MONITORING REPORT

Wood waste-to-energy project at Sawmill-25 (Arkhangelsk)

JI project reference number: 0039

Monitoring report #2

Monitoring period:
Start date: 1 January 2008
End date: 31 December 2010

Version 1.2

Date of preparation: 14 November 2011

Content

1. Introduction

This Monitoring report summarizes operation of the JI project “Wood waste-to-energy project at Sawmill-25 (Arkhangelsk)” and is aimed on calculation of the emission reductions achieved by the project activity during the period covered by this report.

1.1 Emission reductions for the monitoring period

During this monitoring period, the project activity has achieved emission reductions of **105 339** tCO_2e.

1.2 Monitoring period

1 January 2008 - 31 December 2010

1.3 Comments

This is the second monitoring report since the determination of the project. The first one was issued for monitoring of the pre-Kioto emission reductions of 2006-2007. The second report is prepared in accordance with the determined project design documentation (PDD) «Wood waste-to-energy project at Sawmill-25 (Arkhangelsk)» Version 2.0 dd 18 May 2007. All the data are collected and emission reductions calculation is made in accordance with the procedures described in Section D “Monitoring Plan” of the PDD.

Letter of Approval for the project by the Russian Government is issued in the decree N709 dated 30 December 2010. The project is listed under number 13 in the list of approved projects.

Letter of Approval of Investor Country will be issued later after approval of the carbon purchase contract in due course.

2. General project activity

2.1 Title of the project

Wood waste-to-energy project at Sawmill-25 (Arkhangelsk)

2.2 Sectoral scope

Sector: 1. Energy industries (renewable/non-renewable sources)

2.3 Crediting period

1 January 2008 - 31 December 2012

2.4 Location of the project

The considered project is located on the territory JSC “Sawmill-25”, Arkhangelsk, Russia. Sawmill 25 is the largest sawmill in the North-West of Russia. The company is a part of the Titan Group, which is one of the biggest timber industry companies in Russia, integrating on the upstream basis various production units (enterprises) starting from timber logging, up to the final products manufacturing. JSC “Sawmill 25” is focused on production of saw-timber products and pulp chips. Main production facilities are located on two sites: Tsiglomen and Maimaksa.

2.5 Short project description

The project is aimed at increasing the amount and efficiency of bark and wood waste (BWW) use as a fuel for generating heat and power, thus reducing consumption of expensive and environmentally dirtier fossil fuel, the amount of dumped BWW and GHG emissions into the atmosphere.

The project provides for implementation of the following solutions:

1. Construction of a new BWW boiler-house at Tsiglomen production site;

2. Construction of a new BWW combined heat power (CHP) plant at Maimaksa production site.

2.6 Status of implementation of the project

Currently all actions according to the project are totally completed. Construction was conducted with minor deviations from scheduled terms pointed in the PDD for Tsiglomen (2005) and Maimaksa production sites (2006-2007).

The BWW boiler-house at Tsiglomen production site was commissioned according to the Certificate of acceptance in operation dd 31.03.2006.

The new BWW combined heat power (CHP) plant at Maimaksa production site was commissioned according to the Certificate of acceptance in operation dd 07.05.2008.

From February to May of 2008 CHP at Maimaksa production site worked in the testing mode and supplied steam and electricity to the plant internal consumers.

2.7 Responsible party for the monitoring report

JSC "Sawmill 25"

- Head Energy Engineer – Nezgovorov A. V.

Camco

- JI Manager – Ryumin O.V.

3. Monitoring plan and results of the project monitoring

3.1 Monitoring plan

3.1.1 Methodological approach

3.1.1.1. Baseline methodology

The baseline was developed in compliance with “Guidance on criteria for baseline setting and monitoring”[1]. The project developer uses JI specific approach, but definitely coordinating it with the requirements set forth in Decision 9/CMP.1, Annex *B* “Criteria for baseline setting and monitoring”[2].

3.1.1.2 Monitoring methodology

Selection of monitoring approach was made in compliance with “Guidance on criteria for baseline setting and monitoring” and requirements of Decision 9/CMP.1, Appendix B “Criteria for baseline setting and monitoring”. The project developer used JI specific approach for establishing the monitoring. Collection of all key parameters required to calculate greenhouse gas emissions is undertaken in compliance with the established practice of Sawmill 25. The monitoring plan data should be stored for at least 2 years after the end of the crediting period.

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[1] Guidance on criteria for baseline setting and monitoring (version 02), JISC

[2] Report of the Conference of the parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, held at Montreal from 28 November to 10 December 2005. Decision 9/CMP.1 Guidelines for the implementation of Article 6 of the Kyoto protocol. Appendix B Criteria for baseline setting and monitoring. p.12-13.

3.1.2 Monitored parameter in the project

Parameters which presented in the Table 3.1 are controlled according to the Monitoring Plan.

Parameters 2 ($NCV_{BWW,1,y}$) and 8 ($NCV_{BWW,2,y}$) are presented in the reporting documents in the Gkal/thousand m^3. Following formulae is used for the transferring of the data unit from Gkal to GJ:

$$GJ = 4.18 \times Gkal$$

The constants used for emission reductions calculation are presented in the Table 3.2.

Table 3.1.

Data to be collected according to the monitoring plan

ID	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
TSIGLOMEN PRODUCTION SITE								
ID1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Heat meter readings
2. $NCV_{BWW,1,y}$	Net calorific value of BWW on working mass	Heat engineering laboratory of ASTU[3]	GJ/t	m	Quarterly	100 %	Electronic and paper	The average value is determined at the end of the year
ID 3. $W_{BWW,1,y}$	Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)						
MAIMAKSA PRODUCTION SITE								
ID 4. $HG_{gross,2,new,y}$	Gross heat generation at the new CHP plant	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Steam-flow meter readings
ID 5. $HS_{2,new,y}$	Heat energy supply from the new CHP plant	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Heat meter readings
ID 6. $HS_{2,old,PJ,y}$	Heat energy supply from the old boiler house	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Heat meter readings
ID 7. $EG_{2,new,y}$	Gross electric power generation at the new CHP plant	Department of head energy engineer	MWh	m	Continuously	100 %	Electronic and paper	Power meter readings

[3] ASTU – Arkhangelsk State Technical University

8. $NCV_{BWW,2,y}$	Net calorific value of BWW on working mass	Heat engineering laboratory of ASTU	GJ/t	m	Quarterly	100 %	Electronic and paper	The average value is determined at the end of the year
ID 9. $W_{BWW,2,y}$	Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)						
ID 10. $FC^{m}_{oil,2,PJ,y}$	Mass fuel oil consumption at Maimaksa production site	Department of head energy engineer	t	m	Monthly	100 %	Electronic and paper	Readings of level meter in the fuel oil storage tank
ID 11. $NCV_{oil,2,y}$	Net calorific value of fuel oil	Certification of fuel	GJ/t	m	For each incoming batch of fuel oil	100 %	Electronic and paper	The average value is determined at the end of the year

Table 3.2.

Constants used for calculation, according to the PDD

TSIGLOMEN PRODUCTION SITE				
Parameter	Data variable	Data unit	Value	Data source
$\eta_{oil,1,old,y}$	Efficiency factor for oil-fired boilers of the old boiler house		0.753	PDD, p.39
$HA_{oil,1,old,y}$	Share of heat for auxiliary needs of oil-fired boilers		0.07	PDD, p.39
$EF_{CO2,oil}$	Emission factor of CO_2 for fuel oil	t CO_2e/GJ	0.07659	PDD, p.39
$\eta_{BWW,1,new,y}$	Efficiency factor for new utilizing boilers		0.85	PDD, p.39
	Evaporation heat	GJ/t	24.42	PDD, p.40
MAIMAKSA PRODUCTION SITE				
$EF_{CO2,grid,y}$	CO_2 emission factor for power from grid	t CO_2/MWh	0.68	PDD, p.40
$FC^{max}_{BWW,2,BL,y}$	The max highest amount baseline BWW consumption	m^3/year	93 216	PDD, p.41
ρ_{BWW}	BWW density	t/m^3	0.8	PDD, p.41
$\eta_{BWW,2,old,y}$	Efficiency factor for the utilizing boilers of the old boiler houses		0.813	PDD, p.41
$\eta_{oil,2,old,y}$	Efficiency factor for the oil-fired boilers of the old boiler house		0.91	PDD, p.41
$HA_{BWW,2,old,y}$	Share of heat for auxiliary needs of the utilizing boilers		0.07	PDD, p.42
$HA_{oil,2,old,y}$	Share of heat for auxiliary needs of oil-fired boilers		0.07	PDD, p.42
$\eta_{BWW,2,new,y}$	Efficiency factor for new utilizing boilers		0.85	PDD, p.43

Table 3.3.

The input values for calculation emissions reductions of methane from dumping BWW at the landfill for Tsiglomen and Maimaksa production sites according to the PDD

Parameter	Data unit	Value
The conversion factor from organic carbon to cubic meters of biogas	m^3/kg	1.87
Global warming potential for CH_4	tCO_2/tCH_4	21
Density of methane	kg /m^3	0.654
Methane concentration into the biogas	%	50
Half-life of the biomass	years	15
Decomposition factor	$years^{-1}$	0.046
Generation factor		0.77
Methane oxidation factor		0.10
Percentage of the stockpile under aerobic conditions	%	20
Organic carbon content (dry basis)	%	50
Moisture content	%	55
Lignin fraction of C		0.25

3.1.3 QA/QC for the project monitoring

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Methodology QA/QC procedures developed for these data
ID 2, 8, 11	Low	The laboratory equipment is regularly verified.
ID 1, 4, 5, 6	Low	Heat meters are regularly verified and regularly cross-checked with balance data.
ID 7	Low	Power meters are regularly cross-checked with balance data.
ID 10	Low	Measurements of level in the fuel oil storage tank are regularly cross-checked with supplier's data.

Table 3.4.

Information about calibration equipment necessary for monitoring project

Device name	Type	Data variable	Serial number	Uncertainty level	Installation time	Date of the last check	Expected date of the next check
TSIGLOMEN PRODUCTION SITE							
Heat meter	SPT 961	ID1. Heat energy supply from the new boiler house	4051	0.05%	01.11.06	20.10.09	replaced by #17248
Heat meter	SPT 961.2		17248	0.05%	01.11.09	07.10.09	07.10.13
		ID2. Net calorific value of BWW on dry mass	Certified laboratory conducted measuring				
		ID3. Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)				
MAIMAKSA PRODUCTION SITE							
Heat meter	SPT 943.1	ID4. Gross heat generation at the new CHP plant	6911	0.05%	09.07.07	09.07.07	replaced by #15174
	SPT 961.1		15174	0.05%	10.06.08	10.06.08	10.06.12
Heat meter	SPT 943.1	ID5. Heat energy supply from the new CHP plant	6911	0.05%	09.07.07	09.07.07	replaced by #15174
	SPT 961.1		15174	0.05%	10.06.08	10.06.08	10.06.12
Heat meter	SPT 943.1	ID6. Heat energy supply from the old boiler house	3781	0.05%	29.11.06	27.09.10	replaced by #6911
			6911	0.05%	27.09.10	09.07.07	09.07.11
Power meter	INT-1530	ID7. Gross electric power generation at the new CHP plant	410371	1.50%	01.11.07	Not necessary[4]	
		ID8. Net calorific value of BWW on dry mass	Certified laboratory conducted measuring				
		ID9. Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)				
Gauge stick	-	ID10. Mass fuel oil consumption at Maimaksa production site	-	±0.5 sm	01.10.01	Not necessary	
		ID11. Net calorific value of fuel oil	Certificate of fuel oil from supplier				

[4] Since electricity is used only for the Sawmill-25 needs and not purchased to the external consumers

3.1.3.1 Personnel training

During the project of realization the training of workers and maintenance qualification upgrade for personnel was made.

3.1.3.2 Monitoring system

Operational and management structure applied by Sawmill-25 corresponds to determined Monitoring Plan of the PDD.
Sawmill-25 is responsible for initial data that presented to the project developer. The input data for monitoring is provided by the departaments of Sawmill-25. In case of any doubt regarding the accuracy of the input data, those are checked and revised by the specialists of Sawmill-25 The preliminary version of the monitoring report is submitted to the management of Sawmill-25 for review. In case any mistakes are identified, specialists of Camco Carbon Russia Limited correct the report accordingly.

Table 3.5.

The procedure of preparation documentation for monitoring

№	Data variable	Metering frequency	Recording registration: manually/ automatically	Title of temporary report	Responsible, who will processing this documentation	Storage method (Electr/paper), Place of storage	Type of document where is storage data	Responsible who approving the report	Comments
TSIGLOMEN PRODUCTION SITE									
1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	continuously	automatically	Register of the boiler house	Operator of the boiler house	Paper, Chief of the boiler house archive	Register of heat energy generation at Tsiglomen site per month	Head Energy Engineer	
2. $NCV_{BWW,1,y}$	Net calorific value of BWW on working mass	quarterly	manually	Protocol analysis of BWW	ASTU	Paper, Head Energy Engineer department	Protocol analysis of BWW	Head of heat engineering laboratory ASTU	
3. $W_{BWW,1,y}$	Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)							
MAIMAKSA PRODUCTION SITE									
4. $HG_{gross,2,new,y}$	Total heat generation at the new CHP plant	continuously	automatically	Report of workshop	Heating engineer	Paper, Head Energy Engineer department	Report of heat generation and fuel consumption at CHP per month	Head of CHP	

5. $HS_{2,new,y}$	Heat energy supply from the new CHP plant	continuously	automatically	Report sheet of CHP operator	CHP operator	Paper, Head Energy Engineer department	Report of heat generation and fuel consumption at CHP per month	Head of CHP	
6. $HS_{2,oldPJ,y}$	Heat energy supply from the old boiler house	continuously	automatically	Report sheet of boiler operator	Boiler operator	Paper, Head Energy Engineer department	Report of heat generation and fuel consumption at boiler house per month	Chief of boiler house	
7. $EG_{2,new,y}$	Gross electric power generation at the new CHP plant	continuously	automatically	Report sheet of CHP shift electrician	CHP shift electrician	Paper, Head Energy Engineer department	Report of electricity supply	Head of CHP	
8. $NCV_{BWW,2,y}$	Net calorific value of BWW on working mass	quarterly	manually	Protocol analysis of BWW	ASTU	Paper, Head Energy Engineer	Protocol analysis of BWW	Head of heat engineering laboratory ASTU	
9. $W_{BWW,2,y}$	Moisture of BWW	Excluded for simplification (Please see the Section 3.1.5 Revision to the monitoring plan)							
10. $FC^{m}_{oil,2,PJ,y}$	Mass fuel oil consumption at Maimaksa production site	Monthly	manually	Report sheet of boiler operator	Boiler operator	Paper, Chief of boiler house archive	Report sheet of boiler operator	Head of CHP	
11. $NCV_{oil,2,y}$	Net calorific value of fuel oil	For each incoming batch of fuel oil	manually	Certificate of fuel oil	Supplier	Paper, Chief of boiler house archive	Certificate of fuel oil	Supplier	

3.1.4 Calculation of GHG emission reductions

The amount of total GHG emission reductions for both places, t CO_2 calculated by equation:

$$ER_y = ER_{1,y} + ER_{2,y} \quad (3.1)$$

where

$ER_{1,y}$ - is total GHG emission reductions at the Tsiglomen production site, t CO_2/year;

$ER_{2,y}$ - is total GHG emission reductions at the Maimaksa production site, t CO_2/year.

TSIGLOMEN PRODUCTION SITE

The amount GHG emission reductions (t CO_2) calculated by following equation:

$$ER_{1,y} = ER_{oil,1,old,y} + ER_{BWW,dump,1,y} \quad (3.2)$$

where

$ER_{oil,1,old,y}$ - is CO_2 emission reductions from fuel oil burning at the old (municipal) boiler house, t CO_2/year;

$ER_{BWW,dump,1,y}$ - is CH_4 emission reductions from anaerobic decomposition of dumped BWW, t CO_2e/year.

The amount GHG emission reductions from fuel oil burning at the old (municipal) boiler house calculated by equation:

$$ER_{oil,1,old,y} = \frac{HS_{1,new,y}}{\eta_{oil,1,old,y} \times (1 - HA_{oil,1,old,y})} \times EF_{CO2,oil} \quad (3.3)$$

where

$HS_{1,new,y}$ - is heat energy supply from the new boiler house, obtained from the monitoring, identification number (ID1), GJ/year.

$\eta_{oil,1,old,y}$ - is efficiency factor for oil-fired boilers of the old boiler house, accepted at 0.753 according to the table 3.2;

$HA_{oil,1,old,y}$ - is share of heat for auxiliary needs of oil-fired boilers, accepted at 0.07 according to the table 3.2;

$EF_{CO2,oil}$ - is emission factor of CO_2 for fuel oil, accepted at 0.07659 t CO_2/GJ according to the table 3.2.

Numerical values of $ER_{BWW,dump,1,y}$ are determined by the "Calculation of CO_2-equivalent emission reduction from BWW prevented from stockpiling or taken from stockpiles" model developed by BTG biomass technology group B.V.[5]

The constants used in model to calculate emission reductions of the methane from the anaerobic decomposition of dumping BWW at the landfill are presented in table 3.3.

In this model variable parameter is mass amount of BWW burnt at the new boiler house $FC^m_{BWW,1,new,y}$. t/year, calculated in following equation:

[5] Model developed on the basis "Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, Worldbank PCFplus research, August 2002"

$$FC^{m}_{BWW,1,new,y} = \frac{HS_{1,new,y}}{\eta_{BWW,1,new,y} \times (1 - HA_{BWW,1,new,y}) \times NCV_{BWW,1,y}} \quad (3.4)$$

where

$HS_{1,new,y}$ - is heat energy supply from the new boiler house, obtained from the monitoring, identification number (ID1), GJ/year;

$\eta_{BWW,1,new,y}$ - is efficiency factor for the new utilizing boilers, accepted at 0.85 according to the table 3.2;

$HA_{BWW,1,new,y}$ - is share of heat for auxiliary needs of the new utilizing boilers, accepted at 0.07 according to the table 3.2;

$NCV_{BWW,1,y}$ - is BWW net calorific value related to the working mass, obtained from the monitoring, identification number (ID2), GJ/t.

MAIMAKSA PRODUCTION SITE

The amount GHG emission reductions calculated by following equation tCO_2:

$$ER_{2,y} = ER_{grid,2,y} + ER_{oil,2,y} + ER_{BWW,dump,2,y} \quad (3.5)$$

where

$ER_{grid,2,y}$ - is CO_2 emission reductions from fossil fuel burning at grid-connected electric power plants, t CO_2;

$ER_{oil,2,y}$ - is CO_2 emission reductions from fuel oil burning at Maimaksa production site, t CO_2;

$ER_{BWW,dump,2,y}$ - is CH_4 emission reductions from anaerobic decomposition of dumped BWW, t CO_2e.

The amount GHG emission reductions from fossil fuel burning at grid-connected electric power plants, calculated as follows:

$$ER_{grid,2,y} = EG_{2,new,y} \times EF_{CO2,grid,y} \quad (3.6)$$

where

$EG_{2,new,y}$ - is total electric power generation at the new CHP plant, obtained from the monitoring, identification number (ID7), MWh;

$EF_{CO2,grid,y}$ - is CO_2 emission factor for power from grid, accepted at 0.68 t CO_2/MWh, according to the table 3.2.

CO_2 emission reductions from fuel oil burning at Maimaksa production site is defined in following equation:

$$ER_{oil,2,y} = (FC_{oil,2,BL,y} - FC_{oil,2,PJ,y}) \times EF_{CO2,oil} \quad (3.7)$$

where

$FC_{oil,2,BL,y}$ - is fuel oil consumption at Maimaksa production site under the baseline, GJ/year;

$FC_{oil,2,PJ,y}$ - is fuel oil consumption at Maimaksa production site under the project, GJ/year;

$EF_{CO2,oil}$ - is emission factor of CO_2 for fuel oil, accepted at 0.076 t CO_2/GJ, according to the table 3.2.

It should be noted that if $ER_{oil,2,y} < 0$ then is should be taken $ER_{oil,2,y} = 0$.

Fuel oil consumption at Maimaksa production site under the baseline is calculated by following equation:

$$FC_{oil,2,BL,y} = \frac{HS_{2,new,y} + HS_{2,old,PJ,y} - FC^{max}_{BWW,2,BL,y} \times \rho_{BWW} \times NCV_{BWW,2,y} \times \eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y})}{\eta_{oil,2,old,y} \times (1 - HA_{oil,2,old,y})} \quad (3.8)$$

where

$HS_{2,new,y}$ - is heat energy supply from the new CHP plant, obtained from the monitoring, identification number (ID5), GJ/year;

$HS_{2,old,PJ,y}$ - is heat energy supply from the old boiler house under the project, obtained from the monitoring, identification number (ID6), GJ/year;

$FC^{max}_{BWW,2,BL,y}$ - is maximal volume of BWW burnt in the old boiler houses (including boiler house of the MTS) under the baseline, accepted at 93 216 m^3/year according to the table 3.3.

ρ_{BWW} - BWW density, accepted at 0.8 t/m^3 according to the table 3.2.

$NCV_{BWW,2,y}$ - is BWW net calorific value on working mass, obtained from the monitoring, identification number (ID8), GJ/t.

$\eta_{BWW,2,old,y}$ - is efficiency factor for the utilizing boilers of the old boiler houses, is accepted at 0.813, according to the table 3.2;

$\eta_{oil,2,old,y}$ - is efficiency factor for the oil-fired boilers of the old boiler house, accepted at 0.91 according to the table 3.2;

$HA_{BWW,2,old,y}$ - is share of heat for auxiliary needs of the utilizing boilers, accepted at 0.07 according to the table 3.2;

$HA_{oil,2,old,y}$ - is share of heat for auxiliary needs of the oil-fired boilers, accepted at 0.07 according to the table 3.2.

Fuel oil consumption at Maimaksa production site under the project (GJ/year), calculated by equation:

$$FC_{oil,2,PJ,y} = FC^{m}_{oil,2,PJ,y} \times NCV_{oil,2,y} \quad (3.9)$$

where

$FC^{m}_{oil,2,PJ,y}$ - is mass fuel oil consumption at the Maimaksa site, obtained from the monitoring, identification number (ID10), t/year;

$NCV_{oil,2,y}$ - is average net calorific value of fuel oil, obtained from the monitoring, identification number (ID11), GJ/t.

Numerical values of $ER_{BWW,dump,2,y}$ are determined by the "Calculation of CO_2-equivalent emission reduction from BWW prevented from stockpiling or taken from stockpiles" model developed by BTG biomass technology group B.V.[6]

The constants used in model to calculate emission reductions of the methane from the anaerobic decomposition of dumping BWW at the landfill are presented in table 3.3.

In this model variable parameter is the mass difference of total BWW amounts burnt at the Maimaksa production site under the project and the baseline, t/year:

$$\Delta FC^{m}_{BWW,2,y} = \rho_{BWW} \times \left(FC_{BWW,2,PJ,y} - FC_{BWW,2,BL,y} \right) \tag{3.10}$$

where

$FC_{BWW,2,PJ,y}$ - is volume of BWW burnt at Maimaksa production site under the project, calculated by equation (3.13) m^3/year;

$FC_{BWW,2,BL,y}$ - is volume of BWW burnt at Maimaksa production site under the baseline, calculated by equation (3.16) m^3/year;

The volume of BWW burnt at Maimaksa production site under the project, calculated by equation:

$$FC_{BWW,2,PJ,y} = FC_{BWW,2,new,y} + FC_{BWW,2,old,PJ,y} \tag{3.11}$$

where

$FC_{BWW,2,new,y}$ - is volume of BWW burnt at the new CHP plant, calculated by equation (3.14), m^3/year;

$FC_{BWW,2,old,PJ,y}$ - is volume of BWW burnt at the old boiler house under the project, calculated by equation (3.15) m^3/year.

The volume of BWW burnt at the new CHP plant is calculated by equation:

$$FC_{BWW,2,new,y} = \frac{HG_{gross,2,new,y}}{\eta_{BWW,2,new,y} \times NCV_{BWW,2,y} \times \rho_{BWW}} \tag{3.12}$$

where

$HG_{gross,2,new,y}$ - is total heat generation at the new CHP plant, obtained from the monitoring, identification number (ID4), GJ/year;

$\eta_{BWW,2,new,y}$ - is efficiency factor for the utilizing boilers of the new CHP, accepted at 0.85 according to the table 3.2;

[6] Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, World bank PCFplus research, August 2002

$NCV_{BWW,2,y}$ - is BWW net calorific value on working mass, obtained from the monitoring, identification number (ID8), GJ/t.

ρ_{BWW} - is BWW density, accepted at 0.8 t/m^3 according to the table 3.2.

The amount of BWW burnt at the old boiler house under the project is calculated by equation

$$FC_{BWW,2,old,PJ,y} = \frac{HS_{2,old,PJ,y} - FC_{oil,2,PJ,y} \times \eta_{oil,2,old,y} \times (1 - HA_{oil,2,old,y})}{\eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW}} \quad (3.13)$$

where

$HS_{2,old,PJ,y}$ - is heat energy supply from the old boiler house under the project, obtained from the monitoring, identification number (ID6), GJ/year;

$FC_{oil,2,PJ,y}$ - is amount of fuel oil burnt of the Maimaksa site, calculated by equation (3.11), GJ/year;

$\eta_{oil,2,old,y}$ - is efficiency factor for the oil-fired boilers of the old boiler house, accepted at 0.91 according to the table 3.2;

$\eta_{BWW,2,old,y}$ - is efficiency factor for the utilizing boilers of the old boiler houses, accepted at 0.813, according to the table 3.2;

$HA_{oil,2,old,y}$ - is share of heat for auxiliary needs of oil-fired boilers, accepted at 0.07 according to the table 3.2;

$HA_{BWW,2,old,y}$ - is share of heat for auxiliary needs of the utilizing boilers accepted at 0.07 according to the table 3.2;

$NCV_{BWW,2,y}$ - - is BWW net calorific value on working mass, obtained from the monitoring, identification number (ID8), GJ/t.

ρ_{BWW} - is BWW density, accepted at 0.8 t/m^3 according to the table 3.2.

The volume of BWW burnt at Maimaksa production site under the baseline is calculated by equation:

$$FC_{BWW,2,BL,y} = \frac{HS_{2,new,y} + HS_{2,old,PJ,y}}{\eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW}} \quad (3.14)$$

где

$HS_{2,new,y}$ - is heat energy supply from the new CHP plant, obtained from the monitoring, identification number (ID5), GJ/year;

$HS_{2,old,PJ,y}$ - is heat energy supply from the old boiler house under the project, obtained from the monitoring, identification number (ID6), GJ/year;

$\eta_{BWW,2,old,y}$ - is efficiency factor for the utilizing boilers of the old boiler houses, accepted at 0.813, according to the table 3.2;

$HA_{BWW,2,old,y}$ - is share of heat for auxiliary needs of the utilizing boilers, accepted at 0.07 according to the table 3.2;

$NCV_{BWW,2,y}$ - is BWW net calorific value on working mass, obtained from the monitoring, identification number (ID8), GJ/t.

ρ_{BWW} - is BWW density, accepted at 0.8 t/m^3 according to the table 3.2.

3.1.4.1 Leakages

As result of the project realization and according to the calculation in the PDD the leakages are negligible and equal to zero.

3.1.5 Revision of the monitoring plan

Monitoring report is revised due to deviations from monitoring plan developed in Part D of the PDD version 2.0. These deviations are made for improvement of the monitoring accuracy and presented in the table below.

Parameter	As described in the PDD	Used in the monitoring report	Comments
ID 2 $NCV_{BWW,1,y}$	Net calorific value of BWW on dry mass	Net calorific value of BWW on working mass	Calculation net calorific value of BWW on working mass (Formulae D.1-5 in PDD) is not necessary since ASTU protocols already contain this parameter. Therefore net calorific value of BWW on working mass is included into the list of monitored parameters. Net calorific value of BWW on dry mass, moisture of BWW (ID 3) and Formulae D.1-5 are excluded from the monitoring plan. This deviation is made for simplification of the calculations and also for improvement of the monitoring accuracy and transparency.
ID 8 $NCV_{BWW,2,y}$	Net calorific value of BWW on dry mass	Net calorific value of BWW on working mass	Calculation net calorific value of BWW on working mass (Formulae D.1-11 in PDD) is not necessary since ASTU protocols already contain this parameter. Therefore net calorific value of BWW on working mass is included into the list of monitored parameters. Net calorific value of BWW on dry mass, moisture of BWW (ID 9) and Formulae D.1-11 are excluded from the monitoring plan. This deviation is made for simplification of the calculations and also for improvement of the monitoring accuracy and transparency.

3.2 Actual data received from the enterprise for the monitoring period

Data from CJSC “Sawmill 25” received during 2008 -2010 is presented in Annex 1.

4. Results of GHG emission reductions calculation

4.1 Emission reductions

The estimation result of GHG emission reductions during the project is presented in table 4.1.

Table 4.1

Emission reduction during the project, t CO_2-eq

Parameters	2008	2009	2010	Total during 2008-2010
Emission reductions during the project	**24 937**	**37 508**	**42 894**	**105 339**

4.2 Comparison of emission reductions

Year	Amount in PDD, t CO_2-eq	The amount received during monitoring, t CO_2-eq	Absolute deviation, t CO_2-eq
2008	37 715	24 937	- 12 778
2009	41 624	37 508	- 4 116
2010	43 883	42 894	- 989
Total 2008-2010	**123 222**	**105 339**	**- 17 883**

5. Environmental impact

The environmental work is conducted by the enterprise in the area of air protection, protection of water, recycling of wastes. JSC «Sawmill 25» fully obeys all requirements of Russian legislation on the environmental protection.

JSC «Sawmill 25» has a licence the implementation of the collection, use, neutralization, transporting and waste disposal from 20.04.2009 №OT 27-000353(29). The company pays the penalties for the negative impact on the environment. The company has developed the program of environmental control. According to the Russia legislation on the environmental protection the enterprise has to prepare the following official annual statistics forms «2-tp (air)», «2-tp (wastes)». Control over emissions of pollutants into the atmosphere by involving accredited analytical laboratory (FGU “CLATI” for North-West Federal District) license R2006/0047/100/L July 3, 2005.

Annex 1

Actual data received from the enterprise during the project realization in 2008 from Tsiglomen

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	GJ	7 615	9 532	9 548	9 645	9 696	7 274	6 340	7 720	9 106	9 060	9 932	11 201
2. $NCV_{BWW,1,y}$	Net calorific value of BWW on working mass	GJ/t	6.71			5.47			10.66			4.16		

Actual data received from the enterprise during the project realization in 2008 from Maimaksa

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
4. $HG_{gross,2,new,y}$	Total heat generation at the new CHP plant	GJ		18 767	27 774	27 073	21 732	21 048	16 324	21 165	23 694	26 199	22 657	29 353
5. $HS_{2,new,y}$	Heat energy supply from the new CHP plant	GJ		16 540	23 397	22 951	18 504	17 677	13 720	10 221	19 231	22 148	18 720	14 000
6. $HS_{2,old,PJ,y}$	Heat energy supply from the old boiler house	GJ		20 077	17 786	15 698	14 011	4 131	3 441	2 592	5 518	12 551	13 432	14 301
7. $EG_{2,new,y}$	Gross electric power generation at the new CHP plant	MWh		415	977	945	724	688	512	681	792	923	771	982
8. $NCV_{BWW,2,y}$	Net calorific value of BWW on working mass	GJ/t	9.26			10.40			5.27			7.02		
10. $FC^{m}_{oil,2,PJ,y}$	Mass fuel oil consumption at	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Maimaksa production site													
11. $NCV_{oil,2,y}$	Net calorific value of fuel oil	GJ/t												

Actual data received from the enterprise during the project realization in 2009 from Tsiglomen

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	GJ	8215	10352	11198	11346	8986	6773	6697	6759	6747	9164	8549	7719
2. $NCV_{BWW,1,y}$	Net calorific value of BWW on working mass	GJ/t	7.03			4.20			5.37			7.70		

Actual data received from the enterprise during the project realization in 2009 from Maimaksa

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
4. $HG_{gross,2,new,y}$	Total heat generation at the new CHP plant	GJ	44 602	36 970	40 698	40 307	39 175	41 252	21 822	38 806	40 654	42 657	39 714	30 192
5. $HS_{2,new,y}$	Heat energy supply from the new CHP plant	GJ	21 389	17 758	19 066	16 492	15 371	12 104	9 959	12 702	13 389	18 240	23 251	16 667
6. $HS_{2,old,PJ,y}$	Heat energy supply from the old boiler house	GJ	16 273	14 536	13 825	12 685	10 950	3 200	2 831	1 537	3 703	12 103	12 538	16 252
7.	Gross electric power	MWh	1 400	1 429	1 572	1 552	1 467	1 568	699	1 461	1 550	1 622	1 481	1 068

$EG_{2,new,y}$	generation at the new CHP plant													
8. $NCV_{BWW,2,y}$	Net calorific value of BWW on working mass	GJ/t	7.69			9.30			6.32			6.45		
10. $FC^{m}_{oil,2,PJ,y}$	Mass fuel oil consumption at Maimaksa production site	t	0	0	0	0	0	0	0	0	0	0	0	0
11. $NCV_{oil,2,y}$	Net calorific value of fuel oil	GJ/t												

Actual data received from the enterprise during the project realization in 2010 from Tsiglomen

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	GJ	10813.3	10609.4	10973.6	9561.2	8323.4	6351.8	6274.8	6391.2	6663.7	9538.6	9920.0	10860.2
2. $NCV_{BWW,1,y}$	Net calorific value of BWW on working mass	GJ/t	3.41			9.73			8.00			6.40		

Actual data received from the enterprise during the project realization in 2010 from Maimaksa

Value	Data variable	Data unit	January	February	March	April	May	June	July	August	September	October	November	December
4. $HG_{gross,2,new,y}$	Total heat generation at the new CHP plant	GJ	39 595	35 911	38 124	39 450	42 936	40 508	19 957	23 982	38 713	43 985	40 726	30 784
5.	Heat energy supply	GJ	18 543	23 776	27 060	22 590	19 132	17 916	11 264	10 985	19 574	24 150	23 033	20 096

$HS_{2,new,y}$	from the new CHP plant													
6. $HS_{2,old,PJ,y}$	Heat energy supply from the old boiler house	GJ	17 642	15 340	14 648	13 125	6 440	2 926	1 101	771	8 197	11 920	13 921	17 028
7. $EG_{2,new,y}$	Gross electric power generation at the new CHP plant	MWh	1 536	1 341	1 018	1 344	1 563	1 484	656	727	1 377	1 588	1 428	1 097
8. $NCV_{BWW,2,y}$	Net calorific value of BWW on working mass	GJ/t	8.00			8.89			5.17			6.50		
10. $FC^{m}_{oil,2,PJ,y}$	Mass fuel oil consumption at Maimaksa production site	t	0	0	0	0	0	0	0	0	0	0	0	43.6
11. $NCV_{oil,2,y}$	Net calorific value of fuel oil	GJ/t												39.9