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:

Installation of a multi-fuel boiler at CJSC "International Paper" (former Svetogorsk PPM) for waste biomass utilization and energy generation for own needs, Svetogorsk, Russia

Sectoral scopes[1]: 1. Manufacturing industries (4)
2. Waste handling and disposal (13)

Version: 4.3

Date: August 18, 2011

A.2. Description of the project:

The project objective

The project is aimed at utilization of high-moisture and low-calorific waste biomass – bark and wood wastes (BWW) and waste water sludge (WWS) – by its combustion in multi-fuel fluidized bed boiler to generate heat and electricity for internal needs of CJSC "International Paper" (former Svetogorsk pulp and paper mill) and minimize waste landfilling.

Substitution of fossil fuel (natural gas) with renewable biomass and reduction of biomass dumping volumes lead to greenhouse gases (GHG) emission reductions.

Situation prior to the project implementation

The main products of CJSC "International Paper" are office and offset paper. The raw material of paper production is pulp which is produced at the same enterprise. Pulp cooking process uses pulp chips. Production of pulp chips at the Mill's wood preparation facilities yields large quantities of BWW, generally consisting of bark produced during pulp wood debarking.

WWS contains sludge from primary sedimentation tanks and surplus activated sludge from secondary sedimentation tanks at the biological waste water treatment plant, as well as pulp screenings supplied from the pulp cooking line.

BWW, and especially WWS, are difficult-to-burn fuels mainly due to their high moisture content which accounts for the low reactivity and low calorific value of fuel. By the time this project was launched (2000) biomass waste had not been used at the enterprise for energy generation purpose.

Prior to the project implementation BWW were disposed at the nearby dump, some part of it was sold to third parties. Part of WWS, prior to the project, was fired in a special incinerator without energy generation and with addition of fossil fuel for flame stabilization, some WWS was used for production of fiberboard, and the rest was disposed at the dump.

It should be noted that sale of wastes to third parties and their use in manufacturing of products yielded nothing but losses to Svetogorsk PPM. Besides, third-party buyers informed Svetogorsk PPM of prompt termination of BWW purchases from the Mill due to expansion of their own sawmilling capacities and due to the high cost of transportation. The WWS incinerator was almost 100% worn out and was due for decommissioning; installation of a new incinerator required significant investments; operation of the incinerator entailed high annual costs. Fiberboards were of low quality and in little demand.

Disposal of biomass waste at dumps is common practice for Russian pulp and paper industry and does not violate any Russian legislation. Since BWW and WWS utilization as fuel entails numerous difficulties, there are extensive dumping areas next to every pulp mill in Russia, including Svetogorsk PPM. The Mill had all required permits for disposal of BWW and WWS at dumps.

[1] In accordance with the list of sectors approved by JISC. http://ji.unfccc.int/Ref/Documents/List_Sectoral_Scopes.pdf

The required amount of heat for industrial purposes was produced by generating units of Svetogorsk PPM's energy complex consisting of CHPP-3 and CHPP-4. The fuel used is black liquor, natural gas and some amount of residual fuel oil. As a rule, the proportion of fossil fuel that is consumed to cover energy demand is significant at Russian PPMs. The steam produced by black liquor recovery boilers and gas-fired power boilers is fed to the steam turbines which partially meet the Mill's power demand. The lacking amount of electricity is purchased from the grid.

The baseline scenario

In view of the above, further continuation of the existing situation with BWW and WWS handling in all its aspects was not possible. The only acceptable waste handling alternative for the company, without the joint implementation mechanism, was their disposal at landfills.

Further use of the existing energy capacities could meet the heat requirements of Svetogorsk PPM. Technical condition of boilers at CHPP-3 and CHPP-4 could be preserved at the same level for a number of years by carrying out relatively inexpensive routine maintenance. The main fuel for production of the required amount of steam is natural gas.

The project scenario

The project proposes installation at CHPP-4 of a new multi-fuel (biomass) boiler (MFB) running on bark and wood waste and other organic waste generated by Svetogorsk PPM. The boiler was manufactured and mounted by Kvaerner Pulping Oy. The boiler deploys the technology of bubbling fluidized bed combustion. This technology allows for fluctuations in supply of different solid types of biomass fuel of variable moisture and helps to avoid the dependence on fossil fuels. The maximum possible steam output of the boiler when solid fuel is fired without addition of natural gas is 114 tonnes per hour, and when natural gas is used – 150 tonnes per hour. Fly ash is collected in an electrostatic precipitator.

Apart from the boiler itself it was necessary to build a biofuel preparation and feeding system. BWW are fed to the multi-fuel boiler from the Mill's wood preparation facilities by conveyors and pneumatically. Low-concentration WWS is pumped to a special dewatering plant. The mixture of BWW and dewatered (down to 70% moisture content) WWS is fed to the boiler by a conveyor.

The expected results of the project[2]:

- The project enables utilization of 251 thousand tonnes of BWW and 106 thousand tonnes of WWS per year for heat and electricity generation. This means that dumping of BWW and WWS from the Mill's production site is almost completely avoided.
- Reduction in natural gas consumption at Svetogorsk PPM by 67 million m^3 per year.
- Optimization of the Mill's energy generation scheme, enhancement of its reliability and efficiency.
- Mitigation of negative environmental impact, including reduction in GHG emissions (CO_2 and CH_4) by 326 thousand tCO_2e per year.

The project history

The first contract for supply of the multi-fuel boiler was signed with Kvaerner Pulping Oy on February 23, 2000, which is the starting date of the project. Construction and installation works under the project were completed in August 2001. After completion of start up and adjustment works, the boiler was put into operation in October 2001.

The capital investments in the project amounted to $28 million.

When deciding whether to implement the project, the management of Svetogorsk PPM from the very beginning considered the possibility of doing it as a carbon project in order to ensure acceptable return

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[2] Figures are given as an average for the period 2008-2012

on investments. Even before the project was commenced (2000), this issue was discussed with the Autonomous Non-Commercial Organization "Environmental Investment Center". Since the Kyoto Protocol came into effect (2005) and up until now the issues pertaining to preparation of the project design document (PDD) were discussed with ICF International, and since recently also with CCGS LLC (2010), which led to the development of this PDD.

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)
Russian Federation (host Party)	Closed Joint Stock Company "International Paper"	No
One of the parties of Annex B to the Kyoto Protocol	To be determined within 12 months after approval of the project by the Russian Government	No

Closed JSC "International Paper"

The mill was built in 1887 and today is one of the biggest pulp and paper mills in Russia, and the big one in the North-West region of Russia. There are more than 2 500 employees at the mill. Production capacity of the plant allows it to process 1.4 million m^3 of wood per year. Svetogorsk PPM consists of wood-chip production with the capacity of 1 280 thousand tonnes per year; two cellulose plants with the pulping capacity of about 140 thousand tonnes per year; book printing paper production with the capacity of 200 thousand tonnes per year; production of cable paper to manufacture cardboard with the capacity of 50 thousand tonnes per year. Apart from the listed main facilities there are also two generating plants, waste water treatment facility, and a biological treatment plant for biomass with the capacity of 240 thousand m^3 per day.

Fig. A.3-1. Svetogorsk PPM

International Paper Company launched its operations in Russia in 1998 with the acquisition of pulp and paper mill in the city of Svetogorsk. Today, Svetogorsk Mill is one of the largest paper mills in Russia which deploys the most modern technologies and equipment. Located on the Karelian Isthmus, the pulp and paper mill occupies 200 hectares of land. The manufacturing complex includes three pulp mills, two paper-making machines and an A4/A3 paper production line.

The integrated quality and environmental management system to the requirements of international standards ISO 9001 and ISO 14001 is functioning at the enterprise and is being constantly improved.

A.4. Technical description of the project:

A.4.1. Location of the project:

Location of the project: Russian Federation, Leningrad Region, Svetogorsk, CJSC “International Paper”, (See Fig. A.4-1, A.4-2).

Fig. A.4-1. Location of Leningrad Region and the city of Svetogorsk on the map of Russia

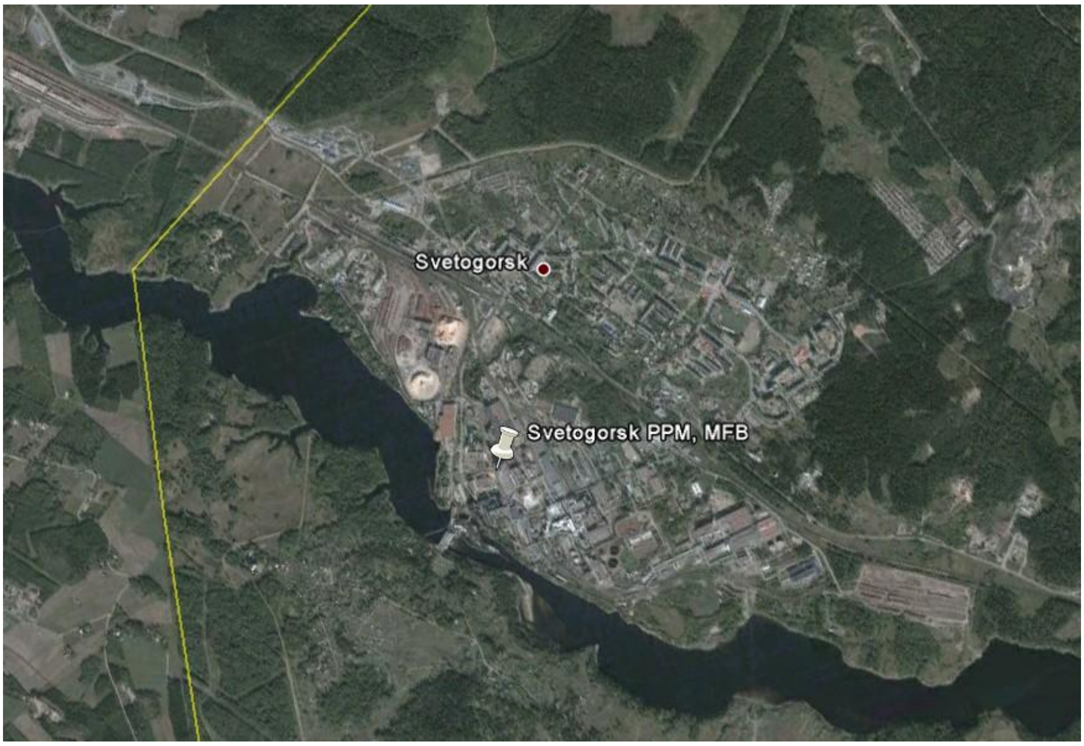

Fig. A.4-2. Google Earth[3] map pinpointing the project activity

[3] Computer program Google Earth, version 6.0.1.2032

A.4.1.1. Host Party(ies):

Russian Federation

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

Leningrad Region

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

City of Svetogorsk

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

The Leningrad Region lies in the North-West of the European part of Russia and is a part of the North-Western Federal District of the Russian Federation.

It covers an area of 83 900 km^2. The population is 1.6 million. The administrative centre of the region is the city of St. Petersburg.

The project is implemented in the city of Svetogorsk. The city is situated on the river Vuoksa in the northern part of the Karelian Isthmus. Its geographical location makes it the northernmost city in the Leningrad Region located on the border with Finland.

Geographic coordinates of the project activity: latitude: 61°06'N, longitude: 28°50'E. Time zone GMT: +3:00.

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

Description of CJSC "International Paper" energy system

The power complex of Svetogorsk PPM consists of two combined heat power plants (CHPP): CHPP-3 and CHPP-4 that supply the Mill and the city of Svetogorsk with heat (fully) and with electricity (partially). Additional electricity is purchased from the grid.

Prior to the Project implementation CHPP-3 had the following equipment:

- 3 steam boilers of E-75-39-440 type modified to increase steam capacity to 90 tonnes/hour each;
- 2 steam boiler E-75-39-440 type with the steam capacity of up to 75 tonnes/hour;
- 1 black liquor recovery boiler of SRK-520 type with the design consumption of 520 tonnes/day of dry substance of black liquor, reconstructed to the capacity of 700 tonnes/day of liquor and steam output of 110 tonnes/hour.

The total maximum steam output of all CHPP-3 boilers is 530 tonnes/hour.

The turbine hall of CHPP-3 houses 4 turbines – three of R-12-35/5M type and one of R-12-35/10 type. The total installed power capacity of the turbines is 48 MW.

All power boilers consume natural gas, with residual fuel oil being a backup fuel. The black liquor recovery boiler runs on black (sulphate) organic liquor (which is a by-product of cellulose production at the Mill) and uses residual fuel oil as a backup fuel.

Prior to the project implementation CHPP-4 had the following equipment:

- 1 steam boiler E-75-39-440 type, reconstructed to the steam capacity of 90 tonnes/hour;
- 1 hot-water boiler of PTVM-30 type;
- 1 black liquor recovery boiler of SRK-520 type with the design consumption of 520 tonnes/day of dry substance of black organic liquor, reconstructed to the capacity of 700 tonnes/day of black liquor and steam output of 110 tonnes/hour.

The total maximum steam output of all CHPP-4 boilers is 200 tonnes/hour, with the heat capacity of the hot-water boiler being 35 Gcal/hour.

The turbine hall of CHPP-4 houses 1 steam turbine of R-12-35/5M type with the power capacity of 12 MW.

The power boiler of E-75-39-440 types runs on natural gas with residual fuel oil being a backup fuel. The PTVM-30 boiler ran on residual fuel oil. The black liquor recovery boiler runs on black (sulphate) organic liquor (which is a by-product of cellulose production at the Mill) and uses residual fuel oil as a backup fuel.

Both CHPPs are interconnected by a common header for fresh steam, therefore some steam from CHPP-4 can be also fed to the turbines of CHPP-3.

Biomass waste generation at the mill

The pulp chips production processes at the mill yield a mix of wood wastes consisting largely of bark with smaller portions of sawdust and off-grade wood material. This mix is treated as one biomass type – bark and wood waste or BWW.

The biological waste water treatment plant generates the following residues: sludge from primary sedimentation tanks and surplus activated sludge of secondary sedimentation tanks which are to be continuously removed from the system. Besides, pulp screenings are generated at the later stages of pulp and paper production. All these waste are herein collectively referred to as waste water sludge or WWS.

Description of the main project solutions

The project envisages installation of a new multi-fuel biomass boiler (See Fig. A.4-3) and associated infrastructure for biomass transportation and preparation and fly ash handling. The boiler is fired with wastes produced by the mill (BWW and WWS) and with natural gas as a backup fuel. The boiler is installed in the building adjacent to CHPP-4. Installation of the new boiler allowed to remove from operation the PTVM-30 hot-water boiler at CHPP-4 and one E-75-39-440 steam power boiler at CHPP-3.

The newly installed biomass boiler as well as the auxiliary equipment e.g., exhaust ductwork, stack and fans occupy an area measuring 30x66 m. The height of the boiler is 35 metres. The boiler and its auxiliary equipment were manufactured by Kvaerner Pulping Oy that also carried out installation works. The fuel is fed to the boiler from two solid fuel silos with the storage capacity sufficient to maintain boiler operation during changes or swings in boiler process steam demand.

Technical characteristics of the new boiler

The new boiler achieves complete combustion of BWW and WWS without supplemental natural gas when BWW moisture is not more than 55% and WWS moisture – 70%. Maximum steam output of the boiler when fed with solid fuel without any natural gas is 114 tonnes per hour, and when natural gas is used - 150 tonnes per hour.

Efficiency factors of the boiler depending on the fuel used are given in the Table A.4-1 below:

Table A.4-1. The new boiler efficiency factors

Fuel	Fuel consumption, tonnes/hour	Steam capacity, tonnes/hour	Temperature of exhaust gases, ^{0}C	Boiler efficiency, %
Natural gas	12.05	150.0	138	93.9
10% WWS, 90% BWW	38.45	80.3	145	88.1
7% WWS, 93% BWW	47.27	101.5	153	88.1
6% WWS, 94% BWW	52.70	114.1	156	88.2

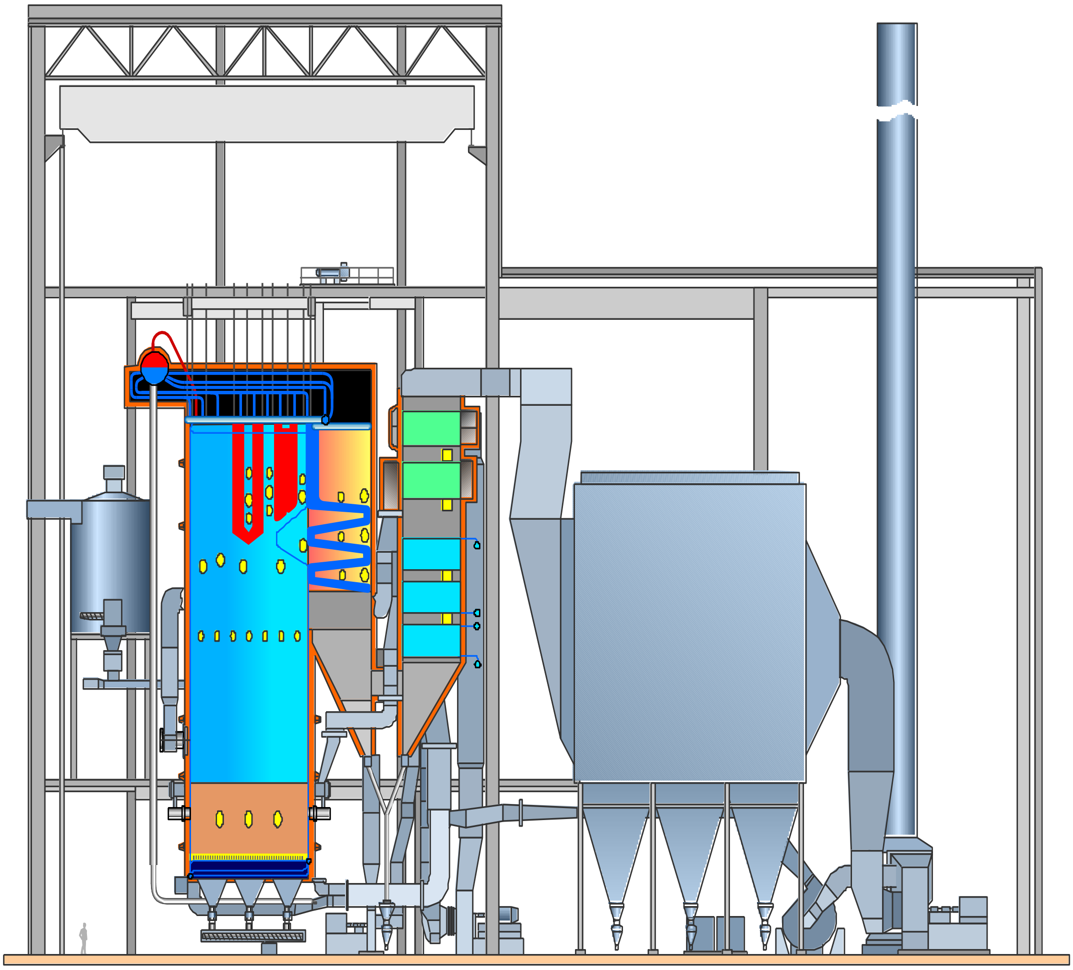

Fig. A.4-3. The scheme of Kvaerner bubbling fluidized bed boiler

The boiler operates on the basis of the bubbling fluidized bed (BFB) technology where fuels are burned in suspension with hot bed material consisting of sand, ash and additives. The hot sand effectively dries and ignites fuels with low heating value or high ash content in various mixtures. Strong turbulence and good mixing result in high combustion efficiency and low emissions. In the BFB technology the sand bed remains as a shallow layer in the lower part of the furnace. The combustion zone extracts all the heat from the fuel and thus BFB combustion is well suited for biomass and recycled fuels. The multi-fuel boiler is a single-drum installation, which consists of the furnace, steam super-heater located in the furnace, and also the second and the third gas flue, where boiling installation, sections of the economizer and the air heater are located.

In the fluidized bed solid particles are in suspension in the moving gas flow and the gas/solid mix behaves like a fluid. When the velocity of the gas remains within the range of 1.5 m/sec to 2.0 m/sec, the bed remains intact like a fluid and does not escape through the furnace with the flow of exhaust gases. In the upper part of the furnace average gas velocity is about 3-4 m/sec. Fuel is transported by the furnace system to the fluidized bed. Light fuel particles are burned above the bed and heavy particles – inside the fluidized bed. Residual pitch is mainly burned inside the bed, whereas volatile substances are burned inside the bed as well as above it. Under standard conditions the temperature of the fluidized bed varies from 700 ^{0}C to 950 ^{0}C.

The fluidized bed consists of sand and ash. Typical bed depth is 0.5 m. Because of the substantial heat content in the bed the burning process is stable and does not require any additional fuel even when burning low grade fuels. Turbulence provides good intermix and burning of the fuel.

Exhaust gas heat is used to produce steam in the furnace steam-tube sections downstream of the combustion sections. Furnace exhaust gases are cooled down first in the steam super-heaters, on the evaporation surfaces of the steam tubes and then further in the boiler section steam tubes further downstream. Ash is removed from flue gases in the electrostatic precipitator.

Table A.4-4. Technical characteristics and parameters of the new boiler

<table>
<tr><td colspan="2" rowspan="2">Expected pressure, MPa (bar)</td><td colspan="2">Inside the drum</td><td>4.9 (49.0)</td></tr>
<tr><td colspan="2">In outlet collector of the steam super-heater</td><td>4.5 (45.0)</td></tr>
<tr><td colspan="4">Expected temperature of superheated steam (fluid), ^{0}C, (saturated steam)</td><td>440</td></tr>
<tr><td colspan="4">Steam capacity, tones/hour (kg/sec)</td><td>150.0 (41.7)</td></tr>
<tr><td colspan="4">Heat capacity, GJ/hour</td><td>430.000</td></tr>
<tr><td colspan="4">Heat power, MW</td><td>119.4</td></tr>
<tr><td colspan="2" rowspan="4">Heated surface of the steam boiler, m^2</td><td colspan="2">Vapor (furnace + fluidized bed grate)</td><td>620+1.640</td></tr>
<tr><td colspan="2">Super-heater (primary, secondary)</td><td>260+170</td></tr>
<tr><td colspan="2">Resuperheater</td><td>230</td></tr>
<tr><td colspan="2">Economizer</td><td>2.170</td></tr>
<tr><td rowspan="2">Volume, m^3</td><td rowspan="2">Steam boiler</td><td rowspan="2">With natural circulation</td><td>Water (based on the max possible level of water in the drum)</td><td>100</td></tr>
<tr><td>Steam (based on the max possible level of water in the drum)</td><td>20</td></tr>
</table>

Heat production scheme of the new boiler

Feed water with the temperature of about 105 ^{0}C is pumped from the de-aerators to the boiler economizer (feed water heater), where it is heated by boiler exhaust gases to about 130 ^{0}C through the heat exchanger wall. Feed water from the economizer is fed to the drum. From the drum it is fed into the furnace steam tubes for evaporation. Steam produced by the boiler with the temperature of 440 ^{0}C and the pressure of 3.9 MPa is fed into the common steam header where it is mixed with steam produced by other steam boilers.

The installation of the new biomass boiler allowed an additional amount of steam to be produced at the plant to replace steam produced by the boiler at CHPP-3 that is to be shut down under the project. The heat production by the new boiler accounts for about 18% of the total volume of heat produced at Svetogorsk PPM. Steam from all power and liquor recovery boilers is collected in one steam header (collector), which joins together CHPP-3 and CHPP-4, and is directed to the steam turbines. The turbines produce about half of the electricity consumed by Svetogorsk PPM, the other half is being supplied from the grid. The waste steam produced by the turbines is consumed internally in production processes of Svetogorsk PPM, used for plant heating and is also sold to the nearby city. Electricity produced by Svetogorsk PPM is not sold to the electric grid.

Fuel feed system of biomass boiler

The multi-fuel boiler is capable of burning about 50 tonnes of biomass per hour. All biomass fuel is by-product (waste) of production processes at Svetogorsk PPM. In order to ensure uninterrupted feeding of biofuel to the boiler and to maintain BWW/WWS mass ratio and other parameters within the allowable limits, the project envisages installation of the corresponding equipment.

All types of BWW are transported from the Mill's wood preparation facilities to the boiler by a system of conveyors and by pneumatic transport.

The moisture content of sludge and pulp screenings will be reduced at the dewatering plant designed by USF "Aguaflow". Sludge and pulp screenings are pumped into the sludge bunker and then fed into two dewatering lines.

Then BWW and dewatered WWS are transported by a system of conveyers (produced by "BMH Wood Technology Oy") into two bunkers (150m^3 each) located at the front of the boiler. Fuel before being received by the bunker has to be mixed in order to become homogeneous. The fuel bunkers have a discharge screw conveyer, which discharges solid fuel to the scrapper conveyer. Fuel flow is distributed to the feeding pipes by the "raked" conveyer.

Each feeding pipe has a valve to avoid backward flow from the furnace. Fuel feeding pipes are fitted with gas feeding and purification system that improves fuel injection and distribution and also cools down the charging pipes.

The backup fuel is natural gas that is used to start up the boiler and to increase steam production when solid fuel is lacking. Natural gas is fed from the main gas pipeline of CHPP-4 to the outside pipeline (length - 240m) and then enters a gas distribution station, where gas pressure is decreased from 0.6 MPa to 0.2 MPa before it is fed into the boiler. From the gas distribution station gas is fed via a shut-off valve and filter to the gas collector and then distributed to the start-up and load burners and their electric lighters.

Start-up burners are located on the furnace side screens and used to heat up sand to the temperature necessary to trigger solid fuel combustion. Start-up burners can also be used to stabilize the combustion process. Load burners are designed to ensure load in case of interruptions of solid fuel supply.

Fly ash handling system

Fly ash consists of unburned hydrocarbon and small sand particles. Ash is removed from flue gases in the electrostatic precipitator. From the precipitator fly ash is delivered by pneumatic conveyers to the bunker. The fly ash bunker is fitted with dry discharge equipment.

Timeframe of the project implementation

Main stages of implementation schedule of the project are presented in the Table A.2-1.

Table A.2-1. Implementation schedule of the project

Milestones	Realization Date
Designing and procurement	1 February, 2000 – 27 October, 2000
Manufacture	12 June, 2000 – 8 December, 2000
Installation and construction work	18 August, 2000 – 29 August, 2001
Installation of equipment	9 October, 2000 – 3 August, 2001
Commissioning	9 July, 2001 – 25 October, 2001
Test operation	1 October, 2001 – 25 October, 2001
Acceptance of work	26 October, 2001 – 26 October, 2001

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:

Combustion of fossil fuel leads to significant emissions of greenhouse gases (GHG). The primary greenhouse gas from fossil fuel combustion is CO_2. Emissions of N_2O and CH_4 from combustion are negligible compared to emissions of CO_2. Emissions of CO_2 from biomass combustion are regarded as climatically neutral and are, therefore, assumed equal to zero. Decomposition of biomass at dumps in anaerobic conditions releases methane. CH_4 emissions in CO_2 equivalent may be very high.

GHG emission reductions as a result of the project at Svetogorsk PPM are achieved due to reduction of fossil fuel (natural gas) consumption and due to prevention of methane emissions into the atmosphere from anaerobic decomposition of BWW and WWS at dumps.

It is unlikely that the project would have been implemented in the absence of the joint implementation mechanism taking into account the following:

- The required steam can be always produced in CHPP-3 and CHPP-4 by firing additional quantities of natural gas in the existing power boilers;
- The project requires large investments and the return on investments for this project in the absence of additional revenues from selling GHG emission reductions is unacceptably low;
- The project implementation involves a fairly new technology of fluidized bed combustion of BWW/WWS mixture with which Svetogorsk PPM has had no experience;
- There are no caps on GHG emissions for companies in Russia;
- It is not expected that there will be any significant changes in the Russian environmental legislation, which might force the company to stop biomass waste dumping.

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

	Years
Length of the crediting period	5
Year	Estimation of annual emission reductions in tonnes of CO_2 equivalent
2008	270 771
2009	297 639
2010	322 221
2011	360 316
2012	380 049
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**1 630 997**
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	326 199

A.5. Project approval by the Parties involved:

The Letters of Approval will be obtained later.

SECTION B. Baseline

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

Selection of the approach to baseline setting

In setting the baseline the PDD developer used JI specific approach based on paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring" [R1].

The baseline was set in accordance with Annex B of the JI Guidelines[4]. The justification of the baseline was elaborated in accordance with paragraphs 23-29 of the "Guidance on criteria for baseline setting and monitoring".

First of all, the most likely baseline scenario was selected based on the analysis of several BWW and WWS handling and heat production alternatives within the framework of this project. Selection of the baseline was justified taking into account Annex 1 to the "Guidance on criteria for baseline setting and monitoring".

The special feature of this project is that the construction and installation works have been completed to date and the project is a reality and is right now generating physical reductions of GHG emissions. Therefore, it is reasonable to determine specific baseline parameters affecting the projected level of GHG emission reductions till the end of 2012, taking into account the accumulated actual project data for the period of 2001-2010.

All key data, factors and assumptions affecting GHG emission reductions are considered on a transparent and conservative basis.

Identification of the likely future scenarios and selection of the baseline scenario

The groups of alternative options for the following three types of project activity were considered separately:

- Production of heat (which is equal to the quantity of steam produced by the multi-fuel biomass boiler);
- BWW handling (the volume of which is equal to the BWW combustion in the multi-fuel biomass boiler);
- WWS handling (the volume of which is equal to the WWS combustion in the multi-fuel biomass boiler).

The following alternatives of heat (steam) production were identified:

Alternative H1. Continuation of the current situation;

Alternative H2. Heat production from heavy fuel oil;

Alternative H3. Heat production from coal;

Alternative H4. Purchase of heat from third-party suppliers;

Alternative H5. Project activity without joint implementation mechanism.

The following alternatives of BWW handling were identified:

Alternative B1. Continuation of the current situation;

Alternative B2. BWW sale to third parties;

Alternative B3. Use of BWW in manufacture of products;

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[4] Annex *Decision 9/CMP.1* (known as the JI Guidelines) includes *Appendix B*, which lays out criteria for baseline setting and monitoring.

Alternative B4. Dumping of BWW;

Alternative B5. Project activity without joint implementation mechanism.

The following alternatives of WWS handling were identified:

Alternative S1. Continuation of the current situation;

Alternative S2. Use of WWS in manufacture of products;

Alternative S3. Incineration of WWS without energy generation;

Alternative S4. Dumping of WWS;

Alternative S5. Project activity without joint implementation mechanism.

The analysis of each alternative is given below.

Production of heat

Alternative H1. Continuation of the current situation

This alternative assumes that heat will be produced by the existing equipment of the energy generating complex of Svetogorsk PPM (CHPP-3 and CHPP -4) as was the case prior to the project implementation.

All power boilers installed in CHPP-3 and CHPP -4 are running on natural gas. The main fuel of the black liquor recovery boilers is black liquor. Another fossil fuel – heavy fuel oil – is used in steam boilers as a back-up fuel, and only in hot-water boiler – as the main fuel. Combustion of wood wastes was discontinued as early as 1996 because of complete wear-out of the two utilizing boilers of KM-75-40.

The combined capacity of all boilers would be sufficient to meet all of the company's heat demand. Provided that relatively cheap scheduled repairs and maintenance are carried out, all of the installed boilers could be normally operated at least up until 2012.

Natural gas is the main fossil fuel used at Svetogorsk PPM. The proportion of natural gas consumed for heat and power generation at the Mill over the period from 1999 to 2010 (that is both before and after the project) was no less than 95% of the total fossil fuel consumption (natural gas+heavy fuel oil) in terms of equivalent fuel.

The natural gas supplier did not demand to limit gas consumption. There is no reason to assume that gas consumption limits would be lowered in the absence of the project.

The cost of natural gas for the company as of the beginning of the project (February 2000) amounted to \$12.6/thousand m^3, whereas the cost of heavy fuel oil stood at \$52.2/t. In terms of equivalent fuel the cost of gas was 3.45 times lower than the cost of heavy fuel oil. Up until now the cost of natural gas in Russia for domestic consumption is significantly lower than the cost of heavy oil. The average purchase price of natural gas in Russia in 2009[5] totaled \$87/thousand m^3, heavy fuel oil - \$365/t.

Natural gas is a more environmentally friendly fuel, pollutant emissions to the atmosphere from its combustion are significantly lower than from combustion of heavy fuel oil and coal.

However, it just might be necessary to fire somewhat more heavy fuel oil in the absence of the project in order to produce additional amount of heat (in hot-water boiler or in black liquor recovery boilers). Nonetheless, following the conservative approach, in calculation of emission reductions (if Alternative H1 is chosen as the baseline scenario) all heat which under the project is produced from biomass will be attributed to natural gas combustion in power steam boilers under the baseline.

Basically, Alternative H1 can be considered as a "heat production from natural gas" scenario.

Alternative H1 is a realistic, the least costly and the most conservative scenario which can be considered as the most likely baseline scenario of heat production.

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[5] http://www.gks.ru/bgd/regl/b10_13/IssWWW.exe/Stg/d6/24-16.htm

Alternative H2. Heat production from heavy fuel oil

Theoretically the existing power boilers can run not only on natural gas but also on heavy fuel oil which is a backup fuel for them. Furthermore heavy fuel oil can be fired in black liquor recovery boilers to produce additional steam, whereas for hot-water boiler heavy fuel oil is the main fuel. However the cost of heavy fuel oil is several times higher than the cost of natural gas (see above). Heavy fuel oil is a less environmentally friendly fuel as compared with natural gas. Operation of a heavy fuel oil system has significant power demands such as heating up and pumping of heavy fuel oil.

Heavy fuel oil consumption at Svetogorsk PPM accounted and still accounts for not more than a few percent of the total consumption of fossil fuel. It is unlikely that in the absence of the project the company would significantly increase its heavy fuel oil consumption by reducing its natural gas consumption. Furthermore this scenario is not conservative in terms of the project emission reduction calculation.

Therefore Alternative H2 was dismissed.

Alternative H3. Heat production from coal

Svetogorsk PPM has never used and is not using coal as fuel. It is highly unlikely that in the absence of the project the company would have to install a coal-fired boiler which would demand a fuel feeding and an ash handling systems to be built. Investment costs in this case would have been comparable to the costs of the project and the operating costs would have been much higher since the fuel would have to be purchased.

Coal is a least "easy-to-handle" fossil fuel which requires higher energy consumption and entails other costs related to preparation of fuel for combustion. Coal boilers are more complicated in operation. Steam output can be better controlled and the peak load handled more efficiently in gas and oil fired boilers. Coal boilers, on the contrary, are not that dynamic. Coal consumption could considerably increase the Mill's negative environmental impact which goes against the principles of an environmentally responsible company [6].

Thus, Alternative H3 is very unlikely and was dismissed.

Alternative H4. Purchase of heat from third-party suppliers

In the neighborhood of Svetogorsk PPM there are no heat producers which could ensure heat supplies to the Mill. Svetogorsk PPM itself is a heat supplier for the city of Svetogorsk.

Therefore Alternative H4 was dismissed.

Alternative H5. Project activity without joint implementation mechanism

Implementation of this alternative will ensure the Mill with the required amount of heat and will provide an opportunity to utilize BWW and WWS generated on site. This will enable reduction in fossil fuel (natural gas) consumption.

However this alternative requires investments in the amount of around $28 million. Economic parameters of the project without additional revenues from sale of emission reductions are unacceptably low (see the Investment analysis in Section B.2). Furthermore, construction and operation of a fluidized bed boiler and auxiliary fuel preparation equipment is not a widely used practice at Russian pulp and paper mills. Svetogorsk PPM doesn't have any previous experience in operating such equipment.

Alternative H5 could hardly have been implemented without the joint implementation mechanism.

BWW handling

Alternative B1. Continuation of the current situation

Prior to the project implementation BWW was disposed to a dump, some amount of BWW was sold to Stora Enso's Imatra Mills in Finland (Imatra, a Finnish city, 6 km from Svetogorsk), and a very small

[6] http://www.internationalpaper.com/RUSSIA/RU/Company/Sustainability/EnvRespEMEA.html

amount of wood waste was used in fiberboard production.

Disposal of biomass wastes at dumps is common practice for Russian pulp and paper and timber industries. There is a landfill for BWW and other biomass waste next to every PPM, including Svetogorsk PPM. These landfills cover extensive areas and are very high. Waste dumping practice does not violate any current Russian legislation, Svetogorsk PPM always had, and has now, all required permits for BWW disposal at dumps and will be able to obtain such in the future in accordance with the established procedure.

Prior to the project the Mill had an opportunity to export some of its BWW to Finland, however Stora Enso decided to stop buying BWW from Svetogorsk PPM from 2001 onwards due to expansion of its own production capacities which led to increase in generation of its own wood wastes. Moreover starting from 2000 the Finish buyer found the transportation costs of BWW from Svetogorsk too high.

Besides delivery of BWW across the Russo-Finish border was complicated by the requirement to obtain an expensive Phytosanitary Inspection Certificate as well as by custom duties which were paid by Svetogorsk PPM. BWW supplies to Finland by Svetogorsk PPM yielded a net loss of around $470 thousand per year.

It should be also said that Finnish customers are very fastidious about the quality of BWW and refused to buy wastes which were stockpiled in an open storage yard for just a couple of months or had a particle-size distribution which did not comply with their standards.

Prior to the project Svetogorsk PPM produced fiberboard, the raw material for this product was mainly waste water sludge. According to the manufacturing technology, wood wastes accounted only for a small proportion (around 7%) of the overall amount of raw material required for production of fiberboard.

Fiberboard production line was shut down in 2001 because the products did not meet up-to-date quality standards and the production itself yielded losses. The company’s net loss was estimated at the level of $400 thousand per year.

In any case the quantity of wood waste which was used in fiberboard production (in the order of 1.5 thousand tonnes per year) was very small against the BWW volumes which are utilized in the multi-fuel boiler under the project (around 250 thousand tonnes per year). Thereby the question whether BWW would or would not have been used in fiberboard production is irrelevant in the context of this analysis of the project alternatives.

Continuation of the current situation in any respect other than continuation of BWW dumping is hardly possible due to serious obstacles. Therefore Alternative B1 was excluded from further consideration.

<u>Alternative B2. BWW sale to third parties</u>

Prior to the project the Mill had an opportunity to export some of its BWW to Stora Enso Company located in Imatra, Finland. However, as mentioned above, in 2001 Stora Enso decided to stop purchasing BWW from Svetogorsk PPM because its own BWW generation increased. It is also necessary to take into account the above indicated complexities and costs entailed by delivery of wastes over border, the net loss of export for Svetogorsk PPM, and the high requirements set by foreign customers to the quality of BWW.

There aren’t any BWW buyers in Russia that would be situated close to Svetogorsk PPM. As for fuel pellets producers, those mainly need sawdust in large quantities. Wood wastes of pulp and paper mills, basically, consist of bark, with which trunk timber particles of uneven particle-size distribution are mixed.

Thus, Alternative B2 is unlikely and was excluded from further consideration.

<u>Alternative B3. Use of BWW in manufacture of products</u>

Due to the peculiarities of the process technology at the pulp and paper mill BWW mainly consists of bark, which is hardly useful for manufacture of any products. The sawdust volumes are fairly small in order to set up a cost-effective production of fuel pellets, for instance.

As stated above, prior to the project Svetogorsk PPM manufactured fiberboard with small additions of sawdust, however this production was shut down because it was yielding losses and the products fell short of the up-to-date quality standards.

Thus, Alternative B3 was excluded from further consideration.

Alternative B4. Dumping of BWW

According to the said above in respect of Alternative B1, disposal of biomass wastes at dumping sites is common practice in Russia which does not violate any laws or regulations. Svetogorsk PPM did not face, and doesn't face now, any barriers to the disposal of BWW at dumps.

This scenario does not require the company to invest into new and expensive BWW utilization equipment, which makes it possible to spend the investment resources on retrofit and expansion of the company's core production facilities.

Taking into account that it is not possible to continue BWW supplies to third parties (see above), dumping of all generated BWW is in fact the only acceptable BWW handling alternative apart from using the joint implementation mechanisms.

Thus, Alternative B4 is quite realistic and can be considered as the most likely baseline scenario of BWW handling.

Alternative B5. Project activity without joint implementation mechanism

Implementation of this alternative will make it possible to ensure utilization of almost all BWW quantity and to produce energy as well.

However due to the reasons stated above for Alternative H5, the project activity could hardly have been implemented without the joint implementation mechanism.

WWS handling

Alternative S1. Continuation of the current situation

Prior to the project some WWS was fired in a special incinerator without energy generation, some part of it was used for production of fiberboard, whereas the remaining amount had to be disposed at dumps.

Prior to the commencement of the project the Mill had an opportunity to fire around 40 tonnes of a.d.m. WWS per day in a "Lurgi" incinerator with addition of heavy fuel oil for flame stabilization and without energy generation. In 2000 the wear and tear level of this incinerator was almost 100% and the company was forced to decommission it. The other two incinerators were also decommissioned because of their wear as early as 1990s.

According to the company's estimates, the construction of a new incinerator would require around $5.6 million which would have to be invested in the period of 2000-2001. Besides operation of this incinerator cost the company around $300 thousand per year.

Some WWS was used in fiberboard production. However the quality of the product was low, the fiberboard had unpleasant odor which hampered its sale and in any case caused losses of around $400 thousand per year. Therefore in 2001 the fiberboard production line was shut down.

The remaining amounts of WWS were disposed to the dump. Dumping of WWS, similar to BWW, is common practice for Russian pulp and paper industry, which does not violate any Russian laws or regulations. Svetogorsk PPM had all permits required for disposal of WWS at dumps.

Continuation of the current situation in any respect other than continuation of WWS disposal at dumps is unlikely mainly due to economic reasons. Therefore Alternative S1 was excluded from consideration.

Alternative S2. Use of WWS in manufacture of products

The fiberboard production line used around 5 thousand tonnes of sludge per year. In 2001 the fiberboard production line was shut down. There are hardly any reasons to believe that in the absence of the project the fiberboard production would have been continued and even fewer reasons to believe that it would have been expanded, because the net loss amounted to around $400 thousand per year. Besides the quality of the product was low and it was in little demand.

Thus, Alternative S2 is unlikely and was therefore excluded from further consideration.

Alternative S3. Incineration of WWS without energy generation

Approximately 14 thousand tonnes of sludge per year were incinerated in the existing “Lurgi” incinerator until it was completely worn out (2000) and shut down. Wastewater sludge was incinerated with addition of heavy fuel oil for flame stabilization without production of energy. Construction of a new incinerator would require around $5.6 million of investments. Operating costs amount to no less than $300 thousand per year.

Due to heavy expenses Alternative S3 seems to be unlikely and was excluded from further consideration.

Alternative S4. Dumping of WWS

Svetogorsk PPM does not face any barriers to the disposal of all of its generated WWS at dumps. Svetogorsk PPM had all required permits for WWS disposal at dumps.

The payment for disposal of hazard class 4 wastes, such as wastewater sludge, amounted according to the company’s data to around $8.4 per tonne in 2000 (RUR 240 per tonne). Additional disposal of 19 thousand tonnes of WWS per year (such quantity of WWS as was incinerated and was used in fiberboard production prior to the project activity) would cost 19 000×8.4 = $160 thousand per year, which is much less than the cost of incinerator operation and losses yielded by fiberboard production ($700 thousand per year + $5.6 million investments!).

Thus based on a simple comparison of costs Alternative S4 can be considered as the most likely baseline scenario of WWS handling.

Alternative S5. Project activity without joint implementation mechanism

Implementation of this alternative will enable utilization of almost all generated WWS alongside energy production.

However due to the reasons stated above for Alternative H5, the project activity could hardly have been implemented without the joint implementation mechanism.

Thus, based on the above analysis of alternatives and with allowance for the results of the investment analysis given further in the text, the following combination of three alternatives was selected as the most likely baseline scenario: Alternative H1, which envisages heat production from natural gas, Alternative B4 and Alternative S4, which envisage dumping of BWW and WWS, respectively.

Justification and description of the methodology for estimation of GHG emissions

When initially reviewed the following emission sources were included within the project boundaries:

For the baseline scenario:

– heat production in power steam boilers of CHPP-3 and CHPP-4 (equal to heat production by multi-fuel biomass boiler), CO_2 emissions from combustion of natural gas;

– BWW and WWS dumping sites, CH_4 emissions from anaerobic decomposition of waste (avoided due to the project);

– transportation of BWW and WWS to the dumping sites, CO_2 emissions from combustion of fossil fuel.

For the project scenario:

– multi-fuel biomass boiler, CO_2 emissions from combustion of natural gas;

– transportation and preparation of BWW and WWS to combustion, CO_2 emissions related to power consumption.

Leakage includes fugitive emissions of CH_4 from production, processing, transport and distribution of natural gas used by the company.

GHG emission reductions

In general case, GHG emission reductions during the year *y* are calculated as follows, tCO_2e:

$$ER_y = BE_y - PE_y - LE_y, \quad (B.1\text{-}1)$$

where BE_y is the baseline GHG emissions during the year *y*, tCO_2e;

PE_y is the project GHG emissions during the year *y*, tCO_2e;

LE_y is the leakage due to the project activity during the year *y*, tCO_2e.

Baseline GHG emissions

In accordance with the above specified sources, in general case, the baseline GHG emissions during the year *y* are calculated by the following formula, tCO_2e:

$$BE_y = BE_{NG,y} + BE_{BWW,y} + BE_{WWS,y} + BE_{tr,y}, \quad (B.1\text{-}2)$$

where $BE_{NG,y}$ is the baseline CO_2 emissions due to additional (as compared to the project) combustion[7] of natural gas in power steam boilers of Svetogorsk PPM during the year *y*, tCO_2e;

$BE_{BWW,y}$ is the baseline CH_4 emissions from decomposition of BWW at dumps during the year *y*, tCO_2e;

$BE_{WWS,y}$ is the baseline CH_4 emissions from decomposition of WWS at dumps during the year *y*, tCO_2e;

$BE_{tr,y}$ is the baseline CO_2 emissions from transportation of BWW and WWS to dumps during the year *y*, tCO_2e.

The baseline CO_2 emissions due to additional combustion of natural gas in power gas-fired steam boilers of Svetogorsk PPM during the year *y* are calculated as follows, tCO_2e:

$$BE_{NG,y} = \Delta FC_{NG,BL,y} \times EF_{CO2,NG}, \quad (B.1\text{-}3)$$

$$\Delta FC_{NG,BL,y} = \frac{\Delta HG_{NG,BL,y}}{\eta_{NG}}, \quad (B.1\text{-}4)$$

$$\Delta HG_{NG,BL,y} = HG_{MFB,y} \quad (B.1\text{-}5)$$

where $\Delta FC_{NG,BL,y}$ is the additional consumption of natural gas in power steam boilers of Svetogorsk PPM under baseline during the year *y*, GJ;

$\Delta HG_{NG,BL,y}$ is the heat production due to additional combustion of natural gas in power steam boilers of Svetogorsk PPM under the baseline scenario during the year *y*, GJ;

$HG_{MFB,y}$ is the heat production by the multi-fuel boiler under the project during the year *y*, GJ;

$EF_{CO2,NG}$ is the CO_2 emission factor for natural gas, tCO_2/GJ;

[7] Emissions of CH_4 and N_2O as a result of fuel combustion are considered to be negligible compared to the emissions of CO_2 and were not considered in the PDD

η_{NG} is the efficiency of natural gas combustion in power steam boilers of Svetogorsk PPM.

Annual production of heat in the multi-fuel boiler $HG_{MFB,y}$ is to be monitored. Actual data are known for the period from 2001 to 2010 (See Table B.1-2); the projections for the years 2011 and 2012 are based on calculation using design heat output of the boiler which is equal to 430 GJ/hour (See Table A.4-4). The projected annual heat production was calculated as follows: 0.85×430×350×24 = 3 070 200 GJ/year, where 0.85 is the assumed load factor of the boiler, 350 is the number of days of operation in a year.

The CO_2 emission factors for natural gas are assumed in accordance with the IPCC Guidelines [R5] to be constant over years and numerically equal to $EF_{CO2,NG} = 0.0561$ tCO_2/GJ.

The efficiency of natural gas combustion in power steam boilers of Svetogorsk PPM is assumed in accordance with the recommendations [R6] for old gas-fired boilers to be numerically equal to η_{NG} = 0.87.

The numerical estimations of avoided CH_4 emissions from decomposition of BWW and WWS at dumps ($BE_{BWW,y}$ and $BE_{WWS,y}$) were made using the model "Calculation of CO_2-equivalent emission reductions from biomass prevented from stockpiling or taken from stockpiles" developed by BTG biomass technology group B.V. for the World Bank [R2]. The model is built on the First Order Decay method with experimental adjustment of a number of parameters to biomass waste. This model can be applied to different types of biomass if their characteristics are known.

In this model most of the parameters are constants and are determined once at the stage of the PDD development. The parameters that vary from year to year are the volumes of BWW and WWS, which are prevented from dumping due to the project activity starting from the year 2001 (the year of commissioning of the multi-fuel boiler). Instead of being disposed at the dump this quantity of BWW and WWS is utilized as fuel under the project.

In accordance with [R2] the formulae for calculation of prevented methane emissions are as follows:

$$BE_{BWW,y} = (1 - w_{lignin,BWW}) \times k_{BWW} \times \frac{C^d_{BWW}}{100} \times \left(1 - \frac{M_{BWW}}{100}\right) \times a \times \zeta \times \left(1 - \frac{\varphi}{100}\right) \times \times (1 - \xi_{OX}) \times \frac{V_m}{100} \times \rho_{CH4} \times GWP_{CH4} \times \sum_{x=2001}^{x=y} \left(W_{BWW,x} \times e^{-k_{BWW} \times (y-x)}\right), \quad \text{(B.1-6)}$$

$$BE_{WWS,y} = (1 - w_{lignin,WWS}) \times k_{WWS} \times \frac{C^d_{WWS}}{100} \times \left(1 - \frac{M_{WWS}}{100}\right) \times a \times \zeta \times \left(1 - \frac{\varphi}{100}\right) \times \times (1 - \xi_{OX}) \times \frac{V_m}{100} \times \rho_{CH4} \times GWP_{CH4} \times \sum_{x=2001}^{x=y} \left(W_{WWS,x} \times e^{-k_{WWS} \times (y-x)}\right), \quad \text{(B.1-7)}$$

where $W_{BWW,x} = FC^m_{BWW,x}$ is the quantity of BWW prevented from dumping which is equal to BWW combusted in the multi-fuel biomass boiler as a result of the project during the year *x*, t;

$W_{WWS,x} = FC^m_{WWS,x}$ is the quantity of WWS prevented from dumping which is equal to WWS combusted in the multi-fuel biomass boiler as a result of the project during the year *x*, t;

M_{BWW} is the moisture content of BWW, %;

M_{WWS} is the moisture content of WWS, %;

$w_{lignin,BWW}$ is the lignin fraction of C for BWW;

$w_{lignin,WWS}$ is the lignin fraction of C for WWS;

k_{BWW} is the decomposition rate constant for BWW, year $^{-1}$;

k_{WWS} is the decomposition rate constant for WWS, year $^{-1}$;

C^{d}_{BWW} is the organic carbon content in BWW on dry basis, %;

C^{d}_{WWS} is the organic carbon content in WWS on dry basis, %;

a is the conversion factor from kg carbon to landfill gas quantity, m^3/kg carbon;

ζ is the generation factor;

φ is the percentage of the stockpile under aerobic conditions, %;

ξ_{OX} is the methane oxidation factor;

V_m is the methane concentration biogas, %;

ρ_{CH4} is the density of methane, kg/m^3;

GWP_{CH4} is the global warming potential of methane, tCO_2e/tCH_4;

y is the year for which to calculate the CO_2-equivalent reduction, year;

x is the year in which fresh biomass is utilized instead of stockpiled, year.

Values $FC^{m}_{BWW,x}$ and $FC^{m}_{WWS,x}$ are to be monitored. Actual data are known for the period from 2001 to 2010 (See Table B.1-2); projections for the years 2011 and 2012 use maximum annual values recorded over the last three years (2008-2010) of operation of the multi-fuel boiler. $FC^{m}_{BWW,2008}$ = 254 702 t, $FC^{m}_{WWS,2010}$ = 110 821 t.

Moisture. For BWW we assumed default value recommended by [R2]: $M_{BWW,x}$ = 50%; for WWS the value was assumed according to [R9] at $M_{WWS,x} = 70\%$.

Lignin fraction of C. The default value recommended by [R2] was assumed: $w_{lignin,BWW}$ = 0.25, $w_{lignin,WWS}$ = 0.25.

Decomposition rate constant. For BWW the default value recommended by [R2] was assumed: $k_{BWW} = -\ln(1/2)/15 = 0.0462$ year^{-1}, where 15 is the recommended default half-life value for wood, years. The value adopted for WWS is default one for sludge according to 2006 IPCC Guidelines [R7]: k_{WWS} = 0.185 year^{-1}.

Organic carbon content on dry basis. For BWW the default value recommended by [R2] was assumed: C^{d}_{BWW} = 53.6%; for WWS this value was assumed according to [R9] C^{d}_{WWS} = 45%.

Conversion factor from kg carbon to landfill gas quantity. The default value recommended by [R2] was assumed: $a = 22.4/12 = 1.87$ m^3/kg carbon, where 22.4 is the molar volume of gas at standard conditions, l/mol; 12 is the molar mass of C, g/mol.

Generation factor. The default value recommended by [R2] was assumed: ζ = 0.77.

Percentage of the stockpile under aerobic conditions. The default value recommended by [R2] was assumed: φ = 10%.

Methane oxidation factor. The default value recommended by [R2] was assumed: ξ_{OX} = 0.10.

Methane concentration in biogas. The default value recommended by [R2] is: V_m = 60%. We assumed a more conservative value V_m = 50%.

Methane density. In accordance with [R10] it was assumed: ρ_{CH4} = 0.716 kg/m^3.

Global warming potential of methane. In accordance with [R2]: GWP_{CH4} = 21 tCO_2e/tCH_4.

Year for which to calculate the CO_2-equivalent reduction. *y* = 2008-2012.

Year in which fresh biomass is utilized instead of stockpiled. *x* = 2001-2012.

CO_2 emissions due to BWW and WWS transportation to dumps under the baseline scenario, in general case, are to be determined on the basis of fuel consumption by motor vehicles with allowance for the distance from the Mill to the dump, lifting capacity and specific fuel consumption of the motor vehicle, type of fuel, its CO_2 emission factor and/or other parameters.

Following the conservative approach and for the sake of simplicity of calculations, CO_2 emissions related to transportation of BWW and WWS to dumps $BE_{tr,y}$ were excluded from consideration.

Ultimately, baseline GHG emissions include only CO_2 emissions from additional natural gas combustion in boilers of Svetogorsk PPM, as well as prevented CH_4 emissions from decomposition of BWW and WWS at dumps:

$$BE_y = BE_{NG,y} + BE_{BWW,y} + BE_{WWS,y}\,. \quad \text{(B.1-8)}$$

Project GHG emissions

In accordance with the above mentioned sources, in general case, the project GHG emissions during the year *y* are calculated by the following formula, tCO_2e:

$$PE_y = PE_{NG,y} + PE_{biomass\_system,y}\,, \quad \text{(B.1-9)}$$

where $PE_{NG,y}$ is the project CO_2 emissions due to natural gas combustion in the multi-fuel biomass boiler of Svetogosk PPM during the year *y*, tCO_2;

$PE_{biomass\_system,y}$ is the project CO_2 emissions due to power consumption for transportation and preparation of BWW and WWS before combustion during the year *y*, tCO_2e.

The project CO_2 emissions due to natural gas combustion in the multi-fuel biomass boiler during the year *y* are calculated by the following formula, tCO_2e:

$$PE_{NG,y} = FC_{NG,PJ,y} \times EF_{CO2,NG}\,. \quad \text{(B.1-10)}$$

where $FC_{NG,PJ,y}$ is the project consumption of natural gas in the multi-fuel biomass boiler of Svetogorsk PPM during the year *y*, GJ.

Annual consumption of gas in the multi-fuel boiler $FC_{NG,PJ,y}$, expressed in energy units, is determined based on actual data of volumetric consumption of natural gas $FC^{v}_{NG,PJ,y}$ and average calorific value of natural gas $NCV_{NG,y}$ both of which are monitored. For the period from 2001 to 2010 actual data for $FC_{NG,PJ,y}$ are known (See Table B.1-2); projections for the years 2011 and 2012 use the minimum annual value recorded over the last three years (2008-2010) of operation of the multi-fuel boiler. $FC_{NG,PJ,2008}$ = 1 080 513 GJ.

Emissions of CO_2 related to power consumption for transportation and preparation of BWW and WWS to combustion

BWW is transported from wood preparation facilities of the mill to the multi-fuel boiler pneumatically. WWS with low concentration is pumped to the sludge dewatering plant where it is compressed and then fed for combustion mixed with BWW. Electricity is consumed for transportation of biomass wastes and for their further preparation before combustion and feeding to the multi-fuel boiler. Svetogorsk PPM does not have separate metering of power consumption at its facilities for transport and preparation of BWW and WWS. According to design data [R8] annual power consumption by the multi-fuel boiler system, including fuel transportation and preparation systems, amounts to 38 647 MWh.

Estimation of emissions $PE_{biomass\_system,y}$ was made assuming the emission factor for grid electricity according to [R3] was equal to 0.55 tCO_2/MWh, then GHG emissions will be: 38 647×0.55 = 21 256 tCO_2/year. It is shown below that these emissions can be excluded from consideration because they are much lower than leakage due to natural gas consumption under the baseline.

The final formula for calculation of project GHG emissions:

$$PE_y = PE_{NG,y} \,. \qquad \text{(B.1-11)}$$

Leakage

Leakage includes fugitive emissions of CH_4 from production, processing, transport and distribution of natural gas used by the company. Since the project implementation leads to reduction in natural gas consumption at Svetogorsk PPM, fugitive emissions are reduced due to the project. Negative leakage should not be taken into account in the final calculation of emission reductions therefore they were excluded from consideration.

However it is worth-while to estimate the value of leakage reduction due to the project. According to CDM methodology ACM0009 [R4], Version 03.2, for Eastern Europe and former USSR the default emission factor of fugitive methane emissions is 921 t CH_4/PJ. Natural gas consumption is reduced due to the project by the value of no less than 2 PJ/year. Then the leakage value amounts to 21×921×2 = 38 682 tCO_2e/year. This value is almost two times bigger than the emissions related to power consumption under the project. This gives sufficient grounds to ignore these project emissions both at the stage of projections and at the stage of monitoring.

Application of the selected approach

All necessary parameters for the baseline and project scenarios were determined based on the above specified methodology with allowance for actual Svetogorsk PPM operation data from 2001 to 2010.

Actual and projected data for the period 2001-2012 are shown in Tables B.1-1 and B.1-2. The key constants for the baseline scenario are described in a tabular form below. See also Annex 2.

Table B.1-1. Data for the baseline scenario

Parameter	Designation	Unit	2001	2002	2003	2004	2005	2006
Heat production due to additional combustion of natural gas in power boilers	$\Delta HG_{NG,BL,y}$	GJ	609 577	2 103 218	2 189 805	2 318 999	2 371 647	2 272 733
Additional consumption of natural gas in power boilers	$\Delta FC_{NG,BL,y}$	GJ	700 633	2 417 492	2 517 017	2 665 516	2 726 031	2 612 337
Disposal of BWW to the dump	$W_{BWW,x}$	t	24 099	154 347	197 044	206 555	231 824	192 884
Disposal of WWS to the dump	$W_{WWS,x}$	t	7 527	62 816	59 878	64 120	65 896	70 349
Parameter	**Designation**	**Unit**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Heat production due to additional combustion of natural gas in power boilers	$\Delta HG_{NG,BL,y}$	GJ	2 283 699	2 731 482	2 838 438	2 821 226	3 070 200	3 070 200
Additional consumption of natural gas in power boilers	$\Delta FC_{NG,BL,y}$	GJ	2 624 941	3 139 634	3 262 573	3 242 788	3 528 966	3 528 966
Disposal of BWW to the dump	$W_{BWW,x}$	t	195 854	254 702	245 499	246 974	254 702	254 702
Disposal of WWS to the dump	$W_{WWS,x}$	t	60 923	95 478	100 232	110 821	110 821	110 821

Table B.1-2. Data for the project scenario

Parameter	Designation	Unit	2001	2002	2003	2004	2005	2006
Heat production by multi-fuel boiler	$HG_{MFB,y}$	GJ	609 577	2 103 218	2 189 805	2 318 999	2 371 647	2 272 733
Consumption of natural gas by multi-fuel boiler	$FC_{NG,PJ,y}$	GJ	349 317	736 209	578 316	1 014 185	906 236	863 297
Consumption of BWW by multi-fuel boiler	$FC^{m}_{BWW,x}$	t	24 099	154 347	197 044	206 555	231 824	192 884
Consumption of WWS by multi-fuel boiler	$FC^{m}_{WWS,x}$	t	7 527	62 816	59 878	64 120	65 896	70 349
Parameter	**Designation**	**Unit**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Heat production by multi-fuel boiler	$HG_{MFB,y}$	GJ	2 283 699	2 731 482	2 838 438	2 821 226	3 070 200	3 070 200

Consumption of natural gas by multi-fuel boiler	$FC_{NG,PJ,y}$	GJ	1 136 818	1 080 513	1 137 228	1 089 101	1 080 513	1 080 513
Consumption of BWW by multi-fuel boiler	$FC^{m}_{BWW,x}$	t	195 854	254 702	245 499	246 974	254 702	254 702
Consumption of WWS by multi-fuel boiler	$FC^{m}_{WWS,x}$	t	60 923	95 478	100 232	110 821	110 821	110 821

*Highlighted in grey are actual values

Data/Parameter	$EF_{CO2,NG}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor for natural gas
Time of determination/monitoring	January 2011
Source of data (to be) use	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Chapter 2, Table 2.2. [R5]
Value of data applied (for ex ante calculations/determinations)	0.0561
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	η_{NG}
Data unit	-
Description	Efficiency of natural gas combustion in power steam boilers of Svetogorsk PPM
Time of determination/monitoring	January 2011
Source of data (to be) use	Methodological tool to determine the baseline efficiency of thermal or electric energy generation systems. Version 01. CDM Executive Board. P.7, Table 1. [R6]
Value of data applied (for ex ante calculations/determinations)	0.87
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Value recommended for old gas-fired boilers
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	M_{BWW}
Data unit	%
Description	BWW moisture content
Time of	January 2011

determination/monitoring	
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 16 [R2]
Value of data applied (for ex ante calculations/determinations)	50
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	M_{WWS}
Data unit	%
Description	WWS moisture content
Time of determination/monitoring	January 2011
Source of data (to be) use	Technical specification of the bubbling fluidized bed boiler, Kvaerner Pulping, 2000. [R9]
Value of data applied (for ex ante calculations/determinations)	70
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Reference value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	$w_{lignin,BWW}$
Data unit	-
Description	Lignin fraction of C for BWW
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 43 [R2]
Value of data applied (for ex ante calculations/determinations)	0.25
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	$w_{lignin,WWS}$
Data unit	-

Description	Lignin fraction of C for WWS
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 43 [R2]
Value of data applied (for ex ante calculations/determinations)	0.25
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	k_{BWW}
Data unit	year^{-1}
Description	Decomposition rate constant for BWW
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 42-43 [R2]
Value of data applied (for ex ante calculations/determinations)	0.0462
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula: $k_{BWW} = -\ln\left(\frac{1}{2}\right)/15$
QA/QC procedures (to be) applied	Based on reference data
Any comment	15 – recommended default value for the half period of wood, years

Data/Parameter	k_{WWS}
Data unit	year^{-1}
Description	Decomposition rate constant for WWS
Time of determination/monitoring	January 2011
Source of data (to be) use	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5, Chapter 3, Table 3.3. [R7]
Value of data applied (for ex ante calculations/determinations)	0.185
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value for sludge
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	C^{d}_{BWW}

Data unit	%
Description	Organic carbon content in BWW on dry basis
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCF plus Research, World Bank, August 2002. Page 43 [R2]
Value of data applied (for ex ante calculations/determinations)	53.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value recalculated on a dry basis
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	C_{WWS}^{d}
Data unit	%
Description	Organic carbon content in WWS on dry basis
Time of determination/monitoring	January 2011
Source of data (to be) use	Technical specification of the bubbling fluidized bed boiler, Kvaerner Pulping, 2000. [R9]
Value of data applied (for ex ante calculations/determinations)	45
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Reference value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	a
Data unit	m^3/kg carbon
Description	Conversion factor from kg carbon to landfill gas quantity
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 24 [R2]
Value of data applied (for ex ante calculations/determinations)	1.87
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula: a=22.4/12
QA/QC procedures (to be) applied	Based on reference data
Any comment	22.4 – is the molar volume of gas at standard conditions, l/mol; 12 – molar mass of C, g/mol.

Data/Parameter	ζ
Data unit	-
Description	Generation factor
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCF plus Research, World Bank, August 2002. Page 41 [R2]
Value of data applied (for ex ante calculations/determinations)	0.77
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	φ
Data unit	%
Description	Percentage of the stockpile under aerobic conditions
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 80 [R2]
Value of data applied (for ex ante calculations/determinations)	10
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	ξ_{OX}
Data unit	-
Description	Methane oxidation factor
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 43 [R2]
Value of data applied (for ex ante calculations/determinations)	0.10
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be) applied	Based on reference data

Any comment	-

Data/Parameter	V_m
Data unit	%
Description	Methane concentration biogas
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 41 [R2]
Value of data applied (for ex ante calculations/determinations)	50
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value is 60%. A more conservative value (50%) was assumed for calculations.
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	ρ_{CH4}
Data unit	kg/m^3
Description	Methane density
Time of determination/monitoring	January 2011
Source of data (to be) use	Methodological tool to determine project emissions from flaring gases containing methane. CDM Executive Board. Table 1. [R10]
Value of data applied (for ex ante calculations/determinations)	0.716
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Reference value of methane density at normal conditions
QA/QC procedures (to be) applied	Based on reference data
Any comment	-

Data/Parameter	GWP_{CH4}
Data unit	tCO_2e/tCH_4
Description	The Global Warming Potential for methane
Time of determination/monitoring	January 2011
Source of data (to be) use	Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002. Page 12 [R2]
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended default value
QA/QC procedures (to be)	Based on reference data

applied	
Any comment	-

Data/Parameter	$\Delta HG_{NG,BL,y}$
Data unit	GJ
Description	Heat production due to additional combustion of natural gas in power boilers
Time of determination/monitoring	Once a year
Source of data (to be) use	1. Energy Department of CJSC “International Paper” (actual data for the heat production by the multi-fuel boiler); 2. Installation of Multi-Fuel Boiler. Detailed Design. CJSC “Giprobum”, Saint-Petersburg, 2000 [R8] (forecast for the heat production by the multi-fuel boiler)
Value of data applied (for ex ante calculations/determinations)	2008: 2 731 482 2009: 2 838 438 2010: 2 821 226 2011: 3 070 200 2012: 3 070 200
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The parameter is assumed equal to the heat production by the multi-fuel boiler during the year *y*. 2008-2010 – actual data, 2011-2012 – forecast on basis of design capacity of the multi-fuel boiler, number of days of its operation in a year and assumed load factor: 0.85×430×350×24=3 070 200 GJ/year.
QA/QC procedures (to be) applied	The heat production meter of the multi-fuel boiler includes the steam flow meter, temperature and pressure gauges. Measuring devices are regularly calibrated in accordance with the schedule and procedure for calibration of instrumentation and control equipment adopted at the Mill. All current signals from the measuring devices are sent to the process information system “Energia”, where heat output is automatically calculated.
Any comment	-

Data/Parameter	$\Delta FC_{NG,BL,y}$
Data unit	GJ
Description	Additional consumption of natural gas in power boilers
Time of determination/monitoring	January 2011
Source of data (to be) use	Formula evaluation
Value of data applied (for ex ante calculations/determinations)	2008: 3 139 634 2009: 3 262 573 2010: 3 242 788 2011: 3 528 966 2012: 3 528 966

Justification of the choice of data or description of measurement methods and procedures (to be) applied	$\Delta FC_{NG,BL,y} = \frac{\Delta HG_{NG,BL,y}}{\eta_{NG}}$, $\Delta HG_{NG,BL,y}$ is the heat production due to additional combustion of natural gas in power steam boilers of Svetogorsk PPM under the baseline scenario during the year *y*, GJ; η_{NG} is the efficiency of natural gas combustion in power steam boilers of Svetogorsk PPM.
QA/QC procedures (to be) applied	Not required
Any comment	-

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:

The approach described in paragraph 2 (a) of Annex 1 to the “Guidelines on criteria for baseline setting and monitoring” [R1] was chosen to demonstrate that reduction in greenhouse gas emissions from sources achieved by the project is additional to that which might have otherwise occurred.

Within the framework of the chosen approach, the project additionality was analyzed using the analysis of the project alternatives, investment analysis and common practice analysis.

Analysis of the project alternatives

The detailed analysis of the project alternative is given in Section B.1. The analysis of the project alternatives indicated that the project activity without joint implementation mechanism can hardly be considered as the baseline scenario.

The following combination of three alternatives was selected as the most likely baseline scenario: Alternative H1, which envisages heat production from natural gas, Alternative B4 and Alternative S4, which envisage dumping of BWW and WWS, respectively.

The investment analysis

Main economic parameters of the project were compared for the two project implementation options:

(a) without sale of GHG emission reductions;

(b) with sale of GHG emission reductions.

The investment analysis was undertaken using data and assumptions relevant for the situation in 2000[8].

The dollar exchange rate was assumed at 28.5 RUR/USD.

The total amount of capital investments in the project was estimated at 28 million USD.

The service lifetime is 20 years. The time horizon of the analysis is limited to 2021.

The price at which the enterprise purchased natural gas in 2000 was at the level of about 13 USD/thousand m^3, however based on the analysis of trends of actual natural gas price growth over the period from 1996 to 2000 it was assumed at 50 USD/thousand m^3.

The price of electricity was assumed at 10 USD/MWh. The payment for disposal of wastes at dumps amounts to 8.4 USD/t.

[8] Final approval of the project financing took place at the board meeting at International Paper on July 11, 2000.

Repair and maintenance costs of the multi-fuel boiler are assumed equal to the costs of additional repair and maintenance of power boilers and are therefore excluded from the analysis.

The expected price of emission reduction unit (ERU) generated in 2008-2012 was assumed equal to 15 USD/tCO_2e, the expected price of early emission reductions (2002-2007) – 3 USD/tCO_2e.

The value of the discount rate is assumed to be 15%, which corresponds to the corporate discount rate for investment projects in CJSC "International Paper".

The results of calculation of the net present value (NPV) and the internal rate of return (IRR) for the two project implementation options are given in Table B.2-1, detailed calculations are given in Annex 2-4.

As is seen, the project implementation without sale of ERUs has a negative NPV and IRR is lower than 15%, whereas additional revenues from sale of emission reductions significantly increase the project economic appeal: NPV = USD 979 thousand, IRR = 15.61% > 15%.

Table B.2-1. Comparison of NPV and IRR

Parameter	Unit	Project without sale of ERUs	Project with sale of ERUs
NPV	Thousand USD	-3 166	979
IRR	%	12.94	15.61

The analysis of the project sensitivity to the change of main parameters is given further below (See Table B.2-2). Due to the revenues received from sale of emission reductions the project becomes much less sensitive to risks demonstrating in six out of eight considered cases an IRR higher than 15%, whereas without sale of emission reductions in all of the cases IRR is lower than 15%.

Table B.2-2. The sensitivity analysis

Parameter	Unit	Project without sale of ERs	Project with sale of ERs
1) Increase in investments by 10%			
NPV	Thousand USD	-5 478	-1 333
IRR	%	11.70	14.23
2) Decrease in investments by 10%			
NPV	Thousand USD	-853	3 292
IRR	%	14.39	17.24
3) Increase in the price of natural gas by 10%			
NPV	Thousand USD	-2 042	2 104
IRR	%	13.68	16.31
4) Decrease in the price of natural gas by 10%			
NPV	Thousand USD	-4 290	-145
IRR	%	12.18	14.91
5) Increase in the consumption of waste biomass fuel by 10%			
NPV	Thousand USD	-2 281	1 864
IRR	%	13.52	16.16
6) Decrease in the consumption of waste biomass fuel by 10%			
NPV	Thousand USD	-4 050	95
IRR	%	12.34	15.06
7) Increase in the price of GHG emission reduction by 10%			

NPV	Thousand USD	-3 166	1 394
IRR	%	12.94	15.87
8) Decrease in the price of GHG emission reduction by 10%			
NPV	Thousand USD	-3 166	565
IRR	%	12.94	15.36

Thus the project without sale of GHG emission reductions is not financially viable.

Common practice analysis

For pulp and paper mills in Russia the common practice is production of heat and electricity by energy sources (CHPPs and boiler houses) with a high proportion of fossil fuel consumption (coal, heavy fuel oil, natural gas). The enterprises where pulp is cooked also use black liquor as fuel. As for wood wastes, mainly the less moist sawdust, chip screenings, off-grade chips and timber residues are used as fuel. As for waste water sludge, it has even higher humidity content and lower calorific value than bark and thus has never been considered as fuel in Russia.

Significant quantities of highly moist bark and sludge are still being dumped due to the difficulties associated with its combustion. Disposal of bark and other biomass wastes at dumps is permitted by the environmental legislation of Russia.

As of the date of the project commencement (December 2000) many Russian pulp and paper mills were equipped with low-efficiency grate type utilizing boilers designed for firing of moist wood wastes only together with significant quantities of heavy fuel oil or natural gas for flame stabilization.

According to the independent technical opinion of specialists of Harris Group International (see Annex 2-5), prior to 2000 there was only one fluidized bed boiler in operation in Russia, and it was located at a pulp plant in Vyborg. In 2000 Arkhangelsk PPM switched one of its utilizing boilers to fluidized bed combustion of BWW. However it should be said that it was implemented within the framework of joint implementation under the Kyoto Protocol. The project at Arkhangelsk PPM went through independent expert review and was submitted for the second JI tender held by Sberbank of Russia[9].

Taking into account the aforesaid, the considered project is not common practice.

According to the above justifications, the emission reductions achieved due to the project are additional to those that might have otherwise occurred.

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

Fig. B.3-1 and B.3-2 show the boundaries, components, main energy, fuel and waste flows of the baseline and project respectively. Table B.3-1 shows emission sources included in and excluded from the project boundaries.

[9] http://www.sbrf.ru/moscow/ru/concurs/2010/index.php?id114=11006872

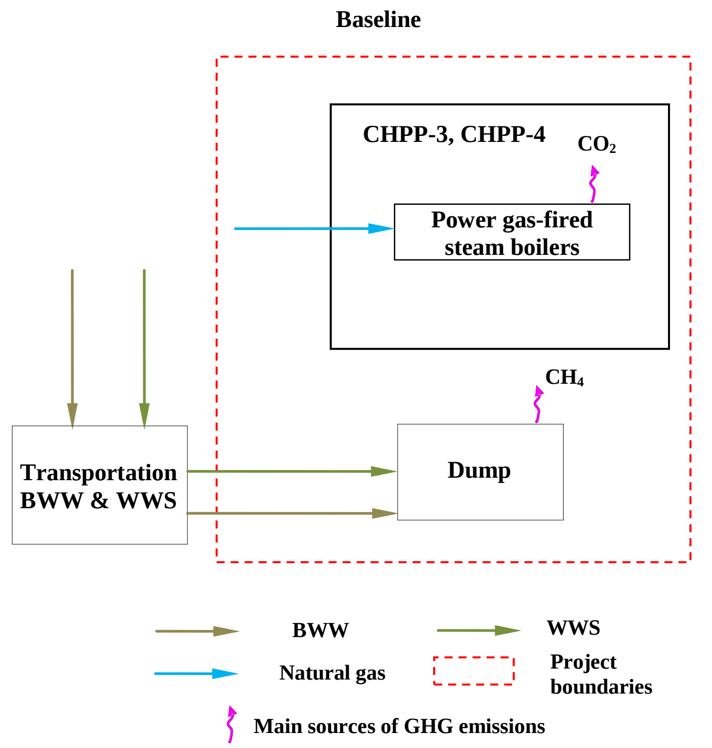

Fig. B.3-1. Boundaries, main components and flows for the baseline scenario

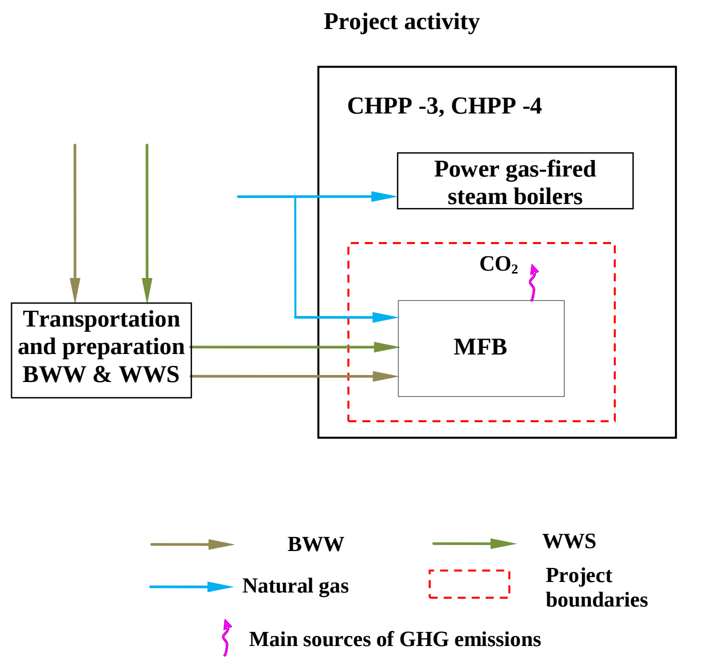

Fig. B.3-2. Boundaries, main components and flows for the project scenario

Table B.3-1. Emission sources included in and excluded from the project boundaries

	Sources	Gas	Incl./Excl.	Justification / Explanation
Baseline	Power steam boilers, additional (as compared to the project) combustion of natural gas	**CO_2**	**Incl.**	**Main emission source**
		CH_4	Excl.	Negligible. Conservative
		N_2O	Excl.	Negligible. Conservative
	Dump, prevented (due to the project) emissions from anaerobic decomposition of BWW	CO_2	Excl.	Climatically neutral
		CH_4	**Incl.**	**Main emission source**
		N_2O	Excl.	Negligible. Conservative
	Dump, prevented (due to the project) emissions from anaerobic decomposition of WWS	CO_2	Excl.	Climatically neutral
		CH_4	**Incl.**	**Main emission source**
		N_2O	Excl.	Negligible. Conservative
	Transportation of BWW and WWS to the dumps, combustion of diesel fuel	CO_2	Excl.	Modest and are excluded for simplification. Conservative
		CH_4	Excl.	Negligible. Conservative
		N_2O	Excl.	Negligible. Conservative
Project	Multi-fuel boiler, combustion of natural gas	**CO_2**	**Incl.**	**Main emission source**
		CH_4	Excl.	Negligible
		N_2O	Excl.	Negligible
	New BWW and WWS preparation and transportation facilities, consumption of electricity	CO_2	Excl.*	Modest and are offset by fugitive emissions related to natural gas handling
		CH_4	Excl.	Negligible
		N_2O	Excl.	Negligible
Leakages	Production, processing, storage, delivery and distribution of natural gas, fugitive emissions	CO_2	Excl.	Negligible. Conservative
		CH_4	Excl.*	Partially offset by minor project emissions. Excluded from consideration. Conservative
		N_2O	Excl.	Negligible. Conservative

* Numerical evaluation was made for these emissions (See Section B.1).

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

The date of baseline setting: 24/01/2011

The baseline was developed by CCGS LLC (CCGS LLC is not the project participant listed in Annex 1 to the PDD)

The contact persons: Alexander Samorodov, Andrey Belikhin

E-mail: a.samorodov@ccgs.ru, a.belikhin@ccgs.ru

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

February 23, 2000 (signing of the first contract with Kvaerner Pulping Oy for delivery of biomass steam boiler)

C.2. Expected operational lifetime of the project:

20 years / 240 months (the expected lifetime of main equipment)

C.3. Length of the crediting period:

5 years / 60 months (from January 1, 2008 to December 31, 2012)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

For development of the project monitoring plan the PDD-writer used a JI-specific approach in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring" [R1].

The data required for estimation of GHG emission reductions are to be collected at the Mill in any case.

All measurement and calibration of equipment is done in accordance with the ФЗ-№102 dated 26.06.2008 "On uniformity of measurements".

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

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
1. $FC^{v}_{NG,PJ,y}$	Volume consumption of natural gas in multi-fuel boiler	Energy Department	thousand m^3	m	Continuously	100%	Electronic and paper	Readings of gas meter at the boiler
2. $NCV_{NG,y}$	Average net calorific value of natural gas	Energy Department	GJ/thousand m^3	m	Quarterly at least	100%	Electronic and paper	Natural gas suppliers' certificates.

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

The project GHG emissions are due to combustion of natural gas in the multi-fuel boiler during the year *y*, tCO_2e:

$$PE_y = PE_{NG,y}, \quad (D.1\text{-}1)$$

where $PE_{NG,y}$ is the project CO_2 emissions due to natural gas combustion in the multi-fuel boiler during the year *y*, tCO_2.

$$PE_{NG,y} = FC_{NG,PJ,y} \times EF_{CO2,NG}, \quad (D.1\text{-}2)$$

where $EF_{CO2,NG}$ is the CO_2 emission factor for natural gas, tCO_2/GJ. In accordance with IPCC Guidelines [R5] $EF_{CO2,NG}$ = 0.0561 tCO_2/GJ;

$FC_{NG,PJ,y}$ is the project natural gas consumption in multi-fuel boiler during the year y, GJ.

$$FC_{NG,PJ,y} = FC^{v}_{NG,PJ,y} \times NCV_{NG,y}, \quad \text{(D.1-3)}$$

where $FC^{v}_{NG,PJ,y}$ is the project volume consumption of natural gas in multi-fuel boiler during the year y (to be monitored), thousand m^3;

$NCV_{NG,y}$ is the average net calorific value of natural gas during the year y (to be monitored), GJ/thousand m^3.

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
3. $FC^{m}_{BWW,x}$	Mass consumption of BWW in multi-fuel boiler	Energy Department	t	m, c	Continuously	100%	Electronic and paper	As per readings of amperemeter installed on the solid fuels conveyor belt after deduction of WWS consumption
4. $FC^{m}_{WWS,x}$	Mass consumption of WWS in multi-fuel boiler	Energy Department	t	m, c	Continuously	100%	Electronic and paper	As per readings of flow meters with allowance for WWS concentration at the inlet to the dewatering unit and its moisture content at the outlet from it

5. $HG_{MFB,y}$	Heat production by multi-fuel boiler	Energy Department	GJ	m, c	Continuously	100%	Electronic and paper	Readings of heat production meter

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

The baseline GHG emissions are determined as a sum of emissions from additional combustion of natural gas in power gas-fired steam boilers of Svetogorsk PPM and prevented emissions from decomposition of BWW and WWS at dumps during the year *y*, tCO_2e:

$$BE_y = BE_{NG,y} + BE_{BWW,y} + BE_{WWS,y}, \qquad (D.1\text{-}4)$$

where $BE_{NG,y}$ is the baseline CO_2 emissions due to additional (as compared to the project) combustion of natural gas in power steam boilers of Svetogorsk PPM during the year *y*, tCO_2e;

$BE_{BWW,y}$ is the baseline CH_4 emissions from decomposition of BWW at dumps during the year *y*, tCO_2e;

$BE_{WWS,y}$ is the baseline CH_4 emissions from decomposition of WWS at dumps during the year *y*, tCO_2e.

$$BE_{NG,y} = \Delta FC_{NG,BL,y} \times EF_{CO2,NG}, \qquad (D.1\text{-}5)$$

$$\Delta FC_{NG,BL,y} = \frac{\Delta HG_{NG,BL,y}}{\eta_{NG}}, \qquad (D.1\text{-}6)$$

$$\Delta HG_{NG,BL,y} = HG_{MFB,y}, \qquad (D.1\text{-}7)$$

where $\Delta FC_{NG,BL,y}$ is the additional consumption of natural gas in power steam boilers of Svetogorsk PPM under baseline during the year *y*, GJ;

$\Delta HG_{NG,BL,y}$ is the heat production due to additional combustion of natural gas in power steam boilers of Svetogorsk PPM under the baseline scenario during the year *y*, GJ

$HG_{MFB,y}$ is the heat production by the multi-fuel boiler during the year *y*, GJ (to be monitored);

η_{NG} is the efficiency of natural gas combustion in power steam boilers of Svetogorsk PPM. According to [R6] η_{NG} = 0.87.

Numerical values of $BE_{BWW,y}$ and $BE_{WWS,y}$ are determined using the model "Calculation of CO_2-equivalent emission reduction from biomass prevented from stockpiling or taken from stockpiles" developed by "BTG biomass technology group B.V." in accordance with [R2]:

$$BE_{BWW,y} = (1 - w_{lignin,BWW}) \times k_{BWW} \times \frac{C^d_{BWW}}{100} \times \left(1 - \frac{M_{BWW}}{100}\right) \times a \times \zeta \times \left(1 - \frac{\varphi}{100}\right) \times \times (1 - \xi_{OX}) \times \frac{V_m}{100} \times \rho_{CH4} \times GWP_{CH4} \times \sum_{x=2001}^{x=y} \left(W_{BWW,x} \times e^{-k_{BWW} \times (y-x)}\right), \quad \text{(D.1-8)}$$

$$BE_{WWS,y} = (1 - w_{lignin,WWS}) \times k_{WWS} \times \frac{C^d_{WWS}}{100} \times \left(1 - \frac{M_{WWS}}{100}\right) \times a \times \zeta \times \left(1 - \frac{\varphi}{100}\right) \times \times (1 - \xi_{OX}) \times \frac{V_m}{100} \times \rho_{CH4} \times GWP_{CH4} \times \sum_{x=2001}^{x=y} \left(W_{WWS,x} \times e^{-k_{WWS} \times (y-x)}\right), \quad \text{(D.1-9)}$$

where $W_{BWW,x} = FC^m_{BWW,x}$ is the quantity of BWW prevented from dumping which is equal to BWW combusted in the multi-fuel biomass boiler as a result of the project during the year *x*, t (<u>to be monitored</u>);

$W_{WWS,x} = FC^m_{WWS,x}$ is the quantity of WWS prevented from dumping which is equal to WWS combusted in the multi-fuel biomass boiler as a result of the project during the year *x*, t (<u>to be monitored</u>);

M_{BWW} is the moisture content of BWW, %. The default value recommended by [R2] was assumed: M_{BWW} = 50%;

M_{WWS} is the moisture content of WWS, %. The value is assumed according to [R9] at $M_{WWS,x}$ =70%;

$w_{lignin,BWW}$ is the lignin fraction of C for BWW. The default value recommended by [R2] was assumed: $w_{lignin,BWW}$ = 0.25;

$w_{lignin,WWS}$ is the lignin fraction of C for WWS. The default value recommended by [R2] was assumed: $w_{lignin,WWS}$ = 0.25;

k_{BWW} is the decomposition rate constant for BWW, year $^{-1}$. The default value recommended by [R2] was assumed: k_{BWW} = –ln(1/2)/15 = 0.0462 year^{-1} (where 15 is the recommended default value for half period of wood, years);

k_{WWS} is the decomposition rate constant for WWS, year^{-1}. The default value for sludge according to 2006 IPCC Guidelines [R7]: k_{WWS} = 0.185 year^{-1};

C^d_{BWW} is the organic carbon content in BWW on dry basis, %. The default value recommended by [R2] was assumed: C^d_{BWW} = 53.6%;

C^d_{WWS} is the organic carbon content in WWS on dry basis, %. The value is assumed according to [R9] at C^d_{WWS} = 45%;

a is the conversion factor from kg carbon to landfill gas quantity, m^3/kg carbon. The default value recommended by [R2] was assumed: a = 1.87 m^3/kg;

ζ is the generation factor. The default value recommended by [R2] was assumed: ζ = 0.77;

φ is the percentage of the stockpile under aerobic conditions, %. The default value recommended by [R2] was assumed: φ = 10%;

ξ_{OX} is the methane oxidation factor. The default value recommended by [R2] was assumed: ξ_{OX} = 0.10;

V_m is the methane concentration biogas, %. In accordance with Section B.1 we assumed V_m = 50%, which is a more conservative value than the one recommended by [R2] on default;

ρ_{CH4} is the density of methane, kg/m^3. In accordance with [R10] we assumed: ρ_{CH4} = 0.716 kg/m^3;

GWP_{CH4} is the global warming potential of methane, tCO_2e/tCH_4. In accordance with [R2]: GWP_{CH4} = 21 tCO_2e/tCH_4;

y is the year for which to calculate the CO_2-equivalent reduction, year;

x is the year in which fresh biomass is utilized instead of stockpiled, year (starting in 2001).

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

This option is not applied.

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

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):

This option is not applied.

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

As shown in Section B.1, leakage is assumed equal to zero.

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):

As shown in Section B.1, leakage is assumed equal to zero.

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):

The GHG emission reduction during the year *y* is determined as a difference between the baseline emissions and the project emissions, tCO_2e:

$$ER_y = BE_y - PE_y,\qquad (D.1\text{-}10)$$

where BE_y is the baseline emissions of GHG during the year *y*, tCO_2e;

PE_y is the project emissions of GHG during the year *y*, tCO_2e.

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:

The industrial environmental monitoring at the Mill is the responsibility of the Department of Environment, Occupational Safety, Fire and Industrial Safety.

The industrial environmental monitoring programme, which is currently implemented by the Mill, will not undergo any significant changes after the project completion and will be fulfilled according to the scheme and schedules approved by local authorities.

Similar to the way it is now, the monitoring will be carried out by the Mill's Department of Environment, Occupational Safety, Fire and Industrial Safety.

The industrial environmental monitoring covers the following:

- Analytical control of compliance with the prescribed pollutant emission standards in accordance with the laboratory control charts;
- Monitoring of the impact of waste disposal sites on underground and surface waters, atmospheric air and soil;
- Control of pollutants content in the atmospheric air on the border of the sanitary protection zone, etc.

The enterprise has the following reporting obligations as per official annual statistic forms:

- 2-tp (air) "Data on Atmospheric Air" containing information on the quantities of trapped and destroyed air pollutants, detailed emissions of specific pollutants, number of emission sources, emission reduction actions and emissions from separate groups of pollutant sources;
- 2-tp (water) "Data on Water Use", containing information on water consumption from natural sources, discharges of effluents and their pollutant content, capacity of wastewater treatment facilities, etc.;
- 2-tp (wastes) "Data on generation, use, decontamination, transportation and disposal of industrial and consumption wastes" which shows annual balance of waste flows with breakdown by type and hazard class.

In accordance with the Russian legislation the Mill develops and implements environment protection actions on an annual basis.

The Svetogorsk mill is certified according to ISO 14001 (forest operations since 2001; environmental management system, since 2004) and OHSAS 18001 (health and safety management system, since 2006). In 2009, the mill obtained FSC Chain-of-Custody certification.

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.
Table D.1.1.1 ID 1	Low	Gas meter is regularly calibrated in accordance with the schedule and procedure for calibration of instrumentation and control equipment adopted at the Mill. All current signals from the measuring devices are sent to the process information system “Energia”.
Table D.1.1.1 ID 2	Low	Data provided by the certified laboratories of the suppliers are used. At the year end an average weighted value is determined.
Table D.1.1.3 ID 3	Low	The ampermeter, whose readings are used to determine the overall flow of solid fuel to the multi-fuel boiler, is regularly calibrated in accordance with the schedule and procedure for calibration of instrumentation and control equipment adopted at the Mill. Current signal from the measuring device is sent to the process information system “Energia”. BWW consumption calculated as a difference between the overall consumption of solid fuel and WWS is cross checked against the total BWW generation and utilization balance at the enterprise.
Table D.1.1.3 ID 4	Low	The flow meters which measure WWS feeding to the dewatering unit are regularly calibrated in accordance with the schedule and procedure for calibration of instrumentation and control equipment adopted at the Mill. All current signals from the measuring devices are sent to the process information system “Energia”. The laboratory analysis of sludge concentration at the inlet to the dewatering unit and of sludge moisture content at the outlet from this unit is carried out every shift in accordance with the developed instructions. The laboratory equipment is regularly calibrated in accordance with the schedule and procedure for checking of instrumentation and control equipment adopted at the Mill.
Table D.1.1.3 ID 5	Low	The heat production meter of the multi-fuel boiler includes the steam flow meter, temperature and pressure gauges. Measuring devices are regularly calibrated in accordance with the schedule and procedure for calibration of instrumentation and control equipment adopted at the Mill. All current signals from the measuring devices are sent to the process information system “Energia”, where heat output is automatically calculated.

The Svetogorsk mill is certified according to ISO 9001 (quality management system, since 2000). The procedures of this standard will be applied in the monitoring of GHG emission reductions.

Actions undertaken during calibration of measuring instruments

The measuring instruments are calibrated during the periods of scheduled shutdown of the equipment. If necessary the removed measuring device is replaced with a backup calibrated instrument. Operation of the equipment without instrumentation and control equipment is not allowed.

Troubleshooting procedure

If the measurement processes do not comply with the standards specified in the design documentation the situation shall be analyzed, alternative monitoring and measuring procedures shall be developed for the period of non-compliance, as well as corrective actions which allow to remedy the identified non-compliance.

If any measuring instrument fails, the parameter shall be metered with the help of a duplicate instrument or if there is no duplicate instrument, the failed device is substituted by a backup calibrated instrument. Operation of the equipment without instrumentation and control equipment is not allowed.

Internal check

Internal check by the enterprise includes checking primary data, furnished to the company which is in charge of the project monitoring during information collection period as well as checking the project monitoring reports.

Test verifications

Regularly, but not more than once per year, the specialist of the company, which is in charge of the monitoring, shall carry out test verifications with a view to verifying the observance of the monitoring plan.

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

Information transfer

The primary request for input monitoring data is made by the specialists of the company which is in charge of the project monitoring to the Director of Power Supply Strategy at CJSC "International Paper" who in his turn gives instructions to collect the requested data. There is a group of employees within the company (a task force) responsible for collection, checking and transfer of monitoring data. The responsibilities of these employees are laid out in the corresponding orders.

The information collected at the enterprise is furnished to the Chief Power Engineer of CJSC "International Paper" who controls meeting the deadlines and data completeness. Then the information is furnished to the Director of Power Supply Strategy at CJSC "International Paper" who in his turn sends the collected information to the company which is in charge of monitoring. All information is sent by e-mail.

The specialists of the company which is in charge of monitoring shall prepare the project monitoring report (GHG emission reduction monitoring report) basing on the received data. Then the monitoring report is submitted for review to the company where the project is implemented.

After the report is checked and amended as required, the company which is in charge of monitoring shall inform the Director of Power Supply Strategy at CJSC "International Paper" about preliminary monitoring results and, if there are no objections on his part, shall make the final decision to submit the project monitoring report for verification to an independent auditor.

The procedure for collection and transfer of information necessary for fulfilment of the project monitoring plan is shown in Fig. D.4-2.

Registration and collection of monitoring data

The information required for calculation of GHG emission reductions is collected in accordance with the procedures for resources monitoring and accounting adopted at the company.

The location of the monitoring points is shown in Fig. D.4-1.

The procedures for primary data registration and storage as well as persons responsible for monitoring are specified in Table D.4-1.

The GHG emission reductions are calculated at the end of each reporting period by the company which is in charge of monitoring.

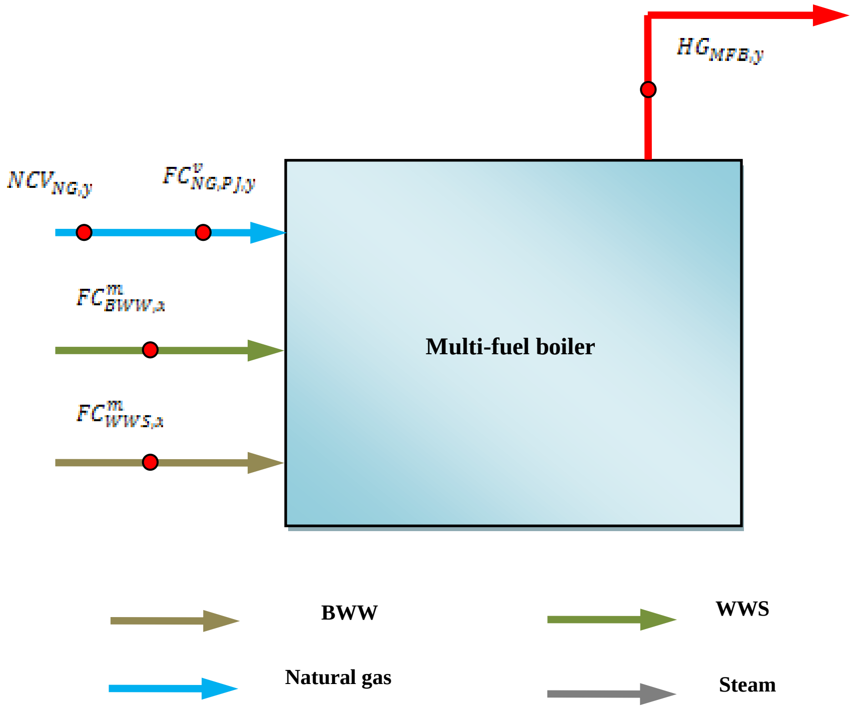

Fig. D.4-1. Location of the monitoring points

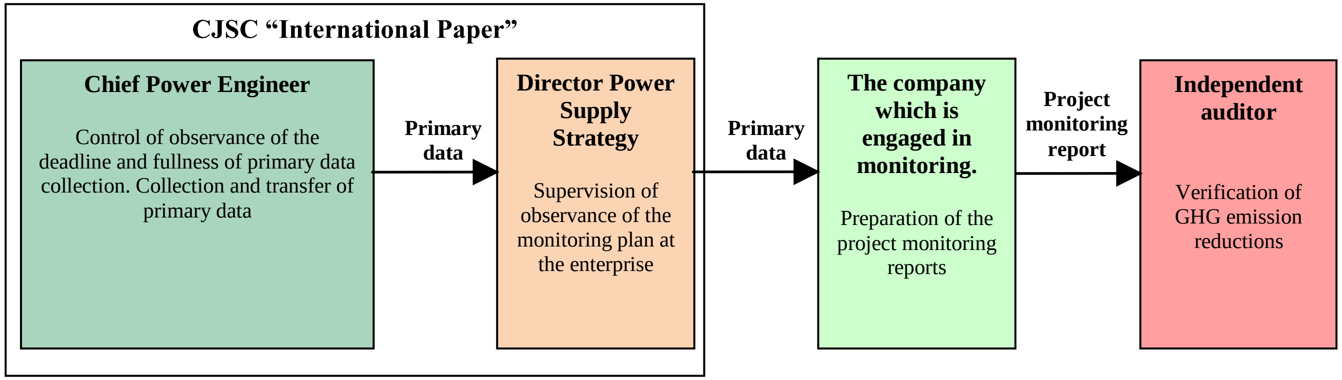

Fig. D.4-2. Organization of collection and transfer of monitoring information

Table D.4-1. Monitoring procedures

Monitored parameter	Procedure for registration, monitoring, record and storage of data (including everyday monitoring)	Person responsible for monitoring
Volume consumption of natural gas in multi-fuel boiler	1. The quantity of consumed natural gas is continuously measured by gas meter. 2. Readings of the measuring device are recorded in the process information system "Energia" and are shown on the displays of all computers which have the required software. The data are printed out on paper and are stored in the computer memory. 3. Data on natural gas consumption shall be stored in the Mill's archive in electronic and hard copy for at least two years after the end of the crediting period or after the last transfer of ERUs.	Head of Boiler Room No.2
Average net calorific value of natural gas	1. Calorific values of natural gas are identified by certified laboratories of the fuel suppliers, fuel certificates are provided for each batch of natural gas delivered to the Mill. 2. Calorific value data are recorded in logs and are transferred to the Department of Energy, and entered into electronic database. 3. Information on calorific values shall be kept in the Mill's archive in electronic and hard copy for at least two years after the end of the crediting period or the last transfer of ERUs.	Leading Engineer of Energy Department
Mass consumption of BWW in multi-fuel boiler	1. Determined based on readings of ampermeter installed on the solid fuels feeding conveyor belt after deduction of WWS consumption.	Head of Boiler Room No.2

	2. The estimated weight is checked against the total BWW generation and utilization balance at the enterprise. 3. Readings of the measuring devices are recorded in the process information system "Energia" and are shown on the displays of all computers which have the required software. The data are printed out on paper and are stored in the computer memory. 4. BWW consumption data shall be kept in the Mill's archive in electronic and hard copy for at least two years after the end of the crediting period or the last transfer of ERUs under the project.	
Mass consumption of WWS in multi-fuel boiler	1. Sludge consumption is determined by electromagnetic flow meters with allowance for its concentration at the inlet to the dewatering unit and its moisture content at the outlet from this unit. 2. The laboratory analysis of sludge concentration at the inlet to the dewatering unit and of sludge moisture content at the outlet from it is carried out every shift in accordance with the developed instructions. 3. Readings of the measuring devices are recorded in the process information system "Energia" and are shown on the displays of all computers which have the required software. The data are printed out on paper and are stored in the computer memory. 4. Data on WWS consumption shall be stored in the Mill's archive in electronic and hard copy for at least two years after the end of the crediting period or after the last transfer of ERUs.	Head of Biological Treatment Facility
Heat production by multi-fuel boiler	1. For monitoring of heat production sensors and transmitters are used, which continuously measure flow rate, temperature and pressure of steam. 2. Readings of the measuring devices are recorded in the process information system "Energia" where heat output is automatically calculated and are shown on the displays of all computers which have the required software. The data are printed out on paper and are stored in the computer memory. 4. Data on heat production and supply shall be stored in the Mill's archive in electronic and hard copy for at least two years after the end of the crediting period or after the last transfer of ERUs.	Head of Boiler Room No.2

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

The monitoring plan was developed by CCGS LLC (CCGS LLC is not a project participant and is not listed in Annex 1 to this PDD).

The contact person: Alexander Samorodov, Andrey Belikhin

E-mail: a.samorodov@ccgs.ru, a.belikhin@ccgs.ru.

SECTION E. Estimation of greenhouse gas emission reductions

The emission reductions were estimated by the formulae in accordance with the methodology described in detail in Section B.1. In the same section all necessary input data are given in a tabular form. Detail calculations are given in Annex 2. Below are the results of the emissions estimation for both scenarios with breakdown by sources for the period 2008-2012.

E.1. Estimated project emissions:

Table E.1-1. Project GHG emissions, tCO_2e

Parameter	2008	2009	2010	2011	2012	2008-2012
GHG emissions, total	**60 617**	**63 798**	**61 099**	**60 617**	**60 617**	**306 747**
CO_2 from combustion, total	60 617	63 798	61 099	60 617	60 617	306 747
CO_2 from natural gas combustion	60 617	63 798	61 099	60 617	60 617	306 747

E.2. Estimated leakage:

Leakages are considered to be zero.

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

Since there is no leakage E.1+E.2=E.1.

E.4. Estimated baseline emissions:

Table E.4-1. Baseline GHG emissions, tCO_2e

Parameter	2008	2009	2010	2011	2012	2008-2012
GHG emissions, total	**331 388**	**361 438**	**383 320**	**420 933**	**440 666**	**1 937 744**
CO_2 from combustion, total	176 133	183 030	181 920	197 975	197 975	937 034
CO_2 from natural gas combustion	176 133	183 030	181 920	197 975	197 975	937 034
CH_4 from decomposition of BWW, WWS	155 255	178 407	201 399	222 958	242 691	1 000 710
CH_4 from decomposition of BWW	104 400	119 679	134 389	149 063	163 076	670 606
CH_4 from decomposition of WWS	50 855	58 728	67 011	73 894	79 616	330 104

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

Table E.5-1. GHG emission reductions, tCO_2e

Parameter	2008	2009	2010	2011	2012	2008-2012
GHG emission reductions, total	**270 771**	**297 639**	**322 221**	**360 316**	**380 049**	**1 630 997**
CO_2 from combustion, total	115 517	119 232	120 822	137 358	137 358	630 287
CO_2 from natural gas combustion	115 517	119 232	120 822	137 358	137 358	630 287
CH_4 from decomposition of BWW, WWS	155 255	178 407	201 399	222 958	242 691	1 000 710
CH_4 from decomposition of BWW	104 400	119 679	134 389	149 063	163 076	670 606
CH_4 from decomposition of WWS	50 855	58 728	67 011	73 894	79 616	330 104

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	60 617	0	331 388	270 771
2009	63 798	0	361 438	297 639
2010	61 099	0	383 320	322 221
2011	60 617	0	420 933	360 316
2012	60 617	0	440 666	380 049
Total (tonnes of CO_2 equivalent)	306 747	0	1 937 744	1 630 997

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:

The Order of the State Committee of the Russian Federation for Environmental Protection as of 16.05.2000 №372 "On the approval of the regulations on the environmental impact assessment of the planned economic and other activity in the Russian Federation" requires that a number of permissions are granted to the project before starting of the construction works and operation of the object.

Requirements and conditions to the project implementation are usually standard if the authorities do not have any particular objections to the project. Once construction works begin the project operator carry out an environmental impact assessment that needs to be submitted to the authorities for approval. This assessment relates to environmental and epidemiological impacts, fire safety, social norms, as well as an assessment of positive effects on the environment and society and mitigation of any possible negative effects.

Before the project implementation according to the legislation of the Russian Federation the CJSC "International Paper" received positive conclusion of the project impacts to the environment from the State Environmental Committee for Saint-Petersburg and Leningradskaya oblast on (Conclusion №861 from 26 September 2000). Below main project impacts on the environment are described:

Emissions into the atmosphere

Most of pollutant emissions from the Mill are sulphur dioxide, nitrogen dioxides.

Increase in BWW utilisation level, reduction in natural gas and heavy fuel oil combustion allowed to reduce the gross quantity of pollutant emissions. Table F.1-1 shows the pattern of pollutant emissions into the atmosphere from combustion of fuel (for heat and power production) at Svetogorsk PPM before and after the installation of multi-fuel boiler. As it is seen, the total emissions of pollutants emitted into the atmosphere from fuel combustion after implementation of the project reduced. But there are additional emissions of hydrogen sulphides and suspended particles.

Table F.1-1. Pattern of pollutant emissions to the atmosphere from fuel combustion (for heat and power production) at Svetogorsk PPM, t/year

Substance	Amount of emissions before installation of MFB	Amount of emissions after installation of MFB
	t/year	t/year
Vanadium pentoxide	1.6888	0.3100
Nitrogen dioxide	863.8944	456.8560
Nitrogen oxide	140.3829	74.2430
Soot	12.5707	0.0430
Sulphur dioxide	1203.9279	288.6979
Hydrogen sulphide	7.4313	15.0387
Suspended particles	-	41.6400
Total	2229.8960	876.8286

Concerning transboundary effect of the project the following can be said. The border with Finland lies 1.8 km from CHPP-4 of Svetogorsk PPM. The distance from Svetogorsk to the nearest Finnish town of Imatra is 7 km. The sanitary protection zone boundary is 850 m from the plant, and the calculations of maximum ground level concentrations of pollutants show that the pollutant emission sources will not have any significant impact on the ground level pollution in residential zone. Basing on this it can be concluded that the project does not have any transboundary effect.

Water

The project provides for water resource protection such as closed water cycles for reagent preparation and cleaning of dewatering equipment and installation. In order to control efficient water usage special water meters were installed. It is provided that polluted industrial waste waters are purified at the already existing sewage water biological treatment facility which capacity is enough to process it thus excluding possible pollution of clean surface waters.

Wastes

As a result of the multi-fuel biomass boiler installation the following wastes:

Wood wastes:
- Bark wood – 245 000 tonnes/year
- Sawdust – 55 000 tonnes/year
- Waste from cellulose sorting – 5 250 tonnes/year
Waste from the affluent treatment plant:
-sediment of preliminary sediment tank – 10 950 tonnes/year
- surplus activated sludge – 5 475 tonnes/year

As a result of the new boiler installation and operation the following waste will be generated:

Processing wastes:
- waste oils (2 hazard class) – 2 tonnes/year
- oiled rags (4 hazard class) – 0.9 tonnes/year
- quartz sand (4 hazard class) – 2 080 tonnes/year
- ash from waste incineration (4 hazard class) – 11 523 tonnes/year
- iron and steel scrap (4 hazard class) – 3 tonnes/year
- waste mineral cotton (4 hazard class) – 1 tonnes/year

Consumption wastes:
- food waste (4 hazard class) – 28.3 tonnes/year
- domestic waste (4 hazard class) – 81.0 tonnes/year

Building wastes:
- roof – ruberoid, insulation material (3 hazard class) – 100 m^3/year
- iron and steel scrap (4 hazard class) – 545 tonnes/year
- concrete installments (4 hazard class) – 180 tonnes (1350 m^3)

The project envisages all required storage facilities for waste being generated. Currently, the plant is considering variants of using ash waste in agriculture and construction.

As a result of the project implementation air pollution and the amount of waste generated at the plant is decreased significantly. Technical characteristics of the project comply with the environmental regulation of the Russian Federation. The environmental impacts of the project realization are permissible.

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:

There were no any significant environmental impact as the result of the project implementation, no such impact is being are expected under the project. The positive decision of the State Expert Commission on Environmental Expertise №861 of 26.09.2000 has been obtained.

SECTION G. Stakeholders' comments

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

The comments on the project were received mainly from the local and federal agencies in the form of positive opinions of state expert reviews of the project activity and in the form of permits for the project implementation. These documents demonstrate that the project complies with the requirements of the technical regulations, and with the industrial safety, environmental and sanitary requirements.

Public hearings were not held as this was not required within the framework of this project.

The project measures were covered in the corporate newspaper "Svetogorsky Rabochy". Only positive reviews and comments were received from the Mill's employees.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	CJSC "International Paper" (ZAO International Paper)
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URL:	-
Represented by:	Sergey Karchevsky
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Mobile:	-
Personal e-mail:	Sergey.Karchevsky@svetogorsk.com

Annex 2

BASELINE INFORMATION

Annex 2-1. Main sheet of calculation of GHG emissions reductions

Key constants	
Actual data	

Emission factor		
Natural gas	56,1	kgCO2/GJ

Boiler efficiency, %	
Gas boilers	87%

Input data:

Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Heat production by MFB	Gcal	145 588	502 321	523 001	553 857	566 431	542 807	545 426	652 372	677 917	673 806
Consumption of BWW in MFB	t	24 099	154 347	197 044	206 555	231 824	192 884	195 854	254 702	245 499	246 974
Consumption of WWS in MFB	t	7 527	62 816	59 878	64 120	65 896	70 349	60 923	95 478	100 232	110 821
Consumption of natural gas in MFB	thousand m3	10 380	21 922	17 257	30 296	27 062	25 741	33 964	32 236	33 874	32 472
	t s f	11 918	25 118	19 731	34 602	30 919	29 454	38 786	36 865	38 800	37 158

Source: Energy Department of CJSC "International Paper"

Project:

Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Heat production by MFB	GJ	609 577	2 103 218	2 189 805	2 318 999	2 371 647	2 272 733	2 283 699	2 731 482	2 838 438	2 821 226	3 070 200	3 070 200
Consumption of BWW in MFB	t	24 099	154 347	197 044	206 555	231 824	192 884	195 854	254 702	245 499	246 974	254 702	254 702
Consumption of WWS in MFB	t	7 527	62 816	59 878	64 120	65 896	70 349	60 923	95 478	100 232	110 821	110 821	110 821
Consumption of natural gas in MFB	GJ	349 317	736 209	578 316	1 014 185	906 236	863 297	1 136 818	1 080 513	1 137 228	1 089 101	1 080 513	1 080 513

Project GHG emissions													
Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GHG emissions, total	**tCO2e**	**19 597**	**41 301**	**32 444**	**56 896**	**50 840**	**48 431**	**63 775**	**60 617**	**63 798**	**61 099**	**60 617**	**60 617**
CO2 from combustion of natural gas	tCO2e	19 597	41 301	32 444	56 896	50 840	48 431	63 775	60 617	63 798	61 099	60 617	60 617

Baseline:

Baseline heat production and fuel consumption													
Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Heat production due to additional combustion of natural gas in power boilers	GJ	609 577	2 103 218	2 189 805	2 318 999	2 371 647	2 272 733	2 283 699	2 731 482	2 838 438	2 821 226	3 070 200	3 070 200
Additional consumption of natural gas in power boilers	GJ	700 663	2 417 492	2 517 017	2 665 516	2 726 031	2 612 337	2 624 941	3 139 634	3 262 573	3 242 788	3 528 966	3 528 966
BWW disposal at dump	t	24 099	154 347	197 044	206 555	231 824	192 884	195 854	254 702	245 499	246 974	254 702	254 702
WWS disposal at dump	t	7 527	62 816	59 878	64 120	65 896	70 349	60 923	95 478	100 232	110 821	110 821	110 821

Baseline GHG emissions													
Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GHG emissions, total	**tCO2e**	**42 506**	**161 410**	**190 308**	**221 391**	**247 960**	**260 485**	**277 193**	**331 388**	**361 438**	**383 320**	**420 933**	**440 666**
CO2 from combustion of natural gas	tCO2e	39 307	135 621	141 205	149 535	152 930	146 552	147 259	176 133	183 030	181 920	197 975	197 975
CH4 from decomposition of BWW, total	tCO2e	1 963	14 444	29 840	45 315	62 149	75 051	87 613	104 400	119 679	134 389	149 063	163 076
CH4 from decomposition of WWS, total	tCO2e	1 236	11 345	19 263	26 541	32 881	38 882	42 321	50 855	58 728	67 011	73 894	79 616

Reductions:

GHG emission reductions													
Parameter	Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GHG emission reductions, total	tCO2e	**22 909**	**120 109**	**157 864**	**164 495**	**197 120**	**212 054**	**213 417**	**270 771**	**297 639**	**322 221**	**360 316**	**380 049**
CO2 from combustion of natural gas	tCO2e	19 711	94 320	108 761	92 640	102 090	98 121	83 484	115 517	119 232	120 822	137 358	137 358
CH4 from decomposition of BWW, total	tCO2e	1 963	14 444	29 840	45 315	62 149	75 051	87 613	104 400	119 679	134 389	149 063	163 076
CH4 from decomposition of WWS, total	tCO2e	1 236	11 345	19 263	26 541	32 881	38 882	42 321	50 855	58 728	67 011	73 894	79 616
								average yearly	**326 199**				
								sum	**1 630 997**				

Annex 2-2. Calculation of prevented methane emissions from anaerobic decomposition of BWW at dump

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

General input data		
Conversion factor organic carbon to biogas (a)	1,87	m^3 biogas/kg carbon
GWP CH_4	21	
Density methane	0,716	kg/m^3
Methane concentration biogas	50%	
Half-life biomass (tau)	15	year
Decomposition constant (k)	0,0462	$year^{-1}$
Generation factor (zeta)	0,77	
Methane oxidation factor	0,10	
Percentage of the stockpile under aerobic	10%	

BWW - bark wood waste

db = dry basis

wb = wet basis

This spreadsheet model is based on the report: "Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles",

Worldbank PCFplus res

Spreadsheet model developed by:

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Biomass specific input data	Biomass from stockpile	Fresh	
Organic carbon content (db)	50,0%	53,6%	db
Moisture content	50%	50%	wb
Organic carbon content (wb)	25,0%	26,8%	wb
Lignin fraction of C	0,25	0,25	

Year	Fresh biomass prevented from stockpiling or taken from: Biomass from stockpile (ton$_w$)	Age of biomass (years)	Fresh (ton$_w$)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
				ton CO2-eq											
2001			24 099	1 963	1 874	1 789	1 709	1 631	1 558	1 487	1 420	1 356	1 295	1 236	1 181
2002			154 347		12 570	12 003	11 461	10 943	10 449	9 977	9 527	9 096	8 686	8 293	7 919
2003			197 044			16 048	15 323	14 631	13 970	13 339	12 737	12 162	11 613	11 088	10 588
2004			206 555				16 822	16 063	15 337	14 645	13 983	13 352	12 749	12 173	11 623
2005			231 824					18 880	18 028	17 214	16 436	15 694	14 985	14 309	13 662
2006			192 884						15 709	15 000	14 322	13 675	13 058	12 468	11 905
2007			195 854							15 951	15 230	14 543	13 886	13 259	12 660
2008			254 702								20 744	19 807	18 912	18 058	17 243
2009			245 499									19 994	19 091	18 229	17 406
2010			246 974										20 114	19 206	18 339
2011			254 702											20 744	19 807
2012			254 702												20 744
Total	**0**		**2 459 186**												
Total emission prevention				**1 963**	**14 444**	**29 840**	**45 315**	**62 149**	**75 051**	**87 613**	**104 400**	**119 679**	**134 389**	**149 063**	**163 076**
													670 606		

Annex 2-3. Calculation of prevented methane emissions from anaerobic decomposition of WWS at dump

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

General input data		
Conversion factor organic carbon to biogas (a)	1,87	m^3 biogas/kg carbon
GWP CH_4	21	
Density methane	0,716	kg/m^3
Methane concentration biogas	50%	
Half-life biomass (tau)	3,75	year
Decomposition constant (k)	0,1850	$year^{-1}$
Generation factor (zeta)	0,77	
Methane oxidation factor	0,10	
Percentage of the stockpile under aerobic	10%	

WWS - waste water sludge

db = dry basis

wb = wet basis

This spreadsheet model is based on the report: "Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles",

Worldbank PCFplus res

Biomass specific input data	Biomass from stockpile	Fresh	
Organic carbon content (db)	50,0%	45,0%	db
Moisture content	70%	70%	wb
Organic carbon content (wb)	15,0%	13,5%	wb
Lignin fraction of C	0,25	0,25	

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Year	Fresh biomass prevented from stockpiling or taken from			Year											
	Biomass from stockpile	Age of biomass	Fresh	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	(ton$_w$)	(years)	(ton$_w$)	ton CO2-eq											
2001			7 527	1 236	1 027	854	710	590	490	407	339	281	234	194	162
2002			62 816		10 317	8 575	7 126	5 923	4 922	4 091	3 400	2 826	2 349	1 952	1 622
2003			59 878			9 835	8 174	6 793	5 646	4 692	3 900	3 241	2 694	2 239	1 861
2004			64 120				10 531	8 753	7 274	6 046	5 025	4 176	3 471	2 884	2 397
2005			65 896					10 823	8 995	7 476	6 213	5 164	4 292	3 567	2 964
2006			70 349						11 554	9 603	7 981	6 633	5 513	4 582	3 808
2007			60 923							10 006	8 316	6 912	5 744	4 774	3 968
2008			95 478								15 682	13 033	10 832	9 002	7 482
2009			100 232									16 462	13 682	11 371	9 451
2010			110 821										18 202	15 127	12 572
2011			110 821											18 202	15 127
2012			110 821												18 202
Total	**0**		**919 682**												
Total emission prevention				**1 236**	**11 345**	**19 263**	**26 541**	**32 881**	**38 882**	**42 321**	**50 855**	**58 728**	**67 011**	**73 894**	**79 616**
													330 104		

Annex 2-4. Calculation of cash flows of the investment project for the two implementation options

Input data

Parameter	Unit	Value
Dollar exchange rate	RUR/$	28,50
Discount rate	%	15
Profit tax rate	%	40
Service life	years	20
Price of natural gas	$/thousand m3	50
Price of electricity	$/MWh	10
Payment for waste disposal at dumps	RUR/t	240
Price of early reductions	$/tCO2e	3,0
Price of ERU	$/tCO2e	15,0

Consumption of fuel and electricity

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BWW consumption by MFB	t			300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000	300 000
WWS consumption by MFB	t			21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675	21 675
Reduction in natural gas consumption	thousand m3			68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842	68 842
Additional electricity consumption	MWh			3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894	3 894

Benefits of the project implementation

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Reduction in natural gas expenses	thousand $			3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442	3 442
Reduction in waste disposal payments	thousand $			2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709	2 709
Increase in electricity expenses	thousand $			39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Total reduction in expenses	thousand $			6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112	6 112

Capital investments

Parameter	Unit	2000	2001
Capital expenditure	thousand $	-14 000	-14 000

Depreciation

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Depreciation charges	thousand $			-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400	-1 400
Fixed assets value	thousand $	14 000	28 000	26 600	25 200	23 800	22 400	21 000	19 600	18 200	16 800	15 400	14 000	12 600	11 200	9 800	8 400	7 000	5 600	4 200	2 800	1 400	0

Taxes

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Profit tax	thousand $		0,00	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79	-1 884,79

Economic parameters without sale of GHG emission reductions

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Net cash flow	thousand $	-14 000	-14 000	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227
Accumulated cash flow	thousand $	-14 000	-28 000	-23 773	-19 546	-15 318	-11 091	-6 864	-2 637	1 590	5 818	10 045	14 272	18 499	22 726	26 953	31 181	35 408	39 635	43 862	48 089	52 317	56 544

NPV	thousand $	-3 166
IRR	%	12,94%

Economic parameters with sale of GHG emission reductions

Parameter	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Amount of ERUs	tCO2e			144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053	144 053
Revenue from sale of ERUs	thousand $			432	432	432	432	432	432	2 161	2 161	2 161	2 161	2 161									
Net cash flow	thousand $	-14 000	-14 000	4 659	4 659	4 659	4 659	4 659	4 659	6 388	6 388	6 388	6 388	6 388	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227	4 227
Accumulated cash flow	thousand $	-14 000	-28 000	-23 341	-18 681	-14 022	-9 363	-4 703	-44	6 344	12 732	19 120	25 508	31 896	36 123	40 350	44 578	48 805	53 032	57 259	61 486	65 714	69 941

NPV	**thousand $**	979
IRR	%	15,61%

Annex 2-5. Independent technical opinion on common practices in Russia

ЗАКРЫТОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО
"ХАРРИС ГРУПП ИНТЕРНЕЙШЕНЛ ПРОЕКТИРОВАНИЕ И СТРОИТЕЛЬСТВО"
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№ 405/08 from 25.07.2008.

to ____________ from 10.06.2008

To: Mr. Sergey Pondar
General Director
OAO "Svetogorsk"

Dear Mr. Pondar,

Referring to your request from 10.06.2008 for the information regarding common practice for wood waste bark boilers in Russia, below is to confirm the following:

Prior to 2000 there were approximately 30 number of pulp and paper mills in Russia with approximately 20 woodwaste boilers in operation.

At this time, there was one operational fluidized bed boiler located at the Vyborg Pulp Mill. This boiler was of Finnish design and was approximately twenty years old.

The Archangelsk Pulp and Paper Mill converted one existing boiler to fluidized bed during 2000 and converted a second boiler during 2005 to fluidized bed and added an electrostatic precipitator. Both boiler burn some oil.

Mondi Board and Paper Syktyvkar installed two fluidized bed combustion boilers during 2003.

Segezha Pulp and Paper mill installed a fluidized boiler during 2004.

Kondopoga Pulp and Paper mill installed a fluidized boiler during 2006.

Fluidized bed boiler for burning of bark, wood wastes, and sludge from effluent treatment is the best available technology of present time used in Russian Pulp and Paper Mills. At the same time, many of the Pulp and Paper Mills in Russia are still burning bark in the conventional greed type boilers.

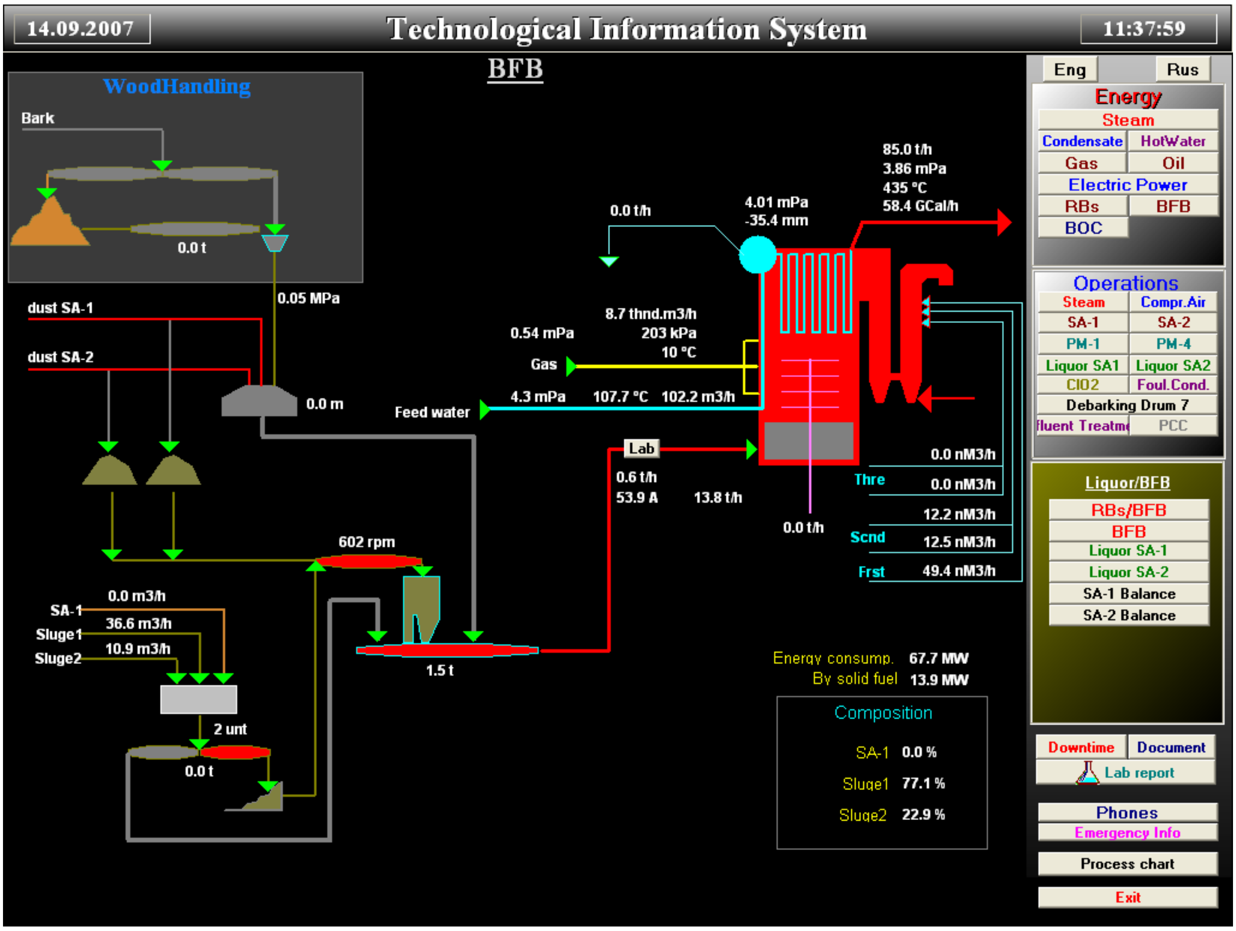
Best regards,
Technical director ZAO HGI PCS Boris Kriman

<u>Annex 3</u>

MONITORING PLAN

See Section D.

Below is a screenshot of the control scheme multi-fuel boiler, taken from the process information system "Energia".



Annex 4

REFERENCES

[R1] Guidance on criteria for baseline setting and monitoring, Version 02, JISC (http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf)

[R2] Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles, PCFplus Research, World Bank, August 2002

[R3] Operational Guidelines for Project Design Documents of Joint Implementation Projects. Volume 1. General Guidelines. Version 2.3. Ministry of Economic Affairs of the Netherlands. May 2004 (http://ji.unfccc.int/CritBasMon/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html)

[R4] Approved consolidated baseline and monitoring methodology ACM0009 «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas» Version 03.2. CDM Executive Board (http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ)

[R5] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy. (http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.htm)

[R6] Methodological tool to determine the baseline efficiency of thermal or electric energy generation systems. Version 01. CDM Executive Board (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf)

[R7] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5, Waste. (http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.htm)

[R8] Installation of Multi-Fuel Boiler. Detailed Design. CJSC "Giprobum", Saint-Petersburg, 2000.

[R9] Technical specification of the bubbling fluidized bed boiler, Kvaerner Pulping, 2000

[R10] Methodological tool to determine project emissions from flaring gases containing methane. CDM Executive Board (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf)

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