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

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SECTION A. General description of the project

A.1. Title of the project:

Utilization of waste wood for steam production at “Uniplyt” Ltd Wood-working and Fibreboard plant
“Uniplyt” Ltd
Version 2
Date: 17 September 2009

A.2. Description of the project:

Purpose of the project

The main project objective is a substituting of natural gas fired thermal generating installations (steam boilers) at Wood-working and Fibreboard plant owned by Uniplyt Ltd company, by wood-fired boiler. Shifting from natural gas to waste wood fuel will result in reducing of GHG emissions and increasing of enterprise energy supply efficiency and safety. Installation of new equipment will increase plant efficiency and help to reduce prime cost of produced fibreboard. Thermal energy (steam of required parameters) will be consumed for technological needs of the plant.

Project concept

The main purpose of the project is substituting of natural-gas fired thermal generating installations (steam boilers) by wood-fired boilers. It is envisaged the construction of new waste wood-fired boiler-houses at Wood-working and Fiberboard plant located in Vygoda and at Veneer plant located in Dzviniach village. Thermal energy (steam of required parameters) will be consumed for technological needs of the plant.
Thermal capacity of steam generating unit that is going to be constructed at Vygoda plant is 13,300 kW (steam output is 18 t/h) Steam parameters required by technology applied are following: steam pressure is 20 bars, steam temperature is 250 ^{0}C. Steam output will be 18 tons/h of steam (including 12 tons/h for fibreboard shop and 6 tons per/hour for milling shop).
Thermal capacity of the boiler to be installed at Dzviniach Veneer plant is 8,000 kW.
Schedule of reconstruction of existing gas-fired boiler-house into waste wood fired boiler-house at Vygoda Woodworking Plant:

1. Equipment manufacturers tender – Till end of March 2007
2. Project design works, licensing, Environment Impact Assessment, etc, preliminary works – February 2007 – March 2007
3. Preparation of place for new boiler to be installed at – foundation, flatting, etc – Till May 2007
4. Construction of new boiler-house, construction of new wood fuel storage – till April 2008
5. Supplying of equipment and installation of new wood-fired steam boiler by July 2007 – May 2008
6. Assembly and start-up works - till end of November 2008
7. Start of operation – February-March 2009

The boiler at the veneer plant is expected to be commissioned in 2009.
All old boilers will be put out of operation but will be remained at the Enterprise and in the case of unforeseen circumstances they could be used as a reserve.
Current project status is project design work for Dzviniach Plant and construction work for Vygoda plant. Pre-feasibility study is completed. Determination of available waste wood amounts directly at site and at Dzviniach Veneer plant and evaluations of possibilities to purchase required additional wood from

local forestries is completed. In the nearest future equipment suppliers tender for Dzviniach plant will be completed.
Risks during project implementation are minimal since only professional workers will implement the project and operate new boiler-house. There are some risks concerning safety of additional waste wood fuel supplies from local industrial companies and forest managing companies as well.
The number of employees at Vygoda Wood-working and Fibreboard plant in 2005 was 483, including 5 part-time employees and 478 full-time workers. In 2004 number of employees was 520 (15 part-time workers and 505 full-time workers, and in 2003 – total number of employees was 534, including 13 part-time employees and 521 full-time employees.
All employees at Vygoda and Dzviniach plants are well qualified and experienced. Regarding waste wood utilization at new boiler-houses, new qualified individuals will be hired as well as old boiler house operators will be reemployed to operate the new installation.

Expected results of the project

Annual revenue from new boiler-house operation is formed by avoiding of natural gas purchasing in the case of project implementation and by obtaining of carbon credits In calculations it was assumed that all ERUs money would be paid after ERUs delivering to the investor registry account (that means no down-payment is required). In case of 10 Euro/t CO_{2e} price the average annual revenue from credits selling is 316.4 thousand Euro.
Annual revenue from 13.3 MW+8MW boilers operation is 3.740 thousand EUR without carbon credits. The revenue means costs saved from natural gas saving.

The project will have positive effect on global environment since consumption of fossil fuels will be avoided. All projected energy requirements of new plant will be met via biomass energy carrier (waste wood), which is a renewable energy source.
Comparing to natural gas combustion, the combustion of wood fuel will be “dirtier” and will require installation of environmental equipment. Due to this fact, it is planned to install the system of inertial ash catchers to each wood-fired boiler. Ash content in venting after such system is installed will not exceed allowable concentrations. Also according Ukrainian environment standards it would be necessary to install another chimney as dissemination of flue gases after new boiler-houses work is anticipated by the way of new individual chimney construction. The height of chimney will be determined during design stage. Besides, after new boiler-houses are constructed, the average region fuel consumption will decrease, and accordingly, harmful substance ejection in atmosphere will be decreased also.

Expected economic effect of the project is considered to be rather positive than negative. The company will have an independent thermal energy supply system, which will avoid natural gas purchase expenses. One of the project goals is focused on waste wood management enhancement.

Social effect of the project will include new jobs at the Vygoda and Dzviniach plants. Energy equipment producers, installation companies, and project organizations will have good business opportunities. Ukrainian Veneer, fibreboard, woodworking market will have additional volumes of products both for Ukrainian and foreign consumers. Money paid to local forest managing companies will be left in region thus making local enterprise richer but will not go to natural distribution companies and finally to natural gas exporting countries.

Project’s contribution to sustainable development is in switching primary energy carriers used for energy production to the sustainable energy source – biomass. Saving millions of cubic meters of natural gas by using wood waste as well as not bringing the wood to the landfill (as it was practiced in the past for many years will contribute to smart growth of the region and its sustainable development.

Project background information

Core business of the enterprise is producing of veneer fibreboard and also the all-round wood-working. Company produces more than the half fibreboard manufactured in Ukraine (55%). The production is exported to 14 countries including USA, Great Britain and Germany. Company owns to facilities: Wood-working and Fibreboard plant at Vygoda village and Veneer plant at Dzviniach village of Ivano-Frankivsk region. The company was awarded with "First Rate" sign for perfect quality of production and services by national image program.

The enterprise represents an entire complex of pre-treatment, hulling, pressing, trimming and auxiliary divisions with the developed infrastructure. The main facilities which ensure the work of the Fibreboard plant are: chips pre-treatment shop, fibreboard production shop, fibreboard trimming shop, gas boiler house, storehouses, electrical equipment shop. At the moment productivity of the fibreboard plant is about 18 mill m^2 of boards per year. Second part of the enterprise is veneer production plant located in Dzviniach village. The main facilities of the veneer plant are veneer production shop with a steaming pool, debarker, huller, gas dryer, veneer jointer and hydraulic press, boiler house, chips storage and gas boiler house. Both plants were commissioned in seventieth and boilers require substitution in the near future.

The Enterprise purchases electric energy from power grid.

At the moment production capacity of Uniplyt is 18 mill m^2 of fibreboard and 14 000 m^3 of veneer per year.
The fibreboard plant has 5 operating gas-fired boilers for steam production – 3 boilers DKVR-10-39 and 2 boilers DE-25-14GM with nominal steam production 10 t/h and 25 t/h respectively. Years of manufacture: boilers #1-3 DKVR-10-39 – 1987, 1989 and 1990, boilers #4-5 DE-25-14 GM – 1985. Efficiency of the boilers: 89% for DKVR boilers and 93% for DE boilers.
Two gas-fired boilers E-2,5-0,9 are installed at the veneer plant. Nominal steam production of these boilers is 2.5 t/h. Years of boilers' commissioning – 1994 for boiler #1 and 1993 for boiler #2. Efficiency of the boilers is 89%. (Please, see **annex 4**, technical caracteristics "Certificate on the quality of boiler manufacture" for old boilers).
Boilers efficiency means gross efficiency , i.e. without loss for own needs.
The boilers were originally designed for gas combustion. The Enterprise regularly spends rather big money to keep the boilers in working condition. **(annex 4).**

As old gas fired boilers use natural gas which is much more expensive than waste wood, the Uniplyt Ltd developed a program of shifting from gas to waste wood fuel by means of reconstruction of energy supply system:

2008-2009 – construction and commissioning of wood fired boiler in Vygoda village (18 t/h of steam)

2009-2010 – construction and commissioning of wood fired boiler in Dzviniach village (5 t/h of steam)

At first management of "Uniplyt" considered the possibility of installation of new wood fired boilers instead of old gas fired boilers in 2005, but construction of new wood fired boilers was not profitable. After receiving information from SEC Biomass about JI projects, management of "Uniplyt" began thinking about the possibility to implement wood fired boilers utilizing the waste wood at the Enterprise..Though new equipment is much more expensive than gas fired boilers, the Enterprise will be able to sell ERUs to the credit buyer(s) and get additional finances for the project. In other case the project is not financially attractive (see annex 2 – discounted payback period of the project without ERU sales is more than 10 years). That is why "Uniplyt" finally decided to reconstruct its energy supply system through realisation of JI project.

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)
Ukraine (Host Party)	"Uniplyt" Ltd	No

1) "Uniplyt" Ltd

Core business of the Plant is wet production of fibreboards and veneer production. The enterprise is the leading company in wet fibreboard production in Ukraine. "Uniplyt" produce 18 mill m^2 of fibreboard per year, it makes up 55 % of total Ukrainian fibreboard production.

The veneer plant produces about 14 th. m^3 of veneer annually. The enterprise implements new technologies in veneer production which favour the increase of veneer sheets production and allow to improve working conditions.

2) Scientific Engineering Centre "Biomass"

SEC Biomass is a consulting and engineering company established in January 1998 and at the moment one of the leading companies in the field of energy production from biomass (wood, straw, manure, municipal solid waste and other organic waste). Since 2004 SEC Biomass also has been rendering the consultancy service in promoting and developing the JI projects in Ukraine. At the moment the number of SEC Biomass employers accounts 24, including half of them working on JI projects in different sectors.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Ukraine

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

Ivano-Frankivsk region

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

Vygoda village, Dzviniach village

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

Uniplyt fibreboard and veneer plants are located on the land plot of 25.22 hectares and owns the developed infrastructure, consisting of steam boiler house, several connections to the technical and potable water supply, sewage system etc. Additionally, the Plant has an access to the motorway that ensures continuous and timely shipment of finished products and delivery of raw material.

Figure 1 Ukraine, showing location of Uniplyt plants.

Fibreboard plant:
Geographical coordinates: 48^{0}55’ nl, 23^{0}54’ el
Address: Zavods’ka st. 4, Vygoda village, Dolyna district, Ivano-Frankivsk region, Ukraine

Veneer plant
Geographical coordinates: 48^{0}45’ nl, 24^0 25’ el
Address: Stepanyaka st. 12, Dzviniach village, Bogorodchany district, Ivano-Frankivsk region, Ukraine

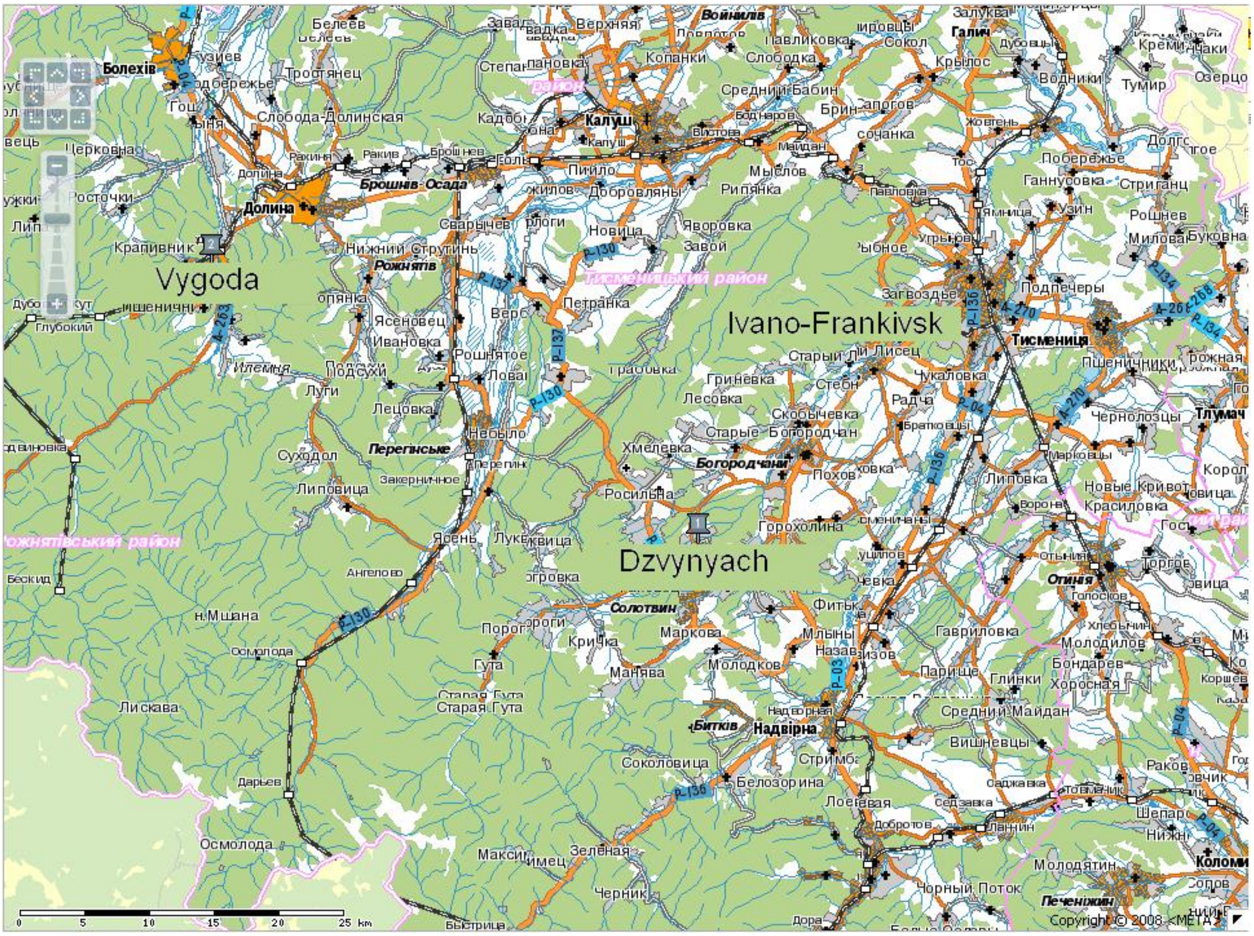

Figure 2. Location of the plants

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

The proposed project involves the reconstruction and modernization of heat supply at Uniplyt Ltd. After the reconstruction heat supply at Uniplyt Ltd will be based mostly on combustion of biomass fuel – waste wood chips. Thus there will be very little consumption of fossil fuel (natural gas as a reserve fuel). Technical details of the project are shown in **Annex 2.2**.

The main purpose of the project is substituting of natural-gas fired thermal generating installations (steam boilers) by wood-fired boilers. It is envisaged the construction of new waste wood-fired boiler-houses at Wood-working and Fiberboard plant located in Vygoda and at Veneer plant located in Dzviniach village. Thermal energy (steam of required parameters) will be consumed for technological needs of the plant.

Thermal capacity of steam generating unit that is going to be constructed at Vygoda plant is 13,300 kW (steam output is 18 t/h) Steam parameters required by technology applied are following: steam pressure is 20 bars, steam temperature is 250 ^{0}C. Steam output will be 18 tons/h of steam (including 12 tons/h for fibreboard shop and 6 tons per/hour for milling shop).

Thermal capacity of the boiler to be installed at Dzviniach Veneer plant is 8,000 kW.

Presently the Fibreboard plant of the Enterprise has three old gas fired boilers (and two reserve gas fired boilers) and purchases electricity from power grid. The veneer plant has one gas fired boiler in operation and one gas fired boiler as a reserve.

Within the project boundaries three old gas fired boilers from the fibreboard plant will be put out of operation. One new boiler (N1 – Vynke) for combustion of waste wood will be installed at the fibreboard plant in Vygoda village. Also one waste wood fired boiler (N2) will be installed instead of old gas fired boilers at Dzviniach veneer plant. The boiler N1 will consume almost twice as much waste wood than it is available at the both plants. The missing waste wood fuel will be purchased from furniture plants and other neighbouring woodworking enterprises. Two gas fired boiler (N3 and N4 – DKVR10/39) at Vygoda fibreboard plant and one gas fired boiler (N5 – E–2.5/0.9) at Dzviniach veneer plant will work as reserve boilers. Natural gas fired boilers N3,4,5 are only for the case of unforeseen or unexpected situation (emergency at the Enterprise that leads to unexpected absence or lack of waste wood for the period more than 12 hours).

Annual amount of heat produced will be about 112000 Gcal/a at fibreboard plant and about 75000 Gcal/a at veneer plant (see **Annex 2.2**).

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

On the whole, reduction of GHG emissions under the project will take place due to reduction of natural gas consumption comparing to baseline scenario due to using of CO_2 neutral fuel (waste wood) to cover the heat demands of the Enterprise.

As a result of the project first stage implementation (instalation of one steam wood fired boiler at fibreboard plant) in 2008 the CO_2 emissions due to natural gas consumption will be reduced. After the implementation of the second project stage (installation of wood fired boiler at veneer plnt) the CO_2 emission reduction from the above mentioned sources will be increased.

Without the project the heat (steam for the technological needs) demand of the Enterprise would be covered by the steam produced at the gas fired steam boilers. Existing boilers will be used for this purpose. In such case all the waste wood produced at the Enterprise would be dumped at the area of the Enterprise and decomposed in aerobic conditions causing the considerable methane emissions into the atmosphere. After the new boilers are put into operation, the Enterprise will be able to cover all its heat demand by the steam produced from the waste wood at the new boilers.

The CO_2 emission reduction after the proposed project implementation will mainly have place as the CO_2 emissions from waste wood burning are climatically neutral and therefore are considered to be zero. N_2O emission from burning of waste wood at the boilers is not included into account as it is negligibly small compared to CO_2 emissions.

- Without the project, the specified above reduction of GHG emissions would not be achieved, since the Enterprise would be used gas-fired boilers to cover its heat demand.

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

The ex ante emissions reductions are estimated to be **175,881** tonnes CO_2 – equivalent for commitment period 2008-2012 or approximately **35,176** tonnes CO_2 – equivalent annually. Note that actual emissions reductions will be based on monitored data and may differ from this estimate.

	Years
Length of the crediting period	5 years (2008-2012)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	4954.3
2009	37584.3
2010	44447.4
2011	44447.4
2012	44447.4
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	175880
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	35176

A.5. Project approval by the Parties involved:

SECTION B. Baseline

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

The baseline scenario stipulates the continuation of existent gas fired boilers operation. In such case the heat demand of the Enterprise is covered by the combustion of natural gas at the new boiler(s), the power required for the new gas boiler(s) operation and to cover the Enterprise own technological needs is purchased from the outside national power grid, and the waste wood is dumped at the landfill at the project site.

Referencing of the approved baseline and monitoring methodology. Justification of the baseline chosen is performed according to the Approved baseline and monitoring methodology AM0036 "Fuel switch from fossil fuels to biomass residues in boilers for heat generation", version 2.1 (hereinafter AM0036, URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html). This methodology is the most suitable of the methodologies approved for Clean Development Mechanism (CDM) projects.

Justification of the choice of methodology and why it is applicable to the project. As it is mentioned in the AM0036, it is applicable to project activities that switch from use of fossil fuels to biomass residues, in existing and, where applicable new, boilers. Among the possible project activities that may be considered under the AM0036, there is one that exactly fits to the proposed project:
Replacement of existing boilers. *The project activity involves the replacement of (an) existing boiler(s) by new boiler(s) that fire(s) mainly or solely biomass residues (some fossil fuels may be co-fired). The replacement shall (a) enable the use of biomass residues or (b) enable an increase in the use of biomass residues beyond historical levels, which would not be technically possible in any of the existing boilers without a retrofit or replacement of the boilers.*
The Table B-1 below explains the reason why the AM0036 can be applied to the proposed project:

Table B-1 Comparison of proposed project activities with applicability of the methodology AM0036

AM0036 Applicability (p.3)	**Does the project activity meet the applicability requirement (Yes) or not (No)**
The heat generated in the boiler(s) is □ Not used for power generation; or □ If power is generated with heat from the boilers, it is not increased as a result of the project activity, i.e, a) site, the power generation capacity installed remains unchanged due to the implementation of the project activity and this power generation capacity is maintained at the pre-project level throughout the crediting perio; and b) the annual power generation during the crediting period is not more than 10% larger than the highest annual power generation in the most recent three years prior to the implementation of the project activity.	*Yes*. The heat generated in boilers is used for steam production only. Power for own needs of the Enterprise is purchased from power grid.
The use of biomass residues or increasing the use of biomass residues beyond historical levels is technically not possible at the project site without a significant capital investment in □ Either the retrofit or replacements of existing boilers or the installation of new boilers; □ Or in a new dedicated biomass supply chain established for the purpose of the project (e.g.	Yes. The project activity meets the applicability requirement because of necessity of significant capital investments in replacement of existing boilers.

collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes).	
Existing boilers at the project site have used no biomass or have used only biomass residues (but no other type of biomass) for heat generation during the most recent three years2 prior to the implementation of the project activity.	Yes. Existing boilers at both bibreboard and veneer plants use only natural gas as a fuel.
No biomass types other than *biomass residues*, as defined above, are used in the boiler(s) during the crediting period (some fossil fuels may be co-fired);	Yes. Only waste wood from veneer and fibreboard production will be used as onw fuel sources. The purchased fuel is also biomass residues from furniture manufacuties.
For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;	Yes. The implementation of the project will not result in an increase of process capacity. Productivity growth may be achieved only as a result of technological process upgrading.
The biomass residues used at the project site, site where the project activity is implemented, should not be stored for more than one year;	Yes. At the moment the part of biomass residues is selled to other enterprises and population, so biomass storage during long period is ruled out. After the project implementation amount of biomass residues won't be enough for enterprise needs, so long-term storage in this case is ruled out too.
No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils) are not eligible under this methodology.	Yes. The biomass residues treatment is not necessary.
The biomass residues are directly generated at the project site or transported to the project site by trucks.	Yes. The most part of waste wood will be generated at the project site, and some quantity will be delivered to the site by trucks.
In case of project activities that involve the replacement or retrofit of existing boiler(s), all boiler(s) existing at the project site prior to the implementation of the project activity should be able to operate until the end of the crediting period without any retrofitting or replacement, i.e. the remaining technical lifetime of each existing boiler should at the start of the crediting period be larger than the duration of the crediting period (7 or 10 years as applicable). For the purpose of demonstrating this applicability condition, project participants should determine and document the typical average technical lifetime of boilers in the country and sector in a conservative manner, taking into account common practices in the sector and country. This may be done based on industry	Yes. All the boilers were installed not long ago (1989 – new boilers at fibreboard plant, 2000 – used boilers at veneer plant). Moreover, not all the boilers are in operation at both plants, so there is a potential of boilers operation without any retrofitting or replacement.

surveys, statistics, technical literature, historical replacement records of boilers in the company, etc. The age of the existing boiler(s) and the average technical lifetime of boilers in the country and sector should be documented in the CDM-PDD.	

According to the 9th point of the applicability the remaining lifetime must be indicated.
All the gas fired boilers have certificates on the boilers quality and must pass an examinations periodically. Results of the last examination are presented in the table below:

Table B-2 – Results of gas fired boilers examination

#	Boiler type	Date of examination	Comments	Date of next examination
1	DE-25/14	20.03.08	Technical state of the boiler allows further operation	20.03.09
2	DE-25/14	24.04.08	-||-	24.04.10
3	DKVR 10-39	19.11.07	-||-	14.06.11
4	DKVR 10-39	27.11.07	-||-	26.11.11
5	DKVR 10-39	11.12.07	-||-	11.12.11

Taking into consideration the fact that only 3 boilers are in operation at the same time, it is expected that at least three boilers are able to stay in operation till the end of 2012.
In practice average lifetime of gas fired boilers is 25 years and more. It is confirmed by different GOSTs and technical specifications.
Limit lifetime – is an operation life, determined by operating documents, after its expiration the boiler operation must be stopped. Limit lifetime of the boiler must be indicated in GOST or in technical specification for boiler manufacturing or ti design documents. If limit lifetime of the boiler is not indicated in GOST, technical specification of design documents, it should be admitted in accordance with a following table:
Limit lifetime of boilers:

N	Boilers characteristics	Limit lifetime, years	Comments
1	Stationary steam boilers with steam capacity less than 4 t/h (P≤0,9MPa).	20	GOST 28193-89
2	Stationary steam oil and gas fired boilers type E with steam capacity 35, 50, 75, 100, 160 t/h.	30	
3	Stationary steam boilers with steam capacity from 4 till 230 t/h (P≤4,0 MPa) ▪ Water-tube boilers with steam capacity up to 35 t/h ▪ Water-tube boilers with steam capacity from 35 up to 230 t/h ▪ Gas-tube and fire-tube boilers	20 30 20	GOST 24005-80
4	Stationary steam boilers with steam capacity up to 300 t/h (4.0 MPa<P≤10.0 MPa)	40 (320 th.h.)	GOST 28269-89
5	Stationary hot-water boilers with heat productivity up to 100 kW: ▪ Cast-iron ▪ Steel	25 15	GOST 20548-93
6	Stationary hot-water boilers: water-tube, gas-tube and fire-tube with heat productivity from 100 kW till 30 MW	15	

7	Stationary hot-water boilers – water-tube and gas-tube with heat productivity more than 30 MW	20	
8	Portable steam and hot-water boilers	12	
9	Boilers for converter gas cooling	8	
10	Heat-recovery boilers	20	
11	Heat-recovery boilers for hydrosulphuric gas combustion	8	
12	Self-contained cast-iron economizers: ▪ Running on mazut and coke gas ▪ Running on natural gas or blast-furnace gas	12 25	
13	Self-contained steel economizers: ▪ Running on mazut and coke gas ▪ Running on natural gas or blast-furnace gas	8 16	

(Source: http://www.chetc.org.ua/ua/Pr_Poslug_TD_1.shtml - information provided by technical examining centre)

On the basis of above-mentioned information all the boilers can be kept in operation till the end of 2012.

According to the AM0036 procedure for the selection of the most plausible baseline scenario should include separate determinations of (1) what would happen to the biomass residues (waste wood) in the absence of the proposed project activity, and (2) how the heat would be generated in the absence of the proposed project activity. So it is necessary to identify most realistic and credible alternatives for heat generation and waste wood treatment separately and using the steps 2 and/or 3 of the latest approved version of the "Tool for the determination and assessment of additionality" (URL: http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf_) to assess which of identified alternatives should be excluded from the further consideration.

For the heat generation the following realistic and credible alternatives were selected by project participants:

- (H1) The proposed project activity not undertaken as JI project (installation of two wood fired boilers of 18 t/h at the fibreboard plant and 4 t/h at the veneer plant of total steam output).
- (H2) The generation of heat in the existing steam boilers using only fossil fuels (continuing of existent situation).
- (H3) Installation of CHP plant for heat production and displacement of power consumption from the power grid.
- The alternative (H6) is not considered because the old gas fired boilers have not exceeded their lifetime and installation of new gas fired equipment is not reasonable at the moment. Economical indexes for such scenario are indicated in Annex 2.

For the use of biomass residues (waste wood) the following alternatives are considered to be the most realistic and credible:

- (B1) The waste wood is dumped or left to decay under the mainly aerobic conditions. This applies, for example, to dumping and decay of wood residues on fields.
- (B2) The waste wood is dumped of left to decay under clearly anaerobic conditions (this applies, for example, to deep landfills with more than 5 meters).
- (B3) The waste is burnt in an uncontrolled manner without utilizing it for energy purposes.
- (B4) The biomass residues are sold to other consumers (to the population in our case) and the predominant use of the biomass residues in the region/country is for energy purposes (heat

generation)

- (B5) The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)
- (B6) The waste wood is used for combined heat and power production at site.
- (B7) The waste wood is used for heat generation at the project site.
- (B8) The waste wood is used for biofuels production (e.g. pellets).

Also it should be admitted that the project is distinguished by the fact that at present, that construction works are partly completed. The possibility of realization of the proposed project with JI component was being considering by the project owner during 2005, thus the assessment of identified alternatives in this PDD is made taking into account the market and policy conditions of 2005.

Consistency of waste wood alternatives with mandatory laws and regulations:

The alternatives (B1) and (B3) do not meet the Ukrainian regulation standards regarding the waste management (the Low # 3073-III from 07.03.2002). It is prohibited in Ukraine to burn the waste in uncontrolled manner and to leave the wastes at the open conditions (like at the fields). In accordance with the Low wastes burial is forbidden if any technology for its utilization exists in Ukraine (article 33 of the Low). Waste wood must be utilized for energy purposes in this case. Thus alternative that envisages the uncontrolled burning of waste wood and dumping of wood under aerobic conditions must be excluded from the further consideration. However, in practice there are no enough consumers for waste wood in a region. It is caused by widespread use of old coal and natural gas fired boilers and absence of wood fired equipment. In such conditions the woodworking enterprises of the region must sell the wood wastes or even give free of charge to the population. The wastes wood utilization is a bottle-neck in Ukraine. A fibreboard enterprise was stopped in 2001 because of problem of waste wood utilization (http://www.nature.org.ua/volun/02_5.htm). The woodworking enterprise "Apogey" was forfeited for using of 0.8 ha of agricultural lands for waste wood landfill (http://uzhgorod.net.ua/news/31032). But total amount of sold wastes is less than total quantity of waste wood generated at the enterprise. In the majority of cases the enterprises prefer to collect the wastes at site, but not to burn in uncontrolled manner. Several letters from the other woodworking enterprises of Ivano-Frankivsk region approve that waste wood utilization is not typical for Ukraine and the enterprises should break the abovementioned low on waste management (see approval letters in **Annex 5**). On the assumption of the fact that the alternative B1 is the common practice in the region, this alternative can't be excluded from the list of alternatives.

The alternative B2 does not meet the Ukrainian legislation (the Low # 3073-III from 07.03.2002) so it must be excluded from consideration.

The other alternatives meet Ukrainian standards.

Formation of the "combined alternatives" from the separate alternatives presented above

The alternative (B3) is unlikely from the poin of view of environmental protection and economical considerations (at the moment the enterprise shouldn't pay for waste wood removal and obtain some profit from waste wood selling to the population and other enterprises).

The alternative (B8) is not profitable because of absence of biofuels market in Ukraine.

The alternative (H6) is not considered because the old gas fired boilers have not exceeded their lifetime and installation of new gas fired equipment is not reasonable at the moment.

Determination of "how the heat would be generated in the absence of proposed project activity" is presented below.

(H1) - the proposed project activity not undertaken as JI stipulates the construction of wood fired boiler of 18 t/h of steam at the fibreboard plant and 4 t/h of steam at the veneer plant. This alternative corresponds to alternative (B7) – when the wood waste is used for heat production at the project site. So we have the combined alternative (A1)=(H1)+(B7)

(H2) - The generation of heat in the existing steam boilers using only fossil fuels (continuing of existent situation). It is the most realistic scenario because doesn't require any investments. This alternative can be combined with the alternatives for waste wood use (B1, B4, B5). However according to the methodology only one scenario which results to the lowest emissions could be used for such combination. In this case we use B1 alternative. So the combined alternative is (A2)=(H2)+(B1).

(H3) – The generation of heat and power in new CHP plants using waste wood as a fuel. The electricity produced will cover own demands of the enterprise and allow to avoid power purchase from national power grid. This alternative can be combined with the alternative for waste wood use (B6). So the combined alternative is (A3)=(H3)+(B6)

The justification of chosen baseline is presented in the sub-chapter B.2

As it mentioned above the baseline scenario is the "combined alternative" A2. The project activity involves the installation of new wood fired boilers at a site. In the absence of the project the heat for the enterprise demands would be produced by gas fired steam boilers. The wood waste wood in the absence of the project be dumped under aerobic conditions (see also B.2).
The key factors determining GHG emissions both in the baseline and in the project scenario have been singled out. These factors are as follows:

- Volume of waste wood generated at the Uniplyt enterprise.
- Heat consumption by the enterprise.
- Amount of fossil fuels combusted.
- Amount of waste wood dumped.

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:

In the baseline scenario (without JI project) the old boilers are continue work in previous mode. All generated wood waste is disposed at the landfill and sold to other enterprises and population. Natural gas is widely used in Ukraine for energy production.

Due to the methodology realistic and credible alternatives should be separately determined regarding:
• what would happen to the **biomass residues** in the absence of the project activity; and
• how the **heat** would be generated in the absence of the project activity.

In our case, in baseline scenario, if the project scenario will not occur, we would have following situation:
1. For heat generation the most realistic and credible alternative is: H2 – the generation of heat in an existing steam boilers using only fossil fuels (natural gas).
2. For biomass residue the most realistic alternatives areB1, B4 and B5 - the waste wood is dumped or left to decay under the mainly aerobic conditions and partly sold to other enterprises. This applies, for example, to dumping and decay of wood residues on fields.
Gas fired boilers are rather new and their replacement is not required.

In baseline scenario there are two sources of greenhouses gases emissions:
1. Emission due to natural gas combustion by operational gas fired boiler during the period of wood processing by the Enterprise – **30167** tons of CO_2e per year.
2. Emission due to waste wood decay at the landfill – on average **2008** tons of CO_2e per year.
Annual baseline emission approximate **38249** tons of CO2e per year

Total baseline scenario emission for the period 2008-2012 is estimated at **191 247** tons of CO_2e.

In the project scenario all five old gas fired boilers will be replaced by two new boilers – one boiler at the fibreboard plant and one boiler at the veneer plant. These boilers will consume all the wood residues of the enterprise and approximately the same amount of wood residues from the nearest furniture production plants.
The biomass residue (waste wood) is an only fuel for these two operational boilers. Two gas boilers at the fibreboard plant and one gas fired boiler at the veneer plant will be kept as reserve boilers for the cases of unforeseen situations at the Enterprise (e.g. unexpected absence or lack of waste wood for the period more than 12 hours).
The following analysis shows why the emissions in the baseline scenario would likely exceed the emissions in project scenario. First, for heat needs in baseline scenario natural gas is used, and in project scenario all needs in heat are covered by new boilers using biomass residue as a fuel. Also in baseline scenario the biomass residues are dumped under aerobic conditions at landfill, what leads to CH_4 emissions, or sold to other enterprises or population to be burnt in nonspecialized boilers and it may cause significant athmosphere pollution.

Reduction of CO_2e by JI project in comparison with baseline scenario.

1. Total replacement of natural gas combustion by biomass (waste wood) combustion.
2. No waste wood will be disposed of at the landfill. The capacity of two boilers is enough to ensure that the all produced wood residues will be burnt.

Project additionality

Application of additionality test to the project
The baseline methodology indicates "Project participants should use the latest approved version of the "*tool for demonstration and assessment of additionality*" (http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf), consistent with the guidance provided above on the selection of the most plausible baseline scenario.

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 identification of the most realistic and credible alternatives for heat generation and waste wood use is presented in the section B.1 and the formation of "combined alternatives" is presented there as well. Below the short description of the alternatives is presented.

Alternative A1

In the Alternative A1 three gas fired boilers at the fibreboard plant and one gas fired boilers at the veneer plant are put out of operation. The rest of the existent boilers are kept in operation as reserve boilers. Instead of decommissioned gas fired boilers two waste wood fired boilers (one boiler at each site) are put into operation. The capacity of the boiler to be installed at the fibreboard plant is 13.3 MW_{th} and capacity of the boiler to be installed at the veneer plant is 8 MW_{th}. Thermal capacity of the wood fired boilers will cover all heat demand of the enterprise. Also all amount of waste wood generated is used at the boilers. The proposed project activity not undertaken as JI project.

Alternative A2

In the alternative A2 the old gas fired steam boilers are kept into operation at both sites of the enterprise. It allows to supply the enterprise with necessary volume of steam without any additional investments. Moreover there is no necessary to build waste wood storage, because the most part of residues is sold.

Alternative A3

In the alternative A3 scenario the new CHP plants are installed instead of the old gas fired boilers. New CHP plants use waste wood as a fuel. Produced steam and power will cover all own needs of the enterprise. Waste wood use allows to solve the problem of waste wood utilization. However this alternative is too expensive because of low electricity cost and high cost of steam turbine installation.

But first of all it is necessary to determine what would happen with the generated waste wood if it was not combusted at the boiler(s). According to the AM0036 the following alternatives of waste wood use should be considered: (B1) the wood is dumped under mainly aerobic conditions; (B2) the waste wood is dumped under clearly anaerobic conditions; (B3) the waste is burnt in an uncontrolled manner without utilizing it for energy purposes; (B4, B5) the waste wood is sold in order to be utilized for power and/or heat generation at other boilers/plants or by population; (B8) the waste wood is used for biofuels production (e.g. pellets).

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

Alternative 1 is in compliance with all mandatory applicable legal regulatory requirements (at the moment all the permissions for project realization are obtained and the project is already started).

Alternative 2 is not in compliance with all mandatory applicable legal regulatory requirements. This alternative assumes waste wood decay under aerobic conditions. Such waste wood treatment is typical for woodworking enterprises of the regin because of absence of waste wood utilization facilities. Ukrainian legislation does not allow waste wood removal to the municipal landfills. Amount of wastes which are purchased by population and other enterprises as a raw materials is not considerable. In such conditions a lot of enterprises have problems with wood wastes utilization and must collect wastes at site. It should be admitted that the alternative 2 represents rather widespread approach which the most of industrial Ukrainian enterprises have already realized at their sites. The natural gas is the most widespread and easy to utilize fuel in Ukraine. The heat generating installations using the natural gas emit fewer pollutants into the atmosphere than any other technologies. In such case the Uniplyt has no any problems with construction of waste wood storage and shouldn't obtain any permits for waste wood collection at site.

Alternative A3

In the Alternative A3 the old outdated gas fired steam boilers are put out of operation. Instead of them new CHP plants using the waste wood are constructed. The CHP plants capacity are 2.4 MW_{el}+13.3 MW_{th} for the fibreboard plant and 1.45 MW_{el}+8 MW_{th} for the veneer plant. CHP plant covers all heat demand of the Enterprise, all CHP plant electricity own needs, while the surplus produced electricity partly covers the Enterprise electricity demand and thus reducing the consumption of electricity from the grid. All amount of waste wood generated is utilized by the CHP plant.

In 2005, "Uniplyt" Ltd started intensive cooperation with SEC Biomass (consultant, that developed the PDD and facilitated the determination). But at the moment "Uniplyt" Ltd consider the different companies as the potential buyers.

Step 2 Investment analysis

To determine whether the proposed project activity is not the most economically or financially attractive or economically or financially feasible without the revenue from the sale of certified emission reductions, the investment analysis was conducted.

Sub-step 2a. Determine appropriate analysis method

Project participants decide to apply the investment comparison analysis (Option II). This project envisages obtaining revenue from the heat sales and gas displacement in addition to ERUs sales. Therefore, simple cost analysis (Option I) cannot be applied, this means that either investment comparison analysis (Option II) or benchmark analysis (Option III) should be conducted.

Sub-step 2b. – Option II. Apply investment comparison analysis

The Net present value of the project (NPV), as a suitable financial indicator for the proposed activity not being registered as JI and for the Alternative 2 were calculated. All relevant data required for such calculations (like investment costs, operating costs, revenues, economical tariffs assumptions, etc.) and the calculations themselves are presented in the **Annex 2.2** It should be admitted that calculations were made for the case of decision making (2006 year) tariffs. The results of the investment comparison analysis taking into account present tariffs are presented in the Table B.1 below:

Table B.1a - Investment comparison analysis for 2006 tariffs

Project type	Discount rate,%	NPV*, EURO	IRR, %	Simple payback period, years	Discounted payback period, years
Alternative 2 (baseline scenario with gas fired boilers)	9%	-	-	-	-
Alternative scenario 3 (CHP plant construction)	9%	-1 650 046	6.1%	8.3	>10
Proposed project with ERUs sales (**Alternative 1**)	9%	-5 642 598	-5,2%	>10	>10

Current prices, tariffs, currency exchange (2006)

	EURO			
Currency exchange	7.36			
	UAH		EURO	
Waste wood price	80.0	UAH/m3	10.87	Euro/m3
Heat supply tariff	0.0	UAH/Gcal	0.00	Euro/Gcal
Natural gas tariff	657.6	UAH/1000 m3	89.35	Euro/1000 m3
ERU price	73.6	UAH/t CO2	10.00	Euro/t CO2
Power tariff for industrial consumers	194.3	UAH/MWh	26.40	Euro/MWh

- * - NPV value is calculated for the period of 2008-2027years.
- All calculations of economical indexes made in the Excel tables attached to the **Annex 2.2.**

However for decision making the Enterprise used forecated growth of prices and tariffs. In this case all the indexes become less attractive:

Table B.1a - Investment analysis including tarrifs growth

Project type	Discount rate,%	NPV*, EURO	IRR, %	Simple payback period, years	Discounted payback period, years
Proposed project with ERUs sales (**Alternative 1**)	9%	-10 602 654	-	>10	>10

Waste wood price is based on the commercial offers of the nearest wood working enterprises (see **Annex 6.**). Natural gas costs were given by the financial department of the Enterprise. Discount rate 9% were assumed based on relative data of financial web-site www.finance.ua.
All investment costs for fibreboard plant were assumed on the base of business plan data given by the Enterprise:

Investment costs		
Item	**Euro**	**UAH**
Steam wood fired boiler produced by "Vyncke" company, Belgium:Operating pressure - 20 bar, heat production - 12300 kW, outlet steam pressure - 20 bar, superheated steam temperature - 250 C.	1 880 095	13 837 500
Design work	81 522	600 000
Frontlift	112 092	825 000
Import of additional equipment and services	112 092	825 000
Construction works	30 978	228 000
Mobilization of the site	34 511	254 000
Materials	495 924	3 650 000
Mounting of the main buildings and process equipment	559 783	4 120 000
Foundation building	269 022	1 980 000
Fire-fighting equipment	62 500	460 000
Other works	552 989	4 070 000
Precommissioning	54 348	400 000
Mounting	40 761	300 000
VAT	446 114	3 283 400
Total	**4 732 731**	**34 832 900**

Financial indicators were calculated for 20-year period (project lifetime). It is minimum period regarding the Guidance on the Assessment of Investment Analysis and maximum remaining lifetime of the boilers taking into consideration the fact that the boilers were manufactured about 20 years ago.

Such financial indicators as NPV, IRR and payback period can't be calculated for the baseline scenario because of absence of investment costs. So, the levelised prime cost of thermal energy was chosen for the comparison of financial appeal. Comparison of specific prime costs of thermal energy for baseline and project scenarios is shown in table B2:

Table B2 – Comparison of levelized prime costs of thermal energy

Prime cost of thermal energy produced at:	
• Gas fired boilers	26.9
• Waste wood fired boilers	30.1

According to the table B2 specific cost of thermal energy produced at wood fired boilers is hihger then cost of energy produced at existent equipment. This fact is explained due to large investments and great amortization assesments during this period. The calculations were made for all lifetime of the project

So from the conducting of comparison investment analysis it is obvious that the proposed project activity not registered as JI cannot be considered as the most financially attractive.

Sub-step 2b – Option III. Benchmark analysis:

Benchmark analysis was chosen for this sub-step. The most appropriate financial indicator for any investment project is internal rate of return (IRR). The IRR is a key indicator for project investor. It can be influenced by perceived technical and/or political risks and by the cost of money. The IRR must exceed at least host country's discount rate in order for the project to be suitable (appropriate) for the investments. However the boiler house is not profitable and IRR can't be calculated for 20-year period. So the one possible indexes in such case are NPV of the project. Proposed project Without ERUs sales project has the NPV=-11.4 mill.Euro. With ERUs sales, the NPV of the proposed project reaches the value of NPV ==-10.6 mill.Euro. The value of IRR=-11.4mill looks not attractive for potential investors comparing with a value -10.6 mill. The value of NPV ==-10.6 mill.Euro for proposed project with ERUs sales is much more financially attractive for making decision to invest into the proposed project.
The financial indicators of the Alternative scenario 3 are lower than for the project without ERU sales and the prime cost of thermal energy is much higher than for the Alternative 2, so this alternative won't be considered as the baseline scenario beceuse it is not economically attractive for the potential investors. Resuming all calculations it can be clearly define that without registering proposed project as JI one and getting possibility of ERUs sales, the project is not financially attractive and baseline scenario (continuation of gas fired boilers operating) would be implemented.

Step 3.Barrier analysis

Additionality of the proposed project can be also proven by applying barriers analysis. These barriers are quite obvious and can be summarized as follows:

a) legal-administrative barriers
• Free of charge placement of biomass residues at a project site;
• Absence of the system of state control over formation and utilization of biomass residues;
• Imperfection of the state tariff policy for heat and power;
•There are no restrictions on CO_2 emissions for enterprises in Ukraine; no such restrictions are expected to be introduced;
• There are all the required permissions for operating the equipment, including those of the ecological nature, approved by the relevant supervisory bodies;

b) investment barriers
• High cost of imported equipment with delivery costs and custom duties taken into account, the total project capital expenditure make EUR 8 580 thousand;
• Absence of adequate sources of project funding available for the Enterprise;
• The project implementation required rather risky financial investments which included both the Enterprise equity and loans.

.c) technological barriers
• Absence of experience of operating facilities for biomass utilization at the enterprise.

Comparative low tariffs for electricity purchase from the grid does not exert influence on the alternatives 1 and 2. But in the case of the Alternative 3 implementation the Enterprise sould install rather expensive equipment for electricity production at site and will get very low revenue from substitution of electricity purchased from the grid because of low power tariffs.

The absence of experience of operating facilities for power generation at the Enterprise would make it very difficult to properly operate the new installation in the case of Alternative 3 implementation. In such case the risk of unexpected stoppages and increasing of downtime is considerably raises. This may lead in turn to the additional expenses due to supplement power purchasing from the grid. So this barrier is considered significant and would prevent the realization of alternative 3.

The risk of irregular waste wood supply to the Enterprise is high enough. Such cases can lead to the boiler cutoff and to the interruption of steam supply to the main production facilities of the Enterprise. This barrier would prevent the alternatives 1 and 3. As concerns the alternative 2, gas fired boilers are the most reliable in Ukraine at the moment from the point of view of fuel supply.

The cost of wood fired boilers installation is very high, because there are no wood fired boilers production in Ukraine with required steam productivity and exported equipment is too expensive. Moreover, the steam turbine installation for electricity production at site increase investment costs approximately twice. This is a significant barrier for implementation of the alternatives 1 and 3.

So the barrier analysis shows that only alternative 2 does not face any listed above barriers and thus should be considered as a baseline scenario.

The barriers related to the alternative 1 (which represents the proposed project activity but not registered as JI) would either impossible or inexpedient to overcome under the normal circumstances. It only made sense to overcome the aforesaid barriers with potential possibility to participate in the Kyoto Protocol mechanism. Therefore the final decision on the project implementation was adopted taking into account a potential possibility to cover part of the costs and to offset risks through the sales the generated ERUs.

These barriers would be either impossible or inexpedient to overcome under the normal circumstances. It only made sense to overcome the aforesaid barriers with potential possibility to participate in the Kyoto Protocol mechanisms.
Therefore, the decision on the project implementation was largely made with taking into account a potential possibility to cover part of the costs and to offset risks through sales of the achieved ERUs.

Step 4. Common practice analysis

There is no serial production of waste wood fired boilers in Ukraine. Each boiler is specially designed and manufactured for certain enterprise. Because of that fact the construction and production of the wood fired boilers are considerably expensive in comparison with gas fired boilers, which are produced as serial equipment. Combustion of wood for heat generation is not widely applied in Ukraine yet. As usual woodworking plants dispose of waste wood at the landfill or combust it in boilers originally designed for other kinds of fuel, or sale waste wood to the population and other enterprises. Examples of Ukrainian enterprises which combust waste wood for heat production are uncommon.

For an investor such project is much more expensive and has higher risks in comparison with baseline scenario. Realization of the project as a JI project with sales of ERUs makes it more attractive for a potential investor, decreases project risks and improves apparently its financial showings.
Taking into account all facts mentioned above proposed project is additional.

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

The proposed JI project boundary include operation of new equipment for heat production at the Enterprise (two waste wood fired boilers) – from fuel supply to the boilers to steam exit from the equipment. The only fuel for the boilers is wood. Natural gas is used only as reserve fuel for reserve boilers for the case of unforeseen or unexpected situation (emergency at the Enterprise that leads to unexpected absence or lack of waste wood for the period more than 12 hours). The process of woodworking and generation of waste wood as well as process of consumption of energy by the Enterprise are beyond the project boundaries. The project envisages that heat generated by the boilers will be used only for own needs of the Enterprise demands. Graphically the project boundary is presented on the figure below.

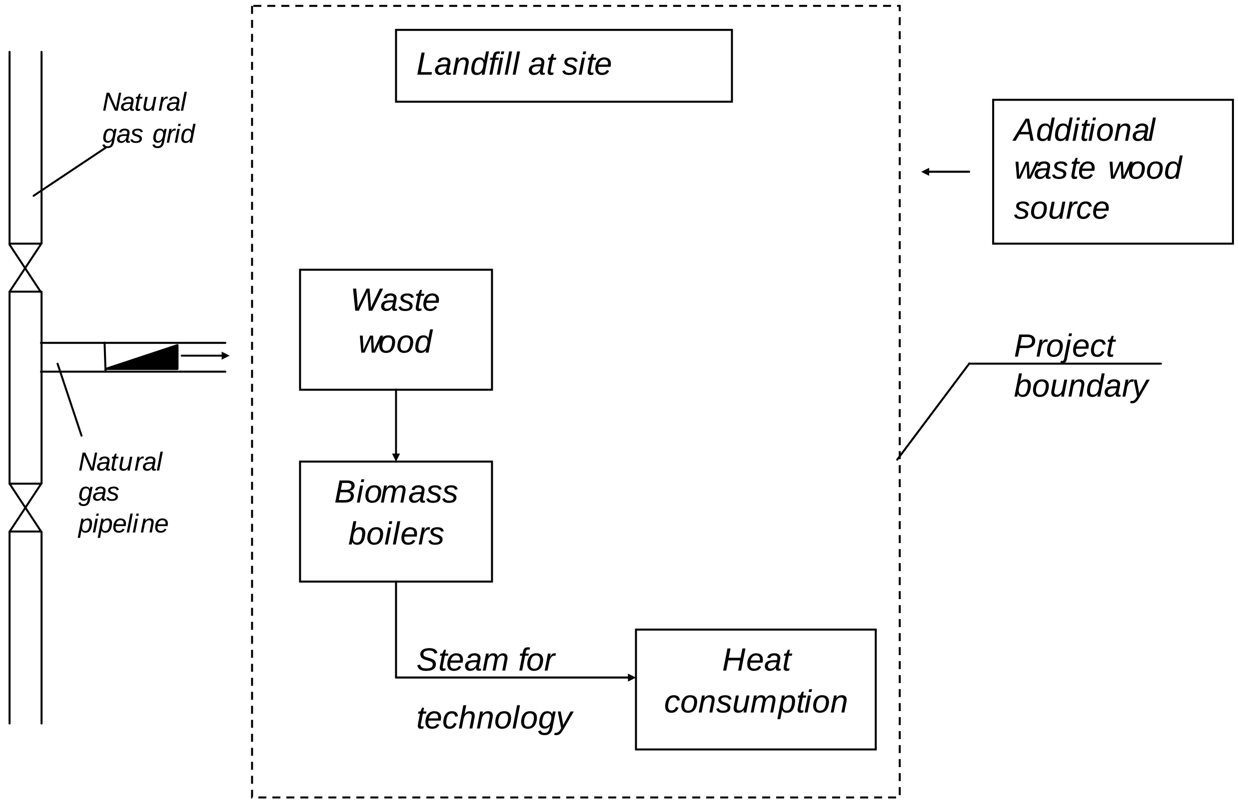

Figure 3. Graphical representation of the JI project boundary.

In project scenario following emission sources are considered:

- Methane emissions from biomass residues combustion at new boiler are taken into consideration as a conservative approach;
- CO_2 emissions from transportation of biomass residues to the project site;
- CO_2 emisions from on-site electricity consumption.

Such elements as connection to natural gas supply and additional waste wood production at furniture plant and electricity consumption from the national grid are closely connected with the project but are not included directly in its boundary. These elements allow to connect the project scenario with baseline scenario and to compare them. In baseline scenario five gas fired boiler provide steam to the Enterprise. In the project scenario steam supply for technology purposes is based on waste wood combustion (two wood fired boilers); the part of the waste wood is purchased from furniture plant; the boilers are totally provides the Enterprise with steam for own needs.

Baseline scenario boundary includes operation of old boiler house at the Enterprise (three operational and one reserve boilers at the fibreboard plant and one operational and one reserve boiler at the veneer plant) – from fuel supply of the boilers to steam exit from the equipment. The only fuel is natural gas. The landfill at the project site is also included in the boundary because all generated amount of waste wood is disposed of at the landfill. The process of treatment of wood and generation of waste wood are beyond the baseline scenario boundaries. Graphically the baseline scenario boundary is presented on the figure below.

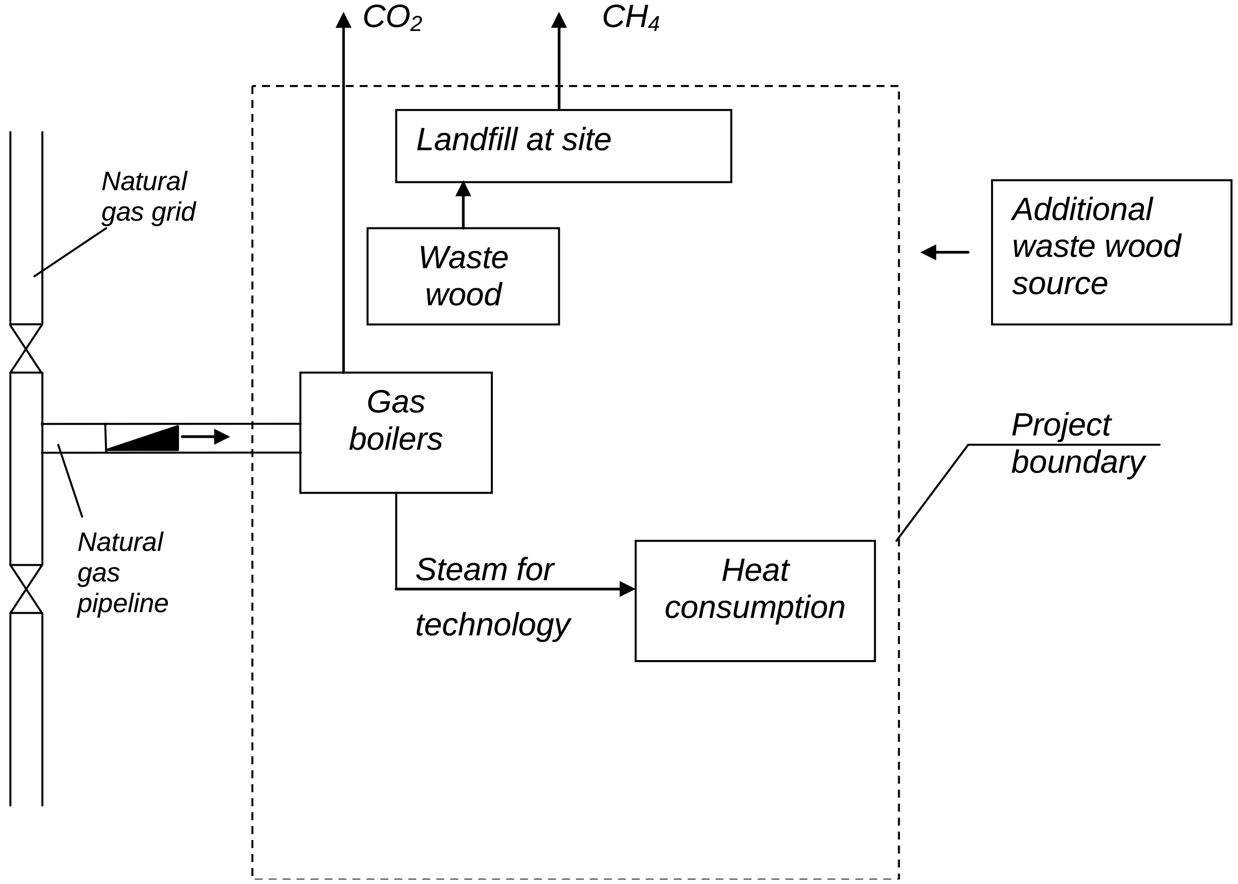

Figure 4. Graphical representation of the baseline scenario boundary.

Emissions of CO_2e are broken into two items in the baseline scenario:
1. Baseline emissions from fossil fuel combustion in boiler(s) for heat generation (BE_{HG},y).
2. Baseline methane emissions due to uncontrolled burning or decay of the biomass residues are considered as conservative approach.

Total baseline scenario emission for the period 2008-2012 is estimated at **194890** tons of CO_2e.

Reduction of CO_2e by JI project in comparison with baseline scenario.

1. Total replacement of natural gas combustion by biomass (waste wood) combustion.

2. No waste wood will be disposed of at the landfill. All amount of waste wood generated will be burned at two wood fired boilers.

Total reduction of CO_2e emission by JI project during 2008-2012 is **175881** tons of CO_2e.

Table B3 – Gases and sources for baseline and project emissions

	Gas	**Source**

Baseline scenario	CO_2	Fossil fuel combustion in boilers for heat generation
	CH_4	Uncontrolled burning or decay of the biomass residues
Project scenario	CO_2	Transportation of biomass residues to the project site
	CH_4	Biomass residues combustion at new boiler
	CO_2	Electricity consumption by new boiler

"Uniplyt" Ltd will be the owner of ERUs. Contact person for registration process at the future JI supervisory board is Mr. Volodymyr Pylypiv, Head of purchase department at "Uniplyt" Ltd (contact information is presented in Annex 1).

Selected JI project boundary includes only emissions directly connected with new boilers operation. Such processes as woodworking and generation of waste wood are beyond the project boundaries. Consequently emissions connected with these processes are also beyond the project boundary. When calculating financial showings of the boilers, the plant is considered as a subsidiary of "Uniplt" Ltd that is as a separate object, which sales heat energy to the Enterprise. This approach is in line with selected project boundary.

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

Scientific Engineering Center "Biomass" – project developer
The company can't be considered as a project participant
Contact persons: Mrs. Tetiana Ielovikova – Consultant ,
2A, Zhelyabov str., 03057, Kyiv, Ukraine
tel. +(38 044) 456 94 62; fax: +(38 044) 456 94 62,
yelovikova@biomass.kiev.ua.
Date of completing the final draft of this baseline section 15 June 2008.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

2006 – construction period for the fibreboard plant.
2009 - construction period for the veneer plant.

C.2. Expected operational lifetime of the project:

20 years 0 months.

C.3. Length of the crediting period:

01.01.2008-31.12.2012yy.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The project is a heat generation from biomass residues project.

All the data will be monitored for both veneer and fibreboard plant, because the project activities are similar for the both sites.

The fuel used is a by-product, woodworking residue from existing woodworking activities.
The conditions are similar to approved consolidated monitoring methodology AM0036 version 2.1 ("Fuel switch from fossil fuels to biomass residues in boilers for heat generation"). AM0036 is referred in the current Monitoring Plan.
AM0036 "Fuel switch from fossil fuels to biomass residues in boilers for heat generation"
URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
Approved consolidated baseline methodology AM0036 version 2.1.

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. **$EF_{FF,CO2,y}$**	CO_2 emission factor of the fossil fuel type displaced by biomass residues for the year *y*	Reliable local or national data	tCO_2e/GJ	m	Review the appropriateness of the data annually	100%	Electronic and paper form	

2. **$HG_{PJ,total,y}$**	Total heat generated in all boilers at the project site, firing both biomass residues and fossil fuels, during the year *y*	On-site measurements	GJ/yr	c	Continuously, aggregated annually	100%	Electronic and paper form	The consistency of metered net heat generation should be cross-checked with the quantity of biomass and/or fossil fuels fired
3. **$BF_{k,y}$**	Quantity of biomass residue type *k* fired in all boiler(s) at the project site during the year *y*	On-site measurements	Tons of dry matter	m	Continuously, aggregated at least annually	100%	Electronic and paper form	The quantity of biomass combusted should be collected separately for all types of biomass.
4. **W**	Moisture content of each biomass residue type *k*	On-site measurements	% Water content	m	Continuously, mean values calculated at least annually	100%	Electronic and paper form	In case of dry biomass, monitoring of this parameter is not necessary.
5. **$FC_{i,y}$**	Quantity of fossil fuel type *i* fired in all boiler(s) at the project site during the year *y*	On-site measurements	m^3	m	Continuously, aggregated at least annually	100%	Electronic and paper form	The quantity of fossil fuels combusted should be collected separately for all types of fossil fuels.

6. **$FC_{on-site,i,y}$**	Quantity of fossil fuel type *i* combusted at the project site for other purposes than heat generation as a result of project activity during the year *y*	On-site measurements	m^3	m	At least annually	100%	Electronic and paper form	$FC_{on-site,i,y}$ should not include fossil fuels co-fired in the boiler(s) but should include all other fossil fuel consumption at the project site that is attributable to the project activity, such as for on-site transportation or treatment of biomass residues.
7. **$EC_{PJ,y}$**	On-site electricity consumption attributable to the project activity during the year *y*	On-site measurements	MWh	m	Continuously, aggregated at least annually	100%	Electronic and paper form	Cross-check measurement results with invoices for purchased electricity

8. **$EF_{grid,y}$**	CO_2 emission factor for electricity used from the grid	Use ACM0002 to calculate the grid emission factor. If electricity consumption ($EC_{PJ,y}$) is less than 15 GWh/yr, the average grid emission factor (including all grid-connected power plants) may be used.	tCO_2/MWh	e	Either once at the start of the project activity or updated annually, consistent with guidance in ACM0002	100%	Electronic and paper form	
9. **N_y**	Number of truck trips during the year *y*	On-site measurements	-	M	Continuously	100%	Electronic and paper form	Check consistency of the number of truck trips with the quantity of biomass combusted
10. **AVD_y**	Average return trip distance (from and to) between the biomass fuel supply sites and the site of the project plant during the year *y*	Records by project participants on the origin of the biomass	Km	e	Regularly	100%	Electronic and paper form	If biomass is supplied from different sites, this parameter should correspond to the mean value of km traveled by trucks that supply the biomass plant.

11. **NCV_i**	Net calorific value of fossil fuel type *I*	Use accurate and reliable local or national data	GJ / m^3	e	Review the appropriateness of the data annually	100%	Electronic and paper form	
12. **$EF_{km,CO2,y}$**	Average CO_2 emission factor per km for the trucks during the year *y*	Choose emission factors applicable for the truck types used from the literature in a conservative manner	tCO_2/km	e	At least annually	100%	Electronic and paper form	
13. **$EF_{CH4,BF}$**	CH_4 emission factor for the combustion of the biomass residues in the boilers	On-site measurements or default values	tCH_4/GJ	e, m	Quarterly	100%	Electronic and paper form	CH_4 emission factor is a default value and determined in accordance with Methodology AM0036 version 02, tables 4, 5
14. **$EF_{CO2,LE}$**	CO_2 emission factor of the most carbon intensive fuel used in the country	use national default values for the CO_2 emission factor	tCO_2/GJ	E	Annually	100%	Electronic and paper form	

15. **NCV_k**	Net calorific value of biomass residue type *k*	On-site measurements	GJ/ton of dry matter	m	At least every six months, taking at least three samples for each measurement.	100%	Electronic and paper form	Check the consistency of the measurements by comparing the measurement results with measurements from **previous years**, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements

Project emissions rise from two emission source:

Emission source 1. Emissions from on-site natural gas consumption.

Emission source 2. Methane emissions from biomass residue combustion.

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

Project emissions include CH_4 emissions from the combustion of biomass residues ($PE_{CH4,BF,y}$), as this source is included in the project boundary and CO_2 emissions form additional waste wood transportation to the project site:

$$PE_y = PE_{CO2,TR,y} + PE_{CO2,EC,y} + GWP_{CH4} \cdot PE_{CH4,BF,y}$$

Where:

$PE_{CO2,TR,y}$ = CO2 emissions from off-site transportation of biomass residues to the project site (tCO2/yr);

GWP_{CH4} =Global Warming Potential for methane valid for the relevant commitment period;

$PE_{CH4,BF,y}$ =CH_4 emissions from the combustion of waste wood at the new boilers during the year y (tCO_2/yr)

$PE_{CO2,EC,y}$ =CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr).

Emissions from fossil fuel combustion and electricity consumption are not included in the project boundaries.

a) CO2 emissions from transportation of biomass residues to the project site (PETR,CO2,y)

In cases where the biomass residues are not generated directly at the project site, project participants shall determine CO2 emissions resulting from transportation of the biomass residues to the project plant. In many cases transportation is undertaken by vehicles.
According to the Option 1 of the Methodology, emissions are calculated on the basis of distance and the number of trips:

$$PE_{CO2,TR,y} = N_y \cdot AVD_y \cdot EF_{km,CO2}$$

Where:

$PE_{CO2,TR,y}$ = CO2 emissions from off-site transportation of biomass residues to the project site (tCO2/yr);

N_y - Number of truck trips during the year y;

$EF_{km,CO2}$ - Average CO_2 emission factor for the trucks measured during the year y (tCO_2/km)

$EF_{km,CO2}$ is 74100 kg/TJ in accordance with IPCC data. Using data of the Enterprise for biomass transportation (62720 kg of diesel per year, NCV of diesel is 43 MJ/kg, fuel consumption is 62720 kg/yr, average distance for all tracks is 165250 km/yr) it could be calculated that EF is 0.00121tCO_2/km.
All the data for calculation of transport emissions were presented by the Enterprise.

b) Methane emissions from combustion of biomass residues ($PE_{CH4,BF,y}$ **)**

The project participants decided to include this source in the project boundary. The CH_4 emissions caused by waste wood combustion at new boilers according to the equation (10) of AM0036 are calculated as follows:

$$PE_{CH4,BF,y} = EF_{CH4,BF} \cdot BF_y \cdot NCV_K$$

Where:
$BF_{PJ,k,y}$ = Quantity of waste wood (biomass residue) combusted in the new boilers during the year y (tons of dry matter);
NCV_K = Net calorific value of the biomass residue (waste wood) (GJ/ton of dry matter);
$EF_{CH4,BF}$ = CH4 emission factor for the combustion of waste wood in the new boilers (tCH_4/GJ).The emission factor was calculated in accordance with Methodology and equal 41.1 kg/Tj. This value is constant.

The net calorific value of dry matter waste wood (in MJ/kg) is following:

$$NCV_K = NCV_{wet,10\%} = \frac{100}{100-W}.$$

Where W = moisture content of waste wood.

To determine the CH_4 emission factor the IPCC default value is used. The uncertainty of the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor must be applied to the CH_4 emission factor. The level of the conservativeness factor depends on the uncertainty range of the estimate for the CH_4 emission factor.
Appropriate conservativeness factor shall be chosen to multiply with the estimate for the CH_4 emission factor
The amount of purchased biomass will be registered according to invoices and delivery notes of the seller. The weight of purchased waste wood will be determined on the basis of waste wood volumeindicated in delivery notes. The calculations will be based on existing literature data and waste wood passports.
The amount of own waste wood is calculated on the basis of boiler's fuel consumption. The feeding system of the boiler contains 4 screws with an adjustable rotating frequency. Waste wood volume is calculated taking into consideration screws' volume and rotating frequence and using passport data on waste wood density.
Amount of combusted wood can be cross-checked from the amount of produced steam considering boiler efficiency and NCV of waste wood.

All the calculations will be cross-checked through produced thermal energy and net calorific value of the waste wood.

c) CO2 emissions fromon-site electricity consumption ($PE_{CO2,EC,y}$)

CO_2 emissions from on-site electricity consumption ($PE_{CO2,EC,y}$) are calculated by multiplying the electricity consumption by an appropriate grid emission factor, as follows:

$$PE_{CO2,EC,y} = EC_{PJ,y} \cdot EF_{grid,y}$$

Where:
$PE_{CO2,EC,y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)
$EC_{PJ,y}$ = On-site electricity consumption attributable to the project activity during the year *y* (MWh)
$EF_{grid,y}$ = CO_2 emission factor for electricity used from the grid (tCO_2/MWh). It was calculated using the Operating Margin Simple Aproach. It was calculated for PDD "Utilization of Coal Mine Methane at the Coal Mine named after A.F. Zasyadko" and as far as this PDD has a positive report of determinators, this parameter can be considered as conservative.
Electricity meters used for on-site electricity consumption measurements are present in table below:

	Name	Type	Data registration	Q-ty	Meters' verification period and verification organization
1.	Active electricity meter	Input #1 SAZU – I670 Клас точності 2.0 Input #2 SAZU – I670M Accuracy class 2.0	Data registration: -daily -mothly Data are taken off at 9.00 am every day and are filed to .xls file	2 items	5 years OJSC "Prykrpattia oblenergo"
2.	Reactive electricity meter	Input #1 SR4U – I673M Accuracy class 2.0 Input #2	Data are taken off at 9.00 am every day and are filed to .xls file	2 items	5 years OJSC "Prykrpattia oblenergo"

		SR4U – I673M Accuracy class 2.0			

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
15 $BF_{k,v}$	Amount of waste wood consumed by wood fired boilers during the year *y*	On-site measurements. Department of head energy engineer	Tons of dry matter	M	Continuously	100%	Electronic and paper form	
16. $\eta_{boiler,FF}$	Energy efficiency of the boiler that would be used in the absence of the project activity	Technical manufacture's information		-	Once at the project start	100%	Electronic and paper form	The higher value among the measured efficiency prior to the implementation of the project activity and manufacturer's information on the efficiency=89%

17. $EF_{FF, CO2, y}$	Emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity	IPCC default emission factor	tCO_2/GJ	-	Review the appropriateness of the data annually	100%	Electronic and paper form	Reliable national data on CO_2 emission factor is not available
18. $HG_{PJ,biomass,y}$	Heat generated with incremental biomass residues used as a result of the project activity during the year *y*	On-site measurements. Department of head energy engineer	GJ/yr	M	Continuously	100%	Electronic and paper form	

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

Baseline emissions include CO_2 emissions from fossil fuel combustion in the boilers in the absence of the project activity and CH_4 emissions from treatment of biomass residues in the absence of the project activity:

$$BE_y = BE_{HG,y} + BE_{BF,y}$$

Where:

BE_y – Baseline emissions during the year y (tCO_2/yr);

$BE_{HG,y}$ – Baseline emissions from fossil fuel combustion for heat generation in the boilers (tCO_2/yr);

$BE_{BF,y}$ – Baseline due to natural decay of waste wood at the landfill (tCO_2/yr);

Baseline emissions from fossil fuel combustion for heat generation in the boilers

Baseline emissions from fossil fuel combustion in the boiler(s) are determined by multiplying the heat generated with fossil fuels that are displaced by biomass residues with the CO2 emission factor of the least carbon-intensive fossil fuels that would be used in the absence of the project activity and by dividing by the average net efficiency of heat generation in the boiler(s), as follows:

$$BE_{HG,y} = \frac{HG_{PJ,biomass,y} \cdot EF_{FF,CO_2,y}}{\eta_{boiler,FF}}$$

Where:

$BE_{HG,y}$ = Baseline emissions from fossil fuel combustion in the boiler(s) during the year y (tCO_2/yr);

$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr); this value will be measured directly by means of quantity of steam output measurement. The accuracy of this value is guarantied by means of regular certification of all measuring eqiuipment according to the passports of devices.

$EF_{FF,CO2,y}$ =56.1 =CO_2 emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity (tCO_2/GJ).

$\eta_{boiler,FF}$ =89% =Energy efficiency of the boiler that would be used in the absence of the project activity;

Heat meters used for measurement of heat generated with incremental biomass residues used as a result of the project activity are presented below:

3.1.	Steam capacity meter	DN80, PN40 ; min. = 90 kg/h, Qmax = 8.599 kg/h (steam 1,1 MPa g, t = 199°C) Prowirl 72W Serial number №A2094802000 Endress+Hauser Accuracy class 2.0	Technical data registration: -every hour -daily -monthly The report is created automatically by the program	1 item	2 years State enterprise “Ivano-Frankivsk regional scientific technical centre of standardization, metrology and certification”
3.2.	Steam capacity meter	DN200, PN40 Qn = 12.000 kg/h (steam 2,0 MPa g, t = 250°C) PMD75-ABA7881BABU Serial number.№ 9700920109D Endress+Hauser Accuracy class 2.0	Technical data registration: -every hour -daily -monthly The report is created automatically by the program	1 item	2 years State enterprise “Ivano-Frankivsk regional scientific technical centre of standardization, metrology and certification”
3.3.	Steam capacity meter	DN200, PN40 Qn = 20.000 kg/h (steam 2,0 MPa g, t = 250°C) PMD75-ABA7881BABU Serial number.№ 9700930109D Endress+Hauser Accuracy class 2.0	Technical data registration: -every hour -daily -monthly The report is created automatically by the program	1 item	2 years State enterprise “Ivano-Frankivsk regional scientific technical centre of standardization, metrology and certification”

Baseline emissions due to natural decay of waste wood at the landfill

As project participants decided to include this emission reduction source into the project boundaries then baseline emissions due to decay of the biomass residues ($BE_{Biomass,y}$) is determined in two steps:

Step 1: Determination of the quantity of biomass residues used as a result of the project activity.
Step 2: Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues.
Step 1. Determination of the quantity of biomass residues used as a result of the project activity ($BF_{PJ,k,y}$).

According to AM0036 and chosen scenario, the total quantity of biomass residues used in the project plant is attributable to the project activity and hence $BF_{PJ,k,y} = BF_{k,y}$

Step 2. Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues.
As the most likely baseline scenario for the use of the biomass residues is that the biomass residues would decay under aerobic conditions, the baseline emissions are calculated according to the Methodology AM0036 by musltiplying the quantity of biomass residues that wouldnot be used in the absence of the project activity with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BF,y} = GWP_{CH4} \cdot \sum_{x=1} BF_{PJ,k.y} \cdot NCV_k \cdot EF_{burning,CH4,k,y}$$

Where:

$BE_{BF,y}$ =Baseline emissions due to uncontrolled burning or decay of the biomass residues (tCO2e/yr);

GWP_{CH4} =Global Warming Potential of methane valid for the commitment period (tCO2e/tCH4);

$BF_{PJ,k.y}$ =Quantity of biomass residue type k used for heat generation as a result of the project activity during the year y (tons of dry matter or liter);

NCV_k =Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter);

$EF_{burning,CH4,k,y}$ = 0,001971 =CH4 emission factor for uncontrolled burning of the biomass residue type k during the year y (tCH4/GJ)

Leakages

As concerning the leakages, the Methodology outlines the options that may be used to demonstrate that the biomass residues used in the plant did not increase fossil fuel consumption ot other GHG emissions elsewhere.
According to the Methodology AM0036 there are some approaches that could help to rule out the leakages:

L1 – At the site where the project activity is supplied from with biomass residues, the biomass residues have not been collected or utilized.The supplying enterprise have not any heat or electricity generating equipment which could use biomass residues as a fuel and have no any prospects to install such equipment in the nearest future.
L2 – Absence of the possibility to utilize waste wood for energy purpose is the common situation in the region of project implementation. All woodworking enterprises have problems with waste wood sale. Ivano-Frankivsk region is rich in wood raw materials. In such case it is easy to find additional wood supplying enterprise not far from the enterprise.
L3 – According to the state regulation which forbid waste wood removal to the landfills have to collect all wastes at site. To avoid any problems with ecological services and on the assumption of lack of territory to store waste wood the part of wastes is supplied to the population, mostly free of charge. But this market is very small because the wood residues have no enough quality, have small density and are not convenient in transportation. The rest of waste wood must be also deleted, so the common practice of the region is to remove the residues to the illegal landfills where the residues are left to decay or burnt without energy generation.

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

The section was left blank on purpose.

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:

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):

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as the result of project activity.
In our case the use of the biomass residues did not increase fossil fuel consumption elsewhere, because prior to implementation of the project activity biomass residue have not been collected or utilized, but have been land-filled. This practice would continue in the absence of project activity, because in there is no market emerged for the biomass residues.

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 project reduces CO_2 emissions through substitution of heat generation with natural gas by energy generation with biomass residues (waste wood). The emission ER_y by the project activity during a given year y is the difference between the project emissions (PE_y), emissions due to leakage (L_y) and baseline emissions (BE_y), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y =Emissions reductions during the year y (tCO_2/yr);

BE_y =Baseline emissions during the year y (tCO_2/yr);

PE_y =Project emissions during the year y (tCO_2/yr);

L_y =Leakage emissions during the year y (tCO_2/yr).

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:

Not applicable.

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

As the Methodology indicates, quality control and quality procedures should be applied to the project.
During the project all the meters and instruments will be calibrated regulary as per industry practices. All the data concerning calibration will be collected and archived at the enterprise and issued for verification as required. All measurement equipment have appropriative sertification.
Heat meters are regulary calibrated and corss-checked with balance date.
Weighting equipment is calibrated once/twice per year.
Laboratory equipment is calibrated once per year.
All the monitored data will be archived once a year and will be storaged during 5-year period.
See also Annex 3.

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

The objective of the monitoring plan is to provide a practical framework for collection and management of performance data in order to monitor and verify the GHG emission reduction generated by the Joint Implementation Project.
Collection of information required for calculations of reductions of GHG emissions as a result of the project is performed in accordance with the procedure common for the enterprise. Initial data will be submitted by the environmental department, by the production manager, and by the head energy engineer.
A transparent system for collection and storage of measured data in the electronic form are established. Calculations of emission reduction will be prepared by specialists of **Uniplyt Ltd** at the end of every reporting year. The project manager of **Uniplyt Ltd** prepare reports, as needed for audit and verification purposes. Specialists of "**Scientific Engineering Centre "Biomass"** will check the prepared reports.

Methodology (natural gas)
The monitoring methodology involves monitoring of parameters with regard to the combustion of natural gas in the project activity. Monitoring of parameters for calculating baseline emissions or leakage is not needed.
The net calorific value (provided by the gas supplier) and CO2 emission factor for natural gas (default value) are constant and do not need monitoring. For determination of emission factors, guidance by the 2006 IPCC Good Practice Guidance is followed. The value is chosen in a conservative manner.
The annual natural gas consumption (FF project,,y) should be measured continuously.

Methodology (biomass)

The monitoring methodology involves monitoring of parameters with regard to the combustion, transportation and handling of biomass residues in the project activity.
For emission factors default values from guidance by the 2006 IPCC Good Practice Guidance are used, all values are chosen in a conservative manner.

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

Monitoring plan was developed by "Scientific Engineering Centre "Biomass".
Contact person: Tetiana Ielovikova – Consultant.
E-mail: yelovikova@biomass.kiev.ua.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

According to the used methodology AM0036, generally the project emissions include CO_2 emissions from transportation of biomass residues to the project site ($PE_{T\,y}$), CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PE_{FF\,y}$), CO_2 emissions from consumption of electricity ($PE_{EC,y}$) and, where this emission source is included in the project boundary and relevant, CH_4 emissions from the combustion of biomass residues ($PE_{Biomass,CH4,y}$):

$$PE_y = PE_{T\,y} + PE_{FF\,y} + PE_{EC,y} + GWP_{CH4} \cdot PE_{Biomass,CH4,y}$$

Where:

$PE_{T\,y}$ = CO_2 emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr);

$PE_{FF\,y}$ = CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity (tCO_2/yr);

$PE_{EC,y}$ = CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity (tCO_2/yr);

GWP_{CH4} = Global Warming Potential for methane valid for the relevant commitment period;

$PE_{Biomass,CH4,y}$ = CH_4 emissions from the combustion of biomass residues during the year y (tCO_2/yr).

Carbon dioxide emissions from the combustion of fossil fuels for transportation of biomass residues to the project plant ($PE_{T\,y}$)

$$PE_{CO2,TR,y} = N_y \cdot AVD_y \cdot EF_{km,CO2}$$

Where:

$PE_{CO2,TR,y}$ = CO2 emissions from off-site transportation of biomass residues to the project site (tCO2/yr);

N_y - Number of truck trips during the year y;

$EF_{km,CO2}$ - Average CO_2 emission factor for the trucks measured during the year y (tCO_2/km)

Table E1 – Emissions from the combustion of fosil fuels for transportation of biomass residues to the project plant

Symbol	Unit	Year				
		2008	2009	2010	2011	2012
Ny	1/year	1850	1850	1850	1850	1850
AVD_y	km	85	85	85	85	85
$EF_{km,CO2,y}$	tCO2/km	0,00121	0,0012	0,0012	0,0012	0,0012
	tCO2e/a	190,3	190,3	190,3	190,3	190,3
Total during the commitment period 2008-						951,4

Symbol	Unit	Year 2008	2009	2010	2011	2012
Ny	1/year	200	200	200	200	200
AVD_y	km	40	40	40	40	40
$EF_{km,CO2,y}$	tCO2/km	0,00110	0,0011	0,0011	0,0011	0,0011
	tCO2e/a	8,8	8,8	8,8	8,8	8,8
Total during the commitment period 2008-						43,8

Carbon dioxide emissions from on-site consumption of fossil fuels ($PE_{FF\,y}$)

CO_2 emissions caused by the on-site fossil fuel consumption in the project scenario are calculated as follows:

$$PE_{FF\,y} = \sum_i FC_{on-site,i,y} \cdot NCV_{NG} \cdot EF_{CO2,FF,i}$$

Where

$FC_{on-site,i,y}$ = Quantity of natural gas combusted at the project site during the year y;

NCV_{NG} = Net calorific value of natural has (fossil fuel) combusted at the project site;

$EF_{CO2,FF}$ = CO_2 emission factor for natural gas combusted at the project site, tCO_2/GJ.

As the new boilers don't need natural gas use for co-combstion and waste wood is mostly produced at site, there are no project emission caused be on-site consumption of fossil fuel

CO_2 emissions from electricity consumption ($PE_{EC,y}$)

CO_2 emissions from on-site electricity consumption ($PE_{EC,y}$) are caused by purchase of electricity from the National power grid for own needs of the boilers during operation time and about 1 month period of time each year when the new boilers are stopped due to maintenance and repair works.
CO_2 emissions from on-site electricity consumption ($PE_{CO2,EC,y}$) are calculated by multiplying the electricity consumption by an appropriate grid emission factor, as follows:

$$PE_{CO2,EC,y} = EC_{PJ,y} \cdot EF_{grid,y}$$

Where:
$PE_{CO2,EC,y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr)
$EC_{PJ,y}$ = On-site electricity consumption attributable to the project activity during the year *y* (MWh)
$EF_{grid,y}$ = CO_2 emission factor for electricity used from the grid (tCO_2/MWh). Use ACM0002 to calculate the grid emission factor. If electricity consumption ($EC_{PJ,y}$) is less than 15 GWh/yr, the average grid emission factor (including all grid-connected power plants) may be used.

CO2 emissions from on-site electricity consumption, tCO2e - site 1

Symbol	Unit	Year 2007	2008	2009	2010	2011	2012
$EC_{PJ,y}$	MWh	2772,0	2772,0	2772,0	2772,0	2772,0	2772,0
$EF_{grid,y}$	tCO2/MWh	0,896	0,896	0,896	0,896	0,896	0,896
$PE_{EC,y}$	tCO2	**2483,7**	**414,0**	**2483,7**	**2483,7**	**2483,7**	**2483,7**
Total during the commitment period 2008-2012							**10 348,8**

CO2 emissions from on-site electricity consumption, tCO2e - site 2

Symbol	Unit	Year					
		2007	2008	2009	2010	2011	2012
$EC_{PJ,y}$	MWh	1600,0	1600,0	1600,0	1600,0	1600,0	1600,0
$EF_{grid,y}$	tCO2/MWh	0,896	0,896	0,896	0,896	0,896	0,896
$PE_{EC,y}$	tCO2	**1433,6**	**0,0**	**716,8**	**1433,6**	**1433,6**	**1433,6**
Total during the commitment period 2008-2012							**5 017,6**

Methane emissions from combustion of biomass residues ($PE_{Biomass,CH4,y}$)

The project participants decided to include this source in the project boundary. The CH_4 emissions caused by waste wood combustion at new boilers according to the equation (16) of AM0036 are calculated as follows:

$$PE_{Biomass,CH4,y} = EF_{CH4,BF} \cdot BF_y \cdot NCV$$

Where:

BF_y = Quantity of biomass residue (waste wood) combusted in the new boilers during the year y (tons of dry matter);

NCV = Net calorific value of the biomass residue (waste wood) (GJ/ton of dry matter);

$EF_{CH4,BF}$ =CH_4 emission factor for the combustion of waste wood in the new biomass boilers (tCH_4/GJ).

The net calorific value of waste wood to be combusted in the new biomass boilers is 10.3 GJ/t, and the water content of this fuel is 36% (the data of the project owner).
Thus the net calorific value of dry matter of waste wood is following:

$$NCV = NCV_{wet,10\%} = \frac{100}{100-W} = 10.3 \cdot \frac{100}{100-36} = 16.1 \text{ MJ/t.}$$

To determine the CH_4 emission factor, it was decided not to conduct any measurements at the plant site, but use IPCC default values, as provided in the Table 4 of AM0036 (p.19). The uncertainty of the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor must be applied to the CH_4 emission factor. The level of conservativeness factor depends on the uncertainty range of the estimate for the CH_4 emission factor.
According to the *Table 4. Default CH_4 emissions factors for combustion of biomass residues* of AM0036, default emission factor for waste wood (that corresponds to *wood waste*) is 30 kg CH_4/TJ, and assumed uncertainty is 300%. For such value of uncertainty, the conservativeness factor to be applied according to the *Table 5 Conservativeness factors* of AM0036 is 1.37. So in such case the CH_4 emission factor for waste wood combustion at new CHP plant is:

$$EF_{CH4,BF} = 1.37 \cdot 30 = 41.1 \text{ kg/TJ.}$$

The CH_4 emission from waste wood combustion at new boilers is presented in the Table E.2 below:

Table E.2-The CH_4 emission from waste wood combustion at new biomass boilers

Methane emissions from biomass residues combustion at new boiler, tCO2e

Symbol	Unit	Year					
		2007	2008	2009	2010	2011	2012
BF_y	t of dry matter/a	29369	29369	29369	29369	29369	29369
$BF_{wet,y}$	t of wet matter/a	45889	45889	45889	45889	45889	45889
W	%	36,0	36,0	36,0	36,0	36,0	36,0
NCV	GJ/t of dry matter	16,1	16,1	16,1	16,1	16,1	16,1
$EF_{CH4,BF}$	kgCH4/TJ	41,1	41,1	41,1	41,1	41,1	41,1
$PE_{Biomass,CH4,y}$	tCH4/a	19,43	19,43	19,43	19,43	19,43	19,43
GWP_{CH4}	-	21	21	21	21	21	21
$PE_{Biomass,CH4,y}$	tCO2e/a	**408,0**	**68,0**	**408,0**	**408,0**	**408,0**	**408,0**
Total during the commitment period 2008-2012							**1 699,8**

Methane emissions from biomass residues combustion at new boiler, tCO2e - site#2

Symbol	Unit	Year					
		2007	2008	2009	2010	2011	2012
BF_y	t of dry matter/a	19501	19501	19501	19501	19501	19501
$BF_{wet,y}$	t of wet matter/a	30471	30471	30471	30471	30471	30471
W	%	36,0	36,0	36,0	36,0	36,0	36,0
NCV	GJ/t of dry matter	16,1	16,1	16,1	16,1	16,1	16,1
$EF_{CH4,BF}$	kgCH4/TJ	41,1	41,1	41,1	41,1	41,1	41,1
$PE_{Biomass,CH4,y}$	tCH4/a	12,90	12,90	12,90	12,90	12,90	12,90
GWP_{CH4}	-	21	21	21	21	21	21
$PE_{Biomass,CH4,y}$	tCO2e/a	**270,9**	**0,0**	**135,4**	**270,9**	**270,9**	**270,9**
Total during the commitment period 2008-2012							**948,1**

Total project greenhouse gases emissions in tCO_2 are presented in the Table E.3 below:

Table E.3-Total project greenhouse gases emissions

Total project emissions, tCO2e

Source	Symbol	Year				
		2008	2009	2010	2011	2012
Emissions from biomass residues transportation	PET_y	199.0	199.0	199.0	199.0	199.0
Emissions from on-site fossil fuels consumption	$PEFF_y$	0.0	0.0	0.0	0.0	0.0
Emissions from on-site electricity consumption	$PE_{EC,y}$	414.0	3200.5	3917.3	3917.3	3917.3
Methane emissions from biomass residue combustion	$PE_{Biomass,CH4,y}$	68.0	543.4	678.8	678.8	678.8
Total project emissions	PE_y	**681.0**	**3942.9**	**4795.2**	**4795.2**	**4795.2**
Total project emisions during commitment period 2008-2012						**19 009.5**

E.2. Estimated leakage:

As indicated in the section B.**2 "Barrier analysis for the waste wood use alternatives"** the leakages under the project may be neglected, and therefore, were taken equal to zero.

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

Since leakages can be neglected: E.1+E.2 = E.1 (see section E.1).

E.4. Estimated baseline emissions:

Baseline emissions due to natural gas combustion for heat generation.

In our case when the biomass boilers is going to be put into operation, it is necessary to determine the emission reduction due to displacement of heat ($ER_{heat,y}$).

As the identified baseline scenario is the generation of heat in steam boilers using the fossil fuels (natural gas), baseline emissions are calculated by multiplying the savings of fossil fuel (natural gas) with the emission factor of this fuel (natural gas).

Emissions reductions from savings of fossil fuels are determined by dividing the quantity of generated heat that displaces heat generation in fossil fuel fired boilers (Q_y) by the efficiency of the boiler that would be used in the absence of the project activity (ε_{boiler}), and by multiplying with the CO_2 emission factor of the fuel type that would be used in the absence of the project activity for heat generation ($EF_{CO2,BL,heat,i}$), as follows:

$$BE_{HG,y} = \frac{HG_{PJ,biomass,y} \cdot EF_{FF,CO2,y}}{\eta_{boiler,FF}}$$

Where:

$BE_{HG,y}$ = Baseline emission from fossil fuel combustion for heat generation in the boilers (tCO_2/yr);

$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of project activity (GJ/yr);

$\eta_{boiler,FF}$ =Energy efficiency of the boiler that would be used in the absence of the project activity.

In our case when the baseline scenario is that all heat would in the absence of the project activity be generated in fossil fuel fired boilers $HG_{PJ,biomass,y}$ is determined as a net quantity of heat generated in the biomass boilers from firing biomass residues (waste wood).

$EF_{FF,CO2,y}$ =CO_2 emission factor of the natural gas used for heat generation in the absence of project activity (tCO_2/GJ).

Emission reduction due to displacement of heat generation using fossil fuel by heat generated from biomass residues is presented in the table E.4 below:

Table E.4 - Emission reduction due to displacement of heat generation using fossil fuel by heat generated from biomass residues

Emissions from fossil fuel combustion in boilers for heat generation - site#1

Symbol	Unit	Year 2007	2008	2009	2010	2011	2012
$HG_{PJ,biomass,y}$	GJ/yr	368676	61446	368676	368676	368676	368676
$\eta_{boiler,FF}$	%	89	89	89	89	89	89
$EF_{FF,CO2,y}$	tCO2/TJ	56,1	56,1	56,1	56,1	56,1	56,1
$BE_{HG,y}$	tCO2/yr	23 239	3 873	23 239	23 239	23 239	23 239
Total during commitment period							**96 829**

Emissions from fossil fuel combustion in boilers for heat generation - site#2

Symbol	Unit	Year 2007	2008	2009	2010	2011	2012
$HG_{PJ,biomass}$	GJ/yr	0	0	122400	244800	244800	244800
$\eta_{boiler,FF}$	%	89	89	89	89	89	89
$EF_{FF,CO2,y}$	tCO2/TJ	56,1	56,1	56,1	56,1	56,1	56,1
$BE_{HG,y}$	tCO2/yr	0	0	7 715	15 431	15 431	15 431
Total during commitment period							**54 007**

Baseline emissions due to natural decay or uncontrolled burning of anthropogenic sources of biomass residues

As project participants decided to include this emission reduction source into the project boundaries then baseline emissions due to decay of the waste wood ($BE_{Biomass,y}$) is determined in two steps:

Step 1: Determination of the quantity of biomass residues used as a result of the project activity.

Step2: Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues

Step 1. Determination of the quantity of waste wood used as a result of the project activity ($BF_{PJ,k,y}$)

According to AM0036 and chosen scenario, the part of waste wood used for heat production in project scenario, is purchased from other enterprises and can't be included in the project boundaries. Thus we calculate emissions only for own wastes of the Enterprise.

Step 2. Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues.

As the most likely baseline scenario for the use of the biomass residues is that the biomass residues would decay under aerobic conditions, the baseline emissions are calculated according to the Methodology

AM0036 by musltiplying the quantity of biomass residues that wouldnot be used in the absence of the project activity with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BF,y} = GWP_{CH4} \cdot \sum_{x=1} BF_{PJ,k.y} \cdot NCV_k \cdot EF_{burning,CH4,k,y}$$

Where:

$BE_{BF,y}$ =Baseline emissions due to uncontrolled burning or decay of the biomass residues (tCO2e/yr);

GWP_{CH4} =Global Warming Potential of methane valid for the commitment period (tCO2e/tCH4);

$BF_{PJ,k.y}$ =Quantity of biomass residue type k used for heat generation as a result of the project activity during the year y (tons of dry matter or liter);

NCV_k =Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter);

$EF_{burning,CH4,k,y}$ =CH4 emission factor for uncontrolled burning of the biomass residue type k during the year y (tCH4/GJ)

1)

Baseline methane emissions $BE_{CH4,SWDC,y}$ in tCO_{2e} due to natural decay of waste wood at the landfill during the commitment period (2008-2012) are presented in the table E.5 below:

Table E.5 - Baseline methane emissions $BE_{CH4,SWDC,y}$ in tCO_{2e}

Symbol	Unit	Year					
		2007	2008	2009	2010	2011	2012
EFburning,CH4	tCH4/GJ		0,001971	0,001971	0,001971	0,001971	0,001971
NCVk	GJ/t		10,30	10,30	10,30	10,30	10,30
GWP_{CH4}	tCO2e/tCH4		21	21,00	21,00	21,00	21,00
BF	tCO2/TJ		24800	24800,00	24800,00	24800,00	24800,00
$BE_{HG,y}$	tCO2/yr		1 762	10 573	10 573	10 573	10 573
Total during commitment period							**44 054**

Total baseline CO_2 emissions are presented in the table E.6 below:

Table E.6 - Total baseline CO_2 emissions

Total baseline emissions in tCO2

Source	Symbol	Year 2008	2009	2010	2011	2012
Fossil fuels consumption	$BE_{GH,y}$	3873.2	30954.3	38669.7	38669.7	38669.7
Waste wood disposal at the landfill	$BE_{CH4,SWDC,y}$	1762.2	10572.9	10572.9	10572.9	10572.9
Total baseline emissions		5 635.3	41 527.3	49 242.6	49 242.6	49 242.6
Baseline emissions during 2008-2012						194 890.3

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

The difference between baseline emissions (E.4) and project emissions (E.1) are presented in the table E.7 below:

Table E.7 - Total emission reduction

CO2 Baseline scenario emissions	Unit	2008	2009	2010	2011	2012	Total BL scenario emission 2008-2012
Total CO2 emissions, baseline scenario	ton	5635,322	41527,258	49242,584	49242,584	49242,584	194890,332

CO2 project scenario emissions		2008	2009	2010	2011	2012	Total project scenario emission 2008-2012
Total CO2 emissions, project scenario	ton	680,985	3942,947	4795,187	4795,187	4795,187	19009,494

Total emissions reduction	ton	2008	2009	2010	2011	2012
		4954,337	37584,311	44447,397	44447,397	44447,397

Total emission reductions 2008-2012	ton	175881
Average ER per annum	ton	35176

SECTION F. Environmental impacts

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

Before the start of the project implementation, Uniplyt Ltd has received all the required conclusions of the state ecology examinations.
Project implementation increases biomass residues (waste wood) consumption as fuel while decreasing consumption of fuel oil (natural gas).
This results in the reduction of GHG emissions into the atmosphere.

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 activities are in compliance with Ukrinian regulations regarding waste wood utilization (the Low # 3073-III from 07.03.2002).
Some environmental effects will occur during the project lifetime.

Effects on the medium air

Comparing to natural gas combustion, the combustion of wood fuel will be “dirtier” and will require installation of environmental equipment. Due to this fact, it is planned to install the system of inertial ash catchers to each wood-fired boiler. Ash content in venting after such system is installed will not exceed allowable concentrations. Also according Ukrainian environment standards it would be necessary to install another chimney as dissemination of flue gases after new boiler-houses work is anticipated by the way of new individual chimney construction. Emission of the harmful substances from the project equipment are following: NO_x – 54.7 t/yr, carbon monoxide – 101.1 t/yr, ash – 0.4 t/yr, wood dust – 0.0044 t/yr. To avoid ingress of contamination into the atmosphere project foresees some mitigation measures.

SECTION G. Stakeholders’ comments

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

Information about the project was widespread in newspapers and internet. Example of such article is on web-site: http://www.ua.all-biz.info/news/index.php?newsid=176281. Also the project was discussed at the meetings of district counciland Village council. District council approved the project and has grant a permit for land use for the new boiler house. No other comments were received until now.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Project Participant 1

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Salutation:	Mr.
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Annex 2

Annex 2.1

Economical indexes
Project scenario with JI mechanism

Item	***Year of poeration***												*Depreciated cost*
	0	***1***	***2***	***3***	***4***	***5***	***15***	***16***	***17***	***18***	***19***	***20***	
Investment costs	4 732 731	3 845 560											
Operating costs for boiler #1		943 567	943 567	943 567	943 567	943 567	943 567	943 567	943 567	943 567	943 567	943 567	943 567
Operating costs for boiler #2		0	590 511	590 511	590 511	590 511	590 511	590 511	590 511	590 511	590 511	590 511	590 511
Total operating costs		943 567	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077	1 534 077
Loan interests for boiler #1	0	289 296	191 922	94 548	75 638	56 729	0	0	0	0	0	0	0
Loan interests for boiler #2	0	0	326 873	280 177	233 480	186 784	0	0	0	0	0	0	0
Total loan interests	0	289 296	518 795	374 724	309 119	243 513	0	0	0	0	0	0	0
Amortization assesments for boiler #1		1 037 656	810 149	632 523	493 842	385 566	32 450	25 335	19 780	15 444	12 058	9 414	33 523
Amortization assesments for boiler #2		0	843 143	658 283	513 954	401 269	33 771	26 367	20 586	16 073	12 549	9 797	34 888
Total amortization assesments		1 037 656	1 653 292	1 290 806	1 007 795	786 835	66 221	51 702	40 366	31 516	24 606	19 211	68 411
Revenue for boiler #1		1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020	1 095 020
Revenue for boiler #2		0	727 091	727 091	727 091	727 091	727 091	727 091	727 091	727 091	727 091	727 091	727 091
ERU sales revenue		49 543	375 843	444 474	444 474	444 474	0	0	0	0	0	0	0
Total revenue		1 144 564	2 197 954	2 266 585	2 266 585	2 266 585	1 822 111	1 822 111	1 822 111	1 822 111	1 822 111	1 822 111	1 822 111
Balance sheet profit	0	-1 125 956	-1 508 210	-933 023	-584 407	-297 841	221 812	236 331	247 667	256 518	263 428	268 822	219 623
Income tax	0	0	0	0	0	0	55 453	59 083	61 917	64 129	65 857	67 206	54 906
Net profit	0	-1 125 956	-1 508 210	-933 023	-584 407	-297 841	166 359	177 249	185 750	192 388	197 571	201 617	164 717
Cash flow	-4 732 731	-3 933 860	145 082	357 783	423 389	488 995	232 581	228 951	226 117	223 904	222 177	220 828	233 128
Money on the account	**-4 732 731**	**-8 666 591**	**-8 521 509**	**-8 163 725**	**-7 740 337**	**-7 251 342**	**-4 938 635**	**-4 709 684**	**-4 483 567**	**-4 259 663**	**-4 037 486**	**-3 816 658**	**-3 583 530**
Simple payback period		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Simple payback period													
Discount factor		1.000	0.917	0.842	0.772	0.708	0.299	0.275	0.252	0.231	0.212	0.194	0.178
Discounted cash flow		-3933860	133103	301139	326934	346416	69599	62856	56952	51738	47100	42949	41597
Discounted money on the account	**-4 732 731**	**-8666591**	**-8533488**	**-8232349**	**-7905415**	**-7558999**	**-6539620**	**-6476764**	**-6419812**	**-6368074**	**-6320974**	**-6278025**	**-6236428**
		0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Discounted payback period													

Economic indexes

NPV	**-5 642 598**	**Euro**
IRR	**-5.2%**	
Simple payback period	**>10 years**	**years**
Discounted payback period	**>10**	**years**

Project scenario with ERUs sales (including tariffs growth)

Item	***Year of operation***												*Depreciated cost*
	0	***1***	***2***	***3***	***4***	***5***	***15***	***16***	***17***	***18***	***19***	***20***	
Investment costs	4 732 731	3 845 560											
Operating costs for boiler #1		943 567	1 035 661	1 138 609	1 253 696	1 382 358	3 884 770	4 327 113	4 822 049	5 375 838	5 995 491	6 688 851	6 688 851
Operating costs for boiler #2		0	648 325	723 866	805 078	914 390	2 633 222	2 935 278	3 273 089	3 650 896	4 073 446	4 546 047	4 546 047
Total operating costs		943 567	1 683 986	1 862 475	2 058 774	2 296 748	6 517 992	7 262 391	8 095 138	9 026 735	10 068 937	11 234 898	11 234 898
Loan interests for boiler #1	0	289 296	191 922	94 548	75 638	56 729	0	0	0	0	0	0	0
Loan interests for boiler #2	0	0	326 873	280 177	233 480	186 784	0	0	0	0	0	0	0
Total loan interests	0	289 296	518 795	374 724	309 119	243 513	0	0	0	0	0	0	0
Amortization assesments for boiler #1		1 037 656	810 149	632 523	493 842	385 566	32 450	25 335	19 780	15 444	12 058	9 414	33 523
Amortization assesments for boiler #2		0	843 143	658 283	513 954	401 269	33 771	26 367	20 586	16 073	12 549	9 797	34 888
Total amortization assesments		1 037 656	1 653 292	1 290 806	1 007 795	786 835	66 221	51 702	40 366	31 516	24 606	19 211	68 411
Revenue for boiler #1		1 095 020	1 182 622	1 277 232	1 379 410	1 489 763	3 216 286	3 377 101	3 545 956	3 723 254	3 909 416	4 104 887	4 310 132
Revenue for boiler #2		0	785 258	848 079	915 925	989 199	2 135 607	2 242 387	2 490 972	2 615 520	2 905 469	3 050 743	3 203 280
ERU sales revenue		49 543	375 843	444 474	444 474	444 474	0	0	0	0	0	0	0
Total revenue		1 144 564	2 343 723	2 569 784	2 739 809	2 923 436	5 351 893	5 619 488	6 036 928	6 338 774	6 814 886	7 155 630	7 513 411
Balance sheet profit	0	-1 125 956	-1 512 350	-958 221	-635 879	-403 661	-1 232 320	-1 694 606	-2 098 577	-2 719 477	-3 278 657	-4 098 479	-3 789 897
Income tax	0	0	0	0	0	0	0	0	0	0	0	0	0
Net profit	0	-1 125 956	-1 512 350	-958 221	-635 879	-403 661	-1 232 320	-1 694 606	-2 098 577	-2 719 477	-3 278 657	-4 098 479	-3 789 897
Cash flow	-4 732 731	-3 933 860	140 942	332 585	371 916	383 175	-1 166 099	-1 642 903	-2 058 210	-2 687 961	-3 254 051	-4 079 268	-3 721 487
Money on the account	**-4 732 731**	**-8 666 591**	**-8 525 648**	**-8 193 064**	**-7 821 148**	**-7 437 973**	**-11 362 097**	**-13 005 001**	**-15 063 211**	**-17 751 171**	**-21 005 223**	**-25 084 491**	**-28 805 977**
Simple payback period		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Simple payback period													
Discount factor		1.000	0.917	0.842	0.772	0.708	0.299	0.275	0.252	0.231	0.212	0.194	0.178
Discounted cash flow		-3933860	129305	279930	287187	271451	-348951	-451040	-518401	-621116	-689838	-793375	-664028
Discounted money on the account	**-4 732 731**	**-8666591**	**-8537286**	**-8257356**	**-7970168**	**-7698718**	**-9097297**	**-9548337**	**-10066738**	**-10687853**	**-11377692**	**-12171067**	**-12835096**
		0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Discounted payback period													
Economic indexes													
NPV	**-10 602 654**	**Euro**											
IRR													
Simple payback period	**>10 years**	**years**											
Discounted payback period	**>10**	**years**											

Project scenario without ERUs sales (including tariffs growth)

Item	*Year of poeration*												*Depreciated cost*
	0	**1**	**2**	**3**	**4**	**5**	**15**	**16**	**17**	**18**	**19**	**20**	
Investment costs	4 732 731	3 845 560											
Operating costs for boiler #1		943 567	1 035 661	1 138 609	1 253 696	1 382 358	3 884 770	4 327 113	4 822 049	5 375 838	5 995 491	6 688 851	6 688 851
Operating costs for boiler #2		0	590 511	648 325	723 866	805 078	2 363 131	2 633 222	2 935 278	3 273 089	3 650 896	4 073 446	4 073 446
Total operating costs		943 567	1 626 172	1 786 934	1 977 562	2 187 437	6 247 901	6 960 336	7 757 327	8 648 927	9 646 387	10 762 297	10 762 297
Loan interests for boiler #1	0	289 296	191 922	94 548	75 638	56 729	0	0	0	0	0	0	0
Loan interests for boiler #2	0	0	326 873	280 177	233 480	186 784	0	0	0	0	0	0	0
Total loan interests	0	289 296	518 795	374 724	309 119	243 513	0	0	0	0	0	0	0
Amortization assesments for boiler #1		1 037 656	810 149	632 523	493 842	385 566	32 450	25 335	19 780	15 444	12 058	9 414	33 523
Amortization assesments for boiler #2		0	843 143	658 283	513 954	401 269	33 771	26 367	20 586	16 073	12 549	9 797	34 888
Total amortization assesments		1 037 656	1 653 292	1 290 806	1 007 795	786 835	66 221	51 702	40 366	31 516	24 606	19 211	68 411
Revenue for boiler #1		1 095 020	1 182 622	1 277 232	1 379 410	1 489 763	3 216 286	3 377 101	3 545 956	3 723 254	3 909 416	4 104 887	4 310 132
Revenue for boiler #2		0	727 091	785 258	848 079	915 925	1 977 414	2 135 607	2 242 387	2 490 972	2 615 520	2 905 469	3 203 280
Total revenue		1 095 020	1 909 713	2 062 490	2 227 489	2 405 688	5 193 700	5 512 708	5 788 343	6 214 225	6 524 937	7 010 356	7 513 411
Balance sheet profit	0	-1 175 499	-1 888 546	-1 389 975	-1 066 987	-812 097	-1 120 422	-1 499 330	-2 009 350	-2 466 218	-3 146 057	-3 771 152	-3 317 296
Income tax	0	0	0	0	0	0	0	0	0	0	0	0	0
Net profit	0	-1 175 499	-1 888 546	-1 389 975	-1 066 987	-812 097	-1 120 422	-1 499 330	-2 009 350	-2 466 218	-3 146 057	-3 771 152	-3 317 296
Cash flow	-4 732 731	-3 983 403	-235 254	-99 169	-59 192	-25 262	-1 054 201	-1 447 628	-1 968 984	-2 434 702	-3 121 451	-3 751 940	-3 248 885
Money on the account	**-4 732 731**	**-8 716 134**	**-8 951 388**	**-9 050 557**	**-9 109 749**	**-9 135 010**	**-12 486 710**	**-13 934 338**	**-15 903 322**	**-18 338 024**	**-21 459 474**	**-25 211 415**	**-28 460 300**
Simple payback period		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Simple payback period													
Discount factor		1.000	0.917	0.842	0.772	0.708	0.299	0.275	0.252	0.231	0.212	0.194	0.178
Discounted cash flow		-3983403	-215829	-83469	-45707	-17896	-315466	-397429	-495928	-562594	-661728	-729714	-579702
Discounted money on the account	**-4 732 731**	**-8716134**	**-8931963**	**-9015432**	**-9061139**	**-9079035**	**-10248921**	**-10646350**	**-11142277**	**-11704871**	**-12366599**	**-13096313**	**-13676015**
		0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Discounted payback period													

Economic indexes

NPV	**-11 381 415**	**Euro**
IRR	**#ДЕЛ/0!**	
Simple payback period	**>10 years**	**years**
Discounted payback period	**>10**	**years**

Economical indexes for possible scenario H6

Item	*Year of poeration*															*Depreciated cost*
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*15*	*16*	*17*	*18*	*19*	*20*	
Investment costs	2 738 367	2 702 000														
Operating costs for boiler #1		1 201 686	1 256 857	1 314 769	1 375 561	1 439 374	1 506 361	1 576 680	1 650 497	2 281 005	2 389 891	2 504 202	2 624 209	2 750 196	2 882 463	3 021 323
Operating costs for boiler #2		0	812 439	850 650	890 770	932 894	977 123	1 023 562	1 072 321	1 489 118	1 561 141	1 636 764	1 716 166	1 799 537	1 887 074	1 978 987
Total operating costs		1 201 686	2 069 296	2 165 419	2 266 330	2 372 268	2 483 484	2 600 242	2 722 818	3 770 123	3 951 032	4 140 966	4 340 375	4 549 733	4 769 537	5 000 310
Loan interests for boiler #1	0	199 450	114 911	30 372	24 298	18 223	12 149	6 074	0	0	0	0	0	0	0	0
Loan interests for boiler #2	0	229 670	196 860	164 050	131 240	98 430	65 620	32 810	0	0	0	0	0	0	0	0
Total loan interests	0	429 120	311 771	194 422	155 538	116 653	77 769	38 884	0	0	0	0	0	0	0	0
Amortization assesments for boiler #1		600 390	468 754	365 979	285 738	223 089	174 177	135 988	106 173	18 776	14 659	11 445	8 936	6 977	5 447	4 253
Amortization assesments for boiler #2		0	592 416	462 528	361 119	281 943	220 127	171 864	134 182	26 692	20 839	16 270	12 703	9 918	7 743	6 046
Total amortization assesments		600 390	1 061 170	828 507	646 856	505 032	394 304	307 852	240 355	45 467	35 498	27 715	21 639	16 894	13 190	10 298
Revenue for boiler #1		1 201 686	1 256 857	1 314 769	1 375 561	1 439 374	1 506 361	1 576 680	1 650 497	2 281 005	2 389 891	2 504 202	2 624 209	2 750 196	2 882 463	3 021 323
Revenue for boiler #2		0	776 046	812 439	850 650	890 770	932 894	977 123	1 023 562	1 420 522	1 489 118	1 561 141	1 636 764	1 716 166	1 799 537	1 978 987
Total revenue		1 201 686	2 032 903	2 127 208	2 226 210	2 330 144	2 439 255	2 553 803	2 674 059	3 701 527	3 879 009	4 065 343	4 260 973	4 466 362	4 682 000	5 000 310
Balance sheet profit	0	-1 029 510	-1 409 334	-1 061 141	-842 514	-663 810	-516 301	-393 175	-289 114	-114 063	-107 522	-103 338	-101 041	-100 265	-100 728	-10 298
Income tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net profit	0	-1 029 510	-1 409 334	-1 061 141	-842 514	-663 810	-516 301	-393 175	-289 114	-114 063	-107 522	-103 338	-101 041	-100 265	-100 728	-10 298
Cash flow	-2 738 367	-3 131 120	-348 164	-232 633	-195 658	-158 778	-121 998	-85 323	-48 759	-68 595	-72 024	-75 623	-79 402	-83 371	-87 537	0
Money on the account	**-2 738 367**	**-5 869 488**	**-6 217 652**	**-6 450 285**	**-6 645 942**	**-6 804 720**	**-6 926 718**	**-7 012 041**	**-7 060 800**	**-7 477 597**	**-7 549 620**	**-7 625 243**	**-7 704 646**	**-7 788 016**	**-7 875 554**	**-7 875 554**
Simple payback period		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Simple payback period																
Discount factor		1.000	0.917	0.842	0.772	0.708	0.650	0.596	0.547	0.299	0.275	0.252	0.231	0.212	0.194	0.178
Discounted cash flow		-3131120	-319417	-195803	-151084	-112482	-79290	-50875	-26673	-20527	-19773	-19047	-18348	-17674	-17025	0
Discounted money on the account	**-2 738 367**	**-5869488**	**-6188904**	**-6384707**	**-6535790**	**-6648272**	**-6727563**	**-6778438**	**-6805111**	**-6966318**	**-6986092**	**-7005139**	**-7023486**	**-7041161**	**-7058186**	**-7058186**
Discounted payback period																

Economic indexes

NPV	**-6 148 168**	**Euro**
IRR	**#ДЕЛ/0!**	
Simple payback period	**>15 years**	**years**
Discounted payback period	**>15**	**years**

Annex 2.2

Technical Description of the Project

2. Technical input / Технические данные

Proposed system / Предлагаемая система:

Boiler #1

Thermal capacity/Тепловая мощность	13,3	MW / МВт тепл			
Nominal operating hours/Нагрузка установки	7 700	hr/уr / часов/год			
Nominal loading rate/ Уровень номинальной загрузки	100%				
Overall efficiency/ КПД	78%				
Thermal input (by fuel)/ Потребление тепл. энергии (по топливу)	472 662	GJ/уr / ГДж/год	112 807	Gcal/уr / Гкал/год	
Fuel consumption/Необходимое количество топлива	t/уr / т/год	Moisture content / Влажность, %	LCV, MJ/kg / Теплотворная способность, МДж/кг	Density (t/m3)/ Плотность (т/м3)	Volume (m3/уr) / Объем (м3/год)
Own waste	24800	37,0	10,3	0,70	35 429
Purchased waste	21 089	37,0	10,3	0,70	30 128
Total amount	45 889	37,0	10,3	0,70	65 556

Energy production / производство энергии				
Heat produced (gross) / Произведенная теплота (Брутто)	368 676	GJ/уr / ГДж/год	88 074	Gcal/уr / Гкал/год
Heat losses/ Тепловые потери	3	%		
Heat supplied to consumers (technological purposes) / Теплота отпущенная потребителю (технологические нужды)	357 616	GJ/уr / ГДж/год	85 350	Gcal/уr / Гкал/год
Total substitution of natural gas / Полное замещение природного газа	12 256	th. m3/уr / тыс. нм3/год		

Proposed system / Предлагаемая система:

Boiler #2

Thermal capacity/Тепловая мощность	8,0	MW / МВт тепл			
Nominal operating hours/Нагрузка установки	8 500	hr/yr / часов/год			
Nominal loading rate/ Уровень номинальной загрузки	100%				
Overall efficiency/ КПД	78%				
Thermal input (by fuel)/ Потребление тепл. энергии (по топливу)	313 846	GJ/yr / ГДж/год	74 904	Gcal/yr / Гкал/год	
Fuel consumption/Необходимое количество топлива	t/yr / т/год	Moisture content / Влажность, %	LCV, MJ/kg / Теплотворная способность, МДж/кг	Density (t/m3)/ Плотность (т/м3)	Volume (m3/yr) / Объем (м3/год)
Own waste	0				
Purchased waste	30 471				
Total amount	30 471	37,0	10,3	0,70	43 529

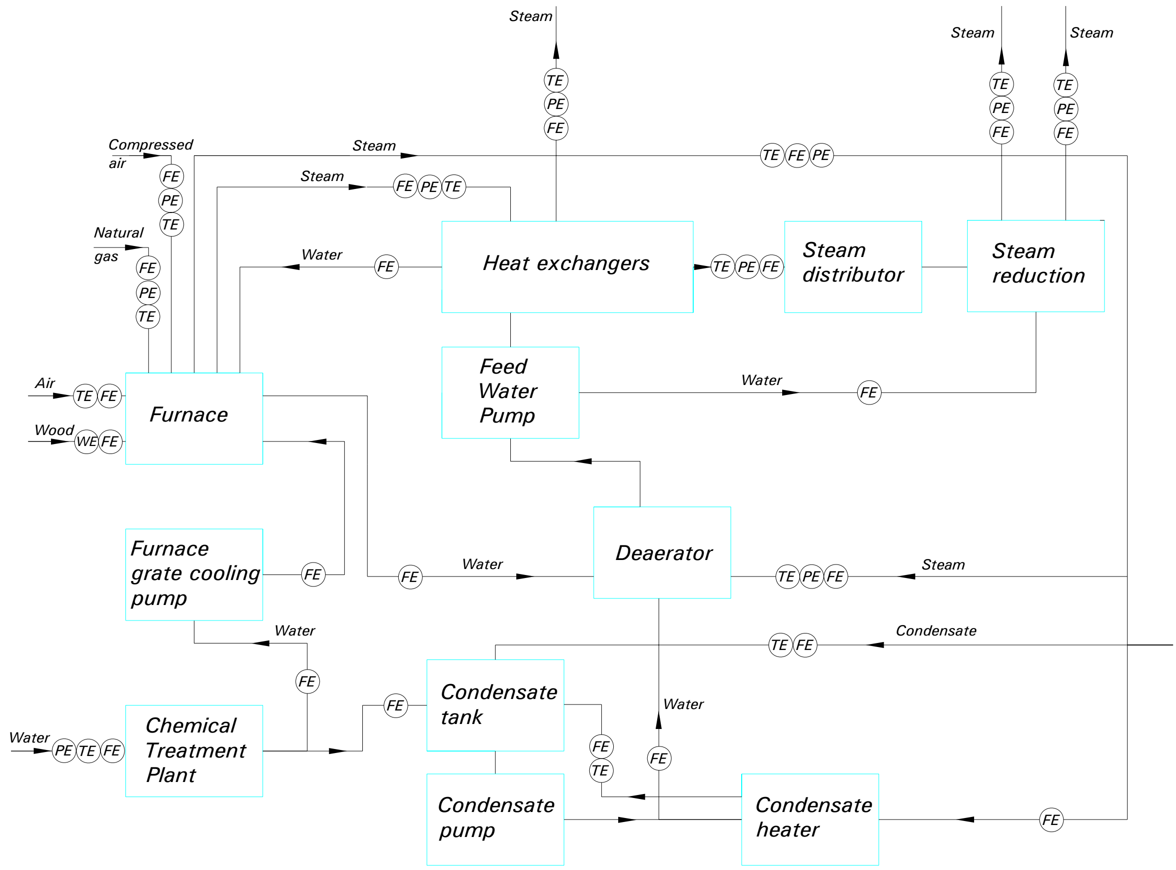
Energy production / производство энергии				
Heat produced (gross) / Произведенная теплота (Брутто)	244 800	GJ/yr / ГДж/год	58 481	Gcal/yr / Гкал/год
Heat losses/ Тепловые потери	3	%		
Heat supplied to consumers (technological purposes) / Теплота отпущенная потребителю (технологические нужды)	237 456	GJ/yr / ГДж/год	56 672	Gcal/yr / Гкал/год
Total substitution of natural gas / Полное замещение природного газа	8 138	th. m3/yr / тыс. нм3/год		

Annex 3

MONITORING PLAN

The implementation of the monitoring plan is to ensure that real, measurable, long-term Greenhouse Gas Emission Reduction can be monitored, recorded and reported. It is a crucial procedure to identity the final ERUs of the proposed project. This monitoring plan for the proposed project activity will be implemented by the project owner, "Uniplyt" Ltd

1. What data will be monitored?
As is shown in Section D, there are two series of data that need to be monitored: Project related emissions and Baseline related emission. The detailed meters installation is illustrated in the following figure:



PE – Pressure measurement
TE – Temperature measurement
FE – Flow measurement
Figure 3.1 – Monitoring scheme for project boiler house

2. How will the data be monitored, recorded and managed?
All meters installed in the proposed project should be accorded with national standard. All the equipment used will be serviced, calibrated and maintained in accordance with the original

manufactures instructions and complete recorded preservation. Data storage and filing system is to be established.
Recording preservation is the most important process in the monitoring plan. Without accurate and efficient record keeping, project emission reductions cannot be verified. As stand in Section D4, the responsible personal for monitoring JI related information would be appointed by the proposal project owner and supervised by the JI developer.
The data are analyzed on a daily basis by the operator. In case of a drift of one parameter the operator can react quickly and fix any potential problems. All data required for the emission calculations will be kept in the onsite-monitoring database. On a regular basis, all monitoring information is analyzed following the formulae in Section B.

3. Calibration of Meter and Metering

Flow meters will be subject to a regular maintenance and periodical calibration according to the manufacturer's recommendation to ensure accuracy. Power meters will be periodically calibrated according to the manufacturer's recommendation to ensure accuracy. The temperature gauge should be subject to a regular maintenance and testing regime to ensure accuracy. The pressure gauge should be subject to a regular maintenance and testing regime to ensure accuracy. At least once a year all meters must be certified by state authorised laboratory.

4. Verification Procedure

The main objective of the verification is to independently verify whether the emission reductions reported in the PDD has been achieved by the proposed project. It is expected that the verification could be done annually.
Main verification activities for the project included:
1) The project owner, "Uniplyt" Ltd will sign a verification service agreement with specific AIE in accordance with relevant JISC regulations:
2) The project owner will provide the completed data records.
3) The project owner will cooperate with AIE to implement the verification process, i.e. the personnel in charge of monitoring and data handling should be available for interview and answer questions honestly; To be summarized, the project owner "Uniplyt" Ltd will implement a proper monitoring plan to make sure that the emission reduction for the proposed project would be measured accurately.

Annex 4

ТзОВ „Лістранссервіс"

77552 смт Вигода, вул. Заводська 4, Долинський район, Івано-Франківська область,
код 35401618, р/р 2600302773001 в ІФФ АБ „Київська Русь" м. Долина, МФО 336008, Св. 100094434, ПН 354016109058

№ 08/14 від 04.11.2008

ТзОВ "Лістранссервіс", в особі директора, Лонгуса Вадима Володимировича, повідомляє, що не продає власні відходи деревини іншим підприємствам, та не використовує їх у жодному випадку. Відходи віддаються населенню, а решта зберігаються на території підприємства.

Директор ТзОВ "Лістранссервіс" **Лонгус В**

“Listransservice” Ltd
77552, Vygode village,
Zavodska str. 4,
Dolyna district, Ivano-Frankivsk region

“Listransservice” Ltd., in the person of the director Vadim Longus, confirms that own wood residues are not sold to other enterprises and are not used for own purposes in any case. The wood wastes are taken by population free of charge and the rest are stored at the enterprise territory.

Director of “Listransservice” Ltd.
Longus V.V.

Відкрите акціонерне товариство
ЖИДАЧІВСЬКИЙ
ЦЕЛЮЛОЗНО-ПАПЕРОВИЙ
КОМБІНАТ
Україна,81700
м. Жидачів Львівської обл.,
вул. Фабрична, 4
Телефони: (03239) 21-163, 21-381
Факси: (03239) 21-163, 21-381

Joint-stock company
ZHYDACHIV
PULP AND PAPER MILL
Fabrichna,4, Zhydachiv
Lvivska oblast
81700 UKRAINE
Tel. (03239) 21-163, 21-381
fax. (03239) 21-163, 21-381

№ 28 від "16" жовтня 2008р.

Керівництво ВАТ "Жидачівський целюлозно-паперовий комбінат", повідомляє, що не продає відходи від деревообробки іншим підприємствам для використання в енергетичних цілях, також не використовує відходи жодним чином і немає такого наміру в подальшому. Частина відходів складуються на території підприємства, а решта вивозиться на неофіційні звалища, періодично віддаються населенню.

Комерційний директор
ВАТ "Жидачівський
целюлозно-паперовий комбінат" **Грицак В.В**

Відкрите акціонерне товариство
ЖИДАЧІВСЬКИЙ
ЦЕЛЮЛОЗНО-ПАПЕРОВИЙ
КОМБІНАТ
Україна,81700
м. Жидачів Львівської обл.,
вул. Фабрична, 4
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fax. (03239) 21-163, 21-381

№ 28 від "16" жовтня 2008р.

Management of OJSC "Zhydachiv Pulp and Paper Plant" confirms that the Enterprise doesn't sell waste wood to other enterprises for energy use. The Enterprise also doesn't use waste wood for own needs and doesn't have such intention in the future. The part of wood residues is stored at the territory of the Enterprise, and the rest is removed to the unmanaged landfills and supplied o the population.

Sales manager of
LSC "Zhydachiv Pulp
And Paper Mill" Grytsak V.V.

Annex 5

ТзОВ „Лістранссервіс"
77552 смт Вигода, вул. Заводська 4, Долинський район, Івано-Франківська область,
код 35401618, р/р 2600302773001 в ІФФ АБ „Київська Русь" м. Долина, МФО 336008,
Св. 100094434, ПН 354016109058

№34 від 08.09.2008

Директору ТзОВ"Уніплит"
Колосу А.Л.
Директор ТзОВ "Лістранссервіс"
Лонгус В.В.

Комерційна пропозиція

ТзОВ "Лістранссервіс", в особі директора Лонгуса Вадима Володимировича, готове до відгрузки тирси технологічної та супутніх відходів для котла Vyncke на ТзОВ "Уніплит", з розрахунком 3000 м.куб./місяць по ціні 116 грн/м.куб.

Директор ТзОВ "Лістранссервіс' Лонгус В.В

#34 from 08.09.08

To: Director of "Uniplit" Ltd
Kolos A.L.
From: Director of "Listransservice" Ltd
Longus V.V.

Commercial Offer

"Listransservice" Ltd in the person of the director Longus Vadym Volodymyrovych is ready to technological sawdust and associated wastes shipment for Vyncke boiler installed at "Uniplit" Ltd. Amount of waste wood is 3000 m^3/month, the price is 116 UAH/m^3.

Director of "Listransservice" Ltd Longus V.V.

Товариство з обмеженою відповідальністю

ЦБМ "ОСМОЛОДА"

Івано-Франківська обл. Рожнятівський р-н, с. Осмолода, вул. 22 Січня 83, тел. 03474 47-518

№ 174

«8» 09 2008 р.

Комерційна пропозиція
ТзОВ «ЦБМ «Осмолода»

ТзОВ «ЦБМ «Осмолода» пропонує Вам продаж опилок в кількості 300 м3 в місяць, за ціною – 112,00 грн. з ПДВ за 1 м3.

З повагою,
Заступник директора ***Л.І. Безрукий***

Розрахунковий рахунок 26005545993841 в Калуському відділенні АКБ „Укрсоцбанк" МФО 336019
Код 31044376, св. 12712802, ІПН 310443709119

Commercial Offer

Pulp and Paper Mill "Osmoloda" Ltd offers sawdusts shipping (300 m^3/month) at the price of 112 UAH/m^3.

Deputy director L.I. Bezrukyi