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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Biomass utilization at JSC Segezha Pulp and Paper Mill (SPPM)

Sectoral scope: (1) Energy industries (renewable-/ non renewable sources)

PDD version: 5.0

Date: 24/02/2011

A.2. Description of the project:

Purpose of the project

The project is aimed at increasing combustion efficiency of bark and wood wastes (BWW) used as fuel for steam production to cover in-house needs of the Mill and reduction of fossil fuel (fuel oil) consumption at the enterprise as a whole.

Concept of the project

The project is implemented on the territory of OJSC "Segezha Pulp and Paper Mill", Karelia, Russian Federation. The project envisages the following measures:

- Reconstruction of the steam boiler No.7 of BKZ-75-39 GMA type running on fuel oil into a fluidized bed boiler of EEE-BKZ-100-3.9-440MDF type, which would enable combustion of BWW;
- Construction of a fuel feed facility and a BWW storage facility.

Bark and wood waste are generated indigenously at the Mill (in the process of paper manufacturing) and purchased from outside. Prior to the project implementation, BWW were fired in old utilization boilers No.1 to 5 with extremely low efficiency with large proportion of fuel oil used for stabilization of BWW burning.

Situation existing before the project implementation

The first attempt to reconstruct boiler No.7 was started as far back as 2002. However it was unsuccessful. During start-up and adjustment works the attempts to make the boiler achieve stable operation failed. The enterprise was compelled to continue utilization of BWW in the old and inefficient boilers.

Baseline scenario

The most realistic baseline scenario is continuation of the existing practice at the enterprise, so the BWW would be combusted in old boilers 1-5 existing at the enterprise and heat would be generated by these boilers and 2 others operating using fuel oil. The scenario does not require significant investments and is not associated with any risks.

Project scenario

The new attempt to reconstruct boiler No.7 costs at least equal to the first one and also was associated with certain risks. Although the experience of operating a fluidized bed boiler was negative, the SPPM management, none the less, chose to complete reconstruction of boiler No.7. This decision was made in view of the possibility to cover some costs and offset project risks by selling GHG emission reduction units (ERUs) within the framework of the Kyoto Protocol mechanism.

Expected results of the project:

- Increased efficiency of secondary fuel (bark and wood wastes) utilization;

- Optimization of energy supply scheme of the production facility, ensuring its reliability and cost-efficiency;
- Reduction of fuel oil portion in the fuel balance of the enterprise. Reduction of fuel oil consumption by 18 324 tonnes per year;
- Mitigation of negative environmental impact, including reduction of GHG emissions by the Mill by 56 874 tonnes of CO_2e/year.

Project costs

The cost of the completion stage of reconstruction is €6.24 million the project amount to €12.96 million.

History of the project, incl. JI component

First reconstruction of the Boiler No.7 was started in June 2002 and completed in December 2003.

At the same time the discussion took place in order to realize the project in the framework of the Kyoto protocol. Negotiations for participation in ERUPT tender took place and PIN was developed (21.11.2003).

Until 2005 the boiler was not started-up.

On 7th of August 2006 the meeting took part where decision was taken to make the Project as JI.

On 7th of September 2006 at the Board of Directors the decision was taken to finalize reconstruction of the boiler No.7.

In 19.09.2006 a tender took place where company «FOSTER WHEELER ENERGIA OY» won a contract for the Boiler No.7 reconstruction.

The completion stage of reconstruction starts October 2006.

Reconstruction is completed November 2007.

In order to secure status of the project as realized under the mechanism of the Article 6 of the Kyoto protocol OJSC “Segezha Pulp and Paper Mill” had concluded a contract with Camco International Ltd. on 12.12.2007 for PDD development and determination.

25 March 2010 the PDD was re-submitted for determination according to the Track 1 procedure to Bureau Veritas Certification.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A: Russian Federation (host Party)	• Legal entity A1: Open Joint Stock Company ”Segezha Pulp and Paper Mill”	No
Party B: United Kingdom of Great Britain and Northern Ireland	• Legal entity B1: Private company “Camco Carbon Russia Limited”	No

Open Joint Stock Company Segezha Pulp and Paper Mill

OJSC "Segezha PPM" is the largest manufacturer of paper bags in Russia. The paper of M-70, M-80, etc. grades, used for manufacturing of paper bags, is produced at the Mill.

Fig. A.3-1. Segezha PPM

The enterprise is located in the town of Segezha in the vicinity of Saint-Petersburg – Murmansk motor and rail roads and Belomor-Baltyisky cannel system. The enterprise has a developed network of motor roads, access railways, loading berths, handling equipment for timber cargo and fuel oil, as well as equipment for finished goods shipment during navigation period at Belomor-Baltyisky cannel. The Mill is located in the region with rich raw material resources.

"Segezha PPM" was commissioned in 1939. In 1992 the Mill was reorganized into OJSC "Segezhabumprom". In 1999 it was reorganized into OJSC "Segezha Pulp and Paper Mill".

The main lines of the mill's activity:

- Production of chemical wood pulp used a semi-product for kraft paper by sulfate process;
- Production of kraft paper for manufacturing of paper bags, packaging and other kinds of paper;
- Output of by-products – wood-chemical products: raw turpentine, raw tall oil, tall colophony, distillated tall oil;
- Production and supply of heat to outside consumers.

Today the Mill is capable of producing up to 414 000 tonnes of sulfate pulp, 330 000 tonnes of kraft paper and kraft liner.

The Mill employs around 3 400 people.[1]

Camco Carbon Russia Limited is a 100% subsidiary of Camco International Ltd. Camco International Limited is a Jersey based public company listed on AIM in London. Camco International is the world leading carbon asset developer under both Joint Implementation and the Clean Development Mechanism of the Kyoto Protocol. Camco's project portfolio consists of more than 100 projects, generating altogether over 149 MT CO_2e of GHG reductions. Camco operates in Eastern Europe, Africa, China, and Southeast Asia. The company has been actively operating in Russia since 2005.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located in the town of Segezha, Republic of Karelia, the Russian Federation.

A.4.1.1. Host Party(ies):

The Russian Federation.

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

The Republic of Karelia.

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

The town of Segezha.

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

The Republic of Karelia is located in the North-West of Russia and is a constituent of the North-West Federal District of the Russian Federation.

Fig. A.4-1. Karelia on the map of Russia

Karelia covers the area of 180 500 km^2 (1.06% of the territory of the Russian Federation). In the west Karelia borders on Finland, in the south it borders on Leningrad and Vologda regions, in the north on

[1] http://www.scbk.ru/portal/content/view/8/28/

Murmansk region and in the east on Arkhangelsk Region. In the north-east the Republic is washed by the White Sea. The population of the Republic of Karelia is 703 100, 37% of the population live in the capital of the Republic – Petrozavodsk.

Over 49% of the area of the Republic is covered with forest (main wood species are pine and spruce), 25% of the territory is covered by water bodies. Karelia has over 60 000 lakes and 27 000 rivers.

Segezha District is located in the east of the Republic.

The town of Segezha (See Fig.A.4-2) is the administrative centre of Segezha District, the Republic of Karelia. It was founded in 1943. The town is located on the Segezha River and on the western bank of Lake Vygozero. Segezha is 700 km from Saint-Petersburg. The population is 33 600 people. Segezha Pulp and Paper Mill is a large enterprise and the main employer in the town of Segezha.

Geographical latitude: 63°44' Geographical longitude: 34°19'. Time zone GMT: +3:00.

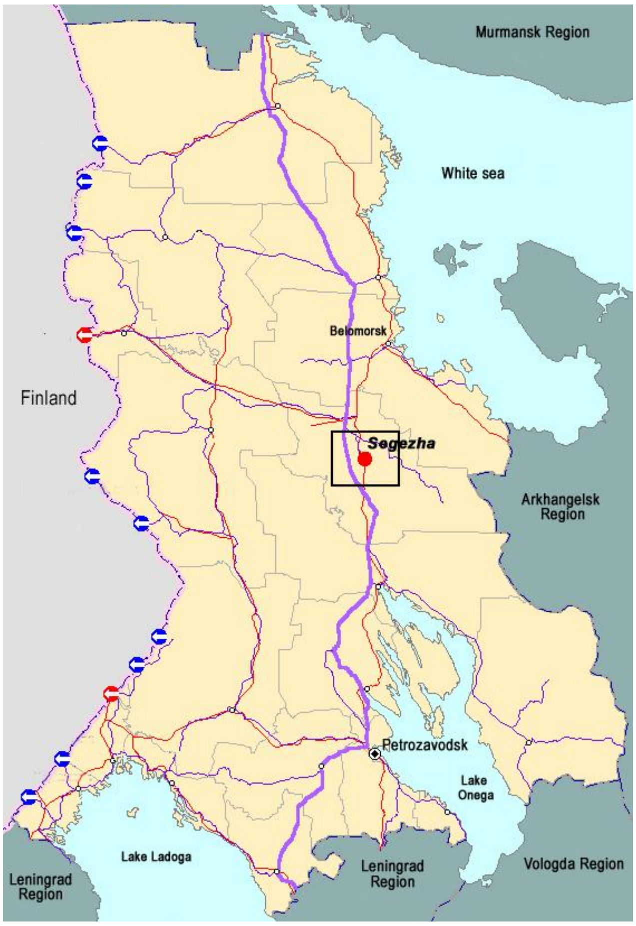

Fig A.4-2. The map of Karelia

Source: Google Earth

Fig A.4-3. Location of "Segezha PPM"

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

Characteristics of energy facilities of SPPM

Energy facilities of SPPM are designed primarily for steam and hot water supply of the main production facilities. Auxiliary function is heat supply of Segezha town via cogeneration system of CHPP-1, for this purpose there are water heating networks for heat and hot water supply of the town.

Since the overall generation of electric power by the Mill is less than electric power consumed by the production facilities, supply of electric power to external consumers is not envisaged.

Energy facilities consist of the following main structural divisions: CHPP-1, CHPP-2, and steam-generating and hot water boiler houses. Steam and hot water boiler houses are conventionally referred to CHPP-1.

The project covers only CHPP-1, and therefore CHPP-2 is excluded from further consideration.

CHPP-1

CHPP-1 operates seven steam boilers with design steam output of 75t/h (see Table A.4-1). Boilers No.1, 2 and 3 of S-75-39 type and boilers No.4 and 5 of CKTI 75-39 FB type run on wood wastes and fuel oil. Boilers No.6 and 7 of BKZ-75-39 GMA type ran on fuel oil only. Boiler No.6 is past its standard operation time and has been decommissioned. Boiler No.7 was reconstructed into EEE-BKZ-100-3.9-440MDF boiler designed for combustion of BWW in fluidized bed.

Table A.4-1. Steam boilers of CHPP-1

No.	Equipment	Commissioning year/ reconstruction year	Steam output, t/h	Steam parameters kgf /cm^2, °C	Fuel
1	S-75-39	1939/1974	75	40/440	BWW, fuel oil
2	S-75-39	1939/1972	75	40/440	BWW, fuel oil
3	S-75-39	1940/1981	75	40/440	BWW, fuel oil
4	CKTI 75-39 FB	1948/1977	75	40/440	BWW, fuel oil
5	CKTI 75-39 FB	1953/1989	75	40/440	BWW, fuel oil
6	BKZ-75-39 GMA	1962/1964	75	40/440	Fuel oil
7	BKZ-75-39 GMA/ EEE-BKZ-100-3.9-440MDF	1966/1968 2003	75 100	40/440	Fuel oil/ BWW, fuel oil

Turbine department of CHPP-1 has four steam turbines (See Table A.4-2).

Table A.4-2. Steam turbines of CHPP-1

Equipment	Year of commissioning	Electric capacity, MWe	Live steam consumption, t/h(max)	Live steam parameters kgf/cm^2. °C	Design backpressure, kgf/cm^2	Steam extraction parameters, t/h; kgf/cm^2
R-12-35-5M	1978	12	120	35/435	5	–
PT-12-35/10M	1980	12	110	35/435	0.035	50/10; 40/1.2
PR-6-35/15/5	1990	6	85	35/435	5	35/15
PR-6-35/15/5	1965	6	85	35/435	5	35/15

Steam-generating boiler house

The steam-generating boiler house has three steam boilers No.8, 9 and 10 of BKZ-75-39 GMA type running on fuel oil (See Table A.4-3). The boiler house was generally operated during heating season only.

Table A.4-3. Steam boilers of the steam-generating boiler house

No.	Equipment	Year of commissioning	Steam output, t/h	Steam parameters, kgf/cm^2, °C	Fuel
8	BKZ-75-39 GMA	1973	75	40/440	Fuel oil
9	BKZ-75-39 GMA	1973	75	40/440	Fuel oil
10	BKZ-75-39 GMA	1974	75	40/440	Fuel oil

Hot water boiler house

The hot water boiler house has two hot water boilers No.3 and 4: one boiler is of PTVM-30M type and one boiler of KVGM-50M type (See Table A.4-4).

Table A.4-4. Boilers of the hot water boiler

No.	Equipment	Year of commissioning	Thermal capacity, Gcal	Water consumption, m^3/h	Fuel
3	PTVM-30M-4	1976	35	430	Fuel oil
4	KVGM-50	1995	50	618	Fuel oil

Background of the project implementation

In 1972-1989 CHPP-1 steam boilers, namely No.1 to 5, were reconstructed to enable co-combustion of wood wastes and fuel oil. The design solutions for reconstruction were identical for all boilers.

Combustion takes place in the furnace extension, installed at the front of the boiler along the full width. BWW are fed to the furnace chamber through a vertical shaft fitted with delivery plates and damper weights for feeding fuel onto the cellular inclined furnace-bar which doesn't allow fuel to fall through. Below at three levels along the BWW flow, regulated supply of air is envisaged, which is necessary for burning.

Operation of these boilers is characterized by instability of steam demand, which depends on utilization of the main production facilities of the PPM.

Since BWW is actually an utilizable component in the total balance of fuel combusted in the boilers, their consumption and feeding interval are variable parameters, which depend on the conveyor charging with bark and on qualification of operators responsible for replenishment of bunkers with bark and on qualification of boiler operators who open counterbalanced dampers of bark bunkers.

Thus the formation of a BWW layer on the furnace-bar fully depends on the operator's skills of handling boiler parameters manually, ensuring optimum layer height on the furnace-bar and maintaining mechanical load and steam parameters of the boiler.

All this significantly complicates the process of BWW drying and combustion on the furnace-bar.

In fact fuel oil has turned from an auxiliary fuel, designed for flame stabilization and maintenance of required temperature in the furnace (on the furnace-bar and in the furnace chamber), into a primary fuel. At any moment of time its proportion never goes down below 80 % by heat release.

Performance data show that the proportion of heat from bark combustion varies in the range of 5-15%. If more bark is fed the normal burning process is disturbed. Steam output of the boiler goes down and more fuel oil is fed to maintain the load. Since heat release from bark combustion is small, boilers No.1 to 5, in fact, run on fuel oil with low gross efficiency.

Because of such extremely inefficient operation mode it was decided to have a different technology of BWW combustion.

Description of main design solutions

Technological processes introduced under the project meet the world's state-of-the-art level of technologies in this sphere. Technical feasibility of the project measures is proven by the practice of several enterprises of the Russian pulp and paper industry. All technological parameters meet environmental performance standards.
The proposed project envisages a set of measures to complete reconstruction of Boiler No.7 (EEE-BKZ-100-3.9-440MDF) using technology of fluidized bed combustion of BWW without fuel oil for flame stabilization.

At that, the bulk of BWW, which is currently utilized in Boilers No.1-5 together with fuel oil, will be fired in Boiler No.7. Boilers No. 1-5 are planned to be transferred to the reserve.

After the project implementation Boiler No. 7 will not be able to take on the whole load covered by Boilers No. 1-5 due to its lower steam capacity. Therefore the lacking heat energy will be generated in Boilers No. 8-10 which are underutilized at present and work mainly during the heating period. This redistribution of load will also lead to reduction of fuel oil combustion at CHPP-1 as heat energy is generated more efficiently in Boilers No. 8-10 than in Boilers No. 1-5.

If the enterprise finds additional amount of BWW unable to be burnt in Boiler No. 7 this BWW will be burnt in Boilers No. 1-5 where lacking heat energy will be generated while Boilers No. 8-10 will continue operating in the same mode.

Fluidized bed combustion technology

Fluidized bed technology in power plants (units with thermal capacity of 50 MW and more) came into extensive use in the mid-1970s under the influence of more and more stringent emission standards.

This technology has been reported to function well both abroad and at a number of Russian enterprises, including pulp and paper mills.

EEE-BKZ-100-3.9-440MDF boiler has a fluidized bed reactor, which is installed in the lower part of the furnace and is fitted with a grate which ensures supply of air from below.

Fluidized bed is formed by screened natural sand, which is made to behave like a bubbling fluid by streams of primary air passing from the bottom of the bed. The air is supplied by a high-pressure fan via nozzles, installed underneath the grating.

Fuel (wood wastes and bark) burns partially in the fluidized bed – in the lower part of the furnace and partially over the bed in a suspended state. Thus, small fuel particles burn quickly over the fluidized bed and larger particles get into the fluidized bed, where they dry and burn.

When firing biofuel the temperature of the fluidized bed varies in the range of 750-950 ^{o}C.

The fuel (BWW) is supplied to CHPP-1 from the existing wood preparation department (WPD) and via the existing system of belt conveyors is fed to boiler fuel bunkers (2 nos.), 20 m^3 each. From these bunkers fuel is fed by screws via rotary valves and down-take pipes onto the fluidized bed furnace grating.

The fluidized bed combustion technology envisages supply of sand on the boiler grating.

The sand bed is heated to the temperature required for ignition of solid fuel and stabilization of burning by startup burners (4 nos.), running on fuel oil. Startup burners are installed at the side walls of the reactor.

Stable fuel burning is ensured by air supplied at different levels:

- Primary air (blast air) under the grate for fuel burning;
- Secondary air over the flame.

Flue gases via a system of flue ducts are directed to the multicyclones and are further release through the existing chimney. Dust collection efficiency of the multicyclones is 90%.

Collected particles consisting of fly ash and sand fines are transported by conveyors to the sand bunker, holding 20 m^3, and further via a sluice feeder and conditioning screw these particles are loaded onto dump trucks.

Some flue gases from the convection shaft of the boiler are fed by recirculation induced draft fans to the mixers, where they are mixed with secondary air in order to reduce NO_x.

Furnace bottom ash (sintered sand and unburned carbon) is removed regularly into the bins installed below the boiler.

Fuel oil is supplied from the mill’s existing fuel oil system, which consists of six vertical metal tanks each capable of holding 10 000 m^3. Fuel oil is fed to the startup burners from two existing fuel oil collectors and then returned to the existing return collector of CHPP-1.

This technology has the following advantages:

- Increased efficiency of BWW combustion: efficient mixing in the fluidized bed and air distribution against air blasting zones ensures high burning efficiency (92-93%);
- Possibility to fire BWW with high moisture content without using oil for flame stabilization;
- Reduction of toxic emissions (nitrogen oxide NO_2, sulfur dioxide SO_2) to the level of maximum permissible concentration. NO_x are reduced significantly down to the value less than 400 mg/m^3 due to low temperature burning with air supply in several tiers. SO_2 capturing efficiency can exceed 80% when limestone is fed to the fluidized bed at a rate corresponding to Ca/S mole ratio – around 10% of fuel consumption given sulfur content of fuel of around 1%.

The reconstructed boiler arrangement is shown in Annex 4, Figure 1. Major technical parameters of the boiler No.7 are provided in the Table A.4-5 below. Process flow scheme of the boiler is shown in Annex 4, Figure 2.

Table A.4-5. Technical characteristics of the boiler No.7

Parameter	Units	Value
Installed steam production capacity	t/hr	53.0
Steam parameters		
pressure	MPa	3.9
temperature	°C	440
Efficiency	%	87.9
Maximum BWW consumption	t/hr	25.5
Fuel oil consumption (for start-up only)	t/year	500

The first stage of reconstruction, results, causes of failure

The following works were implemented at the first stage:

- Construction of the bark preparation facility is completed. The equipment was supplied by Saalasti (Finland);
- At the place of boiler No.7 a new boiler was installed as per the design developed by SP EEE. The boiler and fans were manufactured on the basis of a unit by Sibenergomashservis, Barnaul, supplemented by English nozzles and Damatic automation system by Metso Paper (Finland). Specialists of Sibenergomashservis carried out boiler installation supervision and oversaw start-up and commissioning.

The investment in the first stage amounted to €6.72 million.

Dismantling of the old fuel oil boiler, which had been in operation for 30 years, started in January 2002. Installation work of the new boiler were started in June 2002 and completed in December 2003. The first start-up programme was carried out by CJSC Energobumprom-K in January – March 2004. The second start-up programme was carried out by CJSC SibKOTES and CJSC SP EEE in January – March 2005. Both times it was not possible to achieve stable operation of the boiler. The enterprise was compelled to continue BWW combustion in the old boilers No.1-5.

It is not possible to operate the boiler without additional modification. The materials of the boiler and instrumentation do not sustain the temperature loads produced by heat release in the process of fuel burning in the boiler furnace. Furthermore there are other problems with the project technology, namely:

- To ensure optimum output and stable performance of the boiler it is necessary to provide stable supply of biofuel both in terms of volumes and quality. It is necessary to have a buffer stock to smooth and offset some peculiarities – irregularity, seasonality and other peculiarities of chip production and, as a consequence, peculiarities of wood waste generation.

- The necessary condition of the project implementation is not only construction of a constant buffer stock of fuel with the required quality, but also a corresponding fuel feed technology.

Completion stage of modernization

To complete power boiler No.7 reconstruction project it is necessary to:

- replace fluidized bed reactor;
- carry out modification of the heating surfaces;
- install equipment for fuel wood preparation and feeding to the boiler;
- build a bark and wood waste storage;
- remove shortcomings of auxiliary equipment operation (steam and heavy fuel oil lines, control algorithms, bark feed, control valves).

According to preliminary estimations, additional capital investments will amount to around €6.24 million.

According to the results of tender evaluation, which was held in September 2006, technical specialists and economic departments of the Mill awarded the contract for implementation of the completion stage of reconstruction to FOSTER WHEELER ENERGIA OY.

Implementation of the project will help to:

- switch to a more cost-effective and efficient technology of combustion of solid fuels, such as bark and wood wastes;
- mitigate negative impact upon the environment (reduction of harmful emissions into the atmosphere);
- improve reliability of heat supply and reduce energy losses.

BWW preparation for combustion

To ensure a more even feeding of fuel and to reduce fuel oil consumption it was decided to install a special line for handling, preparation, storage and feeding of wood wastes for combustion to CHPP-1 (imported fuel, old wagons, trays, oversize bulky waste).

The bark handling facility is a metal bunker with screw dischargers at the bottom.

The bark handling facility and wood wastes crusher look like metal bunkers: the former has a moving bottom, the latter has a two-shaft waste crusher in the bottom part. Together they form a process module designed for handling of the ready-to-use imported fuel and processing of oversize bulky waste: trays, wagons, etc.

Fuel chips production facility includes a wood handling unit, a chain log hauler, and a chipping machine. The wood handling unit and the chain log hauler supply wood to the chipping machine, which chops wood into chips.

The scheme of wood fuel flow to CHPP-1 is shown in Annex 4, Figure 3.

<u>Implementation schedule</u>

Implementation schedule for the project according to the Business plan is provided below:

Project	1st quarter 2006	2nd quarter 2006	3rd quarter 2006	4th quarter 2006	1st quarter 2007	2nd quarter 2007	3rd quarter 2007	4th quarter 2007
Project development, permissions obtaining	III 2006 - III 2007						X 2007	
Contract signing, equipment production and supply			VIII 2006 - V 2007					
Dismounting		VI - VII 2006			I - III 2007			
Construction works						IV -IX 2007		
Balancing and precommissioning							X 2007	
Commissioning and start-up								XI 2007

Personnel training

In order to secure proper operation of the reconstructed boiler the personnel of OJSC “Segezha PPM” responsible for the boiler operation was trained by the specialists of «FOSTER WHEELER ENERGIA OY» - the company responsible for the reconstruction, as well at other PPMs. Also responsible specialists are regularly trained and tested on the boilers equipment operation.

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 neglected since these emissions are negligibly small 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.

In general, reduction of GHG emissions under the project is achieved due to increased efficiency of BWW combustion and reduction of fossil fuel (fuel oil) consumption in the Mill’s fuel and energy balance.

Reduction of GHG emissions from fuel oil firing at CHPP-1 is achieved owing to the fact, that after the project implementation, Boiler No. 7 will not be able to take on the whole load covered by Boilers No. 1-5 due to its lower steam capacity. Therefore the lacking heat energy will be generated in Boilers No. 8-10 which are underutilized at present and work mainly during the heating period. This redistribution of load will also lead to reduction of fuel oil combustion as heat energy is generated more efficiently in Boilers No. 8-10 than in Boilers No. 1-5.

- after the project implementation wood waste will be prepared under update technology that will allow to combust them more efficiently;
- wood waste will be burnt in Boiler No. 7 under state-of-the art and more efficient technology of “fluidized bed”. It will allow reducing fuel oil consumption that was previously used for lighting at BWW combustion in Boilers No. 1-5. After the project implementation Boilers No. 1-5 are planned to be transferred to the reserve. If the enterprise finds additional amount of BWW unable to be burnt in Boiler No. 7 this BWW will be burnt in Boilers No. 1-5;
- after the project implementation, Boiler No. 7 will not be able to take on the whole load covered by Boilers No. 1-5 due to its lower steam capacity. Therefore the lacking heat energy will be generated in Boilers No. 8-10 which are underutilized at present and work mainly during the heating period. This redistribution of load will also lead to reduction of fuel oil combustion as heat energy is generated more efficiently in Boilers No. 8-10 than in Boilers No. 1-5.

Total expected GHG emission reductions amounts 284 370 t CO_2e during the crediting period.

In the absence of the project the above said GHG emission reductions would not have been achieved, because Segezha PPM could have continued its operation having the same type of equipment for BWW utilization and no serious obstacles to its operation in the previous mode at least until 2012, taking into account national and sectoral policies and circumstances:

- Technical condition of the old utilization boilers, basically, allowed to continue their operation at the same level for a number of years;
- No significant increase of heat production is planned in the short-term, which would have required commissioning of additional generating facilities;
- Redistribution of load from Boilers No. 1-5 to Boilers No. 8-10 is impossible without the project implementation as the Mill will not be able to utilize BWW otherwise.
- Even without installation of new equipment the Mill utilizes all BWW generated in the process of paper manufacturing as well as wastes from the nearby timber mill;
- No significant changes in the Russian environmental legislation are envisaged, which could have forced the enterprise to stop operating the equipment which existed prior the project;
- There are no limitations to GHG emissions set for enterprises in Russia and such are not expected until 2012;
- In the absence of the project the Mill would have avoided significant and fairly risky investments of their own funds and bank loans;
- In the absence of the project it would be possible to avoid risks associated with a fairly new technology of fluidized bed combustion, which has not been early applied at Segezha PPM.

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

	Years
Length of the crediting period	5
Year	Estimate of emission reductions in tonnes of CO_2 equivalent
2008	56,874
2009	56,874
2010	56,874
2011	56,874
2012	56,874
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	284,370
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	56,874

A.5. Project approval by the Parties involved:

According to Russian legislation, the letter of approval is now issued by the Russian Government on the basis of an expert statement issued by the AIE after the project has been determined against the JI criteria and requirements have been set forth on both international and domestic levels.

Draft Determination Report is issued by Bureau Veritas Certification Holding SAS on 19 July 2010. Expert Opinion is issued by Bureau Veritas Certification Holding SAS on 19 July 2010.

Approval by the Russian Government is issued in the decree N709 dated 30 December 2010. The project is listed under number 14 in the list of approved projects.

SECTION B. Baseline

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

The Baseline is set using JI specific approach and in accordance with the Decision 9/CMP.1. Guidelines for the implementation of Article 6 of the Kyoto Protocol. FCCC/KP/CMP/2005/8/Add.2. 30 March 2006 and on the basis of "Guidance on criteria for baseline setting and monitoring", Version 02.

The baseline was chosen on the basis of critical analysis of various alternatives.

The following alternatives that theoretically meet the required heat demand and ensure full utilization of the available quantity of the BWW were identified for the project:

Alternative 1: Continuation of the existing situation.

Alternative 2: Construction of a wood fuel feed facility and a bark and wood waste storage without completion of boiler No.7 reconstruction.

Alternative 3: Continuation of the present situation (without construction of boiler No.7) with heat produced by boilers No.8-10 running on fuel oil.

Alternative 4: Project activity as not JI.

Each alternative is further considered in detail.

Alternative 1: Continuation of the existing situation.

Technical condition of the old boilers is such that it is possible to continue their operation in the existing mode provided scheduled repairs are carried out. This will ensure generation of the required amount of steam and utilization of all BWW generated at the mill and purchased from outside without any significant and risky capital investments.

Considering the above said and also the results of the cost analysis of other alternatives, *Alternative 1 is the most likely baseline scenario.*

Alternative 2: Construction of a wood fuel feed facility and a bark and wood waste storage without completion of boiler No.7 reconstruction.

Construction of a wood fuel feed facility will ensure stable supply of wood fuel in terms of volume and quality, and construction of a bark and wood waste storage will provide a constant buffer stock of fuel with the specified quality which will offset irregularity, seasonality and other peculiarities of wood processing to produce chips, and consequently, the peculiarities of wood waste generation. This will ensure operation of utilization boilers No.1-5 in more stable mode.

However these measures will not deal with the problems created by the shortcomings of the BWW combustion technology. Surely, implementation of this alternative will result in a more optimum and stable mode of boiler operation. Nevertheless, expansion and upgrading of wood fuel preparation facilities without reconstruction of combustion equipment can hardly be considered reasonable.

Thus, *implementation of Alternative 2 as the baseline is unlikely and was excluded from further consideration.*

Alternative 3: Continuation of the present situation (without construction of boiler No.7) with heat produced by boilers No.8-10 running on fuel oil.

Such scenario would not be feasible, since not all BWW would be combusted and have to be disposed. This practice is the most unlikely for the mill.

Thus, *implementation of Alternative 4 as the baseline is unlikely and was excluded from further consideration.*

Alternative 4: Project activity as not JI.

This alternative will bring more benefits as compared with Alternative 2. However, this alternative requires additional investment for completion of boiler No.7 reconstruction and bears more risks than Alternative 2. Therefore, *implementation of Alternative 3 as the baseline in unlikely*.

Justification of the Baseline chosen.

In order to justify the baseline an investment analysis can be applied. The Investment analysis and sensitivity analysis results are provided in the Section B.2 and demonstrate that the Alternative 4 (Project activity without JI) could not have taken place within the framework of common commercial practice and cannot be considered as the baseline scenario.

Alternative 1 is business as usual scenario and do not require any significant investments in order to ensure its operation. Segezha PPM is operating old units and carries all necessary expenses now and could continue it in the future. On the other hand implementation of Alternative 4 requires investments and it is very hard to find spare cash to invest in the project in relatively short period of time. Common practice in Russia is using the old equipment instead of installation of new units until the old ones are completely broken. Considering good operational conditions of the boilers, there was no need to the project owner to invest money in already good working process.

Therefore it can be concluded that the most plausible baseline scenario is <u>Alternative 1</u>: Continuation of the existing situation.

Description of the baseline scenario

Under the Baseline scenario the Mill would have continued to use its existing capacities, which are capable of utilizing the entire volume of BWW generated in the process of paper manufacturing and BWW supplied from the nearby timber mill. Technical condition of the old utilization boilers No.1 to 5, basically, allowed them to maintain their operation at the same level for a number of years, carrying out scheduled repairs, which do not require significant investments. After the first failed attempt of reconstruction Boiler No.7 is not operable. The management of Segezha PPM does not undertake any new attempts to reconstruct this boiler. This scenario is the least risky and does not require capital investments.

Further the main factors which determine GHG emissions both in the baseline and the project scenarios are considered, namely:

- heat energy production;

- fuel combustion.

Electricity generation does not depend on the project because in any case the turbines will be supplied with sufficient amount of steam regardless of fuel type burnt. Electricity consumption by reconstructed boiler No. 7 and additional electricity consumption for BWW preparation will be compensated by decrease of electricity consumption by inefficient boilers No. 1-5 and by decrease of energy consumption for fuel oil heating and pumping.

<u>**Estimation of emission reductions**</u>

In order to estimate emission reduction Project developers are assessing emissions related to the part of CHPP-1 affected by the Project activity only.

The emission reductions are calculated on the basis of following approach:

Boiler No. 7 is designed for combustion of BWW and steam production. For the purpose of emission reduction estimation it is assumed that all the BWW that is combusted in the Boiler No.7 under the project would be otherwise combusted in the boiler 1-5 under the baseline. Boilers 1-5 need to use fuel oil (mixed with pitch) in order to secure BWW combustion in proportion 21% of BWW to 79% of fuel oil and pitch mixture (see Annex 2 for details) and operate with lower efficiency. Therefore resulting heat production by the boilers 1-5 under the baseline would be higher than by Boiler No.7 under the Project with the same amount of BWW. Remaining part of steam under the project will be compensated by fuel-oil based boilers 8-10.

Pitch that is used in the boilers is admixed to the fuel oil in available amount. Amount of pitch to be burned does not depend on the project activity and in the same amount would be used either under baseline or project. Therefore difference in heat generation will be compensated on account of fuel oil only.

Hot water boilers operation is not affected by the project activity therefore they are excluded from calculation and further monitoring. As well, operation of the Boilers 1-5 under the project is not affected by the project activity because it can be assumed that the same amount of fuel would be combusted with the same heat generation both under the project and baseline scenario.

Annual heat production

Amount of heat production during the year *y* shall be equal for the baseline and project scenarios (GJ):

$$HG_{PJ,y} = HG_{BL,y}, \quad \text{(B.1-1)}$$

where $HG_{PJ,y}$ is the heat production by boiler No.7 and boilers 8-10 under the project during the year *y*, GJ;

$HG_{BL,y}$ is the heat production by boilers 1-5 under the baseline during the year *y*, GJ.

Considering difference in capacities of Boiler No.7 and boilers 1-5 in order to secure condition (B.1-1) fulfillment it is reasonable to assume that the difference in heat generation will be covered by fuel-oil boilers 8-10 that have enough capacity.

Heat production under the project scenario

$$HG_{PJ,y} = HG_{7,PJ,y} + HG_{8-10,PJ,y}, \quad \text{(B.1-2)}$$

where $HG_{7,PJ,y}$ is the heat production under the project by steam boiler No.7 (reconstructed under the project) during the year *y*, GJ. For purpose of emissions reduction estimation heat production by Boiler No.7 is calculated on the basis of its maximum steam output when running on BWW.

$$HG_{7,PJ,y} = D \times \tau_y \times (i_1 - i_2)/1000, \quad \text{(B.1-3)}$$

where D is the maximum hourly steam output of boiler No. 7, t/h. See Table B.1-1;

τ_y is the operation time of boiler No.7, h/year. See Table B.1-1;

i_1, i_2 is the enthalpy of steam and feed water in boiler No.7 respectively, MJ/t. See Table B.1-1.

Table B.1-1. Characteristics of the reconstructed boiler No.7

Value	Variable	Unit	Fuel type	
			BWW	Fuel oil
Maximum steam output	D	t/h	53	100
Boiler operation time	τ_y	h/year	7104	
Pressure of superheated steam	p_1	MPa	3.9	
Temperature of superheated steam	t_1	°C	440	
Temperature of feed water	t_2	°C	145	
Enthalpy of superheated steam	i_1	MJ/t	3309.3	
Enthalpy of feed water	i_2	MJ/t	610.7	

$HG_{8-10,PJ,y}$ is the difference of heat generated by the Boilers 1-5 under baseline and Boiler No. 7 under the project during the year *y*, GJ:

$$HG_{8-10,PJ,y} = HG_{1-5,BL,y} - HG_{7,PJ,y}. \quad \text{(B.1-4)}$$

Fuel combustion under the project

Fuel combusted under the project is formed by:

$FC_{BWW,PJ,y}$ - consumption of BWW under the project during the year y, GJ;

$FC_{oil,PJ,y}$ - is the total consumption of fuel oil under the project during the year y, GJ. Calculated as:

$$FC_{oil,PJ,y} = FC_{oil,8-10,PJ,y} + FC_{oil,7,PJ,y} \quad \text{(B.1-5)}$$

where $FC_{oil,8-10,PJ,y}$ is the consumption of fuel oil in boilers 8-10 for production of additional amount of heat under the project during the year y for meeting condition of (B.1-1), GJ. Calculated as follows:

$$FC_{oil,8-10,PJ,y} = \frac{HG_{8-10,PJ,y}}{\eta_{oil,8-10}}, \quad \text{(B.1-6)}$$

where $\eta_{oil,8-10}$ is the efficiency of fuel oil combustion in boilers 8-10, %; See Table B.1-2.

$FC_{oil,7,PJ,y}$ is the consumption of fuel oil in boiler No.7 under the project during the year y, GJ and is calculated as:

$$FC_{oil,7,PJ,y} = FC^{m}_{oil,7,PJ,y} * NCV_{oil} \quad \text{(B.1-7)}$$

where $FC^{m}{}_{oil,7,PJ,y}$ - mass of fuel oil combusted in boiler No.7 under the project, t (See table A.4-5).

NCV_{oil} - net calorific value of fuel oil, GJ/t.

BWW combustion under the project

$$FC_{BWW,PJ,y} = FC_{BWW,7,PJ,y}, \quad \text{(B.1-8)}$$

where $FC_{BWW,7,PJ,y}$ is the amount of BWW combusted in boiler No.7 under the project during the year y,t;

$$FC_{BWW,7,PJ,y} = \frac{(HG_{7,PJ,y} - HG_{oil,7,PJ,y})}{\eta_{BWW,7}}, \quad \text{(B.1-9)}$$

where $\eta_{BWW,7}$ is the efficiency of BWW combustion in boiler No.7, %; See Table B.1-2.

Project emissions

Project emissions (PE_y) are due to combustion of fuel oil in the boilers No.7 and 8-10:

$$PE_y = FC_{oil,PJ,y} * EF_{oil}, \quad \text{(B.1-10)}$$

where EF_{oil} is the emission factor of fuel oil, equals to 77.4[2] $kgCO_2e/GJ$

Heat production under the baseline

Heat under the baseline is produced by boilers 1-5 operating on BWW and fuel oil mixed with pitch in the amount that is produced by boiler No.7 under the project.

$$HG_{BL,y} = HG_{1-5,BL,y}, \quad \text{(B.1-11)}$$

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy, Table 1.4

where $HG_{1-5,BL,y}$ is the heat production under the baseline by utilization boilers No. 1-5 during the year y, GJ;

$$HG_{1-5,BL,y} = FC_{BWW,1-5,BL,y} \times \eta_{BWW,1-5} + FC_{oil+pitch,1-5,BL,y} \times \eta_{oil,1-5}, \quad \text{(B.1-12)}$$

where $FC_{BWW,1-5,BL,y}$ is the amount of BWW combusted in boilers No.1-5 under the baseline during the year y, GJ, this amount is equal to BWW combusted in Boiler No.7 under the project ($FC_{BWW,7,PJ,y}$, GJ);

$$FC_{BWW,1-5,BL,y} = FC_{BWW,7,PJ,y}, \quad \text{(B.1-13)}$$

$FC_{oil+pitch,1-5,BL,y}$ is the amount of fuel oil and pitch combusted in boilers No.1-5 under the baseline during the year y, GJ. This amount is calculated on the basis of proportion that exists between BWW combusted in boilers 1-5 and fuel oil (mixed with pitch) that is supplied in the boiler in order to secure combustion process. If we compare fuel oil (mixed with pitch) based heat production and BWW based production (see Annex 2), the average proportion in 2006-2007 for fuel oil with pitch accounted for 79.0% by heat release, against 21.0% of BWW. This pattern is used for estimation of fuel oil with pitch combusted in boilers No.1-5 under the project and under the baseline.

$$FC_{oil+pitch,1-5,BL,y} = \frac{FC_{BWW,1-5,BL,y}}{1-0.79} \times 0.79 \quad \text{(B.1-14)}$$

$\eta_{BWW,1-5}$ is the efficiency of BWW combustion in boilers 1-5, %; See Table B.1-2,

$\eta_{oil,1-5}$ is the efficiency of fuel oil and pitch combustion in boilers 1-5, %; See Table B.1-2.

Fuel oil combustion efficiency assumed at 80% as per Parameter charts of the boilers and pitch combustion efficiency is assumed the same as for fuel oil since they are supplied in a mixture and efficiency is given for the mixture. Accordingly efficiency of BWW combustion is calculated as 58 % (see Annex 2 for details).

Efficiency factors for all boilers when running on different fuels are given in Table B.1-2. Efficiency factors for the boilers are assumed constant for all years and similar under the project and the baseline. Data on the efficiency of boiler No.7 are assumed in compliance with project documentation.

Table B.1-2. Efficiency of boilers, %

Fuel	BWW	Fuel oil	BWW + fuel oil	Pitch
Boilers No.1-5 (parameters charts)	58	80		80
Boilers No.7 (project data)	87.9	92.9	89.1	-
Boilers No.8-10	-	87	-	-

<u>Baseline missions</u>

Baseline emissions (BE_y) are due to combustion of fuel oil under the baseline:

$$BE_y = FC_{oil,BL,y} * EF_{oil}, \quad \text{(B.1-15)}$$

where EF_{oil} is the emission factor of fuel oil, equals to 77.4[3] $kgCO_2e/GJ$

[3] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy, Table 1.4

Results of heat production and fuel consumption under the baseline and under the project calculated using approach described above are given in Table B.1-3.

Table B.1-3. Heat production and fuel consumption by the Mill

Parameter, facility	Unit	Years					
		2008	2009	2010	2011	2012	2008-2012
Heat production under the project							
Production by Boiler No.7	GJ	1 016 058	1 016 058	1 016 058	1 016 058	1 016 058	5 080 288
Production by Boilers No.8-10 (additional)	GJ	3 057 097	3 057 097	3 057 097	3 057 097	3 057 097	15 285 484
Total heat production	GJ	4 073 154	4 073 154	4 073 154	4 073 154	4 073 154	20 365 772
Heat production under the baseline							
Production by Boilers No.1-5	GJ	4 073 154	4 073 154	4 073 154	4 073 154	4 073 154	20 365 772
Fuel consumption under the project							
BWW consumption	GJ	1 134 734	1 134 734	1 134 734	1 134 734	1 134 734	5 673 669
	t	159 130	159 130	159 130	159 130	159 130	795 648
Fuel oil consumption	GJ	3 533 954	3 533 954	3 533 954	3 533 954	3 533 954	17 669 772
	t	88 129	88 129	88 129	88 129	88 129	440 643
TOTAL	GJ	4 668 688	4 668 688	4 668 688	4 668 688	4 668 688	23 343 441
Fuel consumption under the baseline							
BWW consumption	GJ	1 134 734	1 134 734	1 134 734	1 134 734	1 134 734	5 673 669
	t	159 130	159 130	159 130	159 130	159 130	795 648
Fuel oil consumption	GJ	4 268 761	4 268 761	4 268 761	4 268 761	4 268 761	21 343 804
	t	106 453	106 453	106 453	106 453	106 453	532 264
TOTAL	GJ	5 403 495	5 403 495	5 403 495	5 403 495	5 403 495	27 017 474

Key parameters used to establish the Baseline

Data/Parameter	$HG_{BL,y}$
Data unit	GJ
Description	Heat production by boilers 1-5 under the baseline during the year *y*
Time of determination/ monitoring	Determined at the time of baseline setting. Will be re-calculated annually on the basis of monitoring results.
Source of data (to be) used	Calculated
Value of data applied (for ex ante calculations/determinations)	**Year**: GJ; **2008**: 4 073 154; **2009**: 4 073 154; **2010**: 4 073 154; **2011**: 4 073 154; **2012**: 4 073 154
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data demonstrate amount of heat that would be generated under the baseline scenario while burning the same amount of BWW in boilers 1-5 with addition of necessary amount of fuel oil.
QA/QC procedures (to be) applied	$HG_{PJ,y}$ is calculated annually on the basis of monitored data using corresponding procedures described in Section D
Any comment	

Data/Parameter	D
Data unit	t/h
Description	is the maximum hourly steam output of boiler No. 7
Time of determination/ monitoring	Set in the Business Plan
Source of data (to be) used	Business Plan
Value of data applied (for ex ante calculations/determinations)	BWW – 53 Fuel oil – 100
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Used for calculation of $HG_{7,PJ,y}$ - heat production by Boiler No.7
QA/QC procedures (to be) applied	n/a
Any comment	no

Data/Parameter	τ_y
Data unit	h/year
Description	is the operation time of boiler No.7
Time of determination/ monitoring	Set in the Business Plan
Source of data (to be) used	Business Plan
Value of data applied (for ex ante calculations/determinations)	7104
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Used for calculation of $HG_{7,PJ,y}$ - heat production by Boiler No.7

QA/QC procedures (to be) applied	n/a
Any comment	no

Data/Parameter	i_1, i_2
Data unit	MJ/t
Description	is the enthalpy of steam and feed water in boiler No.7 respectively
Time of determination/ monitoring	Set in the Business Plan
Source of data (to be) used	Business Plan
Value of data applied (for ex ante calculations/determinations)	i_1 - 3309.3 i_2 - 610.7
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Used for calculation of $HG_{7,PJ,y}$ - heat production by Boiler No.7
QA/QC procedures (to be) applied	n/a
Any comment	no

Data/Parameter	$\eta_{fuel,boiler}$
Data unit	%
Description	efficiency of fuel combustion in boilers No.1-5, 7, 8-10
Time of determination/ monitoring	Determined at the time of baseline setting
Source of data (to be) used	Calculated
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Efficiency of fuel combustion is used for estimation of fuel burnt for het generation
QA/QC procedures (to be) applied	Fuel combustion efficiency for Boiler No.7 and Boilers 1-5 operating on pitch and fuel oil are taken from the Parameter charts of the corresponding boilers that is a reliable data. BWW combustion efficiency for Boilers 1-5 is calculated (see Annex 2 for details).
Any comment	no

Value of data applied:

Fuel	BWW	Fuel oil	BWW + fuel oil
Boilers No.1-5	58.0	80	
Boiler No.7	87.9	92.9	89.1
Boilers No.8-10	-	87	-

Data/Parameter	$FC_{BWW,1-5,BL,y}$
Data unit	GJ
Description	is the amount of BWW fired under the baseline in boilers 1-5 during the year y
Time of determination/ monitoring	Determined at the time of baseline setting
Source of data (to be) used	Calculated, Monitored
Value of data applied (for ex ante calculations/determinations)	n/a

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Amount of BWW to be combusted is equal to the amount of BWW combusted under the baseline scenario.
QA/QC procedures (to be) applied	The value is monitored since is equal to BWW
Any comment	

Data/Parameter	$FC_{oil+pitch,1-5,BL,y}$
Data unit	GJ
Description	is the amount of fuel oil with pitch fired under the baseline in boilers 1-5 during the year *y*
Time of determination/ monitoring	Determined at the time of baseline setting
Source of data (to be) used	Calculated
Value of data applied (for ex ante calculations/determinations)	n/a
Justification of the choice of data or description of measurement methods and procedures (to be) applied	
QA/QC procedures (to be) applied	
Any comment	

Data/Parameter	EF_{oil}
Data unit	kg CO_2e/GJ
Description	Fuel oil emission factor
Time of determination/ monitoring	default
Source of data (to be) used	Values are based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2, Table 2.2
Value of data applied (for ex ante calculations/determinations)	77.4
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The value is used for calculation of CO_2 emissions due to fuel oil combustion in boilers
QA/QC procedures (to be) applied	This value was accepted as conservative
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:

Additionality of the emission reductions achieved due to the project implementation will be demonstrated using approach (a) as defined in paragraph 2 of the Annex I to the "Guidance on criteria for baseline setting and monitoring:

"Provision of traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs".

In order to do so the an alternatives analysis, Investment analysis, Barrier analysis and Common practice analysis are used.

Identification of alternatives to the project activity consistent with current laws and regulations

The alternatives to the Project activity were identified and analyzed in the Section B.1. The following alternatives were identified:

Alternative 1: Continuation of the existing situation.

Alternative 2: Construction of a wood fuel feed facility and a bark and wood waste storage without completion of boiler No.7 reconstruction.

Alternative 3: Continuation of the present situation (without construction of boiler N7) with heat produced by boilers No.8-10 running on fuel oil.

Alternative 4: Project activity as not JI.

All the above mentioned alternatives are in compliance with local and national Laws and regulations. There is no any legal obstacle for realisation of any of the alternative.

Conclusion

Summarizing the analysis Alternative 1 (continuation of existing situation) and Alternative 4 (Project) can be considered credible and realistic among others. They will be further analyzed in the investment analysis.

Investment analysis

Since Project activity contributes to reduction of fuel oil consumption, cost analysis method cannot be applied.

Any investment decision at the enterprise is made by management and shareholders of JSC "Segezha PPM" using investment regulations set up by CJSC "Investlesprom" (management company). Thus, the investment decisions should meet certain financial and economic effectiveness criteria.

Taking into account that management and shareholders of JSC "Segezha PPM" consider only one reasonable and realistic alternative to the existing situation an investment comparison analysis was not applied. Availability of internal guidelines for assessment of investment projects is considered as the most suitable way of decision-making at the enterprise thus benchmark analysis is applied for the Project allowing assessment of its additionality.

JSC "Segezha PPM" implemented the investment regulations for development and implementation of investment projects developed by CJSC "Inveslesprom" for all the companies within the holding. The main financial parameters, which need to be calculated and provided for management consideration, are: Net Present Value (NPV), Discounted Payback period (DPB) and Internal Rate of Return (IRR).

Since main business of JSC "Segezha PPM" is to process timber for production of chemical kraft pulp and kraft paper the implementation of the project would result in diversion of investment capital from main production activities. Consequently, the minimum requirement for such project is that the project should be profitable. Thus, Net Present Value (NPV) is considered as the benchmark that should be positive.

The following assumptions were taken into account when calculating financial parameters of the project:

- Capital investment in the project: €6.72 million for the first stage, €6.24 million for the second stage;
- Fuel oil price equal to 192.44 €/t;
- The discount rate of 12% is based on the internal discount rate of return applicable to this type of projects in accordance with internal investment regulations of JSC "Segezga PPM" and CJSC "Investlesprom".

Table B.2.1 below shows the main economic parameters of the project scenario. For more details, please see Annex 2.

Table B.2.1. Economic parameters

Parameter	Unit	Project
NPV	kEUR	- 3 051.50
IRR	%	8.14

Taking the above into account, it could be stated that the project could not have taken place within the framework of common commercial practice and cannot be considered as the baseline scenario.

Therefore, considering results of alternatives analysis and investment analysis it can be concluded that the most probable Baseline scenario is the Alternative 1: Continuation of the existing situation.

Sensitivity analysis

The sensitivity analysis of the project was based on fluctuations of the following variables: 10% upward and downward change in second stage investment cost and fuel oil price.

The results of sensitivity analysis are shown in the table B.2.2.

Table B.2.2. Outcomes of Sensitivity Analysis

Parameter	Unit	Investments (2nd stage)		Fuel oil price	
		-10%	10%	-10%	10%
NPV	000 €	-2427.06	-3675.94	-4403.53	-1699.48
IRR	%	8.85%	7.47%	6.27%	9.91%

Sensitivity analysis demonstrates that the project activity remains unprofitable with variation of major parameters ±10% and therefore confirms results of Baseline analysis.

Barrier analysis

Implementation of the project at Segezha PPM is associated with the following barriers:

Operational barriers

The Mill has never installed or operated this type of boilers. The first attempt to reconstruct boiler No.7 undertaken in 2002 was unsuccessful. During start-up and adjustment works which lasted till 2005 the Mill still failed to achieve the boiler's stable operation (See Section A.4.2). After the second attempt of reconstruction the start-up and adjustment works will also hardly avoid difficulties.

In order to operate such sophisticated equipment it is necessary to arrange special training of the maintenance personnel. This takes money and time. Furthermore, operation of state-of-the-art equipment requires that the personnel (workers, engineers and managers) should have a high level of motivation, morale, skills and knowledge.

Financial barriers

Among financial barriers are the high cost of imported equipment and associated high charges for delivery and customs clearance, as well as costs of personnel training, startup and commissioning, operational and maintenance expenses.

Furthermore it should be noted that financial investments in implementation of this project are fairly risky, because the reconstructed boiler was never commissioned at the first stage, and the completion stage of reconstruction incurs roughly the same amount of capital investments.

It is also recognized that the opportunity cost of capital is very high. Investments in expansion and modernization of core production, including modern energy saving technologies of paper products manufacturing, could have brought more benefits to the Mill at a lower risk compared to the considered project.

Considering the relatively low investment attractiveness of the project and the existing barriers, the management of Segezha PPM from the very beginning considered the opportunity to obtain financing for the project by selling GHG emission reductions within the framework of the mechanism provided by the Kyoto Protocol.

Considering the above we can conclude that the project implementation faces significant barriers that do not prevent implementation of Alternative 4 that is continuation of current practice and do not require special training, significant technical modernization/improvement of the equipment, financial investments.

Additional revenue from the emission reduction sale can stimulate project owner to attract recourses for the project implementation.

Common practice analysis

Common practice for the enterprises of the Russian pulp and paper industry is heat supply from their own energy generating sources (CHPPs, boiler houses), running typically on fossil fuels (natural gas, coal, fuel oil) and partially on wood wastes. The enterprises where pulping is a part of the process, also use black liquor as fuel, which is a by-product of pulping. Of wood wastes sawdust, off-grade chips, furniture and plywood manufacturing residues are used as fuel. Bark is typically disposed at landfills because of the challenges associated with its combustion. Even if the bark is combusted, this is done, as a rule, using large proportion of fossil fuel for flame stabilization (fuel oil, natural gas), which was the case at Segezha PPM with old utilization boilers No.1-5.

Fluidized bed boilers used for BWW combustion are not widely spread at enterprises of the Russian Federation. There are some projects realized:

1. Kondopoga PPM. The fluidized-bed boilers were installed in 1988-1992 and therefore the project cannot be compared to the proposed project activity due to dramatically different economical conditions in the country.
2. Solombala PPM. The project was to reconstruct fuel oil steam boiler with installation of fluidized bed furnace extension and switch to bark and wood waste combustion. The project was realized as a JI project.
3. Arkhangelsk PPM. The project is reconstruction of one boiler with switching to fluidized bed combustion of BWW and replacement of other boiler with a new fluidized bed combustion boiler. The project was realized as a JI project also.

Therefore we can conclude that this technology is not a common practice for the PPMs in Russia. As well, the fluidized bed combustion boilers installed lately at PPMs are realized using JI mechanism of the Kyoto protocol.

In our opinion, the above stated is sufficient to recognize that the GHG emission reductions generated by JI project activity are additional to those that could have occurred otherwise.

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

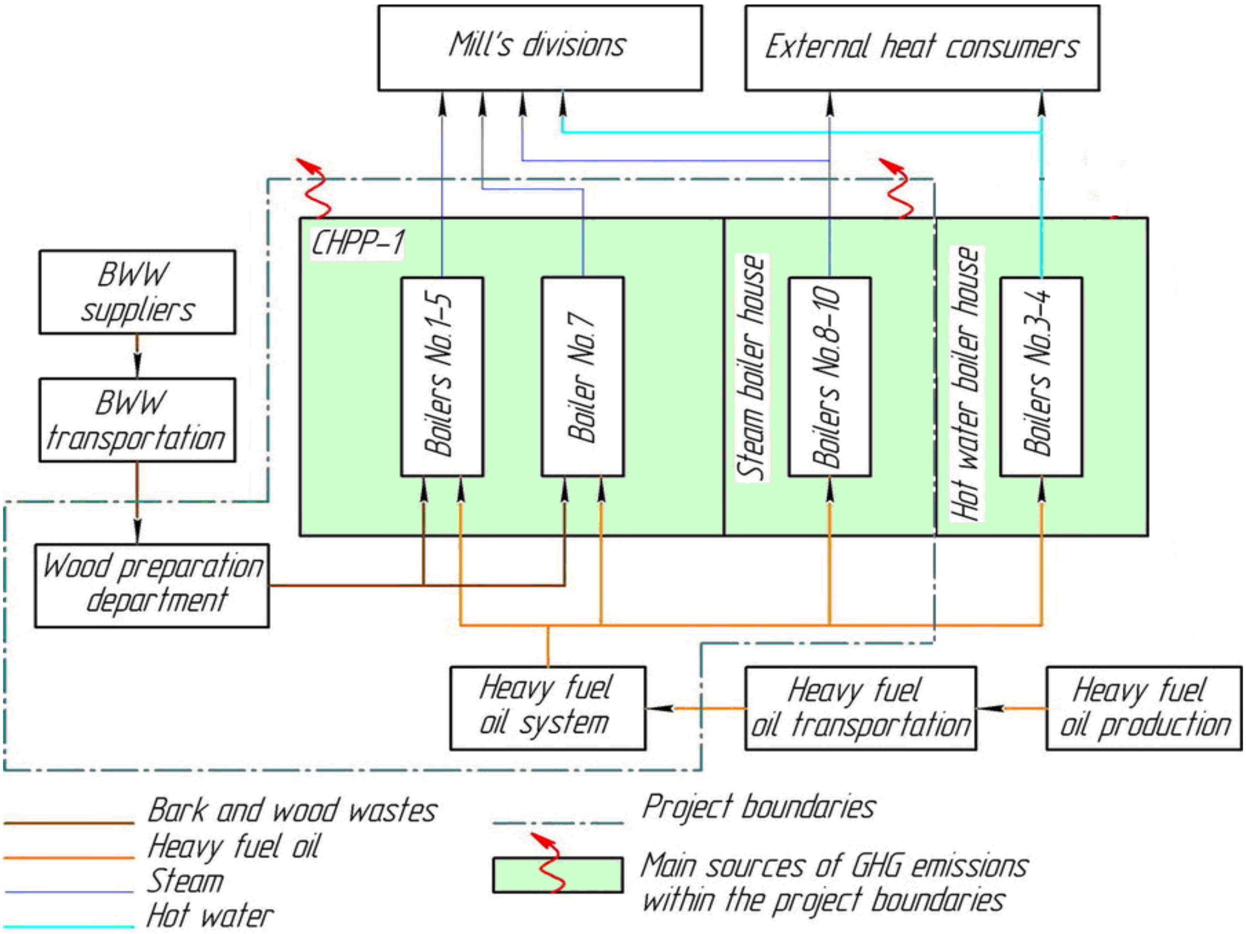

Fig. B.3-1. Main components and the project boundaries

Table B.3.1 Emission sources included in and excluded from the project boundaries

	Source	Gas	Incl./Excl.	Justification / explanation
Baseline	Boilers 1-5, Fuel oil combustion	**CO_2**	**Incl.**	**The main source of emissions**
		CH_4	Excl.	Negligibly small. Conservative.
		N_2O	Excl.	Negligibly small. Conservative.
	Boilers 1-5, BWW combustion	CO_2	Excl.	Regarded equal to zero.
		CH_4	Excl.	Negligibly small. Conservative.
		N_2O	Excl.	Negligibly small. Conservative.
	Boiler house, Pitch combustion	CO_2	Excl.	Considered equal to the project emissions and excluded for simplification
		CH_4	Excl.	Negligibly small. Conservative.
		N_2O	Excl.	Negligibly small. Conservative.
	Boilers 8-10, Fuel oil combustion	**CO_2**	**Incl.**	**The main source of emissions**
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.
Project	Boiler No.7, Fuel oil combustion	**CO_2**	**Incl.**	**The main source of emissions**
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.
	Boiler No.7, BWW combustion	CO_2	Excl.	Regarded equal to zero.
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.
	Boiler house Pitch combustion	CO_2	Excl.	Considered equal to the baseline emissions due to pitch combustion in Boilers 1-5 and excluded for simplification
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.
	Boilers 8-10, Fuel oil combustion	**CO_2**	**Incl.**	**The main source of emissions**
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.
Leakages	Increasing emissions due to transportation of additional amount of BWW	CO_2	Excl.	Negligibly small. (See section E.2)
		CH_4	Excl.	Negligibly small.
		N_2O	Excl.	Negligibly small.

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

Date of baseline setting – 01 March 2010

The baseline was developed by Camco Carbon Russia Limited.

E-mail: project.pareticipant.ru@camcoglobal.com

Camco Carbon Russia Limited is a project participant listed in Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

28/11/2006 (Loan Agreement signing date)

C.2. Expected operational lifetime of the project:

25 years / 300 months.

C.3. Length of the crediting period:

5 years/ 60 months (from 01/01/2008 till 31/12/2012).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

JI specific approach was used based on the demands of the "Guidance on criteria for baseline setting and monitoring" and given the requirements of Decision 9/CMP.1, Appendix B "Criteria for baseline setting and monitoring".

The monitoring plan is designed to record and calculate the GHG emission reductions at Zegezha PPM. Collection of all key data required for estimation of GHG emissions both under the project and the baseline will be performed in accordance with Segezha PPM's practices of fuel, energy and wastes monitoring and environmental impact assessment. The project monitoring does not require any changes to the existing system of data reporting and collection. All necessary data are measured and recorded in any case.The monitoring data should be stored for at least 2 years after the end of the crediting period.

Detailed description of project and baseline scenario and components to be monitored are presented below.

I. Project line description

According to the project scenario Boiler No. 7 operating on BWW is installed and operates for heat production at Segezha PPM. Boiler No. 7 uses BWW both produced at the PPM and purchased from outside. Some amount of fuel oil is also used in the Boiler No. 7.

Under the project scenario boilers No. 1-5 will continue operation and burn certain amount of BWW also.

Boilers 8-10 are used for production of lacking heat in order to secure fulfilment of conditions (B.1-1).

II. Baseline description

Heat under the project will be produced using existing boilers 1-5 using the same amount of BWW as was used by Boiler No. 7 under the project. As well, we assume that amount of BWW burned under the project in boilers 1-5 would be also burned in the same boilers under the baseline.

In some cases total amount of BWW can exceed total maximum amount of BWW that could be burned in the boilers 1-5. In this case heat generation by boilers 1-5 is limited by the maximum possible heat generation using maximum possible BWW burned in boilers 1-5. The difference of heat is assumed to be generated by boiler 1-8 on fuel oil.

III. Monitoring of emission reductions

For the purpose of Emission reductions assessment the following approach is used:

1. BWW burned in Boiler No. 7 under the project would be otherwise burned in the boilers 1-5 in mixture with fuel oil under the baseline. Proportion of fuel oil to BWW was determined ex-ante (see Section B.1).

2. BWW is monitored for the boiler house in total using tensometric scale that is very difficult to calibrate and control. BWW combustion by each boiler is calculated using heat generation be each boiler, fuel oil and pitch consumption, efficiency (see Table B.1-2). Therefore, considering low accuracy of the measures, calculation method will be used based on data obtained from the high accuracy measuring equipment.
3. BWW combustion and heat generation by boilers 1-5 under the project can be used in order to calculate maximum possible portion of BWW burned under the project that could be burned in boilers 1-5 under the baseline. Nevertheless, it is more conservative to use an assumption applied for emission reduction estimation: all BWW burned in boiler No.7 would be burned in boilers 1-5 under the baseline. BWW that excess amount possible to be burned under the baseline in boilers 1-5 can be considered as "fuel switch from fossil fuel (fuel oil) to biomass", in this case excessive BWW under the project fully substitute fuel oil that would be burned in boilers 1-8 under the baseline.
4. Heat generation is monitored for boiler No.7 only.
5. According to the practice applied at the Segezha PPM fuel oil is mixed with pitch. Amount of pitch burned will be monitored in order to calculated amount of fuel oil burned under the project and baseline scenario. Amount of pitch is distributed proportionally to the fuel oil combusted. Amount of pitch is not affected by project activity therefore all fossil fuel reduction due to the project implementation is made on account of fuel oil.
6. Liquid fossil fuel consumption by boilers is monitored by flow meter as mixture of fuel oil with pitch. Consumption of fuel oil and pitch is calculated using approach described above under point 5.
7. Operation of boilers 8-10 is monitored annually in order to calculate efficiency of their operation *ex-post*.

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

This Option is not applicable for the monitoring of the project.

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

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

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

This Option is not applicable for the monitoring of the project.

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

This Option is not applicable for the monitoring of the project.

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

This Option is not applicable for the monitoring of the project.

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

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

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

1. $FC^{m}_{oil+pitch,PJ,y}$	Total mass of fuel oil and pitch combusted in the boiler house under the project	Department of Chief Power Engineer	t	m	Continuously	100 %	Electronic and paper	Readings of fuel oil flow meters. Total amount is a sum. Cross checked with suppliers' data and fuel remaining on the storage.
2. $FC^{m}_{oil+pitch,7,PJ,y}$	Mass of fuel oil and pitch combusted in Boiler No.7 under the project	Department of Chief Power Engineer	t	m	Continuously	100 %	Electronic and paper	Readings of fuel oil flow meters
3. $FC^{m}_{oil+pitch,8-10,PJ,y}$	Mass of fuel oil and pitch combusted in Boilers No.8-10 under the project	Department of Chief Power Engineer	t	m	Continuously	100 %	Electronic and paper	Readings of fuel oil flow meters
4. $NCV_{oil,y}$	Net calorific value of fuel oil	Certificate for fuel or reference data	GJ/ t	m, e	For each incoming batch of fuel oil	100 %	Electronic and paper	Weighted average value is determined at the end of year *y*
5. $HG_{7,PJ,y}$	Heat production by Boiler No.7 under the project	Department of Chief Power Engineer	GJ	m	Daily	100 %	Electronic and paper	Calculated from the readings of steam meter, steam temperature and pressure
6. $HG_{8-10,PJ,y}$	Heat production by Boilers No.8-10 under the project	Department of Chief Power Engineer	GJ	m	Continuously	100 %	Electronic and paper	Readings of heat meter

7. $FC^{m}_{pitch,PJ,y}$	Overall mass quantity of pitch combusted in the boiler house under the project	Department of Chief Power Engineer	t	m	Monthly	100 %	Electronic and paper	Density and volume are measured.
8. $NCV_{pitch,y}$	Weighted average net calorific value of pitch	Certificate of laboratory	GJ/t	e	Quarterly	100 %	Electronic and paper	Weighted average value is determined at the end of year *y*
9. $\eta_{oil,1-5}$	Efficiency of fuel oil combustion in boilers 1-5	Parameter charts of the boilers		e	Annually	100 %	Electronic and paper	Efficiency is monitored for boilers in operation
10. $\eta_{BWW,1-5}$	Efficiency of BWW combustion in boilers 1-5	Parameter charts of the boilers		e	Annually	100 %	Electronic and paper	Efficiency is monitored for boilers in operation
11. $\eta_{oil,7}$	Efficiency of fuel oil combustion in boiler 7	Parameter charts of the boilers		e	Annually	100 %	Electronic and paper	
12. $\eta_{BWW,7}$	Efficiency of BWW combustion in boiler 7	Parameter charts of the boilers		e	Annually	100 %	Electronic and paper	
13. $\eta_{oil,8-10}$	Efficiency of fuel oil combustion in boiler 7	Calculated from fuel consumption and heat production		c	Annually	100 %	Electronic	
14. EF_{oil}	Emission factor for fuel oil	IPCC	tCO_2e/GJ	e	Annually	100 %	Electronic	Latest available version of IPCC guidelines

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):

GHG emission reductions due to the project implementation are a result of fuel oil combustion reduction:

$$ER_y = \Delta FC_{oil,y} \cdot EF_{oil}, \quad \text{(D.1-1)}$$

Where EF_{oil} is the Emission factor for fuel oil, tCO_2e/GJ (IPCC default value);

$\Delta FC_{oil,y}$ is the fuel oil consumption reduction due to the project implementation (calculated by formulae D.1-2), GJ;

$$\Delta FC_{oil,y} = FC_{oil,1-5,BL,y} - FC_{oil,7,PJ,y} - FC_{oil,8-10,PJ,y} \quad \text{(D.1-2)}$$

where $FC_{oil,1-5,BL,y}$ is the amount of fuel oil combusted in Boilers No.1-5 under the baseline during the year *y* (calculated by formulae D.1-3), GJ;

$FC_{oil,7,PJ,y}$ is the amount of fuel oil combusted in Boiler No.7 under the project during the year *y* (calculated by formulae D.1-8), GJ;

$FC_{oil,8-10,PJ,y}$ is the amount of fuel oil combusted in Boilers No. 8-10 under the project during the year *y* (calculated by formulae D.1-14), GJ.

$FC_{oil,1-5,BL,y}$ is calculated as follows:

$$FC_{oil,1-5,BL,y} = FC_{oil+pitch,1-5,BL,y} - FC_{pitch,1-5,BL,y}, \quad \text{(D.1-3)}$$

where $FC_{oil+pitch,1-5,BL,y}$ is the consumption of fuel oil and pitch mixture by the boilers 1-5 under the baseline during the year *y* (calculated by formulae D.1-5), GJ;

$FC_{pitch,1-5,BL,y}$ is the consumption of pitch by the boilers 1-5 under the baseline during the year *y* (calculated by formulae D.1-4), GJ.

Consumption of pitch under the baseline is equal to the consumption of pitch under the project by the boilers influenced by project (boilers 7 and 8-10), therefore:

$$FC_{pitch,1-5,BL,y} = FC_{pitch,7,PJ,y} + FC_{oil+pitch,8-10,PJ,y} * \varpi_{pitch,PJ,y}, \quad \text{(D.1-4)}$$

where $FC_{pitch,7,PJ,y}$ is the quantity of pitch (by heat) combusted under the project in the Boiler No.7 (calculated by formulae D.1-9), GJ;

$FC_{oil+pitch,8-10,PJ,y}$ is the quantity of fuel oil with pitch (by heat) combusted under the project in the boilers 8-10 (calculated by formulae D.1-13), GJ;

$\varpi_{pitch,PJ,y}$ is a share of pitch in the fossil fuels mixture by heat under the project (calculated by formulae D.1-15).

$$FC_{oil+pitch,1-5,BL,y} = \frac{FC_{BWW,1-5,BL,y}}{1-0.79} \times 0.79 \qquad \text{(D.1-5)}$$

where $FC_{BWW,1-5,BL,y}$ is the BWW consumption in boilers 1-5 under the baseline, GJ, assumed equal to BWW combusted in Boiler No.7 under the project:

$$FC_{BWW,1-5,BL,y} = FC_{BWW,7,PJ,y}, \qquad \text{(D.1-6)}$$

where $FC_{BWW,7,PJ,y}$ is the BWW combusted in Boiler No.7 under the project (calculated by formulae D.1-7), GJ,

$$FC_{BWW,7,PJ,y} = \frac{(HG_{7,PJ,y} - (FC_{oil,7,PJ,y} + FC_{pitch,7,PJ,y}) \cdot \eta_{oil,7})}{\eta_{BWW,7}}, \qquad \text{(D.1-7)}$$

where $HG_{7,PJ,y}$ is the heat production by Boiler No.7 under the project, GJ (monitored parameter);

$FC_{oil,7,PJ,y}$ is the quantity of fuel oil combusted in Boiler No.7 under the project (calculated by formulae D.1-8), GJ;

$FC_{pitch,7,PJ,y}$ is the quantity of pitch combusted in Boiler No.7 under the project (calculated by formulae D.1-9), GJ;

$\eta_{BWW,7}$ is the efficiency of BWW combustion in Boiler No.7 (monitored parameter);

$\eta_{oil,7}$ is the efficiency of fuel oil combustion in Boiler No.7 (monitored parameter).

$$FC_{oil,7,PJ,y} = FC^{m}_{oil,7,PJ,y} \cdot NCV_{oil}, \qquad \text{(D.1-8)}$$

where $FC^{m}_{oil,7,PJ,y}$ is the mass of fuel oil combusted in Boiler No.7 (calculated by formulae D.1-12), t;

$NCV_{oil,y}$ is the net calorific value of fuel oil, GJ/t (monitored parameter).

$$FC_{pitch,7,PJ,y} = FC^{m}_{pitch,7,PJ,y} \cdot NCV_{pitch}, \qquad \text{(D.1-9)}$$

where $FC^{m}_{pitch,7,PJ,y}$ is the mass of pitch combusted in Boiler No.7 (calculated by formulae D.1-10), t;

$NCV_{pitch,y}$ is the net calorific value of pitch, GJ/t (monitored parameter).

Considering that pitch is distributed proportionally between boilers according to the fuel oil consumed, $FC^{m}_{pitch,7,PJ,y}$ is calculated as follows:

$$FC^{m}_{pitch,7,PJ,y} = FC^{m}_{oil+pitch,7,PJ,y} \cdot \varpi^{m}{}_{pitch,PJ,y}, \qquad \text{(D.1-10)}$$

where $FC^{m}_{oil+pitch,7,PJ,y}$ is the mass of fuel oil and pitch mixture consumed by the boiler No.7 under the project (monitored parameter), t.

$\varpi^{m}{}_{pitch,PJ,y}$ is a share of pitch in the fossil fuels mixture by mass under the project (calculated by formulae D.1-11).

$\varpi^{m}{}_{pitch,PJ,y}$ is calculated as: $\varpi^{m}{}_{pitch,PJ,y} = \frac{FC^{m}_{pitch,PJ,y}}{FC^{m}_{oil+pitch,PJ,y}}$, (D.1-11)

where $FC^{m}_{pitch,PJ,y}$ is the mass of pitch combusted in the boiler house under the project (monitored parameter), t;

$FC^{m}_{oil+pitch,PJ,y}$ is the total mass of fuel oil and pitch mix burned in the boiler house under the project (monitored parameter), t.

$$FC^{m}_{oil,7,PJ,y} = FC^{m}_{oil+pitch,7,PJ,y} - FC^{m}_{pitch,7,PJ,y}, \quad (D.1\text{-}12)$$

where $FC^{m}_{oil+pitch,7,PJ,y}$ is the mass of fuel oil and pitch mixture consumed by the boiler No.7 (monitored parameter), t;

$FC^{m}_{pitch,7,PJ,y}$ mass of pitch combusted in Boiler No.7 under the project (calculated by formulae D.1-10), t.

$$FC_{oil+pitch,8-10,PJ,y} = \frac{HG_{BL,y} - HG_{7,PJ,y}}{\eta_{oil,8-10}}, \quad (D.1\text{-}13)$$

where $HG_{7,PJ,y}$ is the heat production by Boiler No.7 under the project (monitored parameter), GJ.

$HG_{BL,y}$ is the heat generated by the boilers 1-5 under the baseline due to combustion of the same amount of BWW as in boiler No.7 under the project and necessary amount of fuel oil and pitch mixture (calculated by formulae D.1-16), GJ;

$\eta_{oil,8-10}$ is the efficiency of fuel oil and pitch combustion in boilers 8-10 (calculated *ex-post* by formulae D.1-17).

$$FC_{oil,8-10,PJ,y} = FC_{oil+pitch,8-10,PJ,y} * (1 - \varpi_{pitch,PJ,y}), \quad (D.1\text{-}14)$$

where $FC_{oil+pitch,8-10,PJ,y}$ is the fuel oil with pitch combustion by boilers 8-10 under the project (calculated by formulae D.1-13), GJ.

$\varpi_{pitch,PJ,y}$ is a share of pitch in the fossil fuels mixture by heat under the project (calculated by formulae D.1-15).

$$\varpi_{pitch,PJ,y} = \frac{FC^{m}_{pitch,PJ,y} * NCV_{pitch,y}}{(FC^{m}_{oil+pitch,PJ,y} - FC^{m}_{pitch,PJ,y}) * NCV_{oil,y} + FC^{m}_{pitch,PJ,y} * NCV_{pitch,y}}, \quad \text{(D.1-15)}$$

where $FC^{m}_{pitch,PJ,y}$ is the mass of pitch combusted in the boiler house under the project (monitored parameter), t;

$FC^{m}_{oil+pitch,PJ,y}$ is the total mass of fuel oil and pitch mix burned in the boiler house under the project (monitored parameter), t;

$NCV_{oil,y}$ is the net calorific value of fuel oil (monitored parameter), GJ/t;

$NCV_{pitch,y}$ is the net calorific value of pitch (monitored parameter), GJ/t.

$$HG_{BL,y} = HG_{1-5,BL,y} = FC_{BWW,1-5,BL,y} \times \eta_{BWW,1-5} + FC_{oil+pitch,1-5,BL,y} \times \eta_{oil,1-5}, \quad \text{(D.1-16)}$$

where $FC_{BWW,1-5,BL,y}$ is the amount of BWW combusted in boilers No.1-5 under the baseline during the year *y* (calculated by the formulae D.1-6), GJ;

$FC_{oil+pitch,1-5,BL,y}$ is the amount of fuel oil and pitch mixture combusted in Boilers No.1-5 under the baseline during the year *y* (calculated by the formulae D.1-5), GJ;

$\eta_{BWW,1-5}$ is the efficiency of BWW combustion in boilers 1-5 (monitored parameter);

$\eta_{oil,1-5}$ is the efficiency of fuel oil combustion in boilers 1-5 (monitored parameter).

$$\eta_{8-10} = \frac{HG_{8-10,PJ,y}}{FC^{m}_{oil+pitch,8-10,y} \cdot (1-\varpi_{pitch,PJ,y}) \cdot NCV_{oil,y} + FC^{m}_{oil+pitch,8-10,y} * \varpi_{pitch,PJ,y} * NCV_{pitch,y}}, \quad \text{(D.1-17)}$$

where $HG_{8-10,PJ,y}$ is the heat production by Boilers No.8-10 under the project (monitored parameter), GJ;

$FC^{m}_{oil+pitch,8-10,PJ,y}$ is the mass of fuel oil and pitch combusted in Boilers No.8-10 (monitored parameter), t;

$NCV_{oil,y}$ is the net calorific value of fuel oil, GJ/t (monitored parameter);

$NCV_{pitch,y}$ is the net calorific value of pitch, GJ/t (monitored parameter).

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

As shown in Section E.2 all leakages can be neglected.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This Option is not applicable for the monitoring of the project.

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

This Option is not applicable for the monitoring of the project.

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):

GHG emission reductions during the year *y*, t CO_2e:

$$ER_y = BE_y - PE_y ,\qquad (D.1\text{-}25)$$

where PE_y is the project emissions of GHG, t $CO_{2\,e.}$. See Section D.1.1.2;

BE_y is the baseline emissions of GHG, t $CO_{2\,e.}$. See Section D.1.1.4.

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 enterprise has a dedicated environmental department. The activities of the environmental department are governed by the current law, orders and decrees of the Director General, and by the instructions of the state environmental supervision agency, the Committee for Natural Resources in the Republic of Karelia. The Department has well-qualified personnel able to ensure proper industrial environmental monitoring under the project.

The department is responsible for monitoring of:

- Gas-dust emissions;

- Quality of discharged and river water;
- Utilization, storage, transportation and disposal of production residuals.

During the project implementation the analytical control over various kinds of environmental impacts will be exercised according to the existing procedures and schedule, as it is done at the moment. The data acquired by the analytical laboratory are processed and filed into monthly and yearly reports, which contain all necessary detailed information, including data by production sites, covered by the project.

The company reports in compliance with the following official annual statistical forms:

– 2-tp (air) *Data on the atmosphere air protection*, including the information on the amount of the collected and neutralized atmospheric pollutants, detailed emissions of specific contaminants, number of emission sources, measures for reduction of emissions into the atmosphere and emissions from separate groups of contamination sources (prepared according to the resolution of the Russian State Statistical Committee dd. July 27th of 2001 # 53 "On the establishment of the statistical tools for the arrangement of statistical monitoring over the environment and agriculture ");

– 2-tp (water management) *Data on the water usage*, including the information on the water consumption from natural sources, discharge of waste water and content of contaminants in the water, capacity of water treatment facilities etc. (prepared according to the resolution of the Russian State Statistical Committee dd. November 13th of 2000 # 110 "On the establishment of statistical tools for the arrangement by the MNR of Russia of the statistical monitoring over the mineral reserves, geologic exploration operations and their funding, use of water and the accrued payments for environmental contamination");

– 2-tp (wastes) *Data on the generation, use, neutralization, transportation and emplacement of production and consumption wastes*, including the annual balance of the wastes management separately for their types and hazard classes (prepared according to the resolution of the Russian State Statistical Committee dd. January 17th of 2005 #1 "The order of filling out and submission of the form of federal statistical monitoring N 2-TP (wastes)).

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 D1.2.1 ID 1,2,3	Low	Fuel oil flow meters are installed at the boilers: • No. 4, 5, 9 – primary detectors of DM type (differential pressure gage), model 23574, secondary instrument of KSD 3-C type, model 1020. • No. 2, 3 – primary detectors of JUMO dTRANS p02 DELTA (Germany). • No. 1,8,10 - ultrasonic flowmeter URSV Vslyot MR, of URSV – 110 type. • No. 7 - Coriolis acceleration flowmeter Promass 80, Coriolis acceleration flowmeter Promass 83. All data from the flowmeters is displayed in PIRS electronic system, where data is accumulated and daily, monthly and annual reports are delivered. Fuel oil flowmeters are calibrated regularly. Results of calibrations are recorded in the instrumentation certificates. Moreover, data of flowmeters are cross-checked with the data of level gauges of fuel-oil storage tank.
Table D.1.2.1 ID 4,9	Low	Analyzes of the net calorific value are taken place at the special accredited laboratory. The laboratory equipment is subject to regular calibration. For each batch of fuel oil a certificate is available, which states the fuel quality.
Table D.1.2.1 ID 5,6	Low	Heat meters are calibrated regularly and readings are regularly cross-checked with balance data. The results of calibration are recorded in the instrumentation certificates. All heat production data is displayed in PIRS electronic system, where data is accumulated and daily, monthly and annual reports are delivered.
Table D.1.2.1 ID 7	Low	The volume of pitch is measured by tanks with definite volume and measuring rod.
Table D.1.2.1 ID 8,9,10,11	Low	The data are obtained by testing of the boilers and included into parameters charts
Table D.1.2.1 ID 12	Low	The efficiency is calculated using high accuracy measured parameters
Table D.1.2.1 ID 13	Low	IPCC data can be considered reliable

Calibration.

Calibration and adjustment of the measuring equipment are undertaken by SPPM's metrological service with help of a specialized contractor licensed for the relevant activity in compliance with the federal law "On measuring uniformity". Any possible uncertainty is evaluated and the data are validated by the Metrological engineer based on the passport accuracy for each metering device (please see table D.2-1).

The devices are calibrated in compliance with the schedule designed by the metrological service of SPPM.

Data archiving.

All data required for the monitoring are collected daily, i.e. independent of the JI project component.

The maintenance personnel daily collect and record the data in compliance with internal rules and instructions.

According to paragraph 37 of Decision 9/CMP.1, the data collected and required for determination should be stored for no less than two years after the last project transfer of the emission reduction units (ERUs). The data will be archived electronically and on paper.

Emergency.

All emergencies that would be taken place inside project boundary will be registered by a special service for industrial control in compliance with established procedures. Information about large emergencies will be included into the monitoring report.

If the main metering devices fail, and there are no reserve metering devices available, the monitoring report will use indirect data and evidence, but only if their applicability (data and evidence) is justifiably proved. Likely, a conservative approach will be used.

Table D.2-1. Accuracy of the measurement of monitoring parameters

Parameter	Meter	Accuracy rating	Measurement range	Calibrating period	Notes
Steam production	Steam meter for boilers N 1-5	0.5	0-100 t/h	yearly	No standards are regulating measurement of this parameter.
	Steam meter for boilers N 7	0.5	0-125 t/h	yearly	No standards are regulating measurement of this parameter.
	Steam meter for boilers N 8-10	1.0	0-80 t/h	yearly	No standards are regulating measurement of this parameter.
Fuel oil consumption	Fuel oil flow meter for steam boilers N 1-5	0.5-1.5	0.5-8.0 m^3/h	yearly	No standards are regulating measurement of this parameter.
	Fuel oil flow meter for steam boiler N 7	0.1	3.7-15 t/h	quadrennial	No standards are regulating measurement of this parameter.
	Fuel oil flow meter for steam boilers N 8-10	1.5	0.1-12.0 m^3/sec	yearly	No standards are regulating measurement of this parameter.

Parameter	Meter	Accuracy rating	Measurement range	Calibrating period	Notes
Pitch mass	Measuring rod and tank with definite fixed volume	no data are available	no data are available	biannual	No standards are regulating measurement of this parameter.
NCV of fuel oil	Supplier's equipment	no data are available	no data are available	no data are available	GOST 21261-91
NCV of pitch	External laboratory instrumentation	no data are available	no data are available	no data are available	GOST 147-95

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

The input data for monitoring will be provided by the Environmental Department, the Department of Chief Power Engineer and Production and Technical Department.

The management of Segezha PPM is responsible for:

- normal operation of the equipment;
- timely calibration and proper maintenance of instrumentation;
- collection of all required data for calculation of GHG emission reductions under the project;
- collection of all required data on the environmental impact of the project;
- arranging and conducting training for the mill's personnel regarding collection of data required for the GHG emissions monitoring under the project.

All personnel of the boiler department have undergone certification in compliance with the requirements of Russian Technical Inspection. Furthermore, the personnel underwent training as per their job content within the framework of the contract with the supplier FOSTER WHEELER ENERGIA OY equipment in conjunction with commissioning of Boiler No.7.

Specialist of Camco Carbon Russia Limited on the basis of the provided data shall calculate GHG emission reductions and draw up a monitoring report at the end of each reporting year. In case of any doubt regarding the accuracy of the input data, those are checked and revised by the specialists of Segezha PPM. The preliminary version of the monitoring report is submitted to the management of Segezha PPM for review. In case any mistakes are identified, specialists of Camco Carbon Russia Limited correct the report accordingly. The final version of the report is submitted for verification to the accredited independent entity.

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

The monitoring plan was developed by Camco Carbon Russia Limited.

E-mail: project.participant.ru@camcoglobal.com

Camco Carbon Russia Limited is a project participant listed in Annex 1.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The project emissions of GHG, t CO_2:

The total project emissions of GHG during the year *y*, t CO_2:

$$PE_y = PE_{oil,y},$$ (E.1-1)

where $PE_{oil,y}$ is the project emission of CO_2 due to fuel oil combustion in CHPP-1 during the year *y*, t CO_2;

$$PE_{oil,y} = FC_{oil,PJ,y} \times EF_{CO2,oil} \times 10^{-3},$$ (E.1-2)

where $FC_{oil,PJ,y}$ is the amount of fuel oil combustion in CHPP-1 under the project during the year *y*, GJ. See Section B.1, Table B.1-6;

$EF_{CO2,oil}$ is the CO_2 emission factor for fuel oil combustion, kg CO_2/GJ. According to IPCC[4] $EF_{CO2,oil}$=77.4 kg CO_2/GJ.

Table E.1-1. Estimated project emissions of GHG

Year	Estimated project emissions of GHG, t CO_2 equivalent
2008	273 528
2009	273 528
2010	273 528
2011	273 528
2012	273 528
Total estimated emissions over the crediting period	1 367 640

E.2. Estimated leakage:

GHG emissions due to BWW transportation to Segezha PPM from external suppliers

Initial data for calculations:

Average distance to and from supplier, km

According to the information from the SPPM there are two external suppliers of BWW –"Saw Mill Segezhskiy" (SM) (6 km apart) and "Forestry facility of Medvezhegorsk" (FFM) (110 km apart). Therefore, km_{SM} =**12 km** and $km_{FFM.}$ **= 220 km.**

Annual volume of BWW delivered to the SPPM $FC_{BWW,y}$.

Maximum possible volume of BWW which can be delivered to the SPPM can be estimated as difference between maximum expected BWW consumption (see Table below) and the least expected volume of BWW production at the SPPM (that is expected in 2009 and equals 125 301 t/y). This approach is conservative because does not count BWW supplied to SPPM under the baseline scenario.

[4] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy, Table 1.4

BWW balance

The type of BWW	Unit	Year				
		2008	2009	2010	2011	2012
BWW generated at the mill	t	127 582	125 301	125 317	125 317	125 317
BWW purchased from outside	t	37 046	37 046	37 046	37 046	37 046
Total	t	164 628	162 346	162 363	162 363	162 363

Ratio between volumes purchased from both suppliers is about 1:4 - i.e. 25% arrives from FFM and 75% arrives from SM (see table below).

	2007	**2008**	**2009 (first six months)**
BWW from SM, t	10 457	11 154	1 191
BWW from FFM, t	0	2 686	304
Ratio between FFM/SM	0	0.24	0.26

Therefore:

$$FC_{BWW,SM} = (62\ 363 - 125\ 301) \times 0.75 = \mathbf{27\ 796.5\ t/yr} \qquad \text{E.2-1}$$

$$FC_{BWW,FFM.} = (62\ 363 - 125\ 301) \times 0.25 = \mathbf{9\ 265.5\ t/yr} \qquad \text{E.2-2}$$

Average truck load G_{BWW}.

BWW is delivered by trucks MAZ-551 and Scania-113 with maximum load about 20 t and 30 t accordingly. Nevertheless, following conservative approach PP will use this value equal to 20 t. Therefore, G_{BWW} = **20 t.**

Diesel consumption for both trucks MAZ-551 and Scania-113 are equal[5] to 42 l/100 km and 16 l/100 km correspondingly. Following conservative approach we assume FR_D to be equal to **42 l/100 km.**

Emission factor EF_D for diesel fuel is[6]– **3.2** t CO_2 /t diesel.

Average density of diesel fuel ρ_D is 850 kg/m^3 = **0.85**[7] t/m^3

Total annual run of trucks delivering BWW from each supplier can be calculated as follows:

$$km_{total,SM} = \frac{FC_{BWW,SM} \times km_{SM}}{G_{BWW}} = \frac{27\ 966.5 \times 12}{20} = \mathbf{16\ 677.9\ km} \qquad \text{E.2-3}$$

$$km_{total,FFM.} = \frac{FC_{BWW,FFM.} \times km_{FFM.}}{G_{BWW}} = \frac{9\ 265.5 \times 220}{20} = \mathbf{101\ 920.5\ km} \qquad \text{E.2-4}$$

Annual amount of diesel used for necessary amount of BWW:

---

[5] http://www.putevoi-list.ru/normi-rashoda-topliva.html

[6] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy. The number is obtained by multiplying Default CO_2 emission factors for combustion of diesel fuel (74.1 kg CO_2/TJ) (Table 1.4) to NCV of diesel fuel (43.0 TJ/Gg) (Table 1.2)

[7] http://en.wikipedia.org/wiki/Diesel

$$FC_D = \frac{(km_{total,SM} + km_{total,FFM.}) \times FR_D \times \rho_B}{100} = \quad \text{E.2-5}$$

$$= \frac{(16\ 677.9 + 101\ 920.5) \times 42 \times 0.85}{100} = 42\ 339.7\ \text{kg} = 42.3\,\text{t}$$

GHG emissions due to BWW transportation can be calculated, using the following formula:

$$L_{transport} = FC_D \times EF_D = 42.3 \times 3.2 = \mathbf{135.36}\ \text{t } CO_2\text{/yr} \quad \text{E.2-6}$$

Therefore, leakages of GHG due to BWW transportation is equal to **135.36 t CO_2/yr**

This value is less than 1% of total emissions reductions volume (56 874 t CO_2/yr). Therefore, it can be neglected and therefore assumed equal to zero

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

Since leakages are equal to zero, the sum of E.1 and E.2 equals E.1.

E.4. Estimated baseline emissions:

The baseline emissions of GHG, t CO_2:

$$BE_y = BE_{oil,y}, \quad \text{(E.4-1)}$$

where $BE_{oil,y}$ is the baseline emission of CO_2 due to fuel oil combustion in CHPP-1 during the year *y*, t CO_2;

$$BE_{oil,y} = FC_{oil,BL,y} \times EF_{CO2,oil} \times 10^{-3}, \quad \text{(E.4-2)}$$

where $FC_{oil,BL,y}$ is the amount of fuel oil combustion in CHPP-1 under the baseline during the year *y*, GJ. See Section B.1., Table B.1-6;

Table E.4-1. Estimated baseline emissions of GHG

Year	Estimated baseline emissions of GHG, t CO_2 equivalent
2008	330 402
2009	330 402
2010	330 402
2011	330 402
2012	330 402
Total estimated emissions over the crediting period	1 652 010

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

The GHG emission reductions under the project, t CO_2:

Considering that leakages were neglected, reduction of emissions is determined as the difference between the baseline and the project emissions:

$$ER_y = BE_y - PE_y. \quad \text{(E.5-1)}$$

Table E.5-1. Results of GHG emission reduction estimation

Year	Estimation of GHG emission reductions under the project, t CO_2 equivalent
2008	56 874
2009	56 874
2010	56 874
2011	56 874
2012	56 874
Total estimated emission reductions over the crediting period	284 370

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

Table E.6-1.

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakages (tones of CO_2 equivalent)	Estimated baseline emission (tones of CO_2 equivalent)	Estimated emission reductions (tones of CO_2 equivalent)
Year 2008	273 528	0	330 402	56 874
Year 2009	273 528	0	330 402	56 874
Year 2010	273 528	0	330 402	56 874
Year 2011	273 528	0	330 402	56 874
Year 2012	273 528	0	330 402	56 874
Total (tones of CO_2 equivalent)	1 367 640	0	1 652 010	284 370

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 project is approved by State Environmental Expertise Committee of the Natural Resources and Environment Protection Office of the Ministry of Natural Resources in the Republic of Karelia by the Order #588 of 27.11.03. Repeated expertise for the second stage of reconstruction is not necessary as per information from the GlavGosExpertize of RF (letter #101/01 of 25.01.2007).

Commissioning of the fluidized bed boiler will achieve:

- efficient and environmentally friendly utilization of wood wastes;
- reduced consumption of high-sulfur fuel oil of M-100 grade by 20 900 t/year and, as a result, reduced emissions of sulfur dioxide; and
- improved quality and reliability of heat supply of the Mill.

Calculation data on change of the amount of harmful substances emitted into the atmosphere under the project as regard to the baseline is given in Table F.1-1. Calculations have been made according to PD 34.02.305-98 “Method of defining gross emissions of polluting substances into the atmosphere made by CHPP boiler units”.

Table F.1-1 Change of the amount of harmful substances emitted into the atmosphere as regard to the baseline, t/year; ((+) - increase, (-) - decrease)

Pollutant name	**Total**
Suspended matter	-1.4
Sulfur oxides (SO_x)	-880.9
Nitric oxides (NO_x)	-54.9
Carbon oxide (CO)	-266.7
Total emissions	-1 203.9

Related documentation:

1. Conclusion N199 of Expert commission of state environmental expertise for the project of the boiler No.7 reconstruction.
2. Order #588 of 27.11.03 of the Natural Resources and Environment Protection Office of the Ministry of Natural Resources in the Republic of Karelia on Approval of the State Environmental Expertise Committee Conclusion.
3. Letter from GlavGosExpertize of RF #101/01 of 25.01.2007 on Conclusion of Environmental Expertise for reconstruction of the Boiler #7.

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:

The project does not have any significant impact upon the environment. Moreover, the project leads to reduction of fuel oil combustion, which means reduction of pollutant and GHG emissions into the atmosphere.

SECTION G. Stakeholders' comments

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

No comments have been received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Key factors, determining the GHG emissions

The key factors, determining the GHG emissions in baseline scenarios are:

- Burning of BWW for generation of heat energy;
- Burning of fossil fuel for generation of heat energy;
- Proportion of BWW and fuel oil to be burned.

Summary of key elements of the baseline is presented in table below:

Parameter	Data unit	Description
$HG_{BL,y}$	GJ	Heat production by boilers 1-5 under the baseline during the year *y*
D	t/h	is the maximum hourly steam output of boiler No. 7
τ_y	h/ year	is the operation time of boiler No.7
i_1, i_2	MJ/t	is the enthalpy of steam and feed water in boiler No.7 respectively
$\eta_{fuel,boiler}$	%	efficiency of fuel combustion in boilers No.1-5, 7, 8-10
$FC_{BWW,1-5,BL,y}$	GJ	is the amount of BWW fired under the baseline in boilers 1-5 during the year *y*
$FC_{oil,1-5,BL,y}$	GJ	is the amount of fuel oil fired under the baseline in boilers 1-5 during the year *y*
EF_{oil}	kg CO_2e/GJ	Fuel oil emission factor

Calculation of fuel oil/BWW proportion on the Boilers 1-5

Actual data on heat production and fuel consumption by boilers

2006											
Item	Unit	No.1	No.2	No.3	No.4	No.5	No.1-5	No.7	No.8	No.9	No.10
Heat production	Gcal	**139 634**	**224 366**	**215 068**	**196 598**	**167 886**	**943 552**		121 085	109 141	148 966
	GJ	584 648	939 420	900 490	823 156	702 939	**3 950 652**		506 983	456 973	623 721
Fuel oil consumption	t	**15 738**	**21 883**	**22 248**	**22 016**	**18 840**	**100 725**		13 737	11 784	15 755
Fuel oil based production	GJ	504 875	702 007	713 716	706 273	604 387	**3 231 258**		506 983	456 973	623 721
Pitch based production	GJ	10 182	14 157	14 393	14 243	12 188	65 163				
BWW based production	GJ						654 231				
10 months 2007											
Heat production	Gcal	**189 810**	**196 222**	**166 849**	**118 124**	**97 763**	**768 768**		47 430	36 219	108 724
	GJ	794 734	821 582	698 597	494 585	409 334	**3 218 832**		198 589	151 649	455 227
Fuel oil consumption	t	**19365**	**17607**	**15979**	**13428**	**10230**	**76 609**		4 991	4 397	10 227
Fuel oil based production	GJ	621 229	564 833	512 606	430 770	328 178	**2 457 617**		198 589	151 649	455 227
Pitch based production	GJ	64 744	58 866	53 423	44 894	34 202	256 129				
BWW based production	GJ						505 086				

Analysis of BWW and fuel oil combustion ratio in Boilers No.1-5

		2006	10 months 2007	Average
Heat produced by fuel oil and pitch	GJ	3 296 421	2 713 746	
Heat produced by BWW	GJ	654 231	505 086	
Fuel oil and pitch consumed	GJ	4 120 527	3 392 182	
BWW consumed	GJ	1 127 985	870 838	
Proportion of fuel oil and pitch mixture by fuel consumption		0.782	0.785	0.796
Average value assumed for calculations			**79.0**	%

Calculation of BWW combustion efficiency

Analysis of fuel oil and BWW combusiton efficiency in Boilers No.1-5

Efficiency of fuel and pitch oil combustion		**80%**
	2006	10 months 2007
Proportion of Pitch in total fuel	2.02%	10.42%

	2006	10 months 2007
BWW combusted, GJ	1195586.5	872027
Comb.efficiency of BWW,%	54.721	57.921
Assumed max.comb.efficiency of BWW		**58 %**

Cost analysis of project activity alternatives

Initial data for IA	
DR	12%
Depreciation rate	10.0%
Property tax	2.2%
Profit tax	24.0%

Time period		-4	-3	-2	-1	0	1	2	3
Discount factor		1.57	1.40	1.25	1.12	1.00	0.89	0.80	0.71
Year		**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Investment 1-st stage	kEUR	**6 716.70**							
Investment 1-st stage ajusted for 2006	kEUR					**10 568.86**			
Investment 2-nd stage	kEUR					**6 244.40**			
Investment	kEUR					**-16 813.26**			
Fuel oil savings	t							**18 324.35**	**18 324.35**
Fuel oil price	EUR/t							**192.44**	**192.44**
Fuel oil costs savings	kEUR							**3 526.34**	**3 526.34**
Book value of the asset								**4 414.35**	
Fixed assets less depreciation	kEUR							**3 972.91**	**3 531.48**
Depreciation	kEUR							**-441.43**	**-441.43**
Property tax	kEUR							**-92.26**	**-82.55**
Profit tax	kEUR							**-718.23**	**-720.57**
Dismantling works	kEUR								
Scrap metal sales	kEUR								
Cash flow	kEUR	0.00	0.00	0.00	0.00	-16 813.26	0.00	2 715.84	2 723.22
DCF	kEUR	0.00	0.00	0.00	0.00	-16 813.26	0.00	2 165.05	1 938.34
NPV	***kEUR***	***-3 051.50***							
IRR		**8.14%**							

Time period		4	5	6	7	8	9	10	11
Discount factor		0.64	0.57	0.51	0.45	0.40	0.36	0.32	0.29
Year		**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Investment 1-st stage	kEUR								
Investment 1-st stage ajusted for 2006	kEUR								
Investment 2-nd stage	kEUR								
Investment	kEUR								
Fuel oil savings	t	**18 324.35**	**18 324.35**	**18 324.35**	**18 324.35**	**18 324.35**	**18 324.35**	**18 324.35**	**18 324.35**
Fuel oil price	EUR/t	**192.44**	**192.44**	**192.44**	**192.44**	**192.44**	**192.44**	**192.44**	**192.44**
Fuel oil costs savings	kEUR	**3 526.34**	**3 526.34**	**3 526.34**	**3 526.34**	**3 526.34**	**3 526.34**	**3 526.34**	**3 526.34**
Book value of the asset									
Fixed assets less depreciation	kEUR	**3 090.04**	**2 648.61**	**2 207.17**	**1 765.74**	**1 324.30**	**882.87**	**441.43**	**-0.00**
Depreciation	kEUR	**-441.43**	**-441.43**	**-441.43**	**-441.43**	**-441.43**	**-441.43**	**-441.43**	**-441.43**
Property tax	kEUR	**-72.84**	**-63.13**	**-53.41**	**-43.70**	**-33.99**	**-24.28**	**-14.57**	**-4.86**
Profit tax	kEUR	**-722.90**	**-725.23**	**-727.56**	**-729.89**	**-732.22**	**-734.55**	**-736.88**	**-739.21**
Dismantling works	kEUR								**-358.58**
Scrap metal sales	kEUR								**105.62**
Cash flow	kEUR	2 730.61	2 737.99	2 745.37	2 752.75	2 760.13	2 767.51	2 774.89	2 529.31
DCF	kEUR	1 735.35	1 553.61	1 390.89	1 245.20	1 114.77	997.99	893.44	727.12
NPV	***kEUR***								
IRR									

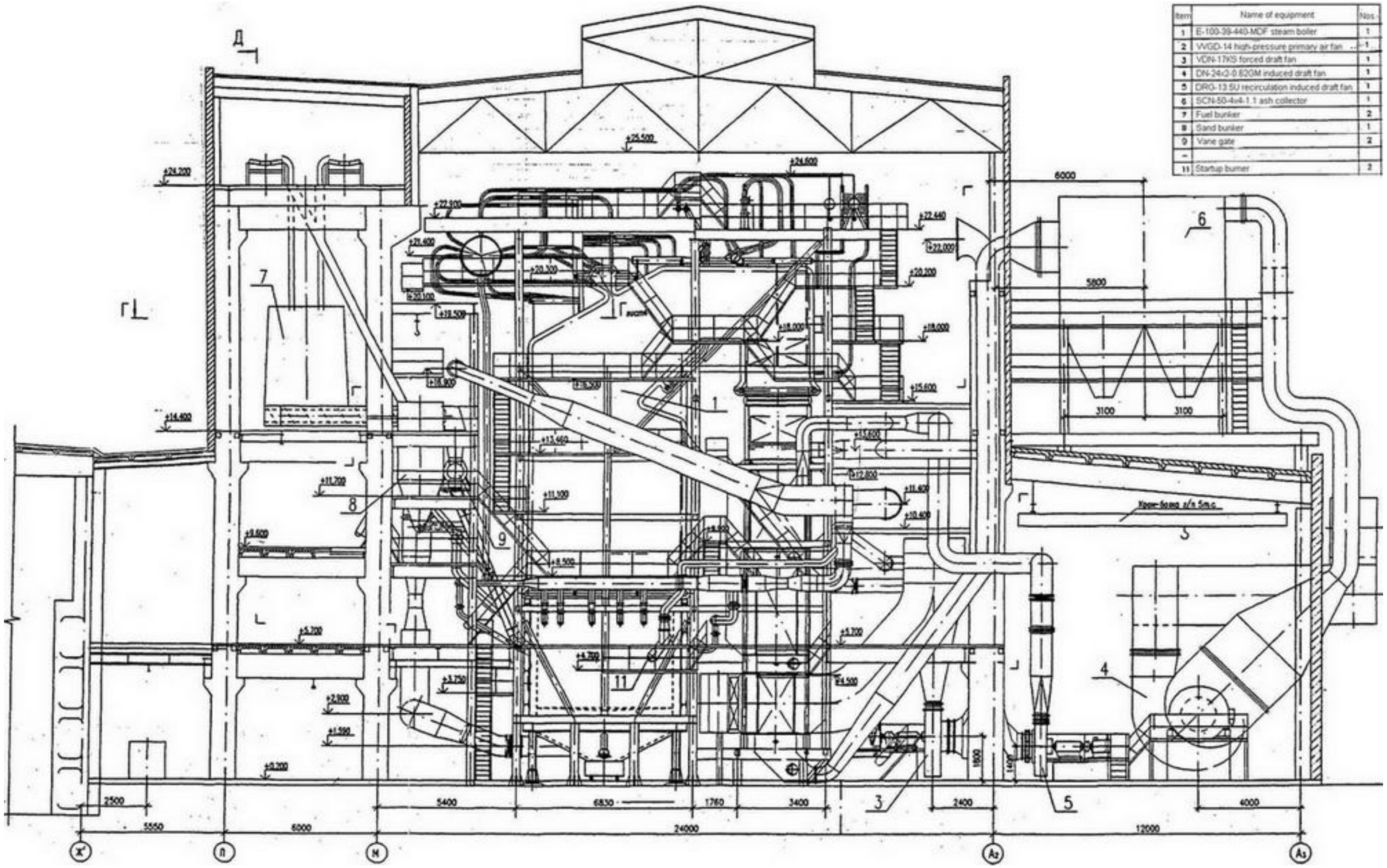
Annex 3

MONITORING PLAN

See Section D.

Annex 4

TECHNOLOGICAL SCHEMES AND FIGURES



Item	Name of equipment	Nos.
1	E-100-39-440-MDF steam boiler	1
2	VVGD-14 high-pressure primary air fan	1
3	VDN-17KS forced draft fan	1
4	DN-24x2-0.62GM induced draft fan	1
5	DRG-13.5U recirculation induced draft fan	1
6	SCN-50-4x4-1.1 ash collector	1
7	Fuel bunker	2
8	Sand bunker	1
9	Vane gate	2
–		
11	Startup burner	2

Figure 1. Arrangement of EEE-BKZ -100-3.9-440MDF boiler

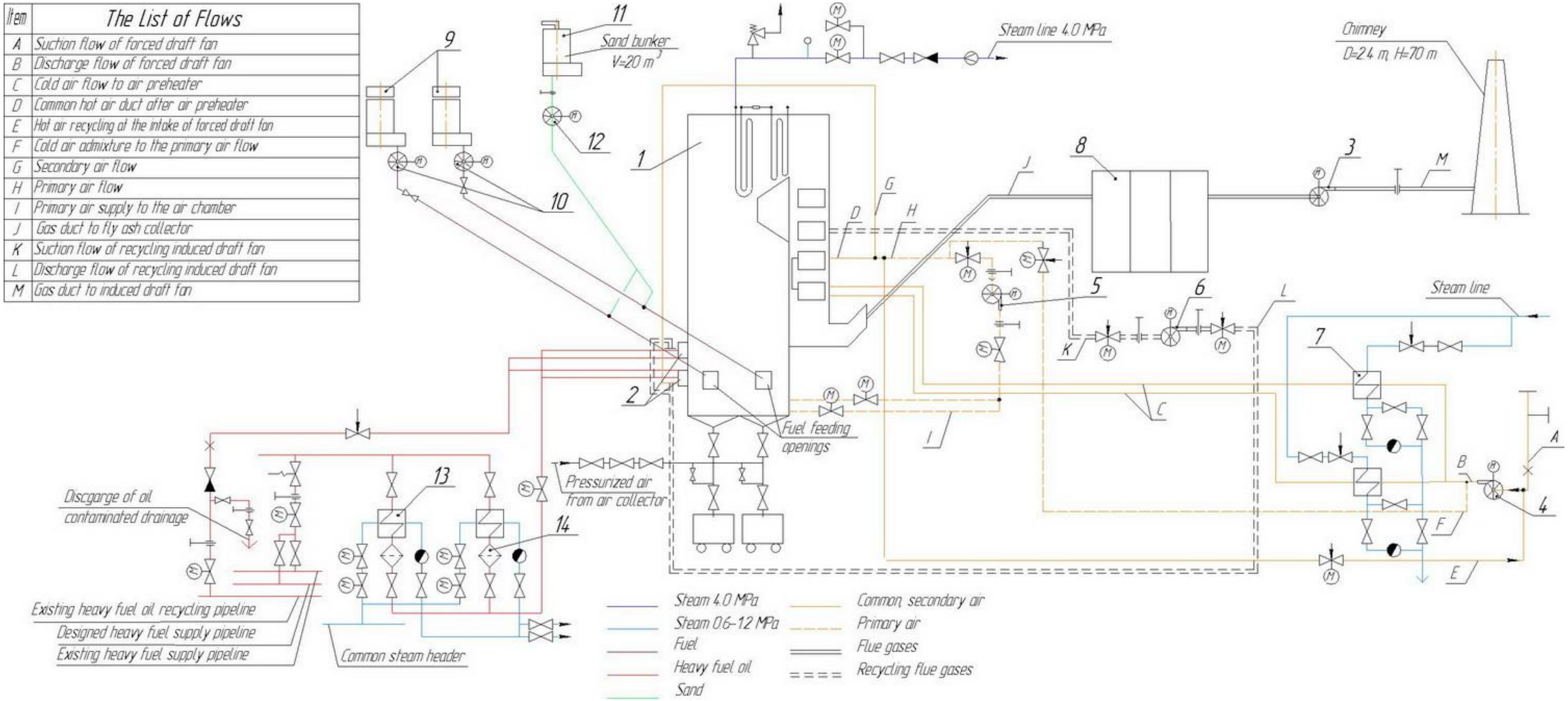


Figure 2. Process flow scheme of EEE-BKZ-100-3.9-440MDF boiler

1 – E-100-39-440-MDF (EEE-BKZ-100-3.9-440MDF) steam boiler; 2 – lighting-up burners; 3 –DN-24x2-0.62GM induced draft fan; 4 –VDN-17KS forced draft fan; 5 – VVGD-14 high-pressure primary air fan; 6 – DRG-13.5U recirculation induced draft fan; 7 – SO-110 air heater; 8 – SCN-50-4x4-1.1 ash collector; 9 –fuel bunker, V=20 m^3 ; 10 – smooth control screw of fuel bunker with 10…60 m^3/h throughput; 11 – sand bunker, V=20 m^3; 12 – sand bunker screw with 3 m^3/h throughput; 13 –fuel oil heater; 14 –fuel oil filter.

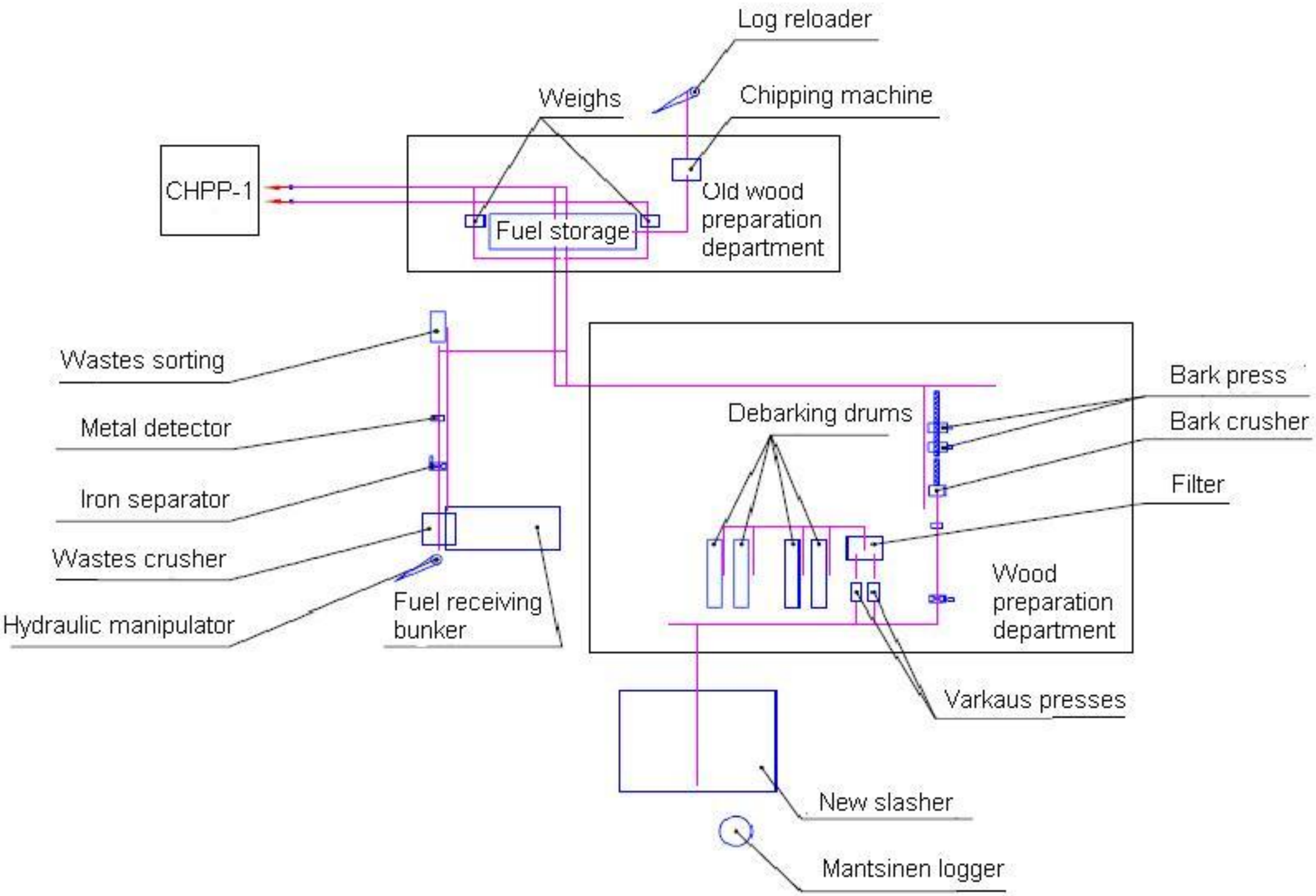


Figure 3. The scheme of wood fuel flow to CHPP-1