/12/2020 Validity: 03/12/2022 665-PT-9001-A /665-PT-9001-B Type: Pressure gauge transmitter Medium pressure Line. Rosemount 2051TG3F2B21AB4Q4. Accuracy class: ±0.05% Serial number: 32561 (A) / 32562 (B) Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-14/11/2019 – 01/12/2020 Validity: 31/05/2022 665-FT-9025 Type: Steam flow transmitter Medium pressure Line. Rosemount 2051CD2F02A1AS5Q4-0305RC32B11B4. Accuracy class: ±0.05% Serial number: 33711 Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-15/11/2019 – 02/12/2020 Validity: 01/06/2022 665-FT-9051 Type: Steam flow transmitter Medium pressure Line. Rosemount 2051CD2F02A1AS5Q4-0305RC32B11B4. Accuracy class: ±0.05% Serial number: 107763 Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-15/11/2019 – 01/12/2020 Validity: 31/05/2022 665-TT-9026 Type: Steam Temperature transmitter Medium pressure line Rosemount 644HFNAJ6Q4 Accuracy class: ±0.15°C.

	Serial number: 0271897 Calibration frequency: 2 years Assembling and calibration date: 11/11/2017 – 16/11/2018 – 15/11/2019 – 04/12/2020 Validity: 03/12/2022 665-PT-9002-A / 665-PT-9002-B / 665-PT-9002-C Type: Pressure gauge transmitter Low pressure line Rosemount 2051TG2A2B21AB4Q4. Accuracy class: ±0.05% Serial number: 32598 (A) / 32599 (B) / 32600 (C) Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-14/11/2019 – 05/12/2020 Validity: 04/06/2022 665-FT-9019 Type: Steam flow transmitter Low pressure line. Rosemount 2051CD2F02A1AS5Q4. Accuracy class: ±0.05% Serial number: 33709 0033709 Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-15/11/2019 – 30/11/2020 Validity: 29/05/2022 665-FT-9023 Type: Deaerator steam pressure flow transmitter Rosemount 2051CD2F02A1AS5Q4-0305RC32B11B4. Accuracy class: ±0.05% Serial number: 33710 Calibration frequency: 18 months. Date of calibration: 14/11/2017-19/11/2018-18/11/2019 – 02/12/2020 Validity: 01/06/2022 665-TT-9024 Type: Steam Temperature transmitter Low pressure line Rosemount 644HFNAJ6Q4

	Accuracy class: ±0.15°C. Serial number: 0271896 Calibration frequency: 2 years Assembling and calibration date: 11/11/2017 – 16/11/2018 – 15/11/2019 – 04/12/2020 Validity: 03/12/2022 663-PT-0106 Type: Pressure gauge transmitter Feed water condition Endress + Hauser PMD75-ARC1WB1UBGAU. Accuracy class: ±0.075% Serial number: D500BE0109C Calibration frequency: According to supplier recommendation, PP define 18 months if was necessary. Assembling and calibration date: 14/11/2017-19/11/2018-12/11/2019 – 03/12/2020 Validity: 02/06/2022 663-TT-0111 Type: Steam temperature transmitter Feed water condition Rosemount 644HFNAJ6Q4. Accuracy class: ±0.15°C. Serial number: 265913 Calibration frequency: 2 years. Assembling and calibration date: 11/11/2017-16/11/2018 – 15/11/2019 – 04/12/2020 Validity: 03/12/2022
QA/QC procedures to be applied	Heat quantities are directly measured by dedicated steam flow meters and pressure/temperature meters. The associated uncertainty is very low, since these parameters are key to the production processes of the Viñales plant and therefore, receive periodic maintenance as part of the production control system. According to PD, version 07, the consistency of metered net heat generation should be cross-checked with receipts from sales (if available) and 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 comparable to previous years). The thermal efficiency index obtained for CP1MP4 was compared to historical efficiency indexes from previous

	monitoring periods. The comparison resulted in a reasonable value, as can be seen below: year | Steam/Biomass index [Ton steam/Ton biomass] 2020 | 2.28 2019 | 2.51 2018 | 2.56 2017 | 3.05 2016 | 1.95 2015 | 2.50 QA/QC index tolerance range [2.0-4.2] was defined according to design energy balance for the power boiler ("Design data of the boiler for training 17 to 20.pdf", Kvaerner pulping power division) using quantity of live steam divided by quantity of wet combusted biomass. Then, average value is in the expected range.
Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable.
Comments	---

Data / Parameter	$EL_{PJ,gross,y}$
Data unit	(MWh)
Description	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.
Source of data	On-site measurement.
Description of measurement methods and procedures to be applied	Parameter was measured using proper electric meters, calibrated and maintained according to manufacture specification and proper industry standards.
Frequency of monitoring/recording	Continuously and aggregated as appropriate, to calculate emission reductions.

Value monitored	2020: 291,597(MWh) 2019: 305,880(MWh) 2018: 310,594(MWh) 2017: 282,762(MWh)
Monitoring equipment	8600-10 Type: Energy Meter Gross Power Measurement Schneider Electric ION 8600 Accuracy class: +/- 0.2% Serial number: LT-1012A701-01 Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024
QA/QC procedures to be applied	1. Monthly rate between receipts from electricity sales (if available) and the calculated displacement of the grid is within a range of ±2%.

2020	n°	sale electricity invoice(A) MWh/month	gross quantity electricity gen MWh/month	Total elec import from grid MWh/month	Total elec consumption MWh/month	Calculated displacement of the grid (B) MWh/month	QA/QC rate (A/B) (0.80-1)
jan	165861	23,878	27,318	25	3,519	23,775	1.00
feb	170618	21,789	24,985	30	3,304	21,650	1.01
mar	177381	24,429	28,018	28	3,678	24,312	1.00
april	184088	23,035	26,449	5	3,506	22,938	1.00
may	189565	24,700	28,215	0	3,599	24,616	1.00
june	195880	20,726	23,879	0	3,254	20,625	1.00
july	201546	18,924	22,048	68	3,297	18,683	1.01
aug	206681	18,829	22,083	0	3,359	18,724	1.01
sept	213604	17,665	20,861	0	3,314	17,547	1.01
oct	219806	21,185	24,540	28	3,505	21,008	1.01
nov	225828	20,616	23,814	44	3,466	20,304	1.02
dec	251985	17,869	19,388	148	2,823	16,417	1.09

2019		sale electricity invoice(A)	gross quantity electricity gen	Total elec import from grid	Total elec consumption	Calculated displacement of the grid (B)	QA/QC rate (A/B)

	n°	MWh/month	MWh/month	MWh/month	MWh/month	MWh/month	(0.80-1)
jan	258074	22,261	28,412	16	3,780	24,615	0.90
feb	264037	20,161	25,785	15	3,455	22,315	0.90
mar	270532	23,035	29,354	0	3,844	25,510	0.90
april	278802	21,623	27,674	27	3,699	23,948	0.90
may	285893	22,589	28,835	14	3,808	25,013	0.90
june	290799	22,319	28,441	0	3,708	24,733	0.90
july	295854	21,884	28,126	56	3,775	24,295	0.90
aug	303108	18,220	24,346	10	3,588	20,747	0.88
sept	307575	14,268	19,465	6	3,213	16,246	0.88
oct	313804	17,879	24,019	0	3,607	20,412	0.88
nov	319239	12,030	15,626	159	2,488	12,980	0.93
dec	326123	20,174	25,798	187	3,558	22,054	0.91

2018	n°	sale electricity invoice(A) MWh/month	gross quantity electricity gen MWh/month	Total elec import from grid MWh/month	Total elec consumption MWh/month	Calculated displacement of the grid (B) MWh/month	QA/QC rate (A/B) (0.80-1)
jan	165861	21,555	25,050	4	3,570	21,476	1.00
feb	170618	22,466	25,822	0	3,436	22,386	1.00
mar	177381	25,631	29,378	0	3,808	25,570	1.00
april	184088	24,469	28,031	51	3,683	24,297	1.01
may	189565	24,290	27,910	0	3,691	24,219	1.00
june	195880	24,709	28,340	6	3,711	24,624	1.00
july	201546	22,293	25,809	21	3,624	22,163	1.01
aug	206681	25,813	29,605	7	3,873	25,724	1.00
sept	213604	20,574	24,019	7	3,561	20,451	1.01
oct	219806	22,760	26,429	0	3,746	22,683	1.00
nov	225828	13,463	13,691	270	2,309	11,112	1.21
dec	251985	23,347	26,509	171	3,694	22,644	1.03

2. Index between electricity generation divided by the quantity of combusted biomass in Power boiler results in a reasonable efficiency comparable to yearly statistic range:

2020	A gross quantity electricity gen MWh/month	B Combusted biomass in PB BDt	QA/QC (0.83-1.34) Index MWh/BDt A/B
jan	27,318	25,216	1.08
feb	24,985	20,011	1.25
mar	28,018	23,970	1.17
april	26,449	18,989	1.39
may	28,215	20,687	1.36
june	23,879	18,336	1.30
july	22,048	17,976	1.23
aug	22,083	18,809	1.17
sept	20,861	18,377	1.14
oct	24,540	22,602	1.09
nov	23,814	21,323	1.12
dec	19,388	23,286	0.83

2019	A gross quantity electricity gen MWh/month	B Combusted biomass in PB BDt	QA/QC (0.83-1.34) Index MWh/BDt A/B
jan	28,412	22,268	1.28
feb	25,785	21,908	1.18
mar	29,354	22,738	1.29
april	27,674	25,299	1.09
may	28,835	23,695	1.22
june	28,441	19,291	1.47
july	28,126	21,025	1.34
aug	24,346	24,582	0.99
sept	19,465	19,495	1.00
oct	24,019	25,648	0.94
nov	15,626	15,893	0.98
dec	25,798	22,996	1.12

	A gross quantity	B Combusted	QA/QC (0.83-1.34) Index

2018	electricity gen MWh/month	biomass in PB BDt	MWh/BDt A/B
jan	25,050	30,585	0.82
feb	25,822	21,156	1.22
mar	29,378	21,486	1.37
april	28,031	21,547	1.30
may	27,910	22,151	1.26
june	28,340	24,835	1.14
july	25,809	22,505	1.15
aug	29,605	26,305	1.13
sept	24,019	21,841	1.10
oct	26,429	25,278	1.05
nov	13,691	25,170	0.54
dec	26,509	24,554	1.08

3. Is important to note that boiler electricity efficiency change when Power plant is carrying out a programmed stoppage. Percentage difference between Measured energy displacement using dedicated equipment and calculated energy displacement according to methodology must be equal or bigger than zero (i.e. Measured energy shall be mayor than calculated energy displacement).

2020	Measured exported energy to grid MWh	Measured energy sawmill consumption MWh	Calculated energy displacement MWh	QA/QC >=0 difference % ((A+B)-C)/C
jan	21,582	2,296	23,824	0.23%
feb	19,751	2,038	21,711	0.36%
mar	22,014	2,415	24,369	0.24%
april	20,773	2,262	22,948	0.38%
may	22,347	2,352	24,616	0.34%
june	18,367	2,359	20,625	0.49%
july	16,557	2,366	18,819	0.56%
aug	16,372	2,456	18,724	0.56%
sept	15,313	2,352	17,547	0.67%
oct	18,669	2,516	21,063	0.58%
nov	18,193	2,422	20,391	1.10%
dec	15,129	2,739	16,713	6.92%

2019	Measured exported energy to grid MWh	Measured energy sawmill consumption MWh	Calculated energy displacement MWh	QA/QC >=0 difference % ((A+B)-C)/C
jan	22,311	2,401	24,648	0.26%
feb	20,209	2,219	22,345	0.37%
mar	23,089	2,489	25,510	0.27%
april	21,677	2,405	24,002	0.33%
may	22,646	2,471	25,040	0.31%
june	22,376	2,439	24,733	0.33%
july	21,939	2,546	24,406	0.32%
aug	18,258	2,570	20,768	0.29%
sept	14,290	2,019	16,258	0.32%
oct	17,913	2,555	20,412	0.27%
nov	12,055	2,710	13,297	11.03%*
dec	20,218	2,703	22,427	2.20%

2018	Measured exported energy to grid MWh	Measured energy sawmill consumption MWh	Calculated energy displacement MWh	QA/QC >=0 difference % ((A+B)-C)/C
jan	19,678	1,877	21,484	0.33%
feb	20,248	2,218	22,386	0.36%
mar	23,215	2,416	25,570	0.24%
april	22,096	2,373	24,399	0.29%
may	21,986	2,304	24,219	0.29%
june	22,216	2,493	24,636	0.30%
july	19,970	2,324	22,206	0.39%
aug	23,191	2,621	25,738	0.29%
sept	18,324	2,250	20,465	0.53%
oct	20,225	2,535	22,683	0.34%
nov	10,630	2,833	11,653	15.53% *
dec	20,785	2,562	22,986	1.57%

*Programmed stoppage

Purpose of the data	Calculation of baseline emissions.

Calculation method	Not applicable.
Comments	---

Data / Parameter	$EL_{PJ,imp,y}$
Data unit	*(MWh)*
Description	Project electricity imports from the grid in year y.
Source of data	On-site measurements.
Description of measurement methods and procedures to be applied	Parameter was measured using proper electric meters, calibrated and maintained according to manufacture specification and proper industry standards.
Frequency of monitoring/recording	Continuously and aggregated as appropriate, to calculate emission reductions.
Value monitored	2020: 375(MWh) 2019: 490(MWh) 2018: 537(MWh) 2017: 448(MWh)
Monitoring equipment	SE-EI-0006/0007 Type: Energy Meter Import Power Measurement Schneider Electric ION 8600 Accuracy class: +/- 0.2% Serial number: PT-1012A934-01 Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024 8600-2_3 Type: Energy Meter Sawmill consumption Schneider Electric ION 8600 Accuracy class: +/- 0.2% Serial number: MT-1010A242-01 Calibration frequency: 7 years Date of last calibration: 17/11/2017

	Validity: 16/11/2024
QA/QC procedures to be applied	Consistency of metered electricity was checked percentage difference between Total power import and receipts from electricity purchases. The difference between measures and invoices are exposed in table below: Refer to parameter $EL_{PJ,gross,y}$ Index between electricity generation divided by the quantity of combusted biomass in Power boiler results in a reasonable efficiency comparable to yearly statistic range: Refer to the parameter $EL_{PJ,gross,y}$
Purpose of the data	Calculation of baseline emissions.
Calculation method	Calculation of baseline emissions and project emissions. Equipment SE-EI-0006/0007 measured total power quantity import to Viñales complex (Viñales sawmill and Power plant). To calculate power import to Power plant is important to consider the available power generation in Viñales complex. The following cases define the quantity of imported electricity to Power plant: 1.- Project electricity imports to Power plant are equal to zero when Available power generation is more or equal to Viñales sawmill energy process demand. When Viñales complex use imported power is necessary to calculate the quantity used in power plant: - Project electricity imports are more than zero when Available power generation is less than Viñales sawmill energy process demand, and is possible to determine as follows: Project electricity imports = Available power generation + Total power import - Electricity import to Viñales sawmill process from the grid Available power generation = Gross quantity electricity generated in power plant - export surplus energy to the grid – Internal Transmission losses before Grid injection.
Comments	---

Data / Parameter	$EL_{PJ,aux,y}$
Data unit	(MWh)

Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y.
Source of data	On-site measurements.
Description of measurement methods and procedures to be applied	Parameter was measured using proper electric meters, calibrated and maintained according to manufacture specification and proper industry standards.
Frequency of monitoring/recording	Continuously and aggregated as appropriate, to calculate emission reductions.
Value monitored	2020: 40,623(MWh) 2019: 42,522(MWh) 2018: 42,707(MWh) 2017: 39,423(MWh)
Monitoring equipment	Viñales_1_6_Manejo_Desechos_Comb TAG: 669-EI-1603/1604 (1-6) Brand: Schneider Electric Model: Ion 7550 Serial number: LI-1010A261-02 Accuracy: +/- 0.2% Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024 Viñales_1_7_CP_Caldera_Poder TAG: 669-EI-1703/1704 (1-7) Brand: Schneider Electric Model: Ion 7550 Serial number: LI-1010A263-02 Accuracy class: +/- 0.2% Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024 Viñales_1_8_CP_Caldera_Poder TAG: 669-EI_1803/1804 (1-8) Brand: Schneider Electric

	Model: Ion 7550 Serial number: LI-1010A264-02 Accuracy class: +/- 0.2% Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024 Viñales_1_9_CP_Caldera_Poder TAG: 669-EI-1903/1904 (1-9) Brand: Schneider Electric Model: Ion 7550 Serial number: LI-1010A262-02 Accuracy: +/- 0.2% Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024 Viñales_1_11_Barra_1B_Ed_Administración TAG: 669-EI-1703/1804 (1-11) Brand: Schneider Electric Model: Ion 7550 Serial number: LI-1010A265-02 Accuracy: +/- 0.2% Calibration frequency: 7 years Date of last calibration: 17/11/2017 Validity: 16/11/2024
QA/QC procedures to be applied	1. Monthly rate between receipts from electricity sales (if available) and the calculated displacement of the grid is within a range of ±2%. Refer to parameter $EL_{PJ,gross,y}$ 2. - Index between electricity generation divided by the quantity of combusted biomass in Power boiler results in a reasonable efficiency comparable to yearly statistic range: Refer to parameter $EL_{PJ,gross,y}$ 3. Percentage difference between Measured energy displacement using dedicated equipment and calculated energy displacement according to methodology must be equal or bigger

	than zero (i.e. Measured energy shall be mayor than calculated energy displacement). Refer to parameter $EL_{PJ,gross,y}$ As the process of the power plant is continuous, is not possible to execute the maintenance/calibration, for the majority of the instruments of the power plant, out of the general plant shutdown. One of the main tasks that are performed during the stoppage is the maintenance of the substation located in power plant site. This is a highly risky task that needs to de-energize certain plant's areas to accomplish. The aforementioned areas include the equipment that register the energy imports and exports from and to the grid. Is in this process where the most substantial difference between the Constitution substation and the power plant equipment are presented, because the substation continuous measuring. Nevertheless, Calculated energy displacement is conservative comparing with measured and invoice energy displacement from the grid, because the measured energy displacement in Constitucion substation is bigger than the calculated energy displacement
Purpose of the data	Calculation of baseline emissions.
Calculation method	According to current PD, page 94, the electricity consumption associated to pneumatic transportation system that carries the biomass from the sawmill and the remanufacturer plants from July to December was calculated as: 348.5 KW *(8,760 hr/yr*0.5) / (1,000 KWh/GWh) = 1.53 GWh/yr. This result is equal to 254 MWh/month that was added to the measured auxiliary electric power consumption for the monitored period.
Comments	---

Data / Parameter	$NCV_{BR,n,y}$
Data unit	(GJ/tonnes of dry matter)
Description	Net calorific value of biomass residue of category n in year y (GJ/tonne on dry-basis)

Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Measurements were carried out by a reputed laboratory, according to international standards. NCV was measured on a dry-basis.
Frequency of monitoring/recording	At least every six months, taking at least three samples for each measurement.
Value monitored	see table below
Monitoring equipment	Not applicable. Net calorific values were measured locally by third party laboratory.
QA/QC procedures to be applied	The consistency of this measurements was compared with values of other projects and relevant data source.

Value monitored:

	$NCV_{BR,n,y}$ (GJ/ton-dry matter)
$BR_{PJ,1,y}$	1SEM/2SEM 2020: 18.43/18.88 2019: 17.80/18.94 2018: 18.01/18.17 2017:18.61/18.09
$BR_{PJ,3,y}$	2020: 18.45/18.46 2019: 18.23/17.98 2018:18.27/17.98 2017:17.65/18.54
$BR_{PJ,4,y}$	2020: 0.00/0.00 2019: 0.00/0.00 2018:0.00/0.00 2017:0.00/0.00

QA/QC procedures to be applied (comparison):

	Nueva Aldea Phase 1 Ref:0258		Trupan Ref:0259	
	NCV_{2014}	NCV_{2015}	NCV_{2013}	NCV_{2014}
Biomass from Industrial operations (on-site)	18.45	18.85	18.40	18.61
Biomass from Industrial operations (off-site)	12.59	16.51		

	<table><tr><td></td><td colspan="2">Nueva Aldea Phase 1 Ref:0258</td></tr><tr><td></td><td>NCV2012</td><td>NCV2013</td></tr><tr><td>Biomass from Industrial operations (on-site)</td><td>18.12</td><td>19.05</td></tr><tr><td>Biomass from Industrial operations (off-site)</td><td>18.12</td><td>16.66</td></tr></table> In addition, the results are according to average value defined by IPCC guideline, 2006: 15.6 TJ/000ton with a range between 7.9 and 31.0 TJ/000ton. TJ/000ton is equivalent to GJ/BDt
Purpose of the data	Calculation of baseline emissions and project emissions.
Calculation method	Not applicable.
Comments	---

Data / Parameter	Moisture content of the biomass residues
Data unit	%
Description	Moisture content of each biomass residues type k.
Source of data	On-site measurement.
Description of measurement methods and procedures to be applied	The biomass residue moisture content was monitored and registered by periodic samples from each biomass type burned in the power boiler. Humidity content was obtained evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process was carried out in dedicated equipment.
Frequency of monitoring/recording	Continuously. Daily samples of biomass residues from industrial and forest operations were taken for moisture content measurement.
Value monitored	<table><tr><td></td><td>Average Moisture content CP1 MP3-2017-2020</td></tr></table>

	<table><tr><td></td><td>**(%)**</td></tr><tr><td>$BR_{PJ,1,y}$</td><td>2020 41.6% (adjusted) 2019:43.4% 2018:41.3% 2017: 44.6% (adjusted)</td></tr><tr><td>$BR_{PJ,3,y}$</td><td>2020:45.5% (adjusted) 2019: 41.9% 2018:41.1% 2017:47.8% (adjusted)</td></tr><tr><td>$BR_{PJ,4,y}$</td><td>2020: n/a 2019: n/a 2018:0.0% 2017:0.0%</td></tr></table>
Monitoring equipment	Electronic moisture analyzer Sartorius MA150C Accuracy class: Class I/+/-0.001 gr. Serial number: 27008246 Calibration frequency: Once a year Date of last calibration: 18/10/2017-11/10/2018-11/10/2019 – 13/10/2020 Validity: 13/10/2021 (estimated) Laboratory Oven MEMMERT UFE 600 Accuracy class: +/- 0.5% Serial number: G611.0831 Calibration frequency: 12 months Date of calibration: 18/01/2017 - 11/10/2018 - 11/10/2019 – 13/08/2020 Validity: 12/08/2021 Laboratory Digital scale Sartorius TE1502S Accuracy class: 0.01gr Serial number: 27402265

	Calibration frequency: 12 months Dates of calibration: 18/10/2017 - 11/10/2018 - 11/10/2019 – 13/10/2020 Validity: 12/10/2021
QA/QC procedures to be applied	---
Purpose of the data	Calculation of baseline emissions and project emissions.
Calculation method	Moisture content is determined using the following equation: Moisture content, biomass type I (%) = [(Sw-Sd)/Sw]*100 Where: Sw: Wet biomass residue type I sample weight. Sd: Bone-dry biomass residue type I weight.
Comments	---

Data / Parameter	Py
Data unit	m3/yr.
Description	Quantity of the main product of the production process produced in year y from plants operated at the project site.
Source of data	On-site measurements.
Description of measurement methods and procedures to be applied	---
Frequency of monitoring/recording	Annually, aggregated as appropriate.
Value monitored	Sawn timber: 2020: m^3/yr.207,124 2019: m^3/yr.211,655 2018: m^3/yr.196.483 2017: m^3/yr.156,863 Processed wood: 2020: m^3/yr. 65,964 2019: m^3/yr.55,052 2018: m^3/yr.61,052

	2017: m³/yr. 76,696
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	(see table below)

	Value applied in PD m^3/yr	Value obtained m^3/yr	Maximum potential production m^3/yr
Sawn timber	352,686	2020 207,124 2019 211,655 2018 196,483 2017 156,863	422,400
Processed wood	88,203	2020 65,964 2019 55,405 2018 61,052 2017 76,696	96,000

Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable.
Comments	Quantity of the main product of the production process is assessed by Viñales Sawmill and Remanufacture plant.

Data / Parameter	LOCy
Data unit	Hours.
Description	Length of the operational campaign in year y.
Source of data	On-site measurements.

Description of measurement methods and procedures to be applied	Records and sum the hours of operation of the project activity facilities during year y.
Frequency of monitoring/recording	Continuously.
Value monitored	2020: 8,388 [Hrs] 2019: 8,760 [Hrs] 2018: 8,760 [Hrs] 2017: 8,544 [Hrs]
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable.
Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable.
Comments	---

Data and parameters monitored from the tool: "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02)

Data / Parameter	FCi,j,y
Data unit	ton/y or m3/y
Description	Quantity of fuel type I combusted in process j during the year y.
Source of data	On-site measurements.
Description of measurement methods and procedures to be applied	On-site fossil fuel consumption will be calculated in this case.
Frequency of monitoring/recording	Continuously.

Value monitored	- Diesel consumption in the power boiler due to operational reasons: 2020: 33,486(ton/y) 2019: 47,578(ton/y) 2018: 31,215(ton/y) 2017: 86,121(ton/y) - LPG consumption in the power boiler due to operational reasons: 2020: 54 (lt/y) 2019: 76(lt/y) 2018: 50 (lt/y) 2017: 138(lt/y) - Diesel consumption due to on-site biomass transportation from the gate to the power boiler conveyor belts and front loaders: 2020: 67,046(ton/y) 2019: 74,562 (ton/y) 2018: 77,858(ton/y) 2017: 69,259(ton/y)- Diesel Consumption due to forestry biomass processing: 2020: 0.0 (ton/y) 2019:0.0 (ton/y) 2018:0.0 (ton/y) 2017: 0.0(ton/y)
Monitoring equipment	663-FT-0508 Type: Fossil fuel flow transmitter. Endress+Hausser 83F40-AABSAAACBAAK Accuracy class: +/- 0.1% Serial number: D606EA16000 Calibration frequency: According to supplier recommendation, PP adopted a calibration frequency of 5 years. Dates of calibration: 12/11/2015-10/11/2016 Validity: 09/11/2021 663-FT-0522 Type: Fossil fuel flow transmitter. Endress+Hausser 83F25-AABSAAACBAAK Accuracy class: +/- 0.5% Serial number: D606E916000 Calibration frequency: According to supplier recommendation, PP define 5 years. Dates of calibration: 10/11/2016 Validity: 09/11/2021
QA/QC procedures to be applied	Project Participant crosschecked the measurement with an annual energy balance that is based on purchased quantities and stock changes.

	The result for QA/QC in the current period, January to December 2017-2018 - 2019 and 2020 were efficiencies of 87.11% -67.88% - 74.62% - 84.77% respectively in the power boiler. According to provider information, power boiler efficiency could be between 66%-86%, then, yearly energy balance is in an acceptable range. Nevertheless, is important consider that the stoppages due to failures or programmed affects the results of the monthly energy balance.
Purpose of the data	Calculation of project emissions.
Calculation method	Fossil fuel consumption due to on-site biomass transportation: This could be the transportation of biomass residues from the conveyor belts and the consumption of the front loaders. The project participant obtained a specific diesel consumption for all the vehicles involved biomass transporting. The total amount of diesel consumed due to on-site biomass transportation was the sum of all the vehicles used for on-site biomass transportation.
Comments	--

Data / Parameter	$NCV_{i,y}$
Data unit	GJ/ton
Description	Weighted average net calorific value of fuel type i in year y.
Source of data	2006 IPCC guideline. Table 1.2, chapter 1 of vol.2.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Any future revision of the IPCC guideline should be taken into account.
Value monitored	$NCV_{Diesel,y}$: 43.3 GJ/ton $NCV_{Fuel\ oil,y}$: 41.7 GJ/ton $NCV_{LPG,y}$: 52.20 GJ/ton
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of project emissions.
Calculation method	Not applicable

Comments	--

Data / Parameter	$EF_{CO2,i}$
Data unit	tCO_2/GJ
Description	Weighted average CO_2 emission factor of fuel type I in year y.
Source of data	2006 IPCC guideline. Table 1.2, chapter 1 of vol.2.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Any future revision of the IPCC guideline should be taken into account.
Value monitored	$EF_{CO2,diesel}$: 0.0748 tCO_2/GJ $EF_{CO2,Fuel\ oil}$: 0.0788 tCO_2/GJ $EF_{CO2,LPG}$: 0.0656 tCO_2/GJ
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of project emissions.
Calculation method	Not applicable
Comments	--

Data and parameters monitored from the tool: "Project and leakage emissions from road transportation of freight" (Version 01.1)

Data / Parameter	$D_{f,m}$
Data unit	Km
Description	Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m.
Source of data	Records of vehicle operator and/or records by project participant.

Description of measurement methods and procedures to be applied	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources.
Frequency of monitoring/recording	Updated whenever the road distance or the source changes.
Value monitored	2020 <table><tr><td>tCO2</td><td>PETR,m</td><td>2,120</td></tr><tr><td>km</td><td>Df,m</td><td>39.1 adjusted</td></tr><tr><td>t</td><td>∑Df,m * FR,f,m</td><td>16,432,694</td></tr><tr><td>gCO2/t*km</td><td>EFCO2,f</td><td>0.000129</td></tr></table>2019 <table><tr><td>tCO2</td><td>PETR,m</td><td>1,854</td></tr><tr><td>km</td><td>Df,m</td><td>32.6 adjusted</td></tr><tr><td>t</td><td>∑Df,m * FR,f,m</td><td>14,374,041</td></tr><tr><td>gCO2/t*km</td><td>EFCO2,f</td><td>0.000129</td></tr></table>2018 <table><tr><td>tCO2</td><td>PETR,m</td><td>2,907</td></tr><tr><td>km</td><td>Df,m</td><td>48.5 adjusted</td></tr><tr><td>t</td><td>∑Df,m * FR,f,m</td><td>22,532155</td></tr><tr><td>gCO2/t*km</td><td>EFCO2,f</td><td>0.000129</td></tr></table>2017 <table><tr><td>tCO2</td><td>PETR,m</td><td>1,836</td></tr><tr><td>km</td><td>Df,m</td><td>37.5 adjusted</td></tr><tr><td>t</td><td>∑Df,m * FR,f,m</td><td>14,234,146</td></tr><tr><td>gCO2/t*km</td><td>EFCO2,f</td><td>0.000129</td></tr></table>Detail of the calculation is provided in Excel named “Third-party biomass” as evidence during verification.
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of project emissions.
Calculation method	Not applicable

Comments	--

Data / Parameter	$FR_{f,m}$
Data unit	[ton]
Description	Total mass of freight transported in freight transportation activity f in monitoring period m.
Source of data	Records by project participant.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Continuously.
Value monitored	2020: 420,234wet tons 2019: 440,881wet tons 2018 464,164wet tons 2017: 379,209wet tons
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of project emissions.
Calculation method	Not applicable
Comments	--

Data and parameters monitored from the tool: "Tool to calculate the emission factor for an electricity system (Version 03.0)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,k,y}$
Data unit	Mass or volume unit
Description	Amount of fuel type i consumed by power plant/unit m, k or n in year y
Source of data	CDEC-SIC public information.

Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Annually for the first crediting period.
Value monitored	See the grid emission factor calculation spread sheet.
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	--

Data / Parameter	$NCV_{i,y}$
Data unit	GJ/mass or volume
Description	Net calorific value (energy content) of fossil fuel type i in year y.
Source of data	CNE (National Energy commission) yearly energy balance.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Annually for the first crediting period.
Value monitored	$NCV_{Pet\ coke,2014}$: 27.8 (GJ/ton) $NCV_{Diesel,2014}$: 43.3 (GJ/ton) $NCV_{IFO\ 180,2014}$: 41.8 (GJ/ton) $NCV_{Natural\ Gas,2014}$: 35.2 (TJ/MMm3) $NCV_{Coal,2014}$: 27.8 (GJ/ton) $NCV_{Butane,2014}$: 45.6 (GJ/ton) $NCV_{Propane,2014}$: 45.6 (GJ/ton)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of baseline emissions.

Calculation method	Not applicable
Comments	In the National energy balance information was not specify if the Calorific values are net or gross. To be conservative, PP applied the guideline of IPCC 2006 (Volume 2, Chapter 1, page 1-16, section 1.4.1.2): "The difference between NCV and GCV is the latent heat of vaporization of the water produced during combustion of the fuel. As a consequence for coal and oil, the NCV is about 5 percent less than the GCV For most forms of natural and manufactured gas, the NCV is about 10 percent less."

Data / Parameter	$EF_{CO2,i,y}$, $EF_{CO2,m,i,y}$
Data unit	[tCO_2/GJ]
Description	CO_2 emission factor of fossil fuel type i used in power unit m in year y.
Source of data	2006 IPCC guideline. Table 1.2, chapter 1 of vol.2.
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Annually for the first crediting period.
Value monitored	$EF_{CO2,Diesel,}$: 0.0726 (tCO_2/GJ) $EF_{CO2,IFO\ 180,}$: 0.0755 (tCO_2/GJ) $EF_{CO2,Natural\ Gas,}$: 0.0543 (tCO_2/GJ) $EF_{CO2,Coal,2014}$: 0.0928 (tCO_2/GJ) $EF_{CO2,Petcoke,}$: 0.0829 (tCO_2/GJ) $EF_{CO2,Butane,}$: 0.0616 (tCO_2/GJ) $EF_{CO2,Propane,}$: 0.0616 (tCO_2/GJ) $EF_{CO2,Natural\ Gas\ Liquid,}$: 0.0543 ($tCO_2$/GJ)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	--

Data / Parameter	$EG_{m,y}$, $EG_{k,y}$
Data unit	[MWh]
Description	Net electricity generated by power plant/unit m, k in year y.
Source of data	CDEC-SIC public information
Description of measurement methods and procedures to be applied	Not applicable.
Frequency of monitoring/recording	Annually for the first crediting period.
Value monitored	See the Emission factor SIC 2020v1.xls See the Emission factor SIC 2019 v4.xls See the Emission factor SIC 2018 v4.xls See the Emission factor SIC 2017 v3.xls
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable
Purpose of the data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	--

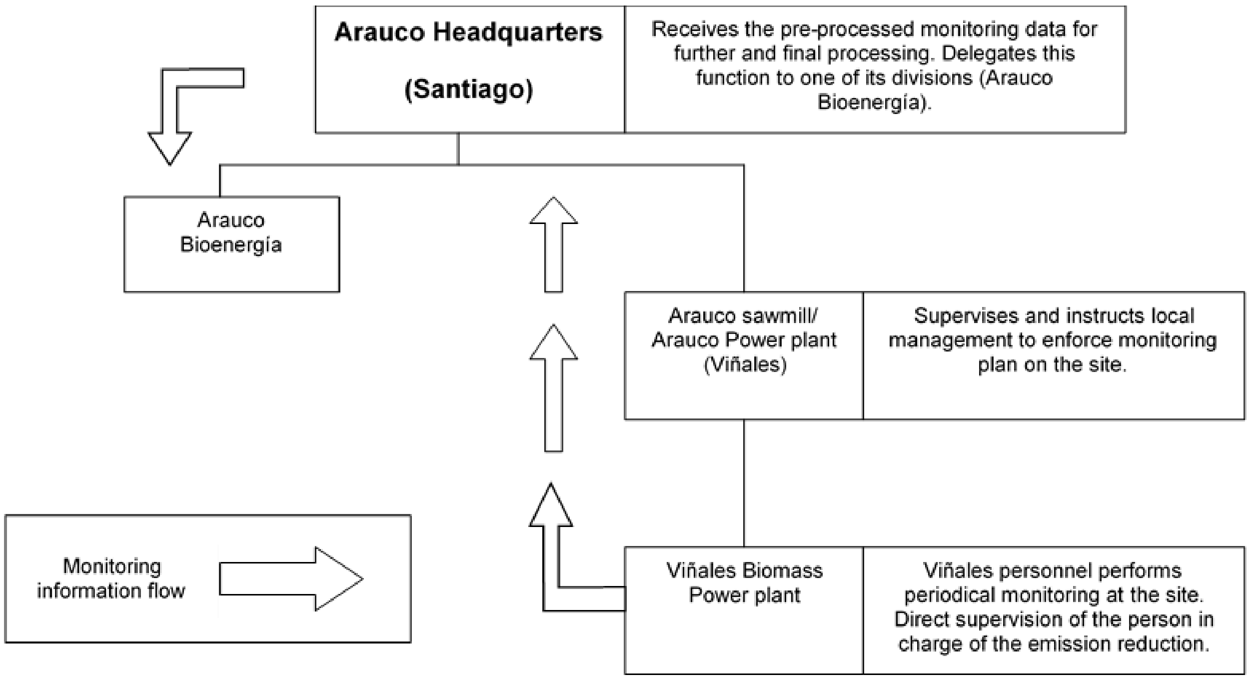
4.3 Monitoring Plan

The monitoring plan designed for Project Viñales Power plant VCS, describes the periodic data procurement by the current design document and point 3.2 of this monitoring report. The objective of a monitoring plan is guaranteeing the quality and assurance control of the parameters, allowing the yearly calculation of the emission reductions associated to project Viñales.

Project participant had defined the steps to follow a correctly critical parameter monitoring plan in “Monitoreo variables críticas proyecto VCS Viñales.pdf”. Parameters are collected and supported in file “Viñales monit CP1MP3.xlsx” for the current monitoring period.

Required parameters to assure and control the quality of the monitoring plan were reported monthly to Arauco’s headquarters in file RPG Viñales APT1[2].xlsx as is indicated in the following diagram:

[2] For years 2017,2018, 2019 and 2020



As is described in point 2.1, Arauco counts with on-site personnel 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. Using a Data Control System (DCS) electricity generated data is monitored continuously and automatically supported in their corresponding files daily or monthly frequency according monitoring plan definition. The information is partially processed and stored on-site, and is sent monthly to Arauco Bioenergía S.A. in Santiago for further and final processing. An internal verification is carried out every month to review the key performance indicators (KPI) and an annually internal verification to check the implementation level of the monitoring report.

A briefly description of the applied monitoring plan is described in the following table:

	Data / Parameter	Description	Responsible	Procurement source area	Monitoring frequency	Generating/Measuring method	Recording method
1	$BF_{PJ,n,y}$	Quantity of biomass residue of category n used in the project activity in year y	Power plant Engineer in charge	Biomass Procurement Area	Continuously	1.- Appropriate equipment installed 2.- Calculation method according PD	Monthly recording and aggregated. File: Recepción biomasa B_Carbono_mmmm_YYYY.xls
2	$BF_{B4,n,y}$	Quantity of biomass residue of category n used in the project activity in year y for which the baseline scenario is B4:					
3	$BF_{B1/B3,n,y}$	Quantity of biomass residue of category n used in the project activity in year y for which the baseline scenario is B1: or B3:					
4	$BF_{B5/B8,n,y}$	Quantity of biomass residue of category n used in the project activity in year y for which the baseline scenario is B5:, B6:, B7: or B8:					Not applicable in current monitoring period
5	$EF_{FF,y,f}$	CO_2 emission factor for fossil fuel type f in year y	Arauco Bioenergia	External and public source.	At least annually	Consulting public IPCC values	Anually recording. File: Viñales monit CP1MP1 yymmdd.xlsx
6	$EF_{CH4,BR}$	CH_4 emission factor for the combustion of biomass residues in the project plant.					
7	$EF_{CO2,LE}$	CO_2 emission factor of the most carbon intensive fossil fuel used in the country.				–	Since leakage is 0, parameter is not used.
8	$HC_{BL,y}$	Baseline process heat generation in year y.	Power plant Engineer in charge	Operation Area/DCS	Continuously and aggregated monthly	1.- Appropriate equipment installed 2.- Calculation method according PD	Monthly recording. File: Operaciones YYYY.xls
9	$EL_{PJ,gross,y}$	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.	Power plant Engineer in charge	idem	Continuously	1.- Appropriate equipment installed	Monthly recording and aggregated. File: Operaciones YYYY
10	$EL_{PJ,imp,y}$	Project electricity imports from the grid in year y.					
11	$EL_{PJ,aux,y}$	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y.					
12	$NCV_{BR,n,y}$	Net calorific value of biomass residue of category n in year y.	Power plant Engineer in charge	External laboratory	Every six months, taking at least three samples for each measurement.	Samples and laboratory process applied by third party.	Measured according defined frequency. File: NCV YYYY.xls

	Data / Parameter	Description	Responsible	Procurement source area	Monitoring frequency	Generating/Measuring method	Recording method
13	Moisture content of the biomass residues	% water content in mass basis in wet biomass residues.	Power plant Engineer in charge	Internal Laboratory	Daily average by type of biomass. Mean value calculated at least annually	Samples and laboratory process applied by internal laboratory. Equipment involved described in point 3.2.	Daily recording and obtain a monthly average. File: Base de datos Contenido de Humedad PBV_mmmm_YY.xls
14	P_y	Quantity of the main product of the production process produced in year y from plants operated at the project site.	Power plant Engineer in charge	Production control/SAP	Annually	Products are registered using SAP system.	Monthly recorded. File: Producción Aserradero YYYY - Pter mmYY.xls
15	LOC_y	Lenght of the operational campaign in year y.	Power plant Engineer in charge	DCS System/Operation Area	Monthly and annually aggregated.	Information registered in Power Plant.	Daily registered and annually aggregated. File: Consumos mes de mmmm YYYY.xls
16	$FC_{i,j,y}$	Quantity of fuel type i combusted in process j during the year y.	Power plant Engineer in charge	Instrumentation Area/DCS	Continuously and monthly aggregated.		Daily recorded and monthly aggregated. File: Recepción biomasa B_Carbono_mmmm_YYYY - Operaciones YYYY.xls
17	$NCV_{i,y}$	Weighted average net calorific value of fuel type i in year y.	Power plant Engineer in charge	External and public source.	At least annually	Consulting public IPCC values	Anually recording. File: Viñales monit CP1MP1 yymmdd.xlsx
18	$EF_{CO2,i}$	Weighted average CO_2 emission factor of fuel type i in year y.					
19	$D_{f,m}$	Retum trip road distance between the origin and destination of freight transportation activity f in monitoring period m.	Power plant Engineer in charge	Biomass Procurement Area	Continuously and annually aggregated.	Provider Geographical references according information in Biomass residues invoices from suppliers.	Monthly recorded an anually aggregated. File: Recepción biomasa B_Carbono_mmmm_YYYY.xls
20	$FR_{f,m}$	Total mass of freight transported in freight transportation activity f in monitoring period m.					
21	$FC_{i,m,y}$, $FC_{i,k,y}$	Amount of fossil fuel type i consumed by power plant/unit m and k in year y.	Arauco Bioenergia	External and public source.	Annually	Consulting third parties data base.Directly obtained by the CDEC-SIC Dispatch Center or	Anually recording and processing. File: Emission Factor SIC 2014 ACM0002 Ver12 ver1 Viñales.xlsx
22	$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y.					
23	$EG_{m,y}$, $EG_{k,y}$	Net electricity generated by power plant/unit m,k in year y.					
24	$EF_{CO2,i,y}$, $EF_{CO2,m,i,y}$	CO_2 emission factor of fossil fuel type y used in power unit m in year y.	Arauco Bioenergia	External and public source.	Anually	Default values indicated in IPCC 2006 Guideline (Volume 2, Chapter 1, page 1-16).	Anually recording and processing. File: Emission Factor SIC 2014 ACM0002 Ver12 ver1 Viñales.xlsx

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

Please note the following:

1. - Differences in baseline and project emission calculations included in tables below are due to the fact that all calculations are done directly in excel spreadsheets with full decimals (no rounding), this implies a decimal precision that is not carried onto word formatted tables because decimals are shown truncated and rounded down. Exact values can be viewed directly in emission reduction calculation spreadsheet.

2. - In emission reduction calculation spreadsheet (Version 01), sheet “Summary” the final result of Baseline and Project activity emissions are truncated and rounded in a conservative way.

3. - Since the emission reduction calculation for the project activity was done monthly, in some cases year-averages were employed the calculations presented below.

5.1 Baseline Emissions

According to ACM0006 (Version 12.1.1), baseline emissions are calculated using equation 2 as follows:

$$BE_y = EL_{BL,GR,y} \cdot EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \cdot EF_{FF,y,f} + EL_{BL,FF/GR,y} \cdot min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

Where:ACM0006 (Version 12.1.1) describe the algorithm used to determine the data above as

BE_y	Baseline emissions in year y (tCO_2).
$EL_{BL,GR,y}$	Baseline minimum electricity generation in the grid in year y (MWh).
$EF_{EG,GR,y}$	Grid emission factor in year y (tCO_2/MWh).
$FF_{BL,HG,y,f}$	Baseline fossil fuel demand for process heat in year y (GJ/yr).
$EF_{FF,y,f}$	CO_2 emission factor for fossil fuel type f in year y (tCO_2/GJ).
$EL_{BL,FF/GR,y}$	Baseline uncertain electricity generation in the grid or on-site in year y (MWh/yr).
$EF_{EG,FF,y}$	CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y (tCO_2/MWh).
$BE_{BR,y}$	Baseline emissions due to disposal of biomass residues in year y (tCO_2e).
y	Year of the crediting period.
f	Fossil fuel type.

following:

Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors

1.1 Determine total baseline process heat generation

As is described in PD, page 52, the amount of process heat that would be generated in baseline during year y ($HC_{BL,y}$) was determined as the difference of the enthalpy of the process heat (steam) supplied to process heat loads in the project activity minus the enthalpy of the feed water, the boiler blow-down and any condensate return to heat generator.

The enthalpies were determined using an on-line tool[3] as a function of turbine condition design for temperature and pressure and monitored continuously to ensure that pressure and temperature stay in an acceptable range around these conditions.

1.2. Determine total baseline electricity generation

Using equation 3 (page 25) of ACM0006 (Version 12.1.1) the baseline electricity generation in the grid can be calculated as follows:

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y}$$

Data:

		2020	2019	2018	2017
(1) Gross quantity of electricity generated.	$EL_{PJ,gross,y}$	291,597 (MWh)	305,880 (MWh)	310,594 (MWh)	282,762 (MWh)
(2) Project electricity imports from the grid.	$EL_{PJ,imp,y}$	375 (MWh)	490 (MWh)	537 (MWh)	448 (MWh)
(3) Total auxiliary electricity consumption required for the operation of the power plant.	$EL_{PJ,aux,y}$	37,573 (MWh)	39,472 (MWh)	39,657 (MWh)	36,373 (MWh)
(4) Auxiliary electricity consumption due to pneumatic transportation system.		3,050 (MWh)	3,050 (MWh)	3,050 (MWh)	3,050 (MWh)

1.3 Determine the baseline capacity of electricity generation

As is defined in PD, page 53, the project activity baseline does not consider on-site power generation. All the power electricity would be generated in grid-connected power plants.

$$CAP_{EG,total,y} = 0$$

1.4. Determine the baseline availability of biomass residues

[3] http://www.peacesoftware.de/einigewerte/wasser_dampf_e.html

As is described in PD, page 53, the biomass type that was used for heat generation in Viñales sawmill during this monitoring period was sawdust and bark from industrial operations. Quantity of heat to process was measured by dedicated equipment described in pages 32 to 34 in the present document.

1.5 Determine the efficiencies of heat generators and efficiencies and heat-to-power ratio of heat engines

As described PD, page 54, and Validation report, page 17, only option 1: "Default values should be chosen" is applicable to the project. Nevertheless, as is indicated in validation report an efficiency of 100%, proposed by "Tool to determine the baseline of thermal or electric energy generation system" it would not result in the most conservative scenario. The lower the baseline heat generator efficiency, the lower would be the amount of biomass associated with power generation. Consequently, the lower recommended efficiency by Andritz and Metso for the project's heat generator is 85%.

1.6 Determine the emission factor of on-site electricity generation with fossil fuels

As describes current PD, page 54, there is no fossil fuel-based power generation identified as part of the baseline scenario. Then:

$$EF_{EG,FF,y} = EF_{EG,GR,y}$$

1.7 Determination of the emission factor of the grid electricity generation

The parameter $EF_{EG,GR,y}$ 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 "Tool to calculate the emission factor for an electricity system (Version 03.0.0)".

- The relevant electricity system is the Central Interconnected System of Chile (SIC), the largest of the fourth transmission systems in Chile, accounting for about 75% of the power generation capacity of the country and supplying. SIC has no interconnection with any other transmission system in Chile or in the region.
- According to current PD, step 2 is not applicable in this case
- According to current PD, page 55, option b was chosen to calculate the Operating Margin (OM). In this case the OM emission factor is calculated using the simple/adjusted method. 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 2020,2019, 2018 and 2017.

The Project Participant used data from 2017 to 2020 to determine the lambda factor that expresses the percentage of the time when low-cost/must-run sources were on the margin:

$$\lambda_y = \lambda_{\frac{2020}{2019}} = 0.0000$$

$$\lambda_y = \lambda_{\frac{2018}{2017}} = 0.0000$$

The rest of the parameters used to calculate the $EF_{EG,GR,y}$ from 2017 and 2020 were obtained from the CDEC-SIC dispatch centre (official and public information).

- The calculation of the $EF_{grid,OM\text{-}adj,y}$ is as follows:

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

$$\sum_{i,j} F_{I,J,2020} COEF_{i,j} = 31{,}558{,}026 \frac{tCO2}{yr}$$

$$\sum_{i,j} F_{I,J,2019} COEF_{i,j} = 32{,}618{,}825 \frac{tCO2}{yr}$$

$$\sum_{i,j} F_{I,J,2018} COEF_{i,j} = 33{,}821{,}314 \frac{tCO2}{yr}$$

$$\sum_{i,j} F_{I,J,2017} COEF_{i,j} = 17{,}257{,}523 \frac{tCO2}{yr}$$

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

$$\sum_{j} GEN_{J,2020} = 39{,}826 \frac{GWh}{yr}$$

$$\sum_{j} GEN_{J,2019} = 42{,}942 \frac{GWh}{yr}$$

$$\sum_{j} GEN_{J,2018} = 39{,}931 \frac{GWh}{yr}$$

$$\sum_{j} GEN_{J,2017} = 24{,}074 \frac{GWh}{yr}$$

    - The CO_2 emissions of low-cost/must run power sources. 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:

$$\sum_{i,k} F_{i,k,2020} * COEF_{i,k} = 93{,}507 \frac{tCO2}{yr}$$

$$\sum_{i,k} F_{i,k,2019} * COEF_{i,k} = 360{,}079 \frac{tCO2}{yr}$$

$\sum_{i,k} F_{i,k,2018} * COEF_{i,k}$ =0 tCO2/yr

$$\sum_{i,k} F_{i,k,2017} * COEF_{i,k} = 379{,}865 \frac{tCO2}{yr}$$

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

$$\sum_{j} GEN_{j,2020} = 35{,}688 \frac{GWh}{yr}$$

$\sum_j GEN_{j,2019} = 34{,}397\ GWh/yr$

$\sum_j GEN_{j,2018}$ =35,563 GWh/yr

$\sum_j GEN_{j,2017}$ =29,917 GWh/yr

Replacing the above values in the equation used to calculate the $EF_{electricity,y}$ for year 2015 and 2016, the operating margin results:

$$EF_{OM,2020} = (1 - 0.0000) * \frac{31{,}558}{39{,}826}\left(\frac{tCO2}{MWh}\right) + 0.0000 * \frac{93{,}507}{35{,}688}\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2020} = EF_{OM,simple\ adjusted,2020} = 792.4\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2019} = (1 - 0.0000) * \frac{32{,}618{,}825}{42{,}942}\left(\frac{tCO2}{MWh}\right) + 0.0000 * \frac{360{,}079}{34{,}397}\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2019} = EF_{OM,simple\ adjusted,2020} = 759.6\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2018} = (1 - 0.0000) * \frac{33{,}821{,}314}{39{,}931}\left(\frac{tCO2}{MWh}\right) + 0.0000 * \frac{0}{35{,}563}\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2018} = EF_{OM,simple\ adjusted,2020} = 847.0\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2017} = (1 - 0.0000) * \frac{17{,}257{,}523}{24{,}073}\left(\frac{tCO2}{MWh}\right) + 0.0000 * \frac{379{,}865}{29{,}917}\left(\frac{tCO2}{MWh}\right)$$

$$EF_{OM,2017} = EF_{OM,simple\ adjusted,2020} = 716.86\left(\frac{tCO2}{MWh}\right)$$

- According to 2020,2019,2018 and 2017 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 both years. These plants are considered to calculate the Build Margin for the years:

$$EF_{BM,2020} = 380.74\left(\frac{tCO2}{MWh}\right)$$

$$EF_{BM,2019} = 289.12\left(\frac{tCO2}{MWh}\right)$$

$$EF_{BM,2018} = 234.13\left(\frac{tCO2}{MWh}\right)$$

$$EF_{BM,2017} = 578.88\left(\frac{tCO2}{MWh}\right)$$

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 $EF_{grid,OM,y}$ and the Build Margin $EF_{grid,BM,y}$, and considering the default value of (0.5) for the weights W_{OM} and (0.5) for the W_{BM}, it is possible to calculate $EF_{grid,CM,y}$. The results obtained were the following:

Data:

		2020	2019	2018	2017
(1) Operating Margin (OM).	$EF_{grid,OM,y}$	0.792 (tCO_2/MWh)	0.759 (tCO_2/MWh)	0.847 (tCO_2/MWh)	0.717 (tCO_2/MWh)
(2) Build Margin (BM).	$EF_{grid,BM,y}$	0.381 (tCO_2/MWh)	0.289 (tCO_2/MWh)	0.234 (tCO_2/MWh)	0.579 (tCO_2/MWh)
(3) Weighting of Operating Margin.	W_{OM}	50%	50%	50%	50%
(4) Weighting of Build Margin.	W_{BM}	50%	50%	50%	50%

<u>Calculations:</u>

			2020	2019	2018	2017
(5) Combined Margin calculation (CM).	$EF_{grid,CM,y}$	(1)*(3)+(2)*(4)	0.587 (tCO_2/MWh)	0.524 (tCO_2/MWh)	0.541 tCO_2/MWh)	0.648 (tCO_2/MWh)

Determine the minimum baseline electricity generation in the grid

Current PD, page 57, describes calculation of this parameter using equation 13 of ACM0006 (Version 12.1.1) methodology:

$$EL_{BL,GR,y} = max[0, EL_{BL,y} - CAP_{EG,total,y}]$$

Determine the baseline biomass-based heat and power generation

Determination of the baseline biomass-based heat generation and the baseline biomass-based cogeneration of process heat and electricity and heat extraction

The following diagram present biomass priority order during CP1MP3.

Biomass consumption in priority order during CP1MP3.

First column represent the total quantity of biomass combusted category n to obtain the total heat generated ($BR_{PJ,n,y}$). Second column represent the total quantity of biomass combusted according defined scenarios.

As is described in the current PD, page 58, (equation 14 in ACM0006 Ver12.1.1) was used to calculate the amount of heat generated with biomass residues.

$$HG_{BL,BR,y} = \sum_{h}\sum_{n}\left(BR_{B4,n,h,y} \cdot NCV_{BR,n,y} \cdot \eta_{BL,HG,BR,h}\right)$$

Data:

		year
(1) Biomass mix from internal industrial operations.	$BR_{PJ,1,y}$	2020 101,891 (BDt/yr) (adjusted) 2019 100,507 BDt/yr) 2018 99,641(BDt/yr) (adjusted) 2017 67,461 (BDt/yr) (adjusted)
(2) Net calorific value (NCV) of biomass mix from internal industrial operations.	$NCV_{BR,1,y}$	2020 18.66 (GJ/BDt) 2019 18.06 (GJ/BDt) 2018 18.09(GJ/BDt) 2017 18.61(GJ/
(3) Biomass mix from external industrial operations	$BR_{PJ,3,y}$	2020 145,354 (BDt/yr) (adjusted) 2019

		163,095 (BDt/yr) (adjusted) 2018 185,538 (BDt/yr) (adjusted) 2017 140,672 (BDt/yr) (adjusted)
(4) Net calorific value (NCV) of biomass mix from external industrial operations.	$NCV_{BR,3,y}$	2020 18.46 (GJ/BDt) 2019 18.11 (GJ/BDt) 2018 18.13 (GJ/BDt) 2017 18.09 (GJ/BDt)
(5) Biomass mix from forestry operations	$BR_{PJ,4,y}$	2020 0.0 (BDt/yr) 2019 0.0(BDt/yr) 2018 0.0(BDt/yr) 2017 0.0(BDt/yr)
(6) Net calorific value (NCV) of biomass mix from forestry operations	$NCV_{BR,4,y}$	2020 --- (GJ/BDt) 2019 --- (GJ/BDt) 2018 ---(GJ/BDt) 2017 --- (GJ/BDt)
(7) Baseline biomass-based heat generation efficiency of heat generator	$h_{BL,HG,BR}$	85%
(A) Total measured heat generated (with fossil fuel)	[(1)*(2)+(3)*(4)+(5)*(6)]*(7)	2020 3,896,059(GJ/y) 2019 4,052,724 (GJ/y) 2018 4,391,498(GJ/y) 2017 3,230,642(GJ/y)

(B) Total heat to process		2020 372,067 (GJ/y) 2019 403,139(GJ/y) 2018 407,559 (GJ/y) 2017 391,052 (BDt/y)
(8) Mix of biomass from internal industrial operations $BR_{PJ,1,y}$, heat generation.	If ((1)*(2)*(7)) < (B), (B), ((1)*(2)*(7))	2020 372,067 (GJ/y) 2019 403,139(GJ/y) 2018

		407,559 (GJ/y) 2017 391,052 (BDt/y)
(9) Biomass mix from external industrial operations	If((B)-(8)<(3)*(4)*(7),(B)-(8),(3)*(4)*(7))	2020 2,280,144(GJ/y) 2019 2,510,248(GJ/y) 2018 2,859,939(GJ/BDt) 2017 2,163,501(GJ/BDt)
(10) Biomass mix from forestry operations	If((B)-(8)-(9)<(5)*(6)*(7),(B)-(8)-(9),(5)*(6)*(7)	2020 0 (GJ/BDt) 2019 0 (GJ/BDt) 2018 0 (GJ/BDt) 2017 0 (GJ/BDt)
(11) Mix of biomass from internal industrial operations, heat generation	$BR_{B4,1,y}$	2020 23,461(BDt/yr) 2019 26,268 (BDt/yr) 2018 26,502 (BDt/yr) 2017 24,721(BDt/yr)
(12) Biomass, attributable to the project activity (for electricity generation)	(A) – (B)	2020 3,523,991(GJ/yr) 2019 3,649,586(GJ/yr) 2018 3,983,939(GJ/yr) 2017 2,839,590(GJ/yr)
(13) Mix of biomass from internal industrial operations, electricity generation, attributable to project activity	$BR_{PJ,,2,y}$	2020: 78,430(BDt(yr) 2019: 74,239(BDt/yr) 2018: 73,139(BDt/yr) 2017: 42,740(BDt/yr)
(14) Biomass from external operations, electricity generation, attributable to project activity	$BR_{PJ,3,y}$	2020: 138,086 (BDt/yr) adjusted 2019: 154,941 (BDt/yr) adjusted 2018:

		176,262 (BDt/yr) adjusted 2017: 133,638 (BDt/yr) adjusted

Determination of the baseline demand for fossil fuels to meet the balance of process heat and corresponding electricity generation

Determination of the baseline fossil fuel based cogeneration of process heat and electricity and remaining process heat demand and baseline heat generation to meet the fossil-based cogeneration of heat and power and the heat to meet the balance of process heat

Both are not applicable, since there would be no fossil-fuel-based heat generators identified in baseline scenario (page 58 and 59, current PD). 100% of the heat demand by the saturated biomass boiler in baseline scenario.

Determination of the baseline emissions due to uncontrolled burning or decay of biomass residues

According ACM0006 Version 12.1.1, baseline emissions are determined separately for biomass residues categories for which scenarios B1 and B3 (aerobic decay or uncontrolled burning) apply, and for biomass residues categories for which scenario B2 (anaerobic decay) apply. According to current PD (page 59), the biomass residues that are used for heat and power generation due to the implementation of the project activity would be dumped or left to decay under mainly aerobic conditions (B1) or burnt in an uncontrolled manner without utilizing then for energy purposes (B3), PP proceed to equation (36) of methodology ACM0006 version 12.1.1, multiplying the quantity of biomass residues with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_{n} BR_{B1/_{B3},n,y} \cdot NCV_{BR,n,y} \cdot EF_{BR,n,y}$$

(15) CH_4 Global Warming Potential	GWP_{CH4}	25
(16) Adjusted CH_4 factor for uncontrolled burning, biomass from industrial operations.	$EF_{BR,3,y}$	821.7 (Kg CH_4/TJ)
(17) Total emissions $BE_{BR,B1/B3,y}$	([(13)*[(17)*(16)*(2)]/1000]+[(14)*[(17)*(16)*(3)/1000]+(12)*[(17)*(16)*(4)/1000])/1000	2020 85,373 (tCO_2e) (adjusted) 2019

		59,942 (tCO2e) (adjusted) 2018 68,275 (tCO2e) (adjusted) 2017 51,662 (tCO2e) (adjusted)

Calculate baseline emissions

According to equation 2 (page 22) of the ACM0006 version 12.1.1:

$$BE_y = EL_{BL,GR,y} \cdot EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \cdot EF_{FF,y,f} + EL_{BL,FF/GR,y} \cdot \min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

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 electricity generation. The emission reductions then, result from the avoidance of biomass open-air burning and the electric power generated with fossil fuels. According to this, the baseline emissions for year y were calculated according to the following resumed formula (page 59, current PD).

(1) Baseline minimum electricity generation in the grid in year y.	$EL_{BL,GR,y}$	2020 251,349(MWh) 2019 263,848 (MWh) 2018 268,424 (MWh) 2017 243,787 (MWh)
(2) Grid emission factor in year y.	$EF_{EG,GR,y}$	2020 0.587(tCO_2/MWh) 2019 0.524(tCO2/MWh) 2018 0.541(tCO2/MWh) 2017 0.648(tCO2/MWh)
(3) Baseline fossil fuel demand for process heat in year y.	$FF_{BL,HG,y,f}$	2020 0 (GJ) 2019 0 (GJ) 2018 0 (GJ) 2017

		0 (GJ)
(4) CO_2 emission factor for fossil fuel type f in year y.	$EF_{FF,y,f}$	2020, 2019,2018 and 2017 Diesel 74.8(tCO_2/GJ) Fuel oil 78.8 (tCO_2/GJ) LPG 65.6 (tCO_2/GJ)
(5) Baseline uncertain electricity generation in the grid or on-site in year y.	$EL_{BL,FF/GR,y}$	2020 0 (MWh) 2019 0 (MWh) 2018 0 (MWh) 2017 0 (MWh)
(6) CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y.	$EF_{EG,FF,y}$	2020 0.587(tCO_2/MWh) 2019 0.524(tCO2/MWh) 2018 0.541(tCO2/MWh) 2017 0.648(tCO2/MWh)
(7) Baseline emissions due to disposal of biomass residues in year y	$BE_{BR,y}$	2020 85,373(tCO_2e) adjusted 2019 59,942 (tCO2e) adjusted 2018 68,275 (/tCO2e) adjusted 2017 51,662 (tCO2e) adjusted

(8) Baseline emissions in year y	**(1)*(2)+(7)**	2020 232,807 (tCO_2e) (adjusted) 2019 198,214 (tCO2e) adjusted 2018 213,375(tCO2e) adjusted 2017 209,605 adjusted (tCO2e)

(*) Calculations are done directly in excel spreadsheets with full decimals (no rounding), this implies a decimal precision that is not carried onto word formatted tables because decimals are shown truncated and rounded down for Baseline emissions calculation. Exact values can be viewed directly in emission reduction calculation spreadsheet.

5.2 Project Emissions

The anthropogenic emissions by sources of GHGs of the project activity in year y (PEy) can be determined using equation 37 of the ACM0006 Version 12.1.1 as follows:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{ww,y} + PE_{BG2,y} + PE_{BC,y}$$

Where:

PE_y Total project activity emissions (tCO_2eq/yr).
$PE_{FF,y}$ Project emissions due to fossil fuel consumption at the project site (tCO_2eq/yr).
$PE_{GR1,y}$ Project emissions due to electricity imports from the grid to the project site (tCO_2/yr).
$PE_{GR2,y}$ Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year y (tCO_2/yr)
$PE_{TR,y}$ Project emissions due to transport of the biomass residues to the project plant (tCO_2/yr).
$PE_{BR,y}$ Project emissions from the combustion of biomass residues (tCO_2/yr).
$PE_{ww,y}$ Emissions from the production of biogas in year y (tCO_2e/yr)
$PE_{BG2,y}$ Emissions from the production of biogas in year y (tCO_2/yr)
$PE_{BC,y}$ Project emissions associated with the cultivation of land to produce biomass in year y (tCO_2e/yr)

According current PD (page 61) considering the particular circumstances of the present project activity, the following simplification apply in this case:

$PE_{GR2,y}= 0$ In this case, there would be no electricity generation in the baseline scenario.
$PE_{ww,y}= 0$ There are no anaerobic treatment of waste water generated from the treatment of biomass residues (if any).
$PE_{BG2,y}= 0$ The project activity does not imply the production of biogas
$PE_{BC,y}= 0$ The project activity does not contemplate the cultivation of land to produce biomass.

Then, equation 37 simplifies and reduces to the following:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{TR,y} + PE_{BR,y}$$

1.- Determination of $PE_{FF,y}$

The project activity implies additional fossil fuel consumption due to:

- Operational reasons associated to additional biomass consumption (e.g. biomass too wet in winter, etc.).
- On-site additional biomass transportation.

According the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”, CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FF,y} = \sum_i FC_{i,j,y} \cdot COEF_{i,y}$$

Where:

$FC_{i,j,y}$ Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr).
$COEF_{i,y}$ CO_2 emission factor for the fossil fuel of type i used in the power boiler (tCO_2/kg).

A) Fossil Fuel consumption in the power boiler

Data:

		year
(1) Diesel used in the power boiler due to operational reasons.	$FC_{diesel,poject\ plant,y}$	2020 28(t/y) 2019 40(t/y) 2018 26 (t/y) 2017 72 (t/y)
(2) Diesel net calorific value.	$NCV_{FF,diesel,y}$	43.30 (GJ/t)
(3) Diesel CO_2 emission factor.	$EF_{FF,y,diesel}$	0.0748 (tCO_2/GJ)

		year
(4) LPG used in the power boiler due to operational reasons.	$FC_{LPG,poject\ plant,y}$	2020 0.03(t/y) 2019 0.04 /t/y) 2018 0.03(t/y) 2017 0.1 (t/y)
(5) LPG net calorific value.	$NCV_{FF,LPG,y}$	52.20 (GJ/t)
(6) LPG CO_2 emission factor.	$EF_{FF,y,LPG}$	0.0656 (tCO_2/GJ)

Calculations:

		year
(7) Emissions due to fossil fuel consumption in the power boiler.	(1)*(2)*(3)+(4)*(5)*(6)	2020 91(tCO_2/y) adjusted 2019 130(tCO2/y) adjusted 2018 85 (tCO2/y) 2017 235 (tCO2/y) adjusted

Fossil fuel consumption due to on-site transportation of biomass residues

Data:

(1) Fossil fuel used for on-site biomass transportation due to the project activity.	$FC_{diesel, roject site,y}$	2020 56.32(t/y) 2019 62.63 (t/y) 2018 65.40 (t/y) 2017 5818 (t/y)
(2) Fossil fuel net calorific value.	$NCV_{FF,diesel,y}$	43.30 (GJ/t)
(3) Fossil fuel CO_2 emission factor.	$EF_{FF,y,diesel}$	0.0748 (tCO_2/GJ)

Calculations:

		year
(7) Emissions due to fossil fuel used for on-site transportation.	(1)*(2)*(3)	2020 182(tCO27y) 2019 203 (tCO2/y) 2018 212 (tCO2/y) 2017 188 (t CO2/y)

Calculations:

(1) Fossil fuel used for processing biomass from forestry operations.	$FC_{diesel,biomass processing,y}$	2020 0(t/y) 2019 0 (t/y) 2018 0 (t/y) 2017 0 (t/y)
(2) Fossil fuel net calorific value.	$NCV_{FF,diesel,y}$	43.30 (GJ/t)
(3) Fossil fuel CO_2 emission factor.	$EF_{FF,y,diesel}$	0.0748 (tCO_2/GJ)

Calculations:

(4) Emissions due to fossil fuel consumption for processing forestry biomass residues.	(1)*(2)*(3)	2020 0.0 (tCO_2/y) 2019 0.0 (tCO2/y) 2018 0.0 (tCO2/y) 2017 0.0 (tCO2/y)

Then, the Carbon dioxide emissions from on-site consumption of fossil fuel was:

		Data
Emissions due to fossil fuel consumption in the power boiler.	$PE_{diesel,poject\ plant,y}$	2020 91(tCO_2/y 2019 130 (tCO2/y) 2018 85 (tCO2/y) 2017 235(tCO2/y)
Emissions due to fossil fuel consumption for on-site transportation	$PE_{diesel,poject\ site,y}$	2020 182(tCO2/y) 2019 203(tCO2/y) 2018 212(tCO2/y) 2017 188(tCO2/y)
Emissions due to fossil fuel consumption for processing forestry biomass residues.	$FC_{diesel,biomass\ processing,y}$	2020 0.0(tCO_2/y) 2019 0.0(tCO2/y) 2018 0.0(tCO2/y) 2017 0.0(tCO2/y)
Total emissions.	$\mathbf{PE_{FF,y}}$	2020 274(tCO_2/y) 2019 332(tCO2/y) 2018 297(tCO2/y) 2017 423(tCO2/y)

2.- Determination of $PE_{GR1,y}$

If electricity is imported from the grid to the project site during year y, corresponding emissions should be accounted for as project emissions, as follows:

$$PE_{GR1,y} = EF_{EG,GR,y} \cdot EL_{PJ,imp,y}$$

Data:

		Data
(1) Project electricity imports from the grid.	$EL_{PJ,imp,y}$	2020 375 (MWh) 2019 490 (MWh) 2018 537(MWh) 2017

		448 (MWh)
(2) Grid emission factor.	$EF_{EG,GR,y}$	2020 0.587(tCO_2/MWh) 2019 0.524(tCO2/MWh) 2018 0.541(tCO2/MWh) 2017 0.648 (tCO2/MWh)

Calculations:

			Data
Total emissions.	(1)*(2)	$PE_{GR1,y}$	2020 220(tCO_2/y) 2019 257(tCO2/y) 2018 290(tCO2/y) 2017 290(tCO2/y)

3.- Determination of $PE_{TR,y}$

Emissions were determined using latest version of the tool "Project and leackage emissions from road transportation of freight".

Data:

		Data
(1) Total mass of freight transported in freight transportation activity f.	$FR_{f,m}$	2020 420,234(wet ton/y) (adjusted) 2019 440,881 (wet tons/y) (adjusted) 2018 464,164 (wet tons/y) (adjusted) 2017 379,209 (wet tons/y) (adjusted)
(2) Weight average calculation.	$S[D_{f,m}*FR_{f,m}]$	2020 16,432,352 (adjusted) 2019 14,374,041 (adjusted) 2018

		22,532,592 (adjusted) 2017 14,234,146 (adjusted)
(3) Default CO_2 emission factor for freight transportation activity f.	EF_{CO2}	129

Calculations:

			Data
Total emissions.	$[(2)*(3)]/10^6$	$PE_{TR,y}$	2020 2,120(tCO_2/y) (adjusted) 2019 1,854(tCO2/y) (adjusted) 2018 2,907(tCO2/y) (adjusted) 2017 1,836 (tCO2/y) (adjusted)

5.3 Leakage

According to the detailed Excel spreadsheet presented during the validation process Viñales Power Plant Project, the supply/demand indexes for each biomass types consumed by the project activity are clearly higher than 1.25 as is established by the criteria of the ACM0006 (Version12.1.1).

Viñales Validation Report indicates that the project activity counts with enough biomass locally, and therefore, is not causing other biomass plants in the area to switch to fossil fuels. As described in the registered PD, supply/demand indexes that Project Participant has performed in detailed research, is anticipated that there are no leakage from the implementation of the project activity.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01/01/2017-31/2017	209,604	6,611	0	202,993
01/01/2018-31712/2018	213,375	9,015	0	204,360
01/01/2019-31/12/2019	198,214	7,539	0	190,675
01/01/2020-31/12/2020	232,806	7,512	0	225,294
Total	**853,999**	**30,677**	**0**	**823,322**

The net emissions reduction for the period of 2017-2020 amounted to 857,941 tCO2e, which was 20.2% lower than the estimate in the PD for the same period. The table below presents a comparison by year, and it shows that in all the years, there was a reduction result that was less than what was reported in the PD.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	PD Emission reductions (tCO_2e)	PD vs NET GHG emissions reduction %
01/01/2017-31/2017	209,604	6,611	0	202,993	258,903	-21.6%
01/01/2018-31712/2018	213,375	9,015	0	204,360	258,903	-21.1%
01/01/2019-31/12/2019	198,214	7,539	0	190,675	258,903	-26.4%
01/01/2020-31/12/2020	232,806	7,512	0	225,294	258,903	-13.0%
Total	**853,999**	**30,677**	**0**	**823,322**	**1,035,612**	**-20.5%**

When calculating baseline emissions reduction, two primary parameters are considered: minimum baseline electricity generation and grid emission factor. During the validation process, it was found that the estimated data in PD for these parameters were higher than the average value of each parameter for the period between 2017 and 2020. Specifically, the estimated value of electricity was found to be 13.4% higher, while the grid emission factor was 19.7% higher. These are the main reasons for the differences that justify the differences in the table above.