MONITORING REPORT

JI0105 - CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya Zapadnaya № 1 Mine”

Monitoring Report 04
Monitoring period
01/11/2011 to 30/04/2012

Version 1
14 June 2012

CONTENTS

<u>Annexes</u>

SECTION A. General project activity information

A.1 Title of the project activity:

CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya-Zapadnaya № 1 Mine”

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)	«Colliery Group «Pokrovs’ke»[1]	no
Netherlands	Carbon-TF B.V.	no

A.2. JI registration number:

UA2000016 / JI0105
The project is approved as JI-project since 09/11/2009.
(http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/FinDet.html)

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 «Colliery Group «Pokrovs’ke», has been utilised in a previous coal boiler, which has been upgraded with a CMM burning system and a flare. The methane has been burned to less harmful CO_2.

The construction of the cogeneration station at the central shaft has started already in 2008 and has been finished at the end of 2011. Initial operation of the first engine was in the end of October 2011. First power production of about 8 MWh was also in October 2011.

In this monitoring the gained emission reductions should be monitored for the purpose of the verification as Emission Reductions Units (ERU).

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

period	CH_4 [m³/period]	Heat generated [MWh]	Power generated [MWh]
01/11/2011-31/12/2011	3,241,291	12,974	317
01/01/2012-30/04/2012	6,780,271	18,143	5,877
Total 2011-2012	10,021,562	31,117	6,194

A.4. Monitoring period:

Start date 01/11/2011

[1] The name of the coal mine changed to «Colliery Group «Pokrovs’ke», see B.4. for justification

End date 30/04/2012

Start day and end day included.

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 this methodological 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 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 this methodological 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 tool.

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

The project has not been installed as planned in the PDD. In the monitoring period only the installation at the main shaft has been completed. The installation of further units as stated in the PDD is delayed due to the lack of funds and should follow in 2012. See Table-3 for details.

The coordinates given in the PDD uses the SK-42 reference system which uses a slightly different reference ellipsoid than the WGS84 (World Geodetic System) system used by Google. The SK-42 system and the substantial cartography are still in use in the most CIS countries and Ukraine too.

The WGS84 coordinates are:

Central Shaft: 48°15’31’’ N, 36°59’30’’ E
Air Shaft: 48°15’20’’ N, 37°01’57’’ E

Table-2 Status of Implementation

Unit: upgraded previously coal fired steam boiler at central shaft	
Manufacturer: Biysk Boiler Plant	
Type: KE-25-14KC	
Serial Number: 6827 (not visible)	
Inventar Number: 4022 (visible)	
Capacity: 25 t/h steam (approx. 25 MW)	
Activity	**Status**
year of construction	06/05/1986
last major overhaul	22/12/2002 - Ukrteploservis
Last inspection	15/03/2011 - Derzhgorpromnadzor
Commission of upgrade	20/03/2003
Official completion of upgrade	31/03/2003
Start of initial operation, first tests	summer 2003
Start of operation	October 2003
Planned installation date [PDD]	October 2003

Unit: Flare 1	
Manufacturer: Hofstetter Umwelttechnik AG	
Type: HOFGAS®-IFL4c 9000	
Serial Number:H 10244	
Capacity: max. 9,000 m³/h gas (20-40% CH_4), max 25 MW firing capacity	
Activity	**Status**
Year of construction	2008
Last inspection	2010, Sinapse
Commission date	21/03/2008
Start of operation	October 2010
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 1	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-S. LC.	
Serial Number: 4590982	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2011, Sinapse
Commission date	-
Start of operation	-
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 2
Manufacturer: GE Jenbacher GmbH & Co.KG
Type: JMS 620 GS-S. LC.

Serial Number: 4533481	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2011, Sinapse
Commission date	-
Start of operation	October 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 3	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4590981	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2012, Sinapse
Commission date	March 2012
Start of operation	November 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 4	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 4934371	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2012, Sinapse
Commission date	January 2012
Start of operation	November 2011
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 5	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-S. LC.	
Serial Number: 4533482	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2011, Sinapse
Commission date	-
Start of operation	-
Planned installation date [PDD]	January 2008

Unit: Cogeneration Unit 6	
Manufacturer: GE Jenbacher GmbH & Co.KG	
Type: JMS 620 GS-L	
Serial Number: 5841531	
Capacity: 3.044 kW el., 3.323 MW th	
Activity	**Status**
Year of construction	2008
Last inspection	2012, Sinapse
Commission date	February 2012
Start of operation	November 2011
Planned installation date [PDD]	January 2008

Table-3 Installation plan [PDD] –original and updated timeline

unit	**installation date (PDD)**	**firing capacity**	**planned installation new timetable**
Central Shaft			
upgraded boiler	Oct 2003	25 MW	October 2003
flare No: 1	Jan 2008	5 MW	1 Flare with 25 MW in October 2010
flare No: 3	Mar 2008	5 MW	Included above
cogeneration units	Jul 2008	total of 48.8 MW	November 2011
Degassing wells			
flare/pump No: 2	Jan 2008	5 MW	2012
flare/pump No: 7	Apr 2008	5 MW	2012
Air Shaft № 2			
flares No: 4-6	Apr 2008	total of 15 MW	2012
cogeneration units	Jun-Oct 2008	total of 67.5 MW	2012
cogeneration units	Jan 2009	total of 30 MW	2012

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

In the PDD the start of operation of the boiler in October 2003 is given instead of the installation date. See Table-2 in A.6 for details. The installation of numerous units is delayed as stated under A.6. Instead of two flares with a capacity of 5 MW one flare with a capacity up to 25 MW has been installed at the central shaft.

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

A revised monitoring plan has been provided. See <Revised Monitoring Plan-KAZ1.V6a.pdf>

The calculation of the emission reductions is not calculated on a yearly basis, but for an individual period. 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.

The formula for the calculation of project emissions from uncombusted methane has been changed. Formulae from the «Methodological “Tool to determine project emissions from flaring gases containing methane”» [AM_Tool_07]) have been applied, see Annex 4. The calculation of project emissions from uncombusted methane from flaring is now more accurate.
The CMM flow measurement for the cogeneration station started working on 14/03/2012. For the period from 01/11/2012 to 13/03/2012 the CMM amount has been calculated using the produced power amount and the efficiency of the engines.

A.9. Changes since last verification:

The installation of the cogeneration units at the main shaft has been completed, the operation started at the end of October 2011.

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

«Colliery Group «Pokrovs’ke»[2]
- Volodymyr Tymchenko, Technical Director since February 2010

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

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

[2] The name of the coal mine changed to «Colliery Group «Pokrovs’ke», see B.4. for justification

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-4 Monitoring equipment

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
2a	CH_4 concentration	Infrared measurement	POLITRON - Draeger	Gas analyser	ARSK 0191	measurement continuous record period 15 min.	2002	0-100 %	4% absolute error in the range below 40% LEL**) 10% relative error in the range above 40% LEL**)	Yearly calibration made using procedures of Sumystandart-metrology. Calibrations made using procedures of Eco Alliance every 2 weeks.	10/2011	
3	NMHC concentration	lab analysis	Chromatograp h	3700 L	279	yearly	unknown	1-5*10^{-4}%	10% for upper range limit 25% for lower range limit	The approved laboratory is responsible for regular recalibrations of the system.	unknown	Donetskstand art-metrology
4	CMM amount to boiler	Vortex flow meter	"Sibnefteavto matika" IJSC, Tyumen, Russia	DRG.MZ-300	06136	measurement continuous record period 15 min.	Sep 2009	562.5-22,500 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*)	Calibration made using procedures of the manufacturer. Calibration frequency – 3 years	30/04/2009	Manufacturer
5	CMM pressure (boiler)	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/W 5132862	measurement continuous record period 15 min.	Sep 2009	0-1.6 bar, abs	0.5%)	Calibration made using procedures of the manufacturer. Calibration	09/12/2011 certificate № 2354	Sumystandart -metrology

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										frequency – 1 year		
6	CMM temperature (boiler)	Resistance thermometer	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0.5% 80F8	09124	measurement continuous record period 15 min.	Sep 2009	-50-250°C	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	29/12/2011 passport to Resistance thermometer № 09455	Sumystandart -metrology
7	Steam amount to boiler	Vortex flow meter	"Sibnefteavto matika" IJSC, Tyumen, Russia	DRG.MZ-200	06135	measurement continuous record period 15 min.	Sep 2009	250-10,000 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*)	Calibration made using procedures of the manufacturer. Calibration frequency – 3 years	30/04/2009	Manufacturer
8	Steam pressure (boiler)	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/A2199938	measurement continuous record period 15 min.	Jan. 2011	0-10 bar, abs	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	09/12/2011	Manufacturer
9	Steam Temperature (boiler)	Resistance thermometer	JSC “Tera”, Chernigov	TSPU 1-3N Pt-100 0,5% 80F8	09436	measurement continuous record period 15 min.	Oct. 2010	-50-250°C	0.5%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	07/11/2011	Sumystandart -metrology
10	CMM amount to flare	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14033	measurement continuous record period 15 min.	Aug. 2011	n.a	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	For unit 14033: 26/04/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
11	CMM amount to flare	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG MZL 200-400	10144	measurement continuous record period 15 min.	Oct. 2010	2,000-40,000 m³/h	1.5% in the range: 0.1 V_{max} to 0.9 V_{max}*)	Calibration made using procedures of the manufacturer. Calibration frequency – 3 years	20/07/2010 By manufac-turer	Manufacturer
12	CMM pressure (flare)	Pressure transmitter	Metran	Metran 150TG2	932847	measurement continuous record period 15 min.	Oct. 2010	0... 60 kPa	0.25%	Calibration made using procedures of the manufacturer. Calibration frequency – 4 years	05/08/2010 By manufac-turer	Manufacturer
13	CMM pressure (flare)	Measuring Transformer	VEGA Grieshaber KG	Vegabar 17	20108320	measurement continuous record period 15 min.	Aug. 2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	13/04/2011 By manufacture r	Manufacturer
14	CMM Temperature	Measuring Transformer	Microterm	MTM201D	3401	measurement continuous record period 15 min.	Oct. 2010	-50 - 100°C	0.25 %	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	31/10/2011	Donetskstand-artmetrology
15	CH_4 Concentration	Infrared measurement	NUK	NGA5 CH_4/O_2	11034	measurement continuous record period 15 min.	Oct. 2010	0...100% CH_4 0...25% O_2	2 %	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	28/10/2011	Donetskstand-artmetrology
16	Electricity	Electricity meter	Actaris	SL7000 Type – SL761E071	53024005	Continuous, cumulative value Read period monthly	Oct. 2010	n.a	0.5%	Initial calibration made by manufacturer using procedures according to IEC61036.	By manufacture r	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										Calibration is spent 1 time in 6 years		
17	Flare Temperature	Thermo couple	Energoterm	TPP-401M	436-11	measurement continuous record period 15 min.	Aug. 2011	0… 1300°C	1.5%	none, thermocouple is supposed to be changed at least one time per year, according to the flaring tool	changed every year	none
18	CMM amount to Cogeneration Unit #1 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14045	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
19	CMM amount to Cogeneration Unit #1 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14032	measurement continuous record period daily	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
20	CMM amount to Cogeneration Unit #1 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
21	CMM amount to Cogeneration Unit #1 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										– 3years		
22	CMM pressure Cogeneration Unit #1 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1770	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
23	CMM pressure Cogeneration Unit #1 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1783	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
24	CMM Temperature Cogeneration Unit #1 (main gas)	Measuring Transformer	Microterm	MTM201D	3687	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
25	CMM Temperature Cogeneration Unit #1 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3685	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
26	CMM amount to Cogeneration Unit #2 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14043	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
27	CMM amount to Cogeneration Unit #2 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
28	CMM amount to Cogeneration Unit #2 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
29	CMM pressure Cogeneration Unit #2 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1771	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
30	CMM pressure Cogeneration Unit #2 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1779	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
31	CMM Temperature Cogeneration Unit #2 (main gas)	Measuring Transformer	Microterm	MTM201D	3691	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
32	CMM Temperature Cogeneration Unit #2 (prechamber	Measuring Transformer	Microterm	MTM201D	3681	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
	gas)											
33	CMM amount to Cogeneration Unit #3 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14041	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
34	CMM amount to Cogeneration Unit #3 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14037	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
35	CMM amount to Cogeneration Unit #3 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
36	CMM amount to Cogeneration Unit #3 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
37	CMM pressure Cogeneration Unit #3 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1767	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
38	CMM pressure Cogeneration Unit #3 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1782	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
39	CMM Temperature Cogeneration Unit #3 (main gas)	Measuring Transformer	Microterm	MTM201D	3692	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
40	CMM Temperature Cogeneration Unit #3 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3683	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
41	CMM amount to Cogeneration Unit #4 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14034	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
42	CMM amount to Cogeneration Unit #4 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14036	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
43	CMM amount to Cogeneration Unit #4 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										frequency – 3years		
44	CMM amount to Cogeneration Unit #4 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
45	CMM pressure Cogeneration Unit #4 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1766	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
46	CMM pressure Cogeneration Unit #4 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1780	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
47	CMM Temperature Cogeneration Unit #4 (main gas)	Measuring Transformer	Microterm	MTM201D	3688	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
48	CMM Temperature Cogeneration Unit #4 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3686	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
49	CMM amount to Cogeneration Unit #5 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14040	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
50	CMM amount to Cogeneration Unit #5 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14044	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
51	CMM amount to Cogeneration Unit #5 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
52	CMM amount to Cogeneration Unit #5 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
53	CMM pressure Cogeneration Unit #5 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1769	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
54	CMM pressure Cogeneration Unit #5 (prechamber	Measuring Transformer	Microterm	MTM 700DI	1781	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration	25/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
	gas)									frequency – 1 year		
55	CMM Temperature Cogeneration Unit #5 (main gas)	Measuring Transformer	Microterm	MTM201D	3689	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
56	CMM Temperature Cogeneration Unit #5 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3684	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
57	CMM amount to Cogeneration Unit #6 (main gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14042	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
58	CMM amount to Cogeneration Unit #6 (prechamber gas)	flow calculation unit	"Sibnefteavto-matika" IJSC, Tyumen, Russia	BVR M	14035	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	26/04/2011	Manufacturer
59	CMM amount to Cogeneration Unit #6 (main gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.1000	12059	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency	23/11/2010	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
										– 3years		
60	CMM amount to Cogeneration Unit #6 (prechamber gas)	Gas flow transmitter	"Sibnefteavto-matika" IJSC, Tyumen, Russia	DRG M.160	10567	measurement continuous	2011	1-80 m^3/h	1,5% in the range: 0,1 V_{max} to 0,9 V_{max}*)	Calibration made using procedures of the manufac-turer. Calibration frequency – 3years	23/11/2010	Manufacturer
61	CMM pressure Cogeneration Unit #6 (main gas)	Measuring Transformer	Microterm	MTM 700DI	1768	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
62	CMM pressure Cogeneration Unit #6 (prechamber gas)	Measuring Transformer	Microterm	MTM 700DI	1784	measurement continuous	2011	0÷0,1 MPa	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
63	CMM Temperature Cogeneration Unit #6 (main gas)	Measuring Transformer	Microterm	MTM201D	3690	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer
64	CMM Temperature Cogeneration Unit #6 (prechamber gas)	Measuring Transformer	Microterm	MTM201D	3682	measurement continuous	2011	-50 - 100°C	0,25%	Calibration made using procedures of the manufacturer. Calibration frequency – 1 year	25/05/2011	Manufacturer

ID	Data	Method	Manufacturer	Classification	Serial number	Frequency of mea-surement	Instal-lation	Range	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
65	Electricity	Electricity meter	Elster Metronica	A1800	01226171	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom}	Accuracy class 0,2S; 0,5S; 1; 2 for active energy and 0,5; 1,0; 2,0; 2,0 for reactive energy	Calibration made using procedures of the manufac-turer. Calibration frequency – 12 years	16/06/2011	Manufacturer
66	Electricity (own needs)	Electricity meter	Telecart	Energy-9	53917	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom} 0,01 I_{nom} – I_{max}	Accuracy class 0,2; 0,5; 1,0 for active energy and 0,5; 1,0; 1,0 for reactive energy	Calibration made using procedures of the manufac-turer. Calibration frequency – 6 years	04/10/2010	Manufacturer
67	Electricity (own needs)	Electricity meter	Telecart	Energy-9	53941	measurement continuous	2011	0,8 U_{nom} - 1,2 U_{nom} 0,01 I_{nom} – I_{max}	Accuracy class 0,2; 0,5; 1,0 for active energy and 0,5; 1,0; 1,0 for reactive energy	Calibration made using procedures of the manufac-turer. Calibration frequency – 6 years	04/10/2010	Manufacturer

Note: Changes during fourth monitoring period

Measurement equipment for cogeneration station was added (positions 18-67)

*) The velocities are always in the specified range. The velocities correspond to the following gas flows:
ID 4 CMM flow: Q_{min} = 562.5 m³/h, Q_{max} = 22,500 m³/h
ID 7 steam flow: Q_{min} = 250.0 m³/h, Q_{max} = 10,000 m³/h
ID 10 CMM flow Q_{min} = 1,000 m³/h, Q_{max} = 40,000 m³/h

**) The Draeger Politron is mainly a CH_4 detection and warning system, which is normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.

The conversion of the errors from LEL to % CH_4 in the gas mixture gives the following values:

Table-5 Uncertainty levels of the Draeger Politron

Range	Range	Uncertainty	Uncertainty
< 40% LEL	< 2% CH_4	4% absolute of LEL	0.2 % CH_4 absolute
> 40% LEL	> 2% CH_4	10% relative	Linear error increase starting with 0.2 % CH_4 abs at 2% CH_4 concentration Ending with 10% CH_4 abs at 100% CH_4

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
P13 Eff_{FL}	Flare combustion efficiency	revised monitoring plan	%	Set to: 99.5 % for T_{flare} > 1.000℃ 90.0 % for 500℃ < T_{flare} < 1.000℃ 0.0 % for T_{flare} < 500℃
P16 Eff_{ELEC}	Efficiency of methane destruction / oxidation in power plant	IPCC	%	set at 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
P8, B49 $CEF_{ELEC,PJ}$	CO_2 emission factor of the grid	National Environmental Investment Agency of Ukraine, NEIA	t CO_2 / MWh	Official Ukrainian data have been published at 12/05/2011 at the NEIA website. According to the information given in the PDD these data are taken into account. Set to: 1.063 t CO_2 / MWh for 2011-2012
B55 EF_{HEAT}	CO_2 emission factor of fuel used for captive power or heat	National Environmental Investment Agency of Ukraine, NEIA	tCO_2/MWh	set to 0.3415 tCO_2/MWh Using the value for “Other Bituminous Coal” of 25,87 t C/TJ, [NEIA-2]
B57 Eff_{COAL}	Energy efficiency of coal fired heat plant	Boiler pass	%	set to 73.5% (RMP)

B.2.2. List of variables:

Table-7 List of variables

ID number	Data variable	Source of data	Data unit	Comment

P1 PE	Project emissions	monitored data	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P2 PE_{ME}	Project emissions from energy use to capture and use methane	monitored data	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P3 PE_{MD}	Project emissions from methane destroyed	monitored data	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P4 PE_{UM}	Project emissions from uncombusted methane	monitored data	tCO_{2eq}	calculated using formulae from the revised monitoring plan
P5 $CONS_{ELEC,PJ}$	Additional electricity consumption by project	electricity meter	MWh	
P9 PE_{Flare}	Project emissions from flaring	monitored data	tCO_{2eq}	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- 10-13	t CH_4	
P14 MD_{ELEC}	Methane destroyed by power generation	monitored data	t CH_4	calculated using formulae from the revised monitoring plan
P15 MM_{ELEC}	Methane sent to power generation	monitored data	t CH_4	calculated using formulae from the revised monitoring plan
P17 MD_{HEAT}	Methane destroyed by heat generation	monitored data	t CH_4	calculated using formulae from the revised monitoring plan
P18 MM_{HEAT}	Methane sent to boiler	flow meter	t CH_4	calculated using formulae from the revised monitoring plan
P24 CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various)	lab analysis	t CO_2 / t NMHC	calculated if applicable
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	
P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	used to check if more than 1% of emissions and to calculate r
P27 r	Relative proportion of NMHC compared to methane	lab analysis	%	calculated if applicable, based on the lab analysis.
B1 BE	Baseline emissions	monitored data	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	monitored data	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	monitored data	t CO_{2eq}	calculated using formulae from the revised monitoring plan
B14 CMM_{PJ}	CMM captured by the project activity	flow meters	t CH_4	
B46 GEN	Power generation by project	power meter	MWh	Cumulative value
B47 HEAT	Heat generation by project	heat meter	MWh	measured using steam flow data
T_{Flame}	Flame temperature of the flare	temperature meter	[℃]	

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

Table-8 GHG emissions by sources of the project activity

ID number	Data variable	Source of data	Data unit	Comment
P12 MM_{FL}	Methane sent to flare	measured ID's- 10-13	t CH_4	
P15 MM_{ELEC}	Methane sent to power generation	monitored data	t CH_4	calculated using formulae from the revised monitoring plan
P18 MM_{HEAT}	Methane sent to boiler	flow meters	t CH_4	
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	
P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	used to check if more than 1% of emissions and to calculate r

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

Table-9 GHG emissions by sources of the baseline

ID number	Data variable	Source of data	Data unit	Comment
B14 CMM_{PJ}	CMM captured by the project activity	flow meter	t CH_4	
B46 GEN	Power generation by project	power meter	MWh	Cumulative value
B47 HEAT	Heat generation by project	heat meter	MWh	measured using steam flow data

B.2.5. Data concerning leakage

Not applicable.

B.2.6. Data concerning environmental impacts

The project meets all the ecological requirements and all ecological permissions are present for equipment used in the project. In general all the activities which were performed from the beginning of the project led to the significant reduction of the methane emissions into the atmosphere and now almost all of CMM is utilized at the Central Shaft.

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

The data for the boiler 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. Eco-Alliance ensures regular backups and archiving. Further on the data is stored and archived by Eco-Alliance.
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 the flare and the cogeneration units Sinapse has provided a system for data collecting, archiving and sending to Internet, called Graphic Data Manager RSG 40 Memograph M. The data is stored in the memory of computer for 6 months. Every month coal mine personnel save the data into flash memory and send it to Eco-Alliance.

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.

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 «Colliery Group «Pokrovs'ke» through supervising and coordinating activities of his subordinates, such as the degasification engineer, heating technician, and safety engineering departments.
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.
The general supervision of the monitoring system is executed by the administration of the coal mine under the existing control and reporting system.

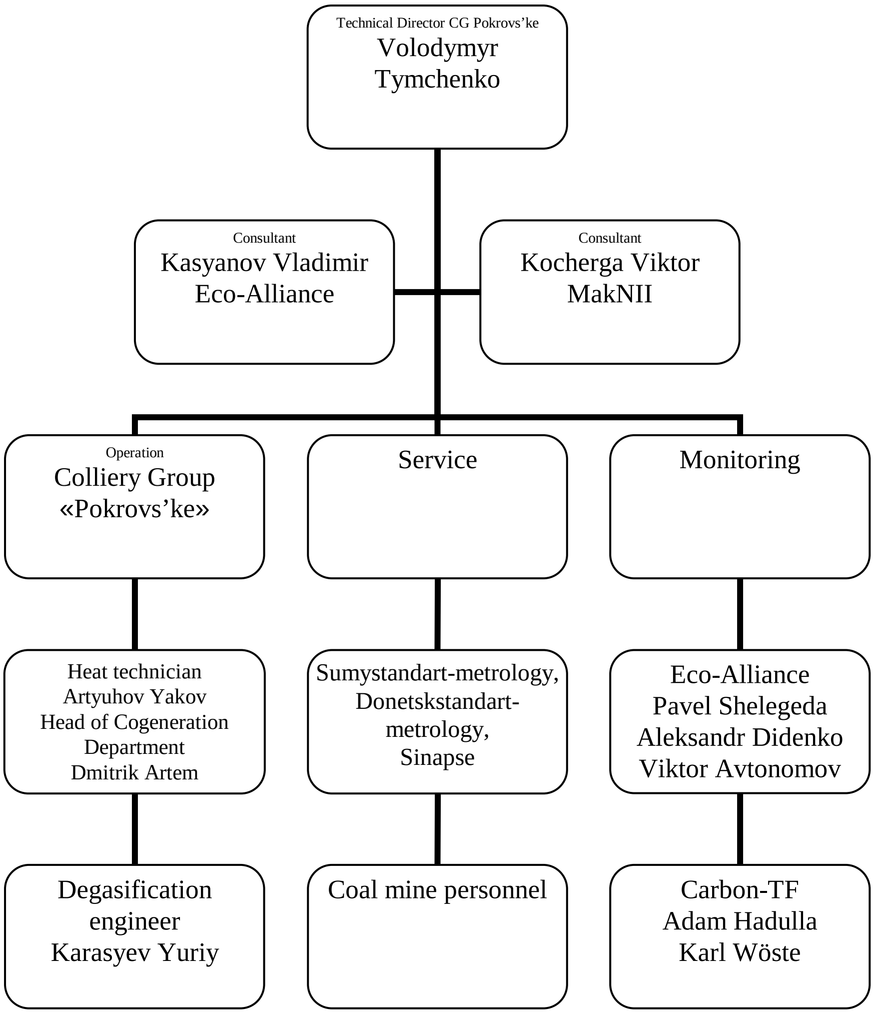


Figure 1 – Organigram

C.1.2. Trainings:

The employees of the boilerhouse responsible for the monitoring control have been trained on–the–job during the installation of the system. The responsible personnel of Eco-Alliance have 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.
The personnel of the flare unit and cogeneration units, responsible for monitoring control have been trained on–the–job during the installation of the flare unit, cogeneration units and monitoring system by Sinapse.

C.2. Involvement of Third Parties:

- Sumystandartmetrolology and Donetskstandartmetrolology are subsidiaries of the “Ukrainian Ukrainian Centre for Standardisation and Metrology”, which is part of the “State Committee for Matters of Technical Regulations and Consumer Politics”, which is part of the government, were involved for the regular calibration of the measuring equipment.
- Respirator has been involved for the lab analysis (NHMHC) of the CMM in 2011 and 2012.
- Eco-Alliance provided the electronically data acquisition system and the monitoring activity together with the coal mine personnel.
- As the provider of flare equipment, cogeneration units and belonging monitoring system, Sinapse performs maintenance and adjustment of the monitoring system.

C.3. Internal audits and control measures:

Every 2 weeks a monitoring engineer from Eco-Alliance makes audits and remarks this in the operational journal. The mechanic on duty from the coal mine makes daily audits.

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

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.

QM procedure:

For boilerhouse:
- Electronic data are stored at Eco-Alliance and Carbon-TF.
- Back-ups are made regularly by Eco-Alliance and Carbon-TF.
- A monitoring engineer from Eco-Alliance checks the data from web-site every day and makes internal weekly reports.
- Eco Alliance prepares monthly reports which are checked by Carbon-TF B.V.
- Additionally data are recorded manually in journals by the coal mine personnel
- The journals are checked daily by the chief heat technician and cross-checked by Eco Alliance every 2 weeks. Monitoring engineer from Eco-Alliance makes a remark in the operational journal.
- The paper data are stored at the coal mine.

- The mechanic on duty from the coal mine makes daily audits.
- Eco-Alliance makes service audits every month.

For flare and cogeneration units:

- Electronic data are stored in the memory of Graphic Data Manager RSG 40 Memograph.
- Back-ups are made regularly by personnel of the coal mine's Cogeneration Section.
- Data are recorded manually in journals by personnel of the coal mine's Cogeneration Section.
- The journals are checked daily by the engineer of technical diagnostics and cross-checked by the programmers of the Cogeneration Section.
- The paper data are stored at the coal mine.
- Every month personnel of the Cogeneration Section send electronic data from the flare to Eco-Alliance.

General:

- Carbon-TF prepares the monitoring report, which is checked by Eco-Alliance and the coal mine.

C.4. Troubleshooting procedures:

The general troubleshooting for the steam boiler hasn't changed. In case of disturbance the gas supply to the boiler is shut down by a quick acting valve and the CMM supplied by the degasification system of the coal mine is blown to the atmosphere. The flare is also automatically shut down in case of faults.
The procedures are available at the coal mine. The coal mine personnel are instructed to follow the procedures.

SECTION D. Calculation of GHG emission reductions

D.1. Table providing the formulas used:

Table-10 Formulae used taken from the Revised Monitoring Plan

ID number	Data variable	Formula
P1 PE	Project emissions	$PE = PE_{ME} + PE_{MD} + PE_{UM}$
P2 PE_{ME}	Project emissions from energy use to capture and use methane	$PE_{ME} = CONS_{ELEC,PJ}$ x $CEF_{ELEC,PJ}$
P3 PE_{MD}	Project emissions from methane destroyed	$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT})$ x $(CEF_{CH4} + r$ x $CEF_{NMHC})$
P4 PE_{UM}	Project emissions from uncombusted methane	$PE_{UM} = GWP_{CH4}$ x $[MM_{ELEC}$ x $(1 - Eff_{ELEC}) + MM_{HEAT}$ x $(1 - Eff_{HEAT})] + PE_{Flare}$
P11 MD_{FL}	Methane destroyed by flaring	$MD_{FL} = \sum_{i=1}^{n} MM_{FL,i} x \eta_{flare,i}$
P14 MD_{ELEC}	Methane destroyed by power generation	$MD_{ELEC} = MM_{ELEC}$ x Eff_{ELEC}
P17 MD_{HEAT}	Methane destroyed by heat generation	$MD_{HEAT} = MM_{HEAT}$ x Eff_{HEAT}
PE_{Flare}	Project emissions from flaring	$PE_{Flare} = (MM_{Fl} - MD_{Fl})$ x GWP_{CH4}
P27 r	Relative proportion of NMHC compared to methane	$r = PC_{NMHC} / PC_{CH4}$
B1 BE	Baseline emissions	$BE = BE_{MR}$-+ BE_{Use}
B3 BE_{MR}	Baseline emissions from release of methane into the atmosphere that is avoided by the project activity	$BE_{MR} = CMM_{PJ}$ x GWP_{CH4}
B4 BE_{Use}	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity	$BE_{Use} = GEN * EF_{ELEC} + (HEAT / Eff_{COAL}) * EF_{HEAT}$
B14 CMM_{PJ}	CMM captured in the project activity	$CMM_{PJ} = (MM_{FL} + MM_{ELEC} + MM_{HEAT})$
ER	Emission reductions	$ER = BE - PE$

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.

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

D.3.1. Comparison

Period	**Prospected emission reductions, PDD [t CO_{2eq}]**		**Monitored emission reductions [t CO_{2eq}]**	
	Full year	Proportionally for the monitoring period	In tonnes CO_2eq and percentage of the prospected emission reductions	
01/11/2011-31/12/2011	1,787,002 (2011)	297,834	48,516	16,3%
01/01/2012-30/04/2012	1,781,880 (2012)	593,960	102,307	17.2%
Total 2011-2012		891,794	150,823	16.9%

The monitored values are significantly lower than the prospected values, because a big part of the project has not been installed until the end of the monitoring period.

D.3.2 Monitored project emissions

Monitored project emissions [t CO_2eq / a]	
period	01/11/2011-30/04/2012
methane destruction	
flaring	181
heat generation	15,761
power generation	4,508
additional power consumption	
power generation	664
Total	**21,114**

D.3.3 Monitored baseline emissions

Monitored baseline emissions [t CO_2eq / a]	
period	01/11/2011-30/04/2012
release of methane that is avoided by the project	
flaring	1,088
heat generation	116,493
power generation	33,314
production of heat that is displaced by the project	14,458
production of power that is displaced by the project	6,584
Total	**171,936**

D.3.4 Project emissions, baseline emissions and emission reductions

Year	Monitored project emissions (tonnes of CO_2 equivalent)	Monitored leakage (tonnes of CO_2 equivalent	Monitored baseline emissions (tonnes of CO_2 equivalent)	Monitored emissions reductions (tonnes of CO_2 equivalent)
01/11/2011-31/12/2011	6,653	-	55,169	48,516
01/01/2012-30/04/2012	14,461	-	116,768	102,307
Total (tonnes of CO_2 equivalent)	21,114	-	171,936	150,823

Annex 1

REFERENCES

- Project Design Document; Version 04, dated 2008-09-10
- Final Determination Report for the project: JI0105 "CMM utilisation on the Joint Stock Company "Coal Company Krasnoarmeyskaya Zapadnaya № 1 Mine""; Report No: 2008-1279 Rev 01, by DNV Det Norske Veritas, dated 2008-08-30
- Letter of Approval, Nr. 2239/11/10-08, issued on 2008-02-22 by the Ukraine (host party)
- Letter of Approval, Nr. 2008JI02, issued on 2008-04-22 by the Kingdom of the Netherlands (investor party)
- Letter of Endorsement, Nr. 973/10/3-10, issued on 2007-02-02 by the Ukrainian Ministry of Environmental Protection
- supporting evidence documents provided by the coal mine
- revised monitoring plan, dated 2011-03-01
- [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
- [NEIA] Baseline carbon emission factor for electric power approved in Ukraine:

  http://www.neia.gov.ua/nature/doccatalog/document?id=127498
- [NEIA-2] Baseline carbon emission factor for other bituminous coal approved in Ukraine: 25,87 t C/TJ (National Inventory Report of Anthropogenic Emissions from Sources and Absorption by Absorbers of Greenhouse Gases in Ukraine for 1990-2009, Table P4.7)

Annex 2

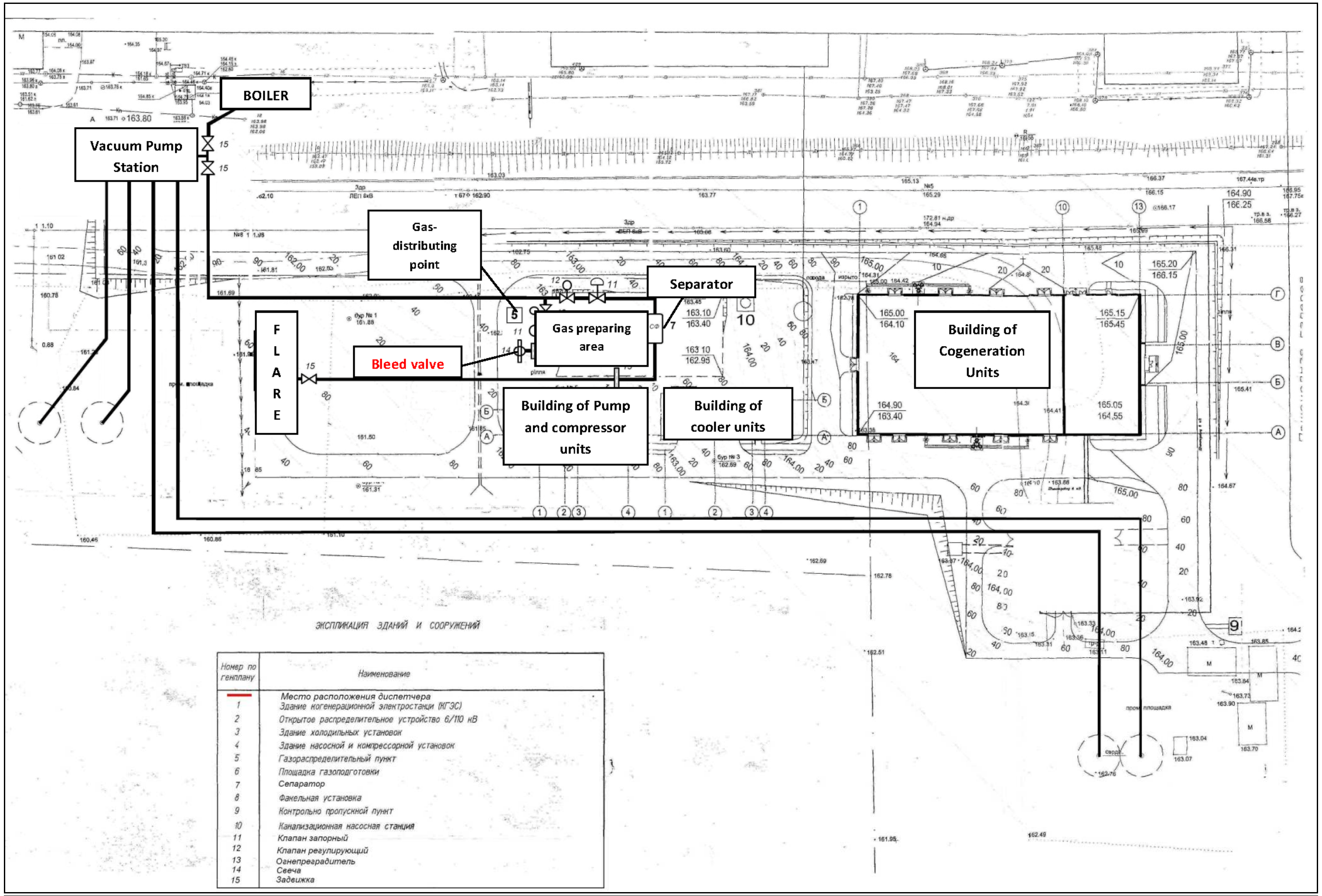


Figure-2 Location Plan – «Colliery Group «Pokrovs'ke», Central Shaft

Annex 3

Energy and material flowchart including metering positions

A3.1 Monitoring plan applied

The electronically measurement procedure, applied since 12/09/2009, is according to the monitoring plan as described in the PDD. A Vortex flow meter instead of a standard orifice as described in the PDD has been used for the measurement of the CMM amount; the flow meters are on par. Manual records (journals) are still used by the coal mine and can be taken for backup.

The CH_4 concentration is measured by a Draeger Politron meter, which is mainly a CH_4 detection and warning system, normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.
Since October 2010 a new gas analyser manufactured by NUK has been installed in the pipeline to the flare.
Further on a third measurement unit by "Woelke" is installed in the central suction system outside the boiler house. The plausibility measurement (Woelke-measurement unit) is not recorded.

A3.2 Measurement unit installation

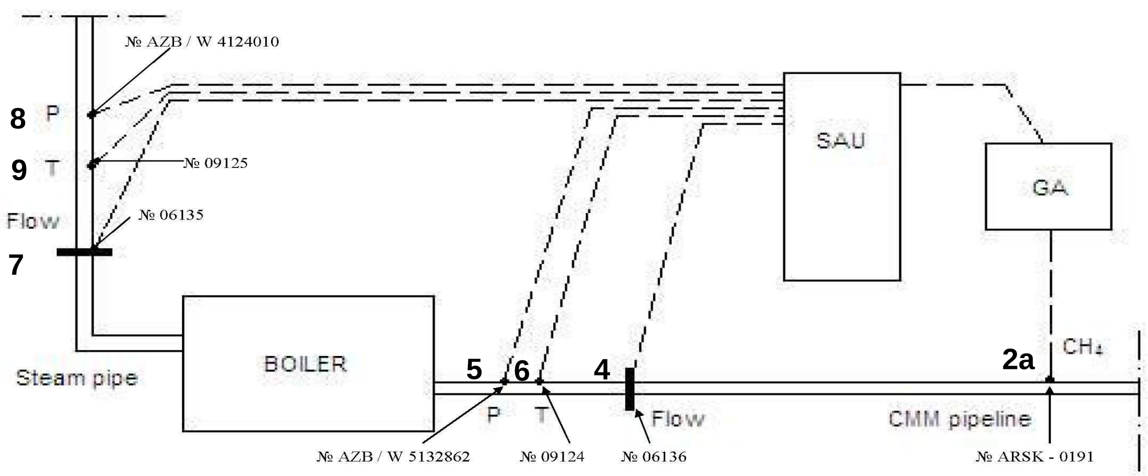


Figure-3 – Installation scheme of the boiler monitoring system
2a) concentration measurement – Draeger Politron
4) CMM flow meter - Vortex
5) CMM pressure
6) CMM temperature
7) steam flow meter - Vortex
9) steam pressure
9) steam temperature

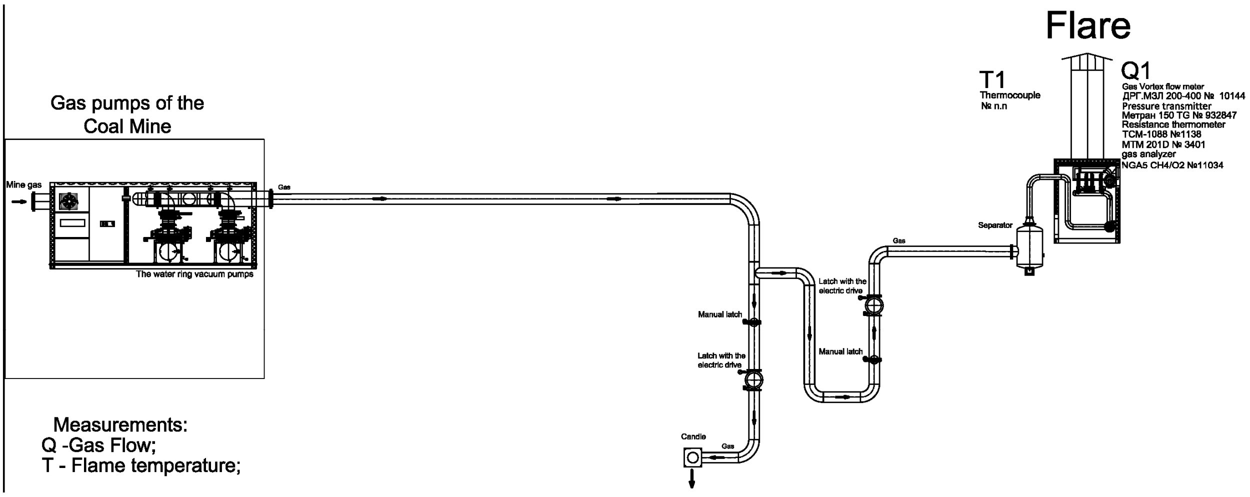
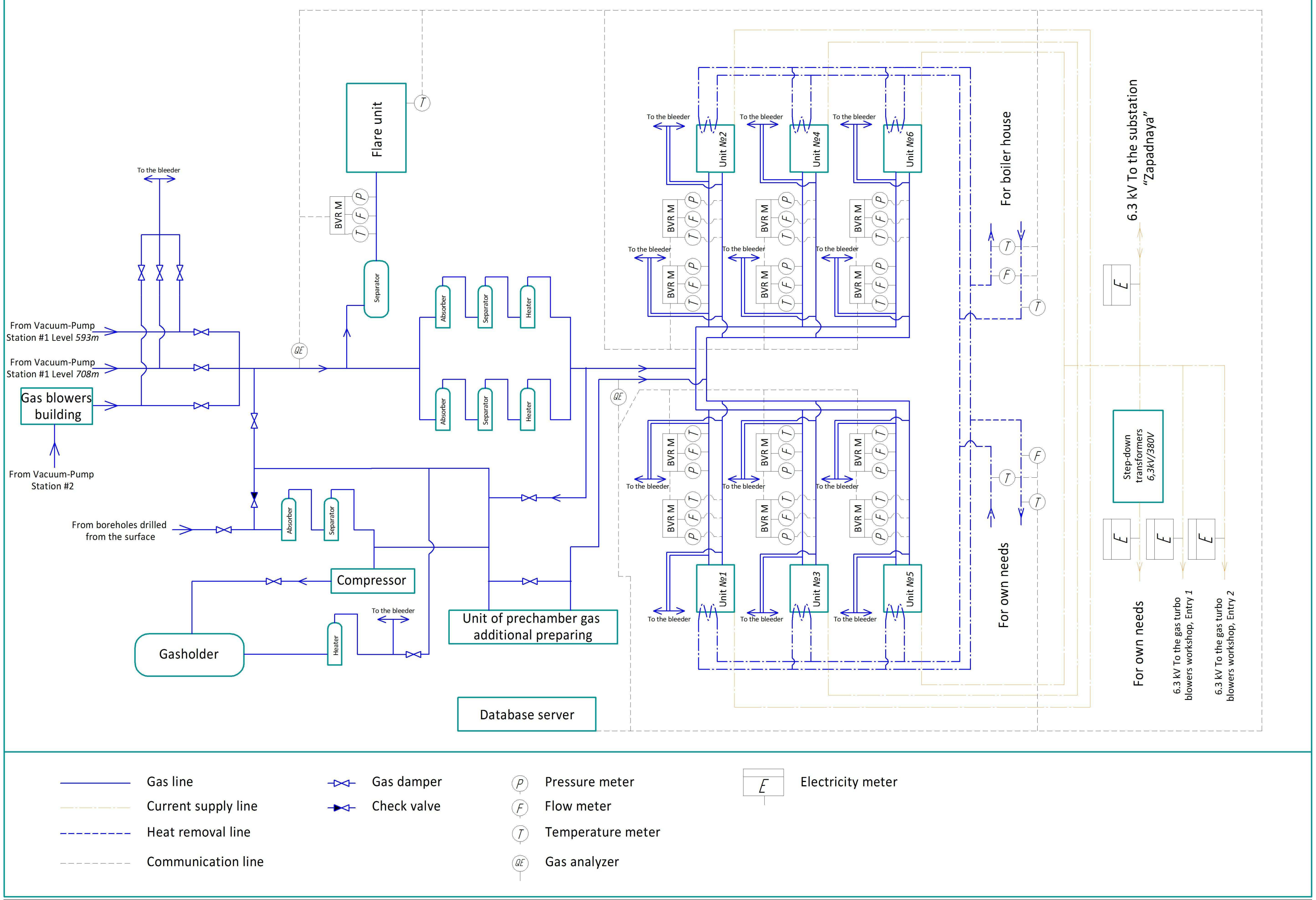


Figure-4 – Installation scheme of the flare monitoring system

- Q1) CMM flow meter - Vortex
  pressure transmitter – Metran 150 TG2
  measuring transformer – MTM-201D
  gas analyser - NGA5
- T1) Thermocouple – TPP-401M

Figure-5 – Next page - Installation scheme of the monitoring system for cogeneration

Scheme of Monitoring units for generated/consumed electric energy, heat energy, and also utilized methane by cogeneration units and flare unit at PJSC «Colliery Group «Pokrovs'ke»



A3.3 Description of the operating scheme for cogeneration units

At the current stage gas is supplied to the Cogeneration station from the vacuum pump station №1 (VPS №1), the main industrial site of PJSC "Colliery Group" Pokrovs'ke".
Also the construction of additional methane supply from the vacuum pump station № 2 (VPS №2) of the air-supply shaft №2 comes to an end. On this line, gas blowers are installed at gas preparing section for gas flow quality increase.
At the gas preparing section there will be mixing of all gas flows in the correct proportions to obtain the methane concentration not below 25%, and the preparation of gas to the desired condition (pressure, temperature, humidity). Excessive gas or gas with low concentration is discharged to the discharge bleeder of the Cogeneration station or the discharge bleeders of VPS №1 and VPS №2.
After mixture assembly, final methane concentration is measured by gas analyzer NGA-5 and the gas flow is split into two lines:
Line 1 - excess gas not used by the cogeneration modules and the boiler is drained on the flare separator and is fed to the flare HOFGAS-IFL4c 9000 for combustion.
Line 2 - preparation of gas for cogeneration units in accordance with the requirements of Jenbacher. At this stage, the gas is dried and cleaned of impurities by passing through the two chambers of irrigation and cooling (fuel gas absorber), two drying chambers (fuel gas separator), two gas heating chambers (fuel gas heater).
To use cogeneration unit in addition to the main (fuel gas) at a concentration > 25% and pressure of min 100 mbar prechamber gas is also required with a concentration of > 25% and min pressure 2,7 bar. Due to the fact that the required concentration of the main and prechamber gas and are more than 25%, the intake of gas required for ignition of prechamber engines is possible as after fuel gas heater, or gas-holder (through heater), or from boreholes drilled from the surface (through absorber and the prechamber gas heater) (supply line to the Cogeneration station was not performed).
The required pressure of prechamber gas is reached in the block of additional prechamber gas preparation (in the case of using prechamber gas from the gas holder block of additional prechamber gas preparation is not used).
To ensure the safe operation of cogeneration units, discharge bleeders are installed before recording assemblies, as well as after recording assemblies before enter to engine of main and prechamber gases. They are used to purge possible explosive mixture after gas systems repairs.
To register energy consumed for own needs the electricity meter installed on the line after own needs transformer 6kV/380V is used. To register electricity consumed by the gas blowers, two electric meters will be installed at the supply inputs of gas blowers №1 and №2.
The generated thermal energy consists of heat given up to the consumer (boiler) and consumed on the own needs. Calculation of the thermal energy is performed by two liquid flow sensors and four temperature sensors.
Registration assemblies of the main and prechamber gas are installed before each module. The composition of each assembly consists of flow sensor, temperature sensor and pressure sensor, and the computing block, which registers utilized methane accumulation. The concentration of prechamber methane gas will be measured before enter into the engine room after the prechamber gas preparation block.
RSLinx Enterprise software of the Rockwell Automation production makes the collection and archiving of the following parameters from the register assemblies and equipment:
- from the computing units - the current flow rate, temperature, pressure and cumulative flow of the methane-air mixture;
- from the gas analyzers of main and prechamber gases - methane and oxygen concentration;
- from the flare - the temperature of the gas combustion;
- from electricity meters - the accumulation of the generated / consumed energy.
At the same time accumulating data (electricity, heat, gas mixture and pure methane) are written to the database in the form in which they were at the time of register. The remaining data are averaged for the recording interval, which is 15 minutes.

Annex 4

Deviation 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:

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

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

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

PE_{Flare} is calculated using adopted formulae from the «Methodological “Tool to determine project emissions from flaring gases containing methane”» [AM_Tool_07] 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:

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

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

$$MD_{FL} = MM_{FL} – (PE_{Flare}/GWP_{CH4}) \quad \text{(5)}$$

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:

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

where:

PE_{Flare}	Project emissions from flaring in the regarded period (t CO_2eq)
MD_{Fl}	Methane destroyed through flaring (t CH_4)

MM_{Fl} Methane measured sent to flaring (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_07])

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
> 1000℃ *)	99.5%	revised monitoring plan Section D.1.1 and Annex 2
500-1000℃ *)	90.0%	[AM_Tool_07-15]
< 500℃	0%	[AM_Tool_07-15]

*) in the original monitoring plan in the PDD a value of 850℃ instead of 1000℃ was given. The value has been changed according to the requirements of the manufacturer.

where:
$T_{Flame,i}$ Flame temperature of the flare in the regarded interval i (℃)
$\eta_{flare,i}$ flare efficiency in the interval i

A.4.2 Cogeneration unit

The power amount of the cogeneration units is counted by power counters. The electronically values are stored in a 15 min cycle. Daily readings are recorded manually in a journal. For the determination of the power amount produced the electronically recorded values are taken.

During the first two months of the monitoring period (November to December 2011) only monthly values have been recorded in the handwritten journals.

The automatically data acquisition system was not working for the cogeneration units until 13/03/2012, so that no reasonable electronically data for power production and methane amount consumed by the units are available. For this period manually recorded data from the journal have been taken for the power production.

The methane amount utilised in this period has been recalculated using the produced power amount and the average power generation efficiency determined using the available electronically data from the later period from 14/03/2012 to 30/04/2012.

$$MM_{CHP} = \frac{GEN_{CHP}}{Eff_{ELEC} \times HV_{CH4}} \tag{29}$$

with

MM_{CHP}	Methane amount utilised by the cogeneration units in the specific period [t CH_4]
GEN_{CHP}	Electricity produced by the project [MWh]
Eff_{CHP}	efficiency of power generation [%] recalculated from electronically recorded data
HV_{CH4}	heating value of methane [9.965 kWh/m³, equal to 13.899 MWh/t]

The efficiency of the power generation in the cogeneration units is recalculated from electronically recorded data from the later period from 14/03/2012 to 30/04/2012.

:

$$Eff_{CHP} = \frac{GEN_{CHP}}{MM_{CHP} \times HV_{CH4}} \tag{30}$$

with

Eff_{CHP}	efficiency of power generation
GEN_{CHP}	Electricity produced by the project in the specific period [MWh]
MM_{CHP}	Methane amount utilised by the cogeneration units in the specific period [t CH_4]
HV_{CH4}	heating value of methane [9.965 kWh/m³, equal to 13.899 MWh/t]

Annex 5

Differences between the determined PDD and implemented project

There are some differences between the determined PDD and implemented project. The conditions defined by paragraph 33 of the JI guidelines are still met for the project.

- The physical location of the project has not changed.
- The emission sources have not changed.
- The baseline scenario has not changed.
- The changes are consistent with the JI specific approach and/or the clean development mechanism (CDM) methodology upon which the determination was prepared for the project.

The differences of the project installation as described in the PDD and the implemented project are listed in the table below.

unit	difference	justification
flares No: 1 & 3	delay	The installation of the flares was delayed due to lacking funds due to delayed project registration.
flares No: 1 & 3	changed number of flares, change capacity firing capacity 25 MW instead of 10 MW	In the PDD two flares with a capacity of 5 MW (total of 10 MW) each were given. The installed flare has a capacity of up to 25 MW. The bigger flare has been offered by the contractor of the CHP units – Sinapse. The coal mine decided to buy one bigger flare instead of two smaller, because of organizing and technical factors.: - design, delivery and mounting of flare unit (as of all equipment for Cogeneration Station) is made by one contractor; - compact size of the unit; - utilisation volume of the air-methane mixture of 1 unit HOFGAS exceeds in two times similar rates of two 5 MWt flares, which primarily were foreseen in PDD.
flares No: 2 & 4-7	delay	The installation of the flares is delayed due to lacking funds. The installation is planned for 2012.
cogeneration units at Central shaft	delay	The installation of the cogeneration units at the main shaft was delayed due to lacking funds.
cogeneration units at Air Shaft	delay	The installation of the cogeneration units is delayed due to lacking funds. The installation is planned for 2012.

The name of the Coal Mine has been changed per 07/09/2010.
The old name "Joint Stock Company "Coal Company Krasnoarmeyskaya-Zapadnaya No 1 Mine"" is no longer valid, the new name is:

"Public Joint Stock Company «Colliery Group «Pokrovs’ke»”

The identifying number and domicile of the legal entity as well as the place of registration remain unchanged.
The change of name has been reported to JISC. JISC has decided that the title of the project 105 registered in the JI Information system cannot be changed and the title of the project will keep the old name of the company.

Annex 6

History of the Document

Version	Date	Nature of Revision
1	14 June 2012	Initial adoption
2		
3		
4		
5		