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

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SECTION A. General description of the project

A.1. Title of the project:

CMM utilisation for heat generation and flaring – "Pivdennodonbaska No 3"

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Prepared by: Emissions-Trader ET GmbH, Adam Hadulla

A.2. Description of the project:

The Donetsk basin (Donbass) is the largest industrial region of Ukraine with coal, metallurgic and chemical industries. Donbass is one of the most hazardous regions of Ukraine in terms 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 [MakNII].

Degassing of Coal Mine Gas (CMM) is an unavoidable occurrence of hard coal mining. In addition to active coal mines there are also a lot of abandoned mines, which still emit CMM after mining. Even after shut down mining activities, the CMM escapes over many years through open shafts, cracks and existing degassing wells in the overburden directly or diffusely into the atmosphere. CMM mainly consists of the harmful greenhouse gas methane (GWP 21), so that using of CMM becomes more important particularly with regard to the world-wide consensus of reducing green-house-gas emissions.

In this project, CMM from the suction system of the coal mine "Pivdennodonbaska № 3", should be utilised for heat generation and for flaring. At the time all of the CMM is not utilised and it is simply vented to the atmosphere.

Currently there are three existing redundant steam boilers in operation with an output of 25 t/h steam each. The boilers are fired with coal and supply the coal mine facilities with heat. In this project two new boilers, which should be fired with CMM, a winter and a summer boiler, should be installed and should displace in this way conventionally heat generated by coal combustion.

Due to the large amount of CMM occurring on the coal mine, additionally a flare with a firing capacity of 5.0 MW should be installed. If the experience with the flare will be good and the amount of CMM remains high, further flares may follow.

There is also a possible cogeneration unit in mind – but actually not economically viable. Before the installation of the cogeneration unit the attainable power prices for the feed in into the grid have to increase to a proper level. Also the feed in conditions have to be guaranteed for a suitable period. At the time all power is purchased from the Ukrainian grid.

The hereby requested ERU's from the conversion of the methane into carbon dioxide are needed to finance the new units and the new infrastructure.

The combustion of methane in the boiler and in the flare results in a significant emissions reduction. The conversion of the harmful greenhouse gas methane with a GWP of 21 into less harmful CO_2 with a GWP of 1 reduces the global warming potential of the emissions by 87%. The displacement of conventionally generated heat (coal) gains further CO_2 emissions reduction.

A.3. Project participants:

Table A- 1 – Project participants

Party involved (*) ((host) indicates a host Party)	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host)	State-run Coal Mine Association «Donetska Vugilna Energetichna Kompanya»	no
Netherlands	Carbon-TF B.V.	no

- State-run Coal Mine Association «Donetska Vugilna Energetichna Kompanya»
(Russian: „Donetskaya Ugolnaya Energeticheskaya Kompanya“ DUEK)
Ukraine, 83000 Donetsk, Artema Street 63
Holding company of the coal mine "Pivdennodonbaska № 3" (Russian: "Yuzhno-Donbasskaya № 3")
- Carbon-TF B.V.
Investor, buyer of the ERU's; Dutch emissions trading company

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located at the coal mine "Pivdennodonbaska № 3", at Vugledar (Donetsk Oblast) in the eastern Ukraine, about 80 km south west to Donetsk. The locations of the Donetsk region as well as location of the coal mine are shown on the maps below.

A.4.1.1. Host Party(ies):

Ukraine

Figure A- 1: Location of the Project in the Ukraine

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

Donetsk Oblast

Figure A-2: Location of Vugledar in the Donetsk Oblast south west to Donetsk

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

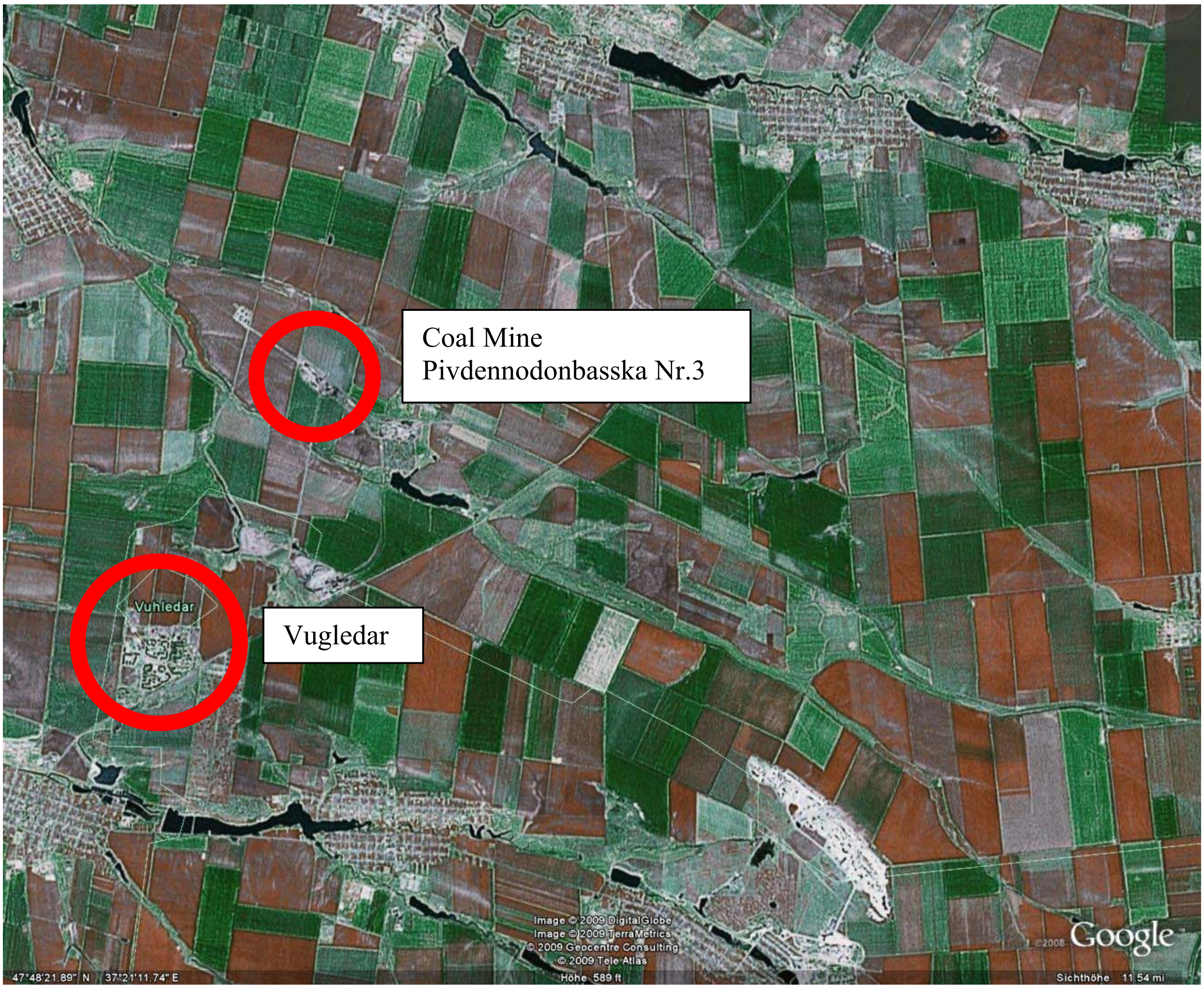


Figure A-3: Location of the Project at 85670 Vugledar

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

The project is located at the coal mine "Pivdennodonbaska № 3" at Vugledar (Donetsk Oblast). The coal mine is located approx 6 km outside the city 47°50'05'' N, 37°15'05" E.

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

Coal mining activity

The coal mine is producing since 1985. The actually produced amount (2007) is about 0.6 million tonnes per annum; a mining activity of 1 million tonnes per year is planned. The remaining coal reservoir is about 145 million tonnes. [PD3].

Degasification activities

The coal mine "Pivdennodonbaska № 3" has multiple shafts, one of which is fitted with a CMM suction system - the Central Shaft. The CMM is simply vented to the atmosphere unused.

The suction system is primarily designed for operational safety in the underground and not for CMM utilisation and there are no national regulations or legal requirements for treatment and utilisation of the captured CMM. It is common practice at Ukrainian coal mines to release the CMM into the atmosphere.

In table A-2 coal production and the methane released to the atmosphere together with the ventilation air and by the central suction system for the years 1995-2005 is shown.

Table A-2 – prospected amount of CH4 from the central suction system

Year	Coal production Thousand tonnes/ day	Methan amount m³/min		
		Ventilation air	Suction system	total
1995	1,70	29,0	2,0	31,0
1996	1,88	21,2	1,1	22,3
1997	2,93	26,9	4,9	34,5
1998	3,27	45,0	1,9	46,9
1999	3,86	45,6	11,0	56,6
2001	4,50	114,6	10,6	125,2
2002	3,57	101,8	13,5	125,3
2003	3,79	80,6	14,3	94,9
2004	3,43	87,8	19,9	107,7
2005	3,79	94,8	14,3	109,1

It is planned to improve the suction system in the underground within the JI-Project, so that more methane will be sucked by the central suction system and less methane will be diluted in the ventilation air. Actually some parts of the suction system in the underground are not connected to the central suction system but simply blow the sucked CMM into the exhaust air, where the methane concentration is diluted to a safe level. It is planned to connect this parts of the coal mine to the central suction system in the underground and allow the utilisation of the methane in this way. There will be no effect on the total amount of methane released by the coal mine.

The methane flow from the improved suction system is prospected by the MakNII Institute [MakNII] in the range from 35.6-57.7 m³/min for the years 2008-2012.

Table A-3 – prospected amount of CH4 from the central suction system

Coal seams to be mined	CH4 amount, m^3/min from the different longwalls							
	9-я восточная лава пл. C_{11}	10-я восточная лава пл. C_{11}	12-я восточная лава пл. C_{11}	13-я восточная лава пл. C_{11}	16-я восточная лава пл. C_{11}	17-я восточная лава пл. C_{13}	18-я восточная лава пл. C_{13}	Total
2007	20.6	-	21.0	-	21.0	-	-	62.6
2008	20.6	-	21.0	-	-	16.1	-	57.7
2009	20.6	-	21.0	-	-	16.1	-	57.7
2010	-	16.9	-	18.7	-	-	15.8	51.4
2011	-	16.9	-	18.7	-	-	15.8	51.4
2012	-	16.9	-	18.7	-	-	-	35.6

As shown in table A-3 there are always three coal seams in mining operation. For the year 2012 only two seams are specified, the specification of the third will follow in the future. The sucked CMM amount depends mainly on the actually mined coal seams and the coal mining progress. Detailed data has been handed over to Emissions-Trader ET GmbH and has been taken into account.

Project activities

The first contact between Emissions-Trader ET GmbH and the State-run Coal Mine Association «Donetska Vugilna Energetichna Kompanya» took place in May 2003. The «Donetska Vugilna Energetichna Kompanya» was then generally interested in CMM utilisation and in emissions trading activities. The Joint Venture Eco-Alliance OOO has been founded together with Emissions-Trader ET GmbH and other companies and has developed the project idea and a contract between ECO-Alliance OOO and DUEK in November 2005. At 14/02/2006 a meeting of the Ukrainian Ministry of Coal Industry, DUEK and the MakNII Institute took place, in which the start of a JI-project based on the Contract No 84 (together with ECO-Alliance) has been manifested. In 2006 a PDD has been prepared by Emissions-Trader ET GmbH and has been validated by TUEV-Nord [TUEV-Nord]. The PDD has been published for global stakeholder comments on 28/08/2006 on the TUEV-Nord website http://www.global-warming.de. The project was originally intended for the Track 1 procedure because the Track 2 procedure was not implemented at that time; the installation took place two months later on 27/10/2006. The project has got the Letter of Approval from Ukraine on 26/03/2008. After the installation of the Track 2 procedure the project participants decided to follow the Track 2 procedure, so that the PDD has been transcribed to the new JI-PDD form and republished by the JISC on the UNFCCC website for the Global Stakeholding Process from 10/07/2008 to 08/08/2008. TUEV-Sued has been chosen as the new AIE because TUEV-Nord hadn't the required accreditation for the scope 8 (mining) at that time.

Utilisation of the methane captured (the project)

In the case of this project CMM from the suction system of the coal mine should be utilised in boilers for heat generation and a flare for methane destruction. The remaining amount of the CMM, which can not be utilised, should be further on released to the atmosphere unused.

It is planned to utilise up to 100% of the CMM amount. The utilisation mainly depends on the heat demand of the coal mine. The units should be supplied with CMM in the following order: primary the boilers and than the flare. The prospected utilisation plan is shown in table A-4.

Table A-4 – Installation plan of the project

unit	**installation date**	**firing capacity**	**product**
Central Shaft			
winter boiler	Oct 2008	23.3 MW	hot water
summer boiler	Oct 2008	8.6 MW	hot water
flare	Oct 2008	5.0 MW	methane destruction

CMM supply

All utilisation units should be connected to the local suction system on the central shaft. The piping in the underground should be retrofitted as mentioned above (see degasification). The pressure generated by the vacuum pumps of the suction systems is sufficient to supply all utilisation units, so that no further compression is needed. The amount of CMM sent to each unit will be measured by separate flow meters. Each branch will be provided with a deflagration flame arrester which prevents backfiring from the utilisation unit into the suction system of the coal mine or any another utilisation unit.

No utilisation unit will affect the central suction system in any way. This is obligatory required by the coal mine.

CMM boilers

At the time there are three redundant steam boilers in operation with a capacity of 25 t/h steam each (approx. 22 MW heat generation per boiler). The boilers are fired with coal and supply the coal mine facilities with heat. In this project one of the existing boilers should be retrofitted with a new CMM burner system and should be used in the winter period for heat generation. Additionally one new small boiler fired with CMM should be installed and should be used in the summer period, when the heat demand is much lower than in the winter period. The heat production will be switched in spring and autumn between the boilers. This allows better efficiencies for the heat production. Both boilers should be equipped with an adequate monitoring system.

The CMM will be fed into the combustion chamber of the boilers, where the methane will be burned completely. The boilers should be operated fully automatically and all essential measured data will be collected and recorded. CMM burner systems have been tested at various sites in Western Europe and are now approved. Proved safety-related equipment is used to minimise the risks of the plant.

Technical data

winter boiler	retrofitted coal steam boiler, originally build in 1980
Original type	KE-25-14C
Manufacturer	Biyskiy Kotelniy Zavod OAO, Merlin Street 63, Biysk, 659303, Altai Krai, Russian Federation
Capacity	25 t/h steam
Effficiency	73.5 % (measured)
Retrofitted boiler	hot water boiler
Retrofitted type	KVGM-20
Retrofitter	LLC Ukrteplostroy, Oktyabrya Street 63, Donetsk, 83030, Donetsk Oblast, Ukraine
Design firing capacity	20 Gcal = 23.34 MW
Efficiency heat production	89%
Expected operation time	October-April
Expected activity level	approx. 60,000 MWh/a
summer boiler	hot water boiler
Type	KVG-7,4
Manufacturer	LLC Ukrteplostroy, Oktyabrya Street 63, Donetsk, 83030, Donetsk Oblast, Ukraine
Design firing capacity	7.4 Gcal = 8.64 MW
Efficiency heat production	92%
Expected operation time	May-September
Expected activity level	approx. 5,000 MWh/a

Flare

A flare with a firing capacity of 5.0 MW each should be installed. The CMM will be fed into the combustion chamber of a flare, where the methane will be burned completely. The plants should be operated fully automatically and all essential measured data will be gathered and recorded.

Flares like this have been tested at various landfill sites in Western Europe and are now approved. Proved safety-related equipment is used to minimise the risks of the plant. The flare is supposed to destroy the remaining CMM amount, which is not used by the boilers, especially in the summer, when the heat demand of the coal mine is low.

Technical data (single flare)	Type: KGUU 5/8 manufactured by Pro2 Anlagentechnik GmbH, Schmelzerstr. 25, 47877 Willich, Germany (planned) enclosed flare with a nominal capacity of 5.0 MW automatically controlled combustion process with minimum combustion temperature of 850°C for at least 2 s and combustion efficiency of at least 99.9 % (Combustion data according to German Legal Requirements for Landfill Gas Combustion) Flare, compressor and all other needed technical equipment are completely build in a container.
Installed firing capacity	5.0 MW
Maximum methane amount required	503 m^3/h CH_4
Expected operation time	8,000 h/a
Expected activity level	40,000 MWh/a

Default combustion efficiency	90% due to AM_Tool_07 "Tool to determine project emissions from flaring gases containing methane" [AM_Tool_07]

Electricity utilisation

Currently all electricity used for the coal mine facilities is purchased from the grid.

Heat utilisation

Currently the heat supply of the coal mine is provided by coal boilers. In the case of the project a part of this energy will be displaced by the heat generation of the project. This amount of conventionally generated heat displaced by the project generates additional ERU's.

Training programme

The responsible personnel of the project developer Eco-Alliance OOO has been trained on the handling with CMM-utilisation units and the applied monitoring systems, during an eight week long practical course in Germany in the autumn of 2005. In this course which has been carried out by A-TEC Anlagentechnik GmbH, a partner company of Eco-Alliance OOO, also the basic principles of emissions trading and the background of the monitoring has been explained. A-TEC Anlagentechnik GmbH is already running several CMM utilisation plants and monitoring systems in Germany.

These trained personnel is the basis of a team of engineers, which should establish a specialised service team in the Ukraine and instruct further operating and monitoring personnel, as well for this project.

Maintenance programme

The maintenance and operation of the project equipment will be provided by the coal mine personnel with support by Eco-Alliance OOO.

Risks of the project

Table A- 5*:* Risk and mitigation to the project

Risk	Mitigation
Lower CMM utilisation than expected	The amount of extracted CMM is higher than the amount of utilised CMM. The amount of CMM is expected to increase in the future, due to the extension of the coal mining activities.
Malfunctioning of the burner systems.	Training of the staff and regular maintenance of equipment.
Lower concentration of methane in extracted gas	The burner systems automatically regulate the amount of gas that is combusted in the utilisation units. Despite that a minimum concentration of 25% CH_4 is required for the central suction system due to legal regulations.

Lower demand for heat	The annual demand of heat at the coal mine is nearly constant. In the estimation conservative values have been taken. Seasonal heat demand has been taken into account. See figure B-1.

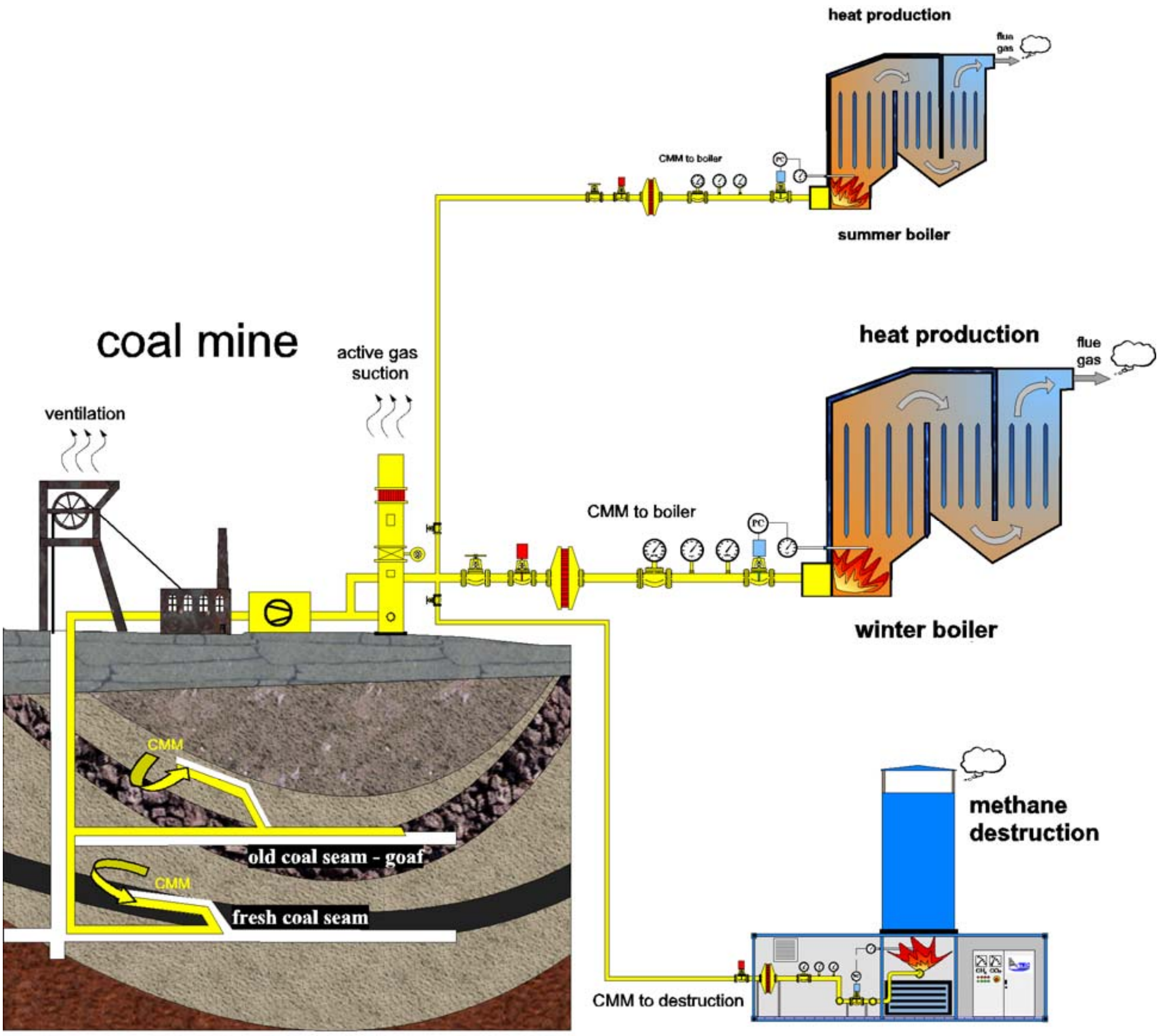


Figure A-5: General scheme of the installation with main project components

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

The emissions reduction is based on the conversion of CMM with its main component methane (GWP 21) into CO_2 (GWP 1) in combustion processes. In absence of the project the whole CMM amount, which should be converted into CO_2 in the heat generation units as well as in the flare would otherwise be released unused to the atmosphere as more harmful methane.

The heat generated by the project displaces conventionally generated heat by coal combustion and reduces the greenhouse gas emissions of the coal mine.

According to the Ukrainian law "On the ecological examination" all projects that can result in violation of ecological norms and/or negative influence on the state of natural environment are subject to ecological examination. In order to comply with regulation the coal mine will submit the project, which envisages CMM utilisation activities, to the Ukrainian Ministry of Environmental Protection for preliminary state ecological expertise.

The project is not "business-as-usual" and faces several barriers, both in terms of prevailing practice and the economic attractiveness of the project. In section B of this PDD, it is shown that the emission reductions would not occur in absence of the project.

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

Table A-6 –Emission reductions during the first crediting period (2008-2012)

	Years
Length of the period within which ERUs are to be earned	5
Length of crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2
2008	43,135
2009	172,539
2010	172,539
2011	172,539
2012	172,539
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	733,291
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	146,658

A.5. Project approval by the Parties involved:

A Letter of Endorsement for the project has been issued by the Ukrainian Ministry of Environmental Protection.

The acceptance of the project by the host party, Ukraine has been stated with a Letter of Approval, Nr. M000017, issued on 26/03/2008.
The acceptance of the project by the investor party, Kingdom of the Netherlands has been stated with a Letter of Approval, Nr. 2008JI06, issued on 22/08/2008.

A conclusion of a Memorandum of Understanding between the Dutch and the Ukrainian Governments is signed.

SECTION B. Baseline

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

The approved consolidated methodology ACM0008 / Version 05 "Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation") has been used to identify the baseline scenario of the proposed JI project [ACM0008].

Applicability of ACM0008

The project involves the extraction of CMM from underground boreholes and gas drainage galleries to capture CMM. This extraction activity is listed as one of the applicable project activity.

The methane is captured and destroyed through utilisation to produce thermal energy, and through flaring.

Ex-ante projections have been made for methane extraction and utilisation. The CMM is captured through existing mining activities. The following steps apply to the coal mine:

- The mine is not an open cast mine
- The mine is not an abandoned/decommissioned coal mine
- There is no capture of virgin coal-bed methane
- There is no usage of CO_2 or any other fluid/gas to enhance CMM drainage. In step 1 below the method of extraction is described in more detail

Hence ACM0008 is fully applicable to this JI project.

Step 1. Identification of technically feasible options for capturing and/or using CBM or CMM

Step la. Options for extraction

According to the ACM0008 methodology, all technically feasible options to extract CMM have to be listed. The technically feasible options are:

A. Pre mining CMM extraction including CBM to Goaf drainage and /or Indirect CBM to Goaf only

B. Post mining CMM extraction

C. Possible combinations of options A and B, with the relative shares of gas specified.

In the case of the project pre mining CMM and post mining CMM from several underground boreholes is collected in a suction system. The gas is sucked from the underground with gas pumps. It is impossible to determine the shares of the different sources A and B, because several drainage branches are connected to each suction systems and every branch collects CMM as long as it is in operation -before, during and after mining. So that in this case option C is the only option that is technically feasible for utilisation purposes. Usually the concentration of methane in the extracted gas ranges from 25-75%.

Step lb. Options for extracted CBM and CMM treatment

Several approaches can be taken to treat the captured CMM of the project:

i. Venting
ii. Using/destroying ventilation air methane rather than venting it
iii. Flaring of CMM
iv. Use for additional grid power generation
v. Use for additional captive power generation
vi. Use for additional heat generation
vii. Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation)
viii. Possible combinations of options i to vii with the relative shares of gas treated under each option specified

All of these options are considered as possible alternatives for the baseline scenario. In step 3 of this section some of these options will be further developed into baseline scenario alternatives. The project activity is covered by the option viii. – the combination of option iii. flaring, and option vi. additional (captive) heat production.

Step lc. Options for energy production

The options for energy production are included in the options iv. to viii. listed in step 1b.

The project activity is covered by the option viii. – the combination of option iii. flaring, and option vi. additional (captive) heat production.

Step 2. Eliminate baseline options that do not comply with legal or regulatory requirements

According to the national safety regulations, the coal mine methane has to be extracted. There is no regulation in place that would require any specific utilisation of the extracted methane. On the other hand, there are no national regulations in place that would prohibit any use of CMM, e.g. for heat and/or electricity generation. Therefore, all the alternatives listed in step lb are in compliance with the existing regulations.

Step 3. Formulation of the baseline scenario alternatives

The following alternatives can be considered for implementation at the project site and are in compliance with the options listed in step lb and step lc. In any case the coal mine has to extract the CMM from the mine for safety reasons. Therefore the alternatives below assume extraction as described in step la and describe in detail the alternatives for treatment and utilisation.

Alternative i. - Venting of CMM

Since there are no legal requirements for treatment and utilisation of the captured CMM, it is common practice at Ukrainian coal mines to release the CMM into the atmosphere. This alternative is the actual situation before project implementation – all of the CMM extracted by the project is released into the atmosphere.

The energy demand and supply of the coal mine in this scenario would continue in the following way:

- Electricity would be supplied by the national/regional grid
- On-site heat demand would be supplied by the coal fired on-site boilers

Alternative ii. Using/destroying ventilation air methane rather than venting it

Actually there is no fully developed alternative, which is state of the art, neither the use nor the destruction, due to the low concentration of the methane in the ventilation air.

In Australia a first VAM power generation demonstration project (about MWel) has been put into operation in October 2007. This project supplies a completely new technology and should originally have been started in summer 2005. The start of operation has been moved several times due to technical problems. In addition to the unknown risks of this new technology very high capital investment (about US$ 4,000/kW) is need, so that this technology is not financially viable.

The energy needs of the mine will be supplied in the same way as described in alternative i.

Alternative iii. Flaring of CMM

The flaring of the captured methane is not required by any existing national regulations. The infrastructure for methane flaring does not exist at the coal mine, so that additional investment would be required. The operation would generate additional costs. Without revenues from emissions trading this alternative would only generate costs and is economically not viable.

The energy needs of the mine would be supplied in the same way as described in alternative i.

This alternative represents a part of the project scenario, see alternative viii.

Alternative iv. – use for additional grid power generation

The captured methane could be utilised in a power plant for power generation. Possible power plant alternatives are:

a) conventional steam power plant, CMM fired

b) combined gas-steam power plant, CMM fired

c) gas turbine, CMM fired

d) gas engine, CMM fired

e) fuel cell, CMM fired

The energy needs of the mine would be supplied in the same way as described in alternative i.

Alternative v. – use for additional captive power generation

The captured methane could be utilised for captive power generation. Possible alternatives are those listed under point iv. - power generation. Furthermore for the on-site heat production also a combined heat and power generation is possible and eligible:

a) cogeneration unit, CMM fired

Depending on the power amount produced the energy needs of the mine would be supplied in the same way as described in alternative i.

Alternative vi. – use for additional heat generation

The captured methane could be utilised for additional heat generation, which means heat, which should be used outside the coal mine facilities. The existing boilers of the coal mine are supposed to supply only the coal mine facilities, the existing heating system is not connected to any other heating system outside the coal mine. So in this case a new heat generation plant should be constructed and connected to a heating system outside the coal mine, e.g. a district heating system. Possible heat generation plant alternatives are:

a) conventional steam boiler, CMM fired
b) conventional hot water boiler, CMM fired

The energy needs of the mine would be supplied in the same way as described in alternative i.

This alternative represents a part of the project scenario, see alternative viii.

Alternative vii. – feed into a gas pipeline (to be used as fuel vehicles or heat /power generation)

There are three possible ways to utilise the captured methane:

a) feeding into a gas pipeline – in this case a new connection to an existing pipeline has to be made. Depending on the quality specification of the pipeline operator, most likely an additionally methane enrichment plant could be required
b) compression of the gas and usage as fuel for vehicles
c) liquefaction of the gas and transportation in tanks for utilisation by external users

The energy needs of the mine would be supplied in the same way as described in alternative i.

Alternative viii. – possible combinations of alternatives i. to vii.

There are numerous possible combinations of the alternatives i. to vii., so that only the project scenario should be described in the following.

The CMM should be utilised for captive heat generation and for flaring. All produced heat should be consummated by the coal mine. The remaining amount of CMM, which can not be utilised for heat generation (especially in the summer), should be flared.

The project scenario consists of the following utilisation steps:

1. A summer and a winter CMM boiler should utilise CMM and produce heat.
2. The remaining available CMM amount, which can not be utilised for heat production should be flared.
3. The remaining required heat amount should be further on produced by the coal boilers, especially in the winter period.

The relative shares of gas vary during a year, mainly depending on the heat demand of the coal mine (summer/winter period). In the calculation the power production is kept constant for each month. Figure

B-1 shows the relative shares of CMM used for heat generation and flaring relative to the total amount of the utilised CMM (100%).

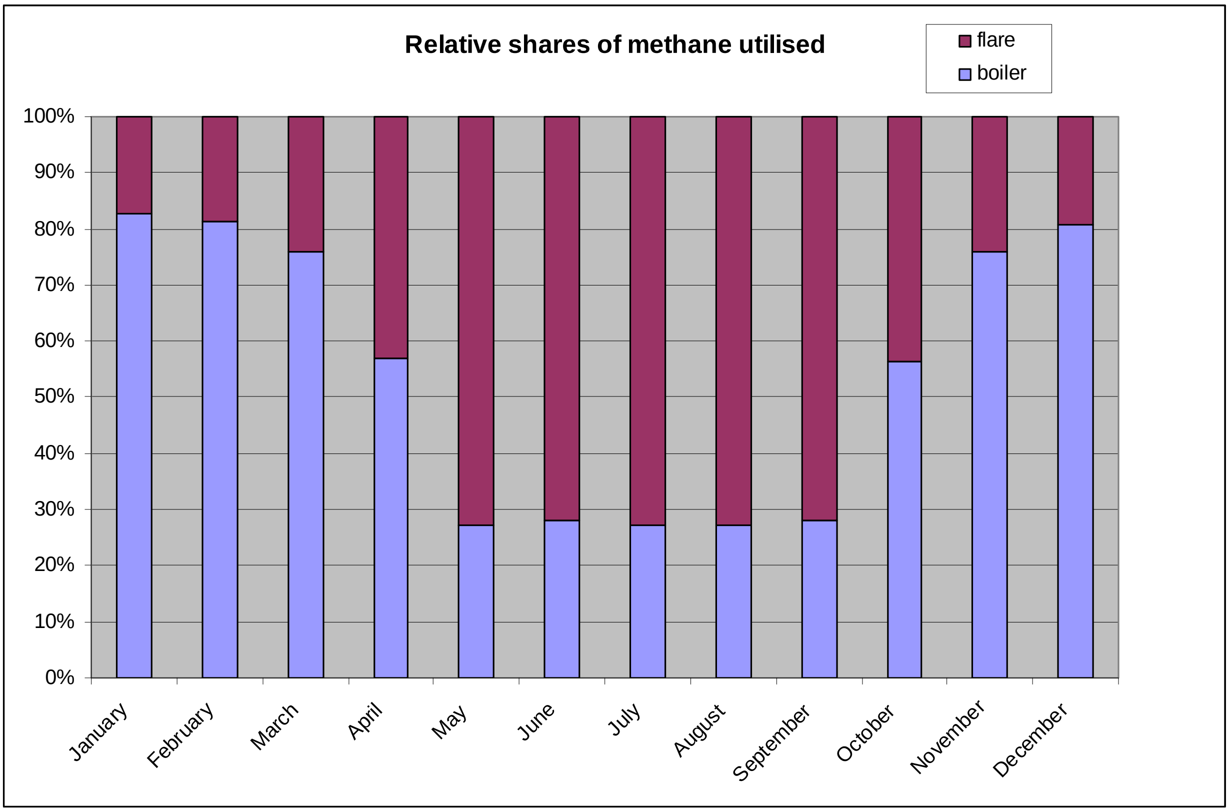


Figure B-1: Relative shares of the CMM utilisation by flaring and heat generation. The value of 100% means 100% of the <u>utilised</u> *CMM amount, whereas the total sucked amount is always higher than the utilised amount.*

Step 4. Elimination of baseline scenario alternatives that face prohibitive barriers

In this section the possible alternatives formulated above will be checked against the existing economic and other barriers for their implementation. Non-realistic alternatives will be eliminated.

Alternative i. Venting

The existing national regulations require that captured CMM has to be vented for safety reasons. There are no legal requirements that prohibit venting or require mines to utilise CMM. This alternative represents the current situation in the absence of the proposed project activity. There are no barriers or external factors that prevent this alternative to be continued. Therefore, this scenario can be considered to be a realistic alternative.

Alternative ii. Using/destroying ventilation air methane rather than venting it

As already mentioned under step 3, there is only one first demonstration project in Australia. This alternative is not financially viable at the time, and a high risk exists due to the implementation of a very new technology, which is not state of the art yet.

Therefore this alternative faces a prohibitive barrier.

Alternative iii. Flaring of CMM

Flaring of CMM is not required by the existing national regulation. Additional investment has to be made by the project owners to install the flare. Without revenues from emissions trading no income but only costs are generated. So this scenario is facing a strong prohibitive barrier, because the investment will not generate any revenues.

This scenario is part of the project scenario with revenues from emissions trading taken into account.

Alternative iv. Use for additional grid power generation

Generally CMM can be used for electricity generation that is delivered to the grid. Under this alternative heat is not generated.

a) conventional steam power plant, CMM fired

Usually power generation in conventional steam power plants is economically viable for middle and large scale plants (more than 20 MWel), so in case of the project the alternatives b) to e), which are listed below, are economically more attractive. The specific invest for a steam power plant in the 5 MW_{el} power class is about 4,000,000 EUR/MW_{el}, while the specific invest of a cogeneration unit is about 1,000,000 EUR/MW_{el}.

Therefore this alternative faces a prohibitive barrier and is eliminated.

b) combined gas-steam power plant, CMM fired

A combined gas-steam power plant is a rather new technology. At present the technology is only available for natural gas, so that the CMM, which has an appreciable lower methane concentration and lower calorific value, should be first conditioned to an adequate quality. The additionally required conditioning plant makes this alternative economically not viable. Further on this alternative would be the first combined gas-steam power plant fired with CMM in Ukraine and there are no skilled and properly trained personnel for the operation and maintenance of this kind of technology.

Therefore this alternative faces multiple prohibitive barriers and is eliminated.

c) gas turbine, CMM fired

At present this technology is only available for gases with high caloric values, so that the CMM, which has a low calorific value, should be first conditioned to an adequate quality. The additionally required conditioning plant makes this alternative economically not viable. Further on this would be the first gas turbine fired with CMM in Ukraine and there are no skilled and properly trained personnel for the operation and maintenance of this kind of technology.

There have been some tests with used airplane engines, which have been fired with unconditioned CMM (there is still an existing demonstration plant in China). However, due to the high maintenance costs and low thermal efficiency, this technology is financially not viable.

Therefore this alternative faces some prohibitive barriers and is eliminated.

d) gas engine, CMM fired

This alternative is the most suitable technology for power generation in the prospected range of performance. In this alternative only power generation for the grid and no heat generation is regarded.

This alternative is not economically viable, because the required revenues for the power feed-in into the grid are not realisable. There is no law in Ukraine which supports power feed-in from renewable energy sources or CMM. The power feed-in requires a special legalisation from the authorities. The actually realisable sale price for power is to low due to the business competition of the grid owners.

Therefore this alternative faces a prohibitive barrier and is eliminated.

e) fuel cell, CMM fired

At present this technology is only available for gases with high caloric values, so that the CMM, which has a low calorific value due to low methane concentration, should be first conditioned to an adequate quality. The additionally required conditioning plant makes this alternative economically not viable. Further on this would be the first fuel cell fired with CMM in Ukraine and there are no skilled and properly trained personnel for the operation and maintenance of this kind of technology.

Therefore this alternative faces multiple prohibitive barriers and is eliminated.

Alternative v. Use for additional captive power generation

The captive power generation faces the same barriers as the additional grid power generation. This alternative is not economically viable, because the required revenues for the power feed-in into the grid are not realisable. There is no law in Ukraine which supports power feed-in from renewable energy sources or CMM. The power feed-in requires a special legalisation from the authorities. The actually realisable sale price for power is to low due to the business competition of the grid owners.

The operation costs of a cogeneration unit are about 25 EUR/MWh. Assuming a power sale price of 30 EUR/MWh a net outcome of 5 EUR/MWh results. Assuming a specific invest of 1.000.000 EUR/MW_{el} and a very high number of operation hours of 8.000 h/a a payback time of 25 years results. On the other hand for a more realistic scenario with 5,600 h/a operation hours per annum, a minimum sale price of about 45 EUR/MWh is needed for the payback of the invest within 10 years (without interest, inflation rate, benefits etc., NPV(0))

This alternative faces a prohibitive barriers and is eliminated.

The captive heat generation is part of the project scenario. See alternative viii.

Alternative vi. Use for additional heat generation

A conventional steam boiler produces steam, so that a steam grid is required for the transportation of the generated heat to the users. Because no such a grid is available the alternative is not realisable.

A conventional hot water boiler produces hot water, which is supposed for the feed-in in a heating grid, e.g. a district heating system. The next available district heating system is too far away to make this alternative economically viable. (About 5.5 km bee-line; about 7 km on streets).

Both alternatives face prohibitive barriers and are eliminated.

However the alternative of captive heat generation with CMM fired boilers is part of the project scenario, see alternative viii.

Alternative vii. feed into a gas pipeline (to be used as fuel vehicles or heat /power generation)

There are three possible ways to utilise the captured methane:

a) feeding into a gas pipeline

In this case a new connection to an existing pipeline has to be made. Also an additionally methane enrichment plant is required to fulfil the quality specification of the pipeline operator. The costs of the enrichment plant and the lacking piping infrastructure make this alternative economically not viable.

Therefore this alternative faces a prohibitive barrier and is eliminated.

b) compression of the gas and usage as fuel for vehicles

This alternative requires a suitable large fleet of vehicles, which are upgraded with CMM compatible engines. But there are not enough such consumers available. Further on the alternative faces a barrier due to the absence of prevailing practises to utilise CMM as vehicle fuel.

Therefore this alternative faces a prohibitive barrier and is eliminated.

c) liquefaction of the gas and transportation in tanks for utilisation by external users

This alternative requires a liquefaction plant. The required investment for the plant is high. There is significant uncertainty in Ukraine on the domestic price of natural gas, and as a consequence, on the economic feasibility of such a project. There are no personnel available, which is skilled and properly trained for the operation and maintenance of such a plant. Further on the alternative faces a barrier due to the absence of prevailing practises to utilise CMM for liquefaction purposes.

Therefore this alternative faces a prohibitive barrier and is eliminated.

Alternative viii. ix. *Possible combinations of options i to vii with the relative shares of gas treated under each option specified.*
This alternative describes the project scenario not registered as JI Project

The project scenario alternative as described in step 3. requires a relatively high investment, the operating and the maintenance costs of the new technology are relatively high, on the other hand the specific energy costs of the coal mine are relatively low . E.g. coal which is actually used for heat generation in the existing boilers is available at cost price and must not be purchased at market price. As shown in the calculation of profitability, the project scenario is financially not attractive. This is proven in section B.2 of this PDD.

In addition there is significant uncertainty in Ukraine on the domestic price of natural gas, and as a consequence, on the economic feasibility of such a project. Project finance in Ukraine is absent as is shown in section B.2 and therefore the investment would have to be paid from the cash flow of the mine.

Thus this alternative is a realistic alternative but faces economical barriers and is eliminated.

Conclusion

There is only one realistic option for the baseline scenario, which is the continuation of the current situation: venting of the CMM into the atmosphere, heat generation with the existing coal fired boilers, and the full purchase of electricity from the grid.

Without additional income from emissions trading, the project is economically not viable and faces prohibitive barriers.

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

In accordance with the chosen methodology, additionality has to be proven by applying the AM_Tool_02 "Tool for demonstration and assessment of additionality", (version 05.2), EB39, Annex 10 [AM_Tool_02]. The result is given below.

Step 1. Alternatives

In accordance with the methodology ACM0008, this step is ignored.

Step 2. Investment analysis

Sub-step 2a. Determination of the analysis method

The proposed JI project should save money, which is actually spent for power purchase and heat generation. Therefore, simple cost analysis (Option I) is not applicable.

Obtaining financial indicators for similar projects in Ukraine is problematic as this project is one of the first in its kind; therefore the investment comparison analysis (Option II) cannot be performed for the identified alternatives and the benchmark analysis (Option III) will be used to test the additionality of the proposed JI project activity.

Sub-step 2b. Application of the benchmark analysis

The core business of «Donetska Vugilna Energetichna Kompanya» the project owner and owner of the Coal Mine "Pivdennodonbaska № 3" is coal mining. The project should save money, which is actually spent for the energy supply of the site. The cost reduction should make the coal mine work more efficient; nevertheless investment capital is needed. According to business as usual rules a minimum requirement for the coal mine owner is that the project should at least be profitable. Ukraine has a high inflation rate with high fluctuations. Corresponding to the inflation rate the banking interest is changing. For the calculations a value of 11.6 % for the inflation rate [CIA] and an interest rate of 15 % (http://www.bank.gov.ua) have been taken into account. Therefore the most relevant benchmark for the mine is the Internal Rate of Return IRR, which should at least be higher as the inflation rate and than the customary banking interest. An average value of 15% has been taken into account.

Sub-step 2c. Calculation and comparison of the indicators

The economic indicators for the proposed project (alternative 8) without JI revenue has been calculated under the following assumptions:

Prices for coal used for heat generation were taken as of spring of 2006 when the decision to implement the project was taken and the first version of the PDD was written. [PDD]

Degasification activities and vacuum pumps were excluded from the capital costs as they are not part of the project (the degasification activities would have to be implemented anyway irrespective of the JI project). A retrofitted connecting pipeline in the underground, which would not have been implemented without the project, has been taken into account.

The project has the following economic indicators:

Table B-1: Economic indicators of the project, without revenues from emissions trading

Economic Parameters – Coal Mine “Pivdennodonbaska № 3”, **without ERU’s**		
IRR	0,98	%
NPV (0 %)	112.153	EUR
NPV (15 %)	-803.571	EUR

NPV (0) is the “net present value” of the invested capital without interest and yield.

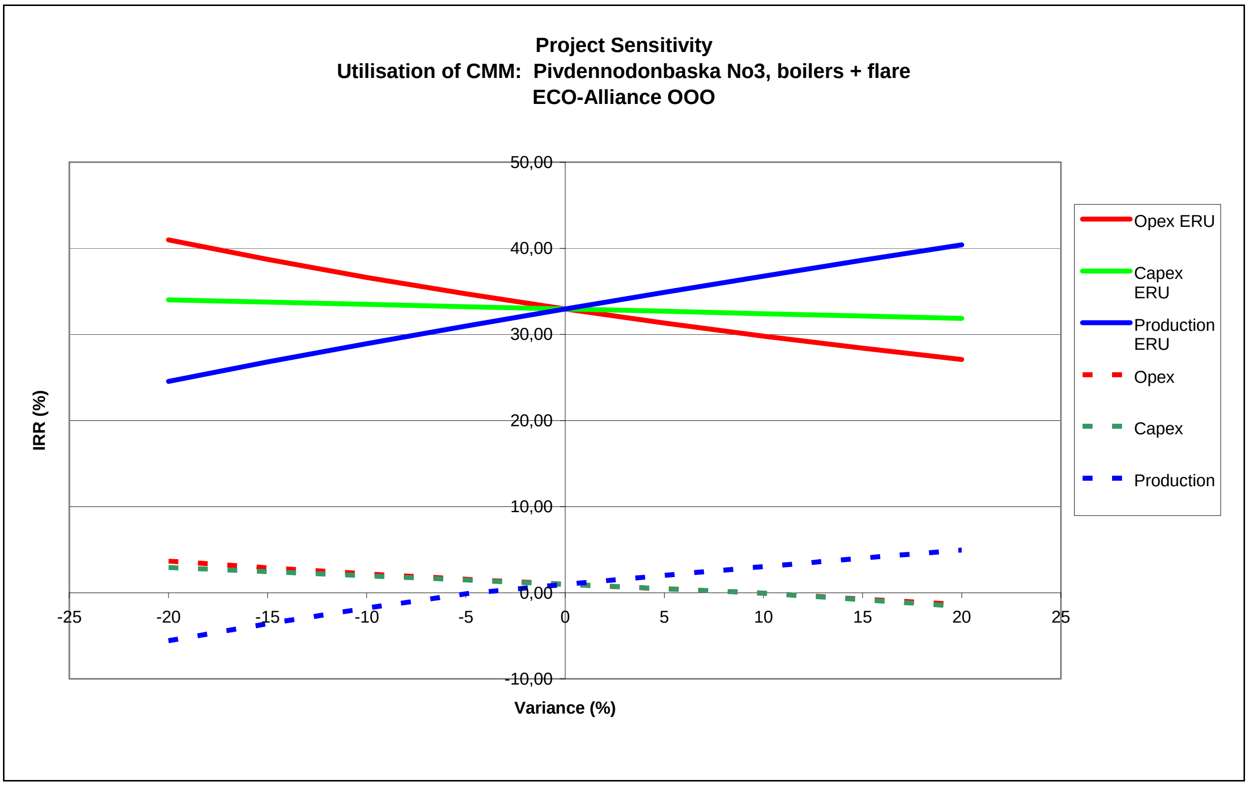
NPV (15) includes the “net present value” of the invested capital less the internal benchmark of the company (here 15%) - the true yield of a project.

It is obvious that the project is not feasible without JI revenues.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis of the proposed project has been carried out, showing the influence of the three main factors of influence: Investment (capex), operating costs (opex) und production on the Internal Rate of Return IRR. The factors have been varied in a range of +/-20

Figure B-2: Sensitivity analysis of economic indicators of the project, without ERU’s



As shown in Figure B-2 the benchmark for the IRR exceeds the set value of (15%) in no case. The Net Present Value NPV(15%) is always negative. The project is financially not attractive without additional income, and becomes first financially attractive with additional revenues from emissions trading.

Step 3. Barrier analysis Sub-step 3a.

Barrier identification

The proposed JI activity faces the following barriers:

Barriers to prevailing practices

According to publicly available information about 2 billion cubic meters of CMM are actually released by Ukrainian coal mines [GGPN] with approximately 13 percent being extracted through degasification systems while the rest released into atmosphere through ventilation systems. Only 79 mln. cubic of this huge amount meters are actually utilised.

The situation at the Coal Mine "Pivdennodonbaska № 3" is similar to the national situation. All of the CMM is released to the atmosphere. Actually there is less practice with CMM utilisation.

Existing legislation is primary orientated on increasing safety of coal mine operations thus facilitating and enforcing development of degasification and ventilation systems at coal mines. Therefore current practices prevent the project from being implemented and clearly prevent the development of CMM utilisation activities.

Actually there are some other Ukrainian JI-Projects concerning the CMM utilisation on several coal mines in the Donbass region, one of which the JI-Project 0035 at the Zasyadko coal mine meanwhile has been accepted by the UNFCCC.

Technology barrier

According to official information the project as first applied in 2006 for validation by would have been one of the first CMM Utilisation projects in Ukraine. In the meantime more projects are planned to be installed as JI-projects and some CMM utilisation units are already in operation. Despite that CMM utilisation is not yet common practice in Ukraine and far away from business as usual. The coal mine has no skilled and properly trained personnel to operate CMM utilisation units. Therefore there is a clear technology barrier for the realisation of the proposed project.

Financial barrier

See step 2c.

A transparent and documented evidence used to proof or cross the barriers has been submitted to the AIE.

Sub-step 3b. Influence of the barriers identified on the alternative baseline scenario

The only viable alternative to the proposed JI activity is the continuation of the existing situation. Since this scenario does not require any additional investment or changes in the technology, it is not affected by the barriers described above. All other alternatives faces barriers and are not feasible.

Step 4. Common practice analysis

Venting the captured CMM into the atmosphere is the common practice in the coal sector of Ukraine. At the time of the project start date in February 2006 there have been about 160 coal mines in Ukraine [GGPN], therefrom about 30-40 bigger mines like Pivdennodonbasska №.3 [EPA]. Only at 5 big coal mines CMM fired boilers have been installed [EPA], [PD3] - Bazhanova Mine (10 MW, since 1974), Chaikino Mine (6.5 MW, 1984), Holodnaya Balka Mine (6.5 MW, 1996), Krasnolimanskaya Mine (10 MW, 2001) and Kirova Mine (6,5 MW, 2003). The few examples show clearly that CMM utilisation is not yet common practice in Ukraine and far away from business as usual.

The proposed activity is not common practice.

Step 5. Impact of JI revenues

As shown in table B-2, the impact of the JI-Project activity allows the crossing of the financial barrier and the project becomes financially attractive.

Table B-2: Economic indicators of the project, with revenues from emissions trading

Economic Parameters – Coal Mine "Pivdennodonbaska № 3"**, with ERU's**		
IRR	32,94	%
NPV (0 %)	3.869.272	EUR
NPV (15 %)	1.123.515	EUR

Further on the impact will help the introduction of the new technologies to the coal mine by making the necessary investment possible, allowing the financing of additional training courses for the personnel, resulting in increased skills, knowledge and practice of team.

Conclusion

The impact of approval of the proposed JI project activity will allow the crossing of the financial hurdles and other barriers that otherwise would prevent the project from being implemented.

The project is additional.

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

Table B-3: Overview on emissions sources included in or excluded from the project boundary

Baseline

	Source	Gas		Justification / Explanation
Baseline Emissions	Emissions of methane as a result of venting	CH_4	Included	The main emission source. The amount of methane to be released depends on the amount utilised. The baseline scenario for the project activity not implemented as a JI project is taken into account.
	Emissions from destruction of methane in the baseline	CO_2	Excluded	There is no flaring and no use for heat and power in the applicable baseline scenario.
		CH_4	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.
		N_2O	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.
	Grid electricity generation (electricity provided to the grid)	CO_2	Excluded	Only CO_2 emissions associated to the same quantity of electricity than electricity generated as a result of the use of methane included as baseline emission will be counted.
		CH_4	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.
		N_2O	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.
	Captive power and/or heat, and vehicle fuel use	CO_2	Included	In the baseline scenario heat would be generated by the on-site coal boilers.
		CH_4	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.
		N_2O	Excluded	Excluded for simplification. This is conservative and in accordance with ACM0008.

Table B-4: Overview on emissions sources included in or excluded from the project boundary

Project activity

	Source	**Gas**		**Justification / Explanation**
Project Emissions	Emissions of methane as a result of continued venting	CH_4	Excluded	Only the change in CMM/CBM emissions release will be taken into account, by monitoring the methane used or destroyed by the project activity.
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Excluded Excluded	The electricity consumption of the vacuum pumps is not included in the project boundary as they are necessary for the extraction itself and is performed both in the baseline and project scenario. The own electricity consumption of the boilers and the flares is not significant*) and has been excluded.
		CH_4	Excluded	Excluded for simplification in accordance with ACM0008. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification in accordance with ACM0008. This emission source is assumed to be very small.
	Emissions from methane destruction	CO_2	Included	From the combustion of methane in the flares and heat generation.
	Emissions from NMHC destruction	CO_2	Included	Actually NMHC accounts less than 1% by volume of the extracted coal mine gas, so NMHC has been excluded for estimating the emission reductions. However the NMHC amount will be monitored on a regular basis and the emissions will be included if the NMHC concentration will exceed 1%.
	Fugitive emissions of unburned methane	CH_4	Included	In accordance with ACM0008, a small amount of uncombusted methane, 0.5% for each unit, will be accounted to keep conservative.
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	Excluded for simplification in accordance with ACM0008. This emission source is assumed to be very small.
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification in accordance with ACM0008. (Besides it is not applicable to the project.)
	Accidental methane release	CH_4	Excluded	Excluded for simplification in accordance with ACM0008. This emission source is assumed to be very small.

*) The average per year over the crediting period is less than 1% of the annual average and does not exceed the amount of 2,000 t CO_{2eq}. Reference JISC "Guidance on Criteria for Baseline Setting and Monitoring", B,11,(a),(iii).

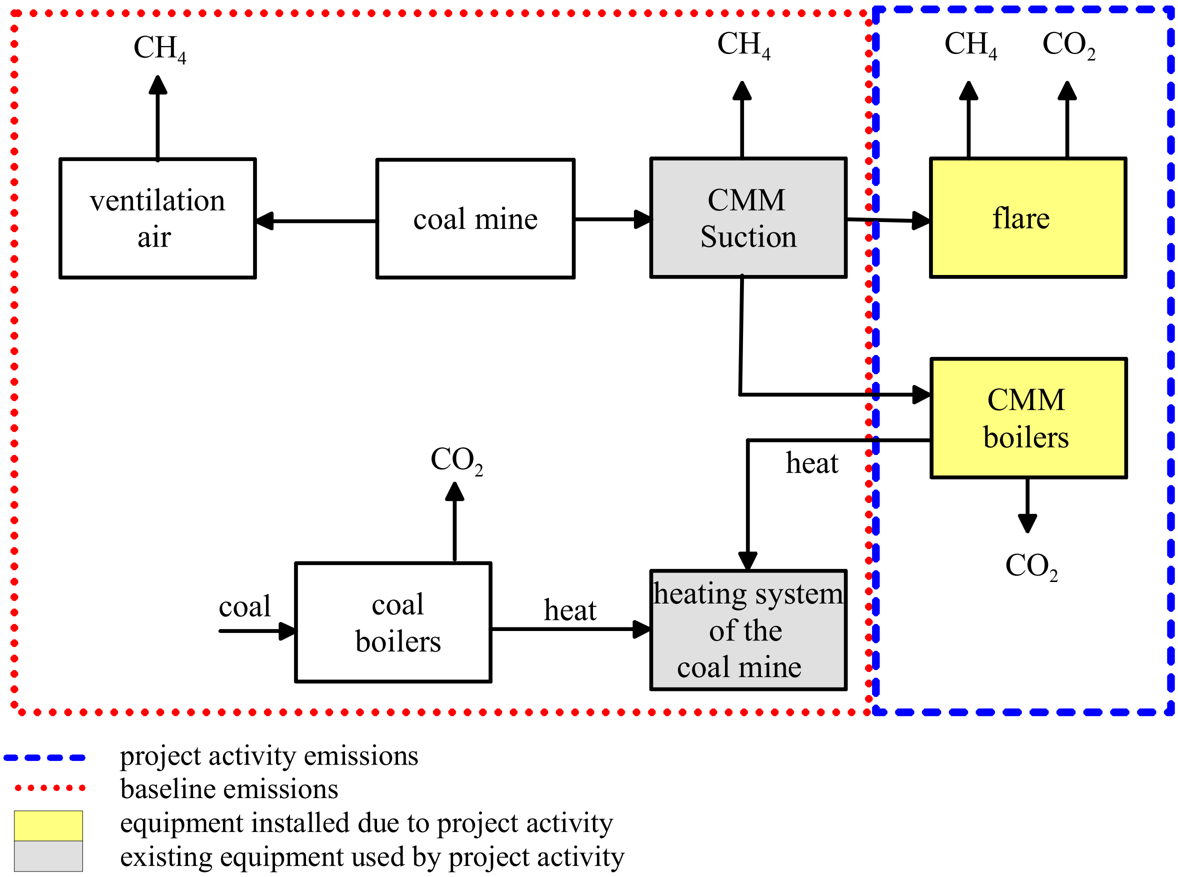


Figure B-3: Project boundary

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

Date of completion of the baseline study: 12/08/2008

Name of person / entity setting the baseline: Emissions-Trader ET GmbH
Schulstrasse 11
46519 Alpen
Germany

Emissions-Trader ET GmbH is not project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

14/02/2006 (Meeting of the Ukrainian Ministry of Coal Industry, DUEK and the MakNII Institute)

C.2. Expected operational lifetime of the project:

at least 10 years, minimum until the end of the crediting period

C.3. Length of the crediting period:

5 years

1st crediting period starting with 01/01/2008

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

A monitoring plan provided by the "Approved consolidated methodology ACM0008", Version 05, Sectoral Scope: 8 and 10, EB 42 is applied to the project [ACM0008].

According to ACM0008, AM_Tool_07, the methodological "Tool to determine project emissions from flaring gases containing methane", EB 28 Meeting report, Annex 13, has been taken for the determination of the project emissions from flaring. According to the tool, the default value of 90% for enclose flares has been taken. Applicability requirements for the monitoring plan of the ACM0008 methodology are identical to respective requirements of the baseline setting. For a detailed overview of the ACM0008 applicability please refer to section B.I of this PDD.

General remarks to the Monitoring Plan:

- The monitoring plan will be updated during the first verification;
- Social indicators such as number of people employed, safety record, training records, etc, will be available to the verifier;
- Environmental indicators such as dust emissions, NO_x, or SO_x will be available to the verifier. These indicators are being reported to the Regional Supervisory Authority on an annual basis;
- The CH_4 and N_2O emission reductions will not be claimed as mentioned in section B.3 and will therefore not be monitored. This is conservative and in accordance with ACM0008;
- IPCC default factors have been taken from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. [IPCC-2]
- In accordance with ACM0008 only methane that is being destroyed by the project should be measured.

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

The ID Numbers used in the tables below refer to the ID numbers as used in ACM0008; missing ID numbers refer to parameters, which are listed in the monitoring plan of the ACM0008, and which are not applicable to the project.

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1 PE_y	Project emissions in year y	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.2, see below
P3 PE_{MD}	Project emissions from methane destroyed	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.2, see below
P4 PE_{UM}	Project emissions from uncombusted methane	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.2, see below

P11 MD_{FL}	Methane destroyed by flare	monitored data	t CH_4	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.2, see below
P12 MM_{FL}	Methane sent to flare	flow meter	t CH_4	m	15 min. cycle	100%	electronic	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.717 kg/m³ [DIN ISO 6976 (1995)] (1013 mbar, 273.15°K). The gas volume is measured on a wet basis.

P13 PE_{Flare}	project emissions from flaring of the residual gas stream	monitored data	t CO_{2eq}	m/c	15 min. cycle	100%	electronic	The parameters used for determining the project emissions from flaring of the residual gas stream (PE_{Flare}) will be monitored as per the AM_Tool_07 *"Tool to determine project emissions from flaring gases containing Methane"*.
P17 MD_{HEAT}	Methane destroyed by heat generation	monitored data	t CH_4	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.2, see below

P18 MM_{HEAT}	Methane sent to boilers	flow meter	t CH_4	m	15 min. cycle	100%	electronic	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.717 kg/m³ DIN ISO 6976 (1995) (1013 mbar, 273.15°K)
P19 Eff_{HEAT}	Efficiency of methane destruction / oxidation in heat plant	IPCC	-	e	ex ante	100%	paper	set at 100% (IPCC 2006)
P23 CEF_{CH4}	Carbon emission factor for combusted methane	IPCC	-	e	ex ante	100%	paper	set at 2.75 t CO_{2eq}/t CH_4
P24 CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various)	lab analysis	-	c	annually	main components	paper	Calculated if applicable, based on the lab analysis. (See P26)
P25 PC_{CH4}	Concentration of methane in extracted gas	measurement	%	m	15 min. cycle	100%	electronic	measurement

P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	m	annually	main components	paper	Used to check if more than 1% of emissions and to calculate r
P27 r	Relative proportion of NMHC compared to methane	lab analysis	%	c	annually	100%	paper	Calculated if applicable, based on the lab analysis.
P28 GWP_{CH4}	Global warming potential of methane	IPCC	-	e	ex ante	100%	paper	set at 21
P32 T_{flare}	Temperature in the exhaust gas of the flare	*AM_Tool_07 methodological "Tool to deter-mine project emis-sions from flaring gases containing Methane"*	°C	m	15 min. cycle	100%	electronic	measurement

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 are defined by the following equation

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad (1)$$

where:

PE_y Project emissions in year y (t CO_2eq)
PE_{ME} Project emissions from energy use to capture and use methane (t CO_2eq)
PE_{MD} Project emissions from methane destroyed (t CO_2eq)
PE_{UM} Project emissions from un-combusted methane (t CO_2eq)

Project emissions from energy use to capture and use methane (PE_{ME}), are obtained by the equation:

$$PE_{ME} = CONS_{ELEC,PJ} \times CEF_{ELEC,PJ} \quad (2)$$

where:

PE_{ME}	Project emissions from energy use to capture and use methane (t CO_2eq)
$CONS_{ELEC,PJ}$	Additional electricity consumption for capture and use or destruction of methane, if any (MWh)
$CEF_{ELEC,PJ}$	Carbon emissions factor of electricity used by the coal mine (t CO_2eq/MWh)

All utilisation units are supplied with CMM from the CMM suction system of the coal mine. The CMM pressure provided by the suction system is sufficient for the operation of all utilisation units and no further compression is needed. The CMM suction system is always in operation for safety reasons in the underground of the coal mine. The CMM suction system would be also in operation in the absence of the project; in this case the methane would be simply blown into the atmosphere. Thus the energy use for capture of the methane is outside the project boundaries and only the part for use methane is regarded.

The flare and the boilers need only very few additional electric power for operation – only for the measurement instruments and control devices. This power consumption is negligible and is not taken into account. $CONS_{ELEC,PJ}$ is set to zero, $CEF_{ELEC,PJ}$ is not needed.
Project emissions from methane destroyed (PE_{MD}) can be obtained by the equation:

$$PE_{MD} = (MD_{FL} + MD_{HEAT}) \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad (3)$$

with:

$$r = PC_{NMHC} / PC_{CH4} \quad (4)$$

where:

PE_{MD}	Project emissions from CMM destroyed (t CO_2eq)
MD_{FL}	Methane destroyed through flaring (t CH_4)
MD_{HEAT}	Methane destroyed through heat generation
CEF_{CH4}	Carbon emission factor for combusted methane (2.75 t CO_2eq/t CH4)
CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various) (t CO_2eq/tNMHC)
r	Relative proportion of NMHC compared to methane
Pc_{CH4}	Concentration (in mass) of methane in extracted gas (%)

PC_{NMHC} NMHC concentration (in mass) in extracted gas (%)

$$MD_{FL} = MM_{FL} - (PE_{flare}/GWP_{CH4}) \quad (5)$$

where:
MD_{FL} Methane destroyed through flaring (t CH_4)
MM_{FL} Methane measured sent to flare (t CO_2eq)
PE_{flare} Project emissions of non-combusted CH_4, expressed in terms of CO_2 from flaring of the residual gas stream (t CO_2eq)

GWP_{CH4} Global warming potential of methane (21 tCO_2eq/tCH_4)

The AM_Tool_07, methodological "Tool to determine project emissions from flaring gases containing methane" gives the following formula for the calculation of PE_{flare}:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \, x \, (1 - \eta_{flare,h}) x \frac{GWP_{CH4}}{1000} \quad \text{(AM\_Tool\_07-15)}$$

where:
$PE_{flare,y}$ Project emissions from flaring of the residual gas stream in year y (t CO_2eq)
$TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$ flare efficiency in the hour h
GWP_{CH4} Global warming potential of methane (21 tCO_2eq/tCH_4)

The flare is used is an enclosed flare. According to the AM_Tool_07 "Tool to determine project emissions from flaring gases containing methane" option a) the usage of a 90% value for the flare efficiency has been chosen instead of the continuous monitoring of the efficiency. In this case $\eta_{flare,h}$ is constant and the equation (AM_Tool_07-15), see above can be simplified to:

$$PE_{flare,y} = MM_{FL} \text{ x } 0.1 \text{ x } GWP_{CH4}$$

where

MM_{FL} is the cumulated yearly amount of methane sent to flare (t CH_4/y)

Uncombusted methane from flaring and end uses (PE_{UM}) can be obtained through the equation:

$$PE_{UM} = GWP_{CH4} \times [MM_{HEAT} \times (1 - Eff_{HEAT})] + PE_{flare} \quad (9)$$

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B1 BE_y	Baseline emissions in year y	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.4, see below
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.4, see below

B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y	monitored data	t CO_{2eq}	c	monthly	100%	electronic	calculated using formulae in Section D.1.1.4, see below
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	flow meter	t CH_4	m	15 min. cycle	100%	electronic	pre-mining + during mining + post-mining methane is collected as a cumulative value, see section B.1, Step 1a for explanation
B18 GWP_{CH4}	Global warming potential of methane	IPCC	t CO_{2eq} / t CH_4	e	ex ante	100%	paper	21 t CO_{2eq} / t CH_4
B19 CEF_{CH4}	Carbon emission factor for combusted methane	IPCC	t CO_{2eq} / t CH_4	e	ex ante	100%	paper	44/16 = 2.75 tCO_2e/tCH_4
B47 $HEAT_y$	Heat generation by project	heat meter	MWh	m	monthly	100%	electronic and paper	cumulative value

B55 $EF_{CO2,Coal}$	CO_2 emission factor of fuel used for captive power or heat	IPCC	tCO_2/TJ	e	ex ante	100%	paper	IPCC 2006 defaults.
B57 Eff_{heat}	Energy efficiency of heat plant	manufacturer data	%	e	ex ante	100%	paper	Efficiency measurement instead of manufacturer data if available

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 are given by the following equation:

$$BE_y = BE_{MR,y} + BE_{Use,y} \quad (10)$$

The baseline emissions from release of methane into the atmosphere in the year y ($BE_{MR,y}$) is obtained by the following equation:

$$BE_{MR,y} = CMM_{PJ,y} \times GWP_{CH4} \quad (14)$$

The total emissions reductions from displacement of heat generation are given by the following equation:

$$BE_{Use,y} = (HEAT_y / Eff_{HEAT}) * EF_{HEAT} \quad (24)$$

Where

$BE_{Use,y}$ Total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO_{2e})

$HEAT_y$ Heat generation by project activity in year y (MWh)

EF_{HEAT} Emissions factor for heat production replaced by project activity (tCO_2/MWh)

Eff_{HEAT} Efficiency of the former heat generation unit, which is displaced by project activity (%)

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

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

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

not applicable

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

not applicable

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

In accordance with ACM0008 the following leakages should be considered:

1. Displacement of baseline thermal energy uses
2. CBM drainage from outside the de-stressed zone
3. Impact of the JI project on coal production
4. Impact of the JI project on coal prices

There is no leakage in the project as:

1. There is no CMM being used for thermal demand under the baseline scenario. Hence there is no leakage for displacement of baseline thermal energy uses
2. There is no CBM involved hence no leakage occurs from CBM drainage from outside the de-stressed zone

3. There is no impact of the JI project on coal production as degasification activities are independent from the JI project. For the coal production it doesn't matter if the methane is utilised or released unused to atmosphere. It also makes no difference, which fuel is used for heat production.

4. The impact of the JI project on coal prices is difficult to assess. The JI project as such does not influence coal production so it is unlikely that the JI project will impact coal prices. The coal prices are mainly affected by the world coal market. Beyond that the coal mine is state-owned and the pricing for coal is regulated by the state.

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

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

Not applicable. There are no leakages and no indirect emissions. See D.1.3 for details.

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

Not applicable. There are no leakages and no indirect emissions. See D.1.3 for details.

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

The greenhouse gas emission reduction gained by the project over a period is the difference between the total baseline emissions over the period and the total project emissions over the period. This is given by the equation:

$$ER_y = BE_y - PE_y \qquad (18)$$

where:

ER_y Emissions reductions of the project activity during the year y (t CO_{2eq})
BE_y Baseline emissions during the year y (t CO_{2eq})
PE_y Project emissions during the year y (t CO_{2eq})

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:

To maintain a consistent and reliable performance of the automatic controlling and monitoring system an adequate quality control and assurance procedures will be implemented that is regulated by the calibration standards and quality norms of the national legislation. Under these requirements of quality control system, regular maintenance and testing regime to ensure accuracy of flow meters, gas-analysers, electricity and heat measuring instruments will be provided. All measuring instruments will be calibrated periodically. The calibration protocols will be archived and proved by an independent entity on an annual basis. A consistency check for all measurement data and the calculation of the emission reductions will be carried out and reported monthly.

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

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
P12 P18 B14 *Methane amount*	medium	The flow meters consist of an orifice and a pressure difference meter. The measured volumetric flow rates are designed for a standardised gas composition and are corrected by the actual gas condition. The measured flow rates will be continuously converted from operation condition to standard state condition by use of the ideal gas law and the actual gas temperature and pressure. The indications of the orifice pressure difference meter and the respective temperature and pressure meters have usually hardly any fluctuations and no recalibration is needed. The meters should be initially controlled during the final inspection by the manufacturer and will be checked regularly according to the manufacturer's instructions. The indications of the measurement instruments should be controlled during the regular inspections while the operation time, and a gauge which is obviously out of order should be substituted. The quality of the determined value for the methane amount is mainly affected by the methane concentration, see P25.
P25 *Methane concentration*	medium	The indication of the CH_4 gas analyser has to be recalibrated periodically. The recalibration will be carried out regularly according to the manufacturer's instructions.
P26 *NMHC concentration*	low	The determination will be provided by an accredited laboratory.

P32 *Flare temperature*	low	The indication of the flame temperature has usually hardly any fluctuations and no recalibration is needed. The meter should be initially controlled during the final inspection by the manufacturer and will be checked regularly according to the manufacturer's instructions. The indication of the meter should be controlled during the regular inspections while the operation time and a gauge which is obviously out of order should be substituted. According to the AM_Tool_07, *"Tool to determine project emissions from flaring gases containing Methane"* the flame temperature pick-up should be recalibrated or replaced every year.
B47 *Heat production*	low	The indication of the measurement instrument should be initially controlled during the final inspection by the manufacturer and will be checked regularly according to the manufacturer's instructions. The gauge will be recalibrated by the manufacturer according to his own recalibration intervals. The indication of the measurement instrument should be controlled during the regular inspections while the operation time and a gauge which is obviously out of order should be substituted.

Irrespective the monitoring plan all installed aggregates and gauges should be controlled during the regular inspections, at least weekly, to assure a proper operation of the facility. Beside the monitored values any other values which are needed for the supervision of the plant should be logged.

Any gauge or apparatus which is detected as obviously out of order should be substituted.
Furthermore emissions measurement for dust, CO, NO_x etc. for all combustion units will be carried out and archived as required by the legal requirements of the Ukrainian Authorities.

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

The plants installed in the project are designed to run fully automatic, so that the operating personnel have only to supervise the correct operation of the plant and the plausibility of the collected and monitored data. In case of disturbances and emergency the plant will be shut down automatically and no unintended emissions are caused. The CMM supply will be locked by quick acting valves. Fire arresters prevent from backfiring into the CMM pipe for safety of the personnel and equipment. During the downtime of the plant the unused CMM will be vented by the coal mine as it would be without the project activity.

In case of emergency an alarm message is sent to a permanently manned place in the control room. The operating personnel, who are on duty, check the plant status and decide on further procedures as clearing the fault, eliminating danger and restarting the plant, sending a service team, informing the project manager, a fire brigade, etc.
Every emergency case is journalised.

The collected data should be stored electronically by the installed data logger and on paper by the plant manager. The data should be read out daily from the data logger and stored and archived in a central data base. The data base can provided with an internet front end by which all stored data can be visualised, controlled and analysed. The administrator of the data base is responsible for the proper work of the data base, routine backups and save storage.

The plant manager is responsible for correctness of the logged data and the administration of the data base. He should regularly verify the electronically recorded data with the handwritten data and check the stored data for plausibility, errors, deviations and non-conformity. All inconsistencies should be discussed with the service and the operation teams, at which the operational and monitoring experience is gained, the plant operation is optimised, and a more accurate monitoring should result.

All stored data will be kept during the whole operation period of the plant and furthermore for at least 5 years.

The plant manager is responsible for the preparation of the standardised weekly report. He is also in charge for the preparation of the summarised monthly and yearly reports, which should be revised by the project manager.

The plant manager is keeping an operational journal which includes the following information:

- compilation and description of all data recorded, required for the calculation of the emission reductions
- description of all records to be kept during the regular inspections, including all corrective action undertaken
- manually logged data collected during the regular inspections
- particular events
- all calibrations carried out, incl. all calibration protocols

The visualisation of the data via internet provides a prompt control of the project operation by the project manager. All data should be continuously checked for consistency, completeness and integrity by Eco Alliance OOO. A detailed plausibility check should be carried out at least monthly.

Based on the procedure described above a detailed annual report should be prepared by Eco Alliance OOO and confirmed by the verifier.

The responsible personnel of Eco Alliance OOO has been trained on the handling with CMM-utilisation units and the applied monitoring systems, during an eight week long practical course in Germany in the autumn of 2005. In this course which has been carried out by A-TEC Anlagentechnik GmbH, a partner company of Eco Alliance OOO, also the basic principles of emissions trading and the background of the monitoring has been explained. A-TEC Anlagentechnik GmbH is already running several CMM utilisation plants and monitoring systems in Germany.

These trained personnel is the basis of a team of engineers, which should establish a specialised service team in the Ukraine and instruct further operating and monitoring personnel, as well for this project. Actually there is no final training procedure established. The project management should be done by the Project Manager from «Donetska Vugilna Energetichna Kompanya», who will be assisted by Eco Alliance OOO. The operation of the plants should be done by the operational personnel of the coal mine "Pivdennodonbaska № 3" with the assistance of Eco Alliance OOO. The service and maintenance of the boilers should be done by the operational personnel of the coal mine. The service and maintenance of the flare should be done by the service personnel of Eco Alliance OOO. The monitoring should be carried out by Eco Alliance OOO and the project manager of «Donetska Vugilna Energetichna Kompanya».

The experience of the Ukrainian personnel will be gained by training on the job together with German service teams. During this period detailed work instruction should be worked out and wrote down.

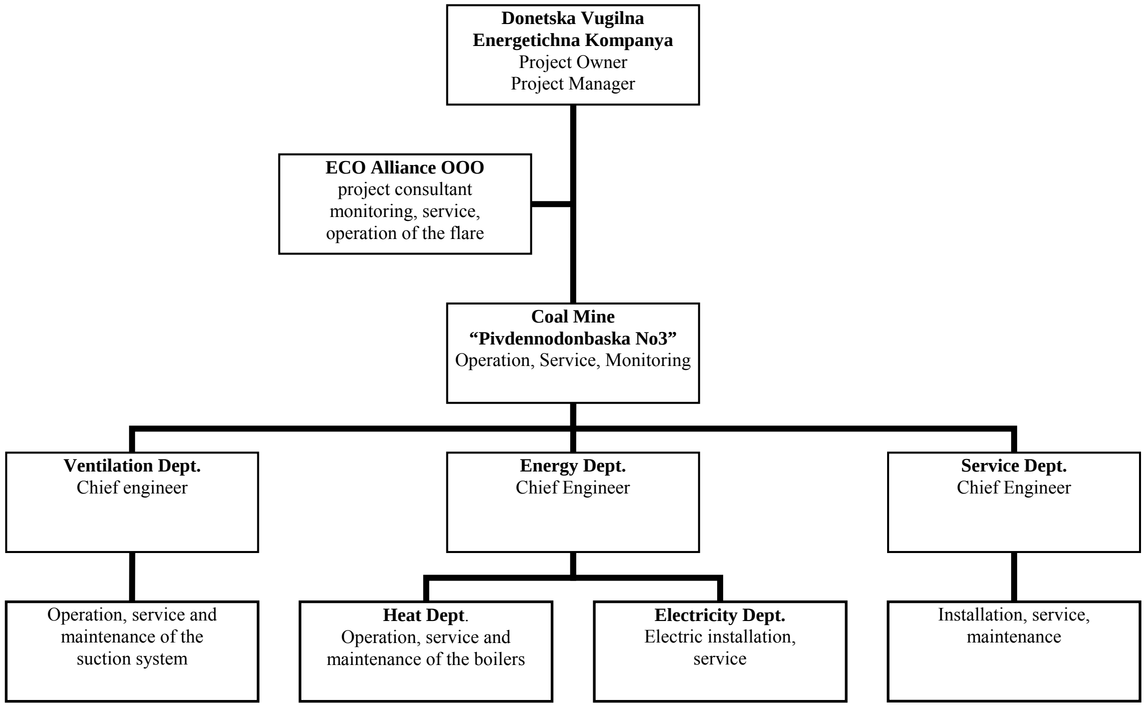


Figure D-1 - Project management structure

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

Date of completion of the monitoring plan: 23/06/2008

Name of person / entity setting the baseline:

Emissions-Trader ET GmbH
Schulstrasse 11
46519 Alpen
Germany

Emissions-Trader ET GmbH is not project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The following calculations are based on the baseline determined in section B. All CMM which is burned in the boilers and the flare is concurrently avoided CMM, which would otherwise escape to the atmosphere in absence of the project. All heat, which is generated by the project, is concurrently displaced heat, which would otherwise be generated by coal combustion.

The project emissions PE are calculated presuming that NMHC has not to be regarded (r = 0).

Table E-1 – Estimated project emissions

Estimated project emissions [t CO_2eq / a]		
year	2008	2009-2012
methane destruction		
flaring	3,292	13,166
heat generation	3,726	14,906
sum	**7,018**	**28,072**

E.2. Estimated leakage:

There is no leakage in this kind of project.

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

Table E-3 – Estimated project emissions and leakage

Estimated project emissions and leakage [t CO_2eq / a]		
year	2008	2009-2012
methane destruction		
flaring	3,292	13,166
heat generation	3,726	14,906
sum	**7,018**	**28,072**

E.4. Estimated baseline emissions:

Table E-4 – Estimated baseline emissions

Estimated baseline emissions [t CO_2eq / a]		
year	2008	2009-2012
release of methane that is avoided by the project		
flaring	15,109	60,436
heat generation	27,544	110,174
production of heat that is displaced by the project	7,500	30,001
sum	**50,153**	**200,611**

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

See table E-6 in section E.6.

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

Table E-6 – Project emissions and emission reductions during the 1st crediting period (2008-2012)

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emissions reductions (tonnes of CO2 equivalent)
2008	7,018	-	50,153	43,135
2009	28,072	-	200,611	172,539
2010	28,072	-	200,611	172,539
2011	28,072	-	200,611	172,539
2012	28,072	-	200,611	172,539
Total (tonnes of CO2 equivalent)	119,306	-	852,597	733,291

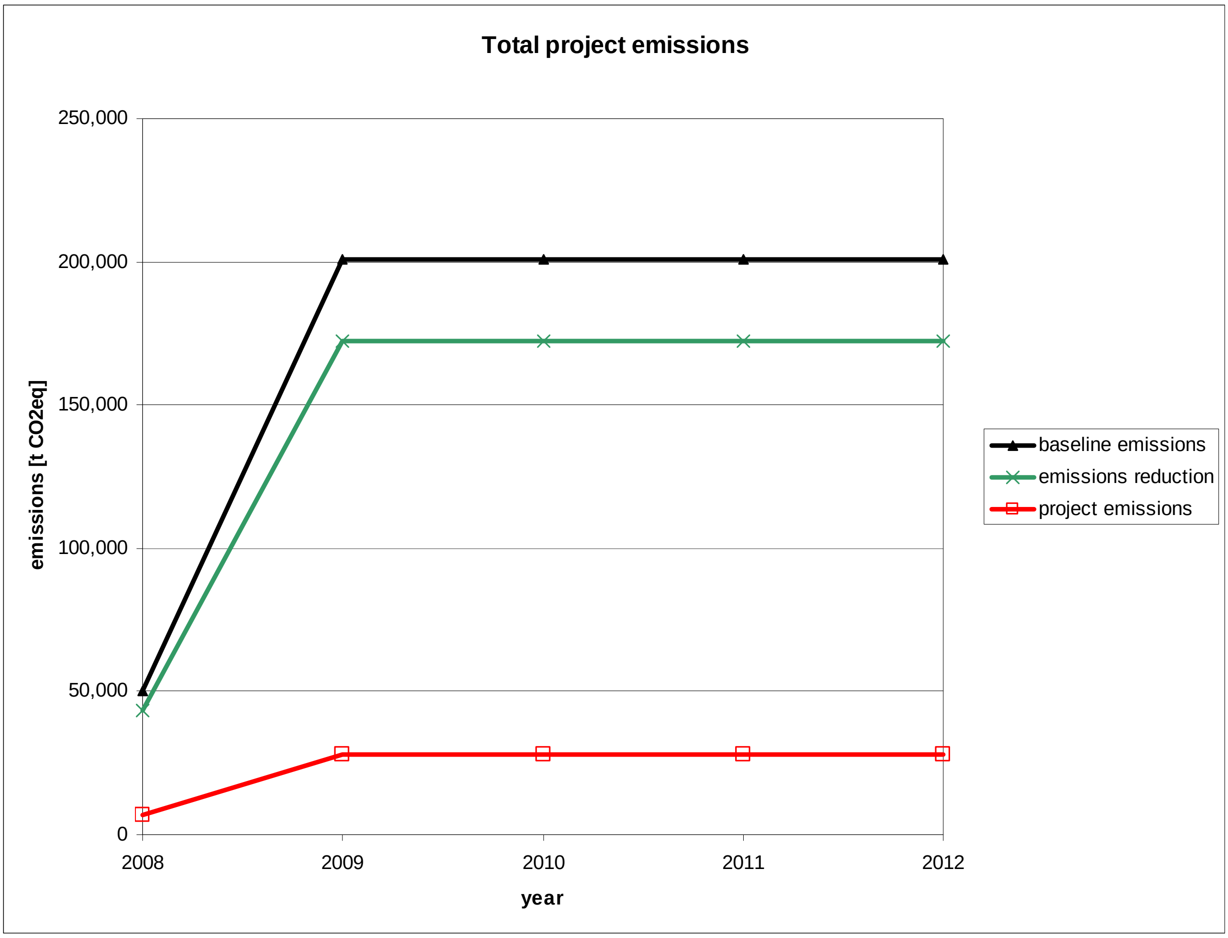


Figure E-1 - Baseline emissions, project emissions and emissions reduction; total project

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 flare including the switchgear and all other accessories needed is built-in in transportable container module. The complete facilities are built in series production at the manufacturer.

The container technology provides an easy removal of the facility after shutdown. The container has only a small footprint and is set up on four small ready-mix concrete plates, which are put under the four angles of the container. Because no groundwork is needed the complete plant can be removed fast and easy and the original state of the site can be restored in an uncomplicated way after shut down.

The boilers are build-in in an existing boiler house together with the other boilers. The installation of the new boilers requires no further use of natural resources.

Both units do not use the natural resources: water, ground and landscape, so that no impairment on nature or landscape is given. The facilities do not produce any waste, sewage or condensate. Due to the very high operational safety standards supplied a very low accident hazard is given. Due to the low intervention to the nature renaturisation is easy. All additional equipment is placed on the ground of the coal mine, no additional ground is needed.

All combustion units require an approval by the Ukrainian Mining Authorities. This approval includes a safety expert opinion and an environmental impact study.

Both facilities cause no harmful environmental impacts. In fact the utilisation of otherwise unused CMM reduces in an active manner the amount of CMM which is released to the atmosphere and provides significant benefits for the global climate production by converting the harmful methane into the less harmful carbon dioxide.

Furthermore the operation of the plants reduces the uncontrollable migration of CMM to the surface in the surrounding area and reduces consequently the accident hazard by fire and explosions caused through methane which would otherwise uncontrollable discharge to the atmosphere.

Beside the positive effect on the global climate protection, no transboundary impacts occur.

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:

There are no significant environmental impacts expected. No environmental impact assessment is needed. The plant has to fulfil the requirements of the Ukrainian Department of Ecology and Nature Conservation. The requirements should be checked by the government when the permission of the plant will be applied.

SECTION G. Stakeholders' comments

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

The project has been introduced to the Ukrainian Government and local authorities with a Project Idea Note (PIN). The authorities appreciated the project and a Letter of Endorsement, dated 18/09/2006 and finally a Letter of Approval, dated 26/03/2008 have been issued by the Ukrainian Ministry of Environmental Protection.
All comments received by the coal mine were positive towards implementation of the project. It was especially noted that utilisation of coal mine methane will increase the safety of the work at the coal mine and create some new working places.

The first PDD has been published for global stakeholder comments on 28/08/2006 on the TUEV-Nord website http://www.global-warming.de. After the installation of the Track 2 procedure by the JISC, the project participants decided to follow the Track 2 procedure, so that the PDD has been transcribed to the new JI-PDD form and republished by the JISC on the UNFCCC website for the Global Stakeholding Process from 10/07/2008 to 08/08/2008.

There was no private stakeholder consultation. The local stakeholder process is not needed, neither to the JI procedures nor to the Ukrainian laws.

Annex 1
CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organization:	State-run Coal Mine Association „Donetska Vugilna Energetichna Kompanya“
Street/P.O.Box:	Artema Street 63
Building:	
City:	Donetsk
State/Region:	Donetsk Oblast
Postal code:	83000
Country:	Ukraine
Phone:	+ 38 (062) 345 7928
Fax:	+ 38 (062) 382 6974
E-mail:	donug@ivcdu.dn.ua
URL:	
Represented by:	Polyakov Eduard Viktorovich
Title:	
Salutation:	Mr.
Last Name:	Polyakov
Middle Name:	Viktorovich
First Name:	Eduard
Department:	Dept. Manager Restructuring and Ecology
Phone(direct):	
Fax (direct):	+ 38 (062) 382 6974
Mobile:	+ 38 (062) 345 7928
Personal e-mail:	

Organization:	Carbon-TF B.V.
Street/P.O.Box:	Horsterweg 221
Building:	
City:	Venlo
State/Region:	
Postal code:	5928 ND
Country:	Netherlands
Phone:	+31 (0) 77 351 7985
Fax:	+31 (0) 77 354 8687
E-mail:	info@carbon-tf.com
URL:	www.carbon-tf.com
Represented by:	Jürgen Meyer
Title:	Managing Director
Salutation:	Dr.
Last Name:	Meyer
Middle Name:	
First Name:	Jürgen
Department:	
Phone(direct):	
Fax (direct):	
Mobile:	
Personal e-mail:	jm@carbon-tf.com

ANNEX 2

BASELINE INFORMATION

Baseline emissions reduction from displacement of heat

The emissions reduction from displacement of heat is given by formula (24) from ACM0008, see D.1.1.4.

$BE_{Use,y} = (HEAT_y / Eff_{HEAT}) * EF_{HEAT}$

Where

$BE_{Use,y}$	Total baseline emissions from the production of heat displaced by the project activity in the year y (tCO_{2e})
$HEAT_y$	Heat generation by project activity in year y (MWh)
EF_{HEAT}	Emissions factor for heat production replaced by project activity (tCO_2/MWh)
Eff_{HEAT}	Efficiency of the former heat generation unit, which is displaced by project activity (%)

The emissions reduction from displacement of heat is calculated using the prospected heat generation of the project $HEAT_y$, the carbon emissions factor of coal EF_{HEAT} and the efficiency of the displaced coal boilers Eff.

The ex ante projection of the thermal energy demand of the coal mine $HEAT_y$ is based on statistics provided by the coal mine. The coal mine is the only one end user. Recorded data sheets for the actually heat demand for the last years are available and are the most efficient way to project the heat demand for the next five years.

All heat produced by the project is used by the coal mine facilities and no external users should be connected. In absence of the project all heat needed for the coal mine facilities would be produced using existing coal boilers. Thus the amount of heat produced is concurrently the amount of heat, which is displaced by the project The project generates heat using the upgraded boiler in the winter period and the new small boiler in the summer period.

Because the coal mine is the only one heat user method a) of the ACM0008 is not applicable in a good manner and method b) is the better choice.

The projected amount of heat $HEAT_y$ is divided by the efficiency of the coal boiler. In this way the amount of burned coal (in terms of produced heat) is gained. The amount is higher than the heat amount used because of the losses in the combustion process.

The amount of displaced heat by coal production ($HEAT_y / Eff_{HEAT}$) is multiplied with the carbon emission factor of coal to determine the displaced CO_2 amount.

Monitoring of $HEAT_y$

The amount of heat $HEAT_y$ is the sum of the heat produced by the winter and summer boiler:

$HEAT_y = HEAT_W + HEAT_S$

where

$HEAT_y$	Heat generation by project activity in year y (MWh)
$HEAT_W$	Heat generation by winter boiler in year y (MWh)
$HEAT_S$	Heat generation by summer boiler in year y (MWh)

The values of $HEAT_W$ and $HEAT_S$ are cumulative values measured and monitored using standard heat meters (flow and temperature difference), one for the summer and one for the winter boiler.

Baseline Carbon Emission Factor for Coal

The current fossil fuel used at the coal mine is coal from own production. The fraction used for firing of the coal boilers is not analysed in a laboratory so that no data is available. The standard carbon emission factor from the IPCC guidelines is taken instead.

The value for “Coking Coal” / “Other Bit. Coal” of 94,600 kg CO_2/TJ has been taken. This is the value with the lowest carbon emissions, thus this is conservative for coal displacement. The value of 94,600 kg CO_2/TJ is responding to 0.3406 t CO_2/ MWh generated heat.

Efficiency of the boilers

The efficiency of the coal fired boilers is given by the manufacturer as 73.49%.

The efficiency of the CMM fired summer boiler is given by the manufacturer as 92%.

The efficiency of the CMM fired summer boiler is given by the manufacturer as 89%.

The efficiencies are determined by the Ukrainian Centre for Standardization and Metrology using the Ukrainian regulations.

Annex 3

MONITORING PLAN

The monitoring plan is listed in section D. In this section additional information are given.

Justification of the combustion efficiency of the chosen flare

According to ACM0008 the AM_Tool_07, methodological “Tool to determine project emissions from flaring gases containing methane”, EB 28 Meeting report, Annex 13, has been taken for the determination of the project emissions from flaring. The default combustion efficiency of 90% for enclosed flares has been taken into account.

The installation scheme of the units and the location of the main monitoring devices is shown if figure Annex 3-1

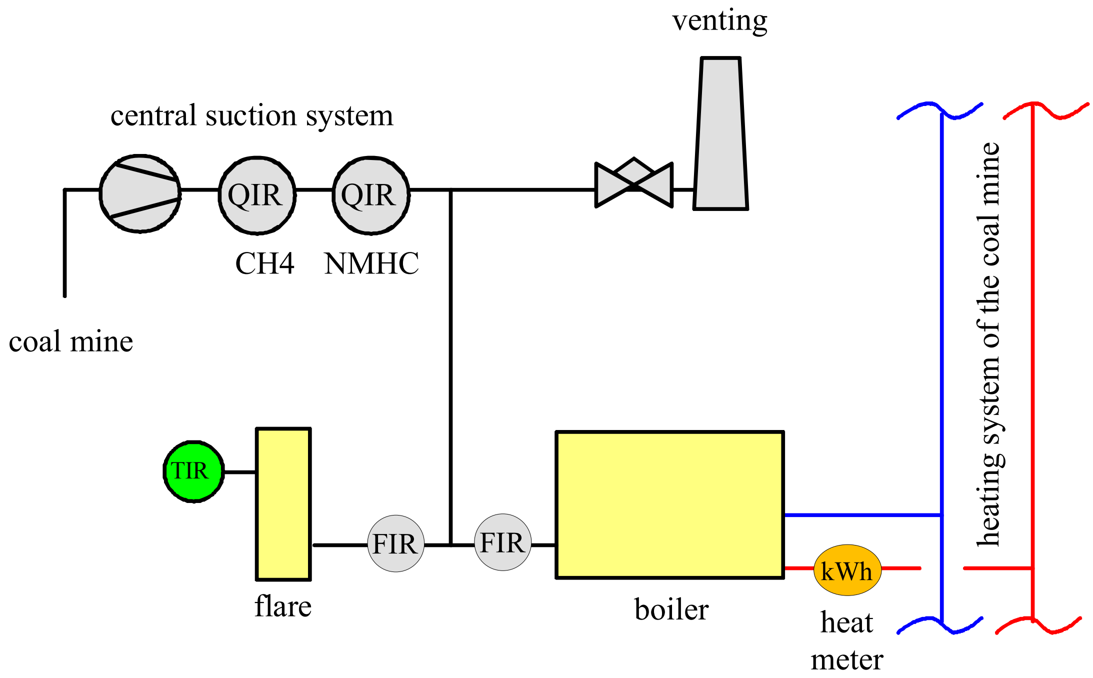


Figure Annex 3-1 Installation scheme

QIR / CH4	***Q**uality-**I**ndication-**R**egistration – continuous meter for methane concentration*
QIR / NMHC	***Q**uality-**I**ndication-**R**egistration – non-continuous lab analysis for concentration of **N**on **M**ethane **H**ydro **C**arbons*
TIR	***T**emperature-**I**ndication-**R**egistration – continuous temperature meter*
FIR	***F**low-**I**ndication-**R**egistration – continuous flow meter*
kWh	***Q**uality-**I**ndication-**R**egistration – continuous heat meter*

Data and parameters not monitored

Data / parameter	ρ_{CH4}
Data unit:	kg/m³
Description:	Density of methane under normal conditions
Source of data:	DIN ISO 6976 (1995)
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 0.717 kg/m³ at standard state conditions 1013 mbar, 273.15°K

Data / parameter	Eff_{HEAT}
Data unit:	-
Description:	Efficiency of methane destruction / oxidation in heat plant
Source of data:	ACM0008, version 4 (IPCC 1996)
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 99.5

Data / parameter	CEF_{CH4}
Data unit:	t CO_2eq / t CH_4
Description:	Carbon emission factor for combusted methane
Source of data:	IPCC
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 2.75

Data / parameter	GWP_{CH4}
Data unit:	t CO_2eq / t CH_4
Description:	Global warming potential of methane
Source of data:	IPCC
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 21

Data / parameter	$EF_{CO2,Coal}$
Data unit:	t C / MJ
Description:	Carbon emissions factor of displaced conventionally generated heat (by coal combustion)
Source of data:	IPCC
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 0.3406 t CO_2/ MWh, see also Annex 2

Data / parameter	HV_{CH4}
Data unit:	MJ / kg
Description:	(lower) heating value of methane
Source of data:	DIN ISO 6976
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 50.035

Data / parameter	η_{flare}
Data unit:	-
Description:	default efficiency for an enclosed flare
Source of data:	AM_Tool_07, methodological "Tool to determine project emissions from flaring gases containing methane"
Measurement procedures (if any):	
Monitoring frequency:	Ex-ante
QA/QC procedures:	
Any comment:	set to 90%

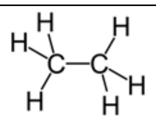
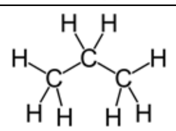
Calculation of CEF_{NMHC}

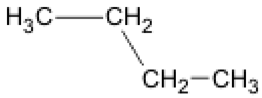
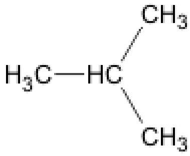
CEF_{NMHC} is various depending on the concentrations of single NMHC's included in the gas. CEF_{NMHC} can be calculated using the formula below:

$$CEF_{NMHC} = \sum_{i=1}^{n} PC_i \times CEF_i$$

where:
CEF_{NMHC} carbon emission factor for combusted non methane hydrocarbons (t CO_2eq/t NMHC)
PC_i concentration (in mass) of NMHC component i in percent of NMHC amount
CEF_i carbon emission factor for combusted NMHC component i (t CO_2eq/t component i)

CEF_i for the most frequently components are given in the table below. Further CEF_i components can be calculated using formula x.

component	formula	structure	CEF [t CO_2eq/t component]
ethane	C_2H_6		2,933
propane	C_3H_8		3,000

n-butane	C_4H_{10}		3,034
i-butane (isobutane)	C_4H_9		3,088

$$CEF_i = \frac{n_{C,i} \times 44}{n_{C,i} \times 12 + n_{H,i}}$$

where:

CEF_i carbon emission factor for combusted NMHC component i (t CO_2eq/t component i)
$n_{C,i}$ number of C atoms in component i
$n_{H,i}$ number of H atoms in component i