JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Wood waste-to-energy project at Sawmill-25 (Arkhangelsk)
Report version number: 2.0
Date: 18 May 2007

A.2. Description of the project:

Purpose of the project

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.

Concept of the project

The project is implemented at the JSC "Sawmill 25", Arkhangelsk, Russia. Manufacturing facilities of the mill comprise two sites named after the places of their location, Tsiglomen site and Maimaksa site.

With reference to the project, BWW includes:
- bark;
- sawdust;
- shavings.

The bulk of BWW is formed at the stage of wood debarking and sawing.

The project provides for implementation of the following solutions:

Stage I:

- Construction of a new BWW boiler-house at Tsiglomen production site (2005).

Stage II:

- Construction of a new BWW combined heat power (CHP) plant at Maimaksa production site (2006-2007).

Expected results of the project:

- Renovation of the farm of utilizing boilers with modern highly efficient boiler units with total rated power 20 MW, which will give a growth of steam generation and ensure increasing amounts of BWW combustion in the boilers by 45.1 thousand tons per year (on average for the period of 2008-2012);
- Reduction of the amount of dumped BWW up to complete stop;
- Reducing fuel oil consumption by 6.4 thousand tons per year;
- Generating about 20 thousand MWh per year of its own power from BWW with reducing fossil fuel consumption at electric power plants of electric grid;
- Reducing pollutant emissions into the atmosphere;
- Reducing CO_2 emissions resulting from burning fossil fuel by 34.1 thousand tons per year;
- Reducing methane emissions resulting from anaerobic decomposition of biomass waste at the landfills by about 9.0 thousand tons of CO_2-equivalent per year (on the average over 2008-2012);

- Cutting costs spent on fossil fuel, reducing payments charged for environment pollution;
- Possible revenues from sale of Emission Reduction Units (ERU) of greenhouse gases (GHG);
- Increasing working places;
- Raising production standards.

Implementation schedule and costs of the project

Parameters	**Tsiglomen production site (BWW boiler-house)**	**Maimaksa production site (BWW CHP plant)**
Amount of investments, ‘000 euro	1 915	9 500
General implementation period, months	12	14

Grounds for the project implementation

JSC ”Sawmill 25” has all the required permits and licenses for carrying out its current activities and the project implementation, which are executed in accordance with legislation of the Russian Federation.

The feasibility study and detail designing have been fulfilled by the JSC “Arkhgiprodrev” specialized developer. The technological processes to be implemented in the project meet the world state-of-art standards accepted in the industry. All the technological parameters meet the environment protection normative requirements.

The project implementation will result in substantial reduction of the fossil fuel consumption and in mitigation of the negative impact on the environment, including reduction of greenhouse gas (GHG) emissions.

The project implementation is subject to direct obligations of the Russian Federation under:

- Convention of long-distance transboundary air pollution of 1979 and the related Protocols on step-by-step limitation and reduction of sulfur and nitrogen oxide emissions or their transboundary flows;
- Convention on climate change of 1992 and the related Kyoto Protocol of 1997, their requirements aimed at raising efficiency of power use and reduction of greenhouse gas emissions.

The project implementation is related to overcoming a whole range of serious legislative, technological, commercial and financial barriers. The decision of implementation of the project was largely made with taking into account potential possibility to cover costs and offset risks owing to sales of the achieved values of ERUs within the mechanisms provided by the Kyoto Protocol (see letter #120-A of 03.04.2002. Annex 2.9). The Sawmill-25 management has considered NEFCO as one of the most probable buyers of ERUs (see letter of 07.06.2006 Annex 2.10).

A.3. Project participants:

Party involved	**Legal entity project participant (as applicable)**	**Please indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Party A: Russian Federation (host Party)	Legal entity A1: Joint Stock Company "Sawmill 25"	No
Party B: EU countries	Legal entity B1: Private company "CAMCO International GmbH"	No
Party B: EU countries	Legal entity B2: Private company "Camco Carbon Russia Limited"	No

JSC "Sawmill 25" is a legal entity in the form of a closed joint stock company. JSC "Sawmill 25" is operating on the basis of the acting legislation of the Russian Federation and its Articles of associations (the Charter).

After having taken over Tsiglomen timber mill Co. Ltd in 2003, JSC "Sawmill 25" has become the biggest sawmill company in the North-West Russia.

JSC "Sawmill 25" is a part of Titan group, founded in 1990. Titan group 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. The mill specialises on sawing fir and pine breeds. The products manufactured by the mill are supplied to Germany, Holland, Ireland, Egypt, Great Britain, France and Algeria as well as to the domestic Russian market. At present, the total sawing capacity of the mill is 700 000 m^3/year.

Main production facilities of JSC "Sawmill 25" are located in the Maimaksa district of Arkhangelsk on the right bank of the Maimaksa River (one of the navigation branches of the Northern Dvina) in the western part of Povrakula peninsula, 20 km far from the city. The length of the site along the coastline is 2.5 km.

Processing the northern wood of special ecological value JSC "Sawmill 25" understands its responsibility for environmental protection and rational use of natural resources. The company takes into account the opinion of Greenpeace and WWF and cooperates with them in its activities and identification of priorities. JSC "Sawmill 25" is a member of Association of Responsible Timber Companies of Russia.

The company pays special attention to the issues of stable forest exploitation and voluntary production certification in accordance with the international standards to exclude the use of illegal timber.

It should be noticed that JSC "Sawmill 25" management pays much attention to the issues of climate change mitigation in accordance with the UN FCCC and the Kyoto protocol.

Camco International GmbH is a subsidiary of Camco International Ltd., a Jersey based public company listed at AIM in London. Camco International is the world leading carbon asset developer and projects promoter under both joint implementation and clean development mechanism of the Kyoto Protocol. Camco's project portfolio consists of more than 70 projects, generating altogether over 100 MT CO2e of GHG reductions all over the world. Camco operates in Eastern Europe, Africa, China, and Southeast Asia. The company has been actively cooperating with Russia since 2005.

Camco Carbon Russia Limited is a subsidiary of Camco International Ltd., a Jersey based public limited liability company listed at AIM in London (index CAO). Camco Carbon Russia has been established with the purpose of investing in projects implemented in the Russian Federation under Article 6 of the Kyoto Protocol to United Nations Framework Convention on Climate Change.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project activity is located at the JSC "Sawmill-25", Arkhangelsk, Russia.

Fig. A.4-1. Location of the city of Arkhangelsk

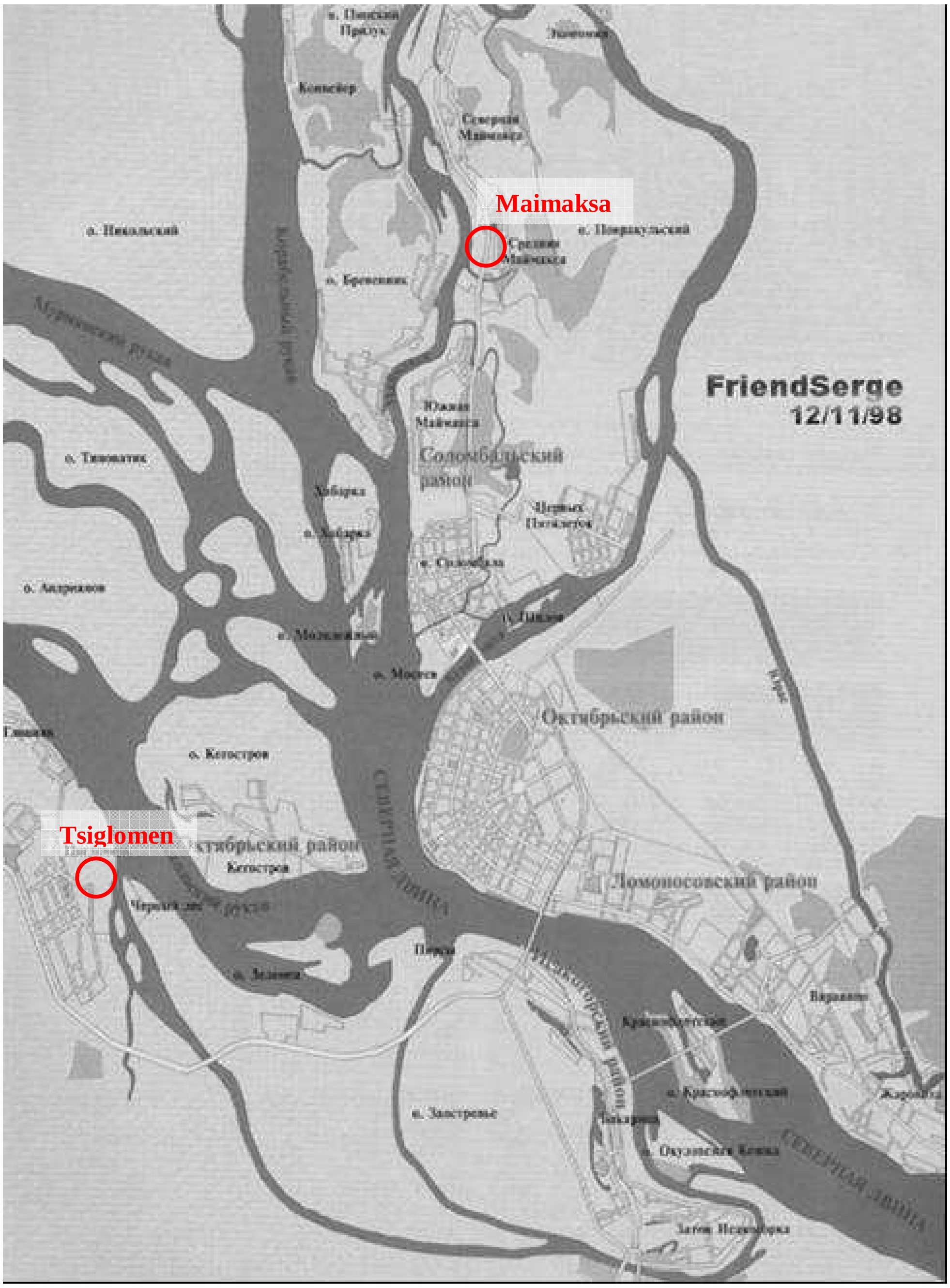

Fig. A.4-2. Location of Maimaksa and Tsiglomen districts

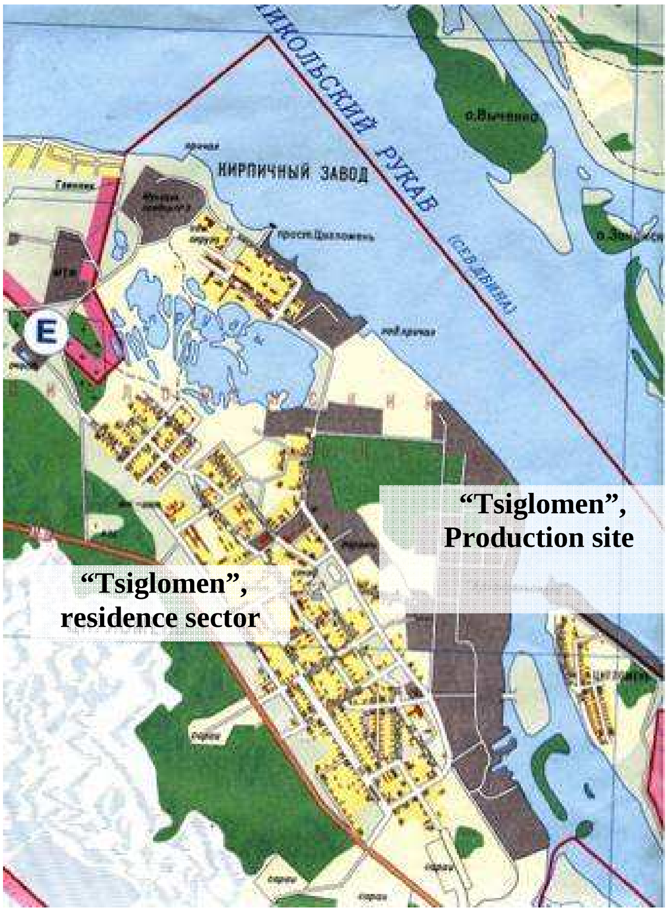

Fig. A.4-3. Tsiglomen production site

Fig. A.4-4. Maimaksa production site

A.4.1.1. Host Party(ies):

Russian Federation

A.4.1.2. Region/State/Province etc.:

Arkhangelsk Region

A.4.1.3. City/Town/Community etc.:

City of Arkhangelsk

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

Arkhangelsk is the administrative center of the Arkhangelsk Region (Oblast).

The population of Arkhangelsk is 349.8 thousand (as per 2006 official data).

Position data: geographic latitude: 64°34', geographic longitude: 40°49'

Time zone: GMT +3:00

The city is situated in the mouth of the Northern Dvina, 40-45 km away from the place where it flows into the White Sea, 1133 km to the north from Moscow.

The city's climate is subarctic and maritime with long winter and short and cool summer. It is formed under the influence of the northern seas and transportation of air masses from the Atlantic in the conditions of the small amount of solar radiation. The average January temperature is –13 °C, that of July is +17 °C. The annual precipitation is 529 mm.

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

The project is implemented in 2 stages.

Stage I. Construction of the BWW boiler-house at Tsiglomen production site (2005)

The first stage of the JI project stipulated construction of the sawmill's own BWW boiler-house with the installed capacity 5 MW in order to fully cover the needs of the Tsiglomen production site. In 2005, the boiler-house was built and set into operation (Fig. A.4-5).

There are two hot-water boilers PR-2500 of the Austrian firm "Polytechnic" with the capacity of 2.5 MW each installed in the new boiler-house. (Fig. A.4-6, Fig. A.4-7).

The boilers are equipped with a furnace with a tilt-and-shearing grate for wood waste combustion. The water output temperature is 110 ^{o}C and pressure is 0.3 MPa. The boilers work at two-loop circuit.

The maximum calculated load in the winter period is 5 MW;

The maximum calculated load in the summer period is 3.8 MW;

The calculated load including heat loss is:
- for saw-timber drying – 3.8 MW;
- for heating – 1.2 MW.

Fig. A.4-5. The new BWW boiler-house at the Tsiglomen production site

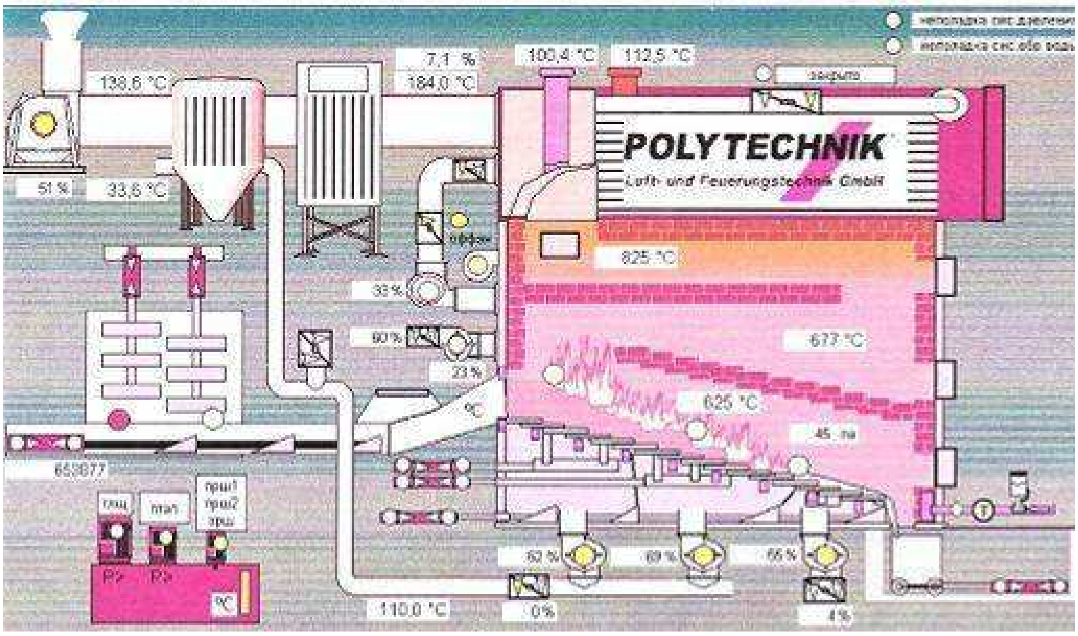

Fig A.4-6. Symbolic circuit of the utilizing boiler "Polytechnik"

+

Fig. A.4-7. Utilizing boilers "Polytechnik"

The boiler's fuel is wood waste (bark and sawdust, mainly) which comes from the wood processing at the Tsiglomen site (Fig. A.4-8).

Fig. A.4-8. Bark and wood waste for the new boiler-house in Tsiglomen

Traditionally (without the project), the Tsiglomen production site has been supplied with heat by an outside provider, i.e. a municipal boiler-house which used fuel oil and BWW while supplying heat both to the sawmill and to the residence sector of "Tsiglomen" district[1]. Annual heat supply to the sawmill constituted about 1/3 of the total annual output of the boiler-house.

The boiler-house consists of 4 oil-fired steam boilers DE-25-14-GM and 2 BWW-fired steam boilers KE-10-14 MT with total installed capacity 80 MW. Actually required capacity of the boiler-house is several times smaller. The maximum amount of wood waste ever utilized in the municipal boiler-house was 50.3 thou m^3 a year. During the last decade, the amount of wood waste utilized in the boiler-house has been steadily decreasing.

In 2006, the municipal authorities handed the boiler-house over to the JSC "Arkhangelsk generating company" for rent. The boiler-house has been operating using fuel oil and practically stopped using wood waste as a fuel. Consumption of fuel oil instead of wood waste is connected with the development strategy of "Arkhangelsk generating company" according to which it is more rational to burn fuel oil to increase the reliability of heat supply of "Tsiglomen" housing estate. This way the company avoids the risk of BWW incomplete delivery from outside.

This situation is also largely explained by imperfection of state tariff policy which does not stimulate using local kinds of fuel. More complex technologies are necessary to use local kinds of fuel. At present conditions it is technologically easier and economically more profitable to burn fuel oil shifting its cost on consumers' shoulders through tariffs.

After the project has been implemented, the municipal boiler-house continued its operation supplying heat to the residence sector only.

Stage II. Construction of a new BWW combined heat power (CHP) plant at Maimaksa production site (2006-2007)

Maimaksa production site is supplied with heat from its own boiler-house consisting of 1 oil-fired steam boiler DE-25-14 GM and 3 BWW utilizing steam boilers KE-10-14 MT. Total installed capacity is 30 MW. This capacity is enough to cover the heat load at sawing 600 000 m^3/year stipulated that fuel oil is added.

There is also a coal boiler-house of small capacity for heating of the sawmill's own motor transport shop (MTS). This boiler-house has been working mostly on firewood for the last years. The coal consumption has not been considerable (15 tons only, in 2006).

[1] Heat supply to the residence sector includes also supply of heat to some other enterprises located in the area.

Fig. A.4-9. The old boiler-house at the Maimaksa production site

At present, the new BWW CHP plant is being built under the project's second stage (Fig. A.4-10, A.4-11). The planned date of setting it into operation is June, 2007. Taking into account the enterprise's plans to increase the drying capacities and to set into operation the dry-end production separation line together with the increase of sawing volume up to 600 thousand m^3/year, the construction of CHP plant will allow to refuse using outside power and cover the heat load.

Fig. A.4-10. Construction of the new BWW CHP plant

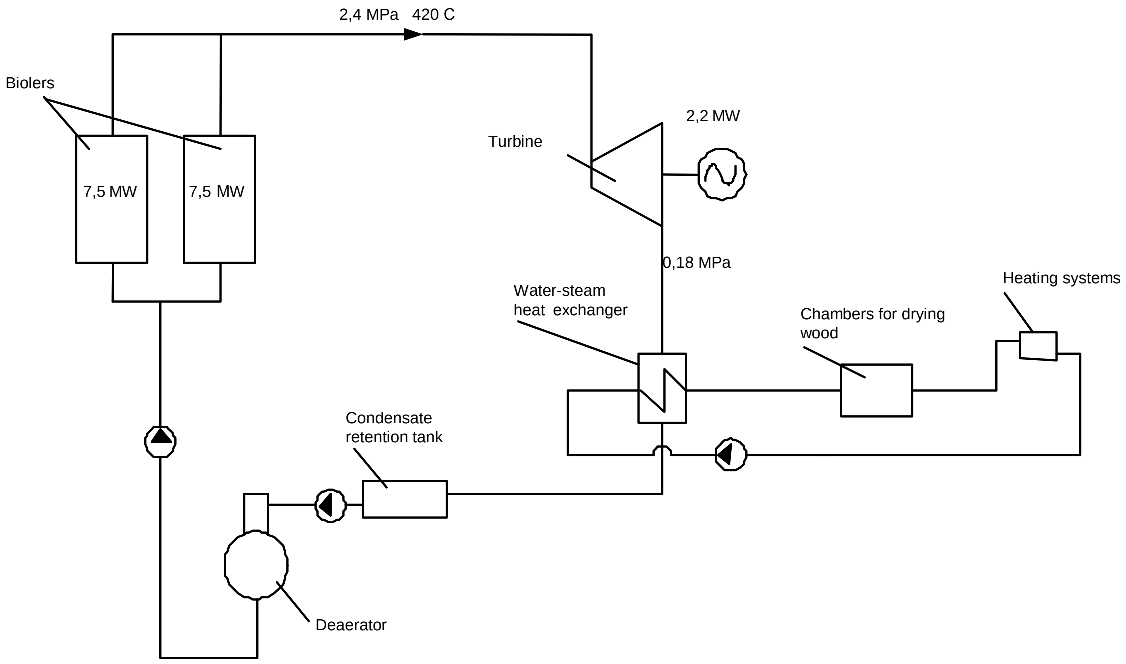

Fig. A.4-11. Basic flow chart of CHP plant

The new plant will be equipped with two steam boilers with the rated capacity 7.5 MW each supplied by the Austrian company “Polytechnik” (Fig. A.4-12) and one turbogenerator with the rated power 2.2 MW and the backpressure 0.18 MPa (Fig. A.4-13).

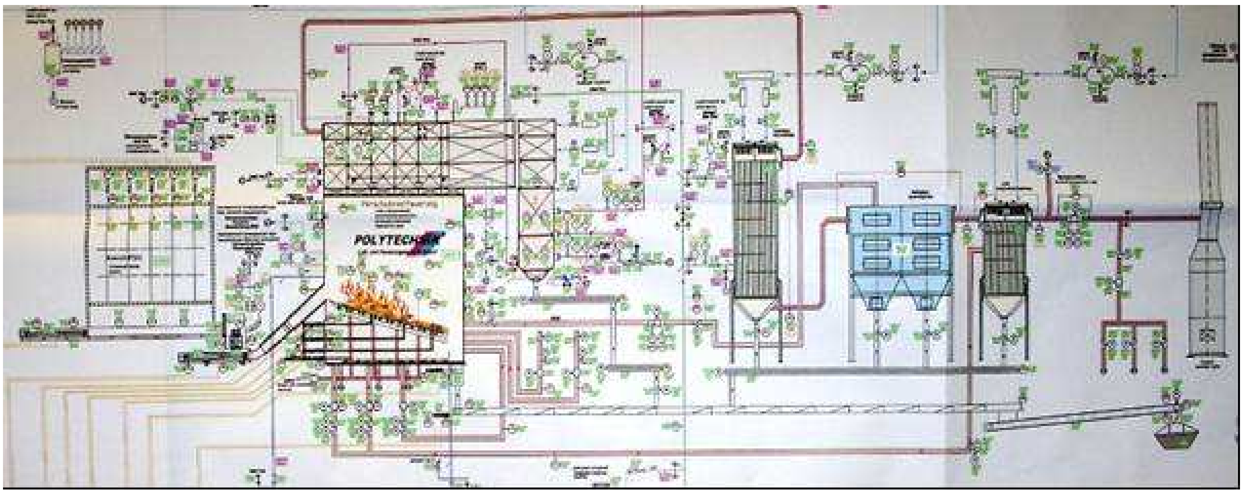

Fig. A.4-12. The scheme of the boiler installation

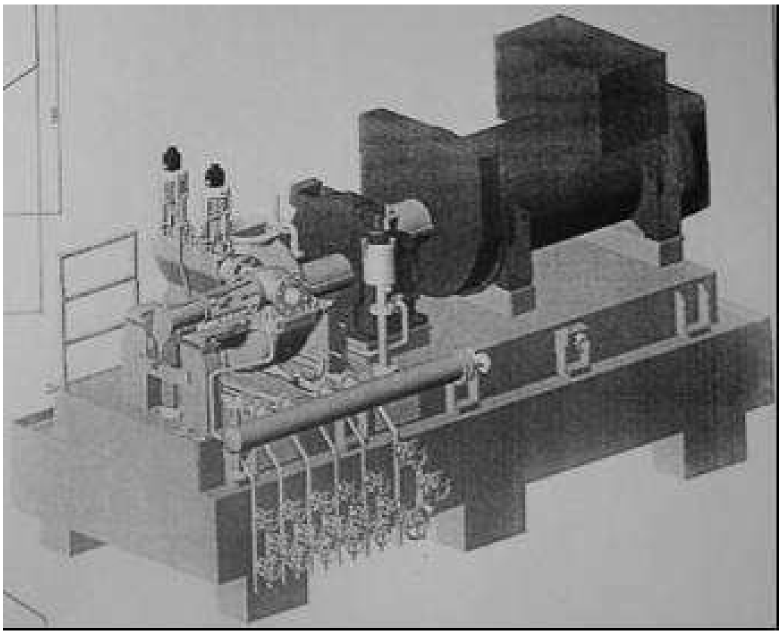

Fig. A.4-13. The general view of the turbine

The heat for the residence sector will be supplied from the old boiler-house owing to burning BWW. As the boiler-house's load will decrease more than four times, the real left service life of its equipment is supposed to be extended essentially. The coal boiler-house will be closed.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

On the whole, reduction of GHG emissions under the project will take place due to:

1) reduction of fuel oil consumption at the old boiler-houses;
2) reduction of the amount of fossil fuel combustion at grid-connected electric power plants;
3) stop of bark dumping and reduction of methane emissions due to anaerobic decomposition of bark.

As a result of the project's first stage, CO_2 emissions from burning fuel oil at the Tsiglomen municipal boiler-house as well as CH_4 emissions from decomposition of bark at the landfill will be reduced. Without the project, heat energy for the enterprise's technological and heating needs would be supplied by the municipal boiler-house using fuel oil. After the sawmill has finished the construction of the new BWW boiler-house, the municipal boiler-house will continue heat supply for the residence sector only. The decrease of the heat load on the municipal boiler-house will lead to proportional reduction of fuel oil consumption. Hence, the aggregate fuel balance in Tsiglomen area (including the old municipal boiler-house and the new boiler-house installed under the project) will change. Fuel oil will be partially substituted by BWW which otherwise has to be dumped.

As a result of the project's second stage implementation, CO_2 emissions from burning fuel oil at the Maimaksa old boiler-house and fossil fuel at the outside grid-connected electric power plants as well as CH_4 emissions from decomposition of bark at the landfill will be reduced. Without the project, both heat used by the sawmill itself and supplied to the residence sector of Srednyaya Maimaksa district would be generated at the sawmill's boiler-houses by burning BWW and fuel oil (coal is actually substituted by firewood). The power for the enterprise and for the residence sector would be provided from the outside power grid. After the new CHP plant is set into operation, the enterprise will be able to provide the Maimaksa production site with its own power and heat generated by burning biomass and practically stop power consumption from the grid. The old boiler-house will continue supply heat to the residence sector burning BWW only. The boiler-house of motor transport shop will be closed. Power supply to the residence sector will be provided according to the existing scheme (i.e., from the power grid). Bark dumping will be stopped.

N_2O and CH_4 emissions from burning are not taken into account as they are negligibly small compared to CO_2 emissions. CO_2 emissions from biomass burning are climatically neutral, and therefore are considered to be zero.

Without the project, the specified reductions of GHG emissions would not have been achieved, since the mill would have kept operating and developing with use of the existing energy equipment, and without serious obstacles for its operation in the current mode at least up to 2012, in view of the situation on the national and/or sectoral level:

- Technical condition of the old boilers, in principle, allows maintaining operation at the previous level for another ten to twenty years;
- An increasing demand for steam could have been covered through burning of additional amount of fuel oil and coal at the old boiler-houses;
- All the required permissions for operating the equipment and the landfill, including environmental authorizations approved by the relevant supervisory bodies, are available;
- Russian nature conservation legislation is unlikely to be changed in a way, which would force the enterprise to abandon operating the equipment in use prior to the project;
- No restrictions on the GHG emissions is set up or expected for Russia-based enterprises prior 2012;
- Without the project, it would have been possible to avoid additional (and rather risky) own financial investments and bank loans;
- Without the project, it would have been possible to avoid the risks related to the absence of the experience in electric power generation at the enterprise.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

Length of the crediting period	**Years**
5 years	2008-20012
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	35 715
2009	41 624
2010	43 883
2011	46 040
2012	48 100
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**215 362**
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	43 072

A.5. Project approval by the Parties involved:

The Parties' Approval Letters will be received later.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

The baselines of "Maimaska" and "Tsiglomen" production sites were chosen based on critical analysis of alternatives of the enterprise's energy supply (see Section B.2).

The baseline scenario stipulates further use of existing energy facilities. Technical condition of the old boilers enables to maintain their operation at the previously achieved level, while doing scheduled repair works with no significant expenses required. Electric power would be supplied from the grid only.

Heat supply of the sawmill and the residence sector at Tsiglomen area would be provided through fuel oil combustion by the old boiler house rented by JSC "Arkhangelsk generating company". This company now operates both large (CHP plants) and small sources of energy (heating boiler houses) using coal and fuel oil as the main fuels. The company is not interested in using BWW, therefore the Tsiglomen boiler house operates on fuel oil only. The company sees the perspectives of the regional energy development with coal share increase; therefore the boiler house's operation may be supposed to be changed to coal in some future. However, following the conservative approach, it is assumed that fuel oil would continue to be burnt in the boiler house at least until 2012.

The enterprise would try to cover all its heat demand at Maimaksa site through BWW burning (which hardly can be done at present). However, the utilizing boilers capacities would be insufficient taking into account the planned increase of sawing and wood drying volumes, therefore shortage of heat energy would have to be covered through fuel oil combustion.

This baseline scenario represents SM-25's business-as-usual operations under existing Russian laws and regulations. These laws and regulations do not impose limits or restrictions on using fossil fuels, dumping waste in landfills, and/or operating existing boilers and other installed equipment at both SM-25 and JSC "Arkhangelsk generating company". Further, no limits or restrictions on GHG emissions have placed on Russian enterprises and they are not expected to be introduced before 2012. There are no special requirements on the utilization of BWW except for the requirement to have the landfill designed, constructed and maintained in compliance with the established rules and standards which are not too strict and/or cost intensive at all. Environmental fees for both harmful emissions into the atmosphere and dumping of BWW in the landfill are quite low and do not impact SM-25's financial condition, which is sound and stable. And finally, this scenario does not require from SM-25 any investment and additional operational costs associated with constriction and running of new energy facilities thus enabling SM-25 to use available investment resources (both equity and loans) for improving and increasing of its main production capacities, including implementation of energy saving technologies at sawing and drying, as envisaged in the mill's corporate development and investment plan adopted in 2002.

The methodological approach for choosing the baseline may be described as follows.

Methodology ACM0006 "Consolidated methodology for electricity generation from biomass residues" [R1] is the most suitable of the methodologies approved for Clean Development Mechanism (CDM) projects.

On the whole, while working out the baseline, the developer suggests his own approach with the use of some elements of the mentioned method and the basis on methodological developments of IPCC, common sense and competence, without coordinating it specifically with any of the approved CDM methodologies; yet, he should obviously coordinate it with requirements laid out in *Decision 9/CMP.1, Annex B* [R2]. Everything concerning assessment of emissions is sufficiently described and justified.

The project is distinguished by the fact that at present, part of the construction-and-assembly works is completed, with the project being already an actually existing development bringing about physical reduction of GHG emissions. The baseline and the project scenarios have been developed on a project-specific basis taking into account the actual available material.

The key factors determining GHG emissions both in the baseline and in the project scenarios have been singled out. These factors are as follows:

- volume of charge stock and BWW formation;
- power consumption;
- heat consumption;
- fossil fuel burning;
- BWW burning;
- BWW dumping.

Below each factor is addressed in details.

TSIGLOMEN PRODUCTION SITE

Volumes of charge stock and BWW formation

According to the SM-25 strategy, the further growth of production shall be achieved mainly at Maimaksa production site while at the Tsiglomen production site, the volumes of wood sawing will be kept at the current level, i.e. 240 000 m^3/year, at least till 2012

Since the above strategy is not effected by the project, the wood sawing at Tsiglomen production site is considered constant and equal to **240 000** m^3/year both in the baseline and in the project scenarios.

The enterprise's specific factors for BWW output as the result of wood sawing were used to determine the amount of BWW formed (Table B.1-1).

Table. B.1-1. BWW formation at the Tsiglomen production site (calculation)

Name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,1,y}$	m^3/year	The enterprise's plan	240 000
Bark share	$\alpha_{bark,1,y}$	-	The enterprise's specific factor	0.10
Sawdust share	$\alpha_{sawdust,1,y}$	-	The enterprise's specific factor	0.17
Bark formation	$P_{bark,1,y}$	m^3/year	$P_{bark,1,y} = P_{saw,1,y} \times \alpha_{bark,1,y}$	24 000
Sawdust formation	$P_{sawdust,1,y}$	m^3/year	$P_{sawdust,1,y} = P_{saw,1,y} \times \alpha_{sawdust,1,y}$	40 800
BWW formation	$P_{BWW,1,y}$	m^3/year	$P_{BWW,1,y} = P_{bark,1,y} + P_{sawdust,1,y}$	**64 800**

As the wood sawing volume according to the enterprise's plans for 2008-2012 neither changes nor depends on the project, the baseline and project volumes of the formed BWW do not change as well and make **64 800** m^3 per year.

Electric power consumption

At present, power for the Tsiglomen production site and for the residence sector is supplied from the power grid.

The project does not stipulate construction of power generating facilities at Tsiglomen production site.

Power consumption by the new boiler-house is compensated by the reduction of power consumption by the old municipal boiler-house and therefore power consumption with and without the project can be supposed to stay at about the same level.

Thus, the power consumption was viewed neither in the baseline nor in the project scenarios.

Heat energy consumption

Heat energy is used for:

1. technological needs of the sawmill;
2. heating of the sawmill;
3. heating of the residence sector (including a number of other enterprises).

Heat consumption for the technology and heating needs does not depend on the project. However, it is advisable to view this factor as it determines absolute volumes of fuel consumption and therefore, GHG emissions.

The necessary amount of heat energy required for the work of the enterprise and for the heating of the residence sector is determined below (Table B.1-2).

Table. B.1-2. Heat consumption at the Tsiglomen production site (calculation)

Name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,1,y}$	m^3/year	The enterprise's plan	240 000
Wood share for drying	$\beta_{dry,1,y}$	-	Average value for the last three years (2003-2005)	0.544
Wood volume for drying	$P_{dry,1,y}$	m^3/year	$P_{dry,1,y} = P_{saw,1,y} \times \beta_{dry,1,y}$	130 572
Number of working days of drying facilities	$d_{dry,1,y}$	days/year	The enterprise's norm	330
Number of days of heating season	$d_{winter,1,y}$	days/year	Climate norm [R3]	253
Summer heat rate for drying	$SEC^{summer}_{dry,1,y}$	GJ/m^3	The enterprise's norm	0.888
Winter heat rate for drying	$SEC^{winter}_{dry,1,y}$	GJ/m^3	The enterprise's norm	1.027
Average annual heat rate for drying	$SEC_{dry,1,y}$	GJ/m^3	$SEC_{dry,1,y} = \left(\begin{array}{l} SEC^{winter}_{dry,1,y} \times d_{winter,1,y} + \\ + SEC^{summer}_{dry,1,y} \times \\ \times (d_{dry,1,y} - d_{winter,1,y}) \end{array} \right) / d_{dry,1,y}$	0.995
Heat consumption for drying	$HC_{dry,1,y}$	GJ/year	$HC_{dry,1,y} = P_{dry,1,y} \times SEC_{dry,1,y}$	129 863
Heat consumption for the heating of shops and office buildings of the sawmill	$HC_{heating,1,y}$	GJ/year	Average value for the last three years (2003-2005)	11 732
Heat consumption for the technology and heating of the sawmill	$HC_{sawmill,1,y}$	GJ/year	$HC_{sawmill,1,y} = HC_{heating,1,y} + HC_{dry,1,y}$	141 595
Heat consumption for the heating of the residence sector	$HC_{housing,1,y}$	GJ/year	Average rounded value for the number of several last years	251 400
Total heat consumption (useful output)	$HC_{1,y}$	GJ/year	$HC_{1,y} = HC_{sawmill,1,y} + HC_{housing,1,y}$	**392 995**

Basing on the above calculations, the necessary amount of heat energy is **392 995** GJ/year. This number is considered both in the baseline and in the project scenarios.

Bark and wood waste (BWW) burning

Under the baseline scenario, BWW burning is absent at Tsiglomen site as the old boiler house handed over for rent to JSC "Arkhangelsk generating company" in 2006 and has been burning fuel oil with probable further change to coal combustion. Following the conservative approach it is assumed further that this boiler house will use fuel oil at least until 2012.

The necessary BWW amount for the new boiler-house is determined below (Table B.1-3).

Table B.1-3. BWW consumption by the new boiler-house at the Tsiglomen production site (calculation)

Name	Symbol	Unit	Justification	Value
Heat consumption for the technology and heating of the sawmill	$HC_{sawmill,1,y}$	GJ/year	See Table. B.1-2	141 595
BWW net calorific value	$NCV_{BWW,1,y}$	GJ/t	Thermotechnical fuel analysis [R4]	7.3744
Efficiency of boilers	$\eta_{BWW,1,new,y}$	-	Boilers tests data [R4]	0.85
Heat share for auxiliary needs	$HA_{BWW,1,new,y}$	-	Assumed	0.07
BWW density	ρ_{BWW}	t/m^3	The enterprise's norm	0.8
BWW consumption	$FC_{BWW,1,new,y}$	m^3/year	$FC_{BWW,1,new,y} = \frac{HC_{sawmill,1,y}}{\eta_{BWW,1,new,y} \times (1-HA_{BWW,1,new,y}) \times NCV_{BWW,1,y} \times \rho_{BWW}}$	**30 362**

As per the above calculations, the BWW amount of **30 362** m^3/year is necessary for full load of the new boiler-house.

Fossil fuel (fuel oil) consumption

Fossil fuel, namely fuel oil, is used by the old municipal boiler-house both in the baseline and in the project scenarios. The only difference is that under the baseline, the boiler-house supplies heat to the residence sector and to the sawmill, while under the project, it only supplies heat to the residence sector. Calculations are provided below in Table B.1-4.

Table B.1-4. Fuel oil consumption by the old boiler-house at the Tsiglomen production site (calculation)

Name	Symbol	Unit	Justification	Base Line	Project
Heat energy supply from the old boiler-house	$HS_{1,old,y}$	GJ/year	See Table B.1-2	392 995	251 400
Fuel oil net calorific value	$NCV_{oil,1,y}$	GJ/t	Reference data [R5]	39.81	39.81
Efficiency of oil-fired boilers	$\eta_{oil,1,old,y}$	-	Boilers test data [R7, R8]	0.753	0.753
Heat share for auxiliary needs of oil-fired boilers	$HA_{oil,1,old,y}$	-	Assumed	0.07	0.07
Fuel oil consumption	$FC_{oil,1,old,y}$	t/year	$FC_{oil,1,old,y} = \frac{HS_{1,old,y}}{NCV_{oil,1,y} \times \eta_{oil,1,old,y} \times (1-HA_{oil,1,old,y})}$	**14 098**	**9 019**

Thus, with the project the fuel oil consumption will reduce from 14 098 t/year to 9 019 t/year, that is by **5 080** t/year.

BWW dumping

As a result of the project, the amount of BWW dumped will decrease by the amount of BWW utilized in the new boiler house, i.e. by **30 362** m^3/year. The relevant calculations of avoided methane emissions since 2006 are provided in Section E.

The results of the calculations for the whole reporting period 2008-2012 at the Tsiglomen site are provided in Annex 2.1-2.4.

MAIMAKSA PRODUCTION SITE

Volumes of charge stock and BWW formation

Irrespective of the project, the enterprise plans to bring the sawing level up to 600 000 m^3/year during the next 2-3 years (Table B.1-5).

Table B.1-5. Wood sawing at Maimaksa production site

Year	Volume of wood sawing, $P_{saw,2,y}$, m^3
2003	344 909
2004	414 258
2005	452 722
2006	467 468
2007	500 000
2008	550 000
2009	600 000
2010	600 000
2011	600 000
2012	600 000

At sawing **600 000** m^3/year, the amount of BWW will be **174 000** m^3/year (Table B.1-6). This amount does not depend upon the project and therefore will be considered the same in the baseline and in the project line.

Table B.1-6. BWW formation[1] at the Maimaksa production site (calculation)

Name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,2,y}$	m^3/year	The enterprise's plan	600 000
Bark share	$\alpha_{bark,2,y}$	-	The enterprise's norm	0.10
Sawdust share	$\alpha_{sawdust,2,y}$	-	The enterprise's norm	0.19
Bark formation	$P_{bark,2,y}$	m^3/year	$P_{bark,2,y} = P_{saw,2,y} \times \alpha_{\text{bark,2,y}}$	60 000
Sawdust formation	$P_{sawdust,2,y}$	m^3/year	$P_{sawdust,2,y} = P_{saw,2,y} \times \alpha_{\text{sawdust,2,y}}$	114 000
BWW formation	$P_{BWW,2,y}$	m^3/year	$P_{BWW,2,y} = P_{bark,2,y} + P_{sawdust,2,y}$	**174 000**

Heat energy consumption

Heat energy is used for:

1. technological needs of the sawmill;
2. heating of the sawmill;
3. heating of the residence sector.

The amount of heat used for technological and heating needs does not depend on the project. However, like in the Tsiglomen case, it is reasonable to address this factor in some more details since it determines absolute volumes of fuel consumption.

[1] Tables B.1-6 – B.1-11 represent calculations for the sawing amount 600 000 m^3/year which is the case for 2009-2012, that is four of the five reporting years. Calculations for the whole reporting period 2008-2012 are provided in Annexes 2.5-2.8.

The table below contains the relevant data (Table B.1-7).

Table. B.1-7. Heat energy consumption at the Maimaksa production site (calculation)

Name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,2,y}$	m^3/year	The development plan of the enterprise	600 000
Wood share for drying	$\beta_{dry,2,y}$	-	Average value for the last three years (2003-2005)	0.539
Volume of wood for drying	$P_{dry,2,y}$	m^3/year	$P_{dry,2,y} = P_{saw,2,y} \times \beta_{dry,2,y}$	323 542
Average heat rate for drying	$SEC_{dry,2,y}$	GJ/m^3	See Table B.1-2	0.995
Heat consumption for drying	$HC_{dry,2,y}$	GJ/year	$HC_{dry,2,y} = P_{dry,2,y} \times SEC_{dry,2,y}$	321 785
Heat consumption for heating of shops and office buildings of the sawmill	$HC_{heating,2,y}$	GJ/year	Average value for the last three years (2003-2005)	20 041
Heat consumption for heat supply of motor transport shop	$HC_{auto,2,y}$	GJ/year	Average value for the last three years (2003-2005)	14 346
Heat consumption for technology and heating of the sawmill	$HC_{sawmill,2,y}$	GJ/year	$HC_{sawmill,2,y} = HC_{heating,2,y} + HC_{dry,2,y} + HC_{auto,2,y}$	356 171
Heat consumption for heating of the residence sector	$HC_{housing,2,y}$	GJ/year	Average value for the last three years (2003-2005)	109 937
Total heat consumption (useful output)	$HC_{2,y}$	GJ/year	$HC_{2,y} = HC_{sawmill,2,y} + HC_{housing,2,y}$	**466 108**

As per the calculations above, the total estimated consumption of heat at the Maimaksa production site at 600 000 m^3/year sawing capacity will be **466 108** GJ/year.

Electric power consumption

Power consumption at the Maimaksa production site will be **21 655** MWh/year (see Table B.1-8 below). Under the baseline scenario, this power is supplied totally by the public power grid, while with the project it is generated by the sawmill's own BWW CHP plant.

Table. B.1-8. Power consumption at the Maimaksa production site (calculation)

Name	Symbol	Unit	Justification	Value
Power rate for sawing	$SEC_{saw,2,y}$	kWh/m^3	Actual data for 2006	9.89
Power consumption at sawing	$EC_{saw,2,y}$	MWh/year	$EC_{saw,2,y} = P_{saw,2,y} \times SEC_{saw,2,y} \times 10^{-3}$	5 934
Power rate for drying chambers and packaging line	$SEC_{dry,2,y}$	kWh/m^3	Actual data for 2006	35.82

Name	Symbol	Unit	Justification	Value
Power consumption by drying chambers and packaging line	$EC_{dry,2,y}$	MWh/year	$EC_{dry,2,y} = P_{dry,2,y} \times SEC_{dry,2,y} \times 10^{-3}$	11 589
Power rate for the auxiliary needs of the on-site energy suppliers[1]	$SEC_{aux,2,y}$	kWh/GJ	Actual data for 2006. It is assumed identical for the baseline and the project scenarios	6.74
The auxiliary needs of on-site energy suppliers	$EC_{aux,2,y}$	MWh/year	$EC_{aux,2,y} = HC_{2,y} \times SEC_{aux,2,y} \times 10^{-3}$	3 142
Other power consumption	$EC_{other,2,y}$	MWh/year	Actual data for 2006	990
Total power consumption	$EC_{2,y}$	MWh/year	$EC_{2,y} = EC_{saw,2,y} + EC_{dry,2,y} + EC_{aux,2,y} + EC_{other,2,y}$	**21 655**

Power consumption by the residence sector is not considered. It is assumed that in any case, power for the residence sector will be supplied from the public grid.

Bark and wood waste (BWW) consumption

Under the baseline scenario and according to the available data for the last years, the management of Maimaksa production site tries to provide heat energy generation through BWW burning using the existing capacities at most. Note that they managed to do this quite well at wood sawing volumes of about 450 000 m^3 per year. Fossil fuel consumption was rather insignificant in 2005-2006 (see below).

However, according to the expert assessment performed by the specialists of sawmill's energy service, the highest possible volume of BWW utilization in the old boiler house is 85 000-90 000 m^3/year. And this limit will undoubtedly be reached at sawing of 600 000 m^3 per year with the corresponding heat consumption increase. Conservatively, the higher number of the specified range, i.e. 90 000 m^3/year, is assumed further.

Besides, as calculations showed, it is possible to burn 3 216 m^3 of BWW per year in the boiler house of the motor transport shop given that coal combustion is completely stopped.

Thus, the total highest baseline BWW consumption is **93 216** m^3 per year.

Under the project, the old boiler house will provide heat only for the residence sector that will need only 24 646 m^3 of BWW per year. The coal boiler house of the motor transport shop will be put out of the operation. The CHP plant will provide heat and power for the Maimaksa production site solely through burning of 96 051 m^3 of BWW per year.

The total volume of project BWW burning is **120 698** m^3 per year.

BWW shortage for burning is absent in both scenarios.

All the necessary data and results of calculations are represented in Table B.1-9.

[1] Referred to the cumulative useful output of heat energy from on-site energy suppliers

Table. B.1-9. BWW consumption at the Maimaksa production site (calculation)[1]

Name	Symbol	Unit	Justification	Base Line	Project
The old sawmill's boiler-house					
Useful output of heat energy owing to BWW burning	$HC_{BWW,2,old,y}$	GJ/year	BL: $HC_{BWW2,old,y} = FC_{BWW,2,old,y} \times \eta_{BWW,2,old,y} \times$; $\times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW}$ PJ: output of heat energy to the residence sector (see Table B.1-7)	401 451	109 937
Utilizing boilers efficiency	$\eta_{BWW,2,old,y}$	-	Boilers tests data [R9]	0.813	0.813
Heat share for auxiliary needs	$HA_{BWW,2,old,y}$	-	Assumed	0.07	0.07
Net calorific value of BWW	$NCV_{BWW,2,y}$	JG/t	Thermotechnical fuel analysis [R4]	7.3744	7.3744
BWW consumption	$FC_{BWW,2,old,y}$	m³/year	BL: max capacity of utilizing boilers; PJ: $FC_{BWW,2,old,y} = HC_{BWW,2,old,y} / (\eta_{BWW,2,old,y} \times$ $\times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW})$	90 000	24 646
Boiler-house of the motor transport shop					
Useful output of heat energy	$HC_{2,auto,y}$	GJ/year	Average value for the last three years (2003-2005)	14 346	0
Boilers efficiency	$\eta_{2,auto,y}$	-	Assumed as in the "main" old boiler house	0.813	-
Heat share for auxiliary needs	$HA_{2,auto,y}$	-	Assumed	0.07	-
BWW consumption	$FC_{BWW,2,auto,y}$	m³/year	$FC_{BWW,2,auto,y} = HC_{2,auto,y} / (\eta_{2,auto,y} \times$ $\times (1 - HA_{2,auto,y}) \times NCV_{BWW,2,y} \times \rho_{BWW})$	3 216	0
The new CHP plant					
Useful output of heat energy	$HC_{2,new,y}$	GJ/year	See Table B.1-7	-	356 171
Utilizing boilers efficiency factor	$\eta_{BWW,2,new,y}$	-	Similar boilers tests data [R4]	-	0.85
Heat share for auxiliary needs	$HA_{2,new,y}$	-	Assumed	-	0.07
Amount of the generated power	$EC_{2,y}$	MWh/ year	See Table B.1-8	-	21 655
Turbine electromechanical efficiency	$\eta_{em,2,turb,y}$	-	Assumed	-	0.95
Heat flow efficiency	$\eta_{hs,2,turb,y}$	-	Assumed	-	0.98
Gross heat generation	$HG_{gross,2,new,y}$	GJ/year	$HG_{gross,2,new,y} = \frac{3{,}6 \times \frac{EC_{2,y}}{\eta_{em,2,turb,y}} + HC_{2,new,y}}{\eta_{hs,2,turb,y} - HA_{2,new,y}}$	-	481 659
Factor of power generation based on heat output	χ	MWh/GJ	Estimation taking into account steam conditions at the turbine input and output	-	0.0573

[1] In the calculation heat losses at heat transporting from the new boiler house to the dryers were not calculated separately as the boiler house is located at the enterprise's territory and the technical state of the heating conduits insulation meets all modern requirements dislike the heating conduits of the old boiler house. These heat losses are attributed to auxiliary needs both under the baseline and under the project.

Name	Symbol	Unit	Justification	Base Line	Project
Heat with waste steam	$HC_{out,2,turb,y}$	GJ/year	$HC_{out,2,turb,y} = \frac{EC_{2,y}}{\chi}$	-	378 058
Heat consumption for CHP plant auxiliary[1]	$HC_{aux,2,new,y}$	GJ/year	$HC_{aux,2,new,y} = HA_{2,new,y} \times HG_{gross,2,new,y}$	-	33 716
Steam consumption through reducing and cooling installation	$HC_{red,2,new,y}$	GJ/year	$HC_{red,2,new,y} = HS_{2,new,y} + HC_{aux,2,new,y} - HC_{out,2,turb,y}$	-	11 830
BWW consumption	$FC_{BWW,2,new,y}$	m³/year	$FC_{BWW,2,new,y} = HG_{gross,2,new,y} / (\eta_{BWW,2,old,y} \times NCV_{BWW,2,y} \times \rho_{BWW})$	-	96 051
On the whole					
Total BWW consumption at the sawmill	$FC_{BWW,2,y}$	m³/year	$FC_{BWW,2,y} = FC_{BWW,2,auto,y} + FC_{BWW,2,old,y} + FC_{BWW,2,new,y}$	**93 216**	**120 697**

Coal consumption

The coal is used in the boiler-house of the motor transport shop (MTS). However by 2006, it was almost completely replaced by BWW and at present, its use is minimal (Table B.1-10).

Table B.1-10. Coal consumption in the boiler-house of MTS (actual)

Year	2003	2004	2005	2006
Coal consumption, t	790.3	569.7	75.0	15.0

Under the project, heat for the MTS will be supplied by the new CHP plant. The old coal boiler-house will be dismantled. However, taking into account the insignificance of coal consumption and following the conservative approach, coal consumption is assumed zero both in the baseline and in the project scenarios and is not further addressed in the PDD.

Fuel oil consumption

In the last several years, fuel oil consumption was very insignificant. According to the enterprise's reports, in 2005, fuel oil was not used at all, while in 2006, fuel oil consumption was only 2.5 tons.

The baseline fuel oil consumption is determined by the necessity of additional heat energy generation in the old boiler house to cover the shortage of heat that can be generated with the use of BWW (see above). The calculations shows that at sawing capacity 600 000 m^3 per year, it will be necessary to burn **1 493** tones of fuel oil per year (see Table B.1-11).

Under the project, it is not necessary to burn fuel oil as the utilizing capacities of the old boiler house and the new CHP plant are more then enough to meet the needs of the sawmill and the residence sector. However in monitoring the account of fuel oil is stipulated.

[1] It is assumed that auxiliary heat consumption by CHP plant is covered by waste steam from the turbine

Table B.1-11. Fuel oil consumption at the Maimaksa production site under baseline (calculation)

Name	Symbol	Unit	Justification	Value
Useful output of heat energy owing to fuel oil burning	$HC_{oil,2,old,y}$	GJ/year	$HC_{oil,2,old,y} = HC_{2,y} - HC_{BWW,2,old,y} - HC_{2,auto,y}$	50 311
Net calorific value of fuel oil	$NCV_{oil,2,y}$	GJ/ton	Reference data [R5]	39.81
Oil-fired boilers efficiency	$\eta_{oil,2,old,y}$	-	Rated index	0.91
Heat share for auxiliary needs	$HA_{oil,2,old,y}$	-	Assumed	0.07
Fuel oil consumption	$FC_{oil,2,old,y}$	ton/year	$FC_{oil,2,old,y} = \frac{HC_{oil,2,old,y}}{NCV_{oil,2,y} \times \eta_{oil,2,old,y} \times (1 - HA_{oil,2,old,y})}$	**1 493**

Dumped BWW

Due to the project, the amount of dumped BWW decreases by the amount of BWW additionally utilized as fuel, which is 120 697 – 93 216 = **27 481** m^3 per year. This will result in avoided methane emissions from the landfill. The calculations of avoided emissions of methane since 2008 are provided in Section E.

Calculations of the GHG emissions reductions at the Maimaksa production site for the whole reporting period 2008-2012 are provided in Annexes 2.5-2.8.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

(a) Description of the baseline scenario

The baseline scenario stipulates continuation of the existing practice of energy supply to the mill which includes:

- power supply from the grid at both Tsiglomen and Maimaksa sites;
- supply of heat to Tsiglomen production site from the external boiler house by JSC "Arkhangelsk generating company";
- self production of heat at Maimaksa production site in old boiler house.

Under this scenario up to 93 216 m^3 of BWW (mostly saw dust and wood chips) would be utilized annually by the mill for heat production, another 87 740 m^3 of BWW would be supplied outside to Archangelsk and/or Solombala PPMs, and the rest 57 843 m^3 of BWW (mostly bark) dumped in the landfill. To produce heat for the mill's needs, up to 5 080 tonnes of fuel oil would be combusted at Tsiglomen boiler house by JSC "Arkhangelsk generating company", and up to 1 493 tonnes of fuel oil would be combusted for production of heat at Maimaksa production site by the mill itself. In the coming future the external boiler house rented by JSC "Arkhangelsk generating company" can be switched to coal which is much cheaper than fuel oil, but for conservative reasons this option has not been examined in the PDD since it leads to higher GHG emissions under the baseline and hence, to increased GHG emission reductions under the project. It was assumed that the boiler house would continue running on fuel oil at least until the end of 2012.

(b) Description of the project scenario

The project aims at self supply of heat to both Tsiglomen and Maimaksa production sites of the mill and to self supply of power to Maimaksa production site using exclusively BWW coming internally from processing of wood. The project includes:

- construction of a new 5 MW BWW boiler house worth €2 million at Tsiglomen production site where the minority of final timber products (dry saw materials) is produced, and
- construction of a new 15 MW BWW combined heat power (CHP) plant with 2.2 MW turbine, altogether worth €9.5 million, at Maimaksa production site where the most of the mill's production capacity is located.

For both components, water heating and steam boilers are supplied by the well known manufacturer "Polytechnik", Austria. The first project component, new boiler house at Tsiglomen site, became operational in late 2005.

The project will make it possible to utilize additionally up to 57 843 m^3 of BWW per annum (thus prevailing their dumping in the landfill[1]), and to substitute with BWW up to 6 573 tonnes/year of fuel oil used for production of heat both at the mill and at the outside boiler house, and up to 21 655 MWh/year of power supplied from the grid. No fossil fuel is intended for combustion together with BWW, and the share of bark fed into the boilers can be up to 100%.

This alternative requires from SM-25 to find €11.5 million of investments and additional operational costs associated with constriction and running of new energy facilities thus making SM-25 to use available investment resources (both equity and loans) for improving and increasing of its main production capacities, including implementation of energy saving technologies at sawing and drying, as envisaged in the mill's corporate development and investment plan adopted in 2002.

(c) Additionality of emission reductions

To prove additionality of the project against the baseline, analysis of alternatives as well as barriers and common practice tests have been applied.

Analysis of alternatives to the project activity

The alternatives are described below for Tsiglomen and Maimaksa production sites separately.

Tsiglomen production site

The following alternatives are identified for the project activity at Tsiglomen production site:

Alternative 1: The continuation of the existing practice of heat energy supply by the municipal boiler house working on fuel oil.

Alternative 2: Construction of its own boiler house working on fuel oil.

Alternative 3: Construction of its own boiler house working on coal.

Alternative 4: Construction of its own boiler house working on natural gas.

Alternative 5: Construction of its own boiler house working on BWW without participation in JI project.

Let us perform more detailed analysis of each alternative.

Alternative 1: The continuation of the existing practice of heat energy supply by the municipal boiler house working on fuel oil.

Before the project implementation heat was supplied by the municipal boiler house. The boiler house has been rented by JSC "Arkhangelsk generating company" since 2006. The boiler house works on fuel oil as the leaser is not interested in using BWW as fuel. This situation is largely explained by imperfection of state tariff policy which does not stimulate using local kinds of fuel. More complex technologies are

[1] Following the conservative approach we assume that volumes of BWW sale under the project would not be less than under the baseline.

necessary to use local kinds of fuel. At present conditions it is technologically easier and economically more profitable to burn fuel oil in existing boiler-house shifting fuel oil cost on consumers' shoulders through tariffs.

In principle this situation was convenient for Sawmill 25 which could avoid considerable costs connected with construction and maintenance of its own source of heat energy.

BWW formed at Tsiglomen site are partly sold while the remains are dumped. Bark is dumped first of all as the technologies of its burning are not introduced under the baseline scenario. The main purchaser of BWW is Arkhangelsk pulp and paper mill (APPM) which has preinstalled BWW utilizing capacities. Apart from APPM, only Solombala pulp and paper mill (SPPM) has sawdust-burning capacities. Both mills have limited opportunities for receiving BWW from outside. Moreover, the installed capacities of the two mills do not make even for complete utilization of bark formed at their own sites. Therefore, they have to dump their own bark too.

In the absence of the Kyoto mechanisms that in fact is anticipated in the baseline scenario, neither two mentioned PPMs, i.e. APPM and SPPM, nor other enterprises in the area have interest and/or incentives to increase BWW burning capacities. This is proved by the numerous BWW landfills situated practically near each wood processing enterprise and by extremely weak development of BWW utilizing capacities in the region. Therefore, under the baseline scenario, a big part of remaining BWW at the Tsiglomen site would not find market demand and would thus be dumped at the landfill.

This alternative can be considered as most likely baseline scenario.

Alternative 2: Construction of its own boiler house working on fuel oil.

This alternative was excluded from review as it is known irrational to construct its own source of heat supply working on fuel oil similar to the municipal boiler house which has excessive capacity. This scenario does not provide any economic benefit for the mill.

Alternative 3: Construction of its own boiler house working on coal.

Switch to coal is unlikely as coal burning technology is rather complicated and requires alienation of large territories for fuel store and ash-and-slag landfill. It would be quite problematic as the enterprise does not dispose of extra areas. Besides more harmful emissions into the atmosphere are formed at coal burning compared with burning of other kinds of fuel. And from this point of view there could arise considerable difficulties regarding the project’s approval by environmental bodies. Installation of highly efficient cleaning facilities, for instance, electric filters would be required to capture ash particles that would raise the project’s cost. Based on the above mentioned we may state that switch of the boiler house to coal would be accompanied by considerable technical and ecological barriers. *This alternative was excluded* from review.

Alternative 4: Construction of its own boiler house working on natural gas.

This alternative was excluded from review as gasification of Arkhangelsk and its suburbs is not expected in the nearest future (at least till 2012). Moreover when natural gas will come to Arkhangelsk its price would unlikely be competitive to the price of coal and heavy oil. Federal authorities and JSC “Gazprom” speak at every turn about necessity to raise price for gas explaining this by too large share of gas in Russia’s energy balance and forthcoming entrance of Russia into WTO.

Alternative 5: Construction of its own boiler house working on BWW without participation in JI project.

This alternative faces substantial technological, operational and financial barriers and also does not represent common practice in the industry at all (see below).

This alternative requires from SM-25 to find €2 million of investments and then bear additional operational costs associated with running of new boiler house thus making SM-25 to use available investment resources (both equity and loans) for improving and increasing of its main production capacities. All the more heat supply by the existing municipal boiler house was quite convenient for the sawmill.

Thus in the absence of JI mechanism and additional revenue from selling of GHG emission reductions *this scenario could hardly have been implemented*.

Maimaksa production site

The following alternatives are identified for this project activity:

Alternative 1: The continuation of the existing practice of heat energy supply by its own boiler house and electricity supplied from the grid.

Alternative 2: Construction of its own CHP plant working on fuel oil.

Alternative 3: Construction of its own CHP plant working on coal.

Alternative 4: Construction of its own CHP plant working on natural gas.

Alternative 5: Construction of its own CHP plant working on BWW without participating in JI project.

Let us perform more detailed analysis of each alternative.

<u>Alternative 1:</u> The continuation of the existing practice of heat energy supply by its own boiler house and electricity supplied from the grid.

This alternative is most probable without Kyoto Protocol as the enterprise already had its own source of heat energy supply and the purchase of electricity from the grid is common practice at sawmills in Russia.

If wood sawing reached up to 600 thousand m^3 per year utilizing boilers capacities would not be enough to generate all necessary heat energy. Maximum capacity of BWW burning in the boiler houses makes about 93 thousand m^3/year. Heat energy shortage would be covered owing to fuel oil combustion up to 1.5 thousand tons per year. Coal consumption is assumed equal zero.

Similar to the Tsiglomen production site here it is impossible to sell all BWW surplus to nearby enterprises as well as they would not be much interested in the increase of amount of BWW used as fuel without Kyoto mechanisms. BWW which did not find demand would be dumped.

This alternative can be considered as most likely baseline scenario.

<u>Alternative 2:</u> Construction of its own CHP plant working on fuel oil.

This alternative was excluded from review as construction of energy source working on fuel oil is economically inexpedient due to high fuel cost.

<u>Alternative 3:</u> Construction of its own CHP plant working on coal.

This alternative was excluded from review due to the reasons similar to Tsiglomen production site.

<u>Alternative 4:</u> Construction of its own CHP plant working on natural gas.

This alternative was excluded from review due to the reasons similar to Tsiglomen production site.

<u>Alternative 5:</u> Construction of its own CHP plant working on BWW without participating in JI project.

This alternative would be senseless without participation in JI project under the Kyoto Protocol as the enterprise already had its own source of heat energy working mainly on BWW and covering the needs of both the enterprise and the housing estate. The purchase of electricity from the grid is common practice and does not require rather risky costs for purchase and maintenance of electrogenerating facilities.

This alternative requires from SM-25 to find €9.5 million of investments and then bear additional operational costs associated with running of CHP plant thus making SM-25 to use available investment resources (both equity and loans) for improving and increasing of its main production capacities.

Thus in the absence of JI mechanism and additional revenue from selling of GHG emission reductions *this scenario could hardly have been implemented*.

Barrier analysis

Implementation of the project at Sawmill-25 faces substantial barriers in terms of technology, operations and finance.

Technological barriers

Bark and wood waste are difficult-to-burn kinds of fuel due to their high humidity and heterogeneous breakup. Technologies for their burning are more complicated and expensive compared with technologies for burning gas and liquid fuel correspondingly.

High humidity of bark and wood waste causes decrease of their calorific value, adiabatic burning point, furnace process stability and finally efficiency of the whole boiler unit operation. For comparison: fuel oil and gas boilers efficiency factor – 89-93%, BWW boilers - 70-85%.

BWW breakup should be optimal for this furnace unit. Increasing or decreasing deviation of particles size from optimal size reduces the efficiency of the boiler operation. Too small particles can fall through fire grates and be carried out of furnace by smoke fumes without even beginning to burn. Large particles can put fuel feeding system out of operation and prevent from normal burning conditions in the furnace.

Construction of special covered fuel store with "moving" bed is required to feed BWW into the boiler.

Besides BWW boilers should have increased tail and convective heating surfaces which provide decrease of waste gases temperature down to 110-120 ^{o}C.

As BWW contain mineral admixtures which produce ash and slag at burning it is necessary to install an additional highly efficient fly-ash collector. According to the experience of other enterprises it can be mentioned that when the operation of fly-ash collectors is unsatisfactory large amount of ash particles are thrown out precipitating on ready production (lumber piles) at the storage yard and thus decreasing its quality. Such production is not suitable for export any more. In this case the enterprise has large financial losses. It is a very important risk factor.

It is necessary to bring slag and ash produced in the process of burning out of the furnace and fly-ash collectors and to transport them to ash-and-slag landfill periodically.

Russian industry does not manufacture BWW boilers that can burn BWW without any fossil fuel added. As mentioned bark is utilized in Russia for energy purposes to a very small extent due to its extremely high humidity content and low calorific value. Technologies that enable effectively retrieve energy from BWW, especially from bark, are only available in the US (e.g. Wellons) and Europe (e.g. Polytechnik, Vartsilla etc). These technologies are rather complicated, and because of that an advanced measurement and automatic control system had to be installed to provide for the smooth running of the boilers. Otherwise, there was a risk of technological breakdown of the boilers.

SM-25 had never built or exploited BWW boilers of such type. All the more SM-25 never exploited steam turbines.

Altogether it was a real challenge for SM-25 to implement the project. That is why the project was divided into two stages of which the first stage envisaged construction of a small boiler house at the minor production site to test the technology and the equipment and the second stage was designed with reference to the results of the first stage and envisaged construction of mini BWW CHP plant at the major production site of the mill to provide for both heat and power generation from BWW.

Operational barriers

SM-25 had to overcome certain difficulties not only during the installation phase but also during operation. Workers engaged in the operation of the boilers had to be hired, trained and certified by the supplier. This involved certain costs and time. Besides, operation of the high-tech energy equipment and technology requires higher motivation as well as improved culture, skills and knowledge from all staff including workers, engineers and managers. It also bears noting that high humidity content and low calorific values of bark creates a problem which requires permanent attention while operating the project.

Exploiting of turbines requires their synchronization with frequency of electric current in the grid. SM-25 has no experience of operation of electrogenerating facilities at all.

Financial barriers

Among the financial barriers, the following are worth mentioning:

- High investment costs (€11.5 million) due to high cost of imported equipment, with delivery costs and custom duties included, and high cost of civil works for construction and assembly;
- High alternative cost of capital. Investment in improving and increasing of the main production capacities, including implementation of modern energy saving technologies at sawing and drying, can bring much bigger benefit to the owners being comparable in size with the project;
- Additional operational costs are required to operate and maintain the new installations;
- Internal use of BWW for energy purpose can in future prevent the mill from increasing sales of BWW to the outside buyers in raw and/or as wood pellets. This would mean additional costs to the mill in terms of missed profit;
- Lack of adequate sources for project funding in the Russian Federation. Because of this, SM-25 had to apply to NEFCO for a long-term loan targeted at pollution abatement and at creation of carbon credits.

Commercial risks

- Due to the risk of periodical decrease of heat energy quality, risk of decrease of quality of the end products also exists, as the stability of heat carrier's parameters influences the longitude and quality of wood desiccation.
- Apart from that, the quality can be influenced by ash emissions from chimney. This spoiled timber is not suitable for export any more.
- As a result, utilisation of BWW as a fuel gives rise to questions of decreasing quality of end products and thus commercial risks.
- Besides, internal use of BWW for energy purpose can in future prevent the mill from increasing sales of BWW to the outside buyers in raw and/or as wood pellets that would result in commercial losses.

Due to these barriers the mill have been seeking the opportunity to sell ERUs and also early carbon credits that can be generated before 2008 which issue was discussed by the mill with Environmental Investment Center back in 2002 (Annex 2.9), with NEFCO in 2006 (Annex 2.10), and finally with Camco who was selected by the mill particularly (though not only) because Camco has an access to voluntary carbon markets worldwide.

Common practice analysis

The common practice in the power system of sawmills in Russia includes:

1. Electricity supply from the grid.
2. Heat supply from own boiler houses working on BWW with fuel oil or natural gas adding for flame stabilization.
3. Among BWW sawdust is mainly used as fuel.
4. Bark is mainly dumped.

Electricity supply from the grid is really common practice for sawmills in Russia. Rate of capital costs on low capacity turbines is higher compared with turbines installed at large CHP plants. Efficiency of heat and electricity generation at large CHP plants is higher compared with small CHP plants. Besides domestic industry has not produced low capacity 0.5-2 MW turbines till recently. Therefore it has been more profitable for the sawmills to purchase electricity from the grid instead of generating it themselves. The necessity to have nearby heat supply source is defined by the fact that heat energy (especially steam) cannot be transported to long distances due to large losses, while electricity can be transported to hundreds of kilometers.

Sawdust burning is common practice as furnace equipment (mainly produced domestically) installed at most sawmills is rather efficient and allows burning only sawdust without fuel oil adding. Mainly series-produced boilers of Biysky boiler factory equipped with Pomerantsev furnace extension are used for that purpose. Bark is mainly dumped because of its complicated burning. Therefore decision to install import energy equipment that can work only on bark is outside common practice in Russia.

Factors characterizing common Russian practice which does not stimulate BWW utilization as fuel include:

- no laws on BWW utilization in Russian Federation;
- relatively low set payment for BWW dumping;
- no system of state control on BWW production and utilization;
- imperfection of state tariff policy for heat energy and electricity;
- no expected significant changes of environmental legislation in Russia which could force enterprises to refuse operation of the old equipment;
- no limitations on GHG emissions exist and are expected for enterprises in Russia;
- as a rule, enterprises have all necessary permits for operation of existing equipment and landfills including those of ecological character agreed with relevant control bodies.

Back at the time the project started it was and still is a new and unusual example of investing into new energy facilities in Russian timber industry. In most cases timber companies uses existing energy sources either external, or internal. The innovative character of the project becomes even more obvious if one would take into account that the old boiler house which used to supplying heat to Tsiglomen site of SM-25 is situated on the same site, literally at now material distance from it. In most cases, industrial companies would buy such energy facilities at rather small price to reduce their energy costs instead of spending some €2 million on new boiler house running totally on BWW.

The second project component at Maimaksa site is even more innovative since the common practice in the industry is power supply from the grid. So the decision to invest €9 million in construction of the own mini CHP plant running totally on BWW at Maimaksa site to avoid the use of heavy oil as well as power supply from the grid can be really considered a pioneer project in the industry.

And finally, it is worth noting that traditionally in Russia bark is not used or is only used in a very small proportion (less than 20%) with saw dust and other woodwaste in the boiler houses and CHP plants. Moreover, in most cases BWW is combusted together with heavy oil. From this prospective, the project at Sawmill-25 aimed at combustion of up to 100% of bark without any fossil fuel added is definitely a technological breakthrough.

Referencing to the above the reductions obtained as a result of the project are additional to any that would otherwise occur.

B.3. Description of how the definition of the project boundary is applied to the project:

Fig. B.3-1 represents the principal components and boundaries of the project. At the same time, the diagram shows the main flows of fuel, steam and biomass waste.

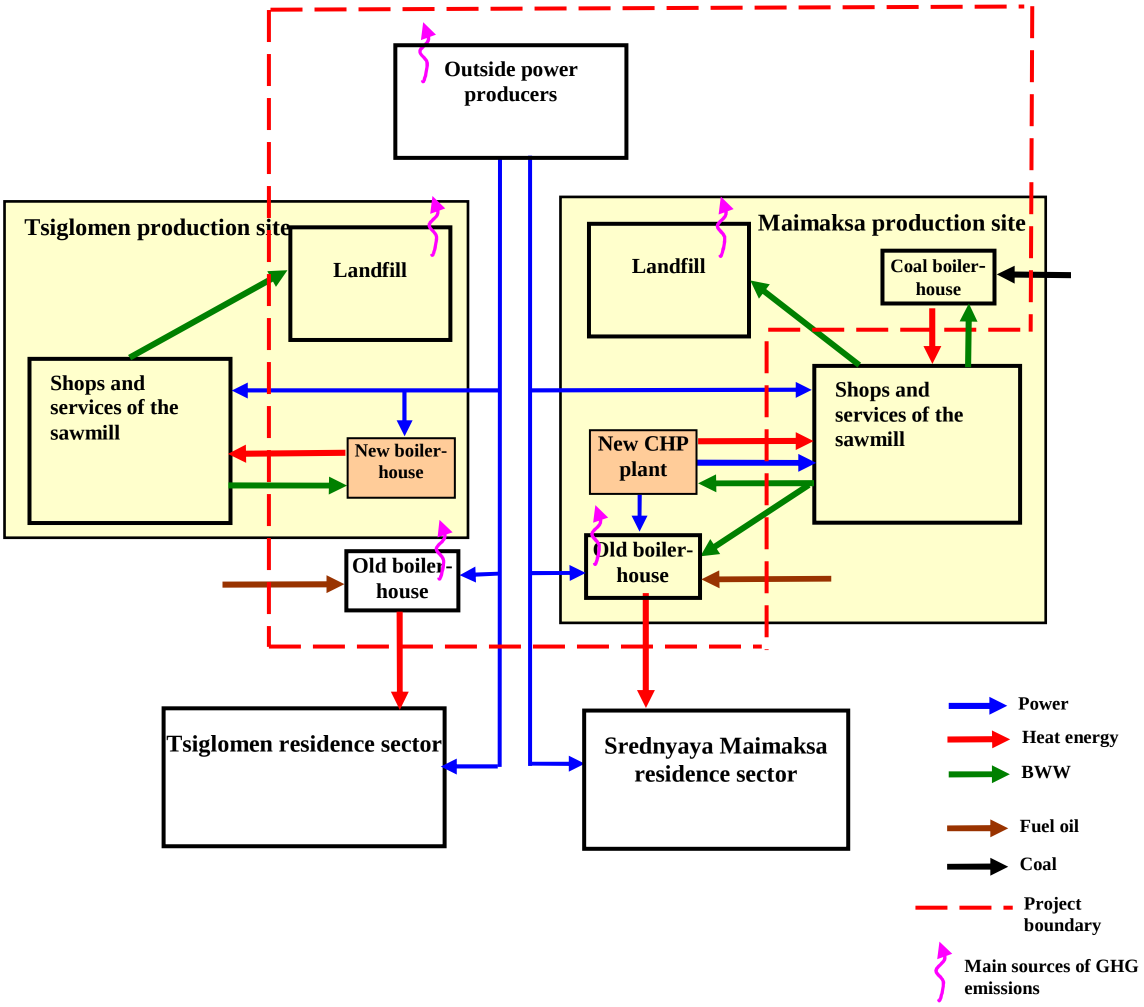

Fig. B.3-1. Principal components and boundaries of the project

Table B.3-1 specifies particular gases and sources which are included in and excluded from the project boundaries. The same table indicates possible leakages.

Table B.3-1. Sources of emissions included in and excluded from consideration

		Source	Gas	Incl./Excl.	Justification/Explanation
Baseline	**Tsiglomen production site**	**Old boiler-house, fuel oil burning**	**CO_2**	**Incl.**	**Main source of emissions**
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Landfill of industrial waste, avoided (owing to the project) emissions from anaerobic decomposition of BWW	CO_2	Excl.	Assumed to be equal to zero
			CH_4	**Incl.**	**Main source of emissions**
			N_2O	Excl.	Considered negligible. Conservative
	Maimaksa production site	**Old boiler-house, fuel oil burning**	**CO_2**	**Incl.**	**Main source of emissions**
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Old boiler-house, BWW burning	CO_2	Excl.	Assumed to be equal to zero
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Coal boiler-house of MTS, coal burning	CO_2	Incl.	Coal consumption is very insignificant. Conservative
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Coal boiler-house of MTS, BWW burning	CO_2	Incl.	Assumed to be equal to zero
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Outside power suppliers, combustion of fossil fuel (power replaced due to the project)	**CO_2**	**Incl.**	**Main source of emissions**
			CH_4	Excl.	Considered negligible. Conservative
			N_2O	Excl.	Considered negligible. Conservative
		Landfill of industrial waste, avoided emissions from anaerobic decomposition of BWW (due to the project)	CO_2	Excl.	Assumed to be equal to zero
			CH_4	**Incl.**	**Main source of emissions**
			N_2O	Excl.	Considered negligible. Conservative

		Source	Gas	Incl./Excl.	Justification/Explanation
Project activity	**Tsiglomen production site**	**Old boiler-house, fuel oil burning**	**CO_2**	**Incl.**	**Main source of emissions**
			CH_4	Excl.	Considered negligible.
			N_2O	Excl.	Considered negligible.
		New boiler-house, BWW burning	CO_2	Excl.	Assumed to be equal to zero
			CH_4	Excl.	Considered negligible.
			N_2O	Excl.	Considered negligible.
	Maimaksa production site	Old boiler-house, BWW burning	CO_2	Excl.	Assumed to be equal to zero
			CH_4	Excl.	Considered negligible.
			N_2O	Excl.	Considered negligible.
		New CHP plant, BWW burning	CO_2	Excl.	Assumed to be equal to zero
			CH_4	Excl.	Considered negligible.
			N_2O	Excl.	Considered negligible.
Leakages		Reduction of the amount of produced and transported fossil fuels	CO_2	Excl.	Considered to be an insignificant source of emissions. Conservative
			CH_4	Excl.	Considered to be an insignificant source of emissions. Conservative
			N_2O	Excl.	Considered negligible. Conservative

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of BL setting – 30 December 2006

BL was developed by Camco International

Contact person: Vladimir Dyachkov

E-mail: vladimir.dyachkov@camco-international.com

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

April 2005 (starting of construction of the boiler house at Tsiglomen production site)

C.2. Expected operational lifetime of the project:

25 years/300 months

C.3. Length of the crediting period:

5 years/ 60 months (Kyoto Protocol first commitment period – from 1st January 2008 to 31st December 2012)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

On the whole, all the key parameters required for determination of GHG emissions reductions are collected in accordance with the practice of registration of fuel, energy, waste and assessment of environmental impact used at "Sawmill 25".

Sources of energy are provided with modern equipment which registers energy resources. Project monitoring will not require changes into the existing and newly mountable systems of data registration and collection. All the necessary data is determined and registered in any case.

Annex 3 includes additional data on major sources of information.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

This Option is not applied to monitoring the project

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	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								
1. $HS_{1,new,y}$	Heat energy supply from the new boiler house	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Heat meter readings
2. $NCV^{dry}_{BWW,1,y}$	Net calorific value of BWW on dry mass	Heat engineering laboratory of ASTU[1]	GJ/t	m	Quarterly	100 %	Electronic and paper	The average value is determined at the end of the year
3. $W_{BWW,1,y}$	Moisture of BWW	Heat engineering laboratory of ASTU	%	m	Monthly	100 %	Electronic and paper	The average value is determined at the end of the year
MAYMAKSA PRODUCTION SITE								
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
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

[1] ASTU – Arkhangelsk State Technical University

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
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
8. $NCV^{dry}_{BWW,2,y}$	Net calorific value of BWW on dry 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
9. $W_{BWW,2,y}$	Moisture of BWW	Heat engineering laboratory of ASTU	%	m	Monthly	100 %	Electronic and paper	The average value is determined at the end of the year
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
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

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

The formula to calculate total GHG emission reductions in the year *y* is, t CO_2-eq:

$$ER_y = ER_{1,y} + ER_{2,y}, \qquad (D.1\text{-}1)$$

where $ER_{1,y}$ is total GHG emission reductions at the Tsiglomen production site over a year *y*, t CO_2-eq;

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

TSIGLOMEN PRODUCTION SITE

GHG emission reductions at Tsiglomen production site over a year *y*, t of CO_2-eq:

$$ER_{1,y} = ER_{oil,1,old,y} + ER_{BWW,dump,1,y}, \quad (D.1\text{-}2)$$

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

$ER_{BWW,dump,1,y}$ is CH_4 emission reductions from anaerobic decomposition of dumped BWW over a year *y*, t CO_2-eq.

$$ER_{oil,1,old,y} = \frac{HS_{1,new,y}}{\eta_{oil,1,old,y} \times \left(1 - HA_{oil,1,old,y}\right)} \times EF_{CO2,oil}, \quad (D.1\text{-}3)$$

where $HS_{1,new,y}$ is heat energy supply from the new boiler house over a year *y*, GJ;

$\eta_{oil,1,old,y}$ is efficiency factor for oil-fired boilers of the old boiler house. According to Section B.1 it is taken constant and equal to 0.753;

$HA_{oil,1,old,y}$ is share of heat for auxiliary needs of oil-fired boilers. According to Section B.1 it is taken constant and equal to 0.07;

$EF_{CO2,oil}$ is emission factor of CO_2 for fuel oil, t CO_2/GJ. According to IPCC Tier 1 [R11] this factor is taken as constant and equal to $EF_{CO2,oil} = 21.1 \times 44/12 \times 0.99/1000 = 0.07659$ t CO_2/GJ.

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. on the basis of [R12].

The values of constants used in the model are explained and justified in Section E.

In this model variable parameter for a year *y* is mass amount of BWW burnt at the new boiler house $FC^m_{BWW,1,new,y}$ over a year *y*, t:

$$FC^m_{BWW,1,new,y} = \frac{HS_{1,new,y}}{\eta_{BWW,1,new,y} \times \left(1 - HA_{BWW,1,new,y}\right) \times NCV_{BWW,1,y}}, \quad (D.1\text{-}4)$$

where $\eta_{BWW,1,new,y}$ is efficiency factor for the new utilizing boilers. According to test data [R4] it is taken constant and equal to 0.85;

$HA_{BWW,1,new,y}$ is share of heat for auxiliary needs of the new utilizing boilers. According to Section B.1 it is taken constant and equal to 0.07;

$NCV_{BWW,1,y}$ is BWW net calorific value on working mass, GJ/t.

$$NCV_{BWW,1,y} = NCV^{dry}_{BWW,1,y} \frac{100 - W_{BWW,1,y}}{100} - 24.42 \times 10^{-3} \times W_{BWW,1,y} , \quad \text{(D.1-5)}$$

where $NCV^{dry}_{BWW,1,y}$ is BWW net calorific value on dry mass, GJ/t;

$W_{BWW,1,y}$ is BWW moisture, %;

24.42 is evaporation heat per 1 % moisture of fuel (or 2 442 kJ/kg of water).

MAIMAKSA PRODUCTION SITE

GHG emission reductions at Maimaksa production site over a year *y*, t of CO_2-eq:

$$ER_{2,y} = ER_{grid,2,y} + ER_{oil,2,y} + ER_{BWW,dump,2,y} , \quad \text{(D.1-6)}$$

where $ER_{grid,2,y}$ is CO_2 emission reductions from fossil fuel burning at grid-connected electric power plants over a year *y*, t CO_2

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

$ER_{BWW,dump,2,y}$ is CH_4 emission reductions from anaerobic decomposition of dumped BWW over a year *y*, t CO_2-eq.

$$ER_{grid,2,y} = EG_{2,new,y} \times EF_{CO2,grid,y} , \quad \text{(D.1-7)}$$

where $EG_{2,new,y}$ is gross electric power generation at the new CHP plant over a year *y*, MWh;

$EF_{CO2,grid,y}$ is CO_2 emission factor for power from grid. According to the special research “Power and district heating emission baselines. ECON Analysis. 2005” [R13] this factor for Arkhangelsk region of Russia till 2012 have been taken equal to $EF_{CO2,grid,y} = 0.68$ t CO_2/MWh.

Baseline power consumption for auxiliary needs of energy sources at Maimaksa production site are considered to be not less than under the project with the same total useful heat supply ($HS_{2,new,y} + HS_{2,old,y}$). It means that power consumption under the project for auxiliary of the new CHP plant will be compensated by reduction of power consumption for the auxiliary of the old boiler house. In this connection it is enough to monitor in particular gross generation of power which would be supplied from the outside grid in the case of baseline.

$$ER_{oil,2,y} = (FC_{oil,2,BL,y} - FC_{oil,2,PJ,y}) \times EF_{CO2,oil}, \quad \text{(D.1-8)}$$

where $FC_{oil,2,BL,y}$ is fuel oil consumption at Maimaksa production site under the baseline over a year *y*, GJ;

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

$EF_{CO2,oil}$ is emission factor of CO_2 for fuel oil, t CO_2/GJ. As aforesaid this factor is taken as constant and equal to $EF_{CO2,oil} = 0.07659$ t CO_2/GJ.

$$FC_{oil,2,BL,y} = \frac{HS_{2,new,y} + HS_{2,old,PJ,y} - FC^{max}_{BWW,2,BL,y} \times \rho_{BWW} \times NCV_{BWW,2,y} \times \eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y})}{\eta_{oil,2,old,y} \times (1 - HA_{oil,2,old,y})}, \quad \text{(D.1-9)}$$

$$FC_{oil,2,PJ,y} = FC^{m}_{oil,2,PJ,y} \times NCV_{oil,2,y}, \quad \text{(D.1-10)}$$

where $HS_{2,new,y}$ is heat energy supply from the new CHP plant over a year *y*, GJ;

$HS_{2,old,PJ,y}$ is heat energy supply from the old boiler house under the project over a year *y*, GJ;

$FC^{max}_{BWW,2,BL,y}$ is maximal volume of BWW burnt in the old boiler houses (including boiler house of the MTS) under the baseline over a year *y*, m^3. According to Section B.1 it is taken constant and equal to 93 216 m^3/year;

ρ_{BWW} is BWW density, t/m^3. ρ_{BWW} = 0.8 t/m^3 is enterprise's norm (typical density of softwood that is processed at the Sawmill 25);

$\eta_{BWW,2,old,y}$ is efficiency factor for the utilizing boilers of the old boiler houses. According to Section B.1 it is taken constant and equal to 0.813;

$\eta_{oil,2,old,y}$ is efficiency factor for the oil-fired boilers of the old boiler house. According to Section B.1 it is taken constant and equal to 0.91;

$HA_{BWW,2,old,y}$ is share of heat for auxiliary needs of the utilizing boilers. According to Section B.1 it is taken constant and equal to 0.07;

$HA_{oil,2,old,y}$ is share of heat for auxiliary needs of the oil-fired boilers. According to Section B.1 it is taken constant and equal to 0.07;

$NCV_{BWW,2,y}$ is BWW net calorific value on working mass, GJ/t.

$$NCV_{BWW,2,y} = NCV^{dry}_{BWW,2,y} \frac{100 - W_{BWW,2,y}}{100} - 24.42 \times 10^{-3} \times W_{BWW,2,y}, \qquad \text{(D.1-11)}$$

where $NCV^{dry}_{BWW,2,y}$ is BWW net calorific value on dry mass, GJ/t;

$W_{BWW,2,y}$ is BWW moisture, %;

24.42 is evaporation heat per 1 % moisture of fuel (or 2 442 kJ/kg of water).

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

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. on the basis of [R12].

The values of constants used in the model are explained and justified in Section E.

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

$$\Delta FC^{m}_{BWW,2,y} = \rho_{BWW} \times \left(FC_{BWW,2,PJ,y} - FC_{BWW,2,BL,y}\right), \qquad \text{(D.1-12)}$$

where $FC_{BWW,2,PJ,y}$ is volume of BWW burnt at Maimaksa production site under the project over a year *y*, m^3;

$FC_{BWW,2,BL,y}$ is volume of BWW burnt at Maimaksa production site under the baseline over a year *y*, m^3;

It should be noted that if $\Delta FC^{m}_{BWW,2,y} < 0$ then is should be taken $\Delta FC^{m}_{BWW,2,y} = 0$.

$$FC_{BWW,2,PJ,y} = FC_{BWW,2,new,y} + FC_{BWW,2,old,PJ,y}, \qquad \text{(D.1-13)}$$

where $FC_{BWW,2,new,y}$ is volume of BWW burnt at the new CHP plant over a year *y*, m^3;

$FC_{BWW,2,old,PJ,y}$ is volume of BWW burnt at the old boiler house under the project over a year y, m^3.

$$FC_{BWW,2,new,y} = \frac{HG_{gross,2,new,y}}{\eta_{BWW,2,new,y} \times NCV_{BWW,2,y} \times \rho_{BWW}}, \quad \text{(D.1-14)}$$

where $HG_{gross,2,new,y}$ is gross heat generation at the new CHP plant over a year y, GJ;

$\eta_{BWW,2,new,y}$ is efficiency factor for the utilizing boilers of the new CHP plant. According to test data [R4] it is taken constant and equal to 0.85.

$$FC_{BWW,2,old,PJ,y} = \frac{HS_{2,old,PJ,y} - FC_{oil,2,PJ,y} \times \eta_{oil,2,old,y} \times (1 - HA_{oil,2,old,y})}{\eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW}}. \quad \text{(D.1-15)}$$

$$FC_{BWW,2,BL,y} = \frac{HS_{2,new,y} + HS_{2,old,PJ,y}}{\eta_{BWW,2,old,y} \times (1 - HA_{BWW,2,old,y}) \times NCV_{BWW,2,y} \times \rho_{BWW}}, \quad \text{(D.1-16)}$$

if $FC_{BWW,2,BL,y} > 93\ 216\ m^3$ then $FC_{BWW,2,BL,y} = 93\ 216\ m^3$.

D.1.3. Treatment of leakage in the monitoring plan:

As shown in Section B.3 all of the leakages can be neglected.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

See Section D.1.2.2.

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

A special environmental department is operating at the enterprise. The department's activities are guided by the acting legislation, orders and instructions of the Director General, prescriptions of the State environmental monitoring service of the Committee on natural resources of the Arkhangelsk Region. The department has at its disposal highly qualified personnel and is able to ensure appropriate environmental monitoring under the project.

The department monitors:

- gas-dust emissions;
- quality of waste water and river water;
- utilization, storage, transfer and burial of industrial waste.

In process of the project implementation, analytical control over various effects on the environment will, as it is today, be exercised in compliance with the existing regulation. The data obtained by the analytical laboratory are processed and brought together in monthly and annual reports, which specify all the required itemized data, including those for the sections affected by the project.

Besides, the enterprise files reports by the following official annual statistical forms:

- 2-tp (air) *Data on protection of atmospheric air*, which contains information on amounts of trapped and neutralized atmospheric pollutants, itemized emissions of specific pollutants, number of emission sources, measures on reduction of emissions into the atmosphere, emissions from particular groups of pollution sources;
- 2-tp (water resources) *Data on water use*, which presents information on consumption of water from natural sources, discharge of waste water, and content of pollutants in it, capacity of treatment facilities, etc.;
- 2-tp (waste) *Data on formation, use, neutralization, transportation and placement of industrial and household waste*, which presents the annual balance of waste flow, by waste types and hazard classes.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Tabl. D.1.2.1 ID 2, 3, 8, 9, 11	Low	The laboratory equipment is regularly verified.
Tabl. D.1.2.1 ID 1, 4, 5, 6	Low	Heat meters are regularly verified and regularly cross-checked with balance data.
Tabl. D.1.2.1 ID 7	Low	Power meters are regularly verified.
Tabl. D.1.2.1 ID 10	Low	Measurements of level in the fuel oil storage tank are regularly cross-checked with supplier's data.

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

Collection of information required for calculations of reductions of GHG emissions as a result of the project is performed in accordance with the procedure common for the enterprise.

Initial data will be submitted by the environmental department, by the production manager, and by the head energy engineer.

Calculations of emission reduction will be prepared by specialists of "Camco International" at the end of every reporting year.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

Monitoring plan was developed by "Camco International"

Contact person: Vladimir Dyachkov
E-mail: vladimir.dyachkov@camco-international.com.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

GHG project emissions include only the CO_2 emissions from fuel oil combustion in the old municipal boiler house at Tsiglomen production site, t CO_2/year:

$$PE_{oil,1,old,y} = FC_{oil,1,old,PJ,y} \times NCV_{oil,1,y} \times EF_{CO2,oil} \quad , \qquad \text{(E.1-1)}$$

where $FC_{oil,1,old,PJ,y}$ is amount of fuel oil burnt in the old municipal boiler house under the project, t/year (see Table B.1-4 and Annex 2.3);

$NCV_{oil,1,y}$ is average net calorific value of fuel oil, GJ/t. According to reference data [R5] it was assumed $NCV_{oil,1,y}$ = 39.81 GJ/t;

$EF_{CO2,oil}$ is CO_2 emissions factor for fuel oil combustion, t CO_2/GJ. According to IPCC Tier 1 [R11] $EF_{CO2,oil} = 21.1 \times 44/12 \times 0.99/1000$ = 0.07659 t CO_2/GJ.

CH_4 and N_2O emissions at fuel combustion are negligibly small.

Results of calculations of GHG project emissions are presented in Table E.1-1 and Annex 2.3.

Table E.1-1. Project GHG emissions, t CO_2-eq

Value name	Reporting year					2008-2012
	2008	2009	2010	2011	2012	
Total GHG emissions	**27 496**	**27 496**	**27 496**	**27 496**	**27 496**	**137 482**

E.2. Estimated leakage:

As indicated in Section B.3, the leakages under the project may be neglected and, therefore, were taken equal zero.

E.3. The sum of E.1. and E.2.:

Since leakages can be neglected: E.1 + E.2 = E.1.

E.4. Estimated baseline emissions:

The GHG baseline emissions include the emissions of:

- CO_2 from fuel oil combustion at the old municipal boiler house of the Tsiglomen site;
- CO_2 from fuel oil combustion at the old boiler house of the Maimaksa site;
- CO_2 from fossil fuel combustion at the electric power plants generating power for public grid;
- Avoided (owing to the project) CH_4 emissions from the landfill because of BWW decay at the Tsiglomen and Maimaksa production sites.

CH_4 and N_2O emissions at fuel combustion are negligibly low and are neglected.

CO_2 emissions from fuel oil combustion at the old boiler house of the Tsiglomen site ($BE_{oil,1,old,y}$) and at the old boiler house of the Maimaksa site ($BE_{oil,2,old,y}$) have been estimated by the formulas:

$$BE_{oil,1,old,y} = FC_{oil,1,old,BL,y} \times NCV_{oil,1,y} \times EF_{CO2,oil} \quad , \qquad \text{(E.4-1)}$$

$$BE_{oil,2,old,y} = FC_{oil,2,old,BL,y} \times NCV_{oil,2,y} \times EF_{CO2,oil} \quad , \qquad \text{(E.4-2)}$$

where $FC_{oil,1,old,BL,y}$ is amount of fuel oil burnt in the old municipal boiler house of the Tsiglomen site under the base line, t/year (see Table B.1-4 and Annex 2.1);

$FC_{oil,2,old,BL,y}$ is amount of fuel oil burnt in the old boiler house of the Maimaksa site under the base line, t/year (see Table B.1-11 and Annex 2.5);

$NCV_{oil,1,y}$, $NCV_{oil,2,y}$ is average net calorific value of fuel oil, GJ/t. According to reference data [R5] it was assumed $NCV_{oil,1,y}$ = $NCV_{oil,2,y}$ = 39.81 GJ/t;

$EF_{CO2,oil}$ is CO_2 emissions factor for fuel oil combustion, t CO_2/GJ. According to IPCC Tier 1 [R11] $EF_{CO2,oil} = 21.1 \times 44/12 \times 0.99/1000$ = <u>0.07659</u> t CO_2/GJ.

CO_2 emissions from fossil fuel combustion at electric power plants of outside grid have been estimated by the formula, t CO_2/year:

$$BE_{grid,2,y} = EC_{2,y} \times EF_{CO2,grid} \quad , \qquad \text{(E.4-3)}$$

where $EC_{2,y}$ is total power consumption (replaced by its own generation under the project) of Maimaksa production site of the enterprise, MWh/year (see Table B.1-8 and Annex 2.5);

$EF_{CO2,grid}$ is CO_2 emissions factor for power from the outside grid, t CO_2/MWh. On the basis of the work “Power and district heating emission baselines. ECON Analysis. 2005” [R13] this factor was assumed equal the constant $EF_{CO2,grid,y}$ = <u>0.68</u> t CO_2/MWh for the Arkhangelsk region till 2012.

Numeral evaluations of the avoided landfill methane emissions from BWW anaerobic decay were conducted under the model of *“Calculation of CO_2-equivalent emission reduction from BWW prevented from stockpiling or taken from stockpiles»* developed by the *“BTG biomass technology group B.V.”* for the World Bank [R12]. The model was based on the *First Order Decay method* with experimental specification of a number of parameters for waste wood landfills.

The developers provided a specific estimation file in Excel format for evaluation purposes. Separate calculations were performed for Tsiglomen and Maimaksa production sites (see pages prints in Annex 2.2, 2.6).

The input values for estimating reductions in methane emissions allowed for changing (or accepting on default) under this model are as follows:

1. *Methane concentration biogas*. Default value: 60%. Due to the conservative approach the value for BWW was accepted equal <u>50</u>%.
2. *Half-life biomass*. The accepted default recommended value for BWW: <u>15</u> years.
3. *Generation factor*. The accepted default recommended value for BWW: <u>0.77</u>.
4. *Methane oxidation factor* The accepted default recommended value for BWW: <u>0.10</u>
5. *Percentage of the stockpile under aerobic conditions.* Default value: 10%. A more conservative value of <u>20</u>% was accepted.
6. *Organic carbon content (dry basis).* The default value proposed for BWW is 53.6%; we accepted a more conservative value of <u>50</u>%.
7. *Moisture content.* The default value proposed for BWW is 50%; we accepted a more conservative value of <u>55</u>%.

8. *Lignin fraction of C.* The accepted default recommended value for BWW: 0.25.
9. *Year in which fresh biomass is utilized instead of stockpiled*. 2006 was accepted for Tsiglomen production site. 2008 was accepted for Maimaksa production site.
10. *Year for which to calculate the CO_2-equivalent reduction.* 2006 was accepted for Tsiglomen production site and 2008 for Maimaksa production site.
11. *Amount of fresh biomass utilized.* Annual data on the reduced amounts of BWW (tons per year) removal to the landfill resulting from the project for the period till 2012 were input.

Results of calculations of GHG emissions under the baseline are presented in Table E.1-2. and Annex 2.1, 2.2, 2.5, 2.6.

Table E.1-2. Baseline GHG emissions, t CO_2-eq.

Value name	Reporting year					2008-2012
	2008	2009	2010	2011	2012	
Total GHG emissions	**63 211**	**69 120**	**71 380**	**73 537**	**75 597**	**352 844**
CO_2 from fossil fuel combustion	58 719	62 262	62 262	62 262	62 262	307 766
old boiler house of the Tsiglomen production site	42 983	42 983	42 983	42 983	42 983	214 916
old boiler house of the Maimaksa production site	2 126	4 553	4 553	4 553	4 553	20 340
grid electric power plants	13 609	14 725	14 725	14 725	14 725	72 511
CH_4 from BWW decay at landfills	4 492	6 859	9 118	11 275	13 335	45 078
Tsiglomen production site	3 593	4 780	5 912	6 994	8 026	29 305
Maimaksa production site	899	2 079	3 206	4 281	5 308	15 773

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

Reduction of GHG emissions by the units and the enterprise as a whole are presented in Table E.1-3.

Table E.1-3. Reduction of GHG emissions, t CO_2-eq.

Value name	Reporting year					2008-2012
	2008	2009	2010	2011	2012	
Total for JSC "Sawmill 25"	**35 715**	**41 624**	**43 883**	**46 040**	**48 100**	**215 362**
Tsiglomen production site	19 080	20 266	21 399	22 480	23 513	106 739
CO_2 from fuel oil combustion	15 487	15 487	15 487	15 487	15 487	77 434
CH_4 from BWW decay at landfill	3 593	4 780	5 912	6 994	8 026	29 305
Maimaksa production site	16 635	21 358	22 484	23 560	24 587	108 624
CO_2 from fuel oil combustion	2 126	4 553	4 553	4 553	4 553	20 340
CO_2 from fossil fuel combustion at grid electric power plants	13 609	14 725	14 725	14 725	14 725	72 511
CH_4 from BWW decay at landfill	899	2 079	3 206	4 281	5 308	15 773

E.6. Table providing values obtained when applying formulae above:

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
2008	27 496	0	63 211	35 715
2009	27 496	0	69 120	41 624
2010	27 496	0	71 380	43 883
2011	27 496	0	73 537	46 040
2012	27 496	0	75 597	48 100
Total (tonnes of CO_2 equivalent)	**137 482**	**0**	**352 844**	**215 362**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

Before the start of the project implementation, JSC “Sawmill 25” has received all the required conclusions of the state ecology examinations.

Project implementation increases BWW consumption as fuel while decreasing consumption of fuel oil. This results in the reduction of GHG emissions into the atmosphere, as well as of harmful substances of 2-4 danger categories.

Table F.1-1. represents the design data of expected changes in the amount of harmful substances thrown into the atmosphere by the project against the baseline.

Project implementation results in the reduction of sulphur dioxide emissions by 544 t/year, carbon oxide by 111 t/year, nitrous oxide by 0.4 t/year, nitrous dioxide by 2.6 t/year, while the solid particles will increase by 3 t/year.

The total decrease of the pollutants emissions into the atmosphere for the whole project is 655 t/year.

Table F.1-1. Alterations in the harmful substance emissions into the atmosphere against the baseline, t/year; (+) -increase, (-) -decrease)

Value name	Unit	Fuel oil*	BWW	Total
- solid particles	t/year	-4,9	7,9	3,0
- sulphur dioxide (SO2)	t/year	-544,0	0,0	-544,0
- nitrous dioxide (NO2)	t/year	-47,8	45,2	-2,6
- nitrous oxide (NO)	t/year	-7,8	7,4	-0,4
- carbon oxide (CO)	t/year	-179	68	-111,1
Total emissions	t/year	-783,1	128,0	-655,1

* - includes the projected decrease of fuel oil use at the Arkhangelsk thermal power station, the main supplier of the electric power to “Sawmill 25”.

Ventilation of boiler rooms is provided due to louver grates installed in the upper and lower zones of wall enclosure and large-size fans. Emissions do not contain harmful substances.

Ash left in the boilers and whirlers are removed through hoses into closed containers excluding environmental dusting.

Household waste waters are disposed into existing sewage networks and further to cleaning facilities. There are no industrial waste waters.

There is no increase of maximum permissible concentrations of harmful substances on the edges of control areas.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Environmental impacts are not considered significant.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

No comments.

REFERENCES

[R1] Revision to the approved consolidated baseline and monitoring methodology ACM0006/Version 05 “Consolidated methodology for electricity generation from biomass residues”. CDM – Executive Board. 18 May 2007

[R2] Decision 9/CMP.1. Guidelines for the implementation of Article 6 of the Kyoto Protocol. FCCC/KP/CMP/2005/8/Add.2. 30 March 2006

[R3] Building norms and rules 23-01-99 “Building climatology”.

[R4] Report “Energy inspection of utilizing-energy boiler units PR-2500 №№1,2 to determine their technical, economic and ecological indices”, Energy center, Arkhangelsk State Technical University, Arkhangelsk, 2005.

[R5] Power-plant fuel of the USSR. Reference book, M.: Energoatomizdat,1995.

[R6] Report “Test results of utilizing boiler units of Tsiglomen sawmill”, Energy center, Arkhangelsk State Technical University, Arkhangelsk, 2003.

[R7] Project of measures on environmental protection.

[R8] Investment project justification “Boiler house reconstruction aimed for complete BWW utilization and environmental protection”, 2002.

[R9] Report “Test results of utilizing boiler units of Sawmill 25”, Energy center, Arkhangelsk State Technical University, Arkhangelsk, 2003.

[R10] Guidance on Criteria for Baseline Setting and Monitoring, Version 01. JISC Fourth meeting. Report - Annex 6, 2006

[R11] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy

[R12] Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, Worldbank PCFplus research, August 2002

[R13] Power and district heating emission baselines. Commissioned by Nordic Council of Ministers. ECON-Report no 2004-114.

[R14] Tool for the demonstration and assessment of additionality. Version 03. UNFCCC.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2
BASELINE INFORMATION

Annex 2.1.
Estimated baseline GHG emissions at Tsiglomen production site

Data name	Unit	Years					
		2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste							
Productivity of sawing	m^3	240 000	240 000	240 000	240 000	240 000	**1 200 000**
Drying	m^3	130 572	130 572	130 572	130 572	130 572	**652 862**
	%	0,544	0,544	0,544	0,544	0,544	-
Amount of wood waste	m^3	64 800	64 800	64 800	64 800	64 800	**324 000**
	t	51 840	51 840	51 840	51 840	51 840	**259 200**
including							
bark	%	10,0	10,0	10,0	10,0	10,0	-
	m^3	24 000	24 000	24 000	24 000	24 000	**120 000**
	t	19 200	19 200	19 200	19 200	19 200	**96 000**
sawdust	%	17,0	17,0	17,0	17,0	17,0	-
	m^3	40 800	40 800	40 800	40 800	40 800	**204 000**
	t	32 640	32 640	32 640	32 640	32 640	**163 200**
Utilized	m^3	0	0	0	0	0	**0**
For sale	m^3	34 438	34 438	34 438	34 438	34 438	**172 190**
To the dump	m^3	30 362	30 362	30 362	30 362	30 362	**151 810**
Heat							
Useful output of energy from boilers	GJ	392 995	392 995	392 995	392 995	392 995	**1 964 975**
Housing estate	GJ	251 400	251 400	251 400	251 400	251 400	**1 257 000**
Sawmill	GJ	141 595	141 595	141 595	141 595	141 595	**707 975**
including							
drying	GJ/m^3	0,995	0,995	0,995	0,995	0,995	-
	GJ	129 863	129 863	129 863	129 863	129 863	**649 315**
heating	GJ	11 732	11 732	11 732	11 732	11 732	**58 660**
Fuel - total							
Consumption of fuel (total)	tce	19 134	19 134	19 134	19 134	19 134	**95 668**
	GJ	561 189	561 189	561 189	561 189	561 189	**2 805 945**
Fuel - mazut							
Consumption of mazut	t	14 098	14 098	14 098	14 098	14 098	**70 492**
	tce	19 134	19 134	19 134	19 134	19 134	**95 668**
	GJ	561 189	561 189	561 189	561 189	561 189	**2 805 945**
Percentage	%	100,0	100,0	100,0	100,0	100,0	**100,0**
Combustion value	GJ/t	39,81	39,81	39,81	39,81	39,81	-
Efficiency of boilers	-	0,753	0,753	0,753	0,753	0,753	-
Auxiliary and energy loss	-	0,070	0,070	0,070	0,070	0,070	-
Useful output of energy from boilers	GJ	392 995	392 995	392 995	392 995	392 995	**1 964 975**
Greenhouse gases							
from burning of mazut	$t\ CO_2e$	42 983	42 983	42 983	42 983	42 983	**214 916**
from the dump	$t\ CO_2e$	3 593	4 780	5 912	6 994	8 026	**29 305**
Emissions of greenhouse gases	**t CO2e**	**46 577**	**47 763**	**48 895**	**49 977**	**51 009**	244 221

Annex 2.2.

Estimated reductions of methane emissions from landfill because of BWW anaerobic decay at Tsiglomen production site

Calculation of CO_2-equivalent emission reduction from BWW prevented from stockpiling or taken from stockpiles

BWW - bark wood waste

General input data		
Conversion factor organic carbon to biogas (a)	1,87	m^3 biogas/kg carbon
GWP CH_4	21	
Density methane	0,654	kg/m^3
Methane concentration biogas	50%	
Half-life biomass (tau)	15	year
Decomposition constant (k)	0,046	$year^{-1}$
Generation factor (zeta)	0,77	
Methane oxidation factor	0,10	
Percentage of the stockpile under aerobic condition:	20%	

LEGEND

db = dry basis
wb = wet basis
yellow cells = unprotected cells
red marks = comment field included

Spreadsheet model developed by:

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Biomass specific input data	Biomass from stockpile	Fresh	
Organic carbon content (db)		50,0%	db
Moisture content		55%	wb
Organic carbon content (wb)	0,0%	22,5%	wb
Lignin fraction of C		0,25	

Year	Fresh biomass prevented from stockpiling or taken from stockpile			Year												Total
	Biomass from st (ton$_w$)	Age of biomass (years)	Fresh (ton$_w$)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2008-2012
				ton CO2-eq												
2001				0	0	0	0	0	0	0	0	0	0	0	0	
2002					0	0	0	0	0	0	0	0	0	0	0	
2003						0	0	0	0	0	0	0	0	0	0	
2004							0	0	0	0	0	0	0	0	0	
2005								0	0	0	0	0	0	0	0	
2006			18 917*						1 050	1 003	957	914	873	834	796	
2007			24 290							1 348	1 288	1 229	1 174	1 121	1 070	
2008			24 290								1 348	1 288	1 229	1 174	1 121	
2009			24 290									1 348	1 288	1 229	1 174	
2010			24 290										1 348	1 288	1 229	
2011			24 290											1 348	1 288	
2012			24 290												1 348	
Total	**0**		**164 654**													
	Total emission prevention			**0**	**0**	**0**	**0**	**0**	**1 050**	**2 351**	**3 593**	**4 780**	**5 912**	**6 994**	**8 026**	**29 305**
	Cumulative total emission prevention			**0**	**0**	**0**	**0**	**0**	**1 050**	**3 401**	**6 995**	**11 774**	**17 687**	**24 680**	**32 706**	

* - data have been received by results of monitoring 2006

Annex 2.3.

Estimated project GHG emissions at Tsiglomen production site

Data name	Unit	2008			2009			2010			2011			2012			2008-2012
		New boiler house	Old boiler house	Total	New boiler house	Old boiler house	Total	New boiler house	Old boiler house	Total	New boiler house	Old boiler house	Total	New boiler house	Old boiler house	Total	
Productivity of sawing and wood waste																	
Productivity of sawing	m^3	240 000			240 000			240 000			240 000			240 000			**1 200 000**
Drying	m^3	130 572			130 572			130 572			130 572			130 572			**783 435**
	%	0,544			0,544			0,544			0,544			0,544			**-**
Amount of wood waste	m^3	64 800			64 800			64 800			64 800			64 800			**324 000**
	t	51 840			51 840			51 840			51 840			51 840			**259 200**
including																	
bark	%	10,0			10,0			10,0			10,0			10,0			**10,00**
	m^3	24 000			24 000			24 000			24 000			24 000			**120 000**
	t	19 200			19 200			19 200			19 200			19 200			**96 000**
sawdust	%	17,0			17,0			17,0			17,0			17,0			**-**
	m^3	40 800			40 800			40 800			40 800			40 800			**244 800**
	t	32 640			32 640			32 640			32 640			32 640			**195 840**
Utilized	m^3	30 362			30 362			30 362			30 362			30 362			**182 172**
For sale	m^3	34 438			34 438			34 438			34 438			34 438			**172 190**
To the dump	m^3	0			0			0			0			0			**0**
Heat																	
Useful output of energy from boi	GJ	141 595	251 400	392 995	141 595	251 400	392 995	141 595	251 400	392 995	141 595	251 400	392 995	141 595	251 400	392 995	**1 964 975**
Housing estate	GJ	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	**1 257 000**
Sawmill	GJ	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	**707 975**
including																	
drying	GJ/m^3	0,995	0	-	0,995	0	-	0,995	0	-	0,995	0	-	0,995	0	-	**-**
	GJ	129 863	0	129 863	129 863	0	129 863	129 863	0	129 863	129 863	0	129 863	129 863	0	129 863	**649 315**
heating	GJ	11 732	0	11 732	11 732	0	11 732	11 732	0	11 732	11 732	0	11 732	11 732	0	11 732	**58 660**
Fuel - total																	
Consumption of fuel (total)	tce	6 107	12 240	18 347	6 107	12 240	18 347	6 107	12 240	18 347	6 107	12 240	18 347	6 107	12 240	18 347	**91 735**
	GJ	179 121	358 994	538 115	179 121	358 994	538 115	179 121	358 994	538 115	179 121	358 994	538 115	179 121	358 994	538 115	**2 690 575**
Fuel - mazut																	
Consumption of mazut	t	0	9 019	9 019	0	9 019	9 019	0	9 019	9 019	0	9 019	9 019	0	9 019	9 019	**9 019**
	tce	0	12 240	12 240	0	12 240	12 240	0	12 240	12 240	0	12 240	12 240	0	12 240	12 240	**61 199**
	GJ	0	358 994	358 994	0	358 994	358 994	0	358 994	358 994	0	358 994	358 994	0	358 994	358 994	**1 794 971**
Percentage	%	0	100	67	0	100	67	0	100	67	0	100	67	0	100	67	**67**
Combustion value	GJ/t	-	39,81	-	-	39,81	-	-	39,81	-	-	39,81	-	-	39,81	-	**-**
Efficiency of boilers	-	-	0,753	-	-	0,753	-	-	0,753	-	-	0,753	-	-	0,753	-	**-**
Auxiliary and energy loss	-	-	0,070	-	-	0,070	-	-	0,070	-	-	0,070	-	-	0,070	-	**-**
Useful output of energy from boi	GJ	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	0	251 400	251 400	**1 257 000**
Fuel - bark and wood waste																	
Consumption of wood waste	m^3	30 362	0	30 362	30 362	0	30 362	30 362	0	30 362	30 362	0	30 362	30 362	0	30 362	**30 362**
	t	24 290	0	24 290	24 290	0	24 290	24 290	0	24 290	24 290	0	24 290	24 290	0	24 290	**121 448**
	tce	6 107	0	6 107	6 107	0	6 107	6 107	0	6 107	6 107	0	6 107	6 107	0	6 107	**30 535**
	GJ	179 121	0	179 121	179 121	0	179 121	179 121	0	179 121	179 121	0	179 121	179 121	0	179 121	**895 604**
Efficiency of boilers	-	0,850	0,731	-	0,850	0,731	-	0,850	0,731	-	0,850	0,731	-	0,850	0,731	-	**-**
Auxiliary and energy loss	-	0,070	0,070	-	0,070	0,070	-	0,070	0,070	-	0,070	0,070	-	0,070	0,070	-	**-**
Useful output of energy from boi	GJ	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	141 595	0	141 595	**707 975**
Percentage	%	100	0	33	100	0	33	100	0	33	100	0	33	100	0	33	**33**
Combustion value	GJ/t	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	**-**
Greenhouse gases																	
from burning of mazut	t CO_2e			27496			27496			27496			27496			27496	**137 482**
Emissions of greenhouse gases	**t CO2e**			**27 496**			**27 496**			**27 496**			**27 496**			**27 496**	**137 482**

Annex 2.4.

Estimated GHG emission reductions at Tsiglomen production site

Data name	Unit	2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste							
Productivity of sawing	m^3	0	0	0	0	0	**0**
Drying	m^3	0	0	0	0	0	**0**
Amount of wood waste	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
including							
bark	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
sawdust	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
Utilized	m^3	30 362	30 362	30 362	30 362	30 362	**151 810**
For sale	m^3	0	0	0	0	0	**0**
To the dump	m^3	-30 362	-30 362	-30 362	-30 362	-30 362	**-151 810**
Heat							
Useful output of energy from boilers	GJ	0	0	0	0	0	**0**
Housing estate	GJ	0	0	0	0	0	**0**
Sawmill	GJ	0	0	0	0	0	**0**
including							
drying	GJ	0	0	0	0	0	**0**
heating	GJ	0	0	0	0	0	**0**
Fuel (total)							
Consumption of fuel (total)	tce	-787	-787	-787	-787	-787	**-3 934**
	GJ	-23 074	-23 074	-23 074	-23 074	-23 074	**-115 370**
Fuel (mazut)							
Consumption of mazut	t	-5 080	-5 080	-5 080	-5 080	-5 080	**-25 398**
	tce	-6 894	-6 894	-6 894	-6 894	-6 894	**-34 469**
	GJ	-202 195	-202 195	-202 195	-202 195	-202 195	**-1 010 974**
Fuel (bark and wood waste)							
Consumption of wood waste	m^3	30 362	30 362	30 362	30 362	30 362	**151 810**
	t	24 290	24 290	24 290	24 290	24 290	**121 448**
	tce	6 107	6 107	6 107	6 107	6 107	**30 535**
	GJ	179 121	179 121	179 121	179 121	179 121	**895 604**
Greenhouse gases							
from burning of mazut	t CO_2e	-15 487	-15 487	-15 487	-15 487	-15 487	**-77 434**
from the dump	t CO_2e	-3 593	-4 780	-5 912	-6 994	-8 026	**-29 305**
Emissions of greenhouse gases		**-19 080**	**-20 266**	**-21 399**	**-22 480**	**-23 513**	**-106 739**

Annex 2.5.

Estimated baseline GHG emissions at Maimaksa production site

Data name	Unit	Year					
		2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste							
Productivity of sawing	m^3	550 000	600 000	600 000	600 000	600 000	**2 950 000**
Drying	m^3	296 581	323 542	323 542	323 542	323 542	**1 590 751**
	%	0,539	0,539	0,539	0,539	0,539	-
Amount of wood waste	m^3	159 500	174 000	174 000	174 000	174 000	**855 500**
	t	127 600	139 200	139 200	139 200	139 200	**684 400**
including							
bark	%	10,00	10,0	10,0	10,0	10,0	-
	m^3	55 000	60 000	60 000	60 000	60 000	**295 000**
	t	44 000	48 000	48 000	48 000	48 000	**236 000**
sawdust	%	19,00	19,0	19,0	19,0	19,0	-
	m^3	104 500	114 000	114 000	114 000	114 000	**560 500**
	t	83 600	91 200	91 200	91 200	91 200	**448 400**
Utilized	m^3	93 216	93 216	93 216	93 216	93 216	**466 081**
For sale	m^3	46 043	53 302	53 302	53 302	53 302	**259 251**
To the dump	m^3	20 241	27 482	27 482	27 482	27 482	**130 168**
Electricity							
Consumption of electricity	MWh	20014	21655	21655	21655	21655	**106 633**
including							
sawmill equipment	MWh/m^3	0,010	0,010	0,010	0,010	0,010	-
	MWh	5 440	5 934	5 934	5 934	5 934	**29 176**
drying and packing line	MWh/m^3	0,036	0,036	0,036	0,036	0,036	-
	MWh	10 624	11 589	11 589	11 589	11 589	**56 981**
boiler houses	MWh/GJ	0,0067	0,0067	0,0067	0,0067	0,0067	
	MWh	2 961	3 142	3 142	3 142	3 142	**15 527**
other	MWh	990	990	990	990	990	**4 950**
From the outside	MWh	20 014	21 655	21 655	21 655	21 655	**106 633**
Heat (тепло)							
Useful output	GJ	439 293	466 108	466 108	466 108	466 108	**2 303 727**
Housing estate	GJ	109 937	109 937	109 937	109 937	109 937	**549 686**
Sawmill	GJ	329 356	356 171	356 171	356 171	356 171	**1 754 041**
including							**0**
drying	GJ/m^3	0,995	0,995	0,995	0,995	0,995	-
	GJ	294 969	321 785	321 785	321 785	321 785	**1 582 108**
heating	GJ	20 041	20 041	20 041	20 041	20 041	**100 204**
automobile facilities	GJ	14 346	14 346	14 346	14 346	14 346	**71 730**
Fuel (total)							
Consumption of fuel (total)	tce	19 696	20 777	20 777	20 777	20 777	**102 803**
	GJ	577 694	609 379	609 379	609 379	609 379	**3 015 211**
Fuel (mazut)							
Consumption of mazut	t	697,5	1 493,5	1 493,5	1 493,5	1 493,5	**6 671,48**
	tce	946,6	2 026,9	2 026,9	2 026,9	2 026,9	**9 054,1**
	GJ	27 763	59 449	59 449	59 449	59 449	**265 558,10**
Percentage	%	4,81	9,76	9,76	9,76	9,76	-
Combustion value	GJ/t	39,81	39,81	39,81	39,81	39,81	-
Efficiency of boilers	-	0,910	0,910	0,910	0,910	0,910	-
Auxiliary and energy loss	-	0,070	0,070	0,070	0,070	0,070	-
Useful output of energy from boilers	GJ	23 496	50 311	50 311	50 311	50 311	**224 742**
Fuel (bark and wood waste)							
Consumption of wood waste	m^3	93 216	93 216	93 216	93 216	93 216	**466 081**
	t	74 573	74 573	74 573	74 573	74 573	**372 865**
	tce	18 750	18 750	18 750	18 750	18 750	**93 749**
	GJ	549 931	549 931	549 931	549 931	549 931	**2 749 653**
Percentage	%	95,2	90,2	90,2	90,2	90,2	**91,2**
Combustion value	GJ/t	7,3744	7,3744	7,3744	7,3744	7,3744	-
Efficiency of boilers	-	0,813	0,813	0,813	0,813	0,813	-
Auxiliary and energy loss	-	0,070	0,070	0,070	0,070	0,070	-
Useful output of energy from boilers 1	GJ	415 797	415 797	415 797	415 797	415 797	**71 730**
Greenhouse gases							
from burning of mazut	t CO_2e	2 126	4 553	4 553	4 553	4 553	**20 340**
from electricity	t CO_2e	13 609	14 725	14 725	14 725	14 725	**72 511**
from dump	t CO_2e	899	2 079	3 206	4 281	5 308	**15 773**
Total	**t CO_2e**	**16 635**	**21 358**	**22 484**	**23 560**	**24 587**	**108 624**

Annex 2.6.

Estimated reductions of methane emissions from landfill because of BWW anaerobic decay at Maimaksa production site

Calculation of CO_2-equivalent emission reduction from BWW prevented from stockpiling or taken from stockpiles

BWW - bark wood waste

LEGEND

db = dry basis
wb = wet basis
yellow cells = unprotected cells
red marks = comment field included

Spreadsheet model developed by:

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General input data		
Conversion factor organic carbon to biogas (a)	1,87	m^3 biogas/kg carbon
GWP CH_4	21	
Density methane	0,654	kg/m^3
Methane concentration biogas	50%	
Half-life biomass (tau)	15	year
Decomposition constant (k)	0,046	$year^{-1}$
Generation factor (zeta)	0,77	
Methane oxidation factor	0,10	
Percentage of the stockpile under aerobic conditions	20%	

Biomass specific input data	Biomass from stockpile	Fresh	
Organic carbon content (db)		50,0%	db
Moisture content		55%	wb
Organic carbon content (wb)	0,0%	22,5%	wb
Lignin fraction of C		0,25	

Year	Fresh biomass prevented from stockpiling or taken from stockpile: Biomass from stockpile (ton_w)	Age of biomass (years)	Fresh (ton_w)	Year (ton CO2-eq): 2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total 2008-2012
2003				0	0	0	0	0	0	0	0	0	0	
2004					0	0	0	0	0	0	0	0	0	
2005						0	0	0	0	0	0	0	0	
2006							0	0	0	0	0	0	0	
2007								0	0	0	0	0	0	
2008			16 193						899	858	820	783	747	
2009			21 985							1 221	1 165	1 113	1 063	
2010			21 985								1 221	1 165	1 113	
2011			21 985									1 221	1 165	
2012			21 985										1 221	
Total	**0**		**104 134**											
	Total emission prevention			**0**	**0**	**0**	**0**	**0**	**899**	**2 079**	**3 206**	**4 281**	**5 308**	**15 773**
	Cumulative total emission prevention			**0**	**0**	**0**	**0**	**0**	**899**	**2 978**	**6 183**	**10 465**	**15 773**	

Annex 2.7.

Estimated project GHG emissions at Maimaksa production site

Data name	Unit	2008			2009			2010			2011			2012			2008-2012
		New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	
Productivity of sawing and wood waste																	
Productivity of sawing	m^3		550 000			600 000			600 000			600 000			600 000		**2 950 000**
Drying	m^3		296 581			323 542			323 542			323 542			323 542		**1 590 751**
			0,539			0,539			0,539			0,539			0,539		**2,696**
Amount of wood waste	m^3		159 500			174 000			174 000			174 000			174 000		**855 500**
	t		127 600			139 200			139 200			139 200			139 200		**684 400**
including																	
bark	%		10,0			10,0			10,0			10,0			10,0		**-**
	m^3		55 000			60 000			60 000			60 000			60 000		**295 000**
	t		44 000			48 000			48 000			48 000			48 000		**236 000**
sawdust	%		19,0			19,0			19,0			19,0			19,0		**-**
	m^3		104 500			114 000			114 000			114 000			114 000		**560 500**
	t		83 600			91 200			91 200			91 200			91 200		**448 400**
Utilized	m^3		113 457			120 698			120 698			120 698			120 698		**596 249**
For sale	m^3		46 043			53 302			53 302			53 302			53 302		**259 251**
To the dump	m^3		0			0			0			0			0		**0**
Electricity																	
Consumption of electricity	MWh		20 014			21 655			21 655			21 655			21 655		**106 633**
including																	
sawmill equipment	MWh/m^3		0,00989			0,00989			0,00989			0,00989			0,00989		**-**
	MWh		5 440			5 934			5 934			5 934			5 934		**29 176**
drying and packing line	MWh/m^3		0,03582			0,036			0,036			0,036			0,036		**-**
	MWh		10 624			11 589			11 589			11 589			11 589		**56 981**
boiler houses	MWh/GJ		0,00674			0,00674			0,00674			0,00674			0,00674		
	MWh		2 961			3 142			3 142			3 142			3 142		**15 527**
other	MWh		990			990			990			990			990		**4 950**
Self-generation of electricity (new HPP)	MWh		20 014			21 655			21 655			21 655			21 655		**106 633**
From the outside	MWh		0			0			0			0			0		**0**

Data name	Unit	2008			2009			2010			2011			2012			2008-2012
		New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	New HPP	Old boiler house	Total	
Heat (тепло)																	
Useful output	GJ	329 356	109 937	439 293	356 171	109 937	466 108	356 171	109 937	466 108	356 171	109 937	466 108	356 171	109 937	466 108	**2 303 727**
Housing estate	GJ	0	109 937	109 937	0	109 937	109 937	0	109 937	109 937	0	109 937	109 937	0	109 937	109 937	**549 686**
Sawmill	GJ	329 356	0	329 356	356 171	0	356 171	356 171	0	356 171	356 171	0	356 171	356 171	0	356 171	**1 754 041**
including																	
drying	GJ/м^3	**0,995**	**-**	**-**	**0,995**	**-**	**-**	**0,995**	**-**	**-**	**0,995**	**-**	**-**	**0,995**	**-**	**-**	**-**
	GJ	294 969	0	294 969	321 785	0	321 785	321 785	0	321 785	321 785	0	321 785	321 785	0	321 785	**1 582 108**
heating	GJ	20 041	0	20 041	20 041	0	20 041	20 041	0	20 041	20 041	0	20 041	20 041	0	20 041	**100 204**
automobile facilities	GJ	14 346	0	14 346	14 346	0	14 346	14 346	0	14 346	14 346	0	14 346	14 346	0	14 346	**71 730**
Heat generation gross	GJ	445 351	0	445 351	481 659	0	481 659	481 659	0	481 659	481 659	0	481 659	481 659	0	481 659	**2 371 985**
Spent steam from the turbine	GJ	349 409	0	349 409	378 058	0	378 058	378 058	0	378 058	378 058	0	378 058	378 058	0	378 058	**1 861 640**
Auxiliary	GJ	31175	0	31 175	33 716	0	33 716	33 716	0	33 716	33 716	0	33 716	33 716	0	33 716	**166 039**
Steam through installation of cooling and pressu	GJ	11 122	0	11 122	11 830	0	11 830	11 830	0	11 830	11 830	0	11 830	11 830	0	11 830	**58 440**
Fuel (bark and wood waste)																	
Consumption of wood waste	m^3	88 811	24 646	113 457	96 051	24 646	120 698	96 051	24 646	120 698	96 051	24 646	120 698	96 051	24 646	120 698	**596 249**
	t	71 049	19 717	90 766	76 841	19 717	96 558	76 841	19 717	96 558	76 841	19 717	96 558	76 841	19 717	96 558	**476 999**
	tce	16 957	4 706	21 663	18 339	4 706	23 045	18 339	4 706	23 045	18 339	4 706	23 045	18 339	4 706	23 045	**113 842**
	GJ	523 942	145 402	669 345	566 657	145 402	712 059	566 657	145 402	712 059	566 657	145 402	712 059	566 657	145 402	712 059	**3 517 583**
Percentage	%	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	**100,00**
Combustion value	GJ/t	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	7,3744	7,3744	-	-
Efficiency of boilers	-	0,85	0,813	-	0,85	0,813	-	0,85	0,813	-	0,85	0,813	-	0,85	0,813	-	-
Auxiliary and energy loss	-	0,07	0,070	-	0,07	0,070	-	0,07	0,070	-	0,07	0,070	-	0,07	0,070	-	-
Useful output of energy from boilers	GJ	414 177	109 937	524 114	447 942	109 937	557 880	447 942	109 937	557 880	447 942	109 937	557 880	447 942	109 937	557 880	**2 755 633**
Greenhouse gases																	
from electricity	t CO_2e			0,0			0,0			0,0			0,0			0,0	**0,0**
from dump	t CO_2e			0,0			0,0			0,0			0,0			0,0	**0,0**
Total	**t CO_2e**			**0,0**			**0,0**			**0,0**			**0,0**			**0,0**	**0,0**

Annex 2.8.

Estimated GHG emission reductions at Maimaksa production site

Data name	Unit	2008	2009	2010	2011	2012	2008-2012
		Year					
Productivity of sawing and wood waste							
Productivity of sawing	m^3	0	0	0	0	0	**0**
Drying	m^3	0	0	0	0	0	**0**
Amount of wood waste	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
including							
	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
sawdust	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
Utilized	m^3	20 241	27 482	27 482	27 482	27 482	**130 168**
For sale	m^3	0	0	0	0	0	**0**
To the dump	m^3	-20 241	-27 482	-27 482	-27 482	-27 482	**-130 168**
Electricity							
Consumption of electricity	MWh	0	0	0	0	0	**0**
including		0	0	0	0	0	
sawmill equipment	MWh/m^3	0	0	0	0	0	**-**
	MWh	0	0	0	0	0	**0**
drying and packing line	MWh/m^3	0	0	0	0	0	**-**
	MWh	0	0	0	0	0	**0**
boiler house	MWh	0	0	0	0	0	**0**
Self-generation of electricity (new HPP)	MWh	20 014	21 655	21 655	21 655	21 655	**106 633**
From the outside	MWh	-20 014	-21 655	-21 655	-21 655	-21 655	**-106 633**
Heat (тепло)							
Useful output of energy	GJ	0	0	0	0	0	**0**
Housing estate	GJ	0	0	0	0	0	**0**
Sawmill	GJ	0	0	0	0	0	**0**
including							
drying	$GJ/м^3$	0	0	0	0	0	**-**
	GJ	0	0	0	0	0	**0**
heating	GJ	0	0	0	0	0	**0**
automobile facilities	GJ	0	0	0	0	0	**0**
generation of electricity	GJ	0	0	0	0	0	**0**
Fuel (total)							
Consumption of fuel (total)	tce	1 966	2 268	2 268	2 268	2 268	**11 039**
	Gcal	21 874	24 506	24 506	24 506	24 506	**119 898**
	GJ	91 651	102 680	102 680	102 680	102 680	**502 371**
Fuel (mazut)							
Consumption of mazut	t	-697	-1 493	-1 493	-1 493	-1 493	**-6 671**
	tce	-947	-2 027	-2 027	-2 027	-2 027	**-9 054**
	Gcal	-6 626	-14 188	-14 188	-14 188	-14 188	**-63 379**
	GJ	-27 763	-59 449	-59 449	-59 449	-59 449	**-265 558**
Fuel (bark and wood waste)							
Consumption of wood waste	m^3	20 241	27 482	27 482	27 482	27 482	**130 168**
	t	16 193	21 985	21 985	21 985	21 985	**104 134**
	tce	2 913	4 295	4 295	4 295	4 295	**20 093**
	GJ	119 414	162 129	162 129	162 129	162 129	**767 929**
Greenhouse gases							
from burning of mazut	t CO_2e	-2 126	-4 553	-4 553	-4 553	-4 553	**-20 340**
from electricity	t CO_2e	-13 609	-14 725	-14 725	-14 725	-14 725	**-72 511**
from dump	t CO_2e	-899	-2 079	-3 206	-4 281	-5 308	**-15 773**
Total	**t CO_2e**	**-16 635**	**-21 358**	**-22 484**	**-23 560**	**-24 587**	**-108 624**

Annex 2.9.

Автономная некоммерческая организация

ЦЕНТР ЭКОЛОГИЧЕСКИХ ИНВЕСТИЦИЙ (ЦЭИ)

г.Архангельск, Троицкий проспект 63, офис 49, тел/факс: (8182)646452

г.Москва, ул.Тверская 22, г-ца «Минск», офис 509, тел/факс.: (095) 299 1509

Генеральному директору
ООО «Цигломенский лесозавод»
г-ну Плетневу Г.А.

№ 120-А от 03.04.02

Уважаемый Глеб Анатольевич!

Для того чтобы намечаемый Вами "Проект мероприятий по сокращению вредного воздействия на окружающую среду" рассматривался в том числе и как проект совместного осуществления по линии Рамочной Конвенции ООН об изменении климата и Киотского Протокола, необходимо выполнить следующие расчеты, которые могут быть проведены сотрудниками ЦЭИ:

1. За период 1990-2001 гг. рассчитать ежегодное количество выбросов парниковых газов, регулируемых Киотским протоколом, и перевести их в эквивалент выбросов CO_2.
2. Построить базовую линию выбросов парниковых газов в эквиваленте CO_2 с учетом прогноза выбросов в ближайшие годы при условии, что "Проект мероприятий..." не был бы реализован.
3. Рассчитать ежегодное снижение выбросов в эквиваленте CO_2 по сравнению с базовой линией при условии реализации "Проекта мероприятий...".

Для выполнения указанных расчетов просим Вас представить следующие статистические данные по предприятию за период 1990-2001 гг. и 1-й квартал 2002 г.:

1. Расход топлива в котельной в натуральном и условном выражении по возможности с указанием данных теплотехнического анализа (Приложение 1.).
2. Выработка тепловой и электрической энергии (Приложение 2).
3. Объемы производства по распиловке древесины (Приложение 3).
4. Объемы образовавшихся кородревесных отходов и объемы вывоза их в места складирования (Приложение 4).

Кроме того, желательно указать прогнозируемые объемы производства по распиловке древесины в ближайшие годы.

Надеемся на Ваше содействие ЦЭИ в получении необходимой информации.

Непосредственно вопросами, касающимися проведения проекта как климатического, занимается сотрудник ЦЭИ Самородов Александр Викторович.

С уважением,
Директор — Юлкин М.А.

Autonomous non-profit organization
ENVIRONMENTAL INVESTMENT CENTER (EIC)

office 49, building 63, Troitsky prospect, Arkhangelsk, 16306.
tel/fax: (8182) 215436
office 509, hotel "Minsk", building 22, Tverskaya street,
Moscow, 103050, тел/факс: (095) 299 1509

General director
«Tsiglomen Sawmill», Ltd.
Mr. G.A.Pletnev

120-A_dated _03.04.02._

Dear Gleb Anatolievich!

To view the planned "Project of measures on reduction of harmful effect on the environment" as a JI project under UN framework convection on climate change and Kyoto protocol as well it is necessary to perform the following calculations that could be done by EIC specialists:

1. To calculate yearly amount of GHG emissions regulated by Kyoto protocol and to convert them into CO_2-equivalent units for the period of 1990-2001.
2. To design baseline of GHG emissions in CO_2-equivalent units taking into account emissions prognosis in the nearest years if "Project of measures…" was not implemented.
3. To calculate yearly reduction of emissions in CO_2-equivalent units compared to baseline if "Project of measures…" was implemented.

To do the following calculations we ask you to submit the following statistic data on the enterprise for the period of 1990-2001 and the first quarter of 2002:

1. Fuel consumption in the boiler house in natural and conditional expression with possible specification of the data of the thermotechnical analysis (Annex 1.).
2. Consumption of heat energy and electricity (Annex 2.).
3. Production volumes of wood sawing (Annex 3.).
4. Volumes of formed BWW and volumes of their removal to the stockpiling places (Annex 4.).

Besides it is desirable to specify the predictable production volumes of wood sawing in the nearest years.

We look forward to your assistance to EIC in the obtaining of the required data.

EIC specialist Alexander Victorivich Samorodov deals with the issues of project implementation as a climate one directly.

Regards,
Director ***M.A.Yulkin***

-

Annex 2.10.

NEFCO

Ms Elena Krasilnikova
Financial Director
JSC Sawmill 25
Postysheva str. 26
163025 Arkhangelsk
RUSSIA

7th June 2006

Reference : Modernisation of Timber Production and Heat and Electricity Supply Systems at Sawmill 25 as a Joint Implementation Project under the Kyoto Protocol

Dear Mrs Krasilinikova,

I am writing to confirm that further to the recent submission of project documentation by AOEEC / NEEG, the Investor's Committee of the Baltic Sea Region Testing Ground Facility (TGF) has given preliminary approval of the above project for carbon financing. We are therefore authorised to negotiate with Sawmill 25 to conclude a draft Emission Reduction Purchase Agreement (ERPA).

In this respect, please find attached a Term Sheet which sets out our terms and conditions for the volume and value of emission reductions to be purchased by the TGF. In summary, we are able to finance up to RUR 65 million within the frame of a forward purchase contract. It should be recognised however that there are uncertainties regarding the approval of early credits for the period 2005-2007 by the Russian Federation, and that only RUR 50 million may be available.

We would welcome the opportunity to work with you and the AOEEC to further develop the documentation for the project and submit it as a Joint Implementation project. In order to do so, our two parties should sign an Option Agreement, to allow us to continue the work towards an ERPA and to make a joint approach to the authorities in Moscow. A first step would be to signal your acceptance of the proposed Term Sheet, and the Option Agreement.

If there are any questions regarding the terms and conditions, please do not hesitate to contact me or our colleague Anders Holmen.

Yours sincerely

ON BEHALF OF

Magnus Rystedt
Managing Director,
Nordic Environment Finance Corporation

Ash Sharma
Programme Manager,
Testing Ground Facility Carbon Fund

Annex 3

MONITORING PLAN

Information sources for the definition of greenhouse gas emissions by the plant

The application of the reckoning method for the definition of GHG emissions requires, except for emission factors, the availability of initial information on different types of the emission-related company operations.

As the control practice of Russian enterprises shows, the main volume of initial data may be derived from the official annual statistical statements compiled by the companies and submitted to the regional statistics committee. If a company doesn't compile some official statistical statements or if they don't include the information required, the internal company data should be used.

The available information sources mutually checking and supplementing each other allow obtaining a reliable volume of the data on company operations, which is the basis for performing reliable GHG emission control.

Let's briefly describe the main information sources.

Statistical form 11-ter „Data on the fuel, thermal power and power use“

This form demonstrates annual data on the power, heat and fuel consumed by the plant for different types of industrial operations, works, specific needs and operation types, as well as on energy consumption by the household sector. Besides that, there is the annex of "Data on the formation and use of secondary energy resources" to the 11-ter form.

The report includes power and fuel consumption, both gross and per product unit. Form 11-ter demonstrates fuel consumption in equivalent units for different types of hard, liquid and gaseous fuels. Separate lines include the fuel energy resources sold to households, fuel consumed as raw material and for non-fuel needs.

The form 11-ter-based reports are especially useful for controlling power consumption, combusted fuel consumption for both the plant as a whole and for separate technological operations and units. The corresponding lines on fuel consumption for power and heat production shall correspond to the data reported under the form 6-tp. The annex to the 11-ter form for secondary resources allows obtaining more specific types and amounts of the biomass combusted.

2-tp (wastes) „Data on the formation, use, sterilization, transportation and allocation of production and consumption wastes“

In the past, this form represented only the data on the toxic waste movements, and since 2002 it has been representing all the company wastes divided by types and danger categories. Some data on the waste dumps are represented as well.

This form can be used for controlling purposes due to its assistance in detecting the amount of wastes with organic content disposed to the dump during the year.

Internal information sources

Additional and detailed information on the fuel consumption and energy balance (in particular, for fuel distribution between small units) can be derived from the internal reports of the chief energy engineer.

In many cases, specific data can be received from the company accounting department.