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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

BTI Biomass Waste-to-Energy Project, Latvia
Report version number: 1.0
Date: 10 May 2007

A.2. Description of the project:

Purpose of the project

The project is aimed at bark and wood waste (BWW) use as a fuel for generating heat. It will allow to reduce consumption of fossil fuel and to reduce GHG emissions into the atmosphere.

Concept of the project

The project is implemented at the LSEZ „Baltic Timber Industries" SIA (BTI), Liepaja, Latvia.

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

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

The project implies implementation of the following engineering solutions:

1. Installation of the new boiler for bark and wood waste combustion and the accompanying auxiliary equipment (2006).

2. Installation of the gas boiler as the reserve source of heat supply (2006).

The boilers were installed in the building of the boiler house that was earlier owned by the engineering company "Hydrolat".

Heat energy supplied by the boiler house covers technological and heating needs of the enterprise.

Expected results of the project:

- Reducing natural gas consumption by 2 835 thousand m^3 per year at the existing Liepaja CHP plant;
- Reducing CO_2 emissions resulting from burning natural gas;
- Possible revenues from sale of Emission Reduction Units (ERU) of greenhouse gases (GHG);
- Increasing working places.

Implementation schedule and costs of the project

The boilers were assembled in January-May 2006 and now the project already represents real development of events and results in physical GHG emission reductions.

The total investments amounted to 1 million US dollars.

Grounds for the project implementation

BTI has all the required permits and licenses for carrying out its current activities and the project implementation, which are executed in accordance with legislation of the Latvia.

The technological processes to be implemented in the project meet the world state-of-art standards accepted in the industry. All the technological parameters meet the environment protection normative requirements.

The project implementation will result in substantial reduction of the fossil fuel consumption and in reduction of greenhouse gas (GHG) emissions.

The project implementation is related to overcoming a whole range of serious technological and financial barriers. The decision of implementation of the project was largely made with taking into account potential possibility to cover investment costs and offset risks owing to ERUs selling within the mechanisms provided by the Kyoto Protocol.

The management of LSEZ „Baltic Timber Industries" SIA signed Carbon Asset Development Agreement (CADA) with CAMCO International on November 1st 2005 before the project implementation. This very Agreement that allowed receiving revenues from emission reductions sale become the governing factor for implementation of project on enterprise heat supply based on biomass waste burning.

On February 7th 2006, Latvia's Cabinet of Ministers approved the "Regulations on UNO Framework Convention on Climate Change".

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: Latvia (host Party)	Legal entity A1: Private Company LSEZ „Baltic Timber Industries" SIA	No
Party B: EU countries	Legal entity B1: Private company "Camco International GmbH"	No

LSEZ „Baltic Timber Industries" SIA was founded on June 2nd 2005. The company has installed new US manufactured equipment and plans to employ 150 employees, including qualified wood processing specialists as well as machine operators and other low qualification workers. The company has just received the status of a free economic zone enterprise.

BTI's main activities are:
1. Production of finished wood products for the international market;
2. Services, such as kiln drying, logs sawing and material surfacing, to the local market.

BTI is a brand new company, but the principals of the company have a combined experience in the wood-working industry of 20 years.

Fig. A.3-1. Warehouse of finished production

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

A.4. Technical description of the project:

A.4.1. Location of the project:

The project activity is located at the LSEZ „Baltic Timber Industries" SIA, Liepaja. Latvia.

A.4.1.1. Host Party(ies):

Latvia

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

Liepaja district

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

City of Liepaja

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

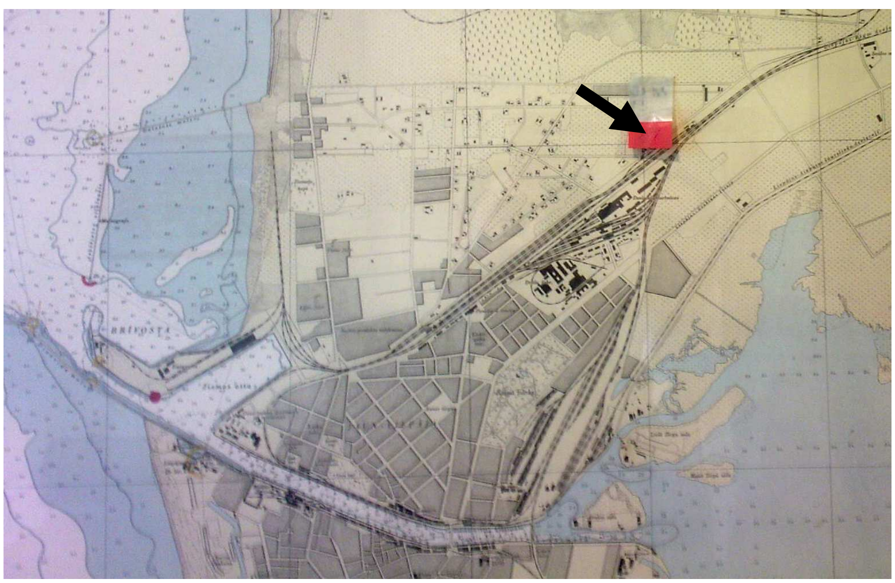

Fig. A.4-2. Location of BTI at the map of Liepaja

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

Liepaja is the third largest city of Latvia situated in the west of the country on the east coast of the Baltic Sea. Liepaja is located 200 km far from Riga and 50 km far from the border with Lithuania.

Position data: geographic latitude: 56°33'N, geographic longitude: 21°1'E.
Time zone: GMT +2:00

The population of Liepaja is 98 thousand.

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

The project stipulates installation of WEISS – Dreizugkessel Type DB-5000-OV-D boiler working on BWW with the capacity of 5.2 MW that generates saturated steam with the pressure of 10 Bar. Steam capacity is 8 t/h. The boiler has been installed in the existing building of the old boiler house. The boiler unit is equipped with furnace chamber with a tilt-and-shearing grate, the boiler, water economizer, cyclone cell systems as an ash collector as well as with automatic storehouse for feeding fuel into the boiler house. (Fig. A.4-3, A.4-4, A.4-5).

The gas boiler CKD Ducla with the capacity of 4.25 MW that also generates saturated steam was installed as the reserve source of heat (to be switched on in case of emergency) (Fig. A.4-6). The steam capacity of the boiler is 6 t/h, the steam pressure is 14 Bar.

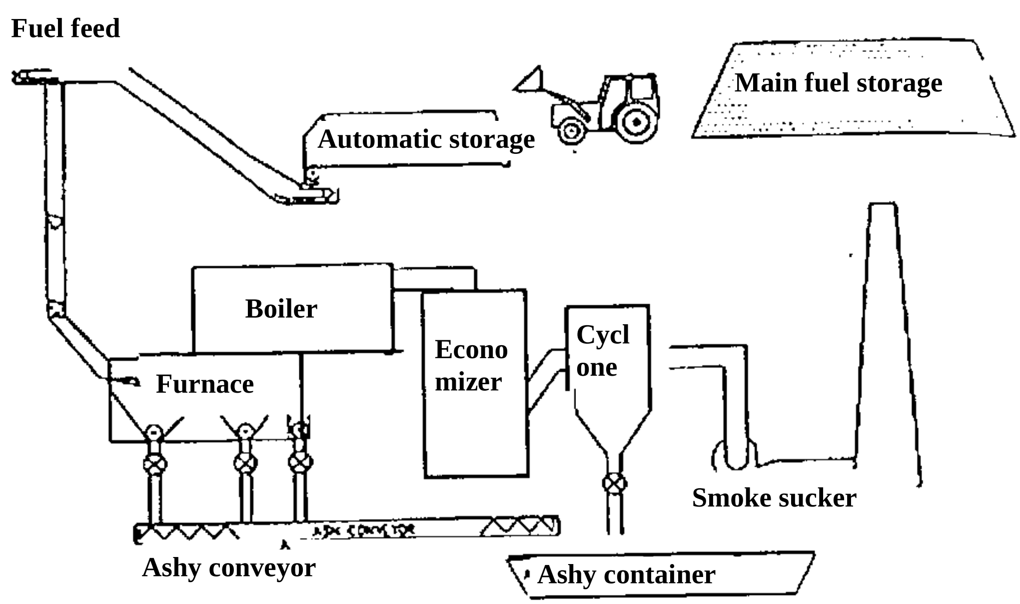

Fig. A.4-3. The scheme of the boiler house

Fig. A.4-4. WEISS – Dreizugkessel Type DB-5000-OV-D boiler working on BWW

Fig. A.4-5. The automatic storehouse of BWW

Fig. A.4-6. Gas boiler CKD Ducla

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:

Fossil fuel combustion results in considerable GHG emissions. CO_2 is the main greenhouse gas from fossil fuel combustion. N_2O and CH_4 emissions from combustion are not considered, as these emissions are negligibly low, compared to emissions of CO_2. CO_2 emissions from burning biomass are climatically neutral and, therefore, are assumed to be equal to zero.

Liepaja CHP plant where natural gas would be additionally burnt to cover the mill's heat load is the main source of CO_2 emissions under baseline.

The project implementation provides for biomass combustion on-site of BTI with corresponding cut of natural gas consumption at Liepaja CHP plant that will result in CO_2 emission reductions.

Without the project, the specified reductions of GHG emissions would not be achieved, as:

- the enterprise could successfully operate and develop using the nearby CHP plant as the source of heat supply;
- it would have been possible to avoid additional and rather risky investments in its own boiler house.

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

Length of the crediting period	**Years**
5 years	**2008-20012**
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	5 337
2009	5 337
2010	5 337
2011	5 337
2012	5 337
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**26 684**
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	5 337

A.5. Project approval by the Parties involved:

The Parties' Approval Letters will be received later.

SECTION B. Baseline

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

The baseline was chosen based on critical analysis of alternatives of the enterprise's heat supply (see Section B.2).

The baseline has been developed on the assumption that without JI project implementation and GHG emission reductions sale the enterprise would receive heat energy from the Liepaja CHP plant working on natural gas. This scenario is not only the most probable one but also the most conservative one compared with scenarios of gas, fuel oil or coal burning in its own boiler house. The baseline scenario is the least risky and is requiring minimal investments.

While working out the baseline, the developer suggests his own approach with the use of some elements of the CDM methodologies AM0036 [R1 and ACM0009 [R2]. Everything concerning assessment of emissions is sufficiently described and justified.

Key factors which determine greenhouse emissions both in the baseline and the project scenarios are reviewed below. These factors are:

- volumes of charge stock and BWW formation;
- electricity consumption;
- heat energy consumption;
- fossil fuel burning;
- bark and wood waste burning;
- bark and wood waste dumping;
- fugitive methane emissions at natural gas production and transporting.

Let us review each factor in detail.

Volumes of charge stock and BWW formation

The enterprise plans to provide the volume of wood sawing at the level of 200 000 m^3/year for the period from 2008 to 2012. The project does not influence the above mentioned plans that is why annual volume of wood sawing is assumed constant and makes **200 000** m^3/year under the baseline and the project.

Production standards on BWW output from wood sawing are used to define the amount of generated BWW (Table B.1-1).

Table B.1-1. Calculation of volumes of BWW formation

Value name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,y}$	m^3/year	The enterprise's plan	200 000
The share of bark	$\alpha_{bark,y}$	-	Production norm	0.10
The share of sawdust	$\alpha_{sawdust,y}$	-	Production norm	0.18
Bark formation	$P_{bark,y}$	m^3/year	$P_{bark,y} = P_{saw,y} \times \alpha_{\text{bark,y}}$	20 000
Sawdust formation	$P_{sawdust,y}$	m^3/year	$P_{sawdust,y} = P_{saw,y} \times \alpha_{\text{sawdust,y}}$	36 000
BWW formation	$P_{BWW,y}$	m^3/year	$P_{BWW,y} = P_{bark,y} + P_{sawdust,y}$	56 000

As the volume of wood sawing does not change according to the enterprise's plans for the period from 2008 to 2012 and does not depend on the project the volume of BWW generated under baseline and the project scenarios does not change either and makes **56 000** m^3 per year.

Electricity consumption

Electricity is supplied from the grid. The project does not stipulate for construction of its own facilities for generating electricity.

Electricity consumption for auxiliary needs of the enterprise increases as a result of the project implementation. The results of the calculations showed (Table B.1-2) that electricity consumption for auxiliary needs of the boiler house will make 711.7 MWh/year. It will result in increase of generating electricity in grid and correspondingly in increase of GHG emissions.

However the factor of electricity consumption increase was excluded from further analysis as it is compensated by liquidation of fugitive methane leakages at natural gas production and transportation more than enough (see Section B.3).

Table B.1-2. Calculation of electricity consumption under the project

Value name	Symbol	Unit	Justification	Value
Installed heat capacity of the boiler	HG_y	MW	According to technical characteristics of the boiler	5.2
Rate of electricity consumption	SEC_{aux}	kW/MW	According to [R3]	28.8
Hours of the boiler house operation per year	T_y	hour	Production norm	7920
Load factor of the boiler	K	-	According to [R3]	0.6
Amount of consumed electricity	$EC_{aux,y}$	MWh/year	$EC_{aux,y} = HG_y \times SEC_{aux} \times T_y \times K \times 10^{-3}$	711.7

Heat energy consumption

Heat energy is used for:

1. technological needs of the sawmill;
2. heating of the sawmill;

Heat consumption for technology and heating needs does not depend on the project. However it is reasonable to review this factor as it defines absolute volumes of fuel consumption and hence of greenhouse gas emissions.

Let us define required amount of heat energy necessary for the work of the enterprise (Table B.1-3).

Table B.1-3. Calculation of heat energy consumption

Value name	Symbol	Unit	Justification	Value
Wood sawing	$P_{saw,y}$	m^3/year	The enterprise's plan	200 000
The share of wood for drying	$\beta_{dry,y}$	-	Production norm	0.544
The volume of wood for drying	$P_{dry,y}$	m^3/year	$P_{dry,y} = P_{saw,y} \times \beta_{dry,y}$	108 800
Number of working days of drying facilities	$d_{dry,y}$	days/year	Production norm	330
Number of days of heating season	$d_{winter,y}$	days/year	Climate norm [R10]	199
Summer rate of heat consumption for drying	$SHC_{dry,y}^{summer}$	GJ/m^3	Production norm	0.888
Winter rate of heat	$SHC_{dry,y}^{winter}$	GJ/m^3	Production norm	1.027

Value name	Symbol	Unit	Justification	Value
consumption for drying				
Average annual rate of heat consumption for drying	$SHC_{dry,y}$	GJ/m^3	$SHC_{dry,y} = \left(\begin{array}{l} SHC_{dry,y}^{winter} \times d_{winter,y} + \\ + SHC_{dry,y}^{summer} \times \\ \times \left(d_{dry,y} - d_{winter,y} \right) \end{array} \right) / d_{dry,y}$	0.972
Heat consumption for drying	$HC_{dry,y}$	GJ/year	$HC_{dry,y} = P_{dry,y} \times SHC_{dry,y}$	105 734
Heat consumption for heat supply of shops and administrative buildings of the enterprise	$HC_{heating,y}$	GJ/year	According to the enterprise's data	8 325
Total sawmill's heat consumption	HC_y	GJ/year	$HC_y = HC_{heating,y} + HC_{dry,y}$	114 059

As Table B.1-3 shows the required amount of heat energy makes **114 059** GJ/year. This figure is laid in baseline and project scenarios.

Fossil fuel (natural gas) consumption

Fossil fuel, in particular natural gas is used at the Liepaja CHP plant in the baseline scenario.

Natural gas can be used in the boiler house of the sawmill under the project though it can be used only in cases of emergency and for a short time. Therefore gas consumption in the boiler house is not predicted though it is subject to obligatory monitoring.

Calculations of natural gas consumption under baseline are summarized in Table B.1-4.

Table B.1-4. Calculations of natural gas consumption under baseline

Value name	Symbol	Unit	Justification	Value
Total sawmill's heat consumption	HC_y	GJ/year	See Table B.1-3	114 059
The factor of heat losses in the steam pipe line	K_{HL}	-	Assumed	0.95
Factor of heat flow at CHP plant	K_{HF}	-	Assumed	0.98
Cogeneration factor	K_{cog}	-	Assumed taking into account [R12]	0.7
Natural gas calorific value	NCV_{NG}	GJ/thousand m^3	Reference data [R5]	33.73
Efficiency factor of gas boilers	η_{NG}	-	Reference data [R6]	0.92
The share of heat for auxiliary needs of gas boilers	HA_{NG}	-	Reference data [R7]	0.025
Additional natural gas consumption at CHP plant	$FC_{NG,y}$	thousand m^3/year	$FC_{NG,y} = \frac{HC_y \ K_{cog}}{NCV_{NG} \eta_{NG} (1 - HA_{NG}) K_{HL} \ K_{HF}}$	2 835

As Table B.1-4 shows additional natural gas consumption at CHP plant under baseline would make **2 835** thousand m^3/year.

Bark and wood waste (BWW) burning

No BWW burning is stipulated according to baseline scenario. The amount of burnt BWW under the project is defined below (Table B.1-5).

Table B.1-5. Calculation of burnt BWW under the project

Value name	Symbol	Unit	Justification	Value
Total sawmill's heat consumption	HC_y	GJ/year	See Table B.1-3.	114 059
BWW net calorific value	NCV_{BWW}	GJ/t	BWW thermotechnical analysis at similar enterprise [R4]	7.3744
Efficiency factor of boilers	η_{BWW}	-	Similar boilers tests data [R4]	0.85
The share of heat for auxiliary needs	HA_{BWW}	-	Assumed	0.07
Density of BWW	ρ_{BWW}	t/m^3	Production norm	0.8
BWW consumption	$FC_{BWW,y}$	m^3/year	$FC_{BWW,y} = \dfrac{HC_y}{\eta_{BWW} \times (1 - HA_{BWW}) \times NCV_{BWW} \times \rho_{BWW}}$	24 458

As Table B.1-5 shows **24 458** m^3 of BWW will be required for complete heat supply of the enterprise.

Bark and wood waste dumping

The opportunity of bark and wood waste dumping is excluded both from the baseline and project scenarios as demand for BWW is rather high in EU countries and in Latvia in particular. In any case BWW would be used efficiently at the enterprise itself or would be sold to outside.

Fugitive methane emissions at natural gas production and transporting

Fugitive methane emissions at natural gas production and transportation existing under baseline were excluded from review as they are compensated by increase of electricity consumption from grid for auxiliary needs of the boiler house under the project line (see details in Section B.3).

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

The additionality is reviewed according to "Tool for the demonstration and assessment of additionality (Version 03)" [R11].

STEP 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

The following alternatives are identified to the project activity:

Alternative 1: Heat energy consumption from the nearby Liepaja CHP plant.

Alternative 2: Construction of its own boiler house working on natural gas.

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

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

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

Let us perform a more detailed analysis of each alternative.

Alternative 1: Heat energy consumption from the nearby Liepaja CHP plant.

The CHP plant of Liepaja works on natural gas produced at Russian fields and is located 3 km far from the BTI sawmill. Heat energy supply by CHP plant seems to be the most probable variant as its implementation requires minimal capital investments (only 3 km long steam pipeline laying is required). It is very important for the enterprise which is at the beginning of its work and for which it is more actual to invest into main production development at the formation stage.

Alternative 2: Construction of its own boiler house working on natural gas.

This alternative is unlikely as there already is nearby energy source working on natural gas (Liepaja CHP plant). Construction of its own boiler house working on natural gas would require rather large investment into equipment and where efficiency of fuel consumption is considerably lower compared to equipment of the city CHP plant working on the cogeneration principle.

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

At present fuel oil cost in Latvia is around 600 $/t or 15 $/GJ. It is the most expensive power-plant fuel. It is evident that fuel oil consumption is not reasonable from the economic point of view. Therefore this alternative was excluded from review.

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

Construction of its own boiler house working on coal is unlikely as coal combustion technology would require alienation of large territories for fuel store and ash-and-slag landfill. And it is quite problematic as the enterprise is located practically within the precincts of the city. Besides more harmful emissions into the atmosphere are produced at coal combustion compared with other kinds of fuel and from this point of view there could arise considerable difficulties of project approval by environmental bodies of Latvia. Installation of highly efficient cleaning facilities, for example, electrofilters would be required to capture ash particles that would make the project more expensive.

Based on the mentioned above we can state that construction of the boiler house working on coal would be accompanied by substantial technical and ecological barriers. The number of coal boiler houses in Latvia has considerably decreased recently.

This alternative was excluded from review.

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

This alternative has the right to exist as BWW which can be used as fuel are formed at the enterprise. However the implementation of this alternative requires construction of its own boiler house and considerable capital investments correspondingly.

This alternative can be viewed as baseline.

The preliminary analysis allowed defining two alternatives to the project scenario which could be implemented and serve as the baseline:

Alternative 1: Heat energy supply by the city CHP plant.
Alternative 5: Construction of its own boiler house working on BWW without participating in JI project.

Sub-step 1b. Consistency with mandatory laws and regulation

There are no prohibitions of Latvian legislation for implementation of the above listed alternatives.

STEP 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

The method of total (integral) capitalized cost analysis is used to compare alternative variants of the investment project.

Sub-step 2b. – Option I. Apply simple cost analysis

Calculations of capitalized costs for alternative variants were performed by the formula:

$$C_{\Sigma,BL} = I_0 + C_{ex}\frac{1-(1+E)^{-T}}{E}, \quad \text{(B.2-1)}$$

where I_0 - initial investments, euro;

E - discount rate. Assumed E =10%;

T - reporing period, we assume T= 6 years (2007-2012);

C_{ex} - operating costs, euro/year.

$$C_{ex} = C_{heat} + C_{fuel} + C_{wage} + C_{el} + C_{water} + C_{am} + C_{rep} + C_{other}, \quad \text{(B.2-2)}$$

Where C_{heat} - costs for heat energy purchase, euro/year;

C_{fuel} - costs for fuel purchase, euro/year;

C_{wage} - wage costs, euro/year;

C_{el} - electricity costs, euro/year;

C_{water} - water costs, euro/year;

C_{am} - capital allowances, euro/year;

C_{rep} - equipment repair costs, euro/year;

C_{other} - other costs, euro/year.

Calculation of discount costs for project scenario is performed by the similar formula though revenues from GHG emission reductions sale are additionally taken into account:

$$C_{\Sigma,PJ} = I_0 + C_{ex}\frac{1-(1+E)^{-T}}{E} - R_{early}\frac{1-(1+E)^{-T_{early}}}{E} - R_{main}\frac{1-(1+E)^{-T_{main}}}{E}, \quad \text{(B.2-3)}$$

Where T_{early} - period of “early” emission reductions sale, T_{early} = 1 year (2007);

T_{main} - period of “main” emission reductions sale, T_{main} = 5 years (2008-2012);

R_{early} - revenue from “early” emission reductions sale, euro/year;

$$R_{early} = ER_y \cdot P_{ERU}^{early}, \quad \text{(B.2-4)}$$

where ER_y - amount of GHG emission reductions per year *y*, т CO_2;

P_{ERU}^{early} - price of “early” emission reduction, P_{ERU}^{early} = 6 euro/t CO_2;

R_{main} - revenue from emission reductions sale during the “main” reporting period 2008-2012.

$$R_{main} = ER_y \cdot P_{ERU}^{main},$$

where P_{ERU}^{main} - price of “main” emission reductions, P_{ERU}^{main} = 15 euro/t CO_2.

The results of calculations are shown in **Table B.2-1.**

Table B.2-1. Investments, costs and integrated discount costs

Data name	Symbol	Unit	Heat supply from outside	BWW as not JI	BWW as JI
Investments	I_0	**euro**	**170 730**	**734 104**	**734 104**
Total operating costs	C_{ex}	**euro/year**	**527 877**	**496 468**	**496 468**
Including:					
costs for heat energy purchase	C_{heat}	euro/year	516 267	-	-
fuel costs	C_{fuel}	euro/year	-	188 327	188 327
wage costs	C_{wage}	euro/year	-	132 000	132 000
electricity costs	C_{el}	euro/year	-	61 127	61 127
water costs	C_{water}	euro/year	-	19 062	19 062
equipment repair costs	C_{rep}	euro/year	4 780	20 555	20 555
capital allowances	C_{am}	euro/year	6 829	29 364	29 364
other costs	C_{other}	euro/year	-	21 569	21 569
Revenues from ERU sale		euro/year	-	-	79 851
Integrated discount costs	C_{Σ}	**euro**	**2 469 771**	**2 731 724**	**2 427 507**

As Table B.2-1 shows integrated discount costs for the alternative provided for heat energy supply from the city CHP plant is 262 000 euro less compared with the alternative of construction of its own boiler house working on BWW without participation in JI project for the period 2007-2012.

As the variant of steam pipeline construction and heat purchase from the city CHP plant is characterized by lower discount costs it is most probable and is taken as baseline.

However in case of the construction of the boiler house with participation in JI project discount costs on the boiler house working on biofuel decrease compared with heat purchase from the city CHP plant. Therefore the decision to construct a boiler house working on biofuel was largely taken taking into consideration the opportunity to cover costs and compensate risks owing to the sale of achieved ERUs.

STEP 3. Barrier analysis

Investment barriers

Investment barriers include:

- high cost of equipment for BWW burning; total capital project costs made 734 000 euro with costs for delivery and customs duties taken into consideration;
- high operating costs for repair and current maintenance of equipment;
- project implementation required rather risky own investments which were quite hard to find as the enterprise was in the period of formation and large investments were required for creation and development of main production.

Technological barriers

BWW are hard-to-burn kind of fuel due to their high humidity and heterogeneous breakup. Correspondingly the technologies for their burning are more complex and expensive compared with technologies for gas or liquid fuel combustion.

High humidity of BWW causes decrease of their calorific value, adiabatic burning temperature, stability of furnace process and finally efficiency of the operation of the whole boiler unit. Compare: efficiency factor of gas boilers – 90-93%, that of BWW boilers - 50-85%.

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

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

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

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

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

Sharp variable humidity and breakup of BWW complicate the automation of burning process and make it less reliable. Therefore constant presence of operating personnel to manage possible irregularities in the operation of the boiler unit is required. It is not required for gas and fuel oil boiler houses.
Thus construction of its own boiler house working on BWW is inevitably accompanied by a number of technological barriers.

It would be reasonable to overcome the specified barriers (investment and technological) only having potential opportunity of participation in Kyoto mechanisms. The management of LSEZ „Baltic Timber Industries” SIA signed Carbon Asset Development Agreement (CADA) with CAMCO International on November 1st 2005 for this purpose. This very Agreement that allowed receiving revenues from emission reductions sale become the governing factor for implementation of project on enterprise heat supply based on biomass waste burning.

STEP 4. Common practice analysis

At present combustion of natural gas supplied from Russia is common practice for generating heat energy and electricity in Latvia. Natural gas is the most ecologically clean kind of fuel among fuels and technologies of its combustion are more simple, efficient and reliable.

The listed grounds are enough to recognize additionality of GHG emission reductions received from the project implementation with respect to the situation without the project.

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

Fig. B.3-1 and B.3-2 show the principal components and boundaries of the baseline and the project. At the same time, the diagrams show the main flows of fuel and energy.

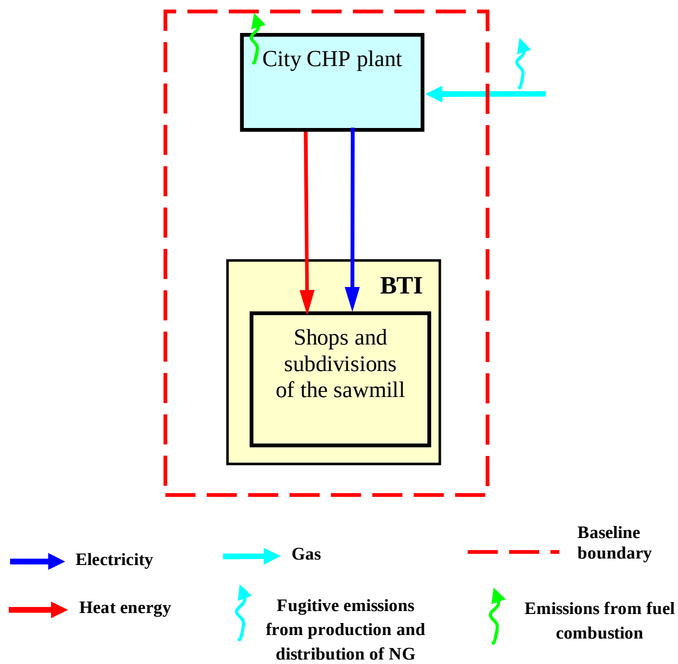

Fig. B.3-1. Principal components and boundaries of the baseline

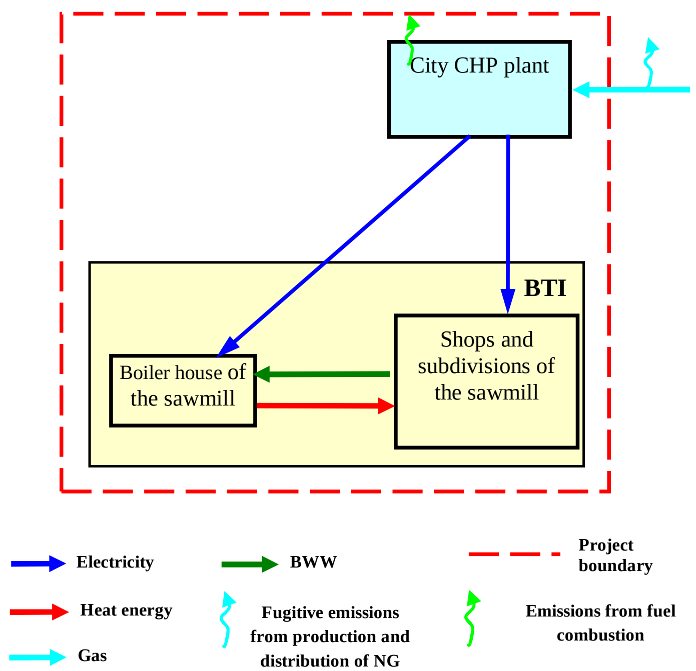

Fig. B.3-2. Principal components and boundaries of the project

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

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

	Source	Gas	Incl./ Excl.	Justification/Explanation
Baseline	City CHP plant, natural gas combustion for BTI heat supply	**CO_2**	**Incl.**	**Main source of emissions**
		CH_4	Excl.	Considered negligible. Conservative
		N_2O	Excl.	Considered negligible. Conservative
Project activity	Boiler house of the sawmill, BWW combustion	CO_2	Excl.	Assumed to be equal to zero
		CH_4	Excl.	Considered negligible
		N_2O	Excl.	Considered negligible
	Grid TPPs, fossil fuel combustion for electricity supply to BTI boiler house	CO_2	Excl.	Considered insignificant and more than twice compensated by reduction of leakages at production and transportation of natural gas
		CH_4	Excl.	Considered negligible
		N_2O	Excl.	Considered negligible
Leakages	Reduction of the amount of produced and transported natural gas	CO_2	Excl.	Considered negligible. Conservative
		CH_4	Excl.	Considered insignificant source of emissions. Conservative
		N_2O	Excl.	Considered negligible. Conservative

According to IPCC [R8] average fugitive methane emissions rate for developing countries and the countries with economy in transition has the following values (Table B.3-2):

Table B.3-2. Fugitive CH_4 emissions from Natural Gas System

Category	Sub-category	CH4	Unit of measure
Gas production	Fugitives	0.01219	$Gg/10^6\ m^3$
	Flaring	0.00000088	$Gg/10^6\ m^3$
Gas transmission	Fugitives	0.000633	$Gg/10^6\ m^3$
	Venting	0.000392	$Gg/10^6\ m^3$
Gas distribution	All	0.0018	$Gg/10^6\ m^3$
Total	-	**0.015016**	**$Gg/10^6\ m^3$**

At baseline annual natural gas consumption 2.835 10^6 m^3 fugitive methane emissions will make 2.835*0.015016=42.57 t CH_4, or 42.57×21=893.98 t CO_2-eq./year.

Increase of GHG emissions from grid power plants made 320 t CO_2/year (see Table B.3-3).

Table B.3-3. GHG emissions resulting from increase of fuel combustion at grid TPPs

Value name	Symbol	Unit	Source of data, calculation formulas	Value
Electricity consumption for auxiliary needs of the boiler house	ΔEC_{aux}	MWh/year	See Table B.1-2.	711.7
CO_2 emission factor for electricity from outside grid	$EF_{CO2,grid}$	t CO_2/MWh	According to [R9]	0.45
Increase of CO_2 emissions from fossil fuel combustion at grid TPPs	ΔE_{grid}	t CO_2/year	$\Delta E_{grid} = EC_{aux} \times EF_{CO2,grid}$	**320**

Thus the increase of GHG emission from power plants generating electricity for grid (+320 t CO_2/year) is compensated by decrease of methane fugitive emissions when producing and transporting natural gas more than enough (-894 t CO_2/year). Therefore methane fugitive emissions and GHG emissions from power plants working for grid were excluded from the further consideration that is quite a conservative decision.

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

Date of BL setting – 20 April 2007

BL was developed by Camco International (Arkhangelsk, Russia)

Contact person: Vladimir Dyachkov

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

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

January 2006 (starting of installation work).

C.2. Expected operational lifetime of the project:

25 years/300 months

C.3. Length of the crediting period:

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

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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

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

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. $FC^{v}{}_{NG,PJ,y}$	Volumetric natural gas consumption at BTI boiler house	Department of head energy engineer	thousand m^3	m	Continuously	100 %	Electronic and paper	Gas meter readings
2. $NCV_{NG,y}$	Net calorific value of natural gas	Data of fuel supplier or reference data	GJ/ thousand m^3	m, e	Quarterly	100 %	Electronic and paper	The average value is determined at the end of the year

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

$$PE_y = PE_{NG,y} \tag{D.1-1}$$

where $PE_{NG,y}$ is project CO_2 emissions from burning of natural gas over a year *y*, t CO_2;

$$PE_{NG,y} = FC^{v}{}_{NG,PJ,y} \times NCV_{NG,y} \times EF_{CO2,NG} \times 10^{-3} \tag{D.1-2}$$

where $FC^{v}{}_{NG,PJ,y}$ is volumetric natural gas consumption at BTI boiler house over a year *y*, thousand m^3;

NCV_{NG} is net calorific value for natural gas, GJ/ thousand m³;

$EF_{CO2,NG}$ is CO_2 emission factor for natural gas, kg CO_2/GJ. According to IPCC [R8] this factor is taken as constant and equal to

$EF_{CO2,NG} = 56.10 \times 0.995 = 55.82$ kg CO_2/GJ.

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3. $HG_{BWW,PJ,y}$	Heat production from BTI BWW boiler	Department of head energy engineer	GJ	m	Continuously	100 %	Electronic and paper	Heat meter readings

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

$$BE_y = BE_{NG,y}, \tag{D.1-3}$$

where $BE_{NG,y}$ is baseline CO_2 emissions from burning of natural gas over a year *y*, t CO_2;

$$BE_{NG,y} = FC_{NG,BL,y} \times EF_{CO2,NG}, \tag{D.1-4}$$

where $FC_{NG,BL,y}$ is additional natural gas consumption at the city CHP plant over a year *y*, GJ;

$$FC_{NG,BL,y} = \frac{(HG_{BWW,PJ,y} + HG_{NG,PJ,y})\, K_{cog}}{\eta_{NG}(1 - HA_{NG})K_{HL}\, K_{HF}}, \tag{D.1-5}$$

where $HG_{BWW,PJ,y}$ is heat production from the BWW boiler, GJ;

η_{NG} is efficiency factor for gas boilers. It is taken constant and equal to 0.92;

K_{HL} is factor of heat losses in the steam pipe line. It is taken constant and equal to 0.95;

K_{HF} is factor of heat flow at CHP plant. It is taken constant and equal to 0.98;

K_{cog} is cogeneration factor. It is taken constant and equal to 0.70;

HA_{NG} is the share of heat for auxiliary needs of gas boilers;

$HG_{NG,PJ,y}$ is heat production from the BTI gas boiler, GJ;

$$HG_{NG,PJ,y} = FC^{v}{}_{NG,PJ,y} \times NCV_{NG,y} \times \eta_{NG} \,. \qquad \text{(D.1-6)}$$

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

This Option is not applied to monitoring the project

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

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

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

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

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

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

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

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

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

The formula to calculate emission reduction over a year *y* is, t CO_2:

$$ER_y = BE_y - PE_y, \qquad (D.1\text{-}7)$$

No new measurements or data are needed than those indicated in D1.1.1 and D 1.1.3.

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:

Regional inspection of the Ministry of Environmental Protection and Regional Development of the Republic of Latvia performs environmental monitoring of the industrial enterprises activities.

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

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Tabl. D.1.1.1 ID 1	Low	Gas meter is regularly calibrated.
Tabl. D.1.1.1 ID 2	Low	The laboratory equipment of natural gas supplier is regularly calibrated.
Tabl. D.1.1.3 ID 3	Low	Heat meters are regularly calibrated and cross-checked with balance data.

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

Collection of information required for calculations of reductions of GHG emissions as a result of the project is performed in accordance with the procedure common for the enterprise.
Initial data will be submitted by the production manager and by the head energy engineer.

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

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

Monitoring plan was developed by "Camco International"

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

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The amount of formed BWW and the capacity of utilizing boiler are enough to cover all heat loads of the enterprise owing to BWW burning. Natural gas combustion in gas boiler is possible only in the event of breakdown of BWW boiler or in the event of substantial increase of wood sawing in excess of planed 200 000 m^3 per year (it is taken into consideration in monitoring plan). Thus gas boiler serves as a reserve source of heat supply.

However no increase of wood sawing exceeding 200 000 m^3 per year is planned under the project line and all heat energy necessary for the enterprise may be generated using BWW boiler. CO_2 emissions from this boiler are considered to be climatically neutral.

Thus GHG project emissions are assumed equal zero.

E.2. Estimated leakage:

There are no leakages under the project.

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

Since leakages can be neglected: E.1 + E.2 = E.1 = 0.

E.4. Estimated baseline emissions:

The GHG baseline emissions include CO_2 emissions from natural gas combustion at Liepaja CHP plant for heat supply of BTI.

CO_2 emissions from fuel combustion are estimated as product of fuel consumption and emission factor at its combustion.

The data on natural gas consumption in GJ for the period 2008-2012 is presented in Annex 2.1.

According to IPCC [R8] CO_2 emission factor for natural gas combustion for the whole project period is taken equal to the constant value: $EF_{CO2,NG} = 56.10 \times 0.995 = 55.82$ kg CO_2/GJ (taking into account oxidation factor).

The results of baseline GHG emissions estimation for the period till 2012 are presented in Table E.4-1.

Table E.4-1. Baseline GHG emissions, t CO_2

Value name	Reporting year					2008-2012
	2008	2009	2010	2011	2012	
GHG emissions	5 337	5 337	5 337	5 337	5 337	**26 684**

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

GHG emissions reduction is shown in Table E.5-1 (also see Annex 2.3)

Table E.5-1. GHG emission reductions, t CO_2

Value name	Reporting year					2008-2012
	2008	2009	2010	2011	2012	
GHG emission reductions	5 337	5 337	5 337	5 337	5 337	**26 684**

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

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
2008	0	0	5 337	5 337
2009	0	0	5 337	5 337
2010	0	0	5 337	5 337
2011	0	0	5 337	5 337
2012	0	0	5 337	5 337
Total (tonnes of CO_2 equivalent)	**0**	**0**	**26 684**	**26 684**

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:

BTI received all necessary approvals of state ecological expertises before the project implementation.

Project implementation allows using BWW as fuel and cut natural gas combustion at the city CHP plant. This will result in reduction of GHG emissions into the atmosphere while solid particles, nitrous oxides and carbon oxides will increase.

Calculation data on alterations in the project harmful substance emissions into the atmosphere against the baseline are presented in Table F.1-1.

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

Value name	Unit	Natural gas	BWW	Total
Harmful substance emissions	**t/year**	**-32.9**	**55.5**	**22.6**
Including:				
solid particles	t/year	0.0	3.4	3.4
sulphur dioxide (SO_2)	t/year	0.0	0.0	0.0
nitrous dioxide (NO_2)	t/year	-7.7	19.6	11.9
nitrous oxide (NO)	t/year	-1.3	3.2	1.9
carbon oxide (CO)	t/year	-23.9	29.3	5.4

Project implementation results in the increase of solid particles emissions by 3.4 t/year, nitrous oxide emissions by 1.9 t/year, nitrous dioxide emissions by 11.9 t/year, and carbon oxide emissions by 5.4 t/year. There are no either baseline or project sulphur oxide emissions.

Total project increase of gross emissions polluting the atmosphere is 22.6 t/year.

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

Environmental impacts are not considered significant.

SECTION G. Stakeholders' comments

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

No comments yet.

REFERENCES

[R1] Approved baseline and monitoring methodology AM0036/ Version 01.1 "Fuel switch from fossil fuels to biomass residues in boilers for heat generation". CDM – Executive Board. 29 September 2006.

[R2] Revision to the approved consolidated baseline methodology ACM0009/ Version 03 "Consolidated baseline methodology for fuel switching from coal or petroleum fuel to natural gas". CDM – Executive Board. 28 July 2006

[R3] Roddatis K.F. Boiler units. M.: Energy, 1977.

[R4] Report "Energy examination of utilizing energy boilers PR-2500 #1,2 to determine their technical economic and ecological parameters», Energocenter of Arkhangelsk Forestry Engineering University, Arkhangelsk, 2005.

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

[R6] Reference book on low power boiler units/Edited by K.F. Roddatis.-M.:Energoatomizdat, 1989.

[R7] Method guidelines for determination of fuel, energy and water consumption by heating boiler houses of municipal heat-and-power utilities for generating heat (4th Edition). Moscow, 2002.

[R8] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2, Energy

[R9] Operational Guidelines for Project Design Documents of Joint Implementation Projects.Volume 1. General guidelines./ Version 2.2. Ministry of Economic Affairs of the Netherlands. June 2003

[R10] Setup and operation of water heat networks. Reference book. Manyuk V.I. and others. – M.: Stroyizdat, 1988.

[R11] Tool for the demonstration and assessment of additionality. Version 03. UNFCCC.

[R12] Sazanov B.V., Citas V.I. Heat-and-power engineering systems of industrial enterprises. M.: Energoatomizdat, 1990.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	LSEZ „Baltic Timber Industries” SIA
Street/P.O.Box:	Brivibas iela
Building:	121A
City:	Liepaja,
State/Region:	Latvia
Postal code:	LV-3401
Country:	Latvia
Phone:	
Fax:	
E-mail:	
URL:	
Represented by:	
Title:	
Salutation:	Mr
Last name:	Bonch-Bruevich
Middle name:	
First name:	Andrey
Department:	
Phone (direct):	
Fax (direct):	
Mobile:	+371 34 26709
Personal e-mail:	abb@atlanticreefers.com

Organisation:	Camco International GmbH
Street/P.O.Box:	Burggasse
Building:	116
City:	1070 Wien
State/Region:	
Postal code:	
Country:	Austria
Phone:	+43 1 52520256
Fax:	+43 1 52520266
E-mail:	
URL:	www.camco-international.com
Represented by:	
Title:	
Salutation:	Mr.
Last name:	Houston
Middle name:	
First name:	Arthur
Department:	
Phone (direct):	+43 1 525 20280
Fax (direct):	
Mobile:	+7 905 507 2293
Personal e-mail:	arthur.houston@camco-international.com

Annex 2

BASELINE INFORMATION

Annex 2.1.

Estimated baseline GHG emissions

Data name		Unit	Years					
			2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste								
Productivity of sawing		m^3	200 000	200 000	200 000	200 000	200 000	**1 000 000**
Drying		m^3	108 800	108 800	108 800	108 800	108 800	**544 000**
		-	0,544	0,544	0,544	0,544	0,544	-
Amount of wood waste		m^3	56 000	56 000	56 000	56 000	56 000	**280 000**
		t	44 800	44 800	44 800	44 800	44 800	**224 000**
including								
	bark	%	10,0	10,0	10,0	10,0	10,0	-
		m^3	20 000	20 000	20 000	20 000	20 000	**100 000**
		t	16 000	16 000	16 000	16 000	16 000	**80 000**
	sawdust	%	18,0	18,0	18,0	18,0	18,0	-
		m^3	36 000	36 000	36 000	36 000	36 000	**180 000**
		t	28 800	28 800	28 800	28 800	28 800	**144 000**
Utilized		m^3	0	0	0	0	0	**0**
For sale		m^3	56 000	56 000	56 000	56 000	56 000	**280 000**
To the dump		m^3	0	0	0	0	0	**0**
Heat								
Sawmill		GJ	114 059	114 059	114 059	114 059	114 059	**570 297**
including								
drying		GJ/m^3	0,972	0,972	0,972	0,972	0,972	-
		GJ	105 734	105 734	105 734	105 734	105 734	**528 671**
heating		GJ	8 325	8 325	8 325	8 325	8 325	**41 627**
Fuel - total								
Consumption of fuel (total)		GJ	95 606	95 606	95 606	95 606	95 606	**478 032**
Fuel - Natural gas								
Consumption of natural gas		thousand. m^3	2 835	2 835	2 835	2 835	2 835	**14 173**
		GJ	95 606	95 606	95 606	95 606	95 606	**478 032**
Percentage		%	100,0	100,0	100,0	100,0	100,0	**100,0**
Combustion value		GJ/thousand m^3	33,73	33,73	33,73	33,73	33,73	-
Efficiency of boilers		-	0,920	0,920	0,920	0,920	0,920	-
Auxiliary and energy loss		-	0,025	0,025	0,025	0,025	0,025	-
Factor of heat flow		-	0,980	0,980	0,980	0,980	0,980	-
Factor of losses in the pipe line		-	0,950	0,950	0,950	0,950	0,950	
Fuel - bark and wood waste								
Consumption of wood waste		m^3	0	0	0	0	0	**0**
		t	0	0	0	0	0	**0**
		GJ	0	0	0	0	0	**0**
Percentage		%	0,0	0,0	0,0	0,0	0,0	**0,0**
Combustion value		GJ/t	0,00	0,00	0,00	0,00	0,00	-
Efficiency of boilers		-	0,000	0,000	0,000	0,000	0,000	-
Auxiliary and energy loss		-	0,000	0,000	0,000	0,000	0,000	-
Greenhouse gases								
from burning of natural gas		t CO_2e	5 337	5 337	5 337	5 337	5 337	**26 684**
Emissions of greenhouse gases		**t CO2e**	**5 337**	**5 337**	**5 337**	**5 337**	**5 337**	**26 684**

Annex 2.2.

Estimated project GHG emissions

Data name	Unit	Years					
		2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste							
Productivity of sawing	m^3	200 000	200 000	200 000	200 000	200 000	**1 000 000**
Drying	m^3	108 800	108 800	108 800	108 800	108 800	**544 000**
	-	0,544	0,544	0,544	0,544	0,544	-
Amount of wood waste	m^3	56 000	56 000	56 000	56 000	56 000	**280 000**
	t	44 800	44 800	44 800	44 800	44 800	**224 000**
including							
bark	%	10,0	10,0	10,0	10,0	10,0	-
	m^3	20 000	20 000	20 000	20 000	20 000	**100 000**
	t	16 000	16 000	16 000	16 000	16 000	**80 000**
sawdust	%	18,0	18,0	18,0	18,0	18,0	-
	m^3	36 000	36 000	36 000	36 000	36 000	**180 000**
	t	28 800	28 800	28 800	28 800	28 800	**144 000**
Utilized	m^3	24 458	24 458	24 458	24 458	24 458	**122 288**
For sale	m^3	31 542	31 542	31 542	31 542	31 542	**157 712**
To the dump	m^3	0	0	0	0	0	**0**
Heat							
Sawmill	GJ	114 059	114 059	114 059	114 059	114 059	**570 297**
including							
drying	GJ/m^3	0,972	0,972	0,972	0,972	0,972	-
	GJ	105 734	105 734	105 734	105 734	105 734	**528 671**
heating	GJ	8 325	8 325	8 325	8 325	8 325	**41 627**
Fuel - total							
Consumption of fuel (total)	GJ	144 288	144 288	144 288	144 288	144 288	**721 439**
Fuel - Gas							
Consumption of gas	t	0	0	0	0	0	**0**
	GJ	0	0	0	0	0	**0**
Percentage	%	0,0	0,0	0,0	0,0	0,0	**0,0**
Combustion value	GJ/t	33,73	33,73	33,73	33,73	33,73	-
Efficiency of boilers	-	0,920	0,920	0,920	0,920	0,920	-
Auxiliary and energy loss	-	0,025	0,025	0,025	0,025	0,025	-
Fuel - bark and wood waste							
Consumption of wood waste	m^3	24 458	24 458	24 458	24 458	24 458	**122 288**
	t	19 566	19 566	19 566	19 566	19 566	**97 830**
	GJ	144 288	144 288	144 288	144 288	144 288	**721 439**
Percentage	%	100,0	100,0	100,0	100,0	100,0	**100,0**
Combustion value	GJ/t	7,3744	7,3744	7,3744	7,3744	7,3744	-
Efficiency of boilers	-	0,850	0,850	0,850	0,850	0,850	-
Auxiliary and energy loss	-	0,070	0,070	0,070	0,070	0,070	-
Greenhouse gases							
from burning of natural gas	t CO_2e	0	0	0	0	0	**0**
Emissions of greenhouse gases	**t CO2e**	**0**	**0**	**0**	**0**	**0**	**0**

Annex 2.3.

Estimated GHG emission reductions

Data name	Unit	Years					
		2008	2009	2010	2011	2012	2008-2012
Productivity of sawing and wood waste							
Productivity of sawing	m^3	0	0	0	0	0	**0**
Drying	m^3	0	0	0	0	0	**0**
Amount of wood waste	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
including							
bark	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
sawdust	m^3	0	0	0	0	0	**0**
	t	0	0	0	0	0	**0**
Utilized	m^3	24 458	24 458	24 458	24 458	24 458	**122 288**
For sale	m^3	-24 458	-24 458	-24 458	-24 458	-24 458	**-122 288**
To the dump	m^3	0	0	0	0	0	**0**
Heat							
Sawmill	GJ	0	0	0	0	0	**0**
including							
drying	GJ	0	0	0	0	0	**0**
heating	GJ	0	0	0	0	0	**0**
Fuel - Gas							
Consumption of natural gas	thousand m^3	-2 835	-2 835	-2 835	-2 835	-2 835	**-14 173**
	GJ	-95 606	-95 606	-95 606	-95 606	-95 606	**-478 032**
Fuel - bark and wood waste							
Consumption of wood waste	m^3	24 458	24 458	24 458	24 458	24 458	**122 288**
	t	19 566	19 566	19 566	19 566	19 566	**97 830**
	GJ	144 288	144 288	144 288	144 288	144 288	**721 439**
Greenhouse gases							
Emissions of greenhouse gases	**t CO2e**	**-5 337**	**-5 337**	**-5 337**	**-5 337**	**-5 337**	**-26 684**

Annex 3

MONITORING PLAN

See Section D.