MONITORING REPORT

JI0079 - CMM utilisation on the Joint Stock Company named Komsomolets Donbassa Coal Mine of DTEK (Donbasskaya Toplivnaya Energeticheskaya Kompanya)

Monitoring Report 02
Monitoring period
04/11/2009 to 31/10/2010

Version 5
03 February 2011

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Annexes

SECTION A. General project activity information

A.1 Title of the project activity:

CMM utilisation on the Joint Stock Company named Komsomolets Donbassa Coal Mine of DTEK (Donbasskaya Toplivnaya Energeticheskaya Kompanya)

A.2. JI registration number:

JI0079 / UA2000011, registered at 09/12/2008.

Details of the project approval can be found under Annex I of this Monitoring Report.

A.3. Short description of the project activity:

In this project CMM, which has been sucked out of the active coal mine “Komsomolets Donbassa”, has been utilised in two enclosed flares and two upgraded boilers. The methane has been burned to less harmful CO_2.

In this monitoring report credits, produced in the second monitoring period should be monitored for the purpose of the verification as Emission Reductions Units ERU.

Table-1 Amount of methane utilised for flaring and heat production

Unit	**period**	**CH_4 [t/period]**
Flare 3+4	04/11/2009 to 31/12/2009	1,002
Flare 3+4	01/01/2010 to 31/10/2010	4,148
Boiler 1 + 2	28/01/2010 to 31/10/2010	1,036
Total	04/11/2009 to 31/10/2010	**6,186**

A.4. Monitoring period:

Start date 04/11/2009 (Flares)
28/01/2010 (Boilers)

End date 31/10/2010 (Flares and Boilers)

Start day and end day included.

This second monitoring period follows up to the end of the first monitoring period. The end date has been set at the request of the Coal Mine Komsomolets Donbassa.

A.5. Methodology applied to the project activity (incl. version number):

A.5.1. Baseline methodology:

The approved consolidated methodology ACM0008 / Version 03 "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring") has been used to identify the baseline scenario of the proposed JI project [ACM0008].

According to ACM0008 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. In difference to the flaring tool a combustion efficiency of 99.5%, according to the IPCC guidelines (see also ACM0008 Version 1 and Version 2), has been taken into account instead of the default value of 90% as given in the flaring tool.

A.5.2. Monitoring methodology:

A monitoring plan provided by the “Approved consolidated baseline methodology ACM0008”, Version 03, Sectoral Scope: 8 and 10, EB28 is applied to the project [ACM0008].

Applicability requirements for the monitoring plan of the ACM008 methodology are identical to respective requirements of the baseline setting.

According to ACM0008 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. In difference to the flaring tool a combustion efficiency of 99.5%, according to the IPCC guidelines (see also ACM0008 Version 1 and Version 2), has been taken into account instead of the default value of 90% as given in the flaring tool.

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

Table-2 Status of Implementation

Unit	**Planned installation date, as stated in the PDD**	**firing capacity**	**Implementation status**
Central Shaft			
new boiler	Oct 2007	10 MW	Delayed, planned for late 2011 or early 2012
flare No: 1	Sep 2007	5 MW	Delayed, planned for late 2011 or early 2012
flare No: 2	Apr 2008	5 MW	Delayed, planned for late 2011 or early 2012

Air Shaft № 3			
cogeneration unit 1	Sep 2008	approx. 3,6 MW	Delayed, planned for summer 2011
cogeneration unit 2	Sep 2008	approx. 3,6 MW	Delayed, planned for summer 2011
cogeneration unit 3	Sep 2008	approx. 3,6 MW	Delayed, planned for summer 2011
Two upgraded boilers	Oct 2007	2 x 10 MW	Installed in October 2009
flare No: 3	Sep 2007	5 MW	Installed in 2008
flare No: 4	Apr 2008	5 MW	Installed in 2008

Table-3 Data of installed units

Unit: Flare 3	
Manufacturer: OAO “NPAO Vniikompressormash” a subsidiary of Ukrrosmetal, Sumy, Ukraine	
Type:UKG-5/8	
Serial Numbers: 03-08	
Capacity: 5-8 MW	
Activity	**Status**
Date of commission	14/02/2008
Last major overhaul	none
Last inspection	August 2009 – Eco-Alliance
Start of operation	09/08/2008
Planned installation date [PDD]	Sept 2007

Unit: Flare 4	
Manufacturer: OAO “NPAO Vniikompressormash” a subsidiary of Ukrrosmetal, Sumy, Ukraine	
Type:UKG-5/8	
Serial Numbers: 04-08	
Capacity: 5-8 MW	
Activity	**Status**
Date of commission	14/02/2008
Last major overhaul	none
Last inspection	August 2009 – Eco-Alliance
Start of operation	27/10/2008
Planned installation date [PDD]	April 2008

Unit: Boiler 1	
Manufacturer: Biyskiy Kotelniy Zavod	
Type: E10-1,4R (KE-10/14 S)	
Serial Numbers: 62350	
Capacity: 10 t steam/h	
Activity	**Status**
Date of commission	1987

Last major overhaul	12.08.2008
Last inspection	18.06.2010
Start of operation	October 2009
Planned installation date [PDD]	October 2007

Unit: Boiler 2	
Manufacturer: Biyskiy Kotelniy Zavod	
Type: E10-1,4R (KE-10/14 S)	
Serial Numbers: 62360	
Capacity: 10 t steam/h	
Activity	**Status**
Date of commission	1987
Last major overhaul	12.08.2008
Last inspection	18.06.2010
Start of operation	October 2009
Planned installation date [PDD]	October 2007

Installation of further units as stated in the PDD is delayed due to the Global Financial Crisis and should follow in late 2011 and 2012.

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

The installation of further units as stated in the PDD is delayed due to the Global Financial Crisis. The coal production decreased and the financial situation of the coal mine get worse. As only four of nine planned units have been installed, the planned amount of emission reductions could not be achieved. Since the coal production and financial situation of the coal mine improved in 2009 and 2010 the continuation of the project installation is planned for coming years.

Central Shaft

At the time the main degasification pipe is renewed. The works should be finalised in summer 2011. The installation of the flares 1 and 2 as well as the boiler 1 is planned for late 2011 or early 2012.

Air shaft

The boilers 1+2 at Air Shaft have been upgraded with a CMM burner system and started operation in October 2009. A monitoring system for the boilers has been installed since January 28, 2010.
The installation of the cogeneration units is planned for summer 2011.

The maximum supply pressure from the existing central gas suction system turned out to be not sufficient for the supply of the flares and the boiler with gas. Both flares have been equipped with compressors for additional pressure generation. The key data of the compressors are given in Table-4.

Table-4 Data of additionally installed compressors

Typ of compressor	rotary
Manufacture / Type	GR-85-24/1,5
Compressor discharge min, m^3/sec or (m^3/min)	0,17÷0,43 (10÷26)
Pressure difference, MPa or (kp/cm^2)	0,01÷0,05 (0,1÷ 0,5)

Engine power max. kW	45
Frequency, 1/s or (RPM)	24,08÷49,25 (1445÷2955)

A.8. Intended deviations or revisions to the registered monitoring plan:

Monitoring Plan has been revised during second monitoring period because of the changes made in method of calculating of additional energy consumption. See < Revised Monitoring Plan-KD.V2.pdf> dated by 03 February 2011.

The calculation of the emission reductions is not calculated on a yearly basis, but for an individual period. The monitoring period lasts from 04/11/2009 to 31/10/2010.
Flow data and flare efficiency as well as the methane amount destroyed by flaring MD_{Fl} are calculated in 15 min. intervals in Excel sheets. The main emissions variables for project emissions, baseline emissions and emissions reductions are calculated on a monthly basis. Yearly sums and a total sum for the monitoring are calculated.

As both flares have been equipped with compressors for additional pressure generation, additional power has been consumed by the project. Formulae for the calculation of consumed power and additional project emissions have been included in the revised Monitoring Plan. These formulae were missing in the original Monitoring Plan.

The formula for the calculation of project emissions from uncombusted methane has been updated. Formulae from the «Methodological “Tool to determine project emissions from flaring gases containing methane”» [AM_Tool]) have been applied, see Annex 4. The calculation of project emissions from uncombusted methane from flaring is now more accurate.

The additional power consumption has been calculated using the Baseline Carbon Emission Factors for the Ukrainian power grid, which have been specified in the PDD.
The consumed power amount has been calculated using the operation hours of the flares until 30/04/2010. On 30/04/2010 electric power meters have been installed, see also Annex 4.

A.9. Changes since last verification:

Installation of two upgraded boilers in winter 2009/2010 for heat production.

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

Coal Mine Komsomolets Donbassa
- Alexander Mikhaylovich Agramakov, Techical Director until 28/04/2009
- Vladimir Raskidkin, Technical Director until 05/05/2010
- Vodopshin Roman Vasil’evich from 11/05/2010

Eco-Alliance OOO
- Vladimir Kasyanov, Managing director
- Pavel Shelegeda, Deputy Director
- Aleksandr Didenko, Monitoring Assistant
- Viktor Avtonomov, Monitoring Assistant

Carbon-TF B.V
- Dr. Jürgen Meyer, Managing Director
- Clemens Backhaus, Managing Director

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

B.1. Monitoring equipment:

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

Table-5 Monitoring equipment

ID	Data	Method	Manufacturer	Classification	Serial number	Range	Frequency of Measurement	Instal-lation	Place of the instalation	Uncertainty level of data	Calibration procedure	Last calibration (№ of the document)	Calibrator
1	CMM flow	Pitot Tube	Paul Gothe, Bochum	‘V9 ‘777	none	no data	Daily	no data	no data	1.5%	None	None	None
2	CMM flow	Gas flow meter	SIEMENS	ME 1120-2CC22-1BA3	Flare №3: K2989B Flare №4: K2989A	298-1566 м3/h	-	2008	Measuring pipeline	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	27.10.2010 passport to flow meter № K2989A 19.11.2010 passport to flow meter № K2989B	Sumystandart-metrology
3	Pressure difference	Pressure difference transmitter	SIEMENS	SITRANS P PED:SEP DS III 7MF4433-1CA02-1AB1-Z	Flare№3: N1-W401-9002993 Flare№4: N1-W401-9002992	0…60 mBar	Every 15 min	2008	Measuring pipeline (Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	02.11.2010 certificate № 2174 02.11.2010 certificate № 2175	Sumystandart-metrology
4	Pressure	Pressure transmitter	SIEMENS	SITRANS P Serie Z	Flare№3: AZB/W1196798 Flare№4: AZB/W7153229	0…1,6 Bar (abs.)	Every 15 min	2010	Measuring pipeline (Corps of the Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	18.10.2010 certificate № 2076 02.11.2010 certificate № 2173	Sumystandart-metrology

5	Tempera-ture	Resistance thermo-meter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5% 80Ф8	Flare№3: 08259 (№08262 was used till March 2010) Flare№4: 08269	-50…+250°C	Every 15 min	Flare№3 2010 Flare№4 2008	Measuring pipeline (After the Gas flow meter)	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	27.10.2010 passport to Resistance thermometer № 08259, №08269 08.10.2009 passport to Resistance thermometer № 08262	Sumystandart-metrology
6	Flame Tempera-ture	Thermo-couple	Herth GmbH	Type S, Pt/PtRh	Flare №3: 69884 Flare №4: 71088	0…+1500°C	Every 15 min	2010	Pipe of the Flare	± 1.5 K in the range from [0-600°C]**) 0.25% from value above 600°C**)	none, thermocouple is supposed to be changed at least one time per year, according to the flaring tool	changed every year	none
7	CH4 concentra-tion	Infrared measure-ment	SIEMENS	ULTRAMAT 23	Flare№3: N1 W4-339	CH4 0…20/100% CO2 0…20/100% O2 0…5/25%	Every 15 min	2008	Distributive apartment of the Flare	2.0%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year Calibrations made using procedures of Eco-Alliance every two weeks	16.11.2010 passport to gasanalizer № N1 W4-339 (03-08)	Sumystandart-metrology Eco-Alliance
8	CH4 concentra-tion	Infrared measure-ment	Analitpribor Smolensk	Gamma 100	2 units №89 and №90	CH4 0…50%	Continuous	no data	Gazoanalizat ornaya VPS	2.0%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year Monthly calibration by coal mine	16.11.2010 certificate № 2260 16.11.2010 certificate № 2261	Sumystandart-metrology Coal mine
9	CH4 concentra-tion	Infrared measure-ment	Azov optic-mechanics plant	SHI-12	3 units: 100156, 500516, 100038	0-100%	Daily	no data	no data	2.5%	Yearly calibrations using procedures of Donbassugleavtom atika and Luganskstandartm etrology	For unit 100156 – 19.08.2010 For unit 500516 – 25.11.2010 For unit 100038 –	Donbassuglea vtomatika Luganskstand artmetrology

												13.09.2010	
10	NMHC concentra-tion	Gas chromat-ography	no data	Gasochrom 3101	LHM-8MD	no data	Yearly	no data	no data	0.001%	Calibration made using procedures of MAKNII Calibration frequency – 1 year	15.10.2010	MAKNII
11	Electric power	Watthour-meter	business «Concern ENERGYMEASURE»	CE6803V	Flare №3: 086568070787744 1 Flare №4: 086568070789405 9	-	Continuous	30.04.2010	Distributive apartment of the Flare	1.0%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 16 years	07.2008	business Concern «ENERGYMEASURE»
12	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №3: 09553	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3 years	01.2010	MEGOMMETR
13	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №3: 08233	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3 years	01.2010	MEGOMMETR

14	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №3: 23934	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3 years	03.2010	MEGOMMETR
15	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №4: 22518	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3 years	02.2010	MEGOMMETR
16	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №4: 23607	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3 years	03.2010	MEGOMMETR
17	Electric power	Transformer of electric current	no data	T 0,66 UZ 0,66 kV 50 Hz 300/5A	Flare №4: 23913	0…0,66 kV (300/5A)	Continuous	2010	Distributive apartment of the Flare	0.5%	Initial calibration made using procedures of manufacturer. Further calibrations made using procedures of Sumystandart-metrology Calibration frequency – 3	02.2010	MEGOMMETR

											years		
18	CMM flow	Gas flow meter	no data	no data(d=151,858)	Boiler №1: 77777	169…3200 m3/h	-	2010	Measuring pipeline before boiler №1	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	passport to flow meter № 77777	Sumystandart-metrology
19	CMM flow	Gas flow meter	no data	no data(d=151,858)	Boiler №2: 77778	169…3200 m3/h	-	2010	Measuring pipeline before boiler №2	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	passport to flow meter № 77778	Sumystandart-metrology
20	Pressure difference	Pressure difference transmitter	APLISENS	PR-28	Boiler №1: 11092049	0…2,5kPa	Every 15 min	2010	Measuring pipeline before boiler №1 (Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	14.10.2010 certificate № 2035	Sumystandart-metrology
21	Pressure difference	Pressure difference transmitter	APLISENS	PR-28	Boiler №2: 02100076	0…2,5kPa	Every 15 min	2010	Measuring pipeline before boiler №2 (Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	14.10.2010 certificate № 2036	Sumystandart-metrology
22	Pressure	Pressure transmitter	SIEMENS	SITRANS P series Z	Boiler №1: AZB/W5132860	0…1,6 Bar	Every 15 min	2010	Measuring pipeline before boiler №1 (Before Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	16.11.2010 certificate № 2259	Sumystandart-metrology
23	Pressure	Pressure transmitter	SIEMENS	SITRANS P series Z	Boiler №2: AZB/X1110846	0…1,6 Bar	Every 15 min	2010	Measuring pipeline before boiler №2 (Before Gas flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	02.11.2010 certificate № 2172	Sumystandart-metrology

24	Tempera-ture	Resistance thermo-meter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №1: 09440	-50...+250°C	Every 15 min	2010	Measuring pipeline before boiler №1 (After Gas flow meter)	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	15.10.2010 passport to Resistance thermometer № 09440	Sumystandart-metrology
25	Tempera-ture	Resistance thermo-meter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №2: 08247	-50...+250°C	Every 15 min	2010	Measuring pipeline before boiler №2 (After Gas flow meter)	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	15.10.2010 passport to Resistance thermometer № 08247	Sumystandart-metrology
26	Steam flow	Steam flow meter	no data	no data(d=96,430)	Boiler №1: 3	0,5566…10,61472 ton/h	-	2010	Measuring pipeline after boiler №1	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	20.10.2010 passport to flow meter № 3	Sumystandart-metrology
27	Steam flow	Steam flow meter	no data	no data(d=96,430)	Boiler №2: 919192	0,5566…10,61472 ton/h	-	2010	Measuring pipeline after boiler №2	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	passport to flow meter № 919192	Sumystandart-metrology
28	Steam Pressure difference	Pressure difference transmitter	APLISENS	PR-28	Boiler №1: 06091154	0…63kPa	Every 15 min	2010	Measuring pipeline after boiler №1 (Steam flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	14.10.2010 certificate № 2034	Sumystandart-metrology
29	Steam Pressure difference	Pressure difference transmitter	APLISENS	PR-28	Boiler №2: 06091155	0…63kPa	Every 15 min	2010	Measuring pipeline after boiler №2 (Steam flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	14.10.2010 certificate № 2033	Sumystandart-metrology

30	Steam Pressure	Pressure transmitter	APLISENS	PC-28	Boiler №1: 03081167	0…1,6MPa	Every 15 min	2010	Measuring pipeline after boiler №1 (Before Steam flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	26.10.2010 certificate № 2127	Sumystandart -metrology
31	Steam Pressure	Pressure transmitter	APLISENS	PC-28	Boiler №2: 03081169	0…1,6MPa	Every 15 min	2010	Measuring pipeline after boiler №2 (Before Steam flow meter)	0.25%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	26.10.2010 certificate № 2130	Sumystandart -metrology
32	Steam Tempera-ture	Resistance thermo-meter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №1: 09446	-50...+250°C	Every 15 min	2010	Measuring pipeline after boiler №1 (After Steam flow meter)	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	15.10.2010 passport to Resistance thermometer № 09446	Sumystandart -metrology
33	Steam Tempera-ture	Resistance thermo-meter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №2: 09449	-50...+250°C	Every 15 min	2010	Measuring pipeline after boiler №1 (After Steam flow meter)	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	15.10.2010 passport to Resistance thermometer № 09449	Sumystandart -metrology
34	Water tempera-ture	Resistance thermome-ter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №1: 09447	-50...+250°C	Every 15 min	2010	Measuring pipeline before boiler №1	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	18.11.2010 passport to Resistance thermometer № 09447	Sumystandart -metrology
35	Water tempera-ture	Resistance thermome-ter	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5%	Boiler №2: 09450	-50...+250°C	Every 15 min	2010	Measuring pipeline before boiler №2	0.5%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year	16.11.2010 passport to Resistance thermometer № 09450	Sumystandart -metrology

36	CH4 concentration	Infrared measure-ment	SIEMENS	ULTRAMAT 23	N1 W4-340	CH4 0…20/100% CO2 0…20/100% O2 0…5/25%	Every 15 min	2010	In the boiler-house	2.0%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year Calibrations made using procedu-es of Eco-Alliance every two weeks	16.11.2010 passport to gasanalizer № N1 W4-340 (04-08)	Sumystandart -metrology Eco-Alliance
37	CH4 concentra-tion	Infrared measure-ment	Analitpribor Smolensk	Gamma 100	1	CH4 0…70%	Continuous	2009	In point of preparation of gas	2.0%	Calibration made using procedures of Sumystandart-metrology Calibration frequency – 1 year Calibrations made using procedu-es of Eco-Alliance every two weeks	16.11.2010 certificate № 2262	Sumystandart -metrology Eco-Alliance

The CH_4 measurement units 7a and 7b are installed in the central suction system of the Air Shaft Nr. 3 and are taken for consistency and plausibility checks only. The SHI-12 units are hand held units which are used by the coal mine personnel to check the indication of the Gamma 100 units for plausibility.
n.n. - means not named or not known

*) FSV: full scale value
**) Fixed within EN 60584-2: 1996, Type S, Class 2

B.1.4. Involvement of Third Parties:

- The lab analysis for the determination of the NMHC concentration has been done by MAKNII
- The calibrations of CH_4-concentration meters in the flares have been done by Eco-Alliance
- The calibrations of CH_4-concentration meters in the central suction station have been done by Ukrteplostroy
- Yearly calibrations of all CH_4 meters are provided by Derzhpromnaglyad Donetsk
- Calibration of the monitoring equipment has been done by Sumy Standartmetrology
- Eco-Alliance OOO supported the coal mine with the collecting of the monitoring data.
- Emissions-Trader ET GmbH has supervised the data for plausibility and completeness.

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

B.2.1. List of fixed default values:

Table-6 List of ex-ante fixed values

ID number	Data variable	Source of data	Data unit	Comment
P8, B49 $CEF_{ELEC,PJ}$	Carbon emission factor of $CONS_{ELEC,PJ}$	official data of Ukrainian power grid	t CO_{2eq}/MWh	SenterNovem data taken instead of not available Ukrainian data, according to information given un the PDD: 2008: 0.695 2009: 0.680 2010: 0.666 2011: 0.651 2012: 0.636
P13 Eff_{FL}	Flare combustion efficiency	PDD / revised monitoring plan ID-6 (T_{flare})	t CH_4	Set to: 99.5 % for T_{flare} > 850℃ 90.0 % for 500℃ < T_{flare} < 850℃ 0.0 % for T_{flare} < 500℃
P16 Eff_{ELEC}	Efficiency of methane destruction/ oxidation by heat generation	ACM0008 / IPCC	%	Set to 99.5 % (IPCC)
P19 Eff_{HEAT}	Efficiency of methane destruction / oxidation in heat plant	ACM0008 / IPCC	%	set at 99.5% (IPCC)
P23, B19 CEF_{CH4}	Carbon emission factor for combusted methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 2.75 t CO_2eq/t CH_4
P28, B18 GWP_{CH4}	Global warming potential of methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 21
P_M	motor capacity	manufacturer data	MWh	set to 45 kW (0.045 MW) for each compressors
P_{total}	total capacity of the flare unit	manufacturer data	MWh	60 kW (0.060 MW) for each flare
Eff_M	effective load of electric motor	[KD]	%	set to 75% for both flares [KD]

Eff_{SB}	effective load of the flare unit during standby	[KD]	%	set to 45% for both flares [KD]
B55 $EF_{CO2,Coal}$	CO_2 emission factor of fuel used for captive power or heat	IPCC 2006 1 Introduction Table 1.2	tCO_2/MWh	Set to 0.3406 tCO_2/MWh Using the value for "Other Bituminous Coal" of 94,600 kg CO_2/TJ
B57 Eff_{heat}	Energy efficiency of heat plant	Boiler pass	%	91 % old coal boiler 91 % upgraded boiler

B.2.2. List of variables:

Table-7 List of variables – struck through symbols are not used in this monitoring report (this variables are referring to project components which are not installed yet)

ID number	Data variable	Source of data (ID Numbers from table 5)	Data unit	Comment
P1 PE	Project emissions	calculated	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P2 PE_{ME}	Project emissions from energy use to capture and use methane	calculated	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P3 PE_{MD}	Project emissions from methane destroyed	calculated	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P4 PE_{UM}	Project emissions from uncombusted methane	calculated	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P5 $CONS_{ELEC,PJ}$	Additional electricity consumption by project	calculated	MWh	calculated using formulae from the revised monitoring plan
P11 MD_{FL}	Methane destroyed by flaring	calculated	$t CH_4$	calculated using formulae from the revised monitoring plan
P12 MM_{FL}	Methane sent to flare	measured ID's- 2,3,4,5,7	$t CH_4$	
~~P14 MD_{ELEC}~~	~~Methane destroyed by power generation~~	~~Calculated~~	~~$t CH_4$~~	~~calculated using formulae from the revised monitoring plan~~
~~P15 MM_{ELEC}~~	~~Methane sent to power plant~~	~~measured~~	~~$t CH_4$~~	
P17 MD_{HEAT}	Methane destroyed by heat generation	calculated	$t CH_4$	calculated using formulae from the revised monitoring plan
P18 MM_{HEAT}	Methane sent to heat generation	measured	$t CH_4$	
~~P24 CEF_{NMHC}~~	~~Carbon emission factor for combusted non methane hydrocarbons (various)~~	~~calculated~~	-	~~Calculated if applicable~~

P25 PC_{CH4}	Concentration of methane in extracted gas	measured ID-7	%	
P26 PC_{NMHC}	NMHC concentration in coal mine gas	measured ID-8	%	Used to check if more than 1% of emissions and to calculate r
~~P27~~ ~~R~~	~~Relative proportion of NMHC compared to methane~~	~~calculated~~	~~%~~	~~Calculated if applicable, based on the lab analysis.~~
$CONS_{ELEC.Flare\ i}$	additional electric energy used by the compressors and other equipment installed in the flare i	calculated	[MWh]	calculated using formula (2c)
$h_{i,M}$	operation hours of compressor from flare i (operation)	counter	[h]	Hand readings from the internal digital counters of the flare units
$h_{i,\ total}$	operation hours of flare i (operation+standby)	counter	[h]	Hand readings from the internal digital counters of the flare units
B1 BE	Baseline emissions	calculated	t CO_{2eq}	calculated using formulae from the revised monitoring plan
B3 BE_{MR}	Baseline emissions from release of methane into the atmosphere that is avoided by the project activity	calculated	t CO_{2eq}	calculated using formulae from the revised monitoring plan
B4 BE_{Use}	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity	calculated	t CO_{2eq}	calculated using formulae from the revised monitoring plan
B14 CMM_{PJ}	CMM captured in the project activity	calculated	t CH_4	sum of flow meters
~~B46~~ ~~GEN~~	~~electricity generation by project~~	~~measured~~	~~MWh~~	
B47 HEAT	Heat generation by project	measured	MWh	
PE_{Flare}	Project emissions from flaring	calculated	t CO_{2eq}	calculated using formulae from the revised monitoring plan
T_{flare}	Flame temperature of the flare	measured ID - 6	℃	

B.2.3. Data concerning GHG emissions by sources of the project activity

Table-8 GHG emissions by sources of the project activity – struck-through symbols are not used in this monitoring report (this variables are referring to project components which are not installed yet)

ID number	**Data variable**	**Source of data** (ID Numbers from table 5)	**Data unit**	**Comment**
P12 MM_{FL}	Methane sent to flare	measured ID's- 2,3,4,5,7	t CH_4	

~~P15 MM_{ELEC}~~	~~Methane sent to power plant~~	~~measured~~	~~t CH_4~~	
P18 MM_{HEAT}	Methane sent to heat generation	measured	t CH_4	

B.2.4. Data concerning GHG emissions by sources of the baseline

Table-9 GHG emissions by sources of the baseline – struck through symbols are not used in this monitoring report (this variables are referring to project components which are not installed yet)

ID number	Data variable	Source of data	Data unit	Comment
B14 CMM_{PJ}	CMM captured and destroyed in the project activity	calculated	t CH_4	sum of flow meters
~~B46 GEN~~	~~electricity generation by project~~	~~measured~~	~~MWh~~	
B47 HEAT	Heat generation by project	measured	MWh	

B.2.5. Data concerning leakage

Not applicable.

B.2.6. Data concerning environmental impacts

DTEK works on reducing greenhouse gas emissions at power plans and also at coal mines. A pilot project was launched in 2007 at the coal mine Komsomolets Donbassa.
After a series of activities, the efficiency of degassing is raised up to 50-60%. In the first phase two thermal utilisation units have been installed. In the second phase two boilers have been upgraded and CMM has been used in these boilers for heat production.
In the next phases CMM should be used in gas engines for power generation.

B.3. Data processing and archiving (incl. software used):

The data are collected, processed and stored using a Siemens SIMATIC PLC S7 system and Siemens WINCC programming software. All data is stored in the internal memory about 2 GB. One time per hour the data are sent via GPS to an Internet-based Server data base. Further on the data is sent to the workstation of Eco-Alliance with frequency 1 time per week, per month and per year and archived 1 time per year on the CD.
The data can be read any time from the internet data base by authorised personnel. The utilised methane amount is automatically calculated and stored in the PLC. As all input data are stored, the automatically calculation can by checked in retrospect any time.

For plausibility checks and potential data back up the data logged in the hand written journals of the suction system can be taken.

B.4. Special event log:

No special events (like fire, accidents, strikes, vandalism, theft etc.).
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SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The general project management is implemented by the Technical Director of the Coal Mine Komsomolets Donbassa through supervising and coordinating activities of his subordinates, such as the Director of Capital Development, the Deputy Director on surface degasification, heat technician, head of safety engineering departments, etc.
Daily a group of mechanics and electricians who are responsible for the measures and maintenance of all technological equipment and measuring instruments are present on-site. There are two shifts, 12 h each. For every shift there is one person on-duty responsible for the proper operation and keeping of the journals.
Overview calculations about the methane amount utilised are made on a monthly and yearly basis and notified in the journal. The monitoring system is supervised by the administration of the coal mine under the existing control and reporting system. The general supervision of the electronically monitoring system is executed by Eco-Alliance OOO, who is consultant for the coal mine.

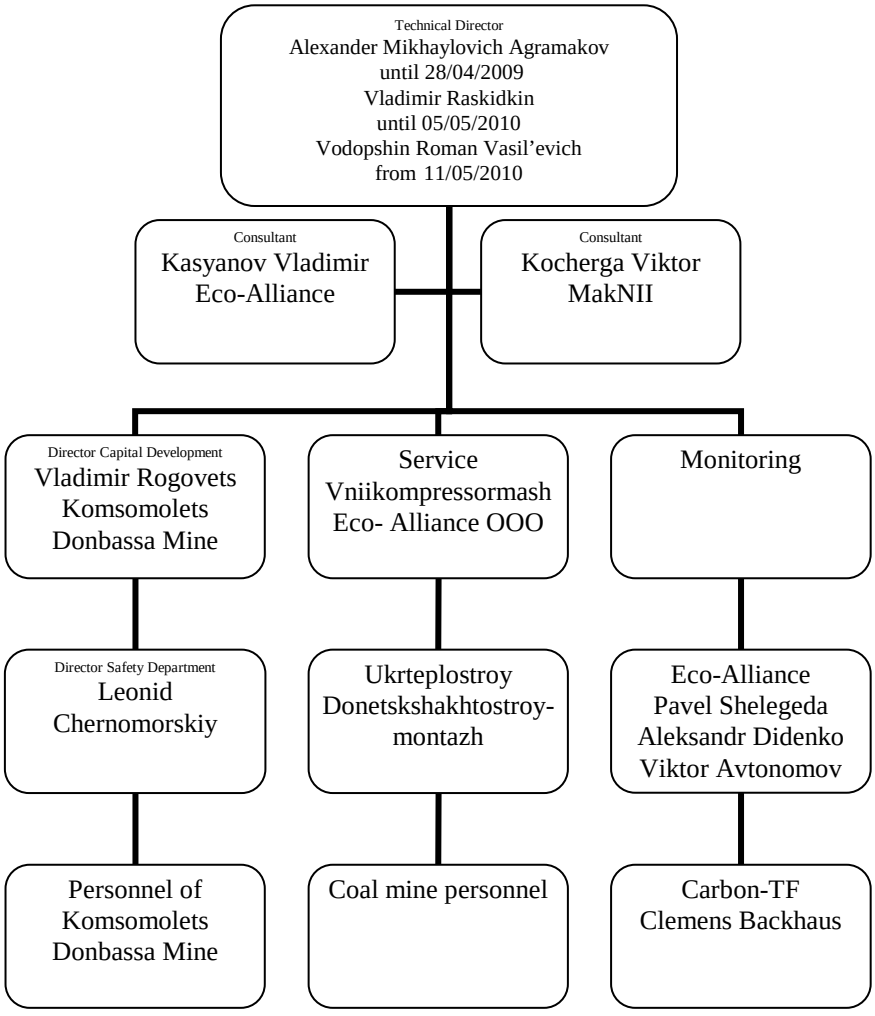

Figure 1 – Organigram

C.1.2. Trainings:

The employees responsible for the monitoring control have been trained on–the–job during the installation of the system. Before installation of the gas equipment on the boilers the personnel of the boiler house have received training in “Donetsk centre of personnel preparing” (Horlovka) on speciality “Personnel serving individual boilers working on gas fuel”.
The responsible personnel of Eco-Alliance has been trained on the handling with CMM-utilisation units and the applied monitoring systems, during several practical courses in Germany. In this courses which has been carried out by A-TEC Anlagentechnik GmbH, a Joint-Venture participant of Eco-Alliance, 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.

C.2. Involvement of Third Parties:

- Sumystandartmetrology, has been involved for the yearly examination and calibrations of the measurement equipment
- MakNII Institute, the “State Makeyevka Institute for Research and Education for Safe Work in the Coal Mining Industry”, a subsidiary of the “Ukrainian Ministry for Fuel and Energy”, has been involved for the lab analysis (NHMHC) of the CMM.
- Ukrteplostroy has been involved for the service and upgrade of the boiler and calibration of the CMM flow meter in the vacuum pump station.
- Donetskshakhtostroymontazh has been involved for installation of pipelines
- Vniikompressormash has delivered the flares been involved for service during the first period
- Eco-Alliance has been involved for monitoring since the beginning of the project and service of the flares since summer 2009

C.3. Internal audits and control measures:

Every 2 weeks a monitoring engineer from Eco-Alliance makes audits and remarks this in the operation journal. The mechanic on duty from the Coal Mine Komsomolets Donbassa makes daily audits.

The monitoring engineer (Eco-Alliance) checks the data from web-site every day and makes internal weekly reports.

Eco-Alliance makes service audits every month.

Methane concentration and CMM flow data of the flares are compared with the indication of the meters from the vacuum pump station for plausibility. The coal mine personnel have been instructed by Eco-Alliance.

C.4. Troubleshooting procedures:

The general troubleshooting for the whole coal mine is available at the coal mine. The coal mine personnel are instructed to follow the procedures.
The flares are automatically shut down in case of faults. Internal trouble shooting procedures are available inside the flares.
The boilers shut down with gas valve cutter automatically in case of emergency. Light and sound alarm is activated. Staff on duty closes valves of the gas supply to the boilers, open blowing bleeders, ventilate the boilers, then determines the cause of boiler stopping and removes it.

SECTION D. Calculation of GHG emission reductions

D.1. Table providing the formulas used:

Table-10 Formulae used taken from the revised monitoring plan, struck-through symbols are not used in this monitoring report (this symbols are referring to project components which are not installed yet).

ID number	Data variable	Nr	Formula
P1 PE_y	Project emissions	(1)	$PE = PE_{ME} + PE_{MD} + PE_{UM}$
P2 PE_{ME}	Project emissions from energy use to capture and use methane	(2)	$PE_{ME} = CONS_{ELEC,PJ} \times CEF_{ELEC,PJ}$
P3 PE_{MD}	Project emissions from methane destroyed	(3)	$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT}) \times (CEF_{CH4} + r \times CEF_{NMHC})$
P4 PE_{UM}	Project emissions from uncombusted methane	(9)	$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT})] + PE_{Flare}$
P5, $CONS_{ELEC}$	Additional electricity consumption by the project	(2a) (2b) (2c)	$CONS_{ELEC,PJ} = \sum_{i=1}^{n} CONS_{ELEC,i}$ $CONS_{ELEC} = CONS_{ELEC,\ Flare\ 3} + CONS_{ELEC,\ Flare\ 4}$ $CONS_{ELEC,\ Flare\ i} = (Eff_M * P_M * h_{i,M}) + ((h_{i,total} - h_{i,M}) * (P_{total} - P_M) * Eff_{SB})$
P11 MD_{FL}	Methane destroyed by flaring	(5)	$MD_{FL} = \sum_{i=1}^{n} MM_{FL,i} \times \eta_{flare,i}$
~~P14 MD_{ELEC}~~	~~Methane destroyed by power generation~~	~~(7)~~	~~$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$~~
P17 MD_{HEAT}	Methane destroyed by heat generation	(8)	$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT}$
PE_{Flare}	Project emissions from flaring	(9a)	$PE_{Flare} = (MM_{Fl} - MD_{Fl}) \times GWP_{CH4}$
~~P27 r~~	~~Relative proportion of NMHC compared to methane~~	~~(4)~~	~~$r = PC_{NMHC} / PC_{CH4}$~~
B1 BE_y	Baseline emissions	(10)	$BE = BE_{MR} + BE_{Use}$
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere that is avoided by the project activity	(14)	$BE_{MR} = CMM_{PJ} \times GWP_{CH4}$
B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity	*(24)*	$BE_{Use} = GEN * EF_{ELEC} + (HEAT / Eff_{HEAT,coal}) * EF_{HEAT}$

B14 CMM_{PJ}	CMM captured and destroyed in the project activity	*(14a)*	$CMM_{PJ} = \sum_{i=1}^{n} MM_i$
ER	Emission reductions	(18)	ER = BE - PE

The formulae included in the monitoring plan are taken from the CDM Methodology ACM0008 respective the revised monitoring plan.

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

Some minor errors which have been identified in hand written operation journals have been corrected. Mistakes were made during the writing the DATA from the monitor into journals. During checking the DATA, the monitoring engineer has made adjustments to the time of measurement, namely: record the exact time (hours and minutes).

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

The tables below provide yearly values. Monthly values are calculated and can be verified in the Excel-Spreadsheet "ER-KD-2009-11-04 to 2010-10-31_V2b.xls".

D.3.1. Project emissions:

period	**project emissions [t CO_{2eq}]**
04/11/2009 to 31/12/2009	3,425
01/01/2010 to 31/10/2010	17,295
Total 04/11/2009 to 31/10/2010	**20,720**

D.3.2. Baseline emissions:

period	**baseline emissions [t CO_{2eq}]**
04/11/2009 to 31/12/2009	21,047
01/01/2010 to 31/10/2010	112,802
Total 04/11/2009 to 31/10/2010	**133,849**

D.3.3. Leakage:

Not applicable.

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

Period	**Emission reductions [t CO_{2eq}]**
04/11/2009 to 31/12/2009	17,622
01/01/2010 to 31/10/2010	95,507
Total 04/11/2009 to 31/10/2010	**113,129**

Annex 1

REFERENCES

- Project Design Document; Version 04, dated 2008-04-14
- Final Determination Report for the project: JI0079 CMM utilisation on the Joint Stock Company named Komsomolets Donbassa Coal Mine of DTEK (Donbasskaya Toplivnaya Energeticheskaya Kompanya), Report No: 2008-200 Rev 02, by DNV Det Norske Veritas, dated 2008-09-18
- Letter of Approval, Nr. M000011, issued on 2007-10-03 by the Ukraine (host party)
- Letter of Approval, Nr. 2007JI04, issued on 2007-11-26 by the Kingdom of the Netherlands (investor party)
- Letter of Endorsment, Nr. 11439/10/310, issued on 2006-12-22 by the Ukrainian Ministry of Environmental Protection
- supporting evidence documents provided by the coal mine
- revised monitoring plan, dated 2011-02-03

[AM_Tool_07] Methodological “Tool to determine project emissions from flaring gases containing methane”, EB 28, Meeting report, Annex 13
http://cdm.unfccc.int/Reference/tools/index.html

[DTEK] Summary of some publications from DETK concerning the project,
<DTEK publications.docx>

[KD] Coal Mine Komsomolets Donbassa

Annex 2

Installation scheme including metering positions

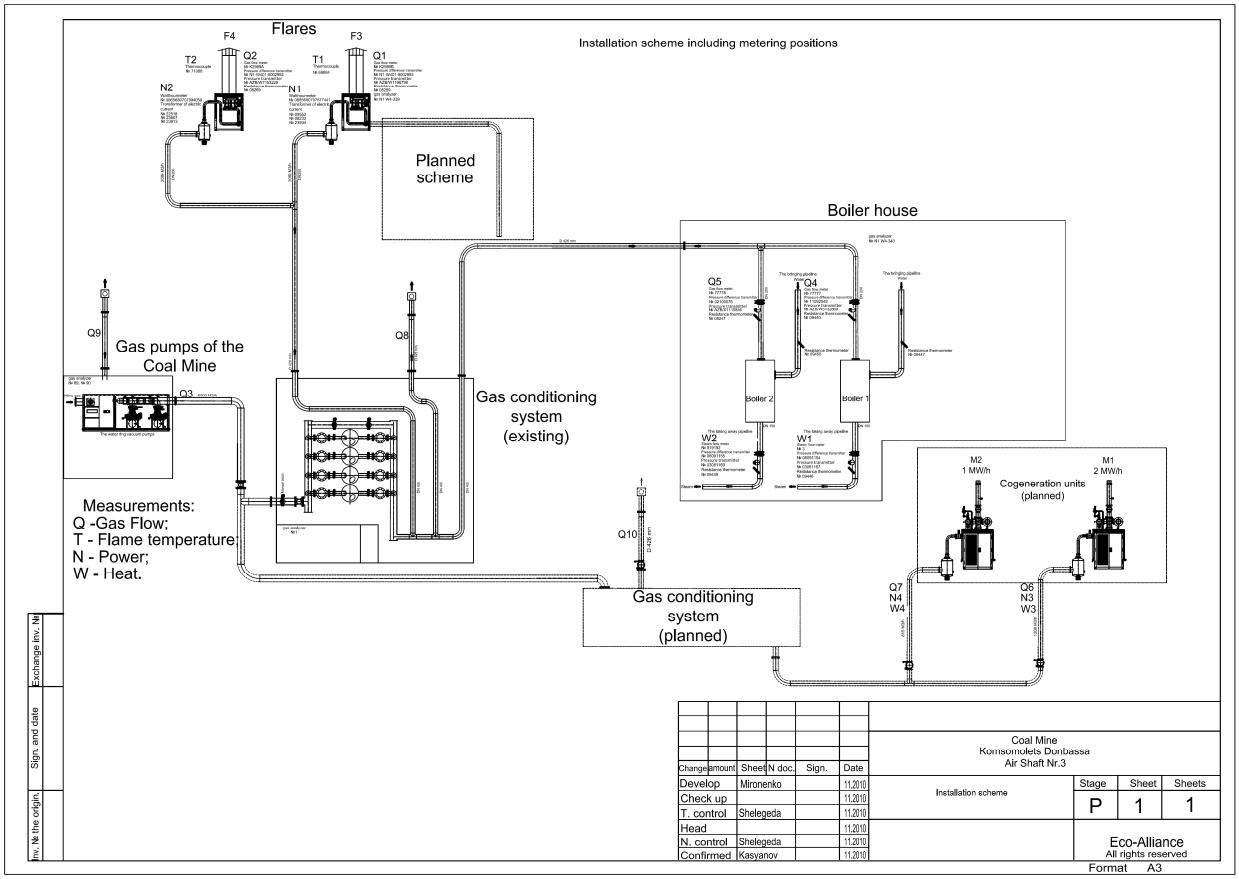

Figure-2 Installation scheme – Coal Mine Komsomolets Donbassa, Air Shaft Nr.3

Annex 3

Data flowchart

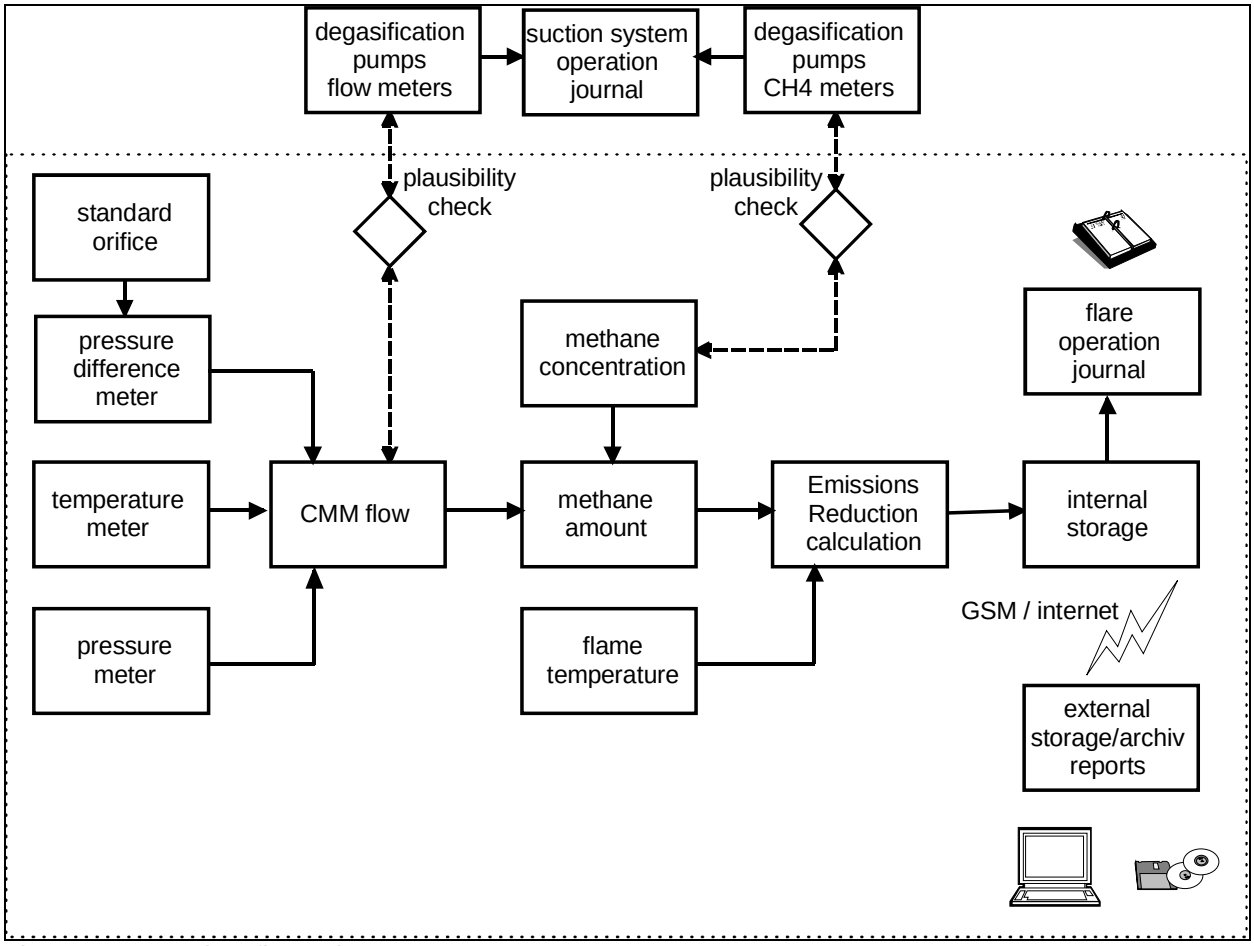

Figure-3 data flow scheme

Annex 4

Deviations from the monitoring plan as stated in the PDD

A4.1 Project emissions from flaring

The formula for the calculation of project emissions from uncombusted methane has been updated. The calculation of project emissions from uncombusted methane from flaring are now more accurate.

In the PDD the formula for project emissions from uncombusted methane is given as per:

$$PE_{UM} = GWP_{CH4} \text{ x } [(MM_{FL} \text{ x } (1 - Eff_{FL}) + MM_{ELEC} \text{ x } (1 - Eff_{ELEC}) + MM_{HEAT} \text{ x } (1 - Eff_{HEAT})] \quad (9) \text{ old}$$

In the revised monitoring plan the formula (9) has been replaced by the following formula:

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

PE_{Flare} is calculated using adopted formulae from the «Methodological "Tool to determine project emissions from flaring gases containing methane"» [AM_Tool] and ACM0008 Version 5. The original formulae refers to a yearly basis. The formulae have been adapted in the revised monitoring plan to variable monitoring periods:

The original formulae are:

$$PE_{flare} = \sum_{i=1}^{n} TM_{RG,i} x(1-\eta_{flare,i}) x \frac{GWP_{CH4}}{1000} \quad (9a)$$

where:

PE_{flare}	Project emissions from flaring in the regarded period (t CO_2eq)
$TM_{RG,i}$	Mass flow rate of methane in the regarded interval i (kg/interval)
$\eta_{flare,i}$	flare efficiency in the interval i
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)
n	number of samples (intervals) in the regarded period

and

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

where:

MD_{FL}	Methane destroyed through flaring in the regarded period (t CH_4)
MM_{FL}	Methane sent to flaring in the regarded period (t CH_4)
PE_{flare}	Project emissions from flaring in the regarded period (t CO_2eq)
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)

In the revised monitoring plan and this monitoring report, formulae 9a and 5, see above have been resolved to fit better to the monitored data.

The project emissions from flaring are calculated using the equation:

$$PE_{flare} = (MM_{Fl} - MD_{FL}) * GWP_{CH4} \quad (9a)$$

where:

PE_{flare}	Project emissions from flaring in the regarded period (t CO_2eq)
MD_{ELEC}	Methane destroyed through power generation (t CH_4)
MM_{ELEC}	Methane measured sent to power plant (t CH_4)
GWP_{CH4}	Global warming potential of methane (21 tCO_2eq/tCH_4)

The formula for the methane destroyed through flaring is:

$$MD_{FL} = \sum_{i=1}^{n} MM_{FL,i} x \eta_{flare,i} \quad (5)$$

where:

MD_{FL}	Methane destroyed through flaring (t CH_4)
$MM_{FL,i}$	Methane sent to flaring in the interval i (t CH_4)
$\eta_{flare,i}$	Efficiency of methane destruction/oxidation in flare in the interval i, see below
n	number of samples (intervals) in the regarded period

The interval is set to 15 min during the monitoring period, which is more accurate than the 1 h intervals from the «Methodological “Tool to determine project emissions from flaring gases containing methane”» [AM_Tool])

For $\eta_{flare,i}$ three different values are taken, depending on the current combustion temperature $T_{Flame,i}$ of the flare in the interval i:

$T_{Flame,i}$	$\eta_{flare,i}$	Source
> 850°C	99.5%	[PDD, revised monitoring plan Section D.1.1 and Annex 3]
500-850°C	90.0%	[AM_Tool_07-15]
< 500°C	0%	[AM_Tool_07-15]

where:

$T_{Flame,i}$	Flame temperature of the flare in the regarded interval i (°C)
$\eta_{flare,i}$	flare efficiency in the interval i

A4.2 Project emissions from energy use to capture and use methane

The formula (2) for the calculation of PE_{ME} is given in the PDD. Until 30/04/2010 the amount of the energy used by the compressors installed in the flares $CONS_{ELEC}$ has not been measured, but calculated using the operation hours of a flare unit and the electric load. After 30/04/2010 the electricuity amount has been measured with electric power meters.
The operating hours have been manually recorded in operation journals by the personnel of the Coal Mine Komsomolets Donbassa separately for each flare. There are two values: the operation time (flare is running) $h_{i,M}$ and the total operation time (flare is running or standby) $h_{i,total}$. The effective electric load and capacity are different if the flare unit is in operation or standby, because the compressor as the main power consumer is not working in standby periods.
Standby means “ready for operation” but not in operation). There have also been “off” periods, where a flare unit was completely shut off and no power has been consumed. These periods are counted as zero for the operation hours.

The total electric capacity of a flare unit P_{total} is 60 kW, 45 kW of which is part of the compressor motor P_M and 15 kW are part of the remaining electric installation like switchgear, light, fans, and mostly heating systems for the winter period.
The effective load of the electric motor has been set to a value of 75%. The capacity of the electric motor is oversized, because the compressor is designed for pressure gradients up to 500 mbar, while the real operational pressure gradients didn't exceed 100 mbar. So the full motor capacity has not been used and the value of 75% is conservative.
The effective load of the remaining electric installation has been set to a value of 45%. The main part of the capacity belongs to heating systems for the winter period. The capacity has not been used and the value of 45% is conservative.

The energy used by the additional compressors installed in the flares $CONS_{ELEC}$ is calculated as follows:

$$CONS_{ELEC,\ Flare\ i} = (Eff_M * P_M * h_{i,M}) + ((h_{i,total}-h_{i,M}) * (P_{total}-P_M) * Eff_{SB}) \quad (2b)$$

with

$CONS_{ELEC,Flare\ i}$ additional electric energy used by the compressors and other equipment installed in the flares [MWh]
$h_{i,M}$ operation hours of compressor from flare i [h] (operation)
$h_{i,\ total}$ operation hours of flare i [h] (operation+standby)
P_M motor capacity [MW], set to 45 kW (0.045 MW) for each compressors
P_{total} total capacity of the flare unit [MW], set to 60 kW (0.060 MW) for each flare
Eff_M effective load of electric motor [%], set to 75% for both flares
Eff_{SB} effective load of the flare unit during standby [%], set to 45% for both flares

The power consumed by the flares is summed using the resolved formula (2a):

$$CONS_{ELEC} = CONS_{ELEC,\ Flare\ 3} + CONS_{ELEC,\ Flare\ 4} \quad (2a)$$

Annex 5

Photo of the plant

Figure-4 Flare 3 and Flare 4 – Komsomolets Donbassa Coal Mine, Air Shaft Nr.3