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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

GHG emission reduction through the commissioning of biogas-fuelled mini- HPPs at the Kurianovo and Lyubertsy waste water treatment facilities of the MGUP Mosvodokanal

Sectoral scope: 1 Energy industries (renewable/non-renewable sources)
PDD version: 03
Date: 01.12.2010

A.2. Description of the project:

Project purposes:

- Improving of the energy efficiency of waste water treatment facilities;
- GHG emission reduction.

Project tasks:

- To increase the reliability of the electricity supply through the independent electricity supply of blowers which support the vitality of biological solids;
- To utilize the biogas with full use of heat in the technological scheme;
- To reduce the electricity consumption from power grid.

Situation existing prior to the starting date of the project

The MGUP Mosvodokanal provide the service of the water supply and sewerage. Treatment facilities in Kurianovo (hereinafter referred as KOS) and treatment facilities in Lyubertsy (hereinafter referred as LOS) are affiliates of the MGUP Mosvodokanal and provide the sewerage service. The project capacity of the KOS is 3 125 million m3 of the treated water per day, the project capacity of the LOS is 3 million m3. The source of the power supply for KOS and LOS is the regional power grid. The heat is provided by own boiler, which burns biogas and natural gas.

The sewage water treatment bring about the sludge. The fermentation of the liquid sludge allows to cut down expenses due to the shrinkage of the sludge for subsequent processing. The biogas is a by-product of the sludge fermentation in methane-tanks and contains 65% methane. The MGUP Mosvodokanal has 44 methane-tanks with total volume 280 thousand m3: KOS - 24 and LOS - 20. Since 1998 the MGUP Mosvodokanal carries out the integrated reconstruction which leads increasing of the biogas production in 1,7 times. At the time the biogas production is equal to 250 thousand m3 per day (more than 90 million m3 per year)[1].

Baseline

The biogas from methane-tanks is turned to the boiler-house for the heat production needing for treatment facilities. The missing heat is compensated with the natural gas consumption. The baseline supposes that the required quantity of the electricity will be provided from the regional power grid. Key figures of the baseline are presented in the following table:

Energy flows for LOS are considered beginning from 2012 because the commissioning of the mini-HPP "Lyubertsy" will be in September 2011.

[1] Press release about mini-HPP "Kurianovo". MGUP "Mosvodokanal", M.: 2009

Project scenario

Project scenario provides for the construction of mini-HPPs in KOS and LOS. The project electrical capacity of each mini-HPP is 10 MW, the project heat rate is 8 MW. Mini-HPPs use biogas from methane-tanks. Mini-HPP KOS supersedes 45% of electricity and 30% of heat. Mini-HPP LOS supersedes 53% of electricity and 12% of heat. Part of the biogas used before the Project in boiler-house will be used on mini-HPPs. It will lead to the increasing of the natural gas consumption. Thus, the Project will reduce electricity consumption from the grid and increase the natural gas consumption.

The Project realization allows to reduce **92 637 t of CO2-eq for the period 2009-2012**.

Project history

MGUP Mosvodokanal has the surplus biogas on the treatment facilities. It is possible thanks to the reconstruction of methane-tanks in 1998. The idea of implementation of the generating capacity operate on the biogas had been discussing in MGUP Mosvodokanal since 2002. First estimation of the emission reduction had been done in 2005 after the meeting with experts of the Russian carbon fund (Denmark). (See the minute of 12 May 2005). Design and survey works and technical and economic assessment showed an approximate volume of CAPEX. Because of large CAPEX it was allowed in 2006 to invite investors for this Project. Potential investors were informed about the approximate CAPEX and indirect income like ERU income. In early 2007 WTE Wassertechnik GmbH in the person of the LLC EFN Eco Service decide to invest this project. The ex-ante assessment shows that the Project is not attractive. Nevertheless possible GHG reduction was determinative factor for the WTE Group. The project started in 2007. The first emission reductions had been obtained in 2009.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved whishes to be considered as project participant (Yes/No)
Party A Russian Federation (Host country)	LLC EFN Eco Service	No
	MGUP Mosvodokanal	No

The LLC EFN Eco Service is the Russian subsidiary of German company WTE Group. WTE Group is one of the leading European companies in the field of water management and environment. The main line of work is the water-supply plants, plants for wastewater treatment, as well as plants for drying, incineration or production of electricity. WTE is a part of the environmental division and the second major focus of the EVN group. WTE has more than 85 environmental projects and is considered the key European recycling company. The LLC EFN Eco Service is an investor and operator of the mini-HPPs in this project.

The MGUP Mosvodokanal is the largest company providing the service of the water supply and sewerage for more than 13 million people in the Moscow region. The MGUP Mosvodokanal is the largest industrial complex in Europe for the production of drinking water and sewerage intake and treating. This company has the developed infrastructure which includes pumping stations, treatment facilities and engineering systems of water supply and distribution. In this Project the MGUP Mosvodokanal acts as the initiator and coordinator, as well as the owner of the biogas.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Russian Federation

Figure A.1. Russian Federation on the world map

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

Moscow

Figure A.2. Moscow on the Russia map

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

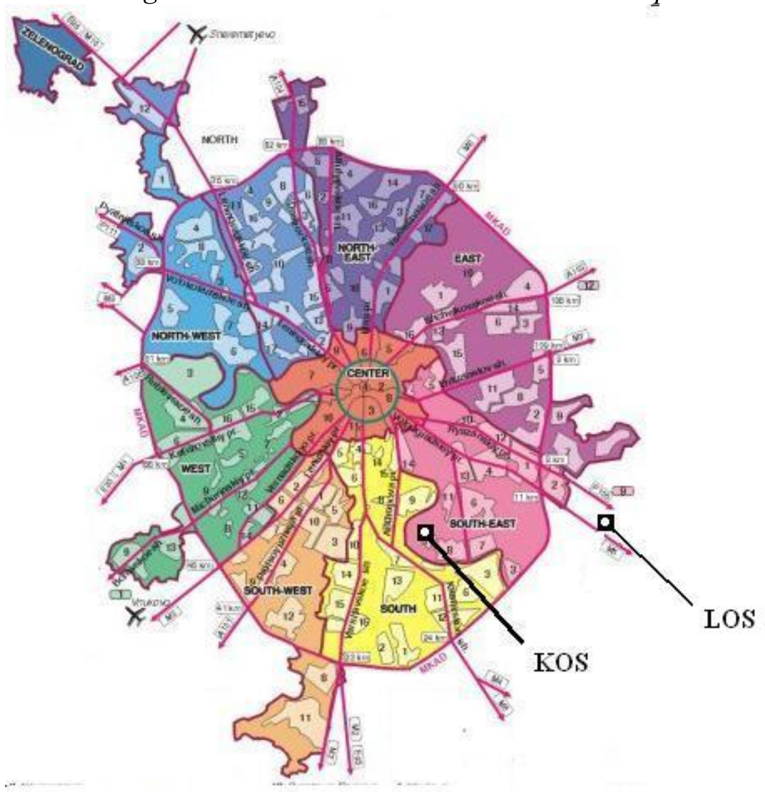
Moscow

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

The Project is realized on KOS and LOS of the MGUP Mosvodokanal. The territory occupied by LOS belongs to Moscow. KOS and LOS are situated in Moscow. GPS-coordinates are:

- KOS – 55°39’38” longitude and 37°41’16” latitude;
- LOS – 55°40’58” longitude and 37°56’50” latitude.

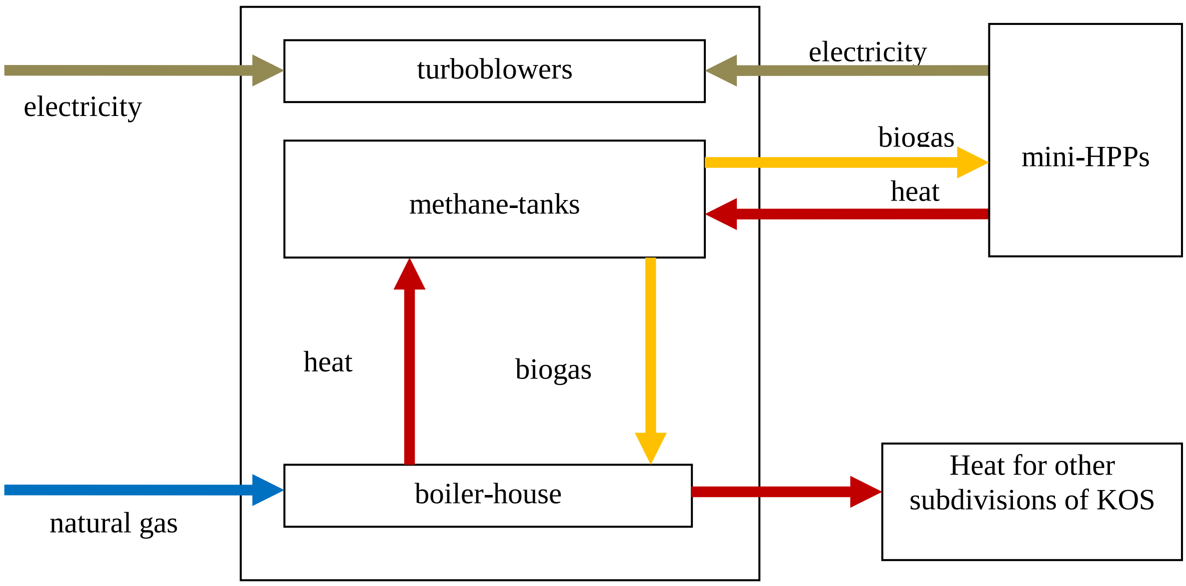
Figure A.3. KOS and LOS on the Moscow map



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

The Project provides the electricity supply of treatment facilities both from power grid and mini-HPPs. Also mini-HPPs will replace the part of the heat generated in boiler house before the Project.

Figure A.5. The scheme of energy recourses flows in Project



Main technical solutions for the mini-HPP

The core of the mini-HPP is 4 of parallel modules. Each module includes:
- piston internal combustion engine GE Jenbacher;
- generator;
- steam generator;
- cooling system.

The original biogas does not meet requirements for fuel supplied to the internal combustion engine. The original biogas should be purified of hydrogen sulphide, silicon compounds (siloxanes) and drained. The permissible content of hydrogen sulphide is less than 1 mg/m3, siloxanes – no more than 1 mg/m3. The humidity is reduced to a level no higher than 40%. The biogas from methane-tanks enters to purification unit through the gas network. The first stage provides for the removal of the hydrogen sulphide, which is produced in the process of the binding with the iron oxide. The highly porous iron ore is used for a filler in the column purification of first stage (desulfitator).

The second stage provides for the removal of non-hydrocarbon organic compounds, including silicon (siloxanes), which is produced in the process of adsorption in the column with activated charcoal. The purified biogas comes to internal combustion engines (ICE) for the disposing. The generated electricity is sent to consumers through a medium voltage system and three transformer substations. The main energy consumers are turboblowers, which provide an airing in biological treatment plants. The fume with a temperature of 450-470 ° C goes to airing, where the fume heat is converted into the steam energy. The steam generating needs in the specially prepared water previously passed through the aeration installation of and chemical treatment. The generated steam is fed through manifold valves to injectors of methane-tanks. This method of the heat recovery is selected for the keeping intact the existing direct steam heating system.

Power generating units are refrigerated by the reused water. After the heat extraction the heated water is pumped into the outer channel of the heat exchanger "pipe in pipe". The inner pipe of the heat-exchanger is the place of the heating of the sludge before methane-tanks. Optionally primary sludge or excess sludge may be used.

Table A.1. Technical data of mini-HPP KOS

Biogas flow	28 mln m3 per year
Capacity of mini HPP -electrical -thermal	 10 MW 6.9 Gcal per hour
Coefficient of efficiency	84.6%
Output - electricity - steam - heat power of hot water	 70 mln kWh per year 33 ths Gcal per year 32 ths Gcal per year
Characteristic of units -unit electricity capacity -number of units -number of cylinder in assembly	 2.5 MW 4 pcs. 20 pcs.
Characteristic of heat-exchanger -number of sections -pipe size -surface of heat-exchange -volume of heated sludge	 4 sections off at 12 pipes 305/273 mm 59 m2*4 205 m3/hour
Operating voltage	6,3 kW
Steam: -pressure -temperature	 8 bar 170°C

Table A.2. Technical data of mini-HPP LOS

Biogas flow	35 mln m3 per year
Capacity of mini HPP -electrical -thermal	 10 MW 6.9 Gcal per hour
Coefficient of efficiency	84.6%
Output - electricity - heat power of hot water	 81 mln kWh per year 74 ths Gcal per year
Characteristic of units -unit electricity capacity -number of units -number of cylinder in assembly	 2.5 MW 4 pcs. 20 pcs.
Characteristic of heat-exchanger -number of sections -pipe size -surface of heat-exchange -volume of heated sludge	 4 sections off at 12 pipes 305/273 mm 59 m2*4 205 m3/hour
Operating voltage	6,3 kW

Figure A.6. Scheme of energy and technology flows in Project of mini-HPP KOS

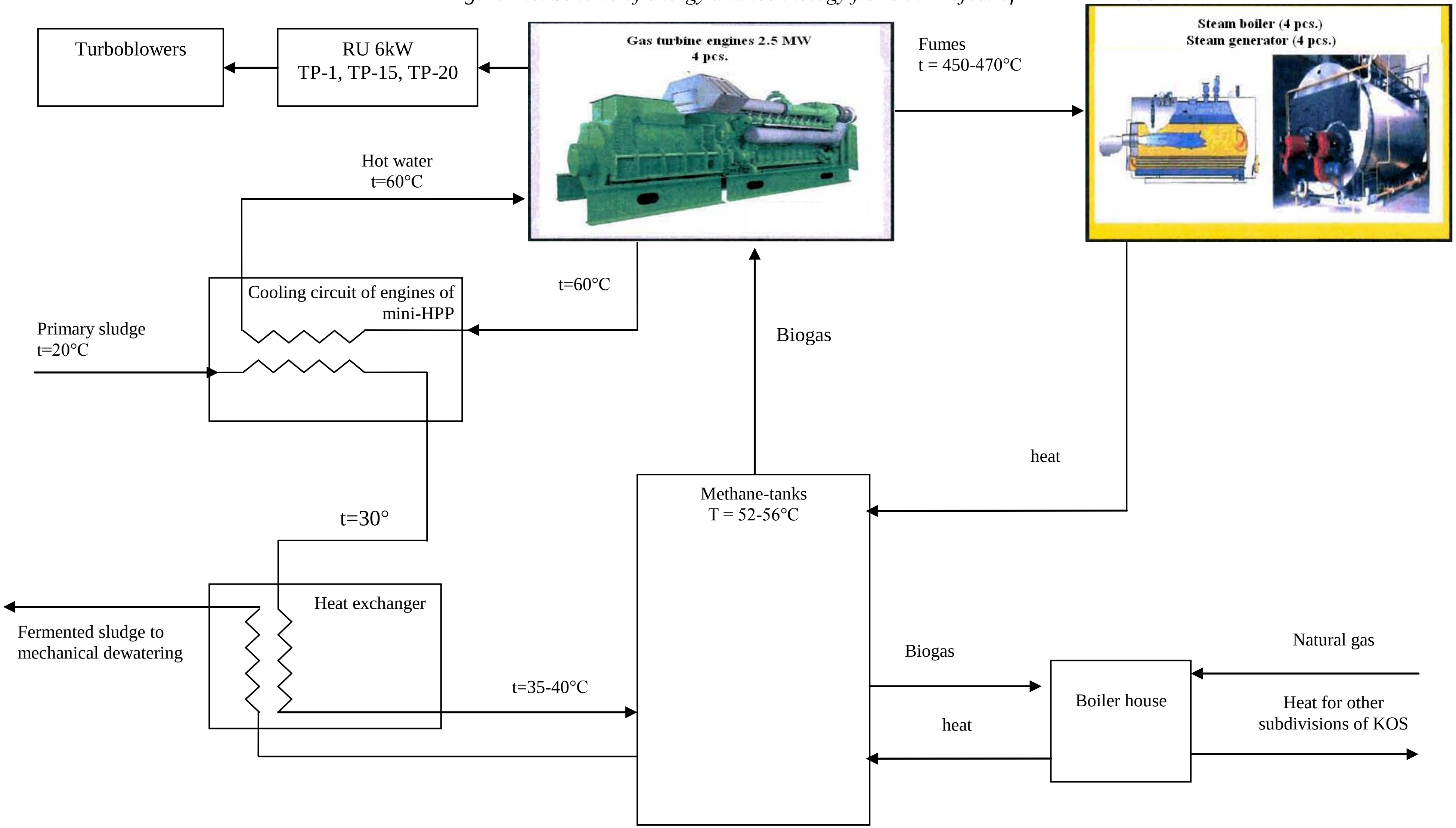


Figure A.7. Scheme of energy and technology flows in Project of mini-HPP LOS

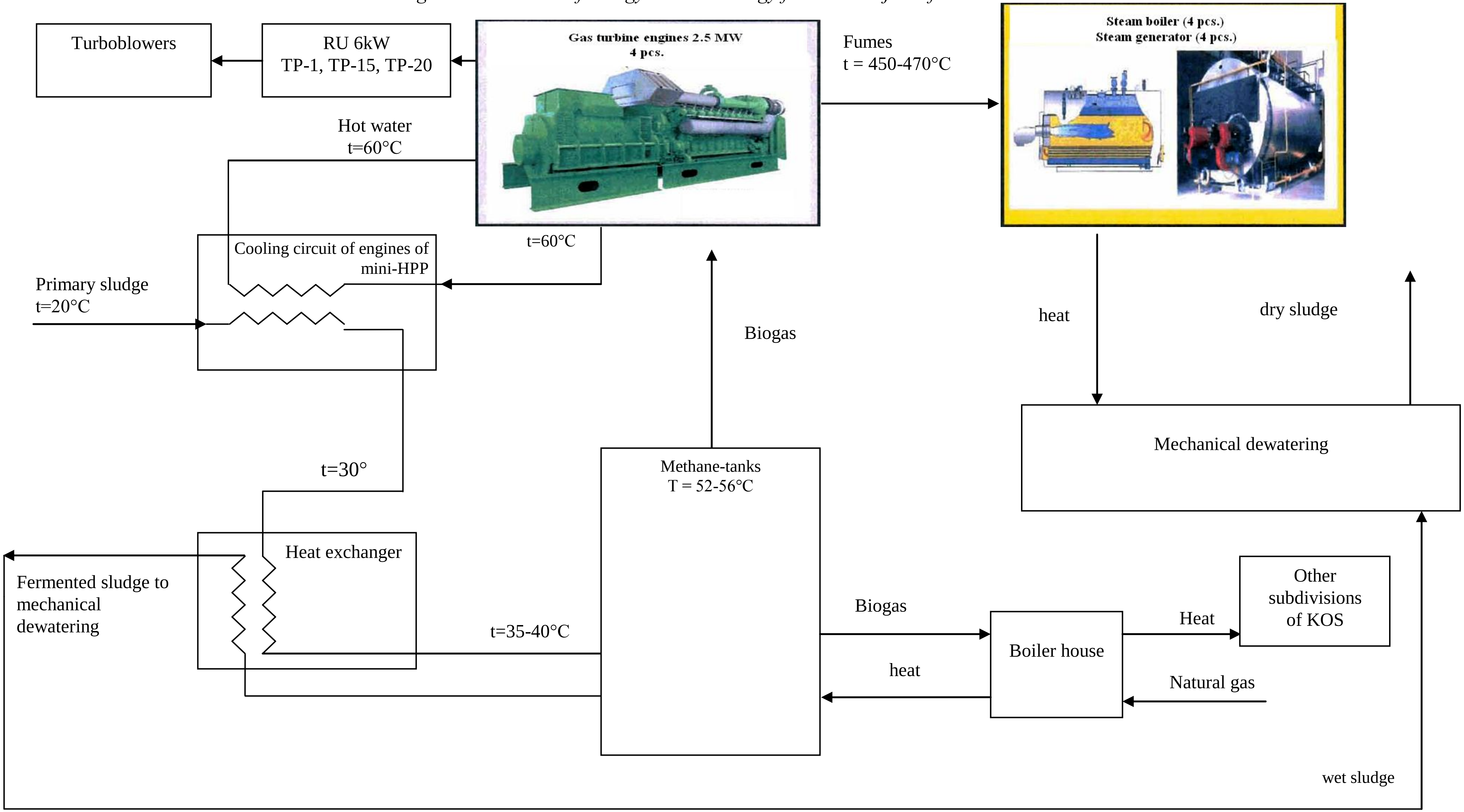


Figure A.7. "Kurianovo" mini-HPP

Project schedule

The design and survey work of mini-HPP KOS started in 2007, the operation began in 2009. The design and survey work of mini-HPP LOS started in 2008. The commissioning and operation are expected at the end of 2011. First GHG emission reductions were taken yearly 2009.

Table A.3. Project schedule

	Mini-HPP "Kurianovo"	Mini-HPP "Lyubertsy"
Design and survey work	01.01.2007 – 31.12.2007	01.08.2008 – 01.05.2010
Installation and construction work	01.01.2008 – 31.12.2008	01.08.2010 – 01.08.2011
Commissioning	25.11.209	01.08.2011 – 01.09.2011
Putting into operation	01.03.2009	01.09.2011

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

The result of the project activity is the generation of heat and electricity on mini-HPPs using biogas from methane-tanks from KOS and LOS. In the absence of Project the electricity would be imported from the regional power grid which would lead to the fossil consumption. In the Baseline the biogas using on mini-HPPs would be burned with the natural gas in the boiler house for the electricity generation.

Therefore the Project will replace the part of electricity from the grid by the electricity generated from the biogas. GHG emission will be reduced as a result because regional power grid will decrease the fossil fuel consumption.

GHG emission reduction can be achieved only in Project and cannot be realized in Baseline:

- Russian legislation does not require the biogas unitization from treatment facilities. The biogas burning in the boiler house or biogas flaring does not exceed the maximum allowable emission of contaminants;
- The generating of electricity from the biogas needs in significant investment about 1 977.4 mln. ruble.

The result of the project activity – the implementation and the operation of mini-HPPs – is the GHG emission reduction through the decreasing of the electricity consumption from the regional power grid.

Table A.4. The electricity from the regional power grid, baseline

Electricity	Unit	2009	2010	2011	2012
KOS	mln kWh	168.16	140,75	131,38	147,17
LOS	mln kWh	157.33	110.80	169.55	137.825

Table A.5. The electricity consumption, project activity

Electricity	Unit	2009	2010	2011	2012
KOS					
Electricity from the mini-HPP	mln kWh	49,42	70,30	70,40	70,40
Electricity from the regional power grid	mln kWh	118.74	70,45	60,98	76,77
LOS					
Electricity from the mini-HPP	mln kWh	-	-	-	87.840
Electricity from the regional power grid	mln kWh	157.33	110.80	169.55	49.985

Energy flows for LOS are considered beginning from 2012 because the commissioning of the mini-HPP "Lyubertsy" will be in September 2011.

The Project realization allows to reduce the electricity consumption on KOS and LOS on **348.37 mln kWh for the period 2009-2012.** The biogas redistribution from the boiler house to the mini-HPP leads to the increasing of GHG emission in the boiler house. But the ERU amount in the regional power grid will be more significant therefore the total balance of the project activity will be positive. Detailed calculation of the GHG emission reduction is provided in the section A.4.3.1.

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

	Years
Length of the crediting period	4
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2009	12 139.92
2010	21 495.95
2011	22 431.89
2012	36 569.31
Total estimated ERU for the crediting period (tones of CO_2 eq)	**92 637**
Average annual reduction, (tones of CO_2 eq)	**23 159.27**

A.5. Project approval by the Parties involved:

The project approval by the Host Party will be provided after the determination of the PDD. On 28.10.2009 the Russian Government issued Decree № 843 and Regulations "On Realization of Article 6 of Kyoto Protocol to United Nations Framework Convention on Climate Change".

The project proponent should submit an application to Sberbank of Russian Federation, that is nominated as Operator of Carbon Units (OCU). The application should include PDD, Determination Expert Opinion, the justification of environmental and energy efficiency criteria, the availability of technical and financial potential, estimated economic and social effects.

After consideration and evaluation of the application OCU forwards recommendations on the project application to Coordination Centre, i.e. the Ministry of Economic Development of Russian Federation. Coordination Centre should make a decision of the approval of the project.

SECTION B. Baseline

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

1. **Indication and description of the approach chosen regarding the baseline setting**

The JI-specific approach is used for the baseline setting. This approach is based on the provision:

- Guidelines for the implementation of Article 6 of the Kyoto Protocol (Appendix B. Criteria for baseline setting and monitoring, part I. Criteria for baseline setting)[2];
- Guidance on criteria for baseline setting and monitoring, version 02 (part D. Guidance on monitoring)[3].

The baseline is determined through considerations of various alternative scenarios with regard to the proposed project activity. As criteria for choosing the baseline scenario the key factors will be determined. The influence of all key factors on alternatives will be considered. The most plausible baseline scenario will be an alternative that is influenced by the factors less than other alternatives. Therefore, the following steps of determining the baseline scenarios are envisaged:

Step1. Description of alternative scenarios.
Step 2. Analysis of the influence of the key factors on the alternatives.
Step 3. Choosing the most plausible alternative scenario

2. **Application of the approach chosen**

Step1. Identification of alternatives

Three alternatives are considered in this PDD:

Alternative 1. Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat support from the boiler-house

This alternative supposes that the required electricity will be provided by the regional power grid. The biogas from methane-tanks is sent to the boiler house for the heat generation. Required heat is produced from the natural gas.

Alternative 2. The Project (without being registered as a JI activity), i.e. the generation of heat and electricity on mini-HPPs with GE Jenbacher engines

This alternative supposes the implementation of GE Jenbacher technologies for mini-HPPs. Gas piston engines with 2.5 MW capacity will be used for the electricity generation. The electricity will be supplied by mini-HPPs and regional power grid.

The biogas from methane-tanks will send to the boiler house and mini-HPPs. The missing heat is produced from the natural gas.

Alternative 3. Generation of electricity and heat on mini-HPPs with using of engines burned the biogas and residual oil

This alternative supposes the implementation of engines which needs in the additional fuel – residual fuel oil.

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[2] Report of the Conference of the Parties, Montreal, 28-10 December 2005
[3] Report of JISC 18, Bonn, 23 October 2009

Outcome from the step 1. Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations

Step 2. Key factor analysis

The key factors impact on the alternatives is considered in this section. The key factors analysis is performed in accordance with paragraph 25 of "Guidance on criteria for baseline setting and monitoring".

Key factors:

- **Technical and technological.** Applicability of technologies in treatment facilities of the MGUP Mosvodokanal with regard to the availability of fuel and energy. Availability of the staff to work with the equipment provided with the alternative. The possibility of risks concerned with the implementation of the new technology;
- **Environmental impact.** Possible increasing of the environmental impact;
- **Administrative and normative.** Obligation of the design documentation approval;
- **Financial and investment.** Volume and return of investment, OPEX.

Analysis of key factors on these alternatives.

Technical and technological

Alternative 1 Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat support from the boiler-house	Influence does not exist. There are not risks concerning this alternative: - the infrastructure and equipment are available - desired level of safety is guaranteed - it is not necessary additional trainings for the staff
Alternative 2 The Project (without being registered as a JI activity), i.e. the generation of heat and electricity on mini-HPPs with GE Jenbacher engines	Influence is significant. The designing was complicate due following reasons: - the synchronization with grid is a mandatory requirement; - the biogas content is unstable and as consequence the demand to the cleaning unit is raised; - trained staff is required.
Alternative 3 Generation of electricity and heat on mini-HPPs with using of Russian origin engines burned the biogas and residual oil	Influence is significant. The designing was impossible due the designing of the additional storage volume for residual oil.

Environmental impact

Alternative 1 Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat support from the boiler-house	Influence does not exist The continuation of current situation will not lead to the increasing of pollutant emissions. GHG emission will not change.
Alternative 2 The Project (without being registered as a JI activity), i.e. the generation of heat and electricity on mini-HPPs with GE Jenbacher engines	Influence is significant. This alternative will lead to the increasing of pollutant emissions. GHG emission will decrease.
Alternative 3	Influence is significant.

Generation of electricity and heat on mini-HPPs with using of engines burned the biogas and residual oil	This alternative will lead to the increasing of pollutant emissions. GHG emission will increase.

Administrative and normative

Alternative 1 Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat support from the boiler-house	Influence does not exist. The company has all required approvals for this activity
Alternative 2 The Project (without being registered as a JI activity), i.e. the generation of heat and electricity on mini-HPPs with GE Jenbacher engines	Significant influence - Design documentation should be permitted, - New permission for pollutant emission is needed.
Alternative 3 Generation of electricity and heat on mini-HPPs with using of Russian origin engines burned the biogas and heavy fuel oil	Significant influence - Design documentation should be permitted. - New permission for pollutant emission is needed.

Financial and investment

Alternative 1 Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat support from the boiler-house	Influence does not exist CAPEX is not needed. OPEX will change by a negligible margin.
Alternative 2 The Project (without being registered as a JI activity), i.e. the generation of heat and electricity on mini-HPPs with GE Jenbacher engines	Influence is significant CAPEX is equal to 1 977 445.86 ths ruble.
Alternative 3 Generation of electricity and heat on mini-HPPs with using of Russian origin engines burned the biogas and residual oil	Influence is significant. CAPEX was not accessed because this alternative is inadmissible

Step 3. Choosing the most plausible alternative scenario

The analysis above shows that the alternative 1 is less affected by key factors, therefore this alternative – Continuation of the current situation i.e. the electricity consumption from the regional power grid and the heat supply from the boiler-house is the **baseline**.

Key parameters for the baseline. Following parameters are similar for KOS and LOS: grid emission factor, NCV of natural gas, emission factor of natural gas. NCVs for all type of fuels are measured in calorie. GHG emission factor for the any fuel combustion is in t CO2 per TJ. The factor 4.1868 J/cal is used in this PDD for conversion from calorie to joule.

Data/Parameter	**EF** $_{CO2, elec, y}$
Data unit	kg CO2 / MW
Description	Grid emission factor
Time of determination/monitoring	Once, during the determination
Source of data (to be) used	Operational Guidelines for Project Design Documents of Joint Implementation Project. Ministry of Economic Affairs of the Netherlands, May 2004
Value of data applied (for ex ante calculations/determinations)	2009 year - 0.557 2010 year - 0.550 2011 year - 0.542 2012 year - 0.534
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Grid emission factor is need for the calculation of the indirect GHG emission in the grid
QA/QC procedures (to be) applied	-
Any comment	Volume 1, Table B2, page 43

Data/Parameter	**NCV** $_{NG}$
Data unit	kcal per m3
Description	Net calorific value
Time of determination/monitoring	monthly
Source of data (to be) used	Passport for NG from OJSC Gazprom
Value of data applied (for ex ante calculations/determinations)	8042
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Annual average NCV is equal to the average from all passports during one year.
QA/QC procedures (to be) applied	The provider of natural gas has to guarantee that the NCV is constant and in compliance with state standard for natural gas.
Any comment	MGUP Mosvodokanal uses 8000 kcal/m3 for ex ante calculations. The ex ante calculation of GHG emission reduction uses 8042 kcal/m3 in accordance with historical records. For the calculation of the real volume of GHG emission reduction will be estimated annual average value.

Data/Parameter	**NCV** $_{HFO}$
Data unit	kcal per kg
Description	Net calorific value
Time of determination/monitoring	on delivery of heavy fuel oil
Source of data (to be) used	Passport for HFO from supplier
Value of data applied (for ex ante calculations/determinations)	9800
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Annual average NCV is equal to the average from all passports during one year.
QA/QC procedures (to be) applied	The supplier guarantees that the quality of heavy fuel oil.
Any comment	MGUP Mosvodokanal uses 9800 kcal/m3 for ex ante calculations. For the calculation of the real volume of GHG emission reduction will be estimated annual average value.

Data/Parameter	$EF_{CO2, NG}$
Data unit	t CO2 / TJ
Description	Emission factor for natural gas
Time of determination/monitoring	Once, during the determination
Source of data (to be) used	2006 IPCC Guidance for national Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	56.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Emission factor for natural gas is need for the calculation of the GHG emission from the natural gas combustion
QA/QC procedures (to be) applied	-
Any comment	Volume 2: energy. Chapter 2: Stationary combustion. Table 2.2. Default CO2 emission factors for stationary combustion in energy industries

Data/Parameter	$EF_{CO2, HFO}$
Data unit	t CO2 / TJ
Description	Emission factor for natural gas
Time of determination/monitoring	Once, during the determination
Source of data (to be) used	2006 IPCC Guidance for national Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	77.4
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Emission factor for natural gas is need for the calculation of the GHG emission from the natural gas combustion
QA/QC procedures (to be) applied	-
Any comment	Volume 2: energy. Chapter 2: Stationary combustion. Table 2.2. Default CO2 emission factors for stationary combustion in energy industries

KOS

Data/Parameter	$EC_{KOS, power grid}$
Data unit	mln kWh
Description	Electricity consumption
Time of determination/monitoring	continuously
Source of data (to be) used	Supply meters SET -4TM.03.01
Value of data applied (for ex ante calculations/determinations)	2009 – 168.162 2010- 140.746 2011 – 131.383 2012 - 147.171
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Electricity consumption leads to indirect GHG emission in regional power grid
QA/QC procedures (to be) applied	Equipment is checked and calibrated accordingly to the passport. Accuracy class is 0,5S. Last checking date is June 2006.
Any comment	Sum of electricity from grid and mini-HPP in the project scenario. For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	$HG_{KOS.net}$
Data unit	ths Gcal
Description	Net heat generation
Time of determination/monitoring	once per day
Source of data (to be) used	heat meters WIST.T.TC
Value of data applied (for ex ante calculations/determinations)	2009 - 223.35 2010- 224.59 2011 – 228.74 2012 – 228.74
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data need for the calculation of fuel flow
QA/QC procedures (to be) applied	Equipment is checked and calibrated accordingly to the passport. Accuracy class is 0,5%.
Any comment	Sum of heat from boiler house and mini-HPP in project scenario. For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	$FC_{KOS, biogas}$
Data unit	mln m3
Description	Biogas consumption in boiler house
Time of determination/monitoring	once per day
Source of data (to be) used	Flowmeter Complex DKO-3702 and KSD-3
Value of data applied (for ex ante calculations/determinations)	2009 - 47 725.7 2010 - 42 839.3 2011 - 40 685.0 2012 - 40 685.0
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This value is equal to the sum of biogas to boiler house and mini-HPP in project
QA/QC procedures (to be) applied	Calibration interval is 1 year. The accuracy level is 5%
Any comment	For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	$HG_{KOS, NG, gross}$
Data unit	ths Gcal
Description	Gross heat produced by natural gas
Time of determination/monitoring	annually
Source of data (to be) used	gas-meter
Value of data applied (for ex ante calculations/determinations)	2009 - 8.21 2010 - 34.92 2011 - 50.81 2012 - 50.81
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is calculated on the basis of total neat generation, boiler efficiency to biogas and natural gas, biogas volume and NCV of biogas
QA/QC procedures (to be) applied	Calibration interval is 1 year. The measurement error is ±5%
Any comment	It will be estimated on the basis of annual fuel balance

Data/Parameter	**$\eta_{KOS, biogas}$**
Data unit	%
Description	Efficiency f boiler house to biogas
Time of determination/monitoring	Once, during of determination
Source of data (to be) used	Parameter charts for boilers
Value of data applied (for ex ante calculations/determinations)	86.7
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The efficiency of boiler house to biogas is equal to the average of efficiency of all boilers (from parameter charts) minus 2.4%[4] for the auxiliary.
QA/QC procedures (to be) applied	Parameter charts are compiled by the independent expert company JSC "SMNU VK" in accordance with existing regulation
Any comment	MGUP Mosvodokanal uses 86% for ex ante calculations

Data/Parameter	**$\eta_{KOS, NG}$**
Data unit	%
Description	Efficiency f boiler house to NG
Time of determination/monitoring	Once, during of determination
Source of data (to be) used	Parameter charts for boilers
Value of data applied (for ex ante calculations/determinations)	87.52
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The efficiency of boiler house to natural gas is equal to the average of efficiency of all boilers (from parameter charts) minus 2.4%[5] for the auxiliary.
QA/QC procedures (to be) applied	Parameter charts are compiled by the independent expert company JSC "SMNU VK" in accordance with the regulation
Any comment	MGUP Mosvodokanal uses 86% for ex ante calculations

[4] Order of Minpromenergo #268 of 04.10.2005
[5] Order of Minpromenergo #268 of 04.10.2005

Data/Parameter	**NCV** $_{KOS, biogas}$
Data unit	kcal per m3
Description	Net calorific value of the biogas KOS
Time of determination/monitoring	monthly
Source of data (to be) used	Monthly report of laboratory of MGUP “Mosvodokanal”
Value of data applied (for ex ante calculations/determinations)	5224
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Annual average NCV is equal to the average from all passports during one year.
QA/QC procedures (to be) applied	This value is based on historical records of the biogas NCV
Any comment	This value for ex ante calculations is estimated on historical records. The analysis is performed by the laboratory of MGUP “Mosvodokanal” (certificate #ROSS RU.0001.514669). For the calculation of the real volume of GHG emission reduction will be estimated annual average value.

LOS

Data/Parameter	**EC** $_{LOS}$
Data unit	mln kWh
Description	Electricity consumption
Time of determination/monitoring	continuously
Source of data (to be) used	supply meters SET-4TM.03.01
Value of data applied (for ex ante calculations/determinations)	2012 – 137.83
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Sum of electricity from grid and HPP in project scenario
QA/QC procedures (to be) applied	Equipment is checked and calibrated accordingly to the passport. Accuracy class is 0,5S. Last checking date is June 2006
Any comment	For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	**HG** $_{\textbf{LOS, net}}$
Data unit	Gcal
Description	Net heat generation
Time of determination/monitoring	once per day
Source of data (to be) used	heat meters WIST.T.TC
Value of data applied (for ex ante calculations/determinations)	2012 – 327.86
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data need for the calculation of fuel flow
QA/QC procedures (to be) applied	Equipment is checked and calibrated accordingly to the passport. Accuracy class is 0,5%.
Any comment	Sum of heat from boiler house and HPP in project scenario/ For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	**FC** $_{\textbf{LOS, biogas}}$
Data unit	mln m3
Description	Biogas consumption in boiler house
Time of determination/monitoring	once per day
Source of data (to be) used	Flow meter Complex DKO-3702 and KSD-3
Value of data applied (for ex ante calculations/determinations)	2012 – 43.75
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data need for the calculation of net heat produced from biogas
QA/QC procedures (to be) applied	Calibration interval is 1 year. Accuracy class is 0,5%.
Any comment	For the calculation of the real volume of GHG emission reduction will be estimated annual value.

Data/Parameter	**HG** $_{\textbf{KOS, NG, gross}}$
Data unit	ths Gcal
Description	Gross heat produced by natural gas
Time of determination/monitoring	annually
Source of data (to be) used	gas-meter
Value of data applied (for ex ante calculations/determinations)	2012 - 142.92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is calculated on the basis of total neat generation, boiler efficiency to biogas and natural gas, biogas volume and NCV of biogas
QA/QC procedures (to be) applied	Calibration interval is 1 year. The measurement error is ±5%
Any comment	It will be estimated on the basis of annual fuel balance

Data/Parameter	**$\eta_{LOS, biogas}$**
Data unit	%
Description	Efficiency f boiler house to biogas
Time of determination/monitoring	Once, during of determination
Source of data (to be) used	Parameter charts for boilers
Value of data applied (for ex ante calculations/determinations)	85.7
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The efficiency of boiler house to biogas is equal to the average of efficiency of all boilers (from parameter charts) minus 2.4%[6] for the auxiliary.
QA/QC procedures (to be) applied	Parameter charts are compiled by the independent expert company JSC “SMNU VK” in accordance with existing regulation
Any comment	MGUP Mosvodokanal uses 86% for ex ante calculations

Data/Parameter	**$\eta_{LOS, NG}$**
Data unit	%
Description	Efficiency f boiler house to NG
Time of determination/monitoring	Once, during of determination
Source of data (to be) used	Parameter charts for boilers
Value of data applied (for ex ante calculations/determinations)	86.25
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The efficiency of boiler house to natural gas is equal to the average of efficiency of all boilers (from parameter charts) minus 2.4%[7] for the auxiliary.
QA/QC procedures (to be) applied	Parameter charts are compiled by the independent expert company JSC “SMNU VK” in accordance with existing regulation
Any comment	MGUP Mosvodokanal uses 86% for ex ante calculations

[6] Order of Minpromenergo #268 of 04.10.2005
[7] Order of Minpromenergo #268 of 04.10.2005

Data/Parameter	NCV $_{LOS, biogas}$
Data unit	Kcal/m3
Description	Net calorific value of the biogas KOS
Time of determination/monitoring	monthly
Source of data (to be) used	Monthly report of laboratory of MGUP "Mosvodokanal"
Value of data applied (for ex ante calculations/determinations)	5457
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Annual average NCV is equal to the average from all passports during one year.
QA/QC procedures (to be) applied	This value is estimated on the basis of historical records. the content analysis is performed by the testing laboratory of MGUP "Mosvodokanal". The accreditation certificate #ROSS RU.0001.516447.
Any comment	MGUP Mosvodokanal uses 5400 kcal per m3 for ex ante calculation

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

Analysis in B.1. demonstrates that the Project is not a baseline.

1. Indication and description of the approach applied

The Project additionality is proved using principles and rules of follow documents:
- Tool for the demonstration and assessment of additionality (version 05.2)[8];
- Guidelines for the implementation of Article 6 of the Kyoto Protocol (paragraph 33);
- Guidance on criteria for baseline setting and monitoring, version 02 (Annex 1. Additionality).

«Tool for the demonstration and assessment of additionality» is represents a sequential analysis, and includes 4 steps.

Step 1. Identification of alternatives;
Step 2. Investment analysis and (or)
Step 3. Barrier analysis;
Step 4. Common practice analysis.

2. Application of chosen approach

Step 1. Identification of alternatives

There are analyzed alternatives indentified in B1. Alternatives 3 is excluded as technically unfeasible.

Alternative 1a. Continuation of the current situation i.e. the electricity consumption from the regional power grid

This alternative supposes that the necessary volume of the electricity will be supplied by the regional power grid.

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

Alternative 1b. Continuation of the current situation i.e. the heat consumption from the boiler house

This alternative supposes that all volume of the heat will be supplied by the boiler house. The biogas produced in methane-tanks will be sent to the boiler house for the heat generation. The missing heat is produced from the natural gas.

Alternative 2a. The Project (without being registered as a JI activity), i.e. the generation of the electricity on mini-HPP with GE Jenbacher engines

This alternative supposes the implementation of GE Jenbacher technologies for mini-HPPs. Gas piston engines with 2.5 MW capacity will be used for the electricity generation. The electricity will be supplied by mini-HPPs and regional power grid.

Alternative 2b. The Project (without being registered as a JI activity), i.e. the generation of the heat on mini-HPP with GE Jenbacher engines

This alternative supposes the implementation of GE Jenbacher technologies for mini-HPPs. Gas piston engines with 2.5 MW capacities will be used for the heat generation. The biogas from methane-tanks will send to the boiler house and mini-HPPs. The missing heat is produced from the natural gas.

Step 2. Investment analysis

This PDD supposes the investment only for alternative 2 and the benchmark analysis is used in this PDD.

The financial attractiveness is evaluated with following financial parameters:

- Payback period;
- IRR;
- NPV.

The Project is attractive if meet following requirements of WTE company:

- Paypack period less than 8 years;
- IRR 15%
- NPV>0.

Results of investment analysis

Alternative 1a and 1b.

The realization of this alternative does not need CAPEX. OPEX are not changed.

Alternative 2a and 2b.

The MGUP Mosvodokanal has tendered the building of mini-HPPs and selected the LLC EFN Eco Service – an affiliate company of WTE group. Financial parameters demonstrated that this project is not attractive for LLC EFN Eco Service:

- Payback period cannot be counted;
- IRR cannot be counted;
- NPV is less than zero.

The decision about financing was made taken into account the Ecological Police of the LLC EFN Eco Service and indirect income like ERU.

Conclusion of Step 2: Alternative 1 is the most plausible alternative.

Step 3. Barrier analysis

Tool for the demonstration and assessment of additionality (version 05.2) read as follows “If the investment analysis shows that the project activity is not a most plausible alternative then proceed from Step 2 should to Step 4”.

Step 4. Common practice analysis

This section supply investigations of previous Steps. The project is unique because of following:

- The existing SNiP 2.04.03-85 “Sewerage. External infrastructure installations» reads that the biogas from treatment facilities should be used for the heat supply. Therefore treatment facilities use generally the biogas in own boiler-house for the heat generation;
- KOS and LOS are biggest treatment facilities in Russian Federation and MGUP Mosvodokanal has enough volume of the biogas after the reconstruction of methane-tanks for the implementing of mini-HPPs;
- the mini-HPPs KOS and LOS burn only the biogas and this Project is first cogeneration biogas based project with such power capacity in Eastern Europe;
- mini-HPPs on KOS and LOS are synchronized with the grid and can compensate a failure in the grid whereas other existing mini-HPPs are not capable of doing it.

Conclusion: alternative 2 is unique Project using significant amount of biogas and generating the energy. Therefore the Project is additional.

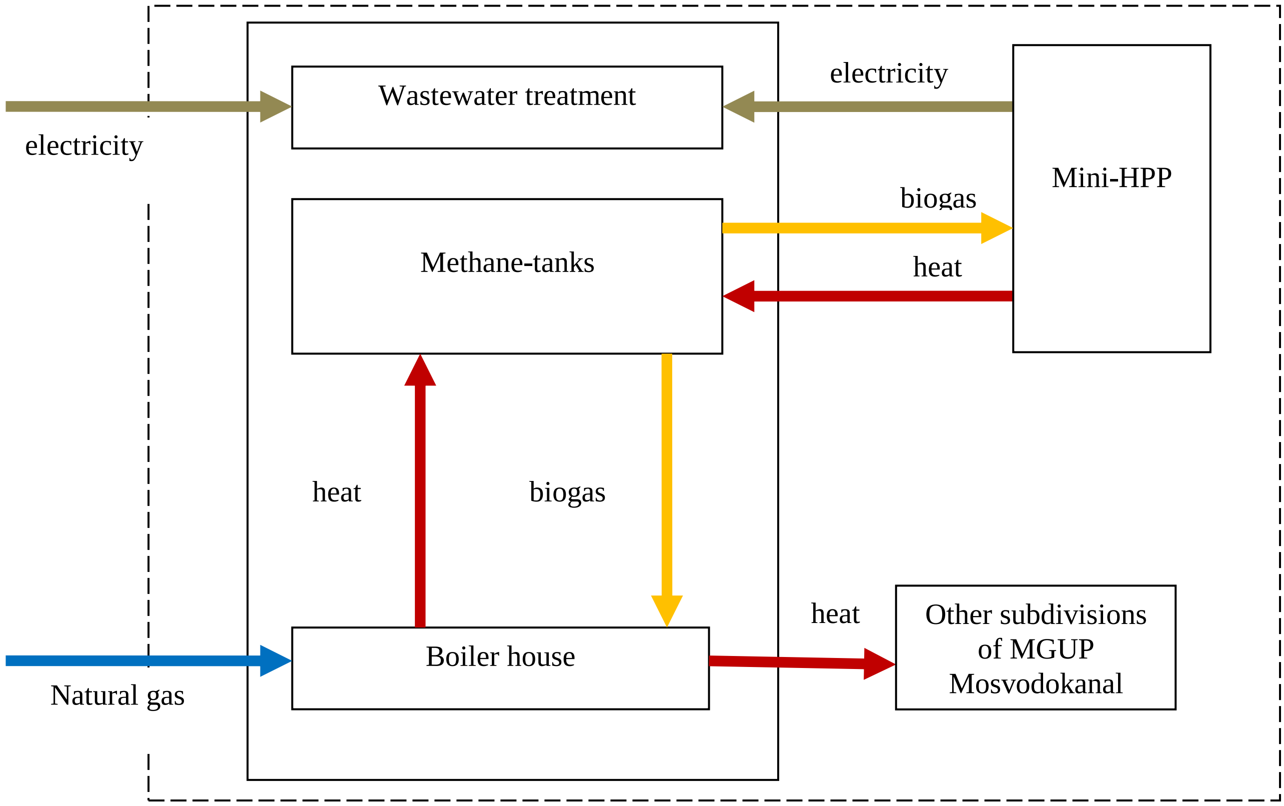
B.3. Description of how the definition of the project boundary is applied to the project:

KOS and LOS facilities have objects which consume the electricity and the heat. GHG emission source are listed in table B.4.

The project boundary includes:

- KOS
- LOS
- Mini-HPP KOS
- Mini-HPP LOS

Figure B.1. Project boundary



boundary of treatment facilities
project boundary

Table B.4. GHG emission source in project and in baseline

	Source	Gas	Included / not included	Description / explanation
Baseline	Electricity consumption	CO_2	Yes	Main baseline emission source
		CH_4	No	Not significant*
		N_2O	No	Not significant*
	Consumption of natural gas	CO_2	Yes	Main baseline emission source
		CH_4	No	Not significant*
		N_2O	No	Not significant*
Project activity	Electricity consumption	CO_2	Yes	Main baseline emission source
		CH_4	No	Not significant*
		N_2O	No	Not significant*
	Consumption of natural gas	CO_2	Yes	Main baseline emission source
		CH_4	No	Not significant*
		N_2O	No	Not significant*
	Consumption of heavy fuel oil	CO_2	Yes	Main baseline emission source
		CH_4	No	Not significant*
		N_2O	No	Not significant*

* See attached spread sheet calculation of the emission reduction and the table 2.2 "Default emission factors for stationary combustion in the energy industries" in IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 2

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

Date of baseline setting: 23/07/2010.
The baseline has been designed by National Carbon Sequestration Foundation – (NCSF, Moscow);
Contact persons:

Marat Latypov, Head of Project Development Department
Tel. +7 499 788 78 35 ext. 103
Fax +7 499 788 78 35 ext. 107
E-mail LatypovMF@ncsf.ru

Agrafena Bugdaeva, Ph.D. in Economics, Lead expert of Project Development Department;
Tel. +7 499 788 78 35 ext. 104
Fax +7 499 788 78 35 ext. 107
E-mail BugdaevaAV@ncsf.ru

National Carbon Sequestration Foundation is not a participant of the Project.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Project start date corresponds to the date of the start of construction work of mini-HPP at KOS - 01.01.2008

C.2. Expected operational lifetime of the project:

14 years and 10 months or 178 months: 01.03.2009 –31.12.2023

C.3. Length of the crediting period:

3 years and 10 months or 46 months: 01.03.2009 – 31.12.2012

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

1. Indication and description of the approach chosen regarding monitoring

The monitoring plan is developed accordingly to specific approach based on following:

- Guidelines for the implementation of Article 6 of the Kyoto Protocol (Appendix B. Criteria for baseline setting and monitoring, II. Monitoring)[9]
- Guidance on criteria for baseline setting and monitoring, Version 02 (D. Guidance on monitoring)[10].

In accordance with the Guidance for JI-PDD users[11] it is obligatory to consider all data and coefficient in section D:

1. Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD;
2. Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), but that are not already available at the stage of determination regarding the PDD; and
3. Data and parameters that are monitored throughout the crediting period.

2. Application of the approach chosen

The monitoring scheme will be similar for KOS and LOS. Monitored data for KOS will be marked *M-n'*, and for LOS – *M-n''*.

GHG emission reduction is calculated based on data about the fuel and electricity. In Project heat and electricity are compensated by the mini-HPP burning the biogas. GHG emission from biogas does not consider because biogas is burned in both scenarios.

GHG emission from the electricity in project is equal to GHG emission from electricity from the regional power grid. GHG emission from fuel in project is equal to GHG emission from natural gas. The natural gas consumption in project will be increased because the part of biogas will be sent to the mini-HPP

9 http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2 9/CMP.1 Guidelines for the implementation of Article 6 of the Kyoto Protocol. Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, held at Montreal from 28 November to 10 December 2005.
10 http://ji.unfccc.int/Sup_Committee/Meetings/index.html Joint Implementation Supervisory Committee, Eighteenth meeting. 22-23.10.2009
11 Guidelines for users of the Joint Implementation project design document form. Version 04

GHG emission from electricity in baseline is the sum of GHG emission from electricity from power grid and mini-HPP, GHG emission from fuel in baseline is GHG emission from natural gas. The natural gas volume is less than in project because all biogas is sent to boiler house.

Data for the calculation of GHG emission in project and in baseline:

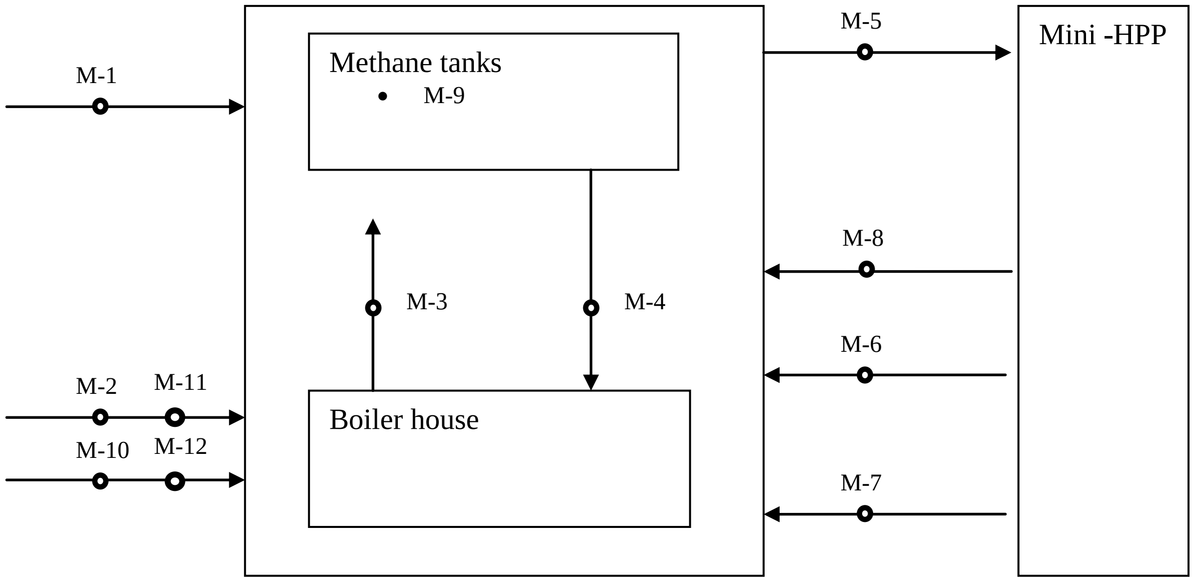
1. Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD:
   - Coefficient of GHG emission from electricity[12];
   - Coefficient of GHG emission from the natural gas[13];
   - NCV of biogas in KOS and LOS;
   - NCV of natural gas[14].
2. Data and parameters that are monitored throughout the crediting period
   - Electricity consumption from the power grid
   - Electricity consumption from mini-HPP
   - Heat consumption from the boiler-house
   - Heat consumption from mini-HPP;
   - Biogas flow in boiler house
   - Biogas flow in mini-HPP
   - Natural gas consumption in KOS and LOS.

Common practice for MGUP Mosvodokanal is to use “kcal/m3” for NCVs. In this PDD 1 cal = 4.1868 J.

More detailed information is in the table D.1.1.1.

12 Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, May 2004, Table B2.
13 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Chapter 1: Introduction. Table 1.4. Default CO2 emission factors for combustion.
14 IPCC Guidelines for National Greenhouse Gas Inventories? 2006. Volume 2: Energy. Table 1.2. Default NCVs and lower and upper limits of the 95% confidence intervals.

Figure D.1. Points of monitoring



		KOS			LOS
M-1'	-	*Electricity from power grid*	*M-1''*	-	*Electricity from power grid*
M-2'	-	*Natural gas*	*M-2''*	-	*Natural gas*
M-3'	-	*Heat from boiler-house*	*M-3''*	-	*Heat from boiler-house*
M-4'	-	*Biogas into boiler-house*	*M-4''*	-	*Biogas into boiler-house*
M-5'	-	*Biogas into mini-HPP*	*M-5''*	-	*Biogas into mini-HPP*
M-6'	-	*Heat from mini-HPP (steam)*	*M-6''*	-	*Heat from mini-HPP (steam)*
M-7'	-	*Heat from mini-HPP (hot water)*	*M-7''*		*Heat from mini-HPP (hot water)*
M-8'	-	*Electricity from mini-HPP*	*M-8''*	-	*Electricity from mini-HPP*
M-9'	-	*NCV of biogas*	*M-9''*	-	*NCV of biogas*
M-10'	-	*Heavy fuel oil*	*M-10''*	-	*Heavy fuel oil*
M-11'	-	*NCV of natural gas*	*M-11''*	-	*NCV of natural gas*
M-12'	-	*NCV of heavy fuel oil*	*M-12''*	-	*NCV of heavy fuel oil*

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Data and parameters that are monitored throughout the crediting period								
M-1'	$EC_{KOS, PA, y}$ Consumption of electricity from grid	supply meters SET-4TM.03.01	mln kWh	m	Continuously	100%	Electronic and paper	ASKUE
M-2'	$FC_{KOS, NG, KOS, y}$ Consumption of natural gas	complex gas meter SG-EK	m 3	m	Once per day	100%	Electronic and paper	
M-9'	$NCV_{biogas\ KOS}$ Net calorific value of biogas KOS	Report of laboratory of MGUP “Mosvodokanal”	kcal per m3	e	Monthly	100%	paper	
M-10'	$FC_{KOS, HFO, KOS, y}$ Consumption of heavy fuel oil at KOS	deed of fuel consumption	tonnes	m	Once after the HFO consumption	100%	paper	HFO is standby fuel for the emergency. The deed of fuel consumption is made obligatory after the HFO consumption, including test works.
M-11’	NCV_{NG} Net calorific value of natural gas	Passport for NG from OJSC Gazprom	kcal per m3	e	monthly	100%	paper	

M-12’	NCV $_{HFO}$ Net calorific value of heavy fuel oil	Passport for HFO from supplier	kcal per kg	e	monthly	100%	paper	
M-1"	EC $_{LOS, PA, y}$ Consumption of electricity from grid	supply meters SET-4TM.03.01	kWh	m	Continuously	100%	Electronic and paper	
M-2"	FC $_{LOS, NG, KOS, y}$ Consumption of natural gas	complex gas meter RS-SPA-M	m 3	m	Once per day	100%	Electronic and paper	
M-9’’	NCV $_{biogas\ LOS}$ Net calorific value of biogas LOS	Report of laboratory of MGUP “Mosvodokanal”	kcal per m3	e	Monthly	100%	paper	
M-10’’	FC $_{KOS, HFO, LOS, y}$ Consumption of heavy fuel oil at LOS	deed of fuel consumption	tonnes	e	Once after the HFO consumption	100%	paper	HFO is standby fuel. The deed of fuel consumption is made obligatory after the HFO consumption. The amount of consumed HFO is calculated on the basis of work time and efficiency of boiler house to HFO
M-11’’	NCV $_{NG}$ Net calorific value of natural gas	Passport for NG from OJSC Gazprom	kcal per m3	e	monthly	100%	paper	
M-12’’	NCV $_{HFO}$ Net calorific value of heavy fuel oil	Passport for HFO from supplier	kcal per kg	e	Each shipment	100%	paper	

Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD								
	$EF_{CO2,elec,y}$ CO2 emission for electricity[15]		gCO2/kWh	e		100%	paper	
	$EF_{CO2,NG,y}$ emission factor for the natural gas[16]		t CO2/TJ	e		100%	paper	
	$EF_{CO2,HFO,y}$ emission factor for the heavy fuel oil [17]		t CO2/TJ	e		100%	paper	
	$\eta_{boiler\ KOS,\ HFO}$ Efficiency of boiler house KOS to HFO,	Parameter charts	%			100%		86.25%
	$\eta_{boiler\ LOS,\ HFO}$ Efficiency of boiler house LOS to HFO	Parameter charts	%			100%		84.37%

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

Formulae D.1.1.2.1 $PE_y = PE_{elec,y} + PE_{fuel,y}$

where:

PE_y - *total emission of GHG emission in project, t CO2-eq*

$PE_{elec,y}$ - *total emission of GHG emission from electricity consumption in project, t CO2-eq*

$PE_{fuel,y}$ - *total emission of GHG emission from fuel consumption in project, t CO2-eq*

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15 Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, May 2004, Table B2.

16 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Volume 2: energy. Chapter 2: Stationary combustion. Table 2.2. Default CO2 emission factors for stationary combustion in energy industries.

17 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Volume 2: energy. Chapter 2: Stationary combustion. Table 2.2. Default CO2 emission factors for stationary combustion in energy industries..

GHG emission from electricity consumption

Formulae D.1.1.2.1.1 $PE_{elec,y} = EC_{PA,y} * EF_{CO2,,elec,y}$

where:

$PE_{elec,y}$ - *total emission of GHG emission from electricity consumption in project, t CO2-eq*

$EC_{PA,y}$ - *total consumption of electricity in project, ths kWh per year*

$EF_{CO2,,elec,y}$ - *CO2 factor from electricity, g CO2 per kWh*

Formulae D.1.1.2.1.1.1 $EC_{PA,y} = EC_{KOS,PA,y} + EC_{LOS,\ PA,y}$

where:

$EC_{PA,y}$ - *total consumption of electricity in project, ths kWh per year*

$EC_{KOS,PA,y}$ - *electricity consumption in project at KOS, ths kWh per year.* $EC_{KOS,PA,y} = EC_{KOS,grid,\ ,y}$

$EC_{LOS,\ PA,y}$ - *electricity consumption in project at LOS, ths kWh per year.* $EC_{LOS,PA,y} = EC_{LOS,grid,\ ,y}$

GHG emission from fuel consumption

Formulae D.1.1.2.1.2 $PE_{fuel,\ y} = PE_{fuel,\ KOS,\ y} + PE_{fuel,\ LOS,\ y}$

where

$PE_{fuel,\ y}$ - *GHG emission from the fuel consumption in project, t CO2-eq*

$PE_{fuel,KOS,\ y}$ - *KOS GHG emission from fuel consumption in project, t CO2-eq*

$PE_{fuel,\ LOS,\ y}$ - *LOS GHG emission from fuel consumption in project, t CO2-eq*

Formulae D.1.1.2.1.2.1. $PE_{fuel,\ KOS,\ y} = (FC_{KOS,\ NG,\ y} * NCV_{HG} * 4.1868 * EF_{CO2,\ NG} + FC_{KOS,\ HFO,\ y} * NCV_{HFO} * EF_{CO2,\ HFO,\ y}) / 1000$

where

$PE_{fuel,KOS,\ y}$ - *KOS GHG emission from fuel consumption in project, t CO2-eq*

$FC_{KOS,\ NG,\ PA,\ y}$ - *natural gas consumption at KOS, mln m3 per year*

NCV_{HG} - *net calorific value of natural gas, 8 042 kcal per m3*

$EF_{CO2,\ NG,\ y}$ - *CO2emission factor for natural gas, 56100 kg/TJ*

4.1868 - *transfer factor from calorie to joule*

$FC_{KOS,\ HFO,\ y}$ - *heavy fuel oil consumption at KOS, ths t per year*

NCV_{HFO} - *net calorific value of heavy fuel oil, 43.4 TJ per ths t*

$EF_{CO2,\ HFO,\ y}$ - *CO2emission factor for heavy fuel oil, 77400 kg/TJ*

Formulae D.1.1.2.1.2.1. $PE_{fuel, LOS, y} = (FC_{LOS, NG, y} * NCV_{HG} * 4.1868 * EF_{CO2, NG} + FC_{LOS, HFO, y} * NCV_{HFO} * EF_{CO2, HFO, y}) / 1000$

where

$PE_{fuel,LOS, y}$ - *LOS GHG emission from fuel consumption in project, t CO2-eq*
$FC_{LOS, NG, PA, y}$ - *natural gas consumption at LOS, mln m3 per year*
NCV_{HG} - *net calorific value of natural gas, 8 042 kcal per m3*
$EF_{CO2, NG, y}$ - *CO2emission factor for natural gas, 56100 kg/TJ*
4.1868 - *transfer factor from calorie to joule*
$FC_{LOS, HFO, y}$ - *heavy fuel oil consumption at LOS, ths t per year*
NCV_{HFO} - *net calorific value of heavy fuel oil, 43.4 TJ per ths t*
$EF_{CO2, HFO, y}$ - *CO2emission factor for heavy fuel oil, 77400 kg/TJ*

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Data and parameters that are monitored throughout the crediting period								
M-1'	$EC_{KOS, PA, y}$ electricity consumption from grid	supply meters SET-4TM.03.01	kWh	m	Continuously	100%	Electronic and paper	ASKUE
M-3'	$HG_{KOS boiler}$ heat from boiler house	heat meter WIST.T TC	Gcal	m	Once per day	100%	Electronic and paper	
M-4'	$FC_{biogas boiler}$ Biogas to boiler house	gas meter complex SG-EK	m3	m	Once per day	100%	Electronic and paper	
M-5'	$FC_{biogas HPP}$ Biogas to mini-HPP	gas meter COMBIMASS	m3	m	Once per two hour	100%	Electronic and paper	

M-6'	$HG_{KOS\ HPP\ steam}$ Heat from mini-HPP (steam)	heat meter TRIO-WIRL FS4000	Gcal	m	Once per half of hour	100%	Electronic and paper	
M-7'	$HG_{KOS\ HPP\ water}$ Heat from mini-HPP (hot water)	heat meter WIST.T TC	Gcal	m	Once per half of hour	100%	Electronic and paper	
M-8'	$EC_{KOS\ HPP}$ Electricity from mini-HPP	supply meters SET-4TM.03.01	kWh	m	Once per two hour	100%	Electronic and paper	
M-9'	$NCV_{biogas\ KOS}$ Net calorific value of biogas KOS	Report of laboratory of MGUP “Mosvodokanal”	kcal per m3	e	monthly	100%	paper	
M-11’	NCV_{NG} Net calorific value of natural gas	Passport for NG from OJSC Gazprom	kcal per m3	e	monthly	100%	paper	
M-12’	NCV_{HFO} Net calorific value of heavy fuel oil	Passport for HFO from supplier	kcal per kg	e	monthly	100%	paper	
M-1'’	$EC_{LOS,\ PA,\ y}$ electricity consumption from grid	supply meters SET-4TM.03.01	kWh	m	Continuously	100%	Electronic and paper	
M-3'’	$HG_{LOS\ boiler}$ heat from boiler house	heat meter WIST.T TC	Gcal	m	Once per day	100%	Electronic and paper	
M-4'’	$FC_{biogas\ boiler}$ Biogas to boiler house	gas meter	m3	m	Once per day	100%	Electronic and paper	
M-5'’	$FC_{biogas\ HPP}$ Biogas to mini-HPP	gas meter	m3	m	Once per two hour	100%	Electronic and paper	The mini-HPP LOS is not constructed. It’s assumed that the measurement equipment will be similar to mini-
M-6'’	$HG_{LOS\ HPP\ steam}$ Heat from mini-HPP (steam)	heat meter	Gcal	m	Once per half of hour	100%	Electronic and paper	
M-7'’	$HG_{LOS\ HPP\ water}$	heat meter	Gcal	m	Once per half of	100%	Electronic and	

	Heat from mini-HPP (hot water)				hour		paper	HPP KOS
M-8''	$EC_{LOS\ HPP}$ Electricity from mini-HPP	supply meters	kWh	m	Once per two hour	100%	Electronic and paper	
M-9'	$NCV_{biogas\ LOS}$ Net calorific value of biogas LOS	Report of laboratory of MGUP "Mosvodokanal"	kcal per m3	e	monthly	100%	paper	
M-11''	NCV_{NG} Net calorific value of natural gas	Passport for NG from OJSC Gazprom	kcal per m3	e	monthly	100%	paper	
M-12''	NCV_{HFO} Net calorific value of heavy fuel oil	Passport for HFO from supplier	kcal per kg	e	monthly	100%	paper	
Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD								
	$EF_{CO2,\ elec}$ CO2 emission factor for electricity	Operational Guidelines for Project Design Documents of Joint Implementation Project [18]	gCO2/kWh			100%		
	$EF_{CO2,\ NG}$ CO2 emission factor for the natural gas	IPCC Guidelines for National GHG Inventories, 2006[19]	t CO2/TJ			100%		
	$\eta_{boiler\ KOS,\ NG}$ Efficiency of boiler house KOS	Parameter charts	%			100%		87.52%

18 Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, May 2004, Table B2.
19 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Volume 2: energy. Chapter 2: Stationary combustion. Table 2.2. Default CO2 emission factors for stationary combustion in energy industries..

	to natural gas,							
	η boiler KOS, biogas Efficiency of boiler house KOS to biogas,	Parameter charts	%			100%		86.70%
	η boiler LOS, NG Efficiency of boiler house LOS to natural gas	Parameter charts	%			100%		86.25%
	η boiler LOS, biogas Efficiency of boiler house LOS to biogas	Parameter charts	%			100%		85.70%

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

Formulae D.1.1.4.1 $BE_y = BE_{elec,y} + BE_{fuel,y}$

where:

BE_y - *total GHG emission in baseline, t CO2-eq*

$BE_{elec,y}$ - *total GHG emission from electricity consumption in baseline, t CO2-eq*

$BE_{fuel,y}$ - *total GHG emission from fuel consumption in baseline, t CO2-eq*

GHG emission from the electricity consumption

Formulae D.1.1.4.1.1 $BE_{elec,y} = EC_{BL,y} * EF_{CO2,,elec,y}$

where:

$BE_{elec,y}$ - *total GHG emission from electricity consumption in baseline, t CO2-eq*

$EC_{BL,y}$ - *total electricity consumption in baseline, ths kWh per year*

$EF_{CO2,,elec,y}$ - *CO2 factor from electricity, equal to 896 g CO2 per kWh*

Formulae D.1.1.4.1.1.1 $EC_{BL,y} = EC_{KOS,BL,y} + EC_{LOS, BL,y}$

where:

$EC_{BL,y}$ - *total electricity consumption in baseline, ths kWh per year*

$EC_{KOS,BL,y}$ - *electricity consumption in baseline at KOS, ths kWh per year*

$EC_{LOS, BL,y}$ - *electricity consumption in baseline at LOS, ths kWh per year*

Formulae D.1.1.4.1.1.1.1 $EC_{KOS,BL,y} = EC_{KOS,grid, ,y} + EC_{KOS,HPP, ,y}$

where:

$EC_{KOS,BL,y}$ - *electricity consumption in baseline at KOS, ths kWh per year*

$EC_{KOS,grid, ,y}$ - *electricity consumption in baseline at KOS, ths kWh per year*

$EC_{KOS,HPP,,y}$ - *electricity consumption from the mini-HPP in baseline at KOS, ths kWh per year*

Formulae D.1.1.4.1.1.1.2 $EC_{LOS,BL,y} = EC_{LOS,grid, ,y} + EC_{LOS,TPP, ,y}$

where:

$EC_{LOS,BL,y}$ - *electricity consumption in baseline at LOS, ths kWh per year*

$EC_{LOS,grid, BL,y}$ - *electricity consumption in baseline at LOS, ths kWh per year*

$EC_{LOS,TPP, BL,y}$ - *electricity consumption from the mini-HPP in baseline at LOS, ths kWh per year*

GHG emission from the fuel consumption

Formulae D.1.1.4.1.2 $BE_{fuel, y} = BE_{fuel, KOS} + BE_{fuel, LOS}$

where:

$BE_{fuel, y}$ - *total GHG emission from fuel consumption in baseline, t CO2-eq*

$BE_{fuel, KOS}$ - *GHG emission from fuel consumption in baseline at KOS, t CO2-eq*

$BE_{fuel, LOS}$ - *GHG emission from fuel consumption in baseline at LOS, t CO2-eq*

Formulae D.1.1.4.1.2.1 $BE_{fuel, KOS} = HG_{NG\ gross\ KOS\ BL} * 4.1868 * EF_{CO2, NG, y}$

where:

$HG_{NG\ gross\ KOS\ BL}$ - *gross heat generation from natural gas at KOS in baseline, ths Gcal*

$EF_{CO2, NG, y}$ - *CO2 factor, 56.1 tonnes per TJ*

4.1868 - *transfer factor from calorie to joule*

Formulae D.1.1.4.1.2.1.1 $HG_{NG\ gross\ KOS\ BL} = HG_{NG\ net\ KOS\ BL} / \eta_{boiler\ KOS, NG}$

where:

$HG_{NG\ gross\ KOS\ BL}$ - *gross heat generation from natural gas in baseline, ths Gcal*

$HG_{NG\ net\ KOS\ BL}$ - *net heat generation from natural gas in baseline, ths Gcal*

$\eta_{boiler\ KOS,\ NG}$ - *efficiency of boiler house KOS to natural gas, 87.52%*

Formulae D.1.1.4.1.2.1.2 $HG_{NG\ net\ KOS\ BL} = HG_{total\ net\ KOS} - HG_{biogas\ net\ KOS\ BL}$

where

$HG_{NG\ net\ KOS\ BL}$ - *net heat generation from natural gas in baseline, ths Gcal*

$HG_{total\ net\ KOS}$ - *total net heat generation at KOS in baseline, equal to the sum of* $HG_{boiler\ KOS\ PJ}$ *and* $HG_{mini\text{-}HPP\ KOS}$ *, ths Gcal*

$HG_{biogas\ net\ KOS\ BL}$ - *net heat generation from biogas at KOS in baseline, ths Gcal*

Formulae D.1.1.4.1.2.1.3 $HG_{biogas\ net\ KOS\ BL} = FC_{biogas\ KOS\ BL} * NCV_{biogas\ KOS} * \eta_{boiler\ KOS,\ biogas} /1000$

where

$HG_{biogas\ net\ KOS\ BL}$ - *net heat generation from biogas at KOS in baseline, ths Gcal*

$FC_{biogas\ KOS\ BL}$ - *biogas consumption, equal to the sum of* $FC_{biogas,\ mini\ HPP\ KOS,\ PJ}$ *and* $FC_{biogas\ boiler\ KOS,\ PJ}$

$NCV_{biogas,\ KOS}$ - *NCV of biogas at KOS, 5224 kcal per m3*

$\eta_{boiler,\ KOS.\ biogas}$ - *efficiency of boiler house KOS to biogas, 86.7 %*

Formulae D.1.1.4.1.2.2 $BE_{fuel,\ LOS} = HG_{NG\ gross\ LOS\ BL} * 4.1868 * EF_{CO2,\ NG,\ y}$

where:

$HG_{NG\ gross\ LOS\ BL}$ - *gross heat generation from natural gas at LOS in baseline, ths Gcal*

$EF_{CO2,\ NG,\ y}$ - *CO2 factor, 56.1 tonnes per TJ*

4.1868 - *transfer factor from calorie to joule*

Formulae D.1.1.4.1.2.1.1 $HG_{NG\ gross\ LOS\ BL} = HG_{NG\ net\ LOS\ BL} / \eta_{boiler\ LOS,\ NG}$

where:

$HG_{NG\ gross\ LOS\ BL}$ - *gross heat generation from natural gas at LOS in baseline, ths Gcal*

$HG_{NG\ net\ LOS\ BL}$ - *net heat generation from natural gas at LOS in baseline, ths Gcal*

$\eta_{boiler\ LOS,\ NG}$ - *efficiency of boiler house LOS to natural gas, 87.52%*

Formulae D.1.1.4.1.2.1.2 $HG_{NG\ net\ LOS\ BL} = HG_{total\ net\ LOS} - HG_{biogas\ net\ LOS\ BL}$

where

$HG_{NG\ net\ LOS\ BL}$ - *net heat generation from natural gas at LOS in baseline, ths Gcal*

$HG_{total\ net\ LOS}$ - *total net heat generation at LOS in baseline, equal to the sum of* $HG_{boiler\ LOS\ PJ}$ *and* $HG_{mini\text{-}HPP\ LOS}$ *, ths Gcal*

$HG_{biogas\ net\ LOS\ BL}$ - *net heat generation from biogas at LOS in baseline, ths Gcal*

Formulae D.1.1.4.1.2.1.3 $HG_{biogas\ net\ LOS\ BL} = FC_{biogas\ LOS\ BL} * NCV_{biogas\ LOS} * \eta_{boiler\ LOS,\ biogas} /1000$

where

$HG_{biogas\ net\ LOS\ BL}$ *- net heat generation from biogas at LOS in baseline, ths Gcal*

$FC_{biogas\ LOS\ BL}$ *- biogas consumption, equal to the sum of* $FC_{biogas,\ mini\ HPP\ LOS,\ PJ}$ *and* $FC_{biogas\ boiler\ LOS,\ PJ}$

$NCV_{biogas,\ LOS}$ *- NCV of biogas at LOS, 5224 kcal per m3*

$\eta_{boiler,\ LOS.\ biogas}$ *- efficiency of boiler house LOS to biogas, 86.7 %*

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

Not applicable.

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

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

Not applicable

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

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable

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

Formulae Д.1.4. 1 $ER_y = BE_y - PE_y$

where

ER_y *GHG emission reduction, tones CO2 per year*

BE_y *GHG emission in baseline, tones CO2 per year*

PE_y *GHG emission in project, tones CO2 per year*

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

Information on the EIA of project will be provided in accordance with the Russian legislation.

In accordance with the legislation in the field of environmental protection, the company should control pollution emissions, wastewater discharges, organize and ensure the management of waste production and consumption, provide specified reports to the competent state bodies (Federal Service for Ecological, Technological and Nuclear Supervision Service). In the MGUP Mosvodokanal work on the environment organized by the Department of Environmental Protection under the leadership of Chief Engineer, First Deputy General Director. Annually develop and implement conservation measures, including environmental monitoring of industrial and economic activities of the enterprise.

The MGUP Mosvodokanal in a timely prepares and gives public authorities the official statistical reports and forms, including:

- 2-TP (air) – data on air protection, including information on the number of trapped and neutralized pollutants, detailed information on emissions of specific pollutants, the sources of emissions, measures to reduce emissions and emissions from individual sources, groups pollution;
- 2-TP (water) – data on water use, including information on the consumption of water from natural sources, sewage and contaminants in the water, water capacity, etc. treatment plants;
- 2-TP (waste) – the data on the generation, use, neutralization, transportation and disposal of waste production and consumption, including the annual balance of waste separately according to types and classes of risk.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
M-1 (table D1.1.1, D1.1.3.)	low	Calibration interval is 10 years. Accuracy class – 0,5S.
M-2 (table D1.1.1, D1.1.3.)	low	Calibration interval is 5 years . Maximum error 0,046%. De facto calibration interval is 3 years.
M-3 (table D1.1.3.)	low	Calibration interval is 3 years . Maximum error is 0.5%.
M-4 (table D1.1.3.)	low	Calibration interval is 3 years . Maximum error is 2.5%.
M-5 (table D1.1.3.)	low	Calibration interval is 3 years . Maximum error is 2.0%.
M-6 (table D1.1.3.)	low	Calibration interval is 4 years . Maximum error 0,5%.
M-7 (table D1.1.3.)	low	Calibration interval is 4 years . Maximum error 0,6%.
M-8 (table D1.1.3.)	low	Calibration interval is 10 years . Accuracy class is 0.5S
M-9 (table D1.1.1, D1.1.3.)	low	This data is provided by MGUP “Mosvodokanal”, testing laboratories. Certificate #ROSS RU.0001.516447 of 01.09.2010 and #ROSS RU.0001.514669 of 02.04.2007
M-10 (table D1.1.1, D1.1.3.)	low	Checking interval is a year..
M-11 (table D1.1.1, D1.1.3.)	low	This data is provided by JSC “Gazprom”, LLC “Gazprom transgaz Moscow”, Moscow office of pipeline operation, testing laboratory. Certificate #ROSS RU.0001.515174 of 21.02.2008
M-12 (table D1.1.1, D1.1.3.)	low	This data is provided by the supplier of heavy fuel oil

Ensuring quality control procedures and the above parameters are guaranteed by compliance with the requirements the following documents:

- Federal law 26.6.2008 N 102-FZ “On ensuring the unity of measurements”;

- M – GOST 8.586.1-2005. "GSOEI. Measuring the rate and quantity of liquids and gases by means of orifice devices. Part 1. The principle of the measurement method and general requirements;
- GOST 8.586.2-2005. "GSOEI. Measuring the rate and quantity of liquids and gases by means of orifice devices. Part 2. Diaphragms. Specifications;
- GOST 8.586.5-2005. "GSOEI. Measuring the rate and quantity of liquids and gases by means of orifice devices. Part 5. The method of measurement ";
- Methods of measurement using the turbine, rotary and vortex meters (PR 50.2.019-2006);
- The order of the state metrological control and supervision over the use and condition of measuring systems with a constriction device (OL 50.2.022-99);
- Methods of measurement measuring complexes with flowmeter-counter PC-SPA M. Consumption of natural gas. (MI, 3021-2006);
- MI 3082-2007. The choice of methods and means of measuring flow rate and quantity of natural gas consumed depending on operating conditions at registration. Recommendations on choice of working standards for calibration. GSOEI. Ltd. CMC Gazmetrologiya, FGUP VNIIR ", Kazan, 2007;
- GOST R ISO / IEC 17025-2000;
- Requirements to implement the gauge works ", approved. Resolution № 17 of 21.09.1994 Russian State Standard;
- State register of measuring instruments;
- PR 50.2.006-94.

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

Operational structure of the project is the existing scheme of collection, transmission and storage of data. Reporting on the consumption of electricity, heat and natural gas on KOS and LOS is a duty of the Power Department (PU "Mosochistvod"). For the preparation of verification reports will be used the scheme shown in Fig. D.3.

Following procedures are provided for the storage of data:

The information of consumption of natural gas and consumption of electricity from power grid, the heat generation from boiler house and biogas into boiler house are read by expert of Power Department (PU "Mosochistvod") once per day. The summary report are collected in Power Department. Annual values are sent to the Department of new technique and development. The senior expert of the Department Of New Technique And Development prepare the table with all monitoring data.

The operator of mini-HPP takes meter readings for "Biogas into mini-HPP", "Heat from mini-HPP (steam)", "Heat from mini-HPP (hot water)", "Electricity from mini-HPP" once per two hours. These values are accumulated in the ten-day report in the controller's office. Monthly summary reports are compared with MGUP "Mosvodokanal" and archived in accounts departments of LLC EFN Eco service and MGUP "Mosvodokanal". Annual values are sent to the Department of new technique and development. The senior expert of the Department Of New Technique And Development prepare the table with all monitoring data.

Net calorific value of biogas is estimated monthly by the laboratory of the MGUP "Mosvodokanal". Net calorific value of natural gas is in monthly passport from JSC Gazprom. Net calorific value of heavy fuel oil is provided once by supplier on the delivery. These values are collected in the Power Department (PU "Mosochistvod") .

Consumption of heavy fuel oil is registered in the deed. This value is archiving in Power Department (PU "Mosochistvod"). Annual values are sent to the Department of new technique and development. The senior expert of the Department Of New Technique And Development prepare the table with all monitoring data.

Monitoring system internal audit is the responsibility of the Head of the Department Of New Technique And Development. The preparation of the monitoring report and the data collection is the responsibility of senior expert of the Department Of New Technique And Development. The annual industrial reports are kept in the Power Department. All data for monitoring plan will be derived and sent for the archiving and application in the Department of new technique and development. The information for the monitoring plan will be kept for two years after the last transfer of ERUs for the the Project.

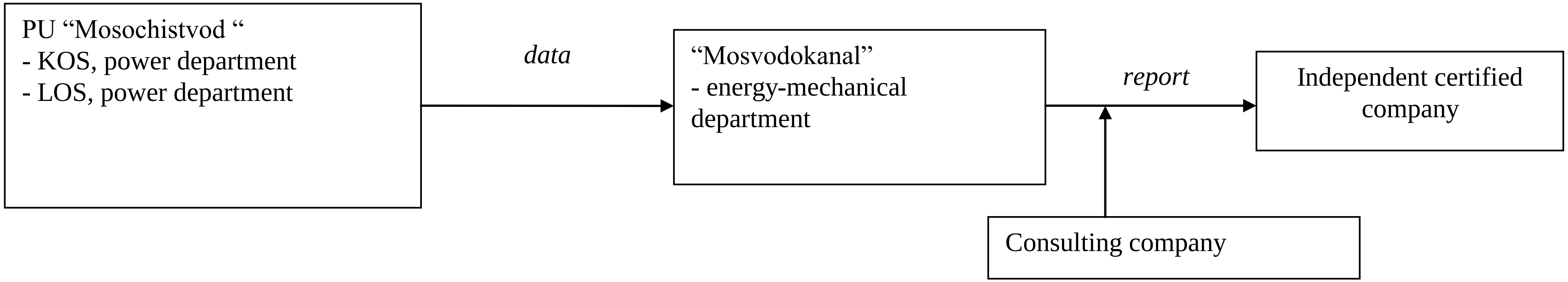

Figure D.3. Operation-management structure of Project

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

The monitoring plan has been designed by National Carbon Sequestration Foundation – (NCSF, Moscow);
Contact persons:

Marat Latypov,

Head of Project Development Department
Tel. +7 499 788 78 35 ext. 103
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National Carbon Sequestration Foundation is not a participant of the Project.

SECTION E. Estimation of greenhouse gas emission reductions

GHG emission from electricity consumption is calculated using emission factor [20]

Table E 1. CO2 factor in power grid for the period 2009-2012

Index	Unit	2009	2010	2011	2012
EF_{CO2}	kg CO2 per MWh	0.557	0.550	0.542	0.534

Table E 2. GHG emission factor and NCVs for fuels

	NCV		Emission factor
	TJ per ths t	kcal per m3 or kcal per kg	t CO2 per TJ
Natural gas	48,1	8042	56.100
Heavy fuel oil	43,4	9800	77.400

E.1. Estimated project emissions:

Project GHG emission includes GHG emission from the electricity and natural gas consumption.

GHG emission from electricity consumption

Table E 3. CO2 emission in power grid

		2009	2010	2011	2012
Electricity from power grid at KOS	mln. kWh	118.74	70.45	60.98	76.77
Electricity from power grid at LOS	mln. kWh	-	-	-	49,99
Factor	Kg CO2/MW	0,557	0,550	0,542	0,534
GHG emission	**t CO2/year**	**66 136,51**	**38 745,96**	**33 052,08**	**67 687,17**

GHG emission from the fuel consumption

Table E 4. CO2 from natural gas consumption

		2009	2010	2011	2012
Natural gas consumption at KOS	mln.-m3	9.11	13.41	14.61	14.91
Natural gas consumption at LOS	mln.-m3	-	-	-	33.63
Factor	t CO2/TJ	56.100			
GHG emission	**t CO2/year**	**17 199.57**	**25 333.71**	**27 595.66**	**91 690.87**
HFO consumption at KOS	t	35.46	10.70	19.00	19.00
HFO consumption at LOS	t	-	-	-	500.00
Factor	t CO2/TJ	77.4			
GHG emission	**t CO2/year**	**119.17**	**35.96**	**63.85**	**1 744.15**

[20] Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, May 2004, Table B2, page 43

Table E.5. GHG emission in Project

Year	Estimated GHG emission in Project, t CO2eq
2009	83 455.25
2010	64 115.63
2011	60 711.59
2012	161 122.20
Total 2009-2012	**369 404.67**

E.2. Estimated leakage:

No

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

Table E.7. Total GHG emission in project and from leakage

Year	Estimated GHG emission in Project, t CO2 eq	Estimated leakage, t CO2 eq	Estimated GHG emission in Project, t CO2 eq
2009	83 455.25	-	83 455.25
2010	64 115.63	-	64 115.63
2011	60 711.59	-	60 711.59
2012	161 122.20	-	161 122.20
Total 2009-2012	**369 404.67**	**-**	**369 404.67**

E.4. Estimated baseline emissions:

GHG emission in baseline is the sum of GHG emission from electricity consumption and natural gas.

GHG emission from electricity consumption

Table E 8. CO2 emission in power grid

		2009	2010	2011	2012
Electricity from mini-HPP KOS	mln kWh	49.42	70.30	70.40	70.40
Electricity from power grid at KOS	mln kWh	118.74	70.45	60.98	76.77
Electricity from mini-HPP LOS	mln kWh	-	-	-	87.84
Electricity from power grid at LOS	mln kWh	-	-	-	49.99
Factor	kg CO2 eq / MW	0.557	0.550	0.542	0.534
GHG emission	**t CO2/year**	**84 494.09**	**77 410.41**	**71 209.42**	**152 187.86**

GHG emission from fuel consumption

Table E 9. CO2emission from natural gas consumption

		2009	2010	2011	2012
KOS					
Heat , net	ths Gcal	223,35	224,59	228,74	228,74
Biogas heat net	ths Gcal	216,17	194,03	184,28	184,28
NG heat net	ths Gcal	7,19	30,56	44,47	44,47
NG heat gross	ths Gcal	8,21	34,92	50,81	50,81
Effectiveness of boiler house, NG	%	87.52			
NCV of natural gas	kcal/m3	8042			
LOS					
Heat , net	ths Gcal	-	-	-	237.86
Biogas heat net	ths Gcal	-	-	-	204.60
NG heat net	ths Gcal	-	-	-	123.26
NG heat gross	ths Gcal	-	-	-	142.26
Effectiveness of boiler house, NG	%	86.25			
NCV of natural gas	kcal/m3	8042			
GHG emission	**t CO2**	**1 928.95**	**8 201.17**	**11 934.06**	**45 503.64**

Table E.10. GHG emission in baseline

Year	Estimated GHG emission in baseline, t CO2 eq
2009	95 595.17
2010	85 611.58
2011	83 143.48
2012	197 691.50
Total For 2009-2012	**462 041.73**

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

Formulae E.5.2 ER = BE – PE

where
ER – emission reduction, tones CO2/year;
BE – GHG emission in baseline, tones CO2/year;
PE – GHG emission in project, tones CO2/year .

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

Year	Estimated GHG emission in project, (t CO_2 eq)	Estimated leakage, (t CO_2 eq)	Estimated GHG emission in baseline, (t CO_2 eq)	Estimated emission reduction, (t CO_2 eq)
2009	83 455.25	-	95 595.17	12 139.92
2010	64 115.63	-	85 611.58	21 495.95
2011	60 711.59	-	83 143.48	22 431.89
2012	161 122.20	-	197 691.50	36 569.31
Total 2009-2012	**369 404.67**	**-**	**462 041.73**	**92 637**

SECTION F. Environmental impacts

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

The environmental impact assessment is obligatory part of project documentation and takes into account following components of environment:

- earth;
- air;
- engineering and geological conditions;
- geomorphologic conditions;
- landscape complexes;
- surface and soil waters;
- soil;
- social and economic conditions of life.

The project documentation is due to the examination in ROSTEHKSPERTIZA and has the approval of MOSKOMEKSPERTIZA.

The environmental impact of the Project is insignificant. It is confirmed by the positive conclusion of the ROSTEHKSPERTIZA.

The analysis of the environmental impacts depends on following regulatory acts:

- Federal low № 7-FL from 10.01.2002 " On Protection of Environment"
- Federal low № 96-FL from 04.05.1999" On Protection of Atmospheric air"
- Federal low № 52-FL from 30.03.1999 "On Sanitary and Epidemiologic Weil-Being of the Population"
- Water Code RF № 74-FL from 03.06.2006
- Federal low № 174-FL from 23.11.1995 "On Ecological Examinations"
- Federal low № 116-FL from 21.07.1997 "On industrial safety"
- Federal low № 117-FL from 21.07.1997 "On Safety of Hydrotechnical Constructions"
- Federal low № 89-FL from 24.06.1998 "On Production and Consumption Wastes"
- Land Code RF № 136 from 25.10.2001

The Project activity does not break the environmental regulation. The construction place of the projected object is industrial space of MGUP Mosvodokanal. The air-permit for mini-HPP KOS is separate document but should be within the bounds of environmental limits of the KOS of MGUP Mosvodokanal. The project of the mini-HPP LOS started later than the project of the mini-HPP KOS and therefore is under consideration at present.

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

The project of the mini-HPP KOS obtained the positive opinion of MOSKOMEKSPERTIZA, № 99-P5/07 IGE on 05/10/2007, and Conclusion of industrial safety examination from "ROSTEHEKSPERTIZA» № 98/06B-321-PB of 2007.

SECTION G. Stakeholders' comments

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

Information about the project was posted on the website MGUP Mosvodokanal 20 04 2006. Comments had not been received. http://www.mosvodokanal.ru/index.php?newsid=962. The duration of comments collection period was one month.

Also tender documentation for mini-HPP KOS and LOS is open and widely available. www.tender.mos.ru

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	MGUP Mosvodokanal
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URL:	www.mosvodokanal.ru
Represented by:	Khrenov Konstantin Evgenievich
Title:	Deputy Director General
Salutation:	Mr.
Last name:	Khrenov
Middle name:	Evgenievich
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ANNEX 2

BASELINE INFORMATION

The baseline scenario is the continuation of current situation, i.e. the electricity consumption from the grid and the heat generation in boiler-house. It leads to the GHG emission from the consumption of electricity from grid and the combustion of fuel (natural gas).

GHG emission from the electricity consumption from grid in baseline is calculated on the basis of data from project scenario about the electricity consumption from mini-HPPs and grid. The sum of HPP and grid electricity is multiplied by the grid emission factor from Operational Guidelines for PDD of JI-Project [21] (hereinafter referred to as ERUPT factor). The application of ERUPT factor can be assumed acceptably because this factor are applied for the calculation of GHG emissions in the baseline in determined PDDs:

- Construction of a new CCGT plant in Tereshkovo, Moscow;
- Construction of a new CCGT plant in Kozhukhovo, Moscow

GHG emission from the fuel combustion is GHG emission from the natural gas consumption. In accordance with the conservativeness principle GHG emission from the consumption of heavy fuel oil is excluded in the baseline scenario.

The consumption of the natural gas is calculated taken into account all data from the heat balance. Total heat generation in HPP and boiler house in project scenario is assumed to be produced in the boiler – house.

[21] Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, May 2004, Table B2, page 43.

Annex 3

MONITORING PLAN

Form for initial data for the preparation of the verification report

ID	Symbol	Item	Unit	Value	Comment
M-1', M-1"	$EC_{grid, y}$	Consumption of electricity from power grid	kWh		
M-2', M-2"	$FC_{NG, y}$	Consumption of natural gas	m 3		
M-3', M-3"	$HG_{boiler, y}$	Heat from boiler house	t		
M-4', M-4"	$FC_{biogas, boiler, y}$	Biogas into boiler house	m3		
M-5', M-5"	$FC_{biogas, HPP, y}$	Biogas into mini-HPP	Gcal		
M-6', M-6"	$HG_{HPP, steam, y}$	Heat from mini-HPP (steam)	t /hour		
M-7', M-7"	$HG_{HPP, water, y}$	Heat from mini-HPP (hot water)	Gcal		
M-8', M-8"	$EC_{TPP, y}$	Electricity from mini-HPP	kWh		
M-9', M-9"	NCV_{biogas}	Net calorific value of biogas	kcal per m3		
M-10', M-10"	$FC_{HFO, y}$	Consumption of heavy fuel oil	tonnes		
M-11', M-11"	NCV_{NG}	Net calorific value of natural gas	kcal per m3		
M-12', M-12"	NCV_{HFO}	Net calorific value of heavy fuel oil	kcal per kg		

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