MONITORING REPORT

JI0078 - CMM utilisation on the Coal Mine № 22 “Kommunarskaya” of the State Holding Joint-Stock Company „GOAO Shakhtoupravlenye Donbass“

Monitoring Report 01
Monitoring period
07/07/2008 to 31/03/2010

Version 1b
16 April 2010

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Annexes

SECTION A. General project activity information

A.1 Title of the project activity:

CMM utilisation on the Coal Mine Nr.22 Kommunarskaya of the State Holding Joint-Stock Company „GOAO Shakhtoupravlenye Donbass“

A.2. JI registration number:

JI0078

A.3. Short description of the project activity:

In this project CMM, which has been sucked out of the active coal mine Coal Mine Nr.22 Kommunarskaya, has been utilised in a flare and a cogeneration unit. The methane has been burned to less harmful CO_2. The cogeneration unit has generated power which has displaced conventionally produced power and gained an additional amount of CO_2 reductions.

Table-1 Amount of methane utilised for heat generation

Unit	**period**	**CH_4 [m³/period]**	**power generated [MWh]**
Flare	07/07/2008-31/03/2010	3.775.086	-
Cogeneration unit	27/01/2009-31/03/2010	1.785.079	6.151
Total	**2008-2010**	**5.560.165**	**6.151**

A.4. Monitoring period:

Start date 07/07/2008, flare
27/01/2009, cogeneration unit

End date 31/03/2010, all units

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 the flaring tool, a combustion

efficiency of 99.5%, according to the IPCC guidelines, 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]. 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, has been taken into account instead of the default value of 90% as given in the flaring tool.

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

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

The project is approved as JI-project since 30/12/2009.
(http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/FinDet.html)

Table-2 Status of Implementation

Unit: Flare	
Manufacturer: Pro2 Anlagentechnik GmbH	
Type: KGU 5/8	
Serial Number:142301	
Capacity: 10 MW	
Efficiency methane generation: 99.5%	
Combustion temperature: 850°C	
Activity	**Status**
Year of construction	2008
Last inspection	2009 – AS Wärmetechnik GmbH
Start of operation	20/12/2009

Unit: cogeneration unit	
Manufacturer: Pro2 Anlagentechnik GmbH using a gas engine from Deutz AG	
Type: NC620K16	
Serial Number: 143901	
Capacity: 3.750 MW firing, 1.35 MW_{el}, 0.93 MW_{th}	
Activity	**Status**
Year of construction	2004
Last major overhaul	June 2008
Last inspection	none
Start of operation	29/01/2009
Planned installation date [PDD]	06/2009

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

Instead of the installation of two new boilers as described in the PDD, two existing small coal boilers have been upgraded with a CMM burner system, whereby an adequate monitoring system is missing.

The installation of the ventilation air heater is delayed due to the Global Financial Crisis.

The installation of the second cogeneration unit is pending to lacking gas amount.

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

The electronically measuring and data storing monitoring system as described in the PDD has not been installed for the two upgraded coal boilers during the monitoring period. These units have not been monitored.

A.9. Changes since last verification:

None. First verification.

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

Coal Mine Nr.22 Kommunarskaya
- Viktor Ivanovich Orlov, Chief Engineer

Eco-Alliance OOO
- Vladimir Kasyanov, Managing Director
- Olga Samus, Consultant

Carbon-TF B.V
- Adam Hadulla, Director Business Development
- Karl Wöste, Senior Consultant

SECTION B. Key monitoring activities

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	Uncertainty level of data	Frequency of Measurement	Instal-lation
1	CH_4 concentration	Infrared measurement	Pro2 Anlagentechnik GmbH using gas analysers from Emerson Process Management GmbH&Co. OHG	BINOS 100	120482003006	low	Continuous record period 15 min.	2008
2	NMHC concentration	lab analysis	n. n.	n. n.	n. n.	low	yearly	n. n.
3	CMM amount to flare	Standard orifice and pressure difference meter	Pro2 Anlagentechnik GmbH	calculation	none	low	Continuous record period 15 min.	2008
4	Gas flow	Standard orifice	Himpe AG	annular chamber standard orifice DIN 19205	Rings:361899	low	Continuous record period 15 min.	2008 changed on 11/11/2009
5	Pressure difference	Pressure difference transmitter	Honeywell	ST3000	08W18 C3059154001001	low	Continuous record period 15 min.	2008

6	Pressure	Pressure transmitter Dry ceramic sensor	Noeding	P 121	EX812126961	low	Continuous record period 15 min.	2008
7	Temperature	Resistance thermometer	JUMO GmbH & Co. KG	DIN EN 60 751 Type 90.2002	n. n.	low	Continuous record period 15 min.	2008
8	Flame temperature	Thermo couple	Herth GmbH	DIN 43733 Type S, PtRh-Pt	71087	low	Continuous record period 15 min.	2008
9	CMM amount to cogenera-tion unit	Standard orifice and pressure difference meter	Pro2 Anlagentechnik GmbH	calculation	none	low	Continuous record period 15 min.	2008
10	Gas flow	Standard orifice	Himpe AG	annular chamber standard orifice DIN 19205	Rings:364581	low	Continuous record period 15 min.	2008
11	Pressure difference	Pressure difference transmitter	Honeywell	ST3000	08W30 C3088100001001	low	Continuous record period 15 min.	2008
12	Pressure	Pressure transmitter Dry ceramic sensor	Noeding	P 121	EX812127126	low	Continuous record period 15 min.	2008
13	Temperature	Resistance thermometer	JUMO GmbH & Co. KG	Type 90.2002	08370003	low	Continuous record period 15 min.	2008

14	Power production	Electricity meter	Actaris	SL7000 Type – SL761C071	53026020	low	Continuous, cumulative value Read period monthly	

B.1.3. Calibration procedures:

Table-5 Monitoring equipment

ID	Data	Uncertainty level of data	Calibration procedure	Last calibration	Calibrator
1	CH_4 concentration	0.5%	Calibration made using procedures of Eco Alliance OOO.	2/2010	Eco Alliance OOO
2	NMHC concentration	unknown	The approved laboratory is responsible for regular recalibrations of the system.	unknown	unknown
3	CMM amount to flare	calculation	none	none	none
4	Gas flow	0.75 % DIN EN ISO 5167-T.1-4	none	none	none
5	Pressure difference	0.0375% of FSV*)	Calibration made using procedures of manufacturer.	2008	Honeywell
6	Pressure	0.2% of FSV*)	Calibration made using procedures of manufacturer.	2008	Noeding/Pro2
7	Temperature	DIN EN 60 751, Class B 0.3+0.005T [K] % of FSV*)	Calibration made using procedures of manufacturer.	2008	JUMO / Pro2
8	Flame temperature of the flare	DIN 43733, Class 2 0°C - 600°C +/-1.5 K 600°C - 1600°C +/- 0.25%	Calibration made using procedures of manufacturer.	2008	Herth
9	CMM amount to flare	calculation	none	none	none
10	Gas flow	0.57 % DIN EN ISO 5167-T.1-4	none	none	none
11	Pressure difference	0.0375% of FSV*)	Calibration made using procedures of manufacturer.	2008	Honeywell
12	Pressure	0.2% of FSV*)	Calibration made using procedures of manufacturer.	2008	Noeding/Pro2

13	Temperature	DIN EN 60 751, Class B 0.3+0.005T [K]	Calibration made using procedures of manufacturer.	2008	JUMO / Pro2
14	Power production				

*) FSV – Full Scale Value

B.1.4. Involvement of Third Parties:

- The lab analysis for the determination of the NMHC concentration has been done by MAKNII
- The calibration of CH_4-concentration has been done by Eco Alliance OOO
- Eco-Alliance OOO supported the coal mine with the collecting of the monitoring data.
- Carbon-TF B.V. 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	tCO_{2eq}/MWh	SenterNovem data taken instead of not available Ukrainian data, according to the information given in the PDD: 2008: 0.695 2009: 0.680 2010: 0.666 2011: 0.651 2012: 0.636
P13 Eff_{FL}	Flare combustion efficiency	IPCC, Methodological "Tool to determine project emissions from flaring gases containing methane"	t CH_4	Set to: 99.5 % for: $T_{Flame} > 850°C$ [PDD, IPCC] 90% for: $500°C < T_{Flame} < 850°C$ [AM_Tool_07] 0% for: $T_{Flame} < 500°C$ [AM_Tool_07]
P16 Eff_{ELEC}	Efficiency of methane destruction / oxidation in power plant	ACM0008 / 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
~~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~~ ~~VAH pass~~	~~%~~	~~73.5 % old coal boiler 90.6 % upgraded boiler (measured value) 98.5 % ventilation air heater~~

B.2.2. List of variables:

Table-7 List of variables

ID number	Data variable	Source of data	Data unit	Comment
P1 PE_y	Project emissions in year y	monitored data	tCO_{2eq}	calculated using formulae from the PDD
P2 PE_{ME}	Project emissions from energy use to capture and use methane	monitored data	tCO_{2eq}	calculated using formulae from the PDD
P3 PE_{MD}	Project emissions from methane destroyed	monitored data	tCO_{2eq}	calculated using formulae from the PDD
P4 PE_{UM}	Project emissions from uncombusted methane	monitored data	tCO_{2eq}	calculated using formulae from the PDD
P5 $CONS_{ELEC,PJ}$	Additional electricity consumption by project	monitored data	MWh	calculated using operation hours of the flares
P11 MD_{FL}	Methane destroyed by flaring	monitored data	t CH_4	calculated using formulae from the PDD
P12 MM_{FL}	Methane sent to flare	monitored data	t CH_4	calculated using formulae from the PDD
P14 MD_{ELEC}	Methane destroyed by power generation	monitored data	t CH_4	calculated using formulae from the PDD
P15 MM_{ELEC}	Methane sent to power plant	monitored data	t CH_4	calculated using formulae from the PDD
~~P17 MD_{HEAT}~~	~~Methane destroyed by heat generation~~	~~monitored data~~	~~t CH_4~~	~~calculated using formulae from the PDD~~
~~P18 MM_{HEAT}~~	~~Methane sent to heat generation~~	~~flow meter~~	~~t CH_4~~	~~calculated using formulae from the PDD~~
~~P24 CEF_{NMHC}~~	~~Carbon emission factor for combusted non methane hydrocarbons (various)~~	~~lab analysis~~	-	~~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_y	Baseline emissions in year y	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	flow meter	t CH_4	equal to P17,MD_{HEAT}
B46 GEN_y	electricity generation by project	monitored data	MWh	
~~B47 $HEAT_y$~~	~~Heat generation by project~~	~~monitored data~~	~~MWh~~	
PE_{Flare}	Project emissions from flaring	monitored data	t CO_{2eq}	Calculated using formula from the flaring Tool (AM_Tool_07)

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	monitored data	t CH_4	calculated using formulae from the PDD
P15 MM_{ELEC}	Methane sent to power plant	monitored data	t CH_4	calculated using formulae from the PDD
~~P18 MM_{HEAT}~~	~~Methane sent to heat generation~~	~~Sum of flow meters~~	~~t CH_4~~	~~calculated using formulae from the PDD~~
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	

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 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	Sum of flow meters	t CH_4	sum of ~~boilers, VAH,~~ flare and cogeneration
~~B47 $HEAT_y$~~	~~Heat generation by project~~	~~monitored data~~	~~MWh~~	~~sum of heat generated by boiler + VAH~~
B46 GENy	electricity generation by project	monitored data	MWh	

B.2.5. Data concerning leakage

Not applicable.

B.2.6. Data concerning environmental impacts

Not applicable.

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

The data are collected, processed and stored using Siemens SIMATIC PLC S7 systems and Siemens WINCC programming software. The PLC and the switchgear are provided by Kuhse GmbH. Every unit is equipped with an own PLC. All data is stored in the internal memory of the PLC's. One time per day all data (also those not required for monitoring) are recalled via GPS to the central Kuhse data base. The server provider ensures regular back ups and archiving. The monitoring relevant data are transmitted every 15 min. from the PLC to a second device – a touch panel and stored on a USB-Stick as backup. The monitoring relevant data are regularly read from the Kuhse internet data base by authorised personnel of Carbon-TF and stored in Excel sheets. For data back up the USB-stick data can be taken.

The CMM flow to the cogeneration unit is not registered by the PLC of the unit. The data are recorded by a DAVID (Data acquisition and visualisation device) developed by the Fraunhofer Institute UMSICHT. The data are stored in the internal memory of the DAVID. One time per day the data are recalled via GPS to the central data base at the Fraunhofer Institute and are available via an internet front end. The server provider ensures regular back ups and archiving.

B.4. Special event log:

Both units have been moved to another location at the coal mine in summer 2009, so that there are production downtimes.

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 Shakhtoupravlenye Donbass, the Holding Company of the Coal Mine Nr.22 Kommunarskaya, through supervision and coordination of activities of his subordinates, such as deputy director on surface degasification, heat technician, and heads of 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. The operation and maintenance of the plant is provided by Eco Alliance OOO.
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 Carbon-TF.

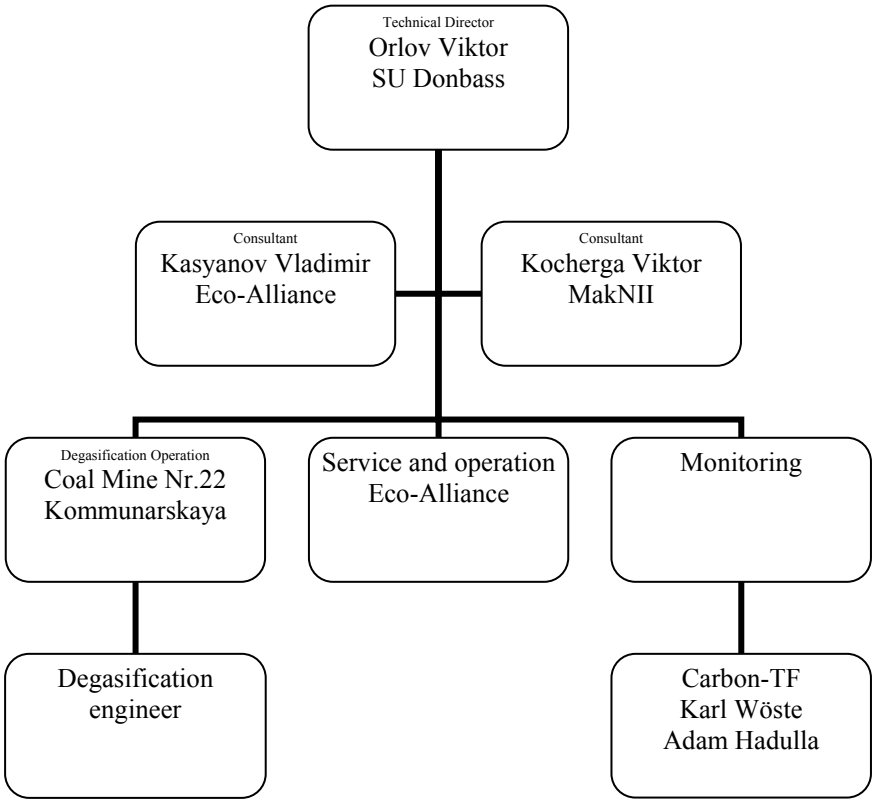


Figure 1 – Organigram

C.1.2. Trainings:

The employees responsible for the monitoring control have been trained on–the–job during the installation of the system.
The responsible personnel of Eco-Alliance has been trained on the handling with CMM-utilisation units and the applied monitoring systems, during an eight week long practical course in Germany in the autumn of 2005 and a two-week practical course in August/September 2008. 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:

- 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 (NMHC) of the CMM.

C.3. Internal audits and control measures:

The flare has been checked by AS Wärmetechnik GmbH, the personnel of Eco Allaince has been trained on the job.

QM procedure:
- The data are recorded automatically
- The recorded data are checked daily by Carbon-TF
- Carbon-TF B.V. prepares monthly reports which are checked by Eco-Alliance OOO
- The paper data are stored at Eco-Alliance OOO.
- Electronic data are stored at Kuhse GmbH, Fraunhofer UMSICHT e.V. and Carbon-TF B.V..
- Back-ups are made regularly Kuhse GmbH, Fraunhofer UMSICHT e.V.and Carbon-TF B.V..
- Carbon-TF prepares the monitoring report, which is checked by Eco-Alliance and the coal mine.

C.4. Troubleshooting procedures:

The units have an automatically shut down system. In case of disturbance the gas supply to the units 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.

SECTION D. Calculation of GHG emission reductions

D.1. Table providing the formulas used:

Table-10 Formulae used taken from the PDD, symbols marked grey are not used in this monitoring report.

ID number	Data variable	Formula
P1 PE_y	Project emissions in year y	$PE_y = PE_{ME} + PE_{MD} + PE_{UM}$
P3 PE_{MD}	Project emissions from methane destroyed	$PE_{MD} = (MD_{FL} + MD_{ELEC} ~~+ MD_{HEAT}~~) \times (CEF_{CH4} + ~~r \times CEF_{NMHC}~~)$
P4 PE_{UM}	Project emissions from uncombusted methane	$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) ~~+ MM_{HEAT} \times (1 - Eff_{HEAT})~~] + PE_{Flare}$
P5, $CONS_{ELEC}$	Additional electricity consumption by the project	$CONS_{ELEC} = 0$
~~P18 MM_{HEAT}~~	~~Methane sent to heat generation~~	~~$MM_{HEAT} = MM_{HEAT,BOILER} + MM_{HEAT,VAH}$~~
~~P27 r~~	~~Relative proportion of NMHC compared to methane~~	~~$r = PC_{NMHC} / PC_{CH4}$~~
B1 BE_y	Baseline emissions in year y	$BE_y = BE_{MR,y} + BE_{Use,y}$
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	$BE_{MR,y} = CMM_{PJ,y} \times GWP_{CH4}$
B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y	$BE_{Use,y} = GEN_y * EF_{ELEC} ~~+ (HEAT_y / Eff_{HEAT,coal}) * EF_{HEAT}~~$
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	$CMM_{PJ,y} = (MD_{FL} + MD_{ELEC} ~~+ MD_{HEAT}~~)$
ER	Emission reductions	$ER_y = BE_y - PE_y$
PE_{Flare}	Project emissions from flaring	$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$

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

A total of 12 random errors resulting from the uncertainties of the measurement equipment have been named and discussed, see <Possible sources of error.pdf> for detailed information. The resulting uncertainty has been determined and subtracted from the results.

Table-11 Resulting uncertainties

Unit	Uncertainty
CHP	1.24%

Flare 1.42%

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

D.3.1. Project emissions:

period	project emissions [t CO_{2eq}]
07/07/2008-31/12/2008	261
01/01/2009-31/12/2009	9,849
01/01/2010-31/03/2010	1,195
Total 2008-2010	**11,305**

D.3.2. Baseline emissions:

period	baseline emissions [t CO_{2eq}]
07/07/2008-31/12/2008	1,941
01/01/2009-31/12/2009	75,909
01/01/2010-31/03/2010	10,027
Total 2008-2010	**87,877**

D.3.3. Leakage:

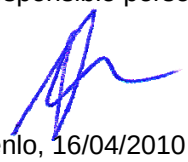
Not applicable.

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

Period	Emission reductions [t CO_{2eq}]
07/07/2008-31/12/2008	1,680
01/01/2009-31/12/2009	66,060
01/01/2010-28/02/2010	8,832
Total 2008-2010	**76,572**

The total GHG emission reduction for the monitoring period 07/07/2008-31/03/2010 is 76.572 t CO_{2eq}.

This monitoring report has been prepared by Carbon-TF B.V.
Responsible person: Adam Hadulla



Venlo, 16/04/2010

Annex 1

REFERENCES

- Project Design Document; Version 07, dated 2009-08-06
- Final Determination Report for the project: JI0078 CMM utilisation on the Coal Mine Nr.22 Kommunarskaya of the State Holding Joint-Stock Company „GOAO Shakhtoupravlenye Donbass“ Report No: 2008-1321 Rev 02, by DNV Det Norske Veritas, dated 2009-08-07
- Letter of Approval, Nr. M000015, issued on 2008-03-26 by the Ukraine (host party)
- Letter of Approval, Nr. 2008JI04, issued on 2008-04-22 by the Kingdom of the Netherlands (investor party)
- supporting evidence documents provided by the coal mine

Annex 2

Technical drawing

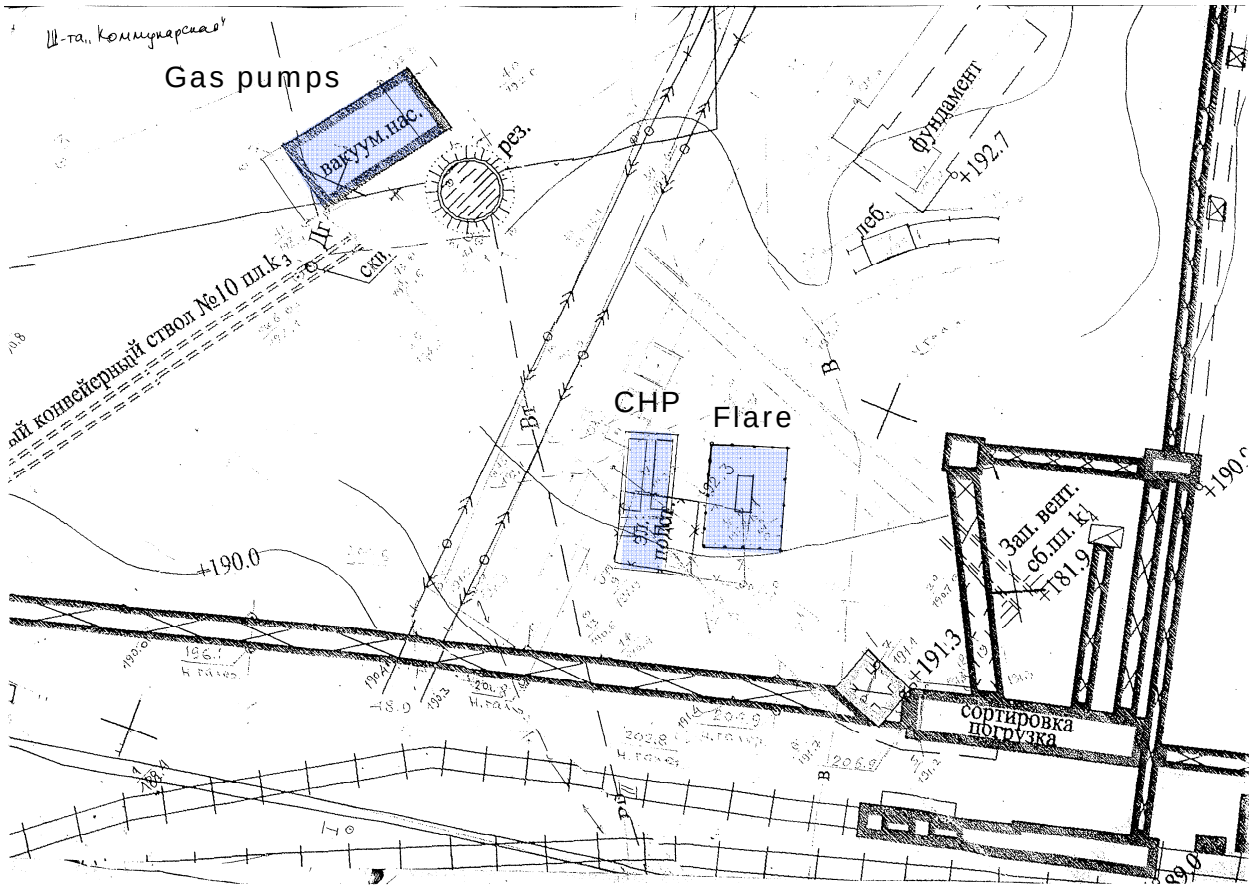


Figure-2 Installation scheme – Coal Mine Nr.22 Kommunarskaya

First installation until June 2009

Вакуум. Нас. – *Gas pumps*

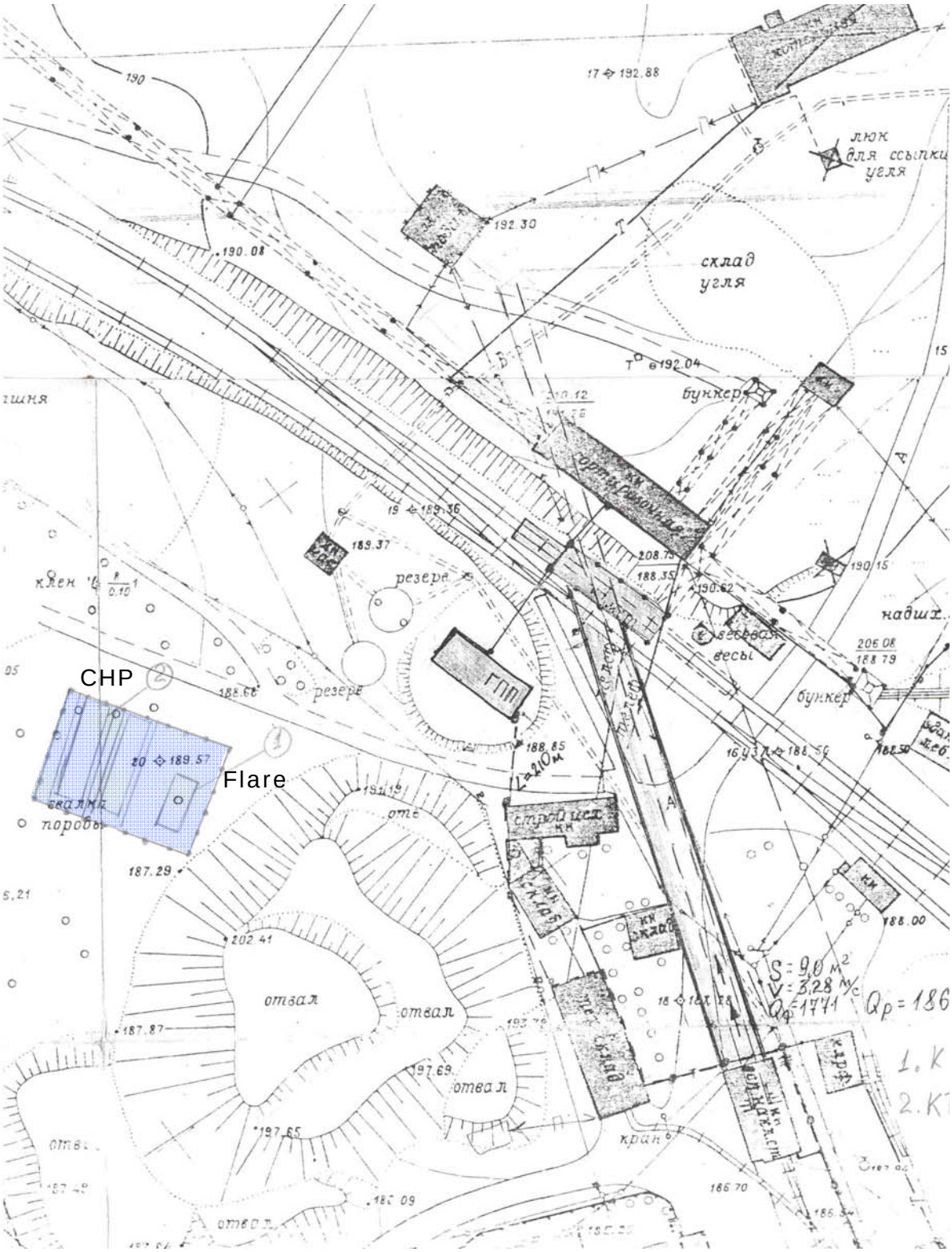


Figure-3 Installation scheme – Coal Mine Nr.22 Kommunarskaya
Second installation since July 2009

Annex 3

Energy and material flowchart including metering positions

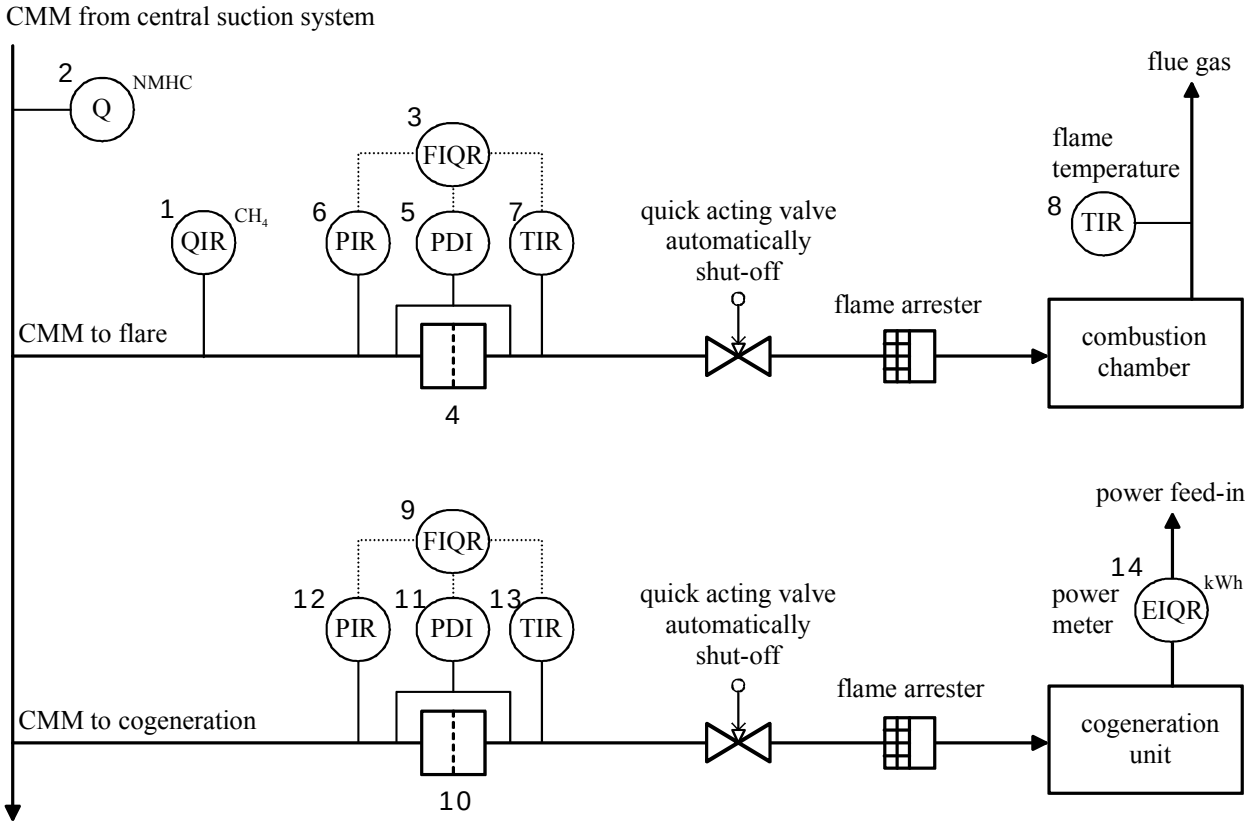


Figure -3 installation scheme and positioning of the meters

Monitoring plan applied

The flare and the cogeneration unit have been equipped with an adequate electronically monitoring system. The monitoring plan applied during the monitoring period is according to the monitoring plan.

Flare
During the first period from 07/07/2008 to 27/01/2009 12:00 the automatically data storage system in the flare was not working. In this period the data have been hand read from the display of the flare and hand recorded in a journal. The data from this journal has been transferred to excel sheets by Carbon-TF.
The automatically system has started operation at 27/01/2009 12:15.
The standard orifice for CMM flow measurement has been changed on 11/11/2009.

Cogeneration unit
During the first period the DAVID system was not working, so that the methane amount consummated by the unit has been recalculated using the produced power amount and the average power efficiency determined from the steady operation period.

$$\dot{V}_{CH4} = \frac{GEN}{Eff_{ELEC} \times HV_{CH4}}$$

with

V_{CH4}	Methane amount utilised by the cogeneration unit [m³ at standard state conditions]
GEN	Electricity produced by the project [kWh]
Eff_{ELEC}	efficiency of power generation [%] recalculated from later steady operation period
HV_{CH4}	heating value of methane [9.965 kWh/m³ m³ at standard state conditions]

The efficiency of power generation is recalculated from later steady operation period:

$$Eff_{ELEC} = \frac{GEN}{\dot{V}_{CH4} \times HV_{CH4}}$$

with

Eff_{ELEC}	efficiency of power generation
GEN	Electricity produced by the project in the specific period [kWh]
V_{CH4}	Methane amount utilised by the cogeneration unit in the specific period [m³ at standard state conditions]
HV_{CH4}	heating value of methane [9.965 kWh/m³ at standard state conditions]