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

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Annexes

SECTION A. General description of the project:

A.1. Title of the project:

"Utilization of Coal Mine Methane at the SE "Makiyivvuhillya".

Sectoral Scope 8. Mining/mineral production

The version number of the document: 2.0

The date of the document: September 20, 2012.

A.2. Description of the project:

The purpose of the proposed project is to reduce greenhouse gas emissions through capturing coal mine methane by degassing system and its using for heat production for the needs of mines of SE "Makiyivvuhillya" in Makiivka, Donetsk region, Ukraine. Thus, in accordance with project scenario, captured coal mine methane will be burned in order to obtain thermal energy and will partly replace coal from the mines, which would be used as fuel in the baseline scenario.

Existing situation before the project

Ukraine is one of the largest coal mining countries. The largest deposits of black coal are located in the Donetsk coal basin, which is an industrial region of Ukraine, covering Donetsk region without Priazovye, east of Dnepropetrovsk region, south of Lugansk region of Ukraine. The main centres of coal production are Donetsk, Makiivka, Krasnoarmiysk, Lisichansk, Horlivka, Pavlograd, etc. The territory of Ukraine has about 167 operating coal mines and 3 strip mines, mines that are currently under decommissioning, as well as enterprises for coal beneficiation, transport enterprises and others.

Coal is found in the area of Donbas at the average depth of 400-800 m, and the average thickness of coal-bed is 0.6-1.2 m. Therefore coal in Donbas is produced mostly by mining. Most mines operate on the depth of 400-800 m but there are 35 mines in Donbas that extract coal from the 1000-1300 m level. Coal-beds in Donetsk basin are interleaved with rock and are usually found every 20-40 m. Coal industry is the only branch of the fuel and energy complex (FEC), where production is supported by direct government subsidies. Existing coal prices do not cover short-term production costs, partly because of too rapid growth of prices for mining equipment and materials. Many mines are in a terrible financial position and cannot make investments in perspective development. Predominantly, this problem concerns not transparent management of coal mining industry. While the prices of materials increase, private manufacturers, who sell these materials, seek the ways to maintain the low price of coal. Predominantly, this problem concerns not transparent management of coal mining industry. While the prices of materials increase, private manufacturers, who sell these materials, seek the ways to maintain the low price of coal. This problem first of all applies to mines that are under state ownership and subordinated to Ministry of Coal Industry (abbreviated - MCI) of Ukraine. The government has a detailed plan for the further closure of unprofitable mines and privatization of most mines that will continue to operate. Energy Strategy to 2030 foresees a substantial increase in coal production to reduce Ukraine's dependence on imported natural gas. However, the ability of the country to achieve these objectives fully depends on further reforms.
One of the most serious problems of coal mining is methane contained in coal deposits. Ukraine ranks fifth in the world in amount of coal mine methane emissions in the atmosphere. As a result of the coal mines operation country emits about 1.2 billion[1] cubic meters of methane into the atmosphere per year. Methane is a risk of poisoning and explosions, and the traditional approach was directed mainly to the problem of getting rid of it. Thus, approximately 15% of volume of methane is captured by mines degassing systems, and not more than half of captured amount is used.

[1] http://nedralugansk.com.ua/8.html

The content of gas in coke oven coal, coal of medium volatile bituminous coals sort, and lean coal, usually is between 20 and 25 m^3/t, while in anthracite it is higher – usually in the range[2] from 40 to 45 m^3/t. Methane-air mixture with 2-15% CH_4 content is potentially explosive, so to maintain appropriate safety conditions it should be lower than 2%. In order to provide them, two main technologies are applied: ventilation of the mine with plenty of air and methane removal.

Degassing coal seams before mining operations (by drilling vertical wells from the surface) and using modern systems of underground degassing can significantly reduce the accident rate and fatal injuries in the coal mines of Ukraine. In addition, removal methane from mine output will allow increasing labour productivity and reducing the production cost of coal, as equipment downtime because of the high content of gas in the mine atmosphere decreases.

The project is initiated by SE "Makiyivvuhillya" in order to improve the environmental situation in the region, and to improve safety in coal mining. Methane high content in mining atmosphere is one of the key factors that determine the complexity of works on coal extraction and its high production cost at the mine. Methane presence in mining atmosphere and threat of explosions impede mining activities development and require increased safety of mining activities.

Baseline scenario

Baseline scenario provides continuation of existing situation, when captured coal mine methane after vacuum-pump station is thrown out in atmosphere, and the needs of mines in the thermal energy are met by burning fossil fuels (black coal) in boilers. At the same time there are large amounts of methane emissions as well as carbon dioxide emissions into the atmosphere that affects the ecological situation in the region. Mines boiler equipment is not modernized while there is low efficiency of thermal energy generation.

Project scenario

The proposed project provides reconstruction of the boiler equipment at the mines of SE "Makiyivvuhillya" for coal mine methane utilization (CMM). CMM will be burned for thermal energy production, which will replace the thermal energy produced from fossil fuels (coal) and thereby decrease greenhouse gas (GHG) emissions to the atmosphere and reduce consumption of fossil fuel (coal). Thermal energy will be used for the own needs of SE "Makiyivvuhillya".

As a result of the project implementation, CMM emissions in the atmosphere will reduce, also through burning CMM in boilers; coal consumption for heating mines will decrease, leading to GHG emissions reduction compared with the current situation.

Improving the efficiency of degassing and using CMM will cause a positive impact on safety of coal mining works, on the economic condition of the State enterprise and the environmental conditions. Project activity implementation will lead to the following results:

- volume of methane emissions in the atmosphere will decrease;
- mines operation will become more productive and safe;
- consumption of fossil fuel (coal) by boilers will significantly reduce for thermal energy production, which is required for the coal mines of SE "Makiyivvuhillya".

The project is environmentally and socially beneficial. Its realization causes less pollution than in case of

[2] PEER (2000): Coal Mine Methane in Ukraine: Opportunities for Production and Investment in the Donetsk Coal Basin. Partnership for Energy and Environmental Reform, Triplett, Jerry, Alexander Filippov, and Alexander Pisarenko, September 2000. www.epa.gov/cmop/docs/ukraine_handbook.pdf

baseline scenario as it reduces methane emissions from mines. Its implementation improves the quality of working environment and reduces negative health effects for the employees of mines. SE “Makiyivvuhillya” has all licenses and permits necessary for project implementation.

Project history

To achieve project purpose in 2004 development of project document for reconstruction of boiler equipment for work at CMM and on-site preparation works was initiated. Construction and installation works started in the second half of 2005, with installation of auxiliary equipment. In mid-2005, installation of main production equipment started.

As the project leads to reduction of greenhouse gas emissions, this reduction was necessarily taken into account when making decision on the project implementation. Emission reductions will be sold as ERUs on the international market of trade emission reductions, and received funds will improve the financial indicators of the project to a level that justifies the means that were used in its implementation. From the very beginning, the joint implementation mechanism was one of the prominent factors of the project and financial benefits under this mechanism plays an important role in making decisions about the beginning of operation and considered to be one of the reasons for the start of project implementation.

A.3. Project participants:

Table 1. Project participants

Party involved	Legal entity project participant (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	SE “Makiyivvuhillya”	No
Estonia	OÜ "Biotehnoloogia"	No

SE “Makiyivvuhillya” is organization that implements the project (Applicant). State Enterprise “Makiyivvuhillya” is the largest association in the public sector of coal industry of Ukraine in coking and thermal coal extraction by the underground method. It includes 9 coal mines and 13 supporting separated subdivisions, 5 subdivisions. SE “Makiyivvuhillya” exploits machinery and equipment for coal mining. The project aims at utilization of coal mine methane (CMM). CMM is an inevitable consequence of coal production. At the coal mines of SE “Makiyivvuhillya” CMM is pumped out from the mine to avoid the danger of explosion. CMM can be captured and used as fuel for heat generation, or simply for deleting it into the atmosphere. Detailed contact details are provided in Appendix 1.

OÜ "Biotehnoloogia". Project participant and a potential buyer of ERUs under the project from Party involved participating in JI project, except the host Party.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project “Utilization of Coal Mine Methane at the SE “Makiyivvuhillya” is planned to be implemented within four fields of mines of SE “Makiyivvuhillya” (“Mine named after V.M.Bazhanov”, “Kholodna Balka”, “Mine “Chaikino” and “Coal Mine Named after S.M. Kirov”, located in Donetsk region, Makiivka.

Location of the project:
CE “Mine named after V.M.Bazhanov” of SE “Makiyivvuhillya” 86119, Donetsk region, Makiivka.
CE “Mine “Kholodna Balka” of SE “Makiyivvuhillya” 86154, Donetsk region, Makiivka.
CE “Coal Mine Named after S.M. Kirov” of SE “Makiyivvuhillya” 86193, Donetsk region, Makiivka.
CE “Mine “Chaikino” of SE “Makiyivvuhillya” 86120, Donetsk region, Makiivka.

A.4.1.1.	**Host Party(ies):**

Ukraine.

Ukraine is the Eastern European country that ratified the Kyoto Protocol to the Framework UN Convention on February 4, 2004, is included in the list of countries of Annex 1, and meets the requirements for participation in Joint Implementation projects.

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

Donetsk region.

A.4.1.3.	**City/Village/Community etc.:**

Makiivka.

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

Figure 1. Map of Ukraine and location of the project area

The project is implemented within the Donetsk region of Ukraine, where the mines of SE "Makiyivvuhillya" situated, Donetsk region, Makiivka. Makiivka is a city of regional subordination in Ukraine, Donetsk region; in fact, it is the north-east suburb of Donetsk. It belongs to 15 largest cities of the country by population. As of January 1, 2011 population of Makiivka was 358,156 inhabitants. The first settlement at the area of modern Makiivka was founded in 1690. Makiivka is located in the south-eastern part of Ukraine at the distance of 13 km from the regional centre of Donetsk and 713 km from the capital of Ukraine, Kyiv. Geographical coordinates of the project are given below:

CE "Mine named after V.M.Bazhanov" of SE "Makiyivvuhillya": 48.093674, 37.976775
CE "Mine "Kholodna Balka" of SE "Makiyivvuhillya": 48.001696, 38.051705
CE "Coal Mine Named after S.M. Kirov" of SE "Makiyivvuhillya": 48.042341, 38.076457
CE "Mine "Chaikino" of SE "Makiyivvuhillya": 48.067741, 37.925234
Satellite photo of the site is shown below in Figure 2.

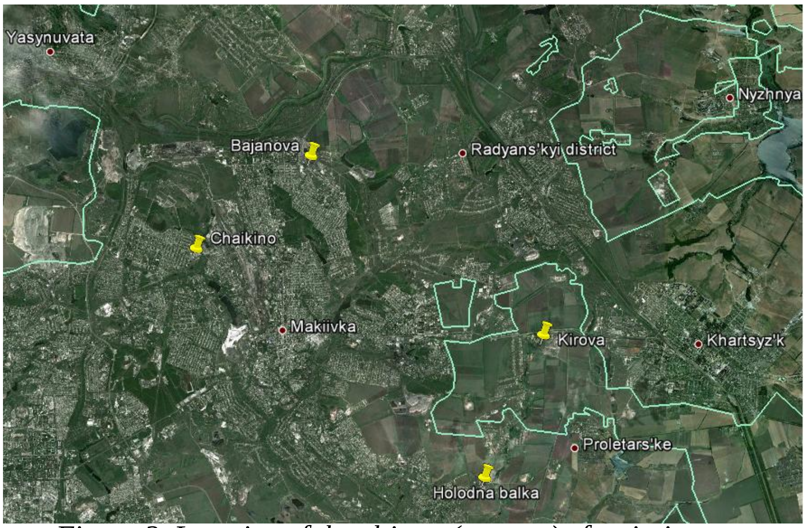

Figure 2. Location of the objects (sources) of emissions

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

The Donetsk basin (Donbas) is the largest industrial region of Ukraine with coal, metallurgic and chemical industries. Donbas is one of the most hazardous regions of Ukraine concerning the level of environmental pollution. The main contributor of methane emissions to the atmosphere is the coal industry. Methane reserves in carboniferous deposits are estimated from 12 to 25 trillion m^3.

Every year, many millions of cubic meters of methane gas (CH_4) are released from the coal mines in Donbas. The methane, present in large quantities in the porous structure of coal, is released by degassing activities and ventilating air circulating in the mine and then discharged into atmosphere leading thus to global warming as methane is #2 greenhouse gas regulated by the Kyoto Protocol.

Degassing (drainage) systems of methane are used to extract methane from gas-bearing rocks before, during and after extraction of coal, depending on the needs of mine. Degassing allows reducing cost of airing of mining output, reducing equipment downtime and improving labour safety. This measure is done by drilling three main types of wells that pass through the coal seam and rock.

At the mines of the State Enterprise "Makiyivvuhillya" inclined underground wells are used, by which degassing of rocks and seams - satellites is made that lie lower and higher the working seam. Gas from such wells usually contains from 30% to 80% of methane, degassing efficiency varies from 20% to 60% of the total volume of gas emitted as a result of mining. With the help of pipelines, degassing wells are connected to vacuum-pump station, and then methane-air mixture is transported to the surface, and usually is thrown out in atmosphere.

In order to implement the proposed project, a number of technical improvements in degassing complex of coal mines were performed, as well as modernization of existing boilers were performed that worked on fossil fuels (coal) by transfer them to gaseous fuel (methane). For the purpose of coal mine methane utilization were taken the following steps:

1. ***Reconstruction of boilers.***

At the moment of decision making on the realization of the Joint Implementation project, thermal needs of mines were met by various boilers in the amount of 21 units that worked on solid fuel - coal, which was supplied from "Mine Butivska". After reconstruction, boilers operate by burning gaseous fuels, in this case, the methane. As methane-air mixture with the methane concentration in the range 5-15% is self-explosive the CMM is not supplied to the boiler house when its concentration in the gases captured is close to critical. It is released in the atmosphere straight from the degasification system. This makes CMM not reliable energy source to ensure continuous heat supply. In the time when CMM concentration is too low for utilization coal as a reserve fuel is used. This makes installation of coal fired boiler a required part of the project activity. Therefore, some boilers can work both on gaseous fuel, and on the solid fuel. After modernization, the efficiency of boilers also increased, which generally improved the energy efficiency of boiler houses. Technical characteristics of boilers that operate under the project are listed below:

Figure 3. Boiler DKVR-10/13

Main technical characteristics of boilers are presented in table below.

Table 2. Main performance capabilities of the boiler DKVR-10/13

Operating parameters	Value
Fuel	Solid fuel, gas, liquid fuel
Rated Steam Capacity, Ton/h	10

Working pressure, MPa	1.3
Overall dimensions, mm	8850x5830x7100
Weight, kg	15420
Efficiency,%	94 (gas), 88 (fuel oil), 86 (solid fuel)

Table 3. Main performance capabilities of the boiler DKVr 6.5/13

Operating parameters	Value
Fuel	Solid fuel, gas, liquid fuel
Rated Steam Capacity, Ton/h	6.5
Working pressure, MPa	1.3
Overall dimensions, mm	6520x3830x4345
Weight, kg	12200
Efficiency,%	94 (gas), 88 (fuel oil), 84 (solid fuel)

Table 4. Main performance capabilities of the boiler E-1/9

Operating parameters	Value
Fuel	Solid fuel, gas, liquid fuel
Rated Steam Capacity, Ton/h	1.0
Working pressure, MPa	0.9
Overall dimensions, mm	3695x2300x2790
Weight, kg	5620
Efficiency,%	94 (gas), 75 (fuel oil)

2. ***Construction of new pipelines, introduction of new vacuum-pump stations*.**

Technical characteristics of the equipment are listed below:

Figure 4. Pump NV-50

Table 5. Main performance capabilities of the vacuum-pump NV-50

Name of parameter	Value
Capacity, m^3/min	50
Vacuum, %	not less than 60
Power, kW	110
Revolutions per minute, r/min	750

Table 6. List of equipment under the project activity

Number	Name of equipment	Amount

"Mine named after V.M. Bazhanov"		
1	Magnetic station SAU-5	2
2	Drilling machine SBH-1	3
3	Pump VVN-2-150	3
4	Gas Analyzer	1
5	System UTAS	1
6	Interferometer SHI-11	2
7	Interferometer SHI-12	3
8	Exhaust Fan	4
9	Pump K-60	2
10	Electromagnet PET-3	3
11	Boiler DKVr-10/13	4
12	Smoke Exhauster D-10	2
13	Valve PKN-200	2
14	Pump NV-50	3
15	Pipeline Degassing	2
16	Degassing air pipeline	2
17	Gas Pipeline	1
18	Pipeline Degassing	1
"Mine "Kholodna Balka"		
1	Boiler DKVr-10/13	1
2	Boiler DKVr-6.5/13	3
3	Boiler E-1/9g	3
4	Pump NV-50	6
5	Pipeline Degassing	1
6	Degassing of coal seams from steel pipes m. #3	1
"Coal Mine Named after S.M. Kirov"		
1	Boiler DKVr-6.5/13	3
2	Boiler LK-2	3
3	Installation PDU-50M-2	2
4	Pump VVN-50м	1
5	Pump NV-50	2
"Mine "Chaikino"		
1	Electric motor VAO-2-450	1
2	Switch PVI-63	1
3	Switch PVI -250	1
4	Pump NVZ 120-40	1
5	Pump K-60M	1
6	Pump K-60	1
7	Pump NV-50	4
8	Machine SBH-1M	2
9	Intercom APKM	2
10	Manometer	4
11	Switch PVI-125	3
12	Electric motor VAO -55	1
13	Gas Analyzer TP-2301	2
14	Boiler DKVr-6.5/13	4

Figure 5. Modernized boiler DKVr-10/13

Application of new devices for metering coal mine methane allows more efficient its using and allows monitoring, simplifies control, ensures safe operation and leads to reduction of burning of fossil fuels and leads to reduction of GHG emissions to the atmosphere. SE “Makiyivvuhillya” has all licenses and permits necessary for project implementation. Necessary for the project equipment is planned to be bought in the leading Ukrainian and European companies on the tender basis.

Degasification activities

Degassing system consists of a network of mine degassing pipelines and vacuum-pump station located on the surface. With the help of degassing coal mine methane is removed from coal seams and surrounding rocks. The process of extracting methane air mixture includes the entire degassing system, which was introduced at the site at present, including wells, drilled from the mine workings, and the system of pipelines, laid to vacuum pump stations that pump out captured methane air mixture, meters for methane costs and analyzers of its concentration, temperature and pressure.

High methane content is among the key factors determining the complexity of coal recovery and its high production cost at the mines of SE “Makiyivvuhillya”. The methane presence and the threat of methane-air mix explosion hamper the progress of the mining works and demand to increase safety working conditions of miners. Statistical survey of fatal accidences occurred in mines witnesses that the great majority of those relate directly to ignition and explosion of methane. The President of Ukraine and the Government preoccupied with concerns on providing safety for coal miners have issued several decrees to support and to regulate activities to be implemented:

- The Decree of the President of Ukraine as of 16th of January 2002 No. 26/2002 “On urgent activities for improvement of work conditions and development of the state supervision at mining enterprises”;
- The Governmental Decree as of 6th of July 2002 No. 939 has approved the Complex Programme of coal-beds degasification at coal mines.

Both decrees focus on improving the safety of the mines, but do not require any utilization of the CMM. According to both decrees there is no necessity to neither flare nor utilize captured CMM.

Combustion of methane air mixture in boilers will meet the internal needs of mines in thermal energy as well as reduce the explosiveness of mining operations. The volume of degassed methane of degassing systems is given, and the share of utilized in boilers methane is shown in the chart below.

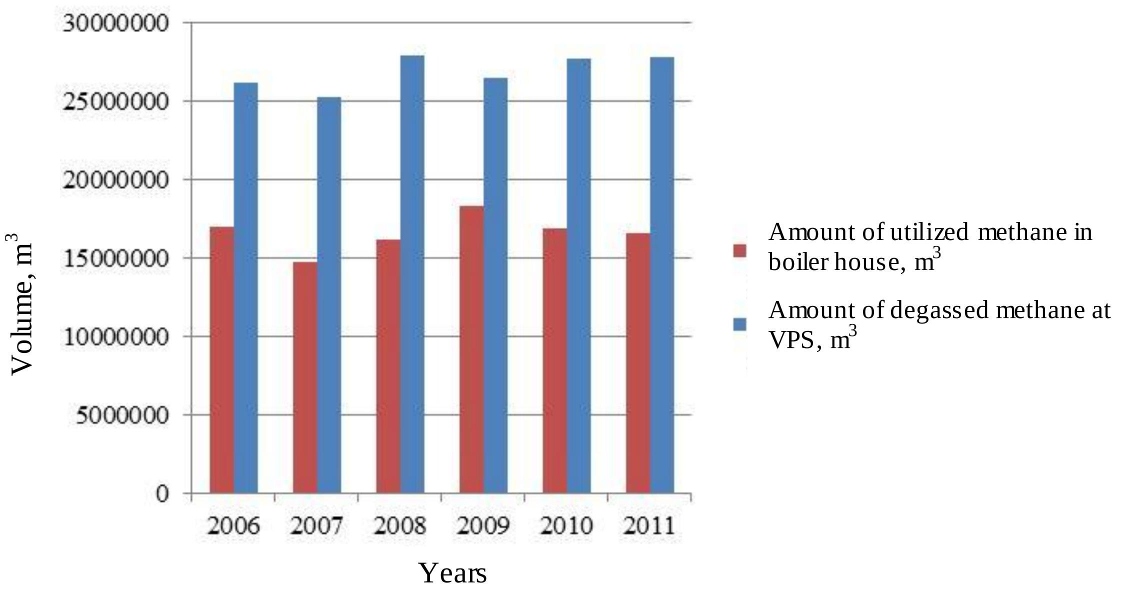

Figure 6. CMM utilization at the mines of SE "Makiyivvuhillya"

After modernization of the project equipment, efficiency of boilers significantly increased, efficiency of the degassing process of coal mines increased, and also concentration of methane in methane air mixture increased. Analyzing this chart it is clear that not all volume of degassed methane is burned in boilers - part of it is thrown out through relief device in the atmosphere. Amount of the consumed degassed methane depends on the needs of the mine in thermal energy.

Consumption of thermal energy at mines is typical for the sector and consists of the following major sources of consumption:

- Heating the mine shafts;
- Heating administrative building;
- Hot water supply at the administrative building;
- Other small consumers (heating, hot water).

From the beginning of the project at the enterprise, the following types of fuel were used. In the baseline scenario – coal of GR 0-200 mm grade that was supplied from mine "Butivska". In the project scenario – methane-air mixture and coal of GR 0-200 mm grade that was supplied from mine "Butivska" (as additional or reserve fuel).

Boiler equipment after reconstruction is able to produce the same amount of energy as before reconstruction. That is boiler equipment productivity has not decreased.

In case if need of mines in heat energy exceeds the current ability to meet this need by using methane as fuel, then there is opportunity to use coal as fuel.

Residual lifetime of boiler equipment after reconstruction enables to continue working throughout the crediting period.

The project uses modern technology solutions and engineering development and practice. Technology of methane utilization in the boiler houses for heat energy production is a modern engineering practice. The project uses advanced technology. Utilization of methane in the boiler houses is a modern technology that is used in the coal industry. Result of implementation of this technology is the reducing emissions of greenhouse gases and pollutants into the atmosphere, promoting energy independence and sustainable development of the industry.

Project implementation will require significant capital investment aimed at modernizing degassing system and capturing methane-air mixture, reconstruction of boiler houses, control and measuring devices, etc.

Introduction of new technology or replacing technology during the crediting period is unlikely, since the utilization of methane in boiler houses of mines for heat energy production meets the interest of mines and their needs in heat energy.

The decision on implementation of technology for coal mine methane utilization was taken in late 2004. The investment phase of the project began in 2005. More precise information is given in the table below:

Table 7. Schedule of the project activity implementation

Activity	Data
Decision-making	14.12.2004
Beginning of investment phase of the project	14.12.2004
End of investment phase of the project	31.12.2012
Beginning of boilers reconstruction and of degassing system	12.07.2005
Beginning of operational phase of the project	01.01.2006
End of operational phase of the project	31.12.2020
Beginning of ERUs generating[3]	01.01.2008

At the mines of SE “Makiyivvuhillya” clear scheme of providing safety regulations during the operation of gas pipelines, boilers, blowers and other fittings of hydrodynamic degassing system is organized. Project equipment is serviced by certified experts of enterprises that pass regular periodic test knowledge. At the mines of SE “Makiyivvuhillya” regular certification of workplace is performed. Before operation workers undersign in safety journal. Protocols of exams are kept in the archive of the enterprise. All sensors and measuring devices are inspected and maintained in good condition.

The project does not require intensive pre-training. Required number of staff can receive basic training on the project site. Most workers, such as operators of heavy equipment, truck and excavators drivers, mechanics and electricians work on the project site. Project needs in technical maintenance are met by local resources: own employees for internal maintenance and contractors for repair. The project provides training. All employees must have valid professional certificates, to undergo periodically safety training and pass exams. Professional education in all professional fields needed for this project can be obtained on site, in Donetsk region, Makiivka.

Technological process is environmentally justified and does not require the use of hazardous materials.

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

[3] Beginning of generation of greenhouse gases reduction units

Anthropogenic GHG emissions are reduced by the project through capturing direct emissions of methane (CMM) and its utilization by combustion, as a result, carbon dioxide with much lower global warming potential is emitted into the atmosphere. Besides, captured CMM is utilized by combustion in boilers to generate heat energy which otherwise would be produced from coal in baseline scenario. Emission reductions would not occur in the absence of the project because no reconstruction would be made to allow CMM capturing and utilizing. Consequently, CMM would be vented into the atmosphere and heat energy produced by coal combustion in boiler houses of the mines.

Besides, industrial policy does not require implementation of CMM utilization measures by coal mines, although according to Energy Strategy of Ukraine to 2030 it is expected that coal production will grow significantly over the next twenty years. Coal is considered a national energy resource that will be used for energy independence of Ukraine. Improving work safety at the mines of SE "Makiyivvuhillya", which will be achieved as a result of the proposed project, meets the declared priorities of Ukraine on further development of coal industry.

Detailed description of the baseline and full analysis of additionality are presented in Section B of this project design document.

Total estimated greenhouse gas emission reductions is 4,053,829 tons of CO_2 equivalent, including:

- for the part of crediting period during the first commitment period under the Kyoto Protocol – 1,337,869 tons of CO_2 equivalent;
- for the period before the part of crediting period during the first commitment period under the Kyoto Protocol – 556,536 tonnes of CO2 equivalent;
- for the part of crediting period after the first commitment period under the Kyoto Protocol – 2,159,424 tons of CO_2 equivalent.

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

Table 2. Estimation of emission reductions volumes for the part of crediting period during the first commitment period under the Kyoto Protocol

	Years
Duration of the crediting period	5
Year	Annual estimated emission reductions in tonnes of CO_2 equivalent
Year 2008	282 964
Year 2009	321 400
Year 2010	296 910
Year 2011	290 619
Year 2012	145 976
Total estimated emission reductions for the crediting period (tonnes of CO_2 equivalent)	1 337 869
Average annual estimated emission reductions for the crediting period (tonnes of CO_2 equivalent)	267 574

Table 9. Estimation of emission reductions volumes for the period before the part of crediting period during the first commitment period under the Kyoto Protocol

	Years
Duration of the period before 2012, for which emission reductions are calculated	2

Year	Annual estimated emission reductions in tonnes of CO_2 equivalent
Year 2006	298 217
Year 2007	258 319
Total estimated emission reductions for the specified period (tonnes of CO_2 equivalent)	556 536
Average annual estimated emission reductions for the specified period (tonnes of CO_2 equivalent)	278 268

Table 10. Estimation of emission reductions volumes after the part of crediting period during the first commitment period under the Kyoto Protocol

	Years
Duration of the period after 2012, for which emission reductions are calculated	8
Year	Annual estimated emission reductions in tonnes of CO_2 equivalent
Year 2013	269 928
Year 2014	269 928
Year 2015	269 928
Year 2016	269 928
Year 2017	269 928
Year 2018	269 928
Year 2019	269 928
Year 2020	269 928
Total estimated emission reductions for the specified period (tonnes of CO_2 equivalent)	2 159 424
Average annual estimated emission reductions for the specified period (tonnes of CO_2 equivalent)	269 928

Length of the part of the crediting period during the first commitment period under the Kyoto Protocol is 5 years or 60 months.

Length of the part of the crediting period after the first commitment period under the Kyoto Protocol is 8 years or 96 months.

A.5. Project approval by the Parties involved:

Letter of Endorsement No. 2665/23/7 dated 20/09/2012 was issued by the State Environment Investment Agency of Ukraine.

Under the national Ukrainian procedure Letter of Approval from Ukraine is expected after passing determination of the project.

Written approval of the project by Party involved participating in the JI project except host Party will be received before the first verification of the project.

SECTION B. Baseline

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

Baseline for the JI project has to be set in accordance with Appendix B to decision 9/CMP.1 (JI guidelines)[4], and with further guidance on baseline setting and monitoring developed by the Joint Implementation Supervisory Committee (JISC). In accordance with the Guidance on Criteria for Baseline Setting and Monitoring (version 3)[5] (hereinafter referred to as Guidance), the baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of GHGs that would **occur in the absence of the proposed project**.

In accordance with the Paragraph 9 of the Guidance the project participants may select either: an approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or a methodology for baseline setting and monitoring approved by the Executive Board of the clean development mechanism (CDM), including methodologies for small-scale project activities, as appropriate, in accordance with paragraph 4(a) of decision 10/CMP.1, as well as methodologies for afforestation/reforestation project activities. Paragraph 11 of the Guidance allows project participants that select a JI specific approach to use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tools, as appropriate; or, if necessary, approved CDM methodologies or methodological tools.

The baseline will then include description and justification in accordance with the “Guidelines for users of the Joint Implementation Project Design Document Form”, version 04[6], using the following step-wise approach:

Stage 1. Definition and description of the theoretical approach chosen regarding baseline setting

Project participants have chosen the following approach regarding baseline setting, defined in the Guidance (Paragraph 9):

- An approach for baseline setting and monitoring already taken in comparable JI cases (JI specific approach).

The baseline for this project should be established in accordance with Annex B JI guidelines. In addition, the baseline should be determined by listing and describing the possible future scenarios based on conservative assumptions and choice most plausible from them. Taking into account JI special approach selected for determining the baseline, in accordance with Article 24 of JISC Guidelines, baseline is identified by listing and describing possible future scenarios based on conservative assumptions and choosing one of the most possible.

To determine the most possible future scenario barrier analysis was used.

After analyzing all variants development of the baseline, two scenarios were identified, one of which reflected the project scenario with JI initiatives. To demonstrate additionality of the project clear and transparent information was provided about similarity of approach of additionality demonstration, it was used in those cases where the final determination of the project was held, with the help of which comparative analysis can be performed.

Description of the possible future scenarios of the baseline are based on the following key factors: policies and legislation, directed to reforming of this sector of industry, economic situation in the country and socio-demographic factors in the relevant sectors, stability of demand on coal market, investment, fuel prices and its availability, national and/or subnational expansion plans for the energy sector.

[4] http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2

[5] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[6] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

Stage 2. Application of the approach chosen

Prior to implementation of this project mines of SE "Makiyivvuhillya" met their needs in thermal energy by burning coal in the boilers of different construction and productivity. Because of this heat balance in the mines had significant energy losses in the old disused thermal generation aggregates (low efficiency of boilers). To change the existing situation the following alternative options were considered:

H1: Heat production by burning natural gas;
H2: Heat production by burning fuel oil;
H3: Heat production by burning coal (continuation of existing situation);
H4: Heat production by burning coal mine methane;
H5: Heat production by burning coal mine methane and coal as reserve fuel;
H6: Heat production by electric boilers;
H7: Purchase of thermal energy from external suppliers.

As for treatment of coal mine methane, mines could:

G1: Release coal mine methane into the atmosphere;
G2: Burn coal mine methane at the flare;
G3: Utilize coal mine methane for heat production in the existing boiler house;
G4: Utilize coal mine methane for combined heat and power production;
G5: Utilize coal mine methane as fuel for automobiles.

Detailed description of these alternatives is given below. Analysis of expediency of their implementation is given below it. Key factors that affect the baseline were taken into account:

a) **Sectoral reform policies and legislation.** In order to improve the efficiency in coal mining and increase coal extraction the Ukrainian Coal Program was adopted by the Resolution of Cabinet of Ministers of Ukraine No. 1205 as of 19th of September 2001. It envisioned state support to coal industry, ownership structure change, improvement of safety conditions at mines and decreasing negative environmental impact caused by coal mining. Coal mine methane utilization was not covered by the Program as well as by other relevant regulation documents, namely:
   - Decree of the President of Ukraine No. 26/2002 as of 16th of January 2002 "On urgent activities for improvement of work conditions and development of the state supervision at mining enterprises";
   - Resolution of Cabinet of Ministers of Ukraine No. 939 as of 6th of July 2002 "On adoption of Health and Safety Program at Coal Mines".

Thus, there were no any regulations in place obliging to utilize the gases captured by methane drainage techniques; consequently, the common practice at Ukrainian mines was its venting into the atmosphere.

b) **Economic situation/growth and socio-demographic factors in the relevant sector as well as resulting predicted demand.** In the early 2000's when it was decided to implement the project, the Ukrainian coal industry was going through economic, financial and technical crisis. Coal production as of 1991 amounted to 135.6 million tons, while in 2000 this indicator reached 80.3 million tons. The main problem of Ukrainian coal industry was because of the fact that coal prices did not reflect either the costs of its production or cost of alternative energy sources that were available or potentially available on the territory of Ukraine. Attracting capital in the coal-mining industry was relatively restrained. Until 2000 because of its unprofitability more than 30% of mines did not operate, the practice of financing maintenance at the expense of operating funds existed at other mines, which led to increasing debt from loans and salaries. In early 2001, debt to workers of coal-mining enterprises amounted to 1.9 billion UAH. Together with hazardous working conditions and high death rate among miners, social tension in the region worsened. As for objective factors they include geological conditions of coal production, which become increasingly difficult, low level of technological development of the national coal mining enterprises, high degree of physical and moral deterioration of fixed assets and above all, coal mining equipment. Subjective ones are connected with limited investment resources, low efficiency of management system of the industry in 2002-2005, and incomplete structural changes, and in addition, lack of market mechanism of price formation in coal production and the presence of intermediaries. Specificity of the coal industry requires constant reconstruction of capital assets to ensure effective performance indicators of coal mines. Optimal period should not exceed 20 years during removing flat seams, and 10 years for vertical seams, respectively. So in 2005 the picture of coal industry looked like this: objects of extraction in Ukraine were the oldest ones among coal mining regions of CIS countries [7]. Total 14 mines or 8.5% operate with operation term less than 30 years, 73 mines or 44.5% with operation term from 30 to 50 years, and operation term of 77 mines or 47% exceed 50 years, including 36 mines that work more than 70 years. At the same time 82 mines with a depth of mining operations over 700 m, including 29 mines with a depth of 1000 m. About 60.5% of mines considered hazardous because of the sudden gas emissions. Deterioration of Ukrainian mining production was accompanied by reducing number of coal mining enterprises. In Register of the enterprises of coal industry number of enterprises in the beginning of 2005 was 285 mines, while only 164 of them almost did not take part in the coal production. In 1991 their number totalled 275 mines, the number of mines that operated reduced by 1.7 times. In the absence of new construction as well as reconstruction and modernization of existing mines it was a decrease of coal production in the industry from 135.6 million tons in 1991 to 78.0 million tons in 2005. The only measure that was performed by the state was restructuring – shutting down the enterprises. Because of this, coal production decreased on 5 million tons. Arrears[8] of the state to the miners of Donetsk region was 75.8 million UAH.

As of the 2005 mines were still unprofitable, but the loss declined. The average price of the coal was 5% lower than the average cost of production in 2005, although among state-owned mines, this figure reached 19%. Cost of production at state-owned mines is on 14% higher than the average costs in Ukraine. As of December 1, 2005 coal sector had unpaid debts amounting to 9.4 billion UAH (1.86 billion U.S. dollars). Significant debts share arose because of taxes or salaries to employees. Although the level of debts increased from year to year, the rate of increase slowed since 1996.

It is assumed that the level of coal production and demand is not influenced by the project. Main outcome of the project is on-site heat generation by utilization of CMM. In the absence of the project activity the same amount of heat would be produced by coal combustion, therefore the same level of service as in the project scenario would be offered in the baseline scenario.

c) **Availability of capital (including investment barriers).** SE "Makiyivvuhillya" had no available funds to finance the investment project, which provided performing a number of modernizations. The only incentive for the proposed project implementation was opportunity to receive investments through joint implementation mechanism under the Kyoto Protocol. However attracting investments by IFI's was not possible because of the fact that investment climate of Ukraine was considered risky, capital markets underdeveloped, private capital could be attracted at prohibitively high cost due to real and perceived risks of doing business in Ukraine. This made management of SE "Makiyivvuhillya" seek for solutions requiring minimal investment that could be covered by own funds of the Enterprise, which were very limited.

d) **Local availability of technologies/techniques, skills and know-how and availability of the best available technologies/techniques in the future.** Technologies, skills and know-how for implementation of the project activity were available. Ukraine has more than 130 year history of

[7] http://masters.donntu.edu.ua/2011/iem/pasichka/library/translate.htm
[8] http://ura.dn.ua/07.10.2005/2625.html

coalmining during which research and development base was created. The technology employed was well known; local suppliers of solutions and equipment were available.

e) **Fuel cost and availability.**

All industries of Ukraine widely use natural gas, coal and electricity, and percentage depends on the peculiarities of a particular economic sector. Ukraine has well developed supplying networks, and therefore these energy sources are available for most industrial consumers. The main fuel in the country is natural gas and coal used for electricity generation and in metallurgy. At the moment of decision making Ukraine was very dependent on natural gas imports because domestic production volumes did not cover the needs of industry. Prices for natural gas and electricity were established at the state level and were relatively stable for couple of previous years. Natural gas was mainly imported from Russia; its price for Ukraine was lower than for European countries. Coal was cheaper kind of fuel than natural gas, due to large reserves of this fuel in Ukrainian depths.

f) **National and/or subnational expansion plans for the energy sector, as appropriate.** Implementation of the project increases energy independence of the enterprise that meets the state strategy for energy policy.

g) **National and/or subnational forestry or agricultural policies, as appropriate.** Project realization did not have any relation to any forestry or agricultural policies.

Analysis of options in baseline scenario:

H1: Heat production by burning natural gas

For introduction of this scenario it would be necessary to modernize boilers and boiler aggregates. This requires creating a new technological scheme of boiler houses, installation of special monitoring and measuring devices, the introduction of measures to control static and dynamic parameters of gas mixture, re-equipping of operating chamber of boilers and installing new burners, gas distribution systems, building and valves replacement. Transition from solid to gaseous fuels (natural gas) will reduce the negative impact on the environment, improve technical specifications of boilers. All these activities require significant financial inflows, but on conditions of the total depending of Ukrainian industry from imported natural gas and high prices for it, this variant is not attractive.

H2: Heat production by burning fuel oil

This variant also provides capital re-equipping boiler houses and changing their technological scheme. Besides, it would be necessary to build fuel oil industry, which is very costly measure. Overall, realization of this option was not reasonable regarding availability of other fuels such as natural gas and coal. According to Ukrainian Statistic Committee heavy oil consumption for energy generation in 2000-2009 by overall coal, lignite and peat production sector was close to zero[9].

Compared to natural gas or CMM combustion emission of air pollutants, GHGs and other negative environmental impacts because of implementation of this variant would have increased being still lower than for the case of coal combustion.

H3: Heat production by burning coal (continuation of existing situation)

[9]The State Statistic Committee of Ukraine, Statistical Yearbook "Fuel and energy of Ukraine". For the period 2006-2009, available on the site http://ukrstat.gov.ua/.

This variant provides burning coal in old boilers in order to receive thermal heat. Coal was supplied from the mine "Butivska" to SE "Makiyivvuhillya" at cost price. As the boilers that were used did not require any changes in the technological scheme of the boiler house, implementation of this variant would require no capital investment. None of the barriers could prevent the implementation of this variant. In terms of environmental protection, use of coal as a fuel is not a favourable factor than, for example, burning natural gas. In general, the implementation of this option required fewer costs than other options such as use of natural gas or coal mine methane. According to those economic conditions, under which mines operated at the moment of decision making, the only possible option for implementation was this one. Thus, among other alternatives, implementation of this option was expedient.

H4: Heat production by burning coal mine methane

In this option the thermal energy is produced by CMM combustion in existing reconstructed boilers. In order to implement this option the gas conditioning system would have to be installed, pipelines would have to be built and burners at the boilers would have to be replaced. As using CMM when its concentration in the gases captured by methane drainage techniques is below 25% is dangerous, it poses a risk to the Mine to remain unheated in the periods of low CMM concentrations. Therefore, this option could not have been considered reliable in terms of satisfying heating demand of the mines, therefore was not feasible. In terms of environmental impacts this would cause the least negative impact.

H5: Heat production by burning coal mine methane and coal as reserve fuel

This variant provides heat generation by burning coal mine methane. To implement this variant it was necessary to reconstruct the degassing system, build new vacuum-pump stations, pave pipelines and change burners on boilers. The process of collecting methane-air mixture and its combustion requires compliance with fire safety measures. To ensure reliable operation of boiler houses this variant certainly requires re-equipping of boilers into gas and coal mixture because use of CMM, concentration of which in gases, captured by degassing systems, is less than 25%, is dangerous. When the concentration of methane is lower than 25%, the boilers will work on fossil fuels (coal). The result of implementing this variant will be: firstly, the use of CMM will provide safe labour conditions of miners, secondly, satisfy mine in cheap thermal energy, thirdly, the combustion of methane will significantly reduce the negative impact on environment, because fugitive methane emissions during operation of coal mines are in 21 times worse than carbon dioxide emissions by burning methane. Coal mines will get some independence from foreign energy resources and improve environmental conditions in the region. Using coal as reserve fuel increases the negative impact on the environment. This variant is environmentally attractive, but it requires significant investments in modernization and building, that SE "Makiyivvuhillya" would not be able to implement in 2005 without additional incentives. This measure is unprofitable for the enterprise.

H6: Heat production by electric boilers

Implementation of this scenario will be performed only in case of attracting large investments for large-scale re-equipping of boiler houses and installation of new electric boilers. But financial condition of SE "Makiyivvuhillya" at that time would not allow implementing such modernization. Also having other energy resources available which required less cash for purchase (coal and CMM) turning to electricity was not reasonable. Therefore this option was clearly economically unattractive. Its realization would cause remote indirect environmental impacts related to electricity production: GHG emissions, air pollution, radioactive waste, thermal pollution, etc.

H7: Purchase of thermal energy from external suppliers

In this option the thermal energy is purchased from Makiivka central heating system. Implementation of this scenario would require the construction of 10-15 km of pipelines for steam use of which would be ineffective because of high heat losses. Against the background of high physical deterioration of heat pipelines and low reliability of thermal units, this variant is not reliable, that can lead to suspension of mines. In this case, methane emissions from mines activities will cause negative environmental impact, and the production of thermal energy by urban boiler houses will result in a remote of indirect carbon dioxide emissions into the atmosphere.

Information on alternative scenarios of using coal mine methane in mines of SE "Makiyivvuhillya" is following:

G1: Release coal mine methane into the atmosphere

The approach of throwing captured methane into the atmosphere is the most realistic and possible, because it reflects the existing situation in the enterprise. Such variant does not require any changes or investments. In addition, Ukrainian legislation does not require that mines utilized removed methane, and the only fee for emissions is paid. Implementation of this scenario would result in the most negative impacts on environment, as methane is a greenhouse gas, global warming potential of which equals to 21 thousand of tCO_2eq/tCH_4. By implementing this option, coal mine methane, produced from system of mine degassing, would be directly released into the atmosphere without any destruction. Thus, this option was possible. This is the most environmentally harmful way of all options for treatment of CMM. It involves high level of emissions CH_4, which is greenhouse gas that is also highly inflammable and in interaction with air can form explosive mixtures.

G2: Burn coal mine methane at the flare.

This option provides burning coal mine methane at the flare. It required installation of the flare, which meant additional costs. This variant does not provide any benefits other than additional costs. Installing the torch for burning captured methane is a sufficiently costly measure that does not require any sectoral or national standard. Mine has no meaning in burning CMM, without receiving any profit from this. The only incentive of this measure implementation is economic incentive of JI mechanism under the Kyoto mechanism. This variant is less environmentally harmful than the previous one, as a result of its implementation carbon dioxide pollution would occur with a lower global warming potential than CH_4. However in view of the economic situation of SE "Makiyivvuhillya", this variant was not possible. In the absence of any legislation that obliged to do this and activity that does not involve any profit, mines had no reasons to implement this option. It was inexpedient for the Mine until there were no other incentives such as those provided under JI mechanism.

G3: Utilize coal mine methane for heat production in the existing boiler house.

In this option CMM is combusted in the Mine's boiler house. Utilization of 100% of CMM is not reasonable due lower heat demand of the Mine in summer period. Therefore, the feasible option is partial utilization of the available CMM. In order to implement this option installation of gas conditioning system, pipelines, reserve boiler as a system back-up, and replacement of boiler burners were required.
Realization of this option is environmentally beneficial as it allows reducing GHG emissions and avoids environmental harm caused by combustion of other fossil fuels, such as for example natural gas, which would happen otherwise.

G4: Utilize coal mine methane for combined heat and power production.

This scenario provides installing cogeneration plant that would burn captured CMM and produce heat and electricity. Implementation of this measure is the best in terms of the environmental component, because then CMM would be most effectively used, while not only heat but also electricity would be produced for mines own needs. But this variant was economically not feasible, taking into account that the cost of 1kW of installed capacity of cogeneration plants is about 500-800 U. S. dollars[10], and the needs of one mine of SE "Makiyivvuhillya" is 8-11 MW, i.e., the total investments in this project were significantly higher than all other alternatives. SE "Makiyivvuhillya" was not able to provide the implementation of this project through a difficult financial situation in 2005. In terms of environmental impact, it would be the best option because it would provide the maximum attainable efficiency of using coal mine methane, giving the necessary heat and electricity for the mines.

G5: Utilize coal mine methane as fuel for automobiles.

[10] http://www.madek.ua/product/gas-generating-sets/cogeneration-systems

In this case, CMM would serve as fuel for ICE[11] automobiles. For realization of this scenario it was necessary to build the whole technological complex for the methane enrichment, namely increasing the percentage of methane in the mixture, establishing gas-filling compressor stations, laying pipelines and access roads. All this requires large capital investments that are not feasible due to the fact that the main priority of the Enterprises was receiving thermal heat. Negative environmental impact would be reduced by CMM utilization, but CO_2 emissions from road transport vehicles would increase.

So, all possible scenarios of this project are listed, met the valid Ukrainian legislation. Expedient options for heat production are:

H3: Heat production by burning coal (continuation of existing situation)
H5: Heat production by burning coal mine methane and coal as reserve fuel

Expedient options for CMM utilization are:

G1: Release coal mine methane into the atmosphere
G3: Utilize coal mine methane for heat production in the existing boiler house

If to join them together, we will get the following probable baseline scenarios that could be implemented by the Mine:

Scenario 1: Thermal energy production by coal burning and CMM emissions into the atmosphere (H3+G1) (continuation of existing situation);

Scenario 2: CMM utilization for heat generation in the boiler houses of mines using coal as reserve fuel, and emissions of surplus CMM into the atmosphere (H5+G3) (project scenario without JI incentives).

As shown in Section B.2. of this document, scenario 2 without JI incentives is not attractive, faces obstacles and would not be implemented in comparable circumstances, therefore, the implementation of this scenario was not justified and cannot be considered as baseline scenario.

Conclusion: Scenario 1 is the most appropriate scenario which could be implemented in the absence of the project. Thus, this option is considered the baseline scenario.

This baseline scenario was selected according to the criteria of JISC Guidance:

- Based on specifics of the project.
- Transparent manner on the choice of approaches, assumptions, methodologies, parameters, data sources and key factors are used. All parameters and data are or monitored by the project participants or taken from sources that provide checked data on each parameter. Project participants use approaches proposed by Supervisory Committee Guide and methodological tools of CDM Executive Board;
- Appropriate national and/or sectoral policies and circumstances, such as stimulating sectoral reforms, local fuel availability, plans to expand the energy sector and economic situation in the project area are taken into account. Above analysis shows that the selected baseline represents the most likely future scenario, taking into account the circumstances of Donbas coal industry of today;
- Thus emission reduction units (ERUs) cannot be achieved because of declining activity outside the project boundaries or because of force majeure. Under the proposed approach, emission reduction units will be received only when under the project CMM will be utilized, excluding reductions arising from activities outside the project boundaries.

[11] Internal combustion engines

- Uncertainty is taken into account and conservative assumptions are used. A number of measures for explaining uncertainty and ensuring conservativeness are implemented:

  a) Where possible, the same approaches to calculating baseline emissions levels and emissions from the project implementation are used as in National Inventory Report of Ukraine. In National Inventory Report of Ukraine country-specific emission factors are used that meet the established values of the Intergovernmental Panel on Climate Change (IPCC);

  b) Where possible, default values are used in order to reduce uncertainty and provide calculations by conservative data.

Baseline emissions

To calculate the baseline emissions the following assumptions are made:

1) ERUs are calculated only for coal mine methane, which was actually used for the production of thermal energy, which otherwise would be received by burning coal;
2) It is assumed that CMM will be available by the end of life of mine;
3) The level of production of coal in the mines in the baseline scenario would be the same as in the project scenario;

Baseline emissions come from two main sources:

1) Emissions of methane from degassing system in the atmosphere. This emission source is the major source of emissions in the baseline scenario. Only that amount of methane is taken for calculation, which was utilized in the boiler houses of mines in the project scenario.
2) Carbon dioxide emissions from thermal heat production in the baseline scenario. These emissions are calculated as emissions resulting from the stationary combustion of coal, equivalent to the amount of coal required for generating the amount of heat generated in the project scenario by burning methane.

List of constant values of the parameters used to calculate the baseline emissions are presented below:

Table 11. List of constant values for calculation of baseline emissions

Data / Parameter	***Data unit***	***Description***	***Data Source***	***Value***
GWP_{CH_4}	tCO_2eq/tCH_4	Global warming potential of methane	IPCC Second Assessment Report[12]	21
ρ_{CH_4}	t/m^3	Methane density	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 4: Fugitive Emissions, Page 4.12. Under standard conditions (temperature 20°C; pressure 101325 Pa)[13]. Value was converted from converted $Gg \cdot m^{-3}$ to t/m^3.	0.00067
NCV_{CH_4}	$GJ/1000\ m^3$	Net calorific value of methane	Grigoriev, Zorin “Theoretical Basics of Thermal Engineering”,	35.82

[12] http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf Page 22.

[13] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf

			Volume 2, Table 7.7, Moscow, 1988, p. 367	
η_{coal}	fraction	Efficiency of the boiler before reconstruction during operating on coal	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1[14]	0.8
η_{gas}	fraction	Efficiency of the boiler after reconstruction during operating on coal mine methane	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1[15]	0.92
C_{coal}	t C/t (coal)	Carbon content in coal	Data of laboratory measurements of SE "Makiyivvuhillya"	0.8455
$OXID_{coal,y}$	fraction	Carbon oxidation factor for coal in period y	National Inventory Report of Ukraine 1990-2010, p. 459, 465, 471 (1.A.1.a – Public Electricity and Heat Production)	In 2008 and earlier – 0.963; in 2009 – 0.963; in 2010 and after – 0.962
NCV_{coal}	GJ/t	Net calorific value of coal	Data of laboratory measurements of SE "Makiyivvuhillya"	22.914

Baseline emissions[16] are calculated as follows:

$$BE_y = BE_{MR,y} + BE_{HEAT,y} \qquad (Equation\ 1)$$

where:

BE_y - GHG emissions in the baseline scenario in period y, tCO_2e;

$BE_{MR,y}$ - GHG emissions in the baseline scenario as a result of methane emission into the atmosphere in period y, tCO_2e;

BE_{HEAT} - GHG emissions in the baseline scenario as a result of coal burning for heat generation in period y, tCO_2e.

GHG emissions in the baseline scenario as a result of methane emission into the atmosphere are calculated as follows:

$$BE_{MR,y} = MD_{CH4,y} \cdot \rho_{CH_4} \cdot GWP_{CH_4} \qquad (Equation\ 2)$$

where:

$MD_{CH4,y}$ - Volume of coal mine methane utilized in the boilers in the project scenario in period y, m^3;

ρ_{CH_4} - Methane density, t/m^3;

GWP_{CH_4} - Global warming potential of methane, tCO_2/tCH_4.

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

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

[16] Calculation results are presented in metric tons of carbon dioxide equivalent (tCO_2eq), 1 metric ton of carbon dioxide equivalent equal to 1 metric ton of carbon dioxide (CO_2), i.e. 1 ton of CO_2-eq = 1 ton of CO_2.

GHG emissions in the baseline scenario as a result of coal burning for heat generation, replaced by methane in the project line, are calculated as follows:

$$BE_{HEAT,y} = \frac{\left(\frac{MD_{CH4,y}}{1000} \cdot NCV_{CH_4} \cdot \eta_{gas}\right)}{\eta_{coal}} \cdot \frac{C_{coal} \cdot OXID_{coal,y}}{NCV_{coal}} \cdot \frac{44}{12} \qquad \textit{(Equation 3)}$$

where:

$MD_{CH4,y}$ - Volume of coal mine methane utilized in the boilers in the project scenario in period *y*, m^3;

NCV_{CH_4} - Net calorific value of methane, GJ/1000 m^3;

η_{gas} - Efficiency of the boiler after reconstruction during operating on coal mine methane, ratio;

η_{coal} - Efficiency of the boiler before reconstruction during operating on coal;

C_{coal} - Carbon content in coal, t C/t (coal);

$OXID_{coal,y}$ - Carbon oxidation factor for coal in period *y*, ratio;

NCV_{coal} - Net calorific value of coal, GJ/t;

$\frac{44}{12}$ - Ration between molecular mass of CO_2 and C. Reflect oxidation of C to CO_2.

Key information and data used to establish the baseline are provided below in tabular form:

Table 12. Volume of coal mine methane utilized in the boilers in the project scenario

Data/Parameter	
Data unit	m^3
Description	Volume of CMM, utilized in boilers for heat production in period *y*
Time of determination/monitoring	Periodic monitoring
Source of data (to be) used	Data of reports of the project owner
Value of data applied (for ex ante calculations/determinations)	According to information provided by the project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This is a key parameter that is determined by measuring equipment of the project owner and recorded in the reports
QA/QC procedures (to be) applied	To provide monitoring of this parameter cross-checking between the point of measuring at VPS and boiler house is performed
Any comment	No

Table 13. Methane density

Data/Parameter	ρ_{CH_4}
Data unit	t/m^3
Description	Methane density
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 4: Fugitive Emissions, Page 4.12.

	Under standard conditions (temperature 20°C; pressure 101325 Pa)[17]. Value was converted from converted Gg·m^{-3} to t/m^3.
Value of data applied (for ex ante calculations/determinations)	0.00067
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	Under standard conditions (temperature 20°C; pressure 101325 Pa). Value was converted from converted Gg·m^{-3} to t/m^3.

Table 14. Global warming potential of methane

Data/Parameter	GWP_{CH_4}
Data unit	$tCO_2eq/t\ CH_4$
Description	Global warming potential of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	IPCC Second Assessment Report [18]
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 15. Net calorific value of methane

Data/Parameter	NCV_{CH_4}
Data unit	GJ/1000 m^3
Description	Net calorific value of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Grigoriev, Zorin "Theoretical Basics of Thermal Engineering", Volume 2, Table 7.7, Moscow, 1988, p. 367
Value of data applied (for ex ante calculations/determinations)	35.82
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 16. Efficiency of the boiler after reconstruction during operating on coal mine methane

Data/Parameter	η_{gas}
Data unit	ratio
Description	Efficiency of the boiler after reconstruction during operating on

[17] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf
[18] http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf Page 22.

	coal mine methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1 [19]
Value of data applied (for ex ante calculations/determinations)	0.92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 17. Efficiency of the boiler before reconstruction during operating on coal

Data/Parameter	η_{coal}
Data unit	ratio
Description	Efficiency of the boiler before reconstruction during operating on coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1 [20]
Value of data applied (for ex ante calculations/determinations)	0.8
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 18. Carbon content in coal

Data/Parameter	C_{coal}
Data unit	t C/t (coal)
Description	Carbon content in coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	0.8455
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine "Butivska"
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

Table 19. Carbon oxidation factor for coal in period y

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

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

Data/Parameter	$OXID_{coal,y}$
Data unit	ratio
Description	Carbon oxidation factor for coal in period y
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	National Inventory Report of Ukraine 1990-2010, p. 459, 465, 471 (1.A.1.a – Public Electricity and Heat Production)
Value of data applied (for ex ante calculations/determinations)	In 2008 and earlier – 0.963; in 2009 – 0.963; in 2010 and after – 0.962
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 20. Net calorific value of coal

Data/Parameter	NCV_{coal}
Data unit	GJ/t
Description	Net calorific value of coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE “Makiyivvuhillya”
Value of data applied (for ex ante calculations/determinations)	22.914
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine “Butivska”
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

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

The following step-wise approach is used to demonstrate that GHG emission reductions, resulting from implementation of this project are additional in relation to any other emission reductions:

Step 1. Indication and description of the approach applied

According to Paragraph 44 (b) of the Annex 1 of the Guidance “Guidance on Criteria for Baseline Setting and Monitoring” version 03, additionality can be demonstrated by provision of traceable and transparent information showing that the same approach for additionality demonstration has already been taken in cases for which determination is deemed final and which can be regarded as comparable, using the criteria outlined for baseline determination in paragraph 12 of the Guidance. It was decided to refer to the positively determined project “CMM Utilisation for Heat Generation and Flaring – “Pivdennodonbaska No 3” (ITL Projects ID: UA2000010). This, project already implemented or the one that will be implemented with comparable conditions (the same measures to reduce the negative impact of GHG, the same country, similar technology, similar scale), will have as a result reduction of anthropogenic emissions by sources or enhancement of net anthropogenic removals by sinks that are additional to any that would have been in the absence of the project, and relevant to this project.

Step 2. Application of the approach chosen

The following steps are performed to demonstrate additionality of this project:

Sub step 2a: Description of comparable project where an accredited independent entity has already positively determined that it would result in a reduction of anthropogenic emissions by sources or an enhancement of net anthropogenic removals by sinks that is additional in the absence the project.

The project "CMM Utilisation for Heat Generation and Flaring – "Pivdennodonbaska No 3" was selected as the comparable JI project. Accredited independent entity has already positively determined that it would result in a reduction of anthropogenic emissions by sources or an enhancement of net anthropogenic removals by sinks that is additional to any that would otherwise occur. This determination has already been deemed final by the JISC. Appropriate documentation such as PDD and Determination Report regarding this project is available traceably and transparently on the UNFCCC JI Website:

http://ji.unfccc.int/JIITLProject/DB/69TQLBPSCWNP7XINEPV9K0U24YGPJ5/details

Sub step 2b: Demonstration that the identified project is a comparable project (to be) implemented under comparable circumstances:

In accordance with paragraphs 44 and 12 Guidance on criteria for baseline setting and monitoring, Version 03 we will demonstrate that for both projects:

1) **Both projects propose the same measures of reducing GHG emissions into atmosphere:** utilization of coal mine methane for heat generation is the main measure, which leads to reduction of greenhouse gases. In any case, boundaries of both projects include the same sources of GHG emissions.
2) **Both projects have comparable geography and implementation time:** both projects are implemented in Ukraine, and the difference between the starting dates of the projects is less than five years – 01.01.2006 for this project and 14.02.2006 for comparable project.
3) **Both projects have similar scale**: both projects are JI large scale projects. In both projects, utilization of coal mine methane of comparable scale is implemented. The proposed project has annual capacity of methane utilization at the level of 10 million m^3 of coal mine methane per mine, and comparable project – at the level up to 7.5 million m^3 of coal mine methane per mine[21], in other words, annual capacity of the proposed project does not exceed the annual capacity of comparable project more than 50%.
4) **Both projects were implemented in the same regulatory conditions.** Regulatory and legal framework and general regulatory practice between the starting dates of the projects did not change so that these changes influenced the projects baseline.

Thus the criteria identified by the Guidance are satisfied and the identified project is indeed a comparable projects implemented under comparable circumstances.

Step 3: Justification why determination of the comparable project refers to this project

The project "CMM Utilisation for Heat Generation and Flaring – "Pivdennodonbaska No 3" and the proposed project are implemented within the same geographic region of Ukraine – the Donbas coal mining region. The implementation timeline is quite similar. Projects will share the same investment profile and market environment. The investment climate will be comparable in both cases with the coal sector being an almost non-profitable sector in Ukraine[22] burdened by many problems. Ukrainian coal sector is largely state-controlled. Energy and Coal Ministry of Ukraine decides production level of state mines, based on their performance. After this, state controlled mines sell their coal to the state Trading Company "Coal of Ukraine". This company also buys coal from private mines and arranges supply of

[21] http://ji.unfccc.int/UserManagement/FileStorage/DJGXQI47LFR91WOPNZBC8HTYKV3S5A

[22] http://www.necu.org.ua/wp-content/plugins/wp-download_monitor/download.php?id=126

coal to thermal electricity companies. Prices for coal mines differ significantly for public and private mines[23].

Both projects also share the investment climate of Ukraine which is far from being favourable. Ukraine is considered to be a high risk country for doing business and investing in. Almost no private capital is available from domestic or international capital markets for mid to long term investments, and any capital that is available has high cost. The table below represents risks of doing business in Ukraine according to various international indexes and studies.

Table 21. International ratings of Ukraine

Indicators	2008	2011	Note
Corruption index of Transparency International [24]	134 position from 180	152 position from 182	Index of corruption
Rating of business practices of The World Bank (The Doing Business) [25]	139 position from 178	145 position from 183	Rating of conduct of business (ease of company opening, licensing, staff employment, registration of ownership, receipt of credit, defence of interests of investors)
The IMD World Competitiveness Yearbook[26]	54 position from 55	57 position from 59	Research of competitiveness (state of economy, efficiency of government, business efficiency and state of infrastructure)
Index of Economic Freedom of Heritage Foundation[27]	133 position from 157	163 position from 179	Determination of degrees of freedom of economy (business, auction, financial, monetary, investment, financial, labour freedom, freedom from Government, from a corruption, protection of ownership rights)
Global Competitiveness Index of World Economic Forum [28]	72 position from 134	82 position from 142	Competitiveness (quality of institutes, infrastructure, macroeconomic stability, education, development of financial market, technological level, innovative potential)

The data above shows that both real and perceived risks of investing in Ukraine are in place and influence the availability of capital in Ukraine both in terms of size of the investments and in terms of capital costs. Comparison of commercial lending rates in Ukraine and in the euro zone for loans for 5 years in Euros is presented in the figure below:

[23] http://www.ier.com.ua/files/publications/Policy_papers/German_advisory_group/2009/PP_09_2009_ukr.pdf

[24] http://cpi.transparency.org/cpi2011/in_detail/

[25] http://www.doingbusiness.org/rankings

[26] http://www.imd.org/research/publications/wcy/upload/scoreboard.pdf

[27] http://www.heritage.org/index/ranking

[28] http://reports.weforum.org/global-competitiveness-2011-2012/

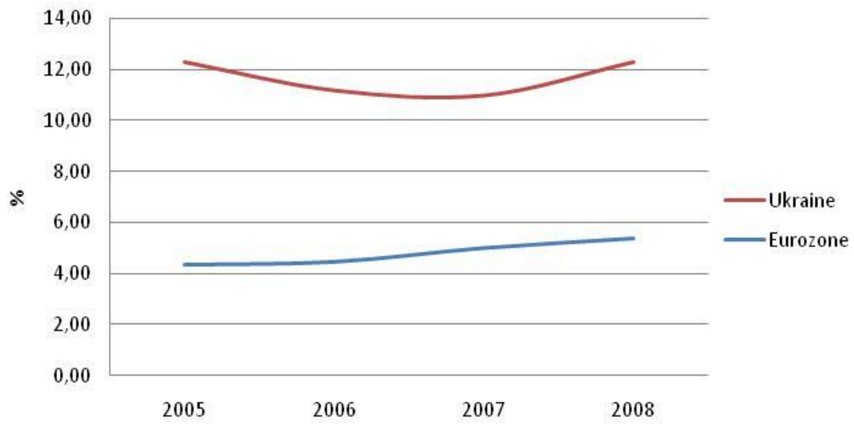

Figure 7. Commercial lending rates, Euros, for four years

As stated at the OECD Roundtable on Enterprise Development and Investment Climate in Ukraine, the current legal basis is not only inadequate, but to a large extent it sabotages the development of market economy in Ukraine. Voices in the western press can basically be summarized as follows: The reforms in the tax and legal systems have improved considerably with the adoption of the commercial Code, Civil Code and Customs Code on 1 January 2004 and new Tax Code on 1 January 2011 but still contain unsatisfactory elements and pose a risk for foreign investors[29]. Ukraine is considered to be heading in the right direction with significant reforms having been put into action but still has a long way to go to realize its full potential. Frequent and unpredictable changes in the legal system along with conflicting and inconsistent Civil and Commercial Codes do not allow for a transparent and stable enforced legal business environment. This is perceived as a great source of uncertainty by international companies, which make future predictions of business goals and strategy risky.

The conclusion from the abovementioned is as follows: the investment climate of Ukraine is risky and unwelcoming, private capital is not available from domestic or international sources or available at prohibitively high cost due to real and perceived risks of doing business in Ukraine as shown by various sources. Alternatives markets, such as Russia, offer similar profile of investment opportunities with lower risk and better business environment.

Subject to the above information, we can conclude that determination of the project "CMM Utilisation for Heat Generation and Flaring – "Pivdennodonbaska No 3" is relevant for this project.

Outcome of the analysis: This section of PDD gives traceable and transparent information that has received positive determination by accredited independent entity that comparative project "CMM Utilisation for Heat Generation and Flaring – "Pivdennodonbaska No 3" (ITL Projects ID: UA2000010) is implemented under comparable circumstances (same GHG mitigation measure, same country, similar technology, similar scale) would result in a reduction of anthropogenic emissions sources or an enhancement of net anthropogenic removals by sinks that is additional to any that would otherwise occur and have provided justification on why this determination is relevant for the project at hand. Therefore, this project is additional.

[29] Foreign Direct Investment in Ukraine - Donbas, Philip Berrys, Problems of Foreign Economic Relations Development and Attraction of Foreign Investments: Regional Aspect, ISSN 1991-3524, Donetsk, 2007, p. 507-510

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

The project activity is limited by the volume of coal mine methane consumption in the boiler houses of mines of SE "Makiyivvuhillya". In the project scenario CMM from vacuum-pump station is supplied to the boiler house where it is burned in boilers in order to receive thermal energy.

According to the baseline for meeting the needs of mines only coal is used in thermal energy. Methane gas from vacuum-pump station is vented into the atmosphere.

The table below shows an overview of all sources of the baseline and project scenarios. The project boundaries are depicted in accordance with the provisions of Articles 13 and 14 of the JISC Guidance.

Table 22. Demonstration of emission sources

	Source	GHG	Incl./ Excl.	Justification/Explanation
Baseline scenario	GHG emissions in the baseline scenario as a result of methane emission into the atmosphere	CH_4	Incl.	Main source of emissions. For calculations only the volume of coal mine methane is taken that is utilized in the project scenario.
	GHG emissions in the baseline scenario as a result of coal burning for heat generation	CO_2	Incl.	Main source of emissions. For calculations only the amount of heat is taken produced by methane in the project scenario.
		CH_4	Excl.	Considered negligible. Conservative comment
		N_2O	Excl.	Considered negligible. Conservative comment
Project scenario	Emissions from utilization of non-methane hydrocarbons (NMHC)	CO_2	Excl.	NMHC emissions are less than 1% of the volume of extracted coal mine gas. Therefore, they were excluded to estimate emission reductions. However, it will be regular monitoring of percentage of NMHC. If their level is higher than 1%, such emissions will be included.
	GHG emissions as a result of surplus methane emissions in the atmosphere	CH_4	Excl.	Excluded for simplification. For calculations of emission reductions is taken only the volume of CMM that is utilized in the project scenario. The project will not affect the way of the treatment of surplus methane.
	GHG emissions in the baseline scenario as a result of electricity consumption for equipment degassing and boiler houses operating	CO_2	Excl.	Excluded for simplification. Degassing and providing thermal energy is required process during coal mining, so equipment will operate regardless of the project.
		CH_4	Excl.	Considered insignificant.
		N_2O	Excl.	Considered insignificant.
	Emissions related to methane combustion in boilers	CO_2	Incl.	Main source of emissions.
	Methane emissions which were not	CH_4	Excl.	Considered insignificant.
		N_2O	Excl.	Considered insignificant.

	burned because of incompleteness of combustion in boilers chamber	CH_4	Incl.	Main source of emissions.

Baseline scenario

Baseline scenario is the continuation of existing situation. CMM is vented through the ventilation system to the atmosphere and heat energy is received by burning fossil fuels (coal). Degassing systems of coal mines and boiler houses are included to the boundaries of the baseline scenario.

Sources of emissions in the baseline scenario are:

- Baseline emissions related to the methane emission into the atmosphere by ventilation system of mines in period *y*;
- Baseline emissions related to thermal energy generation by combustion of coal, replaced in the project scenario in the period *y*;

Project scenario

Project scenario provides utilization of captured CMM in boilers for thermal energy generation for the needs of coal mines and also to reduce coal consumption by its replacement on CMM.

Sources of emissions in the baseline scenario are:

- GHG emissions in the baseline scenario as a result of methane emission into the atmosphere;
- GHG emissions in the baseline scenario as a result of coal burning for heat generation.

Leakage

The only theoretical leakages of the project may be fugitive methane emissions during coal mining. Coal production, which is extracted at the mine "Butivska" and supplied to the mines of SE "Makiyivvuhillya" for combustion in reserve boilers, can lead to methane release and its emitting through the ventilation system into the atmosphere. These leakages are considered insignificant and are excluded from consideration for simplification.
For demonstration of the project boundaries as well as the emissions sources in the baseline and project scenarios are given the following figures:

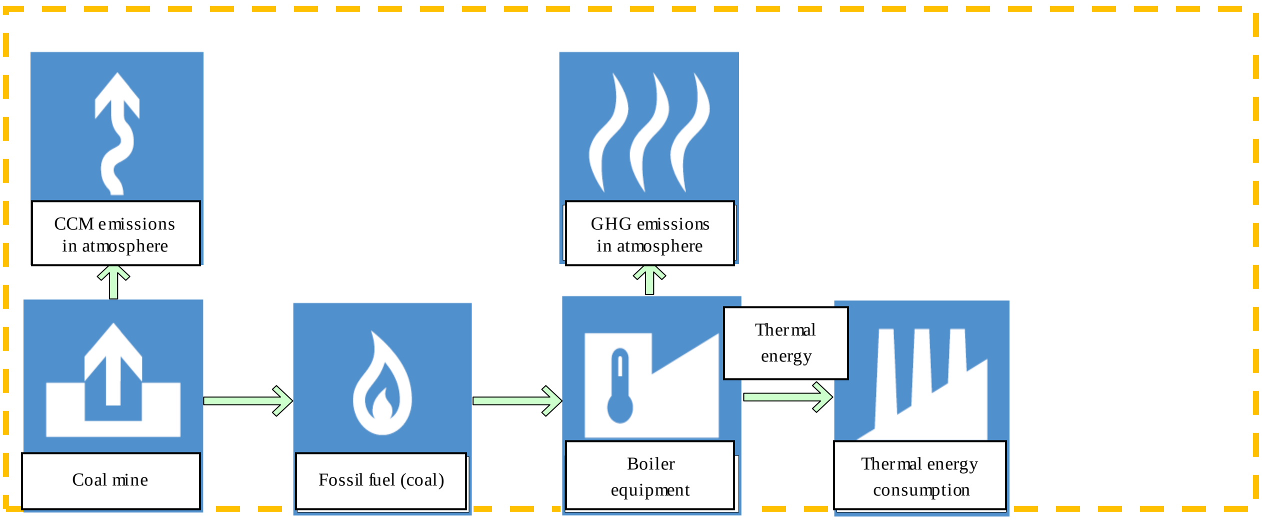

Figure 8. Boundaries of the baseline scenario

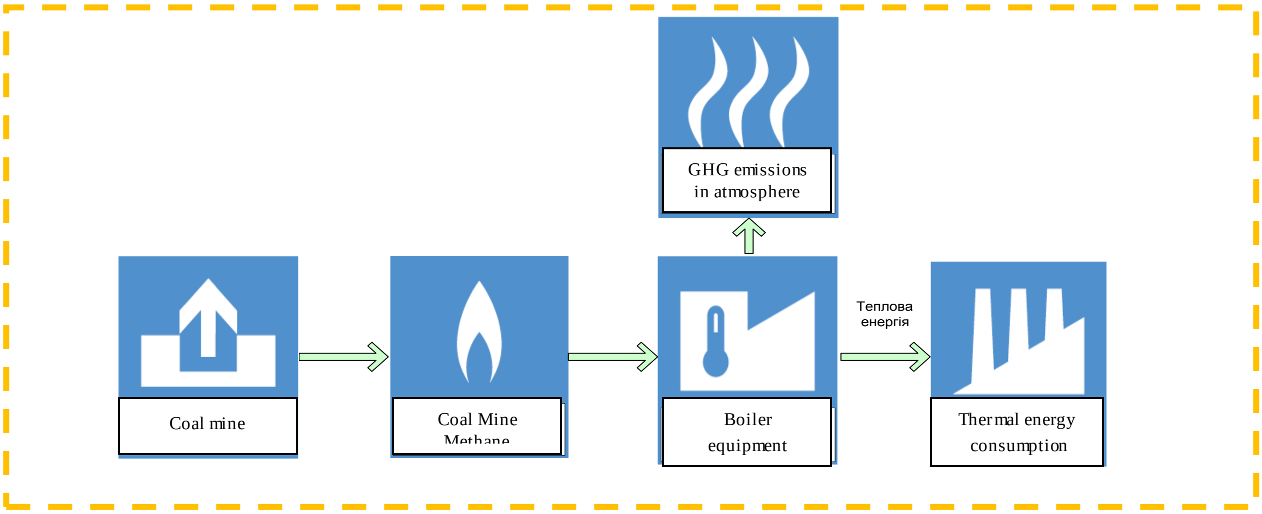

Figure 9. Boundaries of the project scenario

B.4. Further baseline information, including the date of baseline setting and the names of the persons/entities setting the baseline:

Date of baseline setting: 07/08/2012.

Name of person/entity setting the baseline:

Baseline studies were implemented by “SPA “Energometan” LLC, not a project participant.

Contact information:

Company name:	“SPA “Energometan” LLC
Company address:	Ukraine, 86123, Donetsk region, Makiivka, Taigova Street, 1
Contact person:	
Name:	Makarenko Serhiy Vasyliovych
Title:	Director
Phone:	+38(050) 422-45-65
Fax:	+38(050) 422-45-65
Name:	msv@energometan.com

SECTION C. Duration of the project/crediting period

C.1. Starting date of the project:

Starting date of the project is 14th of December 2004 which is the date of preparatory works for the project implementation start-up.

C.2. Expected operational lifetime of the project:

The lifetime of the project is estimated to last until 31.12.2020. Thus the operational lifetime of the project will be 15 years or 180 months.

C.3. Length of the crediting period:

Starting date of the crediting period: 01.01.2006.
End of the crediting period: 31.12.2020
Length of the crediting period: 15 years or 180 months.
Including:

- length of the part of crediting period during the first commitment period under the Kyoto Protocol: 5 years or 60 months (01.01.2008-31.12.2012);
- length of the part of crediting period before the first commitment period under the Kyoto Protocol: 2 years or 24 months (01.01.2006-31.12.2007)
- length of the part of crediting period after the first commitment period under the Kyoto Protocol is 8 years or 96 months (01.01.2013-31.12.2020).

Starting date of emission reductions generation: 01.01.2006 – the beginning of the boiler operation on the coal mine methane. Starting date of generating emission reduction units: 01.01.2008 – beginning of the first commitment period under the Kyoto Protocol.

Emission reductions generated after the crediting period may be used in accordance with an appropriate mechanism under the UNFCCC. The crediting period can extend subject to the approval by the Host Party.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Description and explanation of the monitoring plan chosen a step-wise approach is used:

Step 1. Indication and description of the approach chosen regarding monitoring

Option *a* provided by the "Guidelines for users of the Joint Implementation project design document form" version 04[30], JI specific approach is used for this project and therefore will be used for establishment of a monitoring plan.

The monitoring plan will provide for:

1. *Collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions by sources of GHGs occurring within the project boundary during the crediting period*:

   For monitoring data under the project clear and reliable management structure will be identified to establish the division of responsibilities, and also relevant services at the enterprise are defined. Created services of the plant will collect relevant data in the form of technical reports and other statistical documents. All monitored data will be stored both electronically and in hard copy. The data will be archived and kept at least 2 years after last transfer of emission reduction units.

2. *Collection and archiving of all relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary during the crediting period*:

   For collecting this information, technical reports, acts of laboratory measurements, control measurements and calculations will be used. Monitoring data will be stored both electronically and in hard copy, and also will be archived and kept at least 2 years after last transfer of emission reduction units.

3. *Identification of all potential sources of, and the collection and archiving of data on increased anthropogenic emissions by sources of GHGs outside the project boundary that are significant and reasonably attributable to the project during the crediting period:*

   During the project activity no leakages are expected.

4. *Quality assurance and control procedures for the monitoring process:*

   The quality of collected data will be secured by conducting regular calibrations of applied meters and sensors. Calibration interval will be chosen as per passport or technical manual data. The regional representative of State Metrological System of Ukraine accompanied by energy department of the plant will be responsible for calibration procedures. If any malfunction is done, the meter will be displaced with similar one in accordance with industry standards of Ukraine. It will be set control over the technical condition of the measuring equipment from the side of staff of this company.

30 http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

5. *Procedures for the periodic calculation of the reductions of anthropogenic emissions by sources by the proposed JI project, and for leakage effects, if any*:

During the project implementation leakages outside the project boundaries are not expected. Fugitive methane emissions may be the only potential source of emissions beyond the project boundaries during coal extracting at the mine "Butivska", which is consumed by other mines of SE "Makiyivvuhillya". However, the amount of coal consumed under the project is not significant, so this source of emissions is not taken into account. In the case of substantial growth in coal consumption for any reason, this source of emissions will be taken into account.

Step 2. Application of the chosen approach

Key factors that affect the level of emissions under the project and under the baseline scenario are taken into consideration and detailed in section B.1. Project activity will include monitoring of greenhouse gas emissions in the project and baseline scenarios. Detailed information on the sources of emissions in the project and baseline scenario is shown below.

The data on monitoring of greenhouse gas emissions will be archived appropriately and kept at least 2 years after last transfer of ERUs.

Baseline scenario

The baseline scenario is the continuation of the existing situation. Coal mine methane is released to the atmosphere and thermal energy is received by burning fossil fuels (coal). Degassing systems of coal mines and boiler houses are included to the boundaries of baseline scenario.

Sources of emissions in the baseline scenario are:

- GHG emissions in the baseline scenario as a result of methane emission into the atmosphere;
- GHG emissions in the baseline scenario as a result of coal burning for heat generation.

Project scenario

Project scenario implies utilization of captured coal mine methane in boilers to produce thermal energy for the needs of the coal mines and to reduce coal consumption due to its replacement by CMM.

Sources of emissions in the project scenario are:

- GHG emissions in the project scenario as a result of methane combustion in the boilers;
- GHG emissions in the project scenario as a result of incomplete methane combustion.

Emission reductions as a result of project implementation will be achieved by two main sources:

- Reducing GHG emissions due to CMM release in the atmosphere;
- Reducing GHG emissions due to the coal combustion for heat receiving.

For any monitoring period, data on the following parameters should be collected and recorded:

1. Volume of CMM, utilized in boilers in the project scenario in period *y*

Reported data of the company are used for measuring this parameter. Indications are used for reporting, including to public authorities. To determine this parameter indications of the primary measuring devices are used which are installed at the vacuum-pump station (VPS). These devices measure dynamic pressure and temperature of the mixture methane-air as well as methane concentration. The values of gas volume reduced to standard conditions (temperature 20 ° C, pressure 101325 Pa). Primary data are made by the operator of the measurement point to the special journal. Flow of degassed gas at VPS is calculated using the method of Pitot tube, i.e. the value of gas flow volume depends on the pressure drop at the site of the installed diaphragm. Primary data are logged every hour. By the method of summation daily, monthly and annual technical reports are prepared. The data are stored in electronic and paper forms. Crosscheck is conducted between measurement points at VPS and at the relief devices of boiler houses.

Data and parameters that were not monitored during the whole crediting period, are determined only once (and remain constant during the whole crediting period) and are available at the stage of determination of the PDD, are listed in the table below:

Table 23. Methane density

Data/Parameter	ρ_{CH_4}
Data unit	t/m^3
Description	Methane density
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 4: Fugitive Emissions, Page 4.12. Under standard conditions (temperature 20°C; pressure 101325 Pa)[31]. Value was converted from converted $Gg{\cdot}m^{-3}$ to t/m^3.
Value of data applied (for ex ante calculations/determinations)	0.00067
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	Under standard conditions (temperature 20°C; pressure 101325 Pa). Value was converted from converted $Gg{\cdot}m^{-3}$ to t/m^3.

[31] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf

Table 24. Global warming potential of methane

Data/Parameter	GWP_{CH_4}
Data unit	$tCO_2eq/t\ CH_4$
Description	Global warming potential of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	IPCC Second Assessment Report [32]
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 25. Net calorific value of methane

Data/Parameter	NCV_{CH_4}
Data unit	GJ/1000 m^3
Description	Net calorific value of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Grigoriev, Zorin "Theoretical Basics of Thermal Engineering", Volume 2, Table 7.7, Moscow, 1988, p. 367
Value of data applied (for ex ante calculations/determinations)	35.82
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

[32] http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf Page 22.

Table 26. Efficiency of the boiler after reconstruction during operating on coal mine methane

Data/Parameter	η_{gas}
Data unit	ratio
Description	Efficiency of the boiler after reconstruction during operating on coal mine methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1[33]
Value of data applied (for ex ante calculations/determinations)	0.92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 27. Efficiency of the boiler before reconstruction during operating on coal

Data/Parameter	η_{coal}
Data unit	ratio
Description	Efficiency of the boiler before reconstruction during operating on coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1[34]
Value of data applied (for ex ante calculations/determinations)	0.8
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value

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

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

QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 28. Carbon content in coal

Data/Parameter	C_{coal}
Data unit	t C/t (coal)
Description	Carbon content in coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE “Makiyivvuhillya”
Value of data applied (for ex ante calculations/determinations)	0.8455
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine “Butivska”
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

Table 29. Carbon oxidation factor for coal in period y

Data/Parameter	$OXID_{coal,y}$
Data unit	ratio
Description	Carbon oxidation factor for coal in period *y*
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	National Inventory Report of Ukraine 1990-2010, p. 459, 465, 471 (1.A.1.a – Public Electricity and Heat Production)
Value of data applied (for ex ante calculations/determinations)	In 2008 and earlier – 0.963; in 2009 – 0.963; in 2010 and after – 0.962
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source

Any comment	No

Table 30. Net calorific value of coal

Data/Parameter	NCV_{coal}
Data unit	GJ/t
Description	Net calorific value of coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	22.914
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine "Butivska"
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

Table 31. CO_2 emission factor by methane combustion

Data/Parameter	CEF_{CH4}
Data unit	t CO_2/tCH_4
Description	CO_2 emission factor by methane combustion
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	44/16=2.75
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Ration between molecular mass of CO_2 and CH_4. Reflect oxidation of CH_4 with formation of CO_2.
QA/QC procedures (to be) applied	Accepted fixed
Any comment	No

Table 32. Efficiency of methane destruction/oxidation of heat generating equipment

Data/Parameter	Eff_{HEAT}
Data unit	ratio
Description	Efficiency of methane destruction/oxidation of heat generating equipment
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reference Manual, Table 1.6, p. 1.29[35]
Value of data applied (for ex ante calculations/determinations)	0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Accepted according to data source
QA/QC procedures (to be) applied	Accepted fixed
Any comment	No

The 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.

Parameters such as net calorific value of coal, carbon content in coal, carbon oxidation factor for coal, presented in the above tables may be reviewed at the stage of monitoring according to new publications of relevant documents containing this information.

The data and parameters that are monitored throughout the crediting period:

These data are given in the Sections D.1.1.1. and D.1.1.3. of this project design document.

Measuring devices

Vacuum-pump station. Machinist of vacuum-pump station collects data on accounting of volumes of degassed mixture 1 time per minute. For this accounting, the following devices are needed:

- Vacuum gauge – dilution in the pipeline;

[35] http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref2.pdf

- U-shaped differential pressure gauge – pressure drop at the diaphragm;
- Thermometer – temperature of methane air mixture;
- Manometer – pressure created by vacuum pumps in the pressing pipeline;
- Gas analyzer – percentage content of methane in the degassed mixture;
- Barometer – atmospheric pressure.

Boiler house of the mine. Boiler house operator 1 time per minute collects data on the volume of surplus gas emitted through relief device. For this accounting, the following devices are needed:

- U-shaped differential pressure gauge – pressure drop at the diaphragm;
- Thermometer – temperature the methane-air mixture;
- Manometer – pressure of the methane-air mixture;
- Gas analyzer – percentage content of methane in the methane-air mixture;
- Barometer – atmospheric pressure.

More detailed scheme of metering units of methane volumes for each mine are presented in Annex 4.

Calibration of measuring devices and equipment

Calibration of measuring instruments is performed periodically, in accordance with the technical regulations of the Host party. Calibration should be carried out by authorized representatives of the State Metrology Service of Ukraine.

At each mine in PW on AP sites and Boiler house documentation on accounting of terms of calibration of monitoring measuring devices in accordance with applicable law. Calibration is performed by the State Centre of Standardization, Metrology and Certification.

Chief (Mechanic) of PW on AP sites is responsible for calibration and record keeping on accounting of terms of monitoring measuring devices calibration at the vacuum-pump station. Heating engineer is responsible for calibration and record keeping on accounting of terms of monitoring measuring devices calibration in the boiler house. Mechanic of ventilation and safety sites is responsible for calibration and record keeping on accounting of terms of gas analyzer calibration both at vacuum-pump station, and at the boiler house.

Compliance of monitoring procedures with the standard ones in the industry

Used monitoring procedure corresponds to the standard procedures for the projects of this type and common practice in the industry.

The monitoring approach in this project is fully consistent with the standard ones in the industry and includes monitoring of the coal mine methane amount that was utilized in the boilers in the project scenario.

Consideration of uncertainties and ensure of conservativeness

Carbon content in coal, which is used as fuel for boiler houses in the baseline scenario, is taken in accordance with the certificate of genetic, technological and qualitative characteristics of # 94 for coal production "coal GR 0-200 mm" mine "Butivska" of SE "Makiyivvuhillya".

Certificate is issued by SE "UKRNDIVUGLEZBAGACHENNYA" based on laboratory studies. Scientific and Research Coal Chemistry Laboratory SE "UKRNDIVUGLEZBAGACHENNYA" is accredited according to the requirements of DSTU ISO/IEC 17025:2005 certificate No. 211820. Characteristics of coal according to this study are used for commercial purposes of the enterprise, so uncertainty of the results is low.

Value of methane density was selected for the standard conditions of temperature and pressure. The registration system of volumes of utilized methane-air mixture causes the volume of gas measured under real conditions of registration of data to standard conditions. For this purpose the system performs measurements of temperature and pressure of methane-air mixture.

Uncertainty and used conservative assumptions are taken into consideration. Number of measures for explaining uncertainty and ensuring conservatism were implemented:

- If possible, the same approaches to calculating levels of baseline emissions and emissions from project implementation are used that are National Inventory Report of Ukraine. Country-specific emission factors that meet set values of Intergovernmental Panel on Climate Change (IPCC) are used in National Inventory Report;
- If possible, default values are applied in order to reduce uncertainty and provide calculations by conservative data.

Archiving, data storage and record handling procedure

Documents and reports on the data that are monitored will be archived and stored by the project participants. All machinists of vacuum-pump stations and operators of the boiler houses are responsible for the storage of data on accounting of degassed, recycled and emitted at the relief device of methane. Besides, chief of PW on AP sites and heating engineer prepare standardized daily, weekly, monthly, quarterly and annual reports on extraction, utilization and venting methane. Chief engineer of the mine performs general management on accounting extraction, use and emissions of methane from degassing. Ecologist of the mine sends data on accounting extraction, use and emissions of methane from degassing to the chief engineer of the mine. Chief of PW on AP sites sends data on the amount of methane of degassing, extracted and transferred to the boiler house, to ecologist of the mine. Heating engineer sends data on the amount of methane of degassing, used and emitted at the "candle", to ecologist of the mine. Daily management at the sites is performed by the chief PW on AP sites and by heating engineer. Chief of PW on AP sites controls all data at VPS on the amount of methane of degassing, extracted and transferred to the boiler house, parameters of the workflow, daily logging "Journal of Work Accounting of VPS". Heating engineer controls data at the boiler house on the amount of methane of degassing used and emitted at the relief device ("candle") parameters of the workflow, thermal energy output, daily logging "Journal of Accounting methane gas to the "candle".

All information is transferred to ecologist of the mine. On the basis of the given information ecologist of the mine prepares monthly, quarterly and annual reports on extraction, use and venting of methane of degassing.

All necessary data will be stored both electronically and in hard copy. This documentation and other monitoring data required for determination and verification, as well as any other data monitored and required for verification shall be stored for two years after the last transfer of ERUs within the project. If the expected data for monitoring regarding the quantity of the coal mine methane utilized in the boilers in the project scenario is not available (which are used for the calculation of baseline emissions and project emissions), they will not be taken into account and the reduction will not be considered. This is conservative.

Training of monitoring personnel

At the SE "Makiyivvuhillya" mines clear and organized scheme of personnel training and system of workplace certification works. Every employee passes periodic examination of knowledge on safety and professional standards. Acquiring the necessary skills and knowledge is ensured by local technical and vocational system of education and training. In Ukraine this system is under the state supervision. After vocational school employees receive standard certificate in vocational education. Workers with appropriate training may be allowed to work with such industrial equipment. Company management, where the project is implemented, should provide the appropriate level of professional training, which will allow it to work on certain equipment.

Training safety is obligatory and should be conducted for all project personnel in accordance with local regulations. The procedure for training safety includes training area, training interval, form of education, knowledge tests. Management of the enterprise, where the project is implemented, should ensure the maintenance registration records on such training and periodic inspections of knowledge.

Activity that is directly related to the conduct of monitoring does not require special knowledge, except those relating to the field of vocational training. Thus, the personnel responsible for monitoring implementation receive appropriate training on procedures and monitoring requirements, as well as training and consultations on the Kyoto Protocol, JI projects and monitoring.

Procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting

In case of any errors, unscrupulous acts or contradictions that will be identified during the monitoring process, special commission, which will investigate such cases and give order, will be appointed management of the enterprise, where the project is implemented, the order will include also provisions on the necessary corrective actions that have to be implemented and will help to avoid such situations in the future.

Management of the enterprise, where the project is implemented, should establish a communication channel, which would enable submission by any person, related to monitoring implementation, suggestions, improvements, and ideas for more accurate monitoring in the future. All proposals will be sent to the top management of the enterprise, which must review all the proposals and, if necessary, to implement necessary corrective actions and improvements. The project owner will conduct periodic analysis of the monitoring plan and procedures, and if necessary, will offer corresponding improvements to other project participants.

Procedures that will be implemented in case if expected data from any sources are not available

For data and parameters, monitoring of which is not made during the whole crediting period, and the values are determined only once (and remain unchanged during the whole crediting period) and are available or unavailable at the stage of determination of the PDD, the values indicated in the PDD are used. If updated data are not available, the most recent precise data are used (for example, of the previous period).

For data and parameters, which are monitored during the whole crediting period, standard procedures in this sector for each data type are used. For example cross-checking with suppliers, receiving estimated values, averaging etc. In each case, changing the method of receiving data will be recorded and displayed in the monitoring report. If flowmeters are not available through their calibration or repair, average indicators for the previous three days will be used. The maximum allowed period of flowmeter absence is 3 days.

Emergency preparedness for cases where emergencies can cause unintended emissions

Project activity does not involve any factors or emergencies that may lead to unexpected GHG emissions. Safety of equipment and personnel work is ensured by systematic conducting of instruction on safety. Actions order in case of general emergencies, such as fire, serious equipment failure, etc., is developed as obligatory part of the regulations on entrepreneurial activity in accordance with applicable law.

In case of breakdown of CMM supply system (either of whole system or separate feeding pipe) methane-air mixture will be urgently released into atmosphere through the emergency gas vent stack. The shut-off valves will automatically close CMM supply pipes to boiler house. In case of emergency in the boiler house the CMM supply there will be immediately terminated. Consequently, CMM consumption will not be measured due to the absence of CMM flow to the boiler house, therefore emission reductions will be earned for only the share of CMM which was actually utilized and burned.

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

Project participants selected this option to monitor emission reductions under the project.

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

Data/Parameter	$MD_{CH4,y}$
Data unit	m^3
Description	Volume of CMM, utilized in boilers for heat production in period *y*
Time of determination/monitoring	Periodic monitoring
Source of data (to be) used	Data of reports of the project owner
Value of data applied (for ex ante calculations/determinations)	According to information provided by the project owner
Justification of the choice of data or	This is a key parameter that is determined by measuring equipment of the project owner and recorded in the reports

description of measurement methods and procedures (to be) applied	
QA/QC procedures (to be) applied	To provide monitoring of this parameter cross-checking between the point of measuring at VPS and boiler house is performed. Definition method – measured/calculated. Recording frequency – continuously with monthly reports. Volume of data to be monitored – 100%. Keeping method – electronic and paper archives.
Any comment	Value of gas volume is brought to standard conditions (temperature 20°C, pressure 101325 Pa).

Also for monitoring project emissions data listed in Tables 23, 24, 31 and 32 above are collected and used.

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

Project emissions[36] are calculated as follows:

$$PE_y = PE_{MD} + PE_{UM} \qquad \textit{(Equation 4)}$$

where:

PE_y - GHG emissions in the project scenario in period *y,* tCO_2e;

PE_{MD} - GHG emissions in the project scenario as a result of methane combustion in the boilers in period *y*, tCO_2eq;

PE_{UM} - GHG emissions in the project scenario as a result of incomplete methane combustion in period *y,* tCO_2eq;

GHG emissions in the project scenario as a result of methane combustion in the boilers are calculated as follows:

$$PE_{MD} = MD_{CH_4} \cdot \rho_{CH_4} \cdot CEF_{CH4} \cdot Eff_{HEAT} \qquad \textit{(Equation 5)}$$

where:

$MD_{CH4,y}$ - Volume of CMM, utilized in boilers in the project scenario in period *y*, m^3;

[36] Calculation results are presented in metric tons of carbon dioxide equivalent (tCO_2e), 1 metric ton of carbon dioxide equivalent is equal to 1 metric ton of carbon dioxide (CO_2), i.e. 1 tCO_2eq = 1 tCO_2.

ρ_{CH_4} - Methane density, t/m^3;

CEF_{CH4} - CO_2 emission factor by methane combustion, t CO_2/т CH_4

Eff_{HEAT} - Efficiency of methane destruction/oxidation of heat generating equipment, ratio.

GHG emissions in the project scenario as a result of incomplete methane combustion are calculated as follows:

$$PE_{UM} = MD_{CH_4} \cdot \rho_{CH_4} \cdot (1 - Eff_{HEAT}) \cdot GWP_{CH_4} \qquad \text{(Equation 6)}$$

where:

$MD_{CH4,y}$ - Volume of CMM, utilized in boilers in the project scenario in period *y*, m^3;

ρ_{CH_4} - Methane density, t/m^3;

Eff_{HEAT} - Efficiency of methane destruction/oxidation of heat generating equipment, ratio.

GWP_{CH_4} - Global warming potential of methane, $tCO_2e/t\ CH_4$.

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

Data/Parameter	$MD_{CH4,y}$
Data unit	m^3
Description	Volume of CMM, utilized in boilers in the project scenario in period *y*
Time of determination/monitoring	Periodic monitoring
Source of data (to be) used	Data of reports of the project owner
Value of data applied (for ex ante calculations/determinations)	According to information provided by the project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This is a key parameter that is determined by measuring equipment of the project owner and recorded in the reports
QA/QC procedures (to be) applied	To provide monitoring of this parameter cross-checking between the point of measuring at VPS and boiler house is performed.

	Definition method – measured/calculated. Recording frequency – continuously with monthly reports. Volume of data to be monitored – 100%. Keeping method – electronic and paper archives.
Any comment	Value of gas volume is brought to standard conditions (temperature 20°C, pressure 101325 Pa).

Also for monitoring project emissions data listed in Tables 23, 24, 25, 26, 27, 28, 29 and 30 above are collected and used.

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

Baseline emissions[37] are calculated as follows:

$$BE_y = BE_{MR,y} + BE_{HEAT,y} \quad \text{(Equation 7)}$$

where:

BE_y - GHG emissions in baseline scenario in period y, tCO_2e;

$BE_{MR,y}$ - GHG emissions in the baseline scenario as a result of methane emission into the atmosphere in period y, tCO_2e;

BE_{HEAT} - GHG emissions in the baseline scenario as a result of coal burning for heat generation in period y, tCO_2e.

GHG emissions in the baseline scenario as a result of methane emission into the atmosphere are calculated as follows:

$$BE_{MR,y} = MD_{CH4,y} \cdot \rho_{CH_4} \cdot GWP_{CH_4} \quad \text{(Equation 8)}$$

where:

$MD_{CH4,y}$ - Volume of CMM, utilized in boilers in the project scenario in period y, m^3;

ρ_{CH_4} - Methane density, t/m^3;

GWP_{CH_4} - Global warming potential of methane, $tCO_2e/t\ CH_4$.

[37] Calculation results are presented in metric tons of carbon dioxide equivalent (tCO_2eq), 1 metric ton of carbon dioxide equivalent is equal to 1 metric ton of carbon dioxide (CO_2), i.e. 1 tCO_2eq = 1 tCO_2.

GHG emissions in the baseline scenario as a result of coal burning for heat generation, replaced in the project line by methane, are calculated as follows:

$$BE_{HEAT,y} = \frac{\left(\frac{MD_{CH4,y}}{1000} \cdot NCV_{CH_4} \cdot \eta_{gas}\right)}{\eta_{coal}} \cdot \frac{C_{coal} \cdot OXID_{coal,y}}{NCV_{coal}} \cdot \frac{44}{12} \qquad \textit{(Equation 9)}$$

where:

$MD_{CH4,y}$	- Volume of CMM, utilized in boilers in the project scenario in period y, m^3;
NCV_{CH_4}	- Net calorific value of methane, GJ/1000 m^3;
η_{gas}	- Efficiency of the boiler after reconstruction during operating on coal mine methane, ratio;
η_{coal}	- Efficiency of the boiler before reconstruction during operating on coal;
C_{coal}	- Carbon content in coal, t C/t (coal);
$OXID_{coal,y}$	- Carbon oxidation factor for coal in period y, ratio;
NCV_{coal}	- Net calorific value of coal, GJ/t;
$\frac{44}{12}$	- Ration between molecular mass of CO_2 and C. Reflect oxidation of C to CO_2.

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

This section is left blank on purpose.

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

This section is left blank on purpose.

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

This section is left blank on purpose.

D.1.3. Approach to the leakages in the monitoring plan:

The only theoretical leakages of the project may be fugitive methane emissions during coal mining. Coal production, which is extracted at the mine "Butivska" and supplied to SE "Makiyivvuhillya" mines for combustion in reserve boilers, can lead to methane release and its emitting through the ventilation system into the atmosphere. These leakages are considered insignificant and excluded from consideration for simplification.

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

This section is left blank on purpose.

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

No leakage is expected.

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

Annual emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textit{(Equation 10)}$$

where:

ER_y - Emission reductions as a result of the project implementation in period y, tCO_2e;

BE_y – GHG emissions in the baseline scenario in period y, tCO_2e;

PE_y – GHG emissions in the project scenario in period y, tCO_2e.

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:

Collection and archiving of the information on the environmental impacts of the project will be done based on the approved EIA (if any) or in accordance with the other legislation of Host Party– *State Construction Standard DBN A.2.2.-1-2003: "Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures"*, State Committee Of Ukraine On Construction And Architecture, 2004 (see Section F.1).

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Please indicate table and ID)*	The level of data error (high/medium /low)	Please explain the planned for these data QC/QA procedures or indicate the reason why these procedures are not necessary.
D.1.1.1. – D.1.1.3.	Low	Volume of the coal mine methane utilized in boilers, will be calculated based on measurements of different sensors: pitot tube, methane concentration analyzer, U-shaped manometer, differential pressure gauge, thermocouple, vacuum gauges. Please see Section 3 for more detailed information. Obtained results of testing and maintenance are recorded in the annual Technical reports. Calibration and periodic calibration of measuring devices will be implemented by authorized representatives of the State Metrology Service of Ukraine in accordance with applicable regulatory documents in compliance with the appropriate calibration interval. Full list of measuring equipment and its characteristics will be installed at the stage of preparation of monitoring report. Calibration of equipment will be implemented in accordance with the legislation of host Party – State Standard of Ukraine DSTU 2708:2006 "Metrology. Calibration of measuring instruments. The organization and procedure".

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

The project owner, which will implement the provisions of this monitoring plan in the structure of organization and quality management, is SE "Makiyivvuhillya". Management headed by the director of the enterprise is responsible for the implementation of monitoring, data collection, registration, visualization, storage and reporting of data that were monitored and periodic verifications of measuring devices. Detailed structure of the administrative board of the company will be established in Monitoring report before the primary and the first verification. Executive and management structure of the project for each the mine is shown in the picture below:

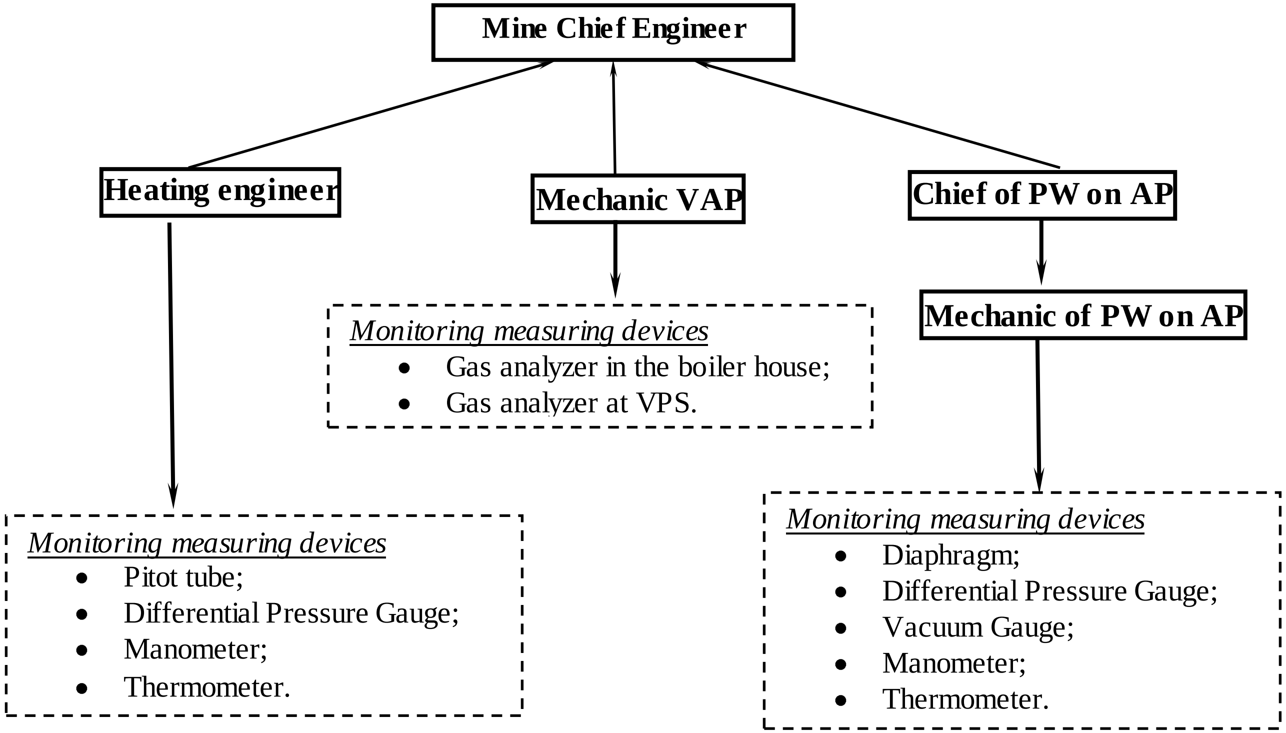

Figure 10. Block diagram of technical support and maintenance at the mines of SE "Makiyivvuhillya"

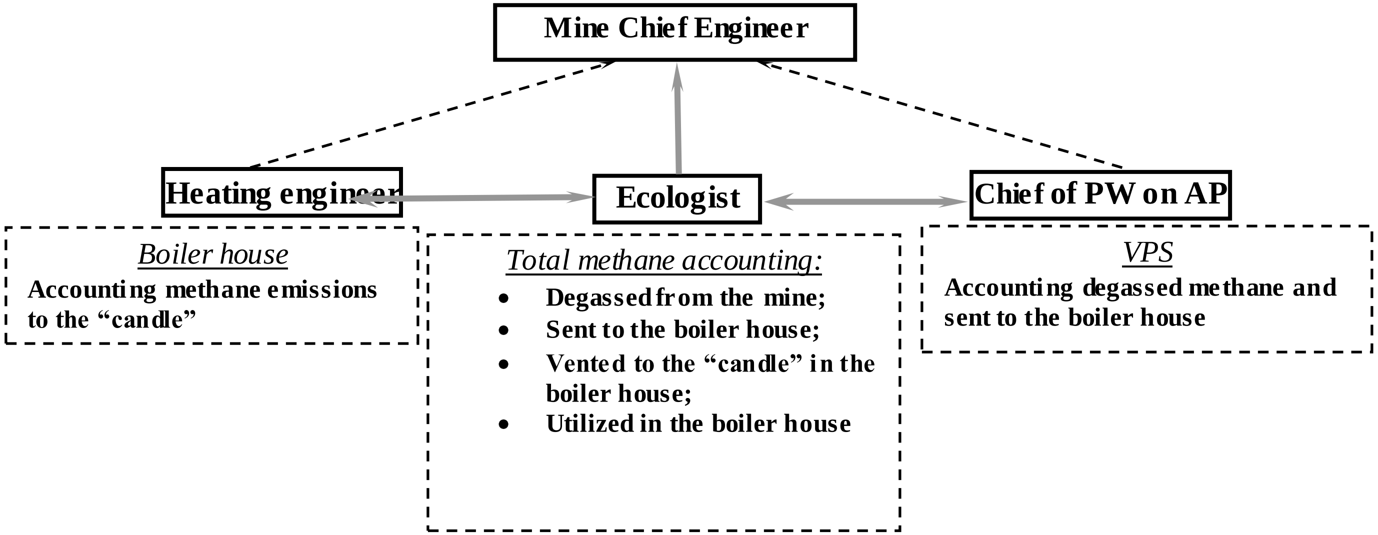

Figure 11. Scheme of responsibility distribution during monitoring implementation

The project includes the following system of management:
Management of SE "Makiyivvuhillya" has overall responsibility for implementation of the project activities and for monitoring. Chief Engineer of the mine is directly responsible for organization of works at the object. He coordinates all issues concerning the operation of installation, repairs, modernization, etc. The control system is well organized by enterprise that promotes safe and accurate collection and identification of data.

D.4. Name of persons/entities establishing the monitoring plan:

Monitoring plan is developed by "SPA "Energometan" LLC, not a project participant.

Contact information:

Company name:	"SPA "Energometan" LLC
Company address:	Ukraine, 86123, Donetsk region, Makiivka, Taigova Street, 1
Contact person:	
Name:	Makarenko Serhiy Vasyliovych
Title:	Director
Phone:	+38(050) 422-45-65
Fax:	+38(050) 422-45-65
Name:	msv@energometan.com

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The formulas used to estimate the project anthropogenic emissions by sources of greenhouse gas emissions, description of calculations by these formulas and all the assumptions used are described in Section D.1.1.2.

Table 33. Estimated project emissions for the part of crediting period during the first commitment period under the Kyoto Protocol

Project emissions	Unit	2008	2009	2010	2011	2012	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	29 586	33 605	31 054	30 397	15 269	**139 911**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	1 135	1 289	1 193	1 166	587	**5 370**
Total project emissions for the part of crediting period during the first commitment period under the Kyoto Protocol	tCO_2e	30 721	34 894	32 247	31 563	15 856	**145 281**

Table 34. Estimated project emissions for the part of crediting period after the first commitment period under the Kyoto Protocol

Project emissions	Unit	2013-2020 Annual emissions	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	216678	**1733424**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	82566	**660528**
Total project emissions for the part of crediting period after the first commitment period under the Kyoto Protocol	tCO_2e	299 244	**2 393 952**

Table 35. Estimated project emissions of the period of generating emission reductions before the first commitment period under the Kyoto Protocol

Project emissions	Unit	2006	2007	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	31 182	27 010	**58 192**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	1 197	1 037	**2 234**

Total project emissions for the part of crediting period during the period of generating emission reductions before the first commitment period under the Kyoto Protocol	tCO_2e	32 379	28 047	**60 426**

E.2. Expected leakages:

No leakages are expected.

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

Table 36. Estimated total project emissions for the part of crediting period during the first commitment period under the Kyoto Protocol

Project emissions	Unit	2008	2009	2010	2011	2012	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	29 586	33 605	31 054	30 397	15 269	**139 911**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	1 135	1 289	1 193	1 166	587	**5 370**
Total project emissions for the part of crediting period during the first commitment period under the Kyoto Protocol	tCO_2e	30 721	34 894	32 247	31 563	15 856	**145 281**

Table 37. Estimated total project emissions for the part of crediting period after the first commitment period under the Kyoto Protocol

Project emissions	Unit	2013-2020 Annual emissions	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	216 678	**1 733 424**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	82 566	**660 528**
Total project emissions for the part of crediting period after the first commitment period under the Kyoto Protocol	tCO_2e	299 244	**2 393 952**

Table 38. Estimated total project emissions of the period of generating emission reductions before the first commitment period under the Kyoto Protocol

Project emissions	Unit	2006	2007	Total
GHG emissions in the project scenario as a result of methane combustion in the boilers	tCO_2e	31 182	27 010	**58 192**
GHG emissions in the project scenario as a result of incomplete methane combustion	tCO_2e	1 197	1 037	**2 234**
Total project emissions for the part of crediting period during period of generating emission reductions before the first commitment period under the Kyoto Protocol	tCO_2e	32 379	28 047	**60 426**

E.4. Estimated baseline emissions:

The formulas used to estimate the project anthropogenic emissions by sources of greenhouse gas emissions, description of calculations by these formulas and all the assumptions used are described in Section D.1.1.3.

Table 39. Estimated baseline emissions for the part of crediting period during the first commitment period under the Kyoto Protocol

Baseline emissions	Unit	2008	2009	2010	2011	2012	Total
GHG emissions in the baseline scenario as a result of methane emission into the atmosphere	tCO_2e	227 069	257 913	238 338	233 287	117 180	**1 073 787**
GHG emissions in the baseline scenario as a result of coal burning for heat generation	tCO_2e	86 616	98 381	90 819	88 895	44 652	**409 363**
Estimated baseline emissions for the part of crediting period during the first commitment period under the Kyoto Protocol	tCO_2e	313 685	356 294	329 157	322 182	161 832	**1 483 150**

Table 40. Estimated baseline emissions for the part of crediting period after the first commitment period under the Kyoto Protocol

Baseline emissions	Unit	2013-2020 Annual emissions	Total
GHG emissions in the baseline scenario as a result of methane emission into the atmosphere	tCO_2e	216678	**1733424**
GHG emissions in the baseline scenario as	tCO_2e	82566	**660528**

a result of coal burning for heat generation			
Estimated baseline emissions for the part of crediting period after the first commitment period under the Kyoto Protocol	tCO_2e	299 244	**2 393 952**

Table 41 Estimated baseline emissions of the period of generating emission reductions before the first commitment period under the Kyoto Protocol

Baseline emissions	Unit	2006	2007	Total
GHG emissions in the baseline scenario as a result of methane emission into the atmosphere	tCO_2e	239 311	207 294	**446 605**
GHG emissions in the baseline scenario as a result of coal burning for heat generation	tCO_2e	91 285	79 072	**170 357**
Estimated baseline emissions for the part of crediting period during the period of generating emission reductions before the first commitment period under the Kyoto Protocol	tCO_2e	330 596	286 366	**616 962**

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

Table 42. Estimated emission reductions for the part of crediting period during the first commitment period under the Kyoto Protocol

Parameter	Unit	2008	2009	2010	2011	2012	Total
Emission reductions for the part of crediting period during the first commitment period under the Kyoto Protocol	tCO_2e	282 964	321 400	296 910	290 619	145 976	**1 337 869**

Table 43. Estimated emission reductions for the part of crediting period after the first commitment period under the Kyoto Protocol

Parameter	Unit	2013 – 2020 Annual emission reductions	Total
Emission reductions for the part of crediting period after the first commitment period under the Kyoto Protocol	tCO_2e	269 928	**2 159 424**

Table 44. Estimated emission reductions of the period of generating emission reductions before the first commitment period under the Kyoto Protocol

Parameter	Unit	2006	2007	Total
Estimated emission reductions of the period of generating emission reductions before the first commitment period under the Kyoto Protocol	tCO_2e	298 217	258 319	**556 536**

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

Table 45. Estimated emissions balance under the proposed project for the part of crediting period during the first commitment period under the Kyoto Protocol

Year	Estimated project emissions (tonnes CO_2 equivalent)	Estimated leakage (tonnes CO_2 equivalent)	Estimated baseline emissions (tonnes CO_2 equivalent)	Estimated emission reductions (tonnes CO_2 equivalent)
Year 2008	30 721	-	313 685	282 964
Year 2009	34 894	-	356 294	321 400
Year 2010	32 247	-	329 157	296 910
Year 2011	31 563	-	322 182	290 619
Year 2012	15 856	-	161 832	145 976
Total (tonnes CO_2 equivalent)	**145 281**	**-**	**1 483 150**	**1 337 869**

Table 46. Estimated emissions balance under the proposed project for the part of crediting period after the first commitment period under the Kyoto Protocol

Year	Estimated project emissions (tonnes CO_2 equivalent)	Estimated leakage (tonnes CO_2 equivalent)	Estimated baseline emissions (tonnes CO_2 equivalent)	Estimated emission reductions (tonnes CO_2 equivalent)
Year 2013	29 316	-	299 244	269 928
Year 2014	29 316	-	299 244	269 928
Year 2015	29 316	-	299 244	269 928
Year 2016	29 316	-	299 244	269 928
Year 2017	29 316	-	299 244	269 928
Year 2018	29 316	-	299 244	269 928
Year 2019	29 316	-	299 244	269 928
Year 2020	29 316	-	299 244	269 928
Total (tonnes CO_2 equivalent)	**234 528**	**-**	**2 393 952**	**2 159 424**

Table 47. Estimated emissions balance under the proposed project for the part of crediting period before the first commitment period under the Kyoto Protocol

Year	Estimated project emissions (tonnes CO_2 equivalent)	Estimated leakage (tonnes CO_2 equivalent)	Estimated baseline emissions (tonnes CO_2 equivalent)	Estimated emission reductions (tonnes CO_2 equivalent)
Year 2006	32 379	-	330 596	298 217
Year 2007	28 047	-	286 366	258 319
Total (tonnes CO_2 equivalent)	**60 426**	**-**	**616 962**	**556 536**

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 Host Party for this project is Ukraine. Environmental Impact Assessment (EIA) is the part of the Ukrainian project planning and permitting procedures. Implementation regulations for EIA are included in the Ukrainian State Construction Standard DBN A.2.2.-1-2003[38] (Title: "Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures").

In Annex F of this standard there is a list of "types of projects or activities that are of high environmental hazard" for which full-scale EIA is obligatory, Ministry of Environment and Natural Resources of Ukraine is competent authority for performing of it. Project activities that consist of utilization of wastes of coal industry and of coal production are included in this list. Project implementation does not impact negatively on the environment; in fact, the impact of the project is estimated as positive. According to the requirements of the host Party, there was no need to develop the EIA for this activity.

Here are some general conclusions within the scope of the EIA:

- Impact on atmospheric air: according to the proposed activity on methane utilization, effect is positive, as emissions pollutants into the atmosphere decrease;
- There is no impact on the water. Project activity of the boiler house will not affect the superficial and underground (ground) water because there are no sources of such pollution. Project equipment and beneficiation technology of coal and rock mass excludes the use of water;
- Impact on flora and fauna is within the permitted;
- Noise impact is limited. The main source of noise will be at the minimum desired distance from residential areas;
- Impact on landscapes: there is no impact as site of construction is located in industrial zone;
- Impact on society: the project activity does not render negative impact on public health because in the area of nearest residential buildings the level of pollution of surface layer of the atmosphere by project emissions is lower than the maximum permissible concentration, sound pressure level is lower that acceptable standards, there are no other sources of influence. All necessary measures are provided by working project, they are directed to protecting of staff from possible negative impact in accordance with sanitary standards.
- There are no transboundary effects. There are no impacts which occur on the territory of any other country, and which are caused by the implementation of this project that is physically located entirely within Ukraine.

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:

[38] *State Construction Standard DBN A.2.2.-1-2003: "Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures"* State Committee Of Ukraine On Construction And Architecture, 2004

Project impact on the environment is not significant and harmful. According to Ukrainian laws and regulations, preparation of reports from Environmental Impact Assessment and positive conclusions of State Department of Ecology and Natural Resources makes procedure of environmental impact assessment.

SECTION G. Stakeholders' comments

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

No stakeholder consultation process for the JI projects is required by the Host Party. Stakeholder comments will be collected during the time of this PDD publication in the internet during the determination procedure.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Middle name:	Viktorovych
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URL:	www.biotehnologia.eu
Represented by:	-
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Personal e-mail:	fred@kaasik.ee

Annex 2

BASELINE INFORMATION

Tables containing the basic elements of the baseline

Table 48. Volume of CMM, utilized in boilers in the project scenario

Data/Parameter	$MD_{CH4,y}$
Data unit	m^3
Description	Volume of CMM, utilized in boilers in the project scenario in period *y*
Time of determination/monitoring	Periodic monitoring
Source of data (to be) used	Data of reports of the project owner
Value of data applied (for ex ante calculations/determinations)	According to information provided by the project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This is a key parameter that is determined by measuring equipment of the project owner and recorded in the reports
QA/QC procedures (to be) applied	To provide monitoring of this parameter cross-checking between the point of measuring at VPS and boiler house is performed. Definition method – measured/calculated. Recording frequency – continuously with monthly reports. Volume of data to be monitored – 100%. Keeping method – electronic and paper archives.
Any comment	Values of gas volume are brought to standard conditions (temperature 20°C; pressure 101325 Pa)

Table 49. Methane density

Data/Parameter	ρ_{CH_4}
Data unit	t/m^3
Description	Methane density
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 4: Fugitive Emissions, Page 4.12. Under standard conditions (temperature 20°C; pressure 101325 Pa)[39]. Value was converted from converted $Gg{\cdot}m^{-3}$ to t/m^3.
Value of data applied (for ex ante calculations/determinations)	0.00067
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source

[39] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf

Any comment	Under standard conditions (temperature 20°C; pressure 101325 Pa). Value was converted from converted $Gg \cdot m^{-3}$ to t/m^3.

Table 50. Global warming potential of methane

Data/Parameter	GWP_{CH_4}
Data unit	$tCO_2eq/t\ CH_4$
Description	Global warming potential of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	IPCC Second Assessment Report [40]
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 51. Net calorific value of methane

Data/Parameter	NCV_{CH_4}
Data unit	$GJ/1000\ m^3$
Description	Net calorific value of methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Grigoriev, Zorin "Theoretical Basics of Thermal Engineering", Volume 2, Table 7.7, Moscow, 1988, p. 367
Value of data applied (for ex ante calculations/determinations)	35.82
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 52. Efficiency of the boiler after reconstruction during operating on coal mine methane

Data/Parameter	η_{gas}
Data unit	ratio
Description	Efficiency of the boiler after reconstruction during operating on coal mine methane
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1 [41]

[40] http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf Page 22.

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

Value of data applied (for ex ante calculations/determinations)	0.92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 53. Efficiency of the boiler before reconstruction during operating on coal

Data/Parameter	η_{coal}
Data unit	ratio
Description	Efficiency of the boiler before reconstruction during operating on coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	CDM Tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems", Version 1[42]
Value of data applied (for ex ante calculations/determinations)	0.8
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 54. Carbon content in coal

Data/Parameter	C_{coal}
Data unit	t C/t (coal)
Description	Carbon content in coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	0.8455
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine "Butivska"
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

Table 55. Carbon oxidation factor for coal in period y

Data/Parameter	$OXID_{coal,y}$

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

Data unit	ratio
Description	Carbon oxidation factor for coal in period y
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	National Inventory Report of Ukraine 1990-2010, p. 459, 465, 471 (1.A.1.a – Public Electricity and Heat Production)
Value of data applied (for ex ante calculations/determinations)	In 2008 and earlier – 0.963; in 2009 – 0.963; in 2010 and after – 0.962
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Accepted according to data source
Any comment	No

Table 56. Net calorific value of coal

Data/Parameter	NCV_{coal}
Data unit	GJ/t
Description	Net calorific value of coal
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	22.914
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value is based on the conclusions of the laboratory which conducts analysis of coal, produced by the mine "Butivska"
QA/QC procedures (to be) applied	Accepted according to data source. Certification of laboratory is checked for conducting these measurements
Any comment	No

Table 57. CO_2 emission factor by methane combustion

Data/Parameter	CEF_{CH4}
Data unit	t CO_2/tCH_4
Description	CO_2 emission factor by methane combustion
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Data of laboratory measurements of SE "Makiyivvuhillya"
Value of data applied (for ex ante calculations/determinations)	44/16=2.75
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Ration between molecular mass of CO_2 and CH_4. Reflect oxidation of CH_4 with formation of CO_2.
QA/QC procedures (to be) applied	Accepted fixed
Any comment	No

Table 58. Efficiency of methane destruction/oxidation of heat generating equipment

Data/Parameter	Eff_{HEAT}
Data unit	ratio
Description	Efficiency of methane destruction/oxidation of heat generating equipment
Time of determination/monitoring	Defined and fixed ex-ante
Source of data (to be) used	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reference Manual, Table 1.6, p. 1.29[43]
Value of data applied (for ex ante calculations/determinations)	0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Accepted according to data source
QA/QC procedures (to be) applied	Accepted fixed
Any comment	No

[43] http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref2.pdf

Annex 3

MONITORING PLAN

Monitoring plan is provided in Section D of this PDD.

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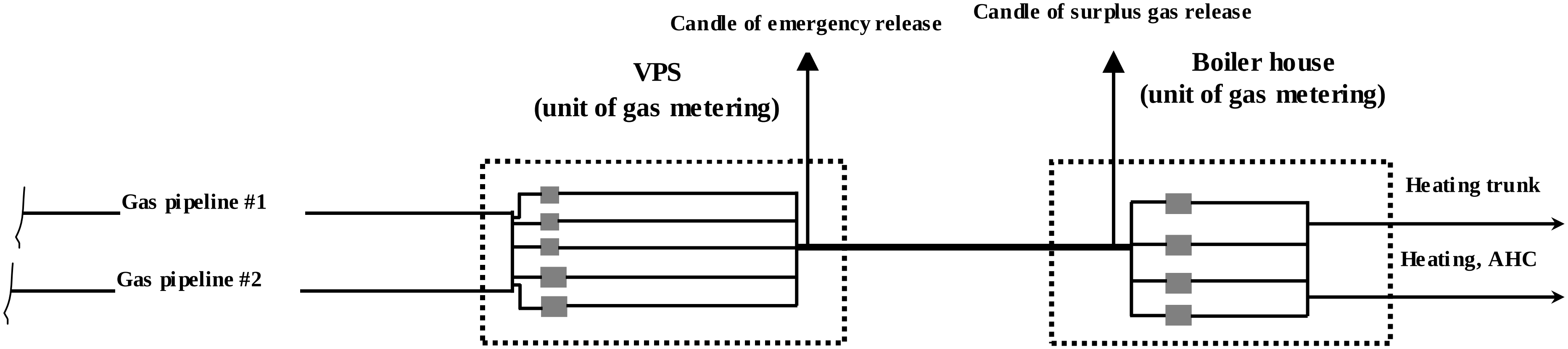
Annex 4

Scheme of accounting CMM amounts at SE "Makiyivvuhillya" mines

"Mine named after V.M.Bazhanov"



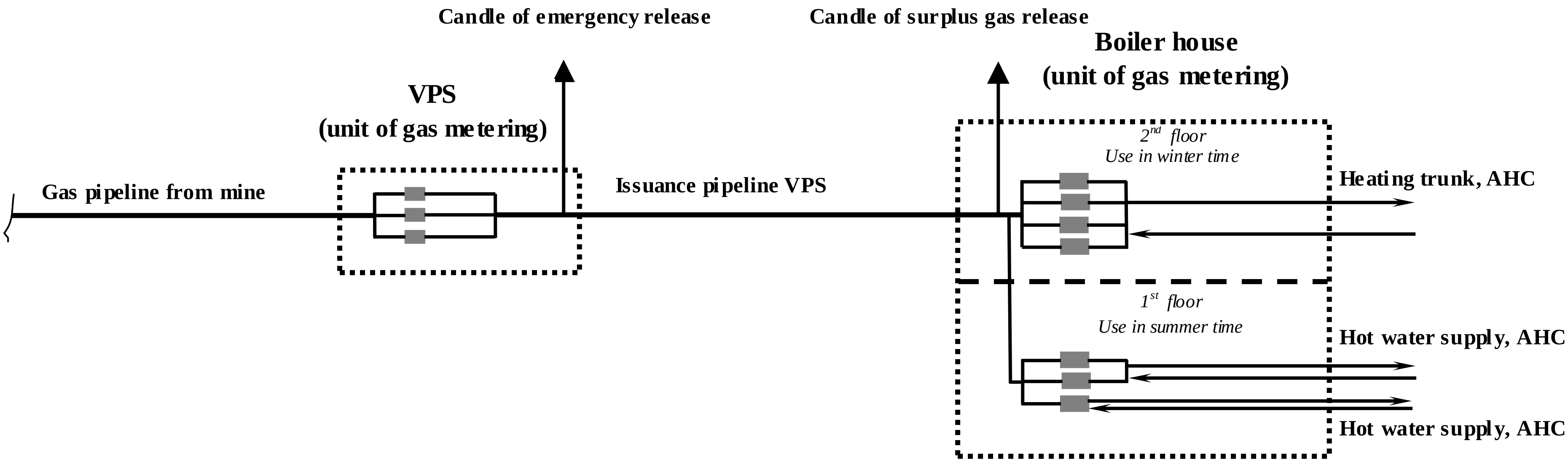
Unit of gas metering at VPS:

- Gas analyzer (operating + reserve)MYTRON 5030i;
- Diaphragm in the pipeline 16";
- Differential pressure gauge;
- Manometer;
- Thermometer.

Unit of gas metering in Boiler house (venting on the "candle"):

- Gas analyzer (TP-2301, KAM-1U3);
- Pitot tube;
- Differential pressure gauge;
- Manometer;
- Thermometer.

"Mine "Kholodna Balka":



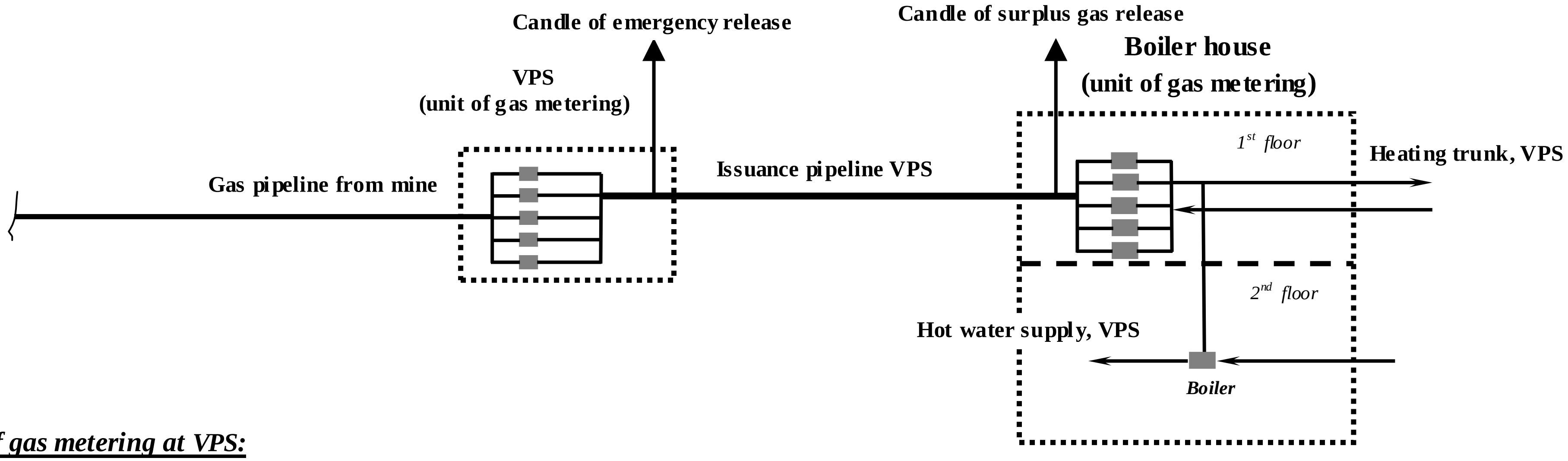
Unit of gas metering at VPS:

- Gas analyzer (operating + reserve) TP-5501;
- Diaphragm in the pipeline 16";
- Differential pressure gauge;
- Manometer;
- Thermometer.

Unit of gas metering in Boiler house (venting on the "candle"):

- Gas analyzer (TP-2301);
- Pitot tube;
- Differential pressure gauge;
- Manometer;
- Thermometer.

"Mine "Chaikino"



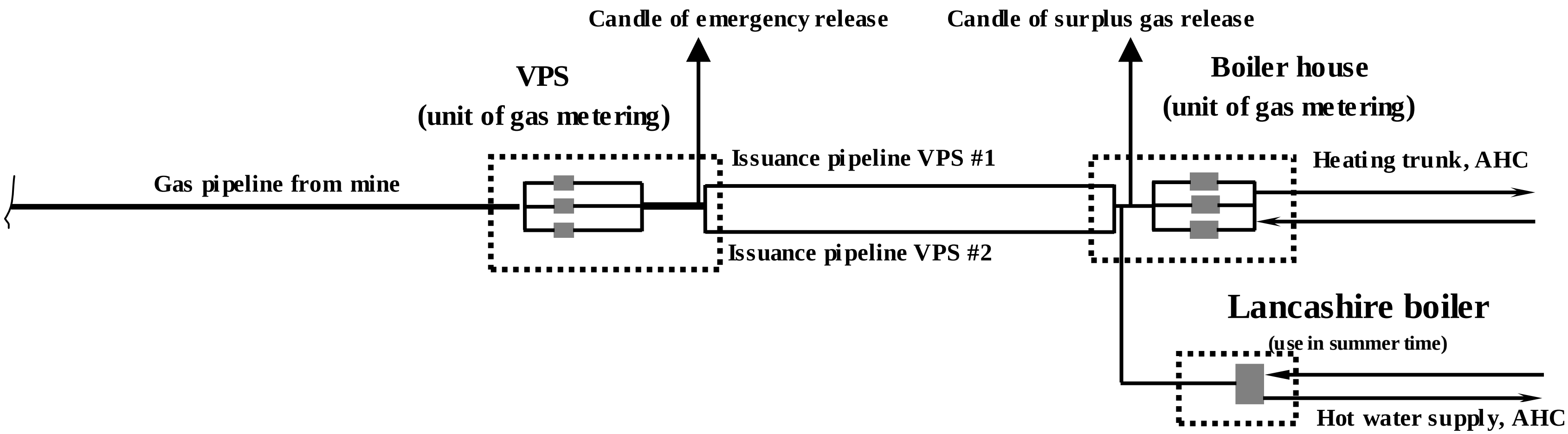
Unit of gas metering at VPS:

- Gas analyzer (operating + reserve) TP-5501;
- Diaphragm in the pipeline 16";
- Differential pressure gauge;
- Manometer;
- Thermometer.

Unit of gas metering in Boiler house (venting on the "candle"):

- Gas analyzer (KAM-1U3);
- Pitot tube;
- Differential pressure gauge;
- Manometer;

"Coal Mine Named after S.M. Kirov"



Unit of gas metering at VPS:

- Gas analyzer (operating + reserve) TP-5501;
- Diaphragm in the pipeline 16";
- Differential pressure gauge;
- Manometer;
- Thermometer.

Unit of gas metering in Boiler house (venting on the "candle"):

- Gas analyzer (KAM-1U3);
- Pitot tube;
- Differential pressure gauge;
- Manometer.

Annex 5

ADDITIONAL INFORMATION ON PROJECT PARTICIPANTS

Organization:	SE "Makiyivvuhillya"
Country of registration:	Ukraine
EDRPOU code (Uniform State Register of Enterprises and Organizations of Ukraine):	32442295
KVED types of economic activities (Code of economic activities according to the general classification of economic activities)	10.10.1 Mining and beneficiation of coal

Data on legal entity that has prepared this project design document:

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