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General Director

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Emissions Source Owner
PJSC «Obolon»

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ANNUAL MONITORING REPORT
(period 01/01/2008-31/12/2010)
Joint Implementation Project

Reducing energy consumption and utilization of waste production at "Obolon" PJSC

MONITORING REPORT OF THE JOINT IMPLEMENTATION PROJECT

CONTENT

A. Description of the project activities

B. Key Monitoring activities

C. Calculations of the GHG emission reductions

Background and Objectives of the Monitoring Report

According to paragraph 36 of the JI guidelines project participants "shall submit to an accredited independent entity a report in accordance with the monitoring plan on reductions in anthropogenic emissions by sources or enhancements of anthropogenic removals by sinks that have already occurred. The report shall be made publicly available."

The objective of the present monitoring report is to provide the complete, consistent, clear, and accurate calculation of the emissions reductions, within the boundaries of the JI project “Reduction of power consumption and waste disposal at “Obolon” PJSC” for the period from 1 January 2008 to 31 December 2010.

SECTION A. Description of the project activity

A.1. Title of the project:

Title: Reduction of power consumption and waste disposal at "Obolon" PJSC

№3: Energy demand

№13: Waste handling and disposal

Version 2.0

Date: 23/08/2011.

A.2. Registration number and approval of JI project:

Registration number: JI UA1000275

State Environmental Investment Agency issued a letter of approval No 1914/23/7 of 22/07/2011.

Ministry of Ecology, Sustainable Development, Transports and Housing, General Directorate for Energy and Climate - Climate and energy efficiency service - Carbon markets desk (France) have issued a letter of approving № 11-0804 5E DNter (DFP, DNA) from 04/08/2011

A.3. Brief description of actions according to the project

The main aim of JOINT IMPLEMENTATION PROJECT "Reduction of power consumption and waste disposal at "Obolon" PJSC" is the fulfillment of the program of complex technical and technological modernization of the plant, implementing the system of utilization of organic waste of beer production, that include as well as technical and organizational measures.

Implementing of measures according to the Project allowed increasing energy efficiency of beer production, to reduce specific amount of the formed organic waste, to ensure its utilization safe for the environment. In turn it led to the reduction

of the amount of energy resources consumed in the beer production process, to refuse the removal of organic waste of the production to the landfills, and as a result, to reduce the emissions of greenhouse gas connected with it.

In accordance with the schedule of the project during the period 2008 - 2010 years the plant had implemented the following measures:

2008:

Constructed drying shops for sparging and disposal of biological waste of beer production. It allowed to prevent the export of the organic waste to landfills and prevent emissions of greenhouse gas (methane) associated with it.

Picture 1.1 Storage containers granular wort after drying and granulation.

Picture 1.1 The building of drier of beer wort

2009:

Replaced steam drying systems of work clothing with electric one.
Replaced water pump 2 at a water station from D-500/65 Rdv.=160kWh with pump Wilo ASP200 Rdv.=132 kWh. It allowed reducing specific consumption of electric energy.

Installed post-treatment system for condensate (differentiation) with capacity 80t a year. It allowed to increase the amount of condensate that is used repeatedly on 10646 t, and also to reduce specific consumption of natural gas, electric energy and GHgas emissions connected with beer production.

2010:

Reconstructed brewing lines № 2 and 3 using energy-saving technologies. It allowed to increase wort output from 550 Gl to 625 Gl for 1 brewing, number of brewing from 52 to 56 a week, 44 workweeks a year, and also to reduce specific consumption of steam for beer brewing, and accordingly the amount of consumption of natural gas, electric energy and GH gas connected with steam production.

Picture 1.3 Control room of brewing lines 2 and 3

Picture 1.4. Brewing lines 2 and 3

Picture 1.5. Energy-saving capacity of brewing line 2 and 3 (reconstruction 2009-2010)

Measures implemented during the period of 2000-2007 years are presented in the Monitoring Report for the corresponding period 01/01/2004-31/12/2007.

A.4. Project Participants:

Table A.1. Project Participants

Party involved	Legal entity project participants (if applicable)	Please, indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	" Obolon" PJSC"	No
France	EDF Trading Limited	No
Netherlands	ING Bank N.V.	No

A.5. Monitoring Period:

Starting date of monitoring: 1/01/2008

Finishing date of monitoring: 31/12/2010

A.6. Changes or correcting of Monitoring Plan compared to determined PDD:

Monitoring plan implemented in accordance with the monitoring plan described in determined PDD. The methodology that was used in the calculation of greenhouse gas emissions caused by the project activity described in section B below (see page 13 of this project)

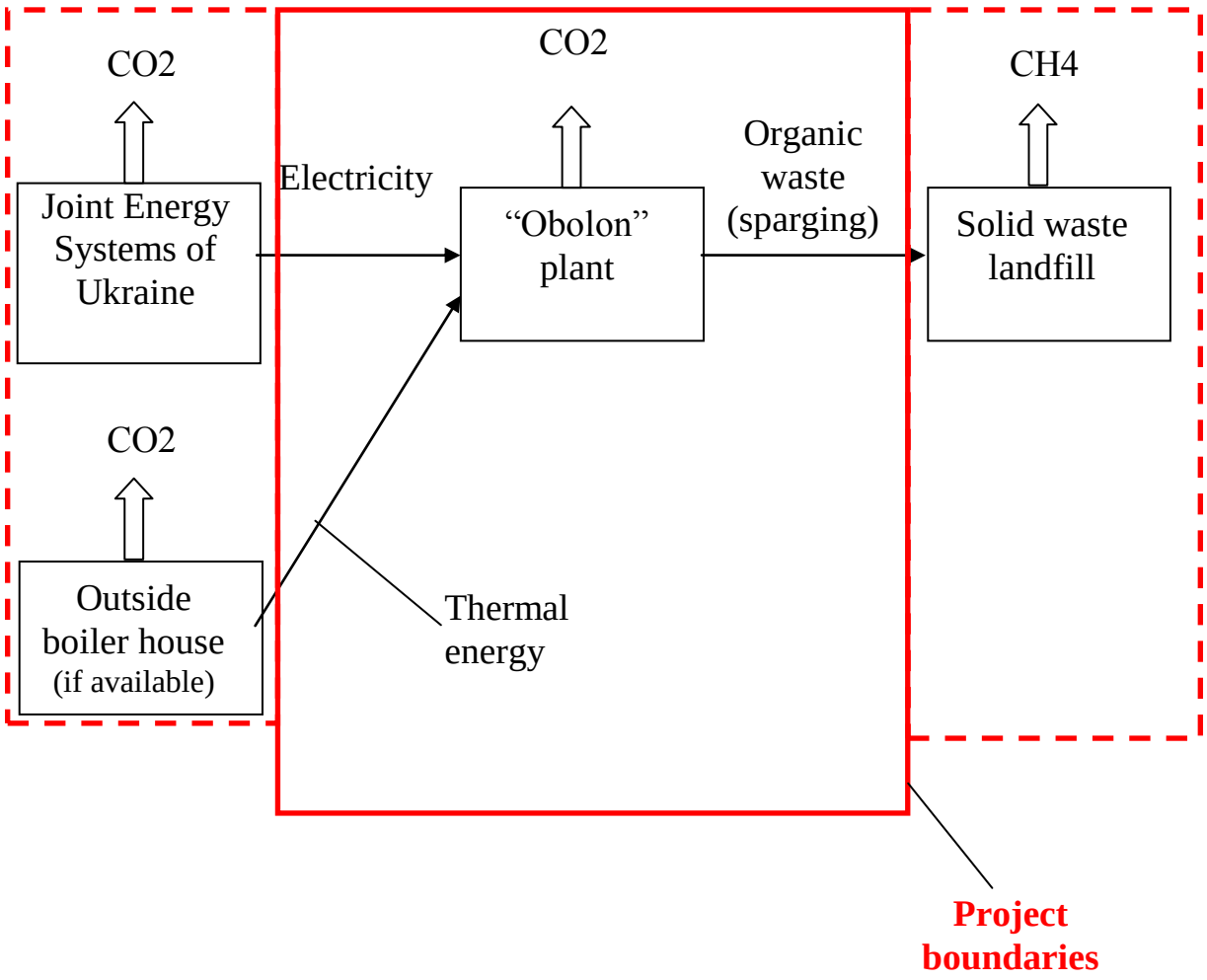
A.7 Changes as to determined PDD.

There were no changes as to determined PDD.

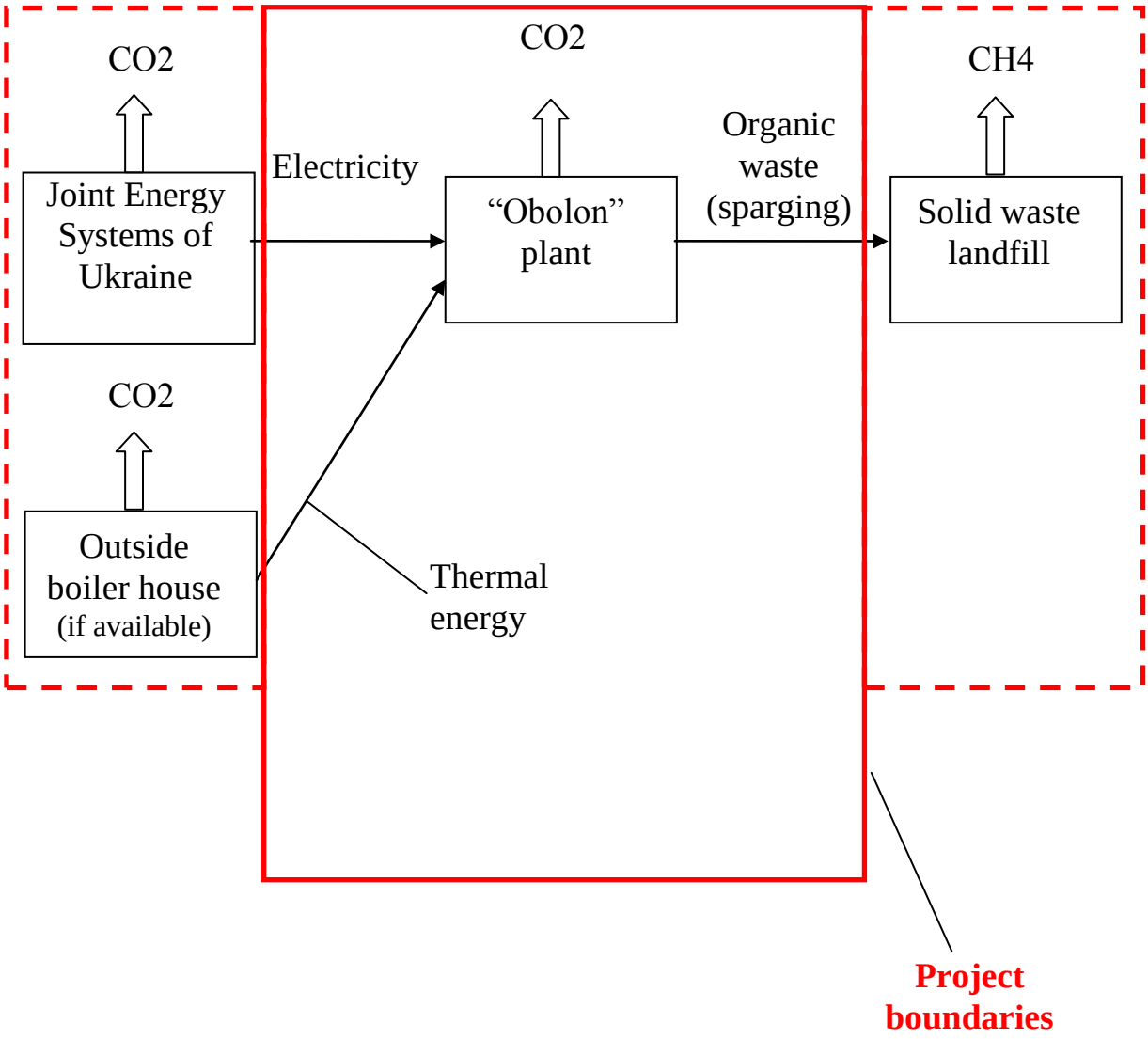
A.8.Project Boundary:

Project Boundary

The approach takes into account when assessing the carbon emissions of CO_2, which are formed as a result of electric and thermal energy needed for beer production. The pictures 2.1 and 2.2 show the boundaries of the project scenario (outlined with red full line).



Picture 2.1. Boundaries of the project scenario



Picture 2.2. Boundaries of the baseline scenario

The list of sources and greenhouse gases included in the project boundary is presented in Table A.2.

Table A.2. Sources of emissions and greenhouse gases included in or excluded from the project boundary.

	Source	Gas	Included?	Reasoning / Explanation
Baseline	Electric power plants of the Joint Electric Systems of Ukraine that use extracted fuels	CO_2	Yes	Emissions caused by the burning of extracted fuels by the electric power plants of the United Electric Systems (UES) of Ukraine to generate electric power used in the production of beer
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Outside heat supplier (OJSC "Generator")	CO_2	Yes	Emissions caused by burning natural gas for generation of thermal energy supplied to the brewery "Obolon" outside supplier (boiler-house OJSC "Generator")
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Technological and generating equipment of the "Obolon" plant	CO_2	Yes	Emissions caused by the burning of natural gas in technological and generating equipment at the "Obolon" plant during the production of beer
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Organic waste from the production of beer (sparging)	CO_2	No	Excluded for simplification purposes
		CH_4	Yes	At the inception of the project the general practice for disposing of organic waste from the production of beer (sparging) was removal of these waste products to landfills where, in the process of rotting gas that contained methane was emitted
		N_2O	No	Excluded for simplification purposes
Project scenario	Electric power plants of JES of Ukraine that use extracted fuels	CO_2	Yes	Emissions caused by the burning of extracted fuels by the JES of Ukraine to generate electric power necessary to make beer
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Outside heat supplier (OJSC "Generator")	CO_2	Yes	Emissions caused by burning natural gas for generation of thermal energy supplied to the brewery "Obolon" outside supplier (boiler-house OJSC "Generator")
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Technological and generating equipment of the "Obolon" plant	CO_2	Yes	Emissions caused by the burning of natural gas in technological and generating equipment at the "Obolon" plant during the production of beer
		CH_4	No	Excluded for simplification purposes
		N_2O	No	Excluded for simplification purposes
	Organic waste	CO2	No	Excluded for simplification purposes

	from the production of beer (sparging)	CH4	Yes	As a result of project implementation will be complete utilization of organic waste (sparging). But if the planned utilization of the system will not ensure full utilization of educated sparging, greenhouse gas emissions caused by its removal of waste landfill to be taken into account in calculations.
		N2O	No	Excluded for simplification purposes

A.9. Physical or legal person setting the Monitoring Report

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Section B. Key Monitoring activities

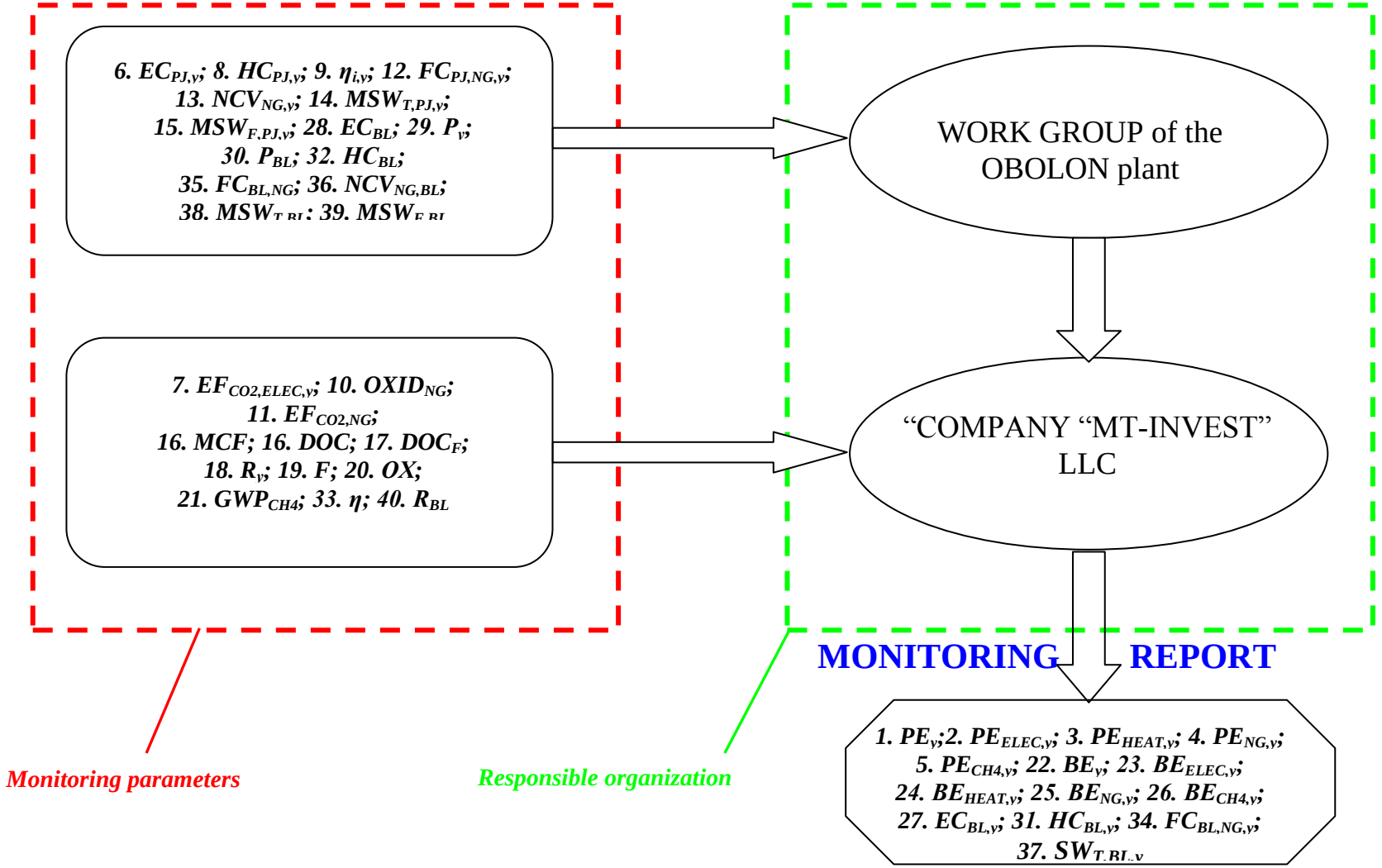
Monitoring Plan was implemented according to the Monitoring Plan presented in the determined PDD. Description of monitoring systems are presented in the sections below.

Key monitoring actions

- Measuring the parameters to be monitored;
- Recording and archiving of data on parameters to be monitored;
- Calculation of emissions and reduction of greenhouse gases.

Monitoring Plan including the main parameters to be monitored, monitoring procedures and methodology for calculating emissions and reductions of greenhouse gases are given in the following sections of this report.

B.1. Information collection scheme:



Picture 3.1 Data collection for monitoring project parameters

Performance of measurement and data collection on the results of measurements included in the responsibilities of the technological stuff. Technological personnel assigned the results of measurements to a working group that brings together all the information into a single database and then passes them to “Company “MT-Invest”. Numerical values of these data are presented in Table B.1of the following sections.

Based on the data “Company “MT-Invest” performs the calculations of emission reduction of greenhouse gases. The numerical value of project emissions, baseline emissions and reduction of greenhouse gas emissions for the period of monitoring are given in Tables C.1, C.2 and C.3 below. Also, the “Company “MT-Invest” performs data collection, which are not measurable, but are subject of monitoring and performs processing of monitoring records.

Detailed description of the monitoring system on each of the options presented in the sections below.

B.2. Monitoring system.

All necessary data as to monitoring of consumption of energy resources and formation of organic waste are limited to reporting acts that are presented in the table below

Table B.1. The data to be monitored.

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№ п/п	Name of the data	Name of form or act of reporting	Data of the counter			
			01/01/2000 31/12/2000	01/01/2004 31/12/2004	01/01/2005 31/12/2005	01/01/2006 31/12/2006
1	2	3	4	5	6	7
1	Electric energy consumed by the	Electrobalance ,form 24-Energetika, annual	39280,265 MWh	83254,615 MWh	64557,951 MWh	68758,893 MWh

	plant Obolon (see p. 17, section B.2.1)					
2	Natural gas consumed by the plant «Obolon" (see p. 18, section B.2.2)	Certificates of acceptance-transfer of natural gas from PJSC "Kyivgas", Monthly, annual	14599 thd.m^3	23160 thd.m^3	24829 thd.m^3	26260 thd.m^3
3	Thermal energy received by the plant Obolon from boiler house OJSC «Generator» (see p. 19, section B.2.3)	Report on the use of fuel, heat and electricity (Form 11-MTP), Acceptance-transfer acts of thermal energy between OJSC "Generator" and PJSC "Obolon", monthly, annual	38902 Gcal	106408 Gcal	0 Gcal	0 Gcal
4	Production of organic waste (see p. 20, section B.2.4)	Report documentation Obolon - "Information about specific indicators of waste and of waste for the previous, current and project for the next year	69612 t	108431 t	85672 t	89488 t
5	Amount of produced beer (see p. 21, section B.2.5)	Report on the use of fuel, heat and electricity (Form 11-MTP), the annual	27644 t.dal	110546 t.dal	86712 t.dal	85666 t.dal

All forms, documents and information stored in paper form for 3 years and then are filed in the archive. The information kept in the following reporting documents is duplicated in the accounting documents and in database of the Chief Energy Department.

All required reporting documentation for the corresponding period of monitoring will be accredited to independent body.

B.2.1. Monitoring System of power consumption .

Calculation of electricity consumption is fulfilled in accordance with the Agreement between Obolon PJSC and PJSC "Kyivenergo" with the help of counters of electric energy of commercial assessment. Meter readings are collected by the employees of the Chief Energy Department. On the basis of received meter readings is formed information about monthly, then annual amounts of electric energy consumption by the plant, afterwards this information is filled to the corresponding summary reports.

Table B.2. Devices that were used to account for electricity consumed

ID number	Type of device	Serial number	Accuracy class	Date of the last verification	Organization that held the verification
1	2	3	4	5	6
1	EPQS 122.21.18LL	598904	0,5	15.12.08	JSC Energozbut Kyivenergo
2	EPQS 122.21.18LL	623630	0,5	15.12.08	JSC Energozbut Kyivenergo
3	EPQS 122.21.18LL	623631	0,5	15.12.08	JSC Energozbut Kyivenergo
4	EPQS 122.21.18LL	623632	0,5	15.12.08	JSC Energozbut Kyivenergo
5	EPQS 122.21.18LL	623634	0,5	15.12.08	JSC Energozbut Kyivenergo
6	EPQS 122.21.18LL	623633	0,5	15.12.08	JSC Energozbut Kyivenergo
7	EPQS 122.21.18LL	623635	0,5	15.12.08	JSC Energozbut Kyivenergo
8	EPQS 122.21.18LL	623636	0,5	15.12.08	JSC Energozbut Kyivenergo
9	EPQS 122.21.18LL	598899	0,5	15.12.08	JSC Energozbut Kyivenergo
10	EPQS 122.21.18LL	623659	0,5	15.12.08	JSC Energozbut Kyivenergo
11	EPQS 122.21.18LL	623652	0,5	15.12.08	JSC Energozbut Kyivenergo
12	EPQS 122.21.18LL	623653	0,5	15.12.08	JSC Energozbut Kyivenergo
13	EPQS 122.21.18LL	623654	0,5	15.12.08	JSC Energozbut Kyivenergo

14	EPQS 122.21.18LL	623637	0,5	15.12.08	JSC Energozbut Kyivenergo
15	EPQS 122.21.18LL	623631	0,5	15.12.08	JSC Energozbut Kyivenergo
16	EPQS 122.21.18LL	623657	0,5	15.12.08	JSC Energozbut Kyivenergo
17	EPQS 122.21.18LL	623658	0,5	15.12.08	JSC Energozbut Kyivenergo
18	EPQS 122.21.18LL	623638	0,5	15.12.08	JSC Energozbut Kyivenergo
19	EPQS 122.21.18LL	623649	0,5	15.12.08	JSC Energozbut Kyivenergo
20	EPQS 122.21.18LL	598895	0,5	15.12.08	JSC Energozbut Kyivenergo
21	EPQS 122.21.18LL	623656	0,5	15.12.08	JSC Energozbut Kyivenergo
22	EPQS 122.21.18LL	623650	0,5	15.12.08	JSC Energozbut Kyivenergo

In accordance with the Reports of parameterization and verification of meters of consumed electric energy differentiated for the period of time the date of the next public verification of the meters is 2014 year.

B.2.2. Monitoring System of natural gas consumption

Calculation of natural gas consumption is carried out under the contract between PJSC "Obolon" and PJSC "Kievgas" by counter commercial metering of natural gas. Based on the data it is generated monthly and annual acceptance-conveyance of natural gas.

Table B.3. Counters of natural gas consumption

ID number	Type of counter	Serial number	Accuracy class	Date of the last verification	Date of the next verification	The institution conducted calibration
1	2	3	4	5	6	7
1	ОЕ-22ДМ	264	0,5	09.11.10	09.11.11	JSC “Kievgas”

B.2.3. Monitoring system of thermal energy consumption

Calculating of thermal energy received from the boiler of OJSC "Generator" was carried out as follows:

- On the verge of pipelines were installed commercial counters.
- Based on its performance on a monthly basis through bilateral acts determined the number of received thermal energy and its cost. The act of transfer of thermal energy goes to the accounting
- Chief Energy Department keeps an internal document (written and electronic) “Steam consumption per year ___ "indicating how much steam production is from domestic boiler, and how much of OJSC “Generator”

Table B.4. Counters of thermal energy consumption

ID number	Type of device	Serial number	Accuracy class	Date of last calibration(verification)	Date of the next calibration(verification)	The institution conducted calibration
1	2	3	4	5	6	7
1	PMC-621	920-00E 042-5A	0.5	2008	Decommissioned	Derzhspozhyvstandart Ukraine “Ukrmetrteststandart”

B.2.4. Monitoring system of organic waste production

Monitoring of the formation of organic waste is as follows:

- Calculation of sparging is formed in the brewing house according to beer recipes. This data is compared and is consistent with data on the number of beer sparging transferred to third parties obtained using the Automobile

scales type TVA-60-10/20-18 (8) and Track scales. Calculation of amount of beer sparging transferred to outside organizations (agricultural organizations, fisheries) by car and wagon scales is done by weighing trucks / cars before and after loading of sparging.

- Collected information is transmitted to the commercial department, which sells beer sparging.
- In the annual report, performed by the main ecologist, information on the number of formed sparging comes in two ways — from the commercial department of the fact (number supplied sparging measured by weighing trucks and cars before and after loading of sparging) and the second source - internal accounting program KUB-3. This program recorded the entire documentation on supply or export of sparging within the reporting period.

The final data are data of the commercial department, which confirmed in accounting KUB-3, they are the basis for all reports. The final is a "certificate of specific indicators of waste and of waste for the previous, current and project for the next year."

During the reporting period, all formed as a result of brewing sparging was sold.

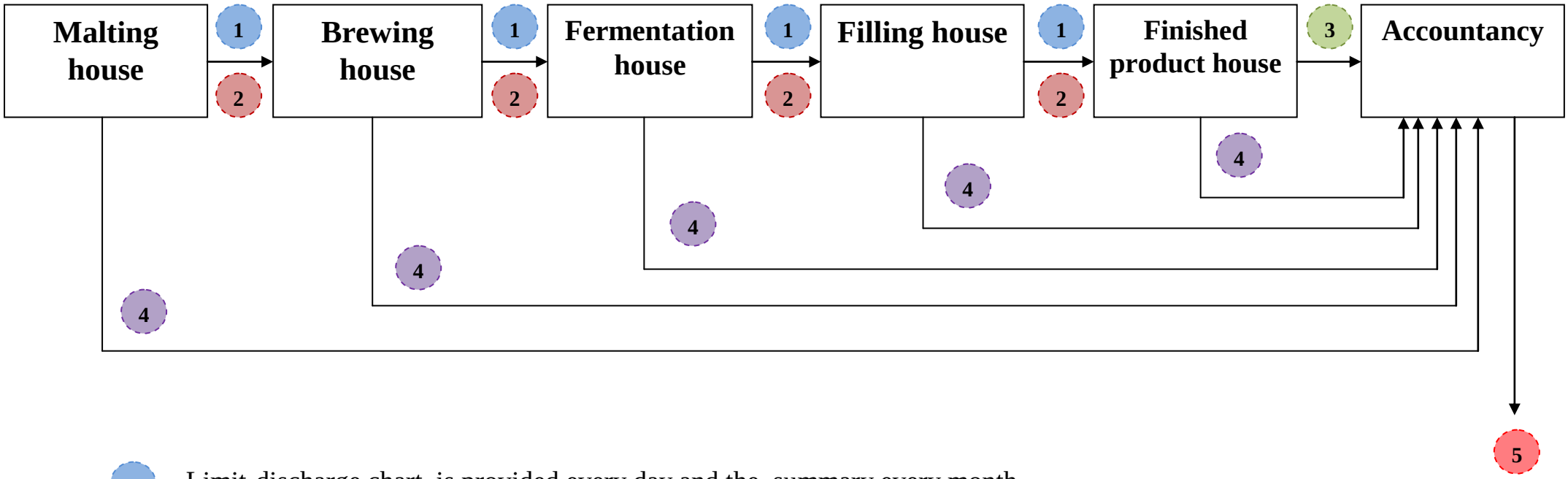
Table B.5. List of scales used for measuring of organic waste for 2010 year.

ID number	Name and type of device	Serial number	Accuracy class	Date of last calibration(verification)	Date of the next calibration(verification)	The institution conducted calibration
1	2	3	4	5	6	7
1	Truck Scales tenzometric type TBA-60-10/20-18(8)	71	1	28.09.10	28.09.12	Derzhspozhyvstandart Ukraine “Ukrmetrtestatandart”
2	Track Scales	2572	1,5	18.02.11	18.08.11	Derzhspozhyvstandart Ukraine “Ukrmetrtestatandart”

B.2.5. Monitoring system of produced beer amount

According to the Quality Management System calculation of the output of PJSC "Obolon" is performed by regulations, which stated in the book of the processes of PJSC "Obolon" PSTS 09 "Manufacturing".

Data on the number of produced beer entered first in the Journal of variable tasks then to the report on the implementation of production plans . At the end the information about output product is recorded in the "Journal of output of ready production," the form of 11-MPT and in a daily electronic reporting module "KUB" in form 01-P.



1 Limit-discharge chart is provided every day and the summary every month

2 Registry of received and supplied products and containers for bottling is given to the expedition every month

3 Registry of received and output production and containers for bottling is given to the expedition every month

4 Report on the workshop is given

5 Monthly Report on the workshop

Picture.3.2. Scheme of calculating of finished products of PJSC "Obolon"

B.2.6. Quality control:

Table B.6. Procedure of quality control (QC) and quality assurance (QA) for data to be monitored.

Data *(Indicate table and ID number)*	Explanation of QA/QC procedures planned for these data, or why such procedures used is not necessary.
Table B.7. *6.* $EC_{PJ,y}$ *Table B.8.* *28.* EC_{BL}	Quantity of electricity consumed by Obolon Brewery determined using equipment in good condition, verified and calibrated in accordance with the applicable requirements of Ukraine of equipment. In addition, the amount of consumed electricity is tested cross-check by the supplier of electric power and state authorities.
Table B.7. *8.* $HC_{PJ,y}$ *Table B.8.* 32. HC_{BL}	Quantity of thermal energy consumed by Obolon Brewery is determined using equipment that is in good condition, verified and calibrated in accordance with the applicable requirements of Ukraine of equipment and calculated on the basis of existing technological standards. In addition, the amount of consumed thermal energy is cross-check tested by the supplier of thermal energy and state authorities.
Table B.7. *11.* $FC_{PJ,NG,y}$ *Table B.8.* *35.* $FC_{BL,NG}$	Quantity of natural gas consumed by Obolon Brewery determined using equipment in good condition, verified and calibrated in accordance with the applicable requirements of Ukraine of equipment This datum is cross-checked by the supplier of natural gas and state authorities.
Table B.7. *12.* $NCV_{NG,y}$ *TableB.8.* *36.* $NCV_{NG,BL}$	Caloric value of fuel (of natural gas) is subject to measurement by the supplier. The Information on the value of this parameter is supplied (Kievgas) in accordance with the procedures regulated by agreements. For ease of calculation, based on statistics and common practice was adopted a constant 8.2 Gcal / thousand. m3 (8200 kkal/m3).
Table B.7. *13.* $MSW_{T,PJ,y}$ *Table B.8.* *38.* $MSW_{T,BL}$	Production and movement of organic waste is subject of careful control by state authorities in the field of ecology and environment protection that is why the trustworthiness of this information is beyond doubt.

Table B.7. *14. $MSW_{F,PJ,y}$*	Production and movement of organic waste is subject of careful control by state authorities in the field of ecology and environment protection. , that is why the trustworthiness of this information is beyond doubt
Table B.7. *7. $EF_{CO2,ELEC,y}$*	During monitoring the emission reductions for this project are used only approved in Ukraine or determined emission factor t CO2 eq. UES of Ukraine for projects that reduce electricity consumption in the year. The project developer annually monitors the relevance of this factor and, if necessary actualizes its value in the development and design of the next periodic monitoring report that will prevent the use of incorrect or outdated ratio.
Table B.8 *29. P_y* *30. P_{BL}*	The amount of output is the subject reporting that passes periodic cross-check testing by state authorities (Tax inspectorate, etc.). This information is duplicated many times at different stages, from the bottling to the sale of the beer, which excludes mistakes or incorrect information.

B.3. List of parameters used to calculate the greenhouse gas emission reductions:

Table B.7. Parameters used to monitor project GHG emissions

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. PE_y	Project GHG emissions	Monitoring of GHG emissions	tCO2e	c	annually	100 %	Electronic/ Paper	
2. $PE_{ELEC,y}$	Project GHG emissions related to the consumption of electric power	Monitoring of GHG emissions	tCO2e	c	annually	100 %	Electronic/ Paper	
3. $PE_{HEAT,y}$	Project GHG emissions related to the consumption of electric power	Monitoring of GHG emissions	tCO2e	c	annually	100 %	Electronic/ Paper	

4.	$PE_{NG,y}$	Project GHG emissions related to the consumption of natural gas	Monitoring of GHG emissions	tCO2e	c	annually	100 %	Electronic/ Paper	
5.	$PE_{CH4,y}$	Project GHG emissions related to the disposal of organic waste at landfills	Monitoring of GHG emissions	tCO2e	c	annually	100 %	Electronic/ Paper	
6.	$EC_{PJ,y}$	Consumption of electric power according to project scenario in year y	Measured with metering equipment. Annual reports	MWh	m	monthly	100 %	Electronic/ Paper	
7.	$EF_{CO2,ELEC,y}$	Coefficient of CO_2 equivalent in UES of Ukraine for projects aimed at reducing electric power consumption in year y	Default value	tCO_2e/MWh	e	annually	100 %	Electronic/ Paper	For 2008 – 1,219[1] tCO_2e/MWh For 2009 – 1.237[2] tCO_2e/MWh For 2010 – 1.225[3] tCO_2e/MWh For 2011-2025 – 1.227[4] tCO_2e/MWh
8.	$HC_{PJ,y}$	Consumption of thermal energy according to project scenario in year y	Measured with metering equipment and normative calculation. Annual reports	Gcal	m	monthly	100 %	Electronic/ Paper	
9.	η	Efficiency coefficient of boiler-house OJSC	Default value		e	once	100 %	Electronic/ Paper	Determined used Tool to determine the baseline efficiency of

[1] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[2] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[3] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[4] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

	“Generator”							thermal or electric energy generation systems[5], Version 1, the option F (Table 1). 0.87
10. $EF_{CO2,NG}$	Emission factor for natural gas	Default value 1996 IPCC[6]	tCO_2e/GJ	e	once	100 %	Electronic/ Paper	0.0561 tCO2e/GJ
11. $FC_{PJ,NG,y}$	Consumption of natural gas according to project scenario in year y	Measured by measuring equipment. Commercial accounting of natural gas for the plant (entire production). Acts with Kyivgas	ths m^3	m	monthly	100 %	Electronic/ Paper	
12. $NCV_{NG,y}$	Caloricity of natural gas	Default value	Gcal/ths m^3	e	annually	100%	Electronic/ Paper	To simplify the calculations and taking into account the statistics of the enterprise in the calculations used $NCV_{NG,y}$ = 8.2 Gcal/ths m^3, which objectively reflects the average calorific value of natural gas consumed by the Obolon brewery.
13. $MSW_{T,PJ,y}$	Total sparging	Measured by	tons	m	monthly	100%	Electronic/	

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

[6] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

		generated according to project scenario in year *y*	measuring equipment and determined by normative calculations. Annual reports					Paper	
14.	$MSW_{F,PJ,y}$	Fraction of sparging disposed to solid waste disposal sites according to project scenario	Company statistical data.		e	annually	100%	Electronic/ Paper	
15.	*MCF*	Methane correction factor (fraction)	Default value. 2006 IPCC [7]		e	once	100%	Electronic/ Paper	
16.	*DOC*	Degradable organic carbon	Default value. 2006 IPCC [8]		e	once	100%	Electronic/ Paper	
17.	DOC_F	Fraction organic waste dissimilated	Default value. 2006 IPCC [9]		e	once	100%	Electronic/ Paper	0.5
18.	R_y	Recovered CH4 in year y	Default value.	tCH4	e	once	100%	Electronic/ Paper	Utilization of GHG is beyond the responsibility of project owners and beyond the boundaries of the project. Therefore, this value for conservative measures was set at 0.
19.	*F*	Fraction of CH4 in landfill gas	Default value. 1996 IPCC [10]		e	once	100%	Electronic/ Paper	
20.	*OX*	Oxidation factor	Default value.		e	once	100%	Electronic/	

[7] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[8] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[9] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[10] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

		1996 IPCC [11]					Paper	
21. GWP_{CH4}	Potential of global warming of methane	According to the decision of the UNFCCC and the Kyoto protocol	$tCO_2e/tCH4$	e	once	100 %	Electronic/ Paper	21 $tCO_2e/tCH4$

Table B.8. Parameters used to monitor greenhouse gas emissions of baseline scenario

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
22. BE_y	Baseline GHG emissions	Monitoring GHG emissions	tons CO2 equivalent	c	annually	100 %	Electronic/ Paper	
23. $BE_{ELEC,y}$	Baseline GHG emissions related to electric power consumption	Monitoring GHG emissions	tons CO2 equivalent	c	annually	100 %	Electronic/ Paper	
24. $BE_{HEAT,y}$	Baseline GHG emissions related to consumption of thermal energy	Monitoring GHG emissions	tons CO2 equivalent	c	annually	100 %	Electronic/ Paper	
25. $BE_{NG,y}$	Baseline GHG emissions related to consumption of natural gas	Monitoring GHG emissions	tons CO2 equivalent	c	annually	100 %	Electronic/ Paper	
26. $BE_{CH4,y}$	Baseline GHG emissions related to disposal of waste at	Monitoring GHG emissions	tons CO2 equivalent	c	annually	100 %	Electronic/ Paper	

[11] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

		landfills							
27.	$EC_{BL,y}$	Consumption of electric power related to baseline scenario in year *y*	Calculated by project developers based on the statistical data of the company and parameters of base year	MWh	c	annually	100 %	Electronic/ Paper	Calculated using formula (8) below
28.	EC_{BL}	Consumption of electric power in base year	Measured with measuring equipment and determined by normative calculations. Annual report.	MWh	m	once	100 %	Electronic/ Paper	According to statistical data of the company for year 2000 EC_{BL}= 39280.265 MWh
29.	P_y	Beer production in year *y*	Production reports	t.dal	m	monthly	100 %	Electronic/ Paper	
30.	P_{BL}	Beer production in base year	Production reports	t.dal	m	once	100 %	Electronic/ Paper	According to statistical data of the company for year 2000 P_{BL}= 27644 t.dal
31.	$HC_{BL,y}$	Consumption of thermal energy in baseline scenario in year y	Calculated by project developers based on the statistical data of the company and parameters of base year	Gcal	c	annually	100 %	Electronic/ Paper	Calculated using formula (10) below
32.	HC_{BL}	Consumption of thermal energy in	Measured with measuring	Gcal	m	once	100 %	Electronic/ Paper	According to statistical data of the company for

		base year	equipment and determined by normative calculations. Annual report						year 2000 HC_{BL} = 38902 Gcal
33.	η	Efficiency coefficient of boiler-house OJSC "Generator"	Default value		e	once	100 %	Electronic/ Paper	Determined used Tool to determine the baseline efficiency of thermal or electric energy generation systems[12], Version 1, the option F (Table 1). 0.87
34.	$FC_{BL,NG,y}$	Consumption of natural gas in base scenario in year y	Calculated by project developers based on the statistical data of the company and parameters of base year	Thousand m^3	c	annually	100 %	Electronic/ Paper	Calculated using formula (12) below
35.	$FC_{BL,NG}$	Natural gas consumption in base year	Measured with measuring equipment. Commercial accounting of gas on the plant (entire production). Act with Kyivgas	ths m^3	m	once	100 %	Electronic/ Paper	According to statistical data of the company for year 2000 HC_{BL} = 14599 ths m^3
36.	$NCV_{NG,BL}$	Caloricity of natural	Company	Gcal/ths m^3	e	once	100%	Electronic/	To simplify the

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

		gas in base year	statistics, data from natural gas supplier					Paper	calculations and taking into account the statistics of the enterprise in the calculations used $NCV_{NG,\,y}$ = 8.2 Gcal/ths m^3, which objectively reflects the average calorific value of natural gas consumed by the Obolon brewery.
37.	$MSW_{T,BL,y}$	Total sparging generated according to base scenario in year y	Calculated by project developers based on statistical data and plant parameters of the base year	tons	c	annually	100%	Electronic/ Paper	Calculated using formula (12) below
38.	$MSW_{T,BL}$	Total sparging generated in base year	Measured with measuring equipment and determined by normative calculations. Environmental reports of government agencies.	tons	m	once	100%	Electronic/ Paper	According to statistical data of the company for year 2000 $MSW_{T,BL}$ = 54735,12 tons
39.	$MSW_{F,BL}$	Fraction of sparging disposed to solid waste disposal sites according to base scenario	According to general practice at Obolon plant and other Ukrainian breweries at the time of		e	once	100%	Electronic/ Paper	According to general practice in year 2000, 100% of organic waste was buried in silos.

		Project inception						
40. R_{BL}	Recovered CH4 in base year	Default value.	tCH4	e	once	100%	Electronic/ Paper	At project inception (year 2000) there were no projects aimed at utilizing landfill gasses in Ukraine. Moreover, utilization of landfill gasses lies outside the control of project owners and outside the project boundaries. Therefore this value was set equal to 0.

No leakage is expected.

B.5. Environmental impacts:

The project implementation does not require collecting information on environmental impact in addition to information gathered at the plant before the project begins.

B.6. Sustainable development

Implementation of the project is significant for the city and region of Ukraine. Its introduction significantly improves the environmental situation in the region by reducing energy consumption, and consequently, greenhouse gas emissions and harmful substances. Also, improvement of ecological situation in the region promotes the recycling of organic waste, which has a positive effect on both the state of the atmosphere (reducing greenhouse gases) and ground (suspension of waste removal garbage landfills).

In addition, project implementation and application of new technologies improve skills and work culture of staff and ensure job creation.

Section C. Calculations of the GHG emission reductions

C.1. Project emissions:

$$PE_y = PE_{ELEC,y} + PE_{HEAT,y} + PE_{NG,y} + PE_{CH4,y}\ , \quad (1)$$

where

PE_y = greenhouse gas emissions in the project scenario in year y, tCO_2e;

$PE_{ELEC,y}$ = greenhouse gas emissions in the project scenario related to the consumption of electric energy in year y, tCO_2e;

$PE_{HEAT,y}$ = greenhouse gas emissions in the project scenario related to the consumption of thermal energy in year y, tCO_2e;

$PE_{NG,y}$ = greenhouse gas emissions in the project scenario related to the consumption of natural gas in year y, tCO_2e;

$PE_{CH4,y}$ = greenhouse gas emissions in the project scenario related to the utilization of organic waste (sparging) during the production of beer through depositing it at landfills, tCO_2e;

y = year for which calculations are carried out.

GHG emissions in the project scenario related to the consumption of electricity are calculated according to the approach described in the Tool to calculate baseline, project and/or leakage emissions from electricity consumption[13], Version 01.

$$PE_{ELEC,y} = EC_{PJ,y} \cdot EF_{CO2,ELEC,y}\ , \quad (2)$$

Where

$PE_{ELEC,y}$ = greenhouse gas emissions in the project scenario associated with the consumption of electric energy in year y, tCO_2e;

$EC_{PJ,y}$ = amount of electricity consumed in the project scenario by Obolon brewery in year y, MWh;

$EF_{CO2,ELEC,y}$ = indirect emissions of electricity consumption of electric energy consumers from the Joint Energy systems of Ukraine, tCO_2e/MWh;

y = year for which calculations are carried out.

GHG emissions in the project scenario related to the consumption of thermal energy are calculated in accordance with the approach described in the Approved CDM methodology ACM009 Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas [14], Version 03.2.

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[13] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[14] ttp://cdm.unfccc.int/filestorage/K/4/P/K4P3YG4TNQ5ECFNA8MBK2QSMR6HTEM/Consolidated%20methodology%20for%20industrial%20fuel%20switching%20from%20coal%20or%20petroleum%20fuels%20to%20natural%20gas.pdf?t=Sm98MTMwNjE0OTEzMy4yNg==|RuLrYV7BOR_qS9hKsApVelA168Q=

$$PE_{HEAT,y} = \sum \frac{HC_{PJ,y}}{\eta} \cdot EF_{CO2,NG} \cdot 4.1868, \quad (3)$$

Where

$PE_{HEAT,y}$ = greenhouse gas emissions in the project scenario related to the consumption of thermal energy in year *y*, tCO_2e;

$HC_{PJ,i,y}$ = amount of thermal energy supplied from OJSC "Generator" for by Obolon brewery according to project scenario in year *y*, Gcal;

η = efficiency coefficient of boiler-house OJSC "Generator", 0.87;

$EF_{CO2,NG}$ = natural gas emission coefficient, tCO_2e/GJ;

4.1868 = conversion coefficient of Gcal into GJ, Gcal/GJ;

y = year for which calculations are carried out.

GHG emissions in project scenario related to the consumption for natural gas are calculated in accordance with approach described in Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[15], Version 02

$$PE_{NG,y} = FC_{PJ,NG,y} \cdot NCV_{NG,y} \cdot EF_{CO2,NG} \cdot 4.1868, \quad (4)$$

Where

$PE_{NG,y}$ = gas emissions in the project scenario related to the consumption of natural gas in year *y*, tCO_2e;

$FC_{PJ,NG,y}$ = volume of natural gas consumed during beer production according to project scenario in year *y*, ths m^3;

$NCV_{NG,y}$ = caloricity of natural gas used by Obolon brewery in year *y*, Gcal/ths m^3;

$EF_{CO2,NG}$ = natural gas emission coefficient, tCO_2e/GJ;

4.1868 = conversion coefficient of Gcal into GJ, Gcal/GJ;

y = year for which calculations are carried out.

For calculating GHG emissions according to project scenario related to the utilization of organic waste from the production of beer by depositing it at landfills a typical approach described in1996 IPCC (1996 IPCC Guidelines for National Greenhouse Gas Inventories) was used.

$$PE_{CH4,y} = (MSW_{T,PJ,y} \cdot MSW_{F,PJ,y} \cdot MCF \cdot DOC \cdot DOC_F \cdot F \cdot \frac{16}{12} - R_y) \cdot (1 - OX) \cdot GWP_{CH4} \quad (5)$$

Where

[15] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

$PE_{CH4,y}$ greenhouse gas emissions in the project scenario related to the disposal of organic waste (sparging) from beer production by depositing it at landfills in year *y*, tCO_2e;
$MSW_{T,PJ,y}$ = total sparging generated according to project scenario in year *y*, tons;
$MSW_{F,PJ,y}$ = fraction of sparging disposed to solid waste disposal sites according to project scenario in year *y*;
MCF = methane correction factor (fraction); (2006 IPCC[16])
DOC = degradable organic carbon (fraction); (2006 IPCC [17])
DOC_F = fraction organic waste dissimilated; (2006 IPCC[18])
F = fraction of CH4 in landfill gas (default value 0.5); (1996[19] IPCC)
$\frac{16}{12}$ = coefficient of conversion of carbon into methane
R_y = recovered CH4 in year *y*, tCH4;
OX = oxidation factor, (0 as stated in 1996 IPCC);
GWP_{CH4} = potential of methane global warming, tCO2e/tCH4; (According to the UNFCCC and the Kyoto Protocol)
y = year for which calculations are carried out.
.
Data used in the calculations of greenhouse gas emissions of the project scenario are presented in Excel file «MR_2008-2010_Obolon_v.1.xls»

Table C.1. Emissions of project scenario.

Year	$PE_{ELEC,y}$ tCO2e	$PE_{HEAT,y}$ tCO2e	$PE_{NG,y}$ tCO2e	$PE_{CH4,y}$ tCO2e	PE_y tCO2e
2008	101487	28728	44606	0	174821
2009	57844	0	47821	0	105665
2010	84230	0	50577	0	134807
Total for 2008-2010:					415294

C.2. Baseline emissions:

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$$BE_y = BE_{ELEC,y} + BE_{HEAT,y} + BE_{NG,y} + BE_{CH4,y}\ , \quad (6)$$

Where
BE_y = GHG emissions according to baseline scenario in year *y*, tCO_2e;

[16] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[17] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[19] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

$BE_{ELEC,y}$ = baseline GHG emissions related to electric power consumption in year *y*, tCO_2e;
$BE_{HEAT,y}$ = baseline GHG emissions related to consumption of thermal energy in year *y*, tCO_2e;
$BE_{NG,y}$ = baseline GHG emissions related to the consumption of natural gas in year *y*, tCO_2e;
$BE_{CH4,y}$ = baseline GHG emissions related to utilization of organic waste from beer production by disposing them at landfills in year *y*, tCO_2e;
y = year for which calculations are carried out.

GHG emissions in baseline scenario related to the consumption of electricity are calculated according to the approach described in the Tool to calculate baseline, project and/or leakage emissions from electricity consumption[20], version 01.

$$BE_{ELEC,y} = EC_{BL,y} \cdot EF_{CO2,ELEC,y}\ , \qquad (7)$$

Where
$BE_{ELEC,y}$ = GHG emissions according to baseline scenario related to consumption of electric power in year *y*, tCO_2e;
$EC_{BL,y}$ = amount of electric power consumed according to baseline scenario by Obolon brewery in year *y*, MWh;
$EF_{CO2,ELEC,y}$ = indirect GHG emissions from consumption of electric power by consumers of electric power in Ukraine, tCO_2e/MWh; (See the formula 2 above)
y = year for which calculations are carried out.

$$EC_{BL,y} = P_y \cdot \frac{EC_{BL}}{P_{BL}}, \qquad (8)$$

Where
$EC_{BL,y}$ = amount of electric power consumed by "Obolon" Brewery in the baseline scenario in a year *y*, MWh;
P_y = volumes of beer production in year *y*, t.dal;
P_{BL} = baseline year volumes of beer production, t.dal;
EC_{BL} = amount of electric power consumed by Obolon brewery in base year, MWh;
y = year for which calculations are carried out.

GHG emissions in the baseline scenario related to the consumption of thermal energy are calculated in accordance with the approach described in the Approved

[20] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

CDM methodology ACM009 Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas [21], Version 03.2.

$$BE_{HEAT,BL,y} = \sum \frac{HC_{BL,y}}{3} \cdot EF_{CO2,NG} \cdot 4.1868\,, \qquad (9)$$

Where

$BE_{HEAT,BL,y}$ = baseline GHG emissions related to consumption of thermal energy by Obolon brewery in year *y*, tCO_2e;
$HC_{BL,y}$ = amount of thermal energy consumed by Obolon brewery in according to baseline scenario in year *y*, Gcal;
η = efficiency coefficient of boiler-house OJSC "Generator", 0.87;
$EF_{CO2,NG}$ = natural gas emission coefficient, tCO_2e/GJ;
4.1868 = conversion of Gcal into GJ coefficient;
y = year for which calculations are carried out.

$$HC_{BL,y} = P_y \cdot \frac{HC_{BL}}{P_{BL}}\,, \qquad (10)$$

Where
$HC_{BL,y}$ = amount of thermal energy used according to baseline scenario by Obolon brewery in year *y*, Gcal;
P_y = volumes of beer production in year *y*, t.dal;
P_{BL} = baseline year volumes of beer production, t.dal;
HC_{BL} = amount of thermal energy consumed by Obolon brewery in base year, Gcal;
y = year for which calculations are carried out.

GHG emissions in baseline scenario related to the consumption of natural gas are calculated according to the approach described in the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, Version 02.

$$BE_{NG,y} = FC_{BL,NG,y} \cdot NCV_{NG,BL} \cdot EF_{CO2,NG} \cdot 4.1868\,, \qquad (11)$$

Where

21

ttp://cdm.unfccc.int/filestorage/K/4/P/K4P3YG4TNQ5ECFNA8MBK2QSMR6HTEM/Consolidated%20methodology%20for%20industrial%20fuel%20switching%20from%20coal%20or%20petroleum%20fuels%20to%20natural%20gas.pdf?t=Sm98MTMwNjE0OTEzMy4yNg==|RuLrYV7BOR_qS9hKsApVelA168Q=

$BE_{NG,y}$ = GHG emissions according to baseline scenario related to consumption of natural gas in year *y*, tCO_2e;
$FC_{BL,NG,y}$ = amount of natural gas consumed by Obolon brewery according to baseline scenario in year *y*, ths m^3;
$NCV_{NG,BL}$ = caloricity of natural gas used in beer production in base year, Gcal/ths m^3;
$EF_{CO2,NG}$ = natural gas emissions ratio, tCO_2e/GJ;
4.1868 = conversion of Gcal into GJ coefficient;
y = year for which calculations are carried out.

$$FC_{BL,NG,y} = P_y \cdot \frac{FC_{BL,NG}}{P_{BL}}, \quad (12)$$

Where
$FC_{BL,NG,y}$ = volume of natural gas used by Obolon brewery in baseline scenario year *y*, Gcal;
P_y = volumes of beer production in year *y*, t.dal;
P_{BL} = baseline year volumes of beer production, t.dal;
$FC_{BL,NG}$ = volume of natural gas used by Obolon brewery in base year, Gcal;
y = year for which calculations are carried out.

For calculating baseline scenario GHG emissions related to utilization of organic waste (sparging) through disposal at landfills was used typical approach described in 1996 IPCC[22] Guidelines for National Greenhouse Gas Inventories was used.

$$BE_{CH4,BL,y} = (MSW_{T,BL,y} \cdot MSW_{F,BL,y} \cdot MCF \cdot DOC \cdot DOC_F \cdot F \cdot \frac{16}{12} - R_{BL}) \cdot (1 - OX) \cdot GWP_{CH4} \quad (13)$$

Where
$BE_{CH4,BL,y}$ = baseline GHG emissions related to utilization of organic waste (sparging) from beer production through disposal at landfills in year *y*, tCO_2e;
$MSW_{T,BL,y}$ = total sparging generated according to baseline scenario in year *y*, tons;
$MSW_{F,BL,y}$ = fraction of sparging disposed to solid waste disposal sites according to baseline scenario in year *y*;
MCF = methane correction factor (fraction); (2006 IPCC[23])
DOC = degradable organic carbon (fraction); (2006 IPCC[24])
DOC_F = fraction organic waste dissimilated; (2006 IPCC[25])

[22] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6e.html

[23] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[24] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

F = fraction of CH4 in landfill gas (default value 0.5); (2006 IPCC[26])

$\frac{16}{12}$ = coefficient for converting carbon into methane;

R_{BL} = recovered CH4 in base year, tCH4;

OX = oxidation factor (0 as stated in 1996 IPCC);

GWP_{CH4} = potential of global warming of methane, tCO2e/tCH4; (According to the UNFCCC and the Kyoto Protocol);

y = year for which calculations are carried out.

$$MSW_{T,BL,y} = P_y \cdot \frac{MSW_{T,BL}}{P_{BL}}, \quad (14)$$

Where

$MSW_{T,BL,y}$ = total sparging generated according to baseline scenario in year y, tons;

$MSW_{T,BL}$ = total sparging generated in base year, tons;

P_y = volumes of beer production in year y, t.dal;

P_{BL} = volumes of beer production in base year, t.dal;

y = year for which calculations are carried out.

Data used for calculation GHG emissions of project scenario and results of calculations are presented in Excel file «MR_2004-2007_Obolon_v.1.xls».

Table C.2. Emissions in baseline scenario.

Year	$BE_{ELEC,y}$ tCO2e	$BE_{HEAT,y}$ tCO2e	$BE_{NG,y}$ tCO2e	$BE_{CH4,y}$ tCO2e	BE_y tCO2e
2008	191479	41999	112441	229825	575744
2009	152413	32944	88198	180274	453830
2010	149114	32547	87134	178100	446894
Total 2008-2010:					1476468

C.3. Leakages:

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No leakages are expected.

[25] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[26] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

C.4. Emission Reductions:

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GHG emission reductions calculated in line with the approach described in Approved CDM methodology ACM009 Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas[27], Version 03.2.

$$ER_y = BE_y - PE_y - LE_y, \quad (15)$$

where

ER_y = emission reduction in year y, tCO_2e;
BE_y = baseline GHG emissions in year y, tCO_2e;
PE_y = GHG emissions from the project activity in year y, tCO_2e;
LE_y = emissions from leakage in year y, tCO_2e.

Data used for calculation GHG emissions of project scenario and results of calculations are presented in the Excel file «MR_2008-2010_Obolon_v.1.xls».

Table C.3. Emission Reduction.

Year	ER_y tCO2e
2008	400922
2009	348164
2010	312088
Total 2008-2010:	1061174

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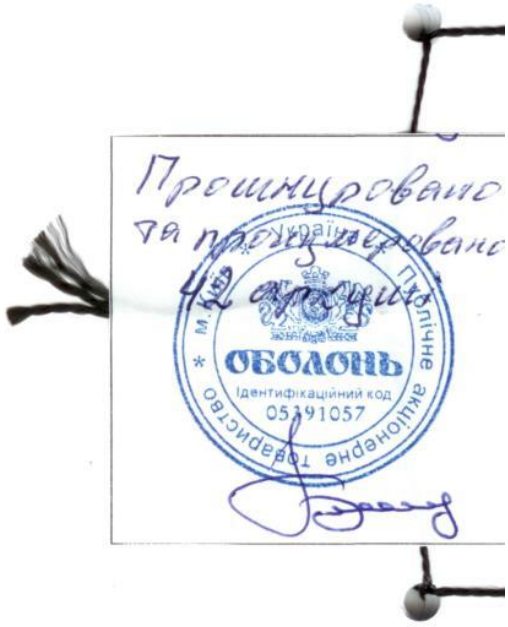
ttp://cdm.unfccc.int/filestorage/K/4/P/K4P3YG4TNQ5ECFNA8MBK2QSMR6HTEM/Consolidated%20methodology%20for%20industrial%20fuel%20switching%20from%20coal%20or%20petroleum%20fuels%20to%20natural%20gas.pdf?t=Sm98MTMwNjE0OTEzMy4yNg==|RuLrYV7BOR_qS9hKsApVelA168Q=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