FIRST PERIODIC JI MONITORING REPORT

Version 4.0
26 April 2011

CONTENTS

SECTION A. General project activity and monitoring information

A.1 Title of the project activity:
"Biogas utilization for generating of electricity and heat at the farms of Ukrainian Dairy Company Ltd."

A.2. JI registration number:
The JI registration number is expected to be received in March 2011.

A.3. Short description of the project activity:
The aim of the project is construction and putting into operation of biogas plants for collection and utilization of biogas with production of electricity and heat at two dairy farms with capacity 4000 and 6000 heads, that belong to "Ukrainian Dairy Company Ltd." As a raw material for biogas production liquid manure from cattle is used.
Baseline scenario is composed of two components.

Component 1
According to component 1 of baseline scenario, at both farms anaerobic lagoons for temporary storage of manure with further usage at fields as fertilizers for agricultural crops are envisaged. Usage of properly designed anaerobic lagoons for manure treatment is in accordance with valid Technological Designing Departmental Regulations of Agro-Industrial Complex 09.06 "Systems of manure removal, treatment, preparation and usage", Kiev 2006, Ukraine AIC, but is followed by substantial methane emissions to atmosphere.
Within the project manure enters the biogas plants instead of anaerobic lagoons, where under the impermeable gasholders of fermenters methane collection as a biogas component takes place. In what follows methane is utilized in cogenerator and/or flare and as a result emissions of this greenhouse gas are reduced.

Component 2
In accordance with component 2 of baseline, electricity from the grid obtained by combustion of fossil fuels at electric power plants that belong to CJSC Kyivoblenergo and JSC Chernigivoblenergo is to be consumed.
Combustion process is followed by emissions of combustion products, including carbon dioxide, into the atmosphere.
Within the project, displacement of electricity from the grid by energy produced from alternative sources, notably as a result of biogas utilization in cogenerators of biogas plants takes place. And this leads to reduction of carbon dioxide emissions.
Data about amount of electric and heat energy produced within the framework of the project, that displaces equivalent amount of electricity from the grid, are provided in Table 1.

Table 1. Amount of electricity displaced in result of project activity, MWh

Period	**Electricity displaced**
1.11.2009-31.12.2009	152
1.01.2010-31.12.2010	5033
Total 2009-2010	*5185*

A.4. Monitoring period:
- Monitoring period starting date: 01.11.2009;
- Monitoring period closing date: 31.12.2010.

First and the last days are included.

A.5. Methodology applied to the project activity (incl. version number):
The project refers to sectoral scope 1 (Energy industries/renewable) and 15 (Agriculture).

A.5.1. Baseline methodology:

The following methods, adopted by the CDM Executive Board of the UNFCCC, were applied to determine the baseline emissions:

- AMS-III.D. "Methane recovery in agricultural and agro industrial activities", version 15;
- AMS-I.C. "Thermal energy for the user with or without electricity", version 13.

Above mentioned methodologies also refer to the "Tool for the demonstration and assessment of additionality" and methodological "Tool to determine project emissions from flaring gases containing methane".

A.5.2. Monitoring methodology:

Monitoring of emission reductions within the project was carried out according to approved methods AMS-III.D "Methane recovery in agricultural and agro industrial activities", version 15 and AMS-I.C "Thermal energy for the user with or without electricity", version 13 as well as methodological "Tool to determine project emissions from flaring gases containing methane".

A.6. Status of implementation including time table for major project parts:

Table 2. Status of implementation (according to PDD version 7)

Activity	**Date**
Beginning of the project investment stage	2008
Launch of: - biogas plant at farm 1, - cogeneration units with generated energy and heat from the renewable source 2,036 MW	2009
Launch of: - biogas plant at farm 2, - cogeneration units with generated energy and heat from the renewable source 3,276 MW	2009

A.7. Intended deviations or revisions to the determined PDD:

In accordance with data of the determined PDD, it was planned to put into operation biogas plant at farm 2 in Komarivka village, Borzniansky region, Chernigiv oblast till the end of 2009 (the general contractor contract #212 of 16.06.08 with the construction company "Ukrbudinvest" Ltd.). But under the influence of global financial crisis that was expanded in 2008-2009 building and assembly works at farm 2 were suspended and startup date of biogas plant was carried over 2011.

Thus, within the monitoring period the following parts of biogas plant had not been operating (table 3, kitting is in accordance with PDD):

Table 3. – Components of biogas plant at farm 2

Index	**Technical characteristics**	**Quantity**
Preliminary fermentation tank	Receiving reservoir: 1525 m^3, height 3 m, width 24x48 m	1
Main digester	Fermenter: 2400 m^3, diameter 24 m, height 6 m	6
Lagoon for after-fermentation	25000 m^3	5
Gas purification system	Pressure 20-50 mBar, temperature 8-10 ºC, pipeline length 50 m,	1

	depth 1,2 m, hydrogen sulphide content – less than 0,2%	
Flare facility	Flare candle: Pressure from 50 mBar, biogas incineration 300-400 m^3/hour	2
Thermal power generator	Cogeneration unit JMC 312Gs-B.L of 526 kW of electric and 566 kW of thermal power	3

In accordance with PDD at farm 1 that is situated in Velykyi Krupil', Zgurivsky region, Kyiv oblast working project envisaged two cogenerators with the following main parameters (Table 4):

Table 4. – Parameters of cogeneration units

Index	**Cogenerator (1) JMC 208 GS-B.L**	**Cogenerator (2) JMC 312 GS-B.L**
Electric power, kW	330	625
Heating capacity, kW	395	686
Gas spending Nm^3/h	170	313

As opposed to PDD data, within the proposed project only one cogenerator (2) JMC 312 GS-B.L is on-stream at the moment. Cogenerator (1) JMC 208 GS-B.L wasn't bought due to the same reason as for the farm 2.
Due to putting into operation of less amount of production capacity, than it was previously planned in working project, within monitoring period only 75% of cattle manure (300 t/day) from projected 400 t/day enters the biogas plant. The remaining 25% of manure continues to be managed in anaerobic lagoons.
In compliance with PDD data it was envisaged production of electrical energy and heat in co generators beginning from 01.11.2009. Actually, during the first month of exploitation generator was going through the setting operation and testing procedures and biogas was combusted at flare candle.
Other deviations in comparison with determined PDD have not been detected.

A.8. Intended deviations or revisions to the determined monitoring plan:
There are no deviations to the determined monitoring plan.

A.9. Changes since last verification:
Not applicable.

A.10. Person(s) responsible for the preparation and submission of the monitoring report:
Ukrainian Dairy Company Ltd:

- Sergiy Dmytriev, chief of heat and power sector, appointed responsible for monitoring by the order #232/1 from 19.09.2009.

Environmental (Green) Investments Fund Ltd:

- Yuriy Pyrozhenko, Inventory and project expert (Agriculture sector);
- Maryna Bereznytska, Inventory and project expert (Waste sector).

SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.4.

Key monitoring activities could be described as follows:

- Accounting of energy production and consumption;
- Accounting of dairy herd and manure physical-chemical analysis control;
- Accounting of the biogas flow and properties;
- The procedure for storage and use of fermented mass in the fields as fertilizer monitoring.

Accounting of energy production and consumption

Reading of meters for the produced energy is conducted on unit-to-unit basis every 12 hours and is entered into the log book. The data is aggregated into the monthly and annual reports and is stored in paper and electronic formats.

Data collection is carried out by a shift caretaker of the Main control board. The responsible person for the collection and archiving of the data is the Chief of heat and power sector of the farm. Monitoring scheme for GHG emission reductions project at farm owned by Ukrainian Dairy Company Ltd. is attached in Annex 1.

Meters check is conducted according to the verification methodology certified by the SE "Ukrmetrteststandart". Chief of heat and power sector of the farm is responsible for meeting the meters checks deadlines.

The amount of electricity and thermal energy consumed for the Farm own needs is determined by monthly calculations in consideration of the working auxiliary equipment load factor, as well as its capacity. The data is archived and stored in paper and electronic formats. The responsible person for the collection and archiving of the data is the Chief of heat and power sector of the farm.

The term of operation in emergency mode according to the technical documentation elaborated by "UKRNDIAGROPROEKT" is 24 hours per year. In 2010 the emergency mode was used within the time limited by technical documentation. The fixed in Monitoring Journal 24 hours were occurred in December of 2010. Emissions have been calculated ex-post on the basis of results of the time of operation in emergency mode and amount of used diesel fuel monitoring.

According to AMS-III.D methods within the project activity if a cogenerator plant operates on fossil fuel during a certain period of time, amount of heat and electrical energy gained in this case is calculated on the basis of monitoring results in compliance with information about fossil fuel specific consumption for energy generation and amount of consumed diesel fuel.

For assuring consumed diesel fuel monitoring the fact of filling fuel diesel-generator tank, degree of its filling (percentages on the main generator control panel) and its operating hours are fixed.

Calculation of fuel consumption is carried out in accordance with technical characteristics of the generator Magnum G400 VSA - 120 liters per 5 hours. A built-in sensor of the fuel tank filling degree is not the subject for calibration.

Accounting of dairy herd and manure physical-chemical analyses control

Cattle livestock is calculated in special electronic registers based on livestock turnover for the period which equates to a balance: sum of cattle head at the beginning of the period and all income should amount to sum of all outlay and cattle head at the end of the year. The responsible person for this information in Monitoring Journal is the chemist laboratory assistant.

Also the chemist laboratory assistant is responsible for the collecting data obtained from the Manure physical-chemical analysis: Fraction of dry substance contained in manure, f_d; Fraction of ash in manure, ASH. Sampling and sample analysis are carried out in accordance with established zootechnics procedures and on the basis of "Instructions on laboratory monitoring of waste disposal plants at cattle-breeding complexes". The Laboratory of ecological and sanitary-epidemiological monitoring of Agro-Industrial complex (AIC) enterprises, chair of cattle hygiene and cattle ecology named after A.K. Skorohodko of the National University of Life and Environmental Sciences of Ukraine is involved.

Accounting of the biogas flow and properties

Accounting of the biogas consumption by cogenerator and flare is determined by the meter on gas-flow inlet to the cogenerator and flare. The responsible person for the collection and archiving of the data is the biogas plant operator. Also the biogas plant operator is responsible for entering to the Journal data biogas temperature, T; Biogas pressure, P; Methane density, D_{CH4} on the basis of these data and biogas content.

The biogas content is determined by Gas control system SGK-1 and as QA/QC procedure by the Laboratory of the Gas Institute of the NAS of Ukraine for Biogas samples, taken at the entry to cogenerator. The results are entered into the Monitoring Journal.

The procedure for storage and use of fermented mass in the fields as fertilizer monitoring at farm 1

1. The fermented mass from fermenters is collected in an open tank by means of airlift in accordance with load-unload overflow schedule. Then, without any additional processing in the automatic mode, the fermented mass is pumped into the 4 lagoons 12600 m^3 volume each. The average level of lagoons filling with fermented mass is not more than 2 m. The fermented mass is stored in lagoons no more than six months.

2. The fermented mass mechanic mixing in the lagoons is provided with the help of firm "Houle" pumps in order to ensure aerobic conditions for mass storage. The pumps operating time is assumed to be 8 hours per day for 365 days (2920 hours/year). The average capacity of one pump amounts to 1890 l/min. The pump works intermittently for 24 hours.

3. Storage time for biomass obtained at the biogas plant output on both farms directly depends on the terms of this mass application to the soil as fertilizer. The use of fermented manure as fertilizer should be implemented in the optimum terms of agricultural technology[1].

4. Manure in liquid form should be applied under the agricultural crops twice a year (autumn and spring), this process is accompanied with the 100% lagoons emptying. Manure is to be applied only once every two or three years in the same area (in case of the annual application of fermented manure in one area the prescribed dose should be less by 30% than the optimal one).

5. The annual input of organic fertilizers norm calculation must be based on the requirements of the Technological Designing Departmental Regulations of Agro-Industrial Complex 09.06 "Systems of manure removal, treatment, preparation and usage", Kiev 2006, Ukraine AIC regarding to fertilizing value of organic matter and removal of biogenic elements (nitrogen, phosphorus and potassium) by the planned harvest crops.

6. During the agricultural land areas calculations for manure application it is necessary to take into account the biogenic elements losses caused by manure digestion in the fermenters of a biogas plant and its fertilizing value (determined on the basis of physical-chemical analysis of fermented mass).

7. Digested manure is applied under crops by means of tank-type spreaders RZHT. Liquid manure is spread on the soil surface by equal portions, it is necessary to avoid fertilizer under and over application. Then the soil should be ploughed up again.

8. Amount of fertilizers for high-yielding forage crops (maize silage, fodder beet, grasses, etc.) should be up to 400 kg/ha of total nitrogen, for grain - 100-150 kg/ha. Chief of heat and power sector of the farm is responsible for entering the data to Monitoring Journal.

[1] "Instructions on laboratory monitoring of waste disposal plants at cattle-breeding complexes", M., "Kolos", Part I – 1982, Part II – 1983 and Part III – 1984.

B.1. Monitoring equipment types

- Gas meters rotary RGK-Ex
- Generated heat meter station Supercom -01-SKS-3
- Pressure sensor - IS-20-S, S1, ECO-1 WIKA
- Temperature sensor - TR10-C WIKA
- Electricity meter Siemens XPS
- Gas control system SGK-1 5BC.550.004

B.1.2. Table providing information on the equipment used (incl. manufacturer, type, serial number, date of installation, date of last calibration, information to specific uncertainty, need for changes and replacements):

The control and monitoring system may be divided into a thermo-electrical part, a biogas part, a manure management part and the procedure for storage and use of fermented mass in the fields as fertilizer monitoring.

Thermo and electrical measurements

For the purpose of monitoring the emission reductions the following parameters are measured:

- Electrical energy generation by cogeneration unit JMC 312 GS-B.L after project activity implementation;
- Thermal energy generation by cogeneration unit JMC 312 GS-B.L after project activity implementation.

Table 5. List of thermo and electric meters

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Grade of accuracy	Year of production	Date of installation	Date of last calibration	Date of next calibration	Remarks
TE1	Amount of electricity generated by JMC 312 GS-B.L	kWh	Electricity meter Siemens XPS	GD 939 997 4 14 WW	2	12.2008	10.10.2009	12.2008	12.2014	X
TE2	Amount of heat generated by JMC 312 GS-B.L	kWh	Generated heat meter station Supercom -01-SKS-3	_	2	12.2008	10.10.2009	12.2008	12.2014	X

Biogas measurements

For the purpose of monitoring of the emission reductions the following parameters are measured:

- Biogas flow consumed by CHP after project activity implementation;
- Biogas flow consumed by flare after project activity implementation.

Table 6. List of biogas flow meters and biogas measurements devices

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Grade of accuracy	Year of production	Date of installation	Data of last calibration	Data of next calibration	Remarks
F1	Biogas flow getting into cogenerator	m^3/hour	Gas meters rotary RGK-1/30-01-4 Ex	0002118/0457	0,1-1,12%	19.06.2008	01.10.2009	16.12.08	16.12.16	X

F2	Biogas flow getting into flare	m^3/hour	Gas meters rotary RGK - 1/30-01-4 Ex	0002043/0956	0,1-1,12%	12.11.2008	01.10.2009	12.11.08	12.11.16	X
F3	Biogas pressure	kPa	Pressure sensor - IS-20-S, S1, ECO-1 WIKA	45675	0,5%	01.11.2008	01.10.2009	12.2008	12.2014	X
F4	Biogas temperature	C^o	Temperature sensor - TR10-C WIKA	45678	_	01.11.2008	01.10.2009	12.2008	12.2014	X
F5	Methane fraction in biogas	relative units	Gas control system SGK-1	1	_	01.07.2009	01.10.2009	07.2009	07.2015	X

Readings of biogas flow meters and biogas measurements devices (Table 6) are presented in Monitoring Journal.
Summary table with results of QA/QC biogas composition analysis in 2009-2010 is given in Annex 3.

Manure management control
Results of physical-chemical analysis of manure to be fermented in biogas plant performed in 2009-2010 are presented in Annex 2.

The procedure for storage and use of fermented mass in the fields as fertilizer monitoring
Results of physical-chemical analysis of fermented mass from biogas plant performed in 2009-2010 are presented in Annex 2.The area of agricultural land, which fertilized with fermented mass in 2009-2010, was 392 ha twice a year in the Kyiv oblast under maize for silage and fodder beet, as well as for grain crops. The nitrogen content in fermented mass is 0,56 tons of nitrogen per day.

B.1.3. Calibration procedures

For thermo and electricity meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval is 6 years for the electricity meter Siemens XPS	SE "Ukrmetrteststandart"
Calibration interval is 6 years for the Generated heat meter station Supercom -01-SKS-3	SE "Ukrmetrteststandart"

For biogas meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval is 8 year for the Gas meters rotary RGK-Ex	SE "Ukrmetrteststandart"

B.1.4. Involvement of Third Parties:

- Company Zorg-Ukraine Ltd;
- SE "Ukrmetrteststandart"[2];
- Laboratory of ecological and sanitary-epidemiological monitoring of AIC enterprises, chair of cattle hygiene and cattle ecology named after A.K. Skorohodko of the National University of Life and Environmental Sciences of Ukraine;
- Laboratory of the Institute of technical thermophysics of the NAS of Ukraine;
- Laboratory of the Gas Institute of the NAS of Ukraine;
- Central geophysical observatory;
- Ukrainian Hydrometeorological Center;
- Authorized affiliate of GE Jenbacher in Ukraine - Company Sinaps;
- CJSC Kyivoblenergo and JSC Chernigivoblenergo.

B.2. Data collection (accumulated data for the whole monitoring period):

For the operational and management structure of the project see PDD section D.3. The Organizational chart of project monitoring is presented at Fig.1.

[2] All measurement equipment must be calibrated according to terms and methodology defined by the SE "Ukrmetrteststandart" requirements.

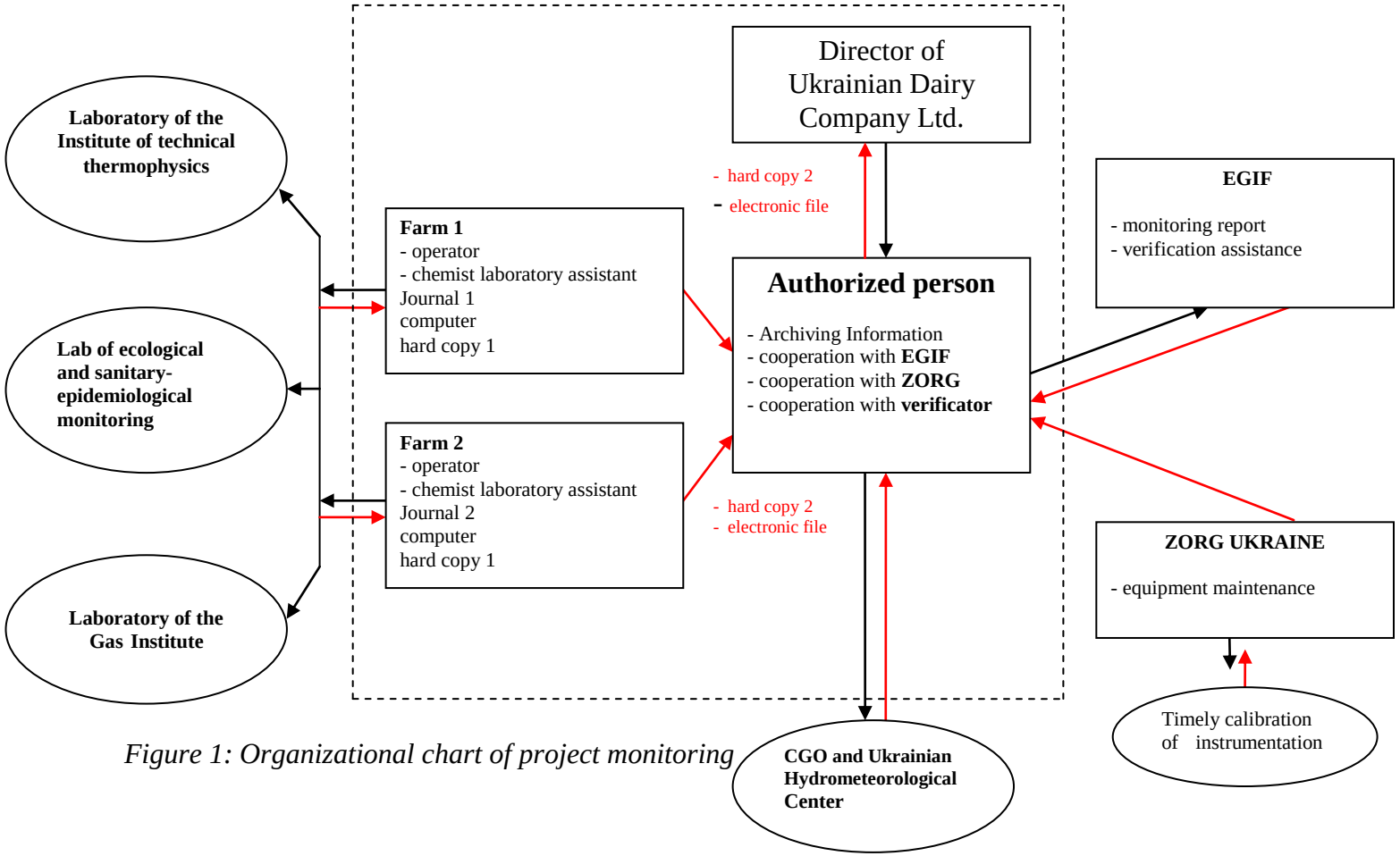


Figure 1: Organizational chart of project monitoring

B.2.1. List of fixed default values:

Table 7. Project and baseline default values

Data variable	Source of data	Data unit	Comment
GWP_{CH4} Global warming potential of CH_4	CDM methodology AMS-III.D. "Methane recovery in agricultural and agro industrial activities", version 15	_	21
B_o Maximum methane producing potential from cattle manure	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, chapter 10: Agriculture, Forestry and Other Land Use (table 10 A-4, data for Eastern Europe)	m^3/kg VS	0,24
η_{flare} Flare efficiency	"Tool to determine project emissions from flaring gases containing methane" (section II, data for open flare)	relative units	0,5
k_c Carbon content in diesel fuel	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual	tC/TJ	20,2
k_o Carbon oxidized factor	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual	fraction	0,99
Q_n Net calorific value of diesel fuel	Ukraine's National Inventory Report on GHG emissions and absorption for 1990-2006 (Annex 2, table A2.3)	TJ/1000 t	42,4
Amount of electrical energy used for putting into operation of biogas plant	Calculated based on PDD data, section D.1.1.2	MWh	146,4
UF_b Correction factor for considering uncertainties	CDM methodology AMS-III.D. "Methane recovery in agricultural and agro industrial activities", version 15	relative units	0,94
Electrical heaters efficiency	Please see PDD, section D.1.1.3	relative units	0,68
Fraction of electrical and heat energy produced in co generators that is spend on biogas plants functioning	Please see PDD, section D.1.1.4	relative units	0,2
D_{CH4} CH_4 density	CDM methodology AMS-III.D. "Methane recovery in agricultural and agro industrial activities", version 15	t/m^3	0,00067

B.2.2. List of variables:

The list of variables was defined in the PDD (section D) in order to calculate emission reductions in a proper way. Some of variables could not be monitored directly, so data should be determined another way. The following table establishes the link between data from the meters and corresponding variables.

Table 8. List of variables monitored directly

ID number	Data variable	Data unit	Recording frequency	Method of calculation	Meters used for calculation
P7	$FV_{RG,h}$ Flow of biogas coming into a flare	m^3/hour	Every hour	Measured by gas-meters	Rotor gas-meters RGK-Ex (please see table 6)
B6	Amount of electrical energy generated in a cogeneration unit	MWh	Monthly	Measured by electrical energy meter	Electricity meter Siemens XPS (please see table 5)
B7	Amount of electrical energy displaced by heat energy generated in a cogeneration unit	MWh	Monthly	Value of amount of heat energy produced is measured by heat energy meter and than divided by electrical heaters efficiency that equals to 0,68 relative units	Meter station of a generated heat Supercom-01-SKS-3 (please see table 5)
P6	V_1 Flow of biogas coming into a cogeneration unit	m^3/hour	Every day	Measured by gas-meters	Rotor gas-meters RGK-Ex (please see table 6)
P11	T Biogas temperature	C^o	Every day	Measured by temperature sensors	Temperature sensors TR10-C WIKA (please see table 6)
P12	P Biogas pressure	Kilopascal	Every day	Measured by pressure sensors	Pressure sensors IS-20-S, S1, ECO-1 WIKA (please see table 6)

Table 9. List of variables not monitored directly

ID number	Data variable	Source of data	Data unit	Recording frequency	Comment
P13	$\rho_{CH4,n}$ CH_4 density at normal conditions	Determined according to temperature and pressure data	t/m^3	Daily	2009: 0,000716 2010: 0,000716
P1 B1	N Cattle population	Average data as to dairy cows population are calculated on the basis of the head turnover for a	heads	Daily	2009: 4049 2010: 4143

		definite period and recorded by operators at farm documents			
P5 B5	ASH Ash fraction (non-organic component) in manure	Physical-chemical manure analyses performed by Laboratory of the National University of Life and Environmental Sciences of Ukraine and Laboratory of the Institute of technical thermophysics of the NAS of Ukraine	relative units	Annually	2009: 0,151 2010: 0,132
P2 B3	Q_m Amount of manure that came into a manure management system	Documents of the farm	kg/day	Daily	2009: 300000 2010: 300000
P4 B4	f_d Fraction of dry matter in manure	Physical-chemical manure analyses performed by Laboratory of the National University of Life and Environmental Sciences of Ukraine and Laboratory of the Institute of technical thermophysics of the NAS of Ukraine	relative units	Annually	2009: 0,062 2010: 0,070
P3	MS_b Manure fraction processed in a biogas plant	Documents of the farm	relative units	Daily	2009: 0,75 2010: 0,75
P9	$w_2 = fv_{CH4,RG,h}$ Volumetric fraction of methane in the residual gas in dry basis at normal conditions	Gas control system SGK-1 readings	relative units	Daily in case of flare candle operation	2009: 0,53 2010: 0,54
P14	H_1 Duration of flare unit operation	Recorded by operator	hours	Daily	2009: 720 2010: 24
P15	H_2 Duration of	Recorded by operator	hours	Daily	2009: 744 2010: 8736

	cogeneration unit operation on biogas				
P16	H_3 Duration of a cogeneration unit and tractor operation on fossil fuel	Recorded by operator	hours	Daily	Cogeneration unit: 2009: 0 2010: 24 Tractor: 2009: 488 2010: 2920
P17	$E_{d,h}$ Quantity of the diesel fuel combusted in co generator and tractor	Monitoring Journal. To ensure the monitoring of diesel consumption by cogenerator the next information is fixed: simply filling in of each tank of diesel generator fuel, the degree of its filling (the per cent on the front panel of the generator) and hours of work. In case of tractor the degree of tank filling and hours of work are to be monitored	t/hour	Monthly	Cogeneration unit: 2009: 0 2010: 0,017 Tractor: 2009: 0,031 2010: 0,031
B9	CEF Emission factor for displacement or consumption of energy from grid	Most recent approved study regarding emission factors for the Ukrainian electricity grid. As the proposed project is implemented using track 1 procedure, emission factor approved by the National Environmental Investments Agency of Ukraine have to be used. The latest study - "Methodology for calculation of specific CO_2 emissions during electrical energy production at power plants and its consumption" (approved by the order #39 from 21.03.2011) is based on the amount of electricity that is released by the power plant, amount of fuel consumed for electricity releasing, fuel net calorific value, heat losses connected with	tCO_2/ MWh	Annually	2009: 1,237 2010: 1,225

		chemical and mechanical combustion incompleteness and technological expenditure of energy in electricity grid. Approved CO_2 emission factors (orders #63 from 15.04.2011 and #43 from 28.03.2011 for 2009 and 2010 respectively) based on above mentioned methodology were used in ER calculations within monitoring period.			
P19	PE_{fm} Methane emissions due to storage of the final sludge	Documents of the farm, physical-chemical analysis of the final sludge. Occurrence/absence of methane emissions are determined based on the following parameters: amount of organic matter in manure, C:N and COD/BOD ratios	tCO_2-eq.	Every year	According to monitoring data methane emissions in result of final sludge storage are not occurring as all stabilization criteria for organic substance mentioned in PDD (section D.1.1.2) have been achieved. In particular: - Technical digestion limit doesn't exceed 64% (amounts to 45%); - C:N ratio in digested biomass is less than 10 (constitutes 9,3); - COD/BOD ratio in digested mass is approximately two times bigger (amounts to 2) than corresponding ratio in manure from cattle premises at the inlet of biogas plant (1,1); - Percents of COD and BOD lost during digestion process are within the limits of

					standards presented in PDD (make up 51 and 73% respectively)
B2	MCF Methane conversion factor for the anaerobic lagoons	Is evaluated with the help of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, chapter 10: Agriculture, Forestry and Other Land Use (Table 10.17, data for Eastern Europe) on the basis of the latest Central geophysical observatory (CGO) and Ukrainian Hydrometeorological Center data as to the average annual temperature (average annual temperatures in Kyiv oblast for 2009-2010 amounted to 9,0 and 9,4°C correspondingly)	relative units	Annually	2009: 0,66 2010: 0,66
B8	EC Amount of electrical energy displaced in result of the project activity	Calculated by the operator as sum of amount of electrical energy generated in a cogeneration unit and amount of electrical energy displaced by heat energy generated in a cogeneration unit and based on assumption that 20% of electrical and heat energy produced in cogenerator is spend on biogas plants functioning	MWh	Monthly	2009: 152,1 2010: 5032,7
P8	w_1 Methane fraction in biogas	Gas control system SGK-1 readings	relative units	Daily	2009: 0,53 2010: 0,54
P10	w_3 Methane fraction in biogas	Biogas composition analyses taken for test at the fermenter for quality control. Withdrawal is carried out by a chemist-laboratory assistant of a biogas plant, analyses are performed in the	relative units	Not less than twice a year	2009: 0,40 2010: 0,54

		laboratory of the Gas Institute of Ukrainian NAS			
P18	FC_s Specific fossil fuel consumption	Documents of the farm	l/kWh	In case cogenerator uses diesel for its operation	2009: 0 2010: 0,025

B.2.3. Data concerning GHG emissions by sources of the project activity:
Directly monitored data (please see Table 8) are collected to handwritten journals/electronically.

Table 10. Data collected in the project scenario

ID number	Variable	Description	Unit	Value	
				1.11.2009-31.12.2009	**1.01.2010-31.12.2010**
P7	$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions	m^3	105708,2	3310,9
P6	V_1	Flow of biogas coming into a cogeneration unit	m^3	36411,6	1205166,1
P11	T	Biogas temperature Since the flow rate is measured by gas-meters, the temperature values are not used in calculations, but are recorded to control methane density	C^o	34-35	34-35
P12	P	Biogas pressure Since the flow rate is measured by gas-meters, the pressure values are not used in calculations, but are recorded to control methane density	Kilopascal	104,7	104,7

B.2.4. Data concerning GHG emissions by sources of the baseline:
Directly monitored data (please see Table 8) are collected to handwritten journals/electronically.

Table 11. Data collected in the baseline scenario

ID number	Variable	Description	Unit	Value	
				1.11.2009-31.12.2009	**1.01.2010-31.12.2010**
B6	_	Amount of electrical energy generated in a cogeneration unit (correction factor 0,8 is applied to account for energy used for biogas plant operation)	MWh	58,2	1925,0
B7	_	Amount of electrical	MWh	93,9	3107,7

		energy displaced by heat energy generated in a cogeneration unit (correction factor 0,8 is applied to account for energy used for biogas plant operation)			

B.2.5. Data concerning leakage:
PDD did not identify any leakage; therefore this section is not applicable.

B.2.6. Data concerning environmental impacts:
The project improved efficiency of use of electricity and heat at the enterprise and thus leaded to decrease of harmful emissions. All activity under the project is performed subject to Ukrainian current environmental law.
Chief engineer of the farm A. Glotov is the person responsible for Ecological issues.

B.3. Data processing and archiving (incl. software used):
Journal of GHG Emission Reduction Monitoring (Monitoring Journal) is kept daily in electronic form (Excel table). For the first date of each month the Journal for the previous month is printed out in two copies and is signed by the authorized persons.
One copy is kept at the farm. The other copy is submitted to the authorized person responsible for monitoring of GHG emission reduction according to the project in Ukrainian Dairy Company Ltd. central office. The file in electronic form with the monthly data is also transferred from the farm. Information about monitoring from both farms is saved in the authorized person's computer as well as in hard copy in the archive.
Everyday notes of the project maintenance are made in the Monitoring Journal.
All data are archived electronically in month and annual reports. Electronically archived data and printed journals will be stored until the end of crediting period plus two years.
There is a special program that provides protection for viewing, opening, changing, deleting files and folders to a specific user (Access Administrator). It is used for Excel files, containing Monitoring Journal information.

B.4. Special event log:
There are no special events took place within the monitoring period.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The general project management is implemented by the Director of Ukrainian Dairy Company Ltd. through the appointment of the authorized person responsible for the supervising and coordinating activities of the monitoring. For the considered monitoring period the chief of heat and power sector of the farm is responsible for the carrying out of the monitoring. In particular, the authorized person is answerable for organization of annual verification of GHG emission reduction according to the project, storing of annual monitoring and verification reports and participates on behalf of the project owner in preparation of the annual report on monitoring (providing information for GHG emission reduction calculation).

The staffing table of those servicing the biogas plant includes a senior operator, an operator on duty and a chemist-laboratory assistant. They have the following responsibilities:

- Collection and keeping of primary information for monitoring of GHG emissions reduction carried out according to the project.
- Fixing meters indications with periodicity identified in a monitoring plan;
- Inserting fixed data into the Monitoring journal of GHG emission reductions;
- Withdrawing physical-chemical analyses of samples for analyses;
- Transporting of samples to laboratories;
- Recording analyses results into the Monitoring journal of GHG emission reductions.

Operators work all day round seven days a week and 365 days a year.

For this monitoring period the names of the personnel involved are as follows:

- Senior operator: V.V. Kocyurbiy;
- Operator on duty: V.V. Dudnyk;
- Chemist-laboratory assistant: Y.I. Molibozhenko.

At the end of each year within monitoring period all the data necessary for the GHG emission reductions calculation from central office are forwarded by the chief of heat and power sector of the farm to the Environmental (Green) Investments Fund Ltd. The monitoring report is compiled and respective calculations are carried out by the specialists of Environmental (Green) Investment Fund Ltd. based on the data provided by Ukrainian Dairy Company Ltd. central office.

C.1.2. Trainings:

The biogas plant operators were trained by the specialists of company Zorg-Ukraine Ltd. on the following issues:

- biogas plant operation;
- failure recovery;
- energy safety;
- using of fermented fertilizers for agricultural needs.

Before operating biogas plant the personnel studied standards of safety regulations at enterprises – "Regulations for labor safety in agricultural production" (НПАОП 01.1-1.01-00, ДНАОП 2.0.00-1.01.-00), as well as safety regulations in gas plant operation.

C.2. Involvement of Third Parties:

Company Zorg-Ukraine Ltd. is involved for the regular calibration of the rotor gas-meters RGK-Ex; meter station of a generated heat Supercom-01-SKS-3, НВП "Techprilad"; pressure sensors IS-20-S, S1, ECO-1 WIKA; temperature sensors TR10-C WIKA; electricity meter Siemens XPS as well as system of gas control SGK-1 5BC.550.004 produced by JISK SPF SENSOR, Kharkiv.

Besides, in implementing the monitoring plan the following entities are engaged by the project owner:

Laboratory of ecological and sanitary-epidemiological monitoring of AIC enterprises, chair of cattle hygiene and cattle ecology named after A.K. Skorohodko of the National University of Life and Environmental Sciences of Ukraine and Laboratory of the Institute of technical thermophysics of the NAS of Ukraine
Performing of physical-chemical manure and final sludge analyses.

Laboratory of the Gas Institute of the NAS of Ukraine
Identification of qualitative and quantitative biogas composition every two weeks with the help of a gas analyzer. Samples are withdrawn by laboratory assistants at farm in special gas sampling tube with two taps and are submitted to the laboratory.

Central geophysical observatory and Ukrainian Hydrometeorological Center
Approval of an average annual temperatures values at project site that are necessary for monitoring of methane conversion factor value for anaerobic lagoons (MCF).
Authorized affiliate of GE Jenbacher in Ukraine - Company Sinaps
Performing of co generators major repairs.

CJSC Kyivoblenergo and JSC Chernigivoblenergo
Electricity supply during the project startup period.

SE "Ukrmetrteststandart"
Responsible for calibration and certification.

C.3. Internal audits and control measures:
At Ukrainian Dairy Company Ltd. was introduced and applied a quality management system ISO 9001:2000. This fact is evidenced by a certificate of quality management system SIC 02.008.220 dated 26 December 2008 issued by "Bureau of International Certification". According to the certificate, cattle breeding, grain and technical crops farming, rendering of services in livestock farming and nutrition production for livestock at Ukrainian Dairy Company Ltd. meets the requirements of the ISO 9001:2000. Procedures for dealing with data gaps and uncertainty are conducted in accordance to this standard. Audit of the processes connected with the quality management system is conducted at the Ukrainian Dairy Company Ltd. in accordance with ISO 9001:2000. Sergiy Dmytriev, chief of heat and power sector, is appointed responsible for the internal quality audit conducting.
Within the framework of quality control procedures, the calculated values of the dry matter amount in cows' manure (6,2 and 7,0 kg/head/day for 2009 and 2010 correspondingly) and ash fractions in a dry matter (0,151 and 0,132 correspondingly) were compared with similar regulatory data for cattle (DM - 6,3 kg/day and ASH - 0,16). Results of the comparison indicate conformity of the aforesaid data (difference for DM data – 1% and 10%, for ASH data – 6% and 17% respectively).
Besides, pursuant to the requirements set in AMS-III.D methodology, VS values (5,3 kg/head/day for 2009 and 6,0 kg/head/day for 2010), were compared with the correspondent default value set in the 2006 IPCC Guidelines (4,5 kg/head/day). Discrepancies between the aforesaid values (18% and 34% respectively) can be explained by the fact that the default value of amount of volatile solids excreted has been elaborated by the IPCC primarily for the countries of Eastern Europe, but the national data indicate the specificity of cattle breeds, stock keeping and fodder rations for milk herd cows that are owned by the Ukrainian Dairy Company Ltd.

C.4. Troubleshooting procedures:
According to the Law of Ukraine "On fire safety" for case of fire the site is provided with two fire water tanks with capacity of 100 m^3 and pumping station. Object is secured by external fire extinguishing.
Emergency situation is possible at the receiving station and manure pumping system in case of the lagoon feeding pump stopping. This incident will trigger the alarm (siren) and the addition of manure in lagoons will be provided by means of the wet organic fertilizer throwing machine, which has the capacity and equipped with a pump for liquid water mixtures pumping.

Hermetic pipelines for manure transport using and manure lagoons waterproofing prevents manure leakages into the soil and groundwater.
In the case of an emergency on biogas plant (termination of biogas supply) generator operates on diesel fuel and the surplus biogas is flared at a gas open flare.
Uninterrupted power supply for milking facility units in case of power failure is provided by means of generator, which works on diesel fuel.
In terms of design decisions, passport requirements on the installation and operation of equipment implementation and adherence to safety the emergencies should not occur at biogas plant.
Every day persons responsible for "Instruction on monitoring of emission reductions within the operational stage of JI Project "Biogas utilization for generating of electricity and heat at the farms of Ukrainian Dairy Company Ltd." (approved by the order #232/2 from 20.09.2009) fulfillment reports to the Chief of heat and power sector of the farm about any malfunctioning. Consequently, in case of any meters equipment failure, data discrepancy will be found within one day. The meter will be substituted by working one. GHG emissions reduction will be calculated by cross-checking method for this period. If any inappropriateness of monitored data is revealed, corrective measures will be conducted either on the monitoring system or for the item specified above. In such case, monitored data will be corrected in a conservative manner. All the information of corrective measures taken on the monitoring system and monitored data itself will be archived along with original monitored data for future verification of emission reductions.

SECTION D. Calculation of GHG emission reductions

D.1. Tables providing the formulas used:

Formulas used were taken from the PDD. Values of parameters used in calculations are given in sections B2.1-B2.4.

Table 13. Project, baseline and emissions reduction estimation

Notation key	Formula description	Formula
PE_y	Project emissions in year *y*, t CO_2-eq.	$PE_y = PE_{PL} + PE_{flare} + PE_{power}$
PE_{PL}	Methane emissions due to physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use, t CO_2-eq.	$PE_{PL} = 0{,}10 \cdot GWP_{CH4} \cdot D_{CH4} \cdot B_o \cdot N \cdot VS \cdot 365 \cdot MS_b$
PE_{flare}	Methane emissions from flaring or combustion of the biogas stream, t CO_2-eq.	$PE_{flare,y} = \sum_h TM_{RG,h} \cdot (1-\eta_{flare}) \cdot \frac{GWP_{CH4}}{1000}$
PE_{power}	CO_2 emissions from the use of fossil fuel or electricity for the operation of the installed facilities, t	$PE_{power,dy} = \sum_h E_{d,h} \cdot k_c \cdot k_o \cdot Q_n \cdot \frac{44}{12}$
BE_y	The total baseline emissions during the year *y*, t CO_2-eq.	$BE_y = BE_{C1} + BE_{C2}$
BE_{C1}	Baseline emissions according to the first component, t CO_2-eq.	$BE_{C1} = GWP_{CH4} \cdot D_{CH4} \cdot MCF \cdot B_o \cdot N \cdot VS \cdot 365 \cdot MS_L \cdot UF_b$
BE_{C2}	Baseline emissions according to the second component, t CO_2-eq.	$BE_{C2} = EC \cdot CEF$
ER_y	GHG emission reductions in year *y*, t CO_2-eq.	$ER_y = BE_y - PE_y$
VS	Amount of volatile solids excreted with cattle manure, kg/head/day	$VS = DM \cdot (1 - ASH)$
DM	Amount of manure excreted, kg dry matter/head/day	$DM = \frac{Q_m}{N} \cdot f_d$
$TM_{RG,h}$	Mass flow rate of methane in the residual gas, kg/hour	$TM_{RG,h} = FV_{RG,h} \cdot fv_{CH4,RG,h} \cdot \rho_{CH4,n}$

D.2. Description and consideration of measurement uncertainties and error propagation:

The hand readings of the meters cause additional uncertainties. In case of obvious errors occurred, monitored data will be corrected in a conservative manner. All the information of corrective measures taken on the monitoring system and monitored data itself will be archived along with original monitored data for future verification of emission reductions. The uncertainty level of data received directly from meters was taking into account in calculations of GHG emissions as required by the Article 10 of "Law of Ukraine on Metrology and Metrological Activity" that states about the results of measurements usage.

D.3. GHG emission reductions (referring to B.2. of this document):

D.3.1. Project emissions:

Period	Project emissions, $tCO_{2eq.}$
1.11.2009-31.12.2009	700
1.01.2010-31.12.2010	2609
Total 2009-2010	*3309*

D.3.2. Baseline emissions:

Period	Baseline emissions, $tCO_{2eq.}$
1.11.2009-31.12.2009	2245
1.01.2010-31.12.2010	20518
Total 2009-2010	*22763*

D.3.3. Leakage:

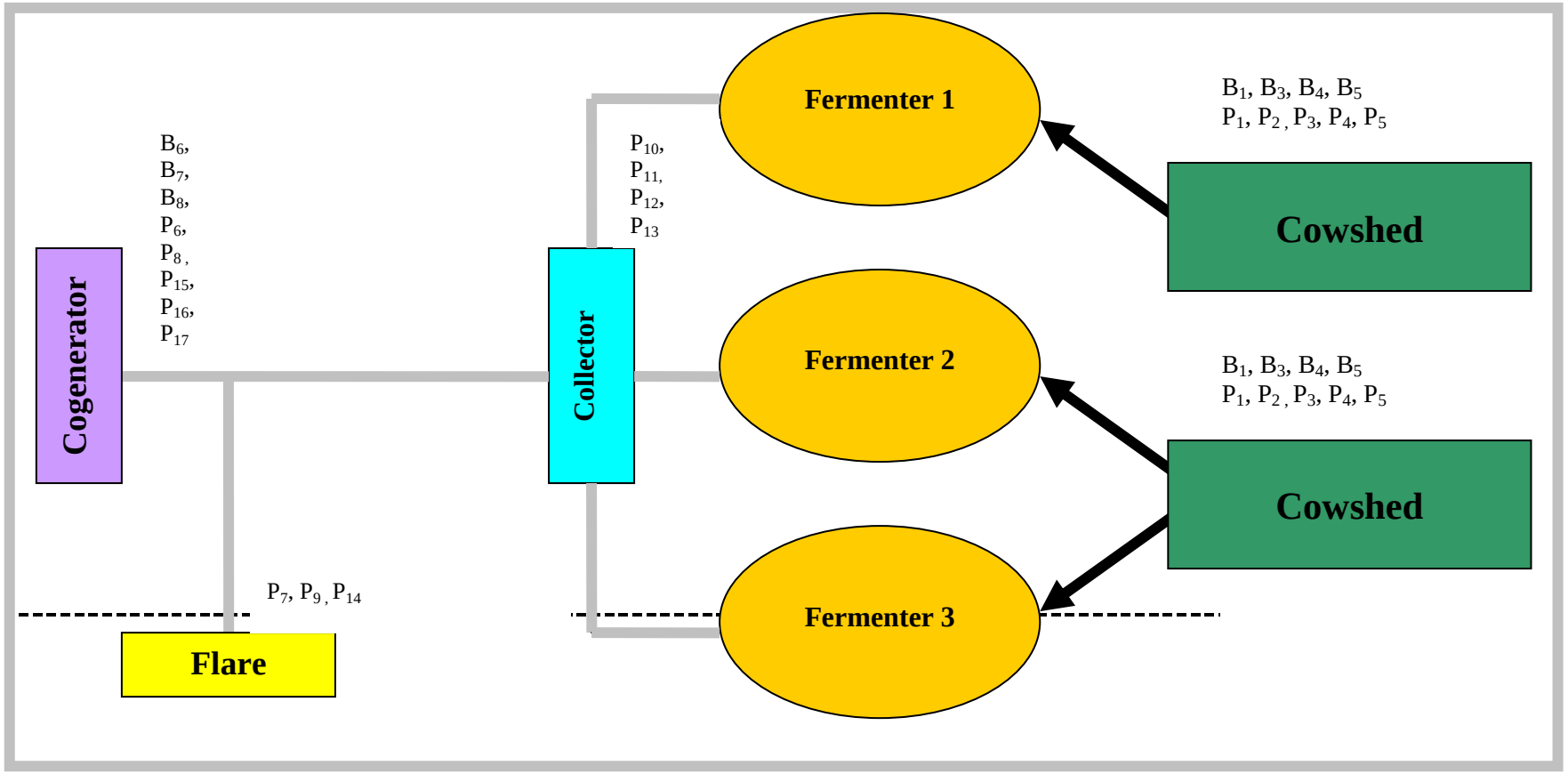
Not Applicable.

D.3.4. Summary of the emissions reductions during the monitoring period:

Period	Emissions reductions, $tCO_{2eq.}$
1.11.2009-31.12.2009	1545
1.01.2010-31.12.2010	17909
Total 2009-2010	*19454*

Annex1

Monitoring scheme for GHG emission reductions project at farm owned by "Ukrainian Dairy Company Ltd."



Annex2

Summary table with results of physical-chemical analysis of raw material and fermented mass from biogas plant performed in 2009-2010

Date	**13.11.09**	**06.07.10**			
Sampling point	**Pump station**	**Receiving reservoir**	**Fermenter 1**	**Fermenter 2**	**Fermenter 3**
Temperature, °C	-	17,3	35,4	34,1	35,3
Solution volume, m^3	-	339	2179	2000	2400
pH	-	6,38	7,91	7,94	7,92
Water content, %	93,76	93,04	96,51	96,63	96,50
Dry matter content, %	6,24	6,96	3,49	3,37	3,50
Organic substance, %	84,94	86,79	79,45	80,14	79,69
Ash, %	15,06	13,21	20,55	19,86	20,31
C:N ratio in raw material	-	18,1			
C:N ratio in fermented mass	-	9,3			
Concentration of organic substance in raw material, mg/l	-	6149			
Concentration of organic substance in fermented mass, mg/l	-	2766			
COD in raw material, mg/l	-	3974			
COD in fermented mass, mg/l	-	1937			
BOD in raw material, mg/l	-	3618			
BOD in fermented mass, mg/l	-	976			

Annex3

Summary table with results of biogas composition analysis in 2009-2010, volume percent

Date	**29.10.09**		**06.11.09**		**03.12.09**		**17.02.10**		**27.04.10**			
# of sample bottle	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**without air**
O_2	0,00	3,99	0,00	5,45	4,41	5,47	0	0	0	0	2,03	0
N_2	2,23	14,14	1,99	22,21	19,41	24,34	4,30	4,13	2,67	3,10	9,48	7,64
CH_4	50,35	42,24	49,39	38,48	25,99	33,67	56,28	54,47	55,53	52,22	50,76	52,86
CO_2	45,59	37,85	46,58	32,00	48,34	34,89	37,44	39,69	40,40	43,23	36,23	38,00
H_2S	0,18	0,13	0,25	0,00	0,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00
H_2O	1,65	1,65	1,79	1,86	1,64	1,63	1,98	1,71	1,40	1,45	1,50	1,50
Total	100	100	100	100	100	100	100	100	100	100	100	100