JI MONITORING REPORT

FOR REPORTING PERIOD 01.06.2011 – 30.04.2012

Version 1.0
May 03, 2012

CONTENTS

SECTION A. General Project activity information

A.1 Title of the project activity:

"Utilization of Coal Mine Methane at the Coal Mine named after A.F. Zasyadko".

A.2. Registration number at JISC:

UA2000004

A.3. Short description of the project activity:

According to data of the mine, during eleven months (01.06.2011 — 30.04.2012) the following amount of methane has been utilized:

For electrical power and heat power. m^3 (fuel gas)	22 411 173
For electrical power and heat power, m^3 (ignition gas)	849 376
For AGFCP m^3	1 226 783
Total	24 487 332

Table 1: Amount of methane utilized during monitoring period.

The project is aimed to prevent methane emission into the atmosphere at Public Joint-Stock Company "Shakhta imeni O.F. Zasyadka", further referred to as PJSC "Shakhta im. O.F. Zasyadka"[1]. CMM extracted and recovered during mine works and because of ventilation of mine, obtained from surface wells drilled into the gob at PJSC "Shakhta im. O.F. Zasyadka", is utilized for:

- Electrical power generation;
- Replacement of heat power that is now generated by coal and gas boilers;
- Production of gas and its use as motor vehicle fuel.

PJSC "Shakhta im. O.F. Zasyadka" has four industrial sites: Vostochnaya, Yakovlevskaya, Centralnaya and Grigoryevskaya. During this monitoring period, Vostochnaya industrial site of Separate Subdivision Combined Heat and Power Plant of Public Joint-Stock Company "Shakhta imeni O.F. Zasyadka" (hereinafter referred to as SS CHP of Public Joint-Stock Company "Shakhta im.O.F. Zasyadka"or SS CHP) was in operation[2]. The electrical power generated at SS CHP was supplied in Mine's main, for PJSC "Shakhta im. O.F. Zasyadka" local consumption. Heat Power generated by SS CHP was fed for consumption at Vostochnaya site. Double-block automatic gas filling station (AGFCP) at Vostochnaya site supplies car fleet of for PJSC "Shakhta im. O.F. Zasyadka" and other vehicles from neighbouring districts with fuel.

In the future, commissioning of the second SS CHP at Yakovlevskaya site is intended, and heat power supply grid as well. This will make Mine able to feed excess electrical power to general consumption grid, supply heat power to Vostochnaya, Yakovlevskaya, and Centralnaya sites, and municipal heat power supply grid. Besides, car gas fuelling stations (AGFCP) will be installed at Yakovlevskaya site.

A.4. Monitoring period:

- Monitoring period starting date: 01/06/2011;
- Monitoring period closing date: 30/04/2012[3].

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

[1] Form of ownership of the Mine was changed as of July 22nd 2011. Previous form of ownership Lease Enterprise "Coal Mine named after A.F. Zasyadko" is no longer valid, whereas a new form of ownership is Public Joint Stock Company "Shakhta imeni O.F. Zasyadka"

[2] Because of entering changes into statutory documents as of July 22nd 2011, the name Structural Unit "Combined Heat and Power Plant" of Lease Enterprise "Coal Mine named after A.F. Zasyadko" has been changed for name Separate Subdivision "Combined Heat and Power Plant" of Public Joint Stock Company "Shakhta imeni O.F. Zasyadka"

[3] Both days were included. Monitoring period includes time from 00-00 01/01/11 up to 24-00 30/04/12.

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 electricity (electrical or motive) and heat and/or destruction by flaring")* has been used to identify the baseline scenario of this JI project. This methodology also refers to the "Tool for calculation of emission factor for *electricity* systems", the latest version of the "Tool for the demonstration and assessment of additionality" and the latest version of the "Tool to determine project emissions from flaring gases containing methane".

A.5.2. Monitoring methodology:

The approved consolidated methodology ACM0008/Version 03 *"Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for electricity (electrical or motive) and heat and/or destruction by flaring")* was used to identify the baseline scenario of this JI project.

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

Activity	Planned installation date, as stated in the PDD	Implementation status
Commissioning of two gas filling compressor stations	March 2004	March 2004
Commissioning of one new gas filling compressor station	March 2005	March 2005
Commissioning of the 1st CHP modules at Vostochnaya site	January 2006	January 2006
Commissioning of the 12 CHP modules at Vostochnaya site	April 2006	April 2006
Delivery of heat power from CHP modules to, and shut-down of boilers Vostochnaya site	September 2006	September 2006
Commissioning of one new gas filling compressor station	November 2007	March 2005
Commissioning of one new gas filling compressor station	January 2008	Delayed due to accident 2007, planned for September 2012
Heat Power delivery from CHP modules to, and shut-down of boilers Yakovlevskaya site	Jule 2008	Delayed due to accident 2007, planned for October 2012
Heat Power delivery from CHP modules to, and shut-down of boilers Centralnaya site	July 2009	Delayed due to accident 2007, planned for October 2012
Commissioning of the 1st CHP unit at Yakovlevskaya site	May 2008	Delayed due to reduction of scopes of mining works after accident occurred in 2007; planned for December 2012
Commissioning of 12th CHP unit at Yakovlevskaya site	December 2009	Delayed due to reduction of scopes of mining works after accident occurred in 2007; planned for December 2012
Supply of heat power to DH - system	September 2009	Delayed due to accident 2007, planned for December 2012

Table 2: Status of implementation (according to PDD version 4.4)

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

There are no deviations from final version of PDD approved by JISC. A delay in the implementation schedule was noted as compared with implementation schedule from PDD as shown above. In view of this, within the monitoring period, following project parts have not been introduced:

- Electrical power: Yakovlevskaya SS CHP is not in operation at this moment. At this site, electrical power generation is not running; as a result, GEN_{CHP} includes only net electrical power generated by Vostochnaya SS CHP;
- Heat Power: during this monitoring period, infrastructure for heat power supply of four sites of Mine and municipal heat power supply grid are absent, save heat power supply from Vostochnaya SS CHP to Vostochnaya site. In view of this, at this monitoring period, monitoring of following variable data was not performed: $HEAT_{deliv,DH,y}$; $HEAT_{deliv,yak,y}$; $HEAT_{deliv,centr,y}$.
  General amount of heat power supplied is equal to amount of heat power supplied from Vostochnaya SS CHP ($HEAT_{deliv,vost,y}$);
- Coal Mine Methane(CMM), utilized at SS CHP: As Yakovlevskaya SS CHP was not in operation during this monitoring period, CMM was not utilized at this SS CHP. Therefore, $MM_{CHP,y}$ included only CMM, utilized by Vostochnaya SS CHP;
- Coal Mine Methane(CMM) utilized at AGFCP. From four planned fuel stations (one- at Vostochnaya site, one- at Centralnaya site, and two-at Yakovlevskaya site), during this monitoring period, block gas filling station at Vostochnaya site has been operating. Therefore for $MM_{GAS,y}$ monitoring, only measured amount of gas supplied to this gas fueling station was used.

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

During 01/06/2011-30/04/2012, no changes occurred since last verification.

A.9. Changes since last verification:

During 01/06/2011-30/04/2012, no changes occurred since last verification.

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

Separate Subdivision Combined Heat Power and Electrical power Plant (SS CHP) at PJSC «Shakhta im. O.F.Zasyadka»

- Borys Bokiy, Deputy General Director, PJSC «Shakhta im. O.F.Zasyadka»
- Yevgen Berezovskiy, Director; SS CHP of PJSC «Shakhta im. O.F.Zasyadka»;
- Valeriy Cherednikov, Lead Engineer, Gas Treatment and Monitoring, SS CHP of Public Joint-Stock Company «Shakhta im. O.F.Zasyadka»;

LLC "Carbon Emissions Partnership Technic".

- Svitlana Lyubarets, Director.

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

The control and monitoring system can be divided into electrical part, heat part, and gas part.

Electrical power measurements

There are no changes since last monitoring period.

Heat Power measurements

There are no changes since last monitoring period.

Coal Mine Methane consumption measurements

There are no changes since last monitoring period.

B.1. Monitoring equipment

1. Electrical power meters "Elster-Metronika";
2. Heat Power meter SA-94/2 M;
3. Gas Analyzer ABB A02040 (for fuel and ignition gas);
4. DBT equipment. (for fuel and ignition gas);
5. DRG.M -10000 flow meters (for fuel GAS) as a part of BKT.M metering systems;
6. Metering system "Universal".

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

The control and monitoring system can be divided into an electrical part, a heat power part, and a gas part.

Electrical power metering devices

Following parameters shall be measured for emission reduction monitoring[4]:

- GEN_{CHP} — net electrical power generated by SS CHP under project (MWh);
- $El_{consumed}$ — net electrical power consumed by Mine (MWh)[5].

According to monitoring plan, initially excess or lack of net electrical power amount was checked as generated by SS CHP GEN_{CHP} in comparison to net electrical power consumed by Mine $El_{consumed}$. Actually, parameters measured are:

- GEN_{CHP} = 76 927,819 MWh;
- $EL_{consumed}$ = 189 329,138 MWh.

As net electrical power amount generated by SS CHP GEN_{CHP} under project is less than net electrical power consumed by Mine $El_{consumed}$., for emission reduction monitoring (see also page 40 of PDD), only amount of net electrical power generated under project of SS CHP is required. This electrical power is measured with two meters (see Table 4) arranged at Substation -110kV site is calculated under the formula:

$$GEN_{CHP} = (E1 + E2), \qquad (1.)$$

Tables below show more detailed information about meters.

Amount of electrical power which has been fed into energy system by Substation 110kV from SS CHP is summarized by way of addition of total electrical power amount generated by each separate SS CHP unit excluding secondary electrical power consumption by SS CHP itself.

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[4] Section D contains respective formulae from Monitoring Plan of PDD.

[5] Net electrical power consumption of Mine $El_{consumed}$ is demonstrated in the report of Chief Energy Engineer of the Mine according to data of thirteen commercial meters located at other 110 kV substations at LE Mine named after A.F.Zasyadko. Meters E17, E18 are included in thirteen commercial meters and are located at Vostochnaya substation 110 kV.

This calculation is performed under following formula.

$$TM_{CHP} = \left(\sum_{5}^{16} E_{mod} - \sum_{3}^{4} E_{aux} \right) = (E5 + E6 + E7 + E8 + E9 + E10 + E11 + E12 + E13 + E14 + E15 + E16) - (E3 + E4), \quad (2.)$$

where:

- TM_{CHP} — net electrical power fed to energy system of Substation -110 from SS CHP (kWh);
- $\sum E_{mod}$ — gross electrical power generated by each individual SS CHP unit (kWh);
- $\sum E_{aux}$ — own electrical power consumption by SS CHP (kWh).

Respective description of meters see in the table 5 provided below. Because for check of electrical power at high voltage, it is impossible to use data directly from meters, current and voltage transformers are used. In the first table, converted data for calculation of actual data are shown.

Cross-checking of EuroALPHA Electrical power Meter Reading

Accounting of electrical power generated by SS CHP is fixed by automated electrical power commercial recording system (AECRS) which included twelve EuroALPHA non -commercial E-meters (E5 — E16), which record generation of each genset, as well as two EuroALPHA non-commercial E-meters (E3 — E4), which record SS CHP electrical power consumption.

Each genset cell is provided with universal microprocessor protection and control devices (REF), which allow, among other functions, performance of technical recording of electrical power amount. Data from REF are hourly fixed in the database. Upon expiry of the day, hourly generation per each genset is fixed.

SS CHP Chief Dispatcher performs daily comparison of readings of AECRS and REF.

Summary crosschecking results from 01.06.2011 until 30.04.2012 are shown in the table 3.

01.06.2011 – 30.04.2012			
Months	**Active electrical power generation AECRS**	**Active electrical power generation REF**	**Relative difference in AECRS-REF readings**
	kWh	**kWh**	**%**
June 2011	**14 041 884**	**14 036 639**	**0,04**
July 2011	**9 105 239**	**9 096 804**	**0,09**
August 2011	**6 817 563**	**6 810 667**	**0,10**
September 2011	**5 092 989**	**5 082 700**	**0,20**
October 2011	**5 410 837**	**5 401 090**	**0,18**
November 2011	**3 376 516**	**3 372 716**	**0,11**
December 2011	**6 283 449**	**6 276 707**	**0,11**
January 2012	**7 835 715**	**7 828 686**	**0,09**
February 2012	**7 475 599**	**7 466 826**	**0,12**
March 2012	**7 277 876**	**7 269 977**	**0,11**
April 2012	**7 596 213**	**7 591 766**	**0,06**
Total	**80 313 879**	**80 234 579**	**0,10**

Table 3. AECRS – REF summary crosschecking results

Electrical power Meters

Number	Metering instrument	Work parameter kWh, kVA	Manufacturer	Type	Serial Number	Accuracy[6]	Data of installation	Data on 01.06.2011	Data on 30.04.2012	Difference	Data of calibration	Data of next calibration	Remarks
E1	Electrical power meter at SS CHP system (6 kV) Wireway	Net electrical power generated by SS CHP system. P,Q	"Elster-Metronika" Russia	Electronic	№ 01116374	0.2S[7]	N/A	10 003,3812	11 026,3366	1 022,9554	13.05.2011	13.05.2017	Double side. Cubicle No.A21
E2	Electrical power meter at SS CHP system (6 kV) Wireway	Net electrical power generated by SS CHP system. P,Q	"Elster-Metronika" Russia	Electronic	№ 01116376	0.2S	N/A	10 471,8549	11 484,0280	1 021,1731	13.05.2011	13.05.2017	Double side. Cubicle No.B22
E17	Commercial electrical power meter 110 kV	Consumption of electrical power from or supply Ukrainian grid with	"Elster-Metronika" Russia	Electronic	№ 01194835	0.2S	N/A	230,6708	760,1514	529,5006	N/A Belongs to supply company	N/A	Substation 110kV T1
E18	Commercial electrical power meter 110 kV	Consumption of electrical power from or supply Ukrainian grid with	"Elster-Metronika" Russia	Electronic	№ 01194834	0.2S	N/A	192,2356	781,9862	589,7506	N/A Belongs to supply company	N/A	Sub-station 110kV T2

Table 4. Electrical power meters arranged at Substation 110kV site

[6] Accuracy level is a generalized parameter of measurement devices that is defined with limits of allowable main and extra uncertainties, as well as with range of other properties that influence accuracy of measurements performed with them. Accuracy levels are regulated by norms for certain types of measurement devices with use of metrological parameters and methods of their normalization.

[7] Accuracy levels 0.2S and 0.5S; letter S means that meter accuracy is normalized commencing from lower limit not in 5% of I_{nom} (nominal limit) (as the case is for meters with no letter, e.g. levels 0,2 and 0,5) but from 1% of I_{nom}, according to GOST 30206-94.

Number	Metering instrument	Work parameter kWh, kVA	Manufacturer	Type	Serial Number	Accuracy	Data of installation	Data on 01.06.2011	Data on 30.04.2012	Difference	Data of calibration	Data of next calibration	Remarks
E3	Electrical power meter at SS CHP system (6 kV) Auxiliary transformer	Electrical power consumed by SS CHP system, P, Q	"Elster-Metronika" Russia	Electronic	№ 01103251	0.5S	N/A	5 193,6832	5 793,8235	600,1403	14.04.2010	14.04.2016	Cubicle No.1
E4	Electrical power meter at SS CHP system (6 kV) Auxiliary transformer	Electrical power consumed by SS CHP system, P, Q	"Elster-Metronika" Russia	Electronic	№ 01103208	0.5S	N/A	5 180,3795	5 788,5187	608,1392	14.04.2010	14.04.2016	Cubicle No.2
E5	Electrical power meters at individual SS CHP modules (6 kV) No.1	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117846	0.2S	N/A	12 015,7114	13 291,8884	1 276,1770	14.04.2010	14.04.2016	Double side. Cubicle No.5
E6	Electrical power meters at individual SS CHP modules (6 kV) No.3	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117849	0.2S	N/A	13 257,1024	14 538,7929	1 281,6905	12.04.2010	12.04.2016	Double side. Cubicle No.7
E7	Electrical power meters at individual SS CHP modules (6 kV) No.5	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117851	0.2S	N/A	13 233,1247	14 740,0544	1 506,9297	07.04.2010	07.04.2016	Double side. Cubicle No.9
E8	Electrical power meters at individual SS CHP modules (6 kV) No.7	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117852	0.2S	N/A	12 667,4530	14 048,7973	1 381,3443	13.04.2010	13.04.2016	Double side. Cubicle No.11
E9	Electrical power meters at individual SS CHP modules (6 kV) No.9	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117855	0.2S	N/A	14 563,6681	15 757,4098	1 193,7417	13.04.2010	13.04.2016	Double side. Cubicle No.13
E10	Electrical power meters at individual SS CHP modules (6 kV) No.11	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117856	0.2S	N/A	13 835,1467	15 116,6903	1 281,5436	07.04.2010	07.04.2016	Double side. Cubicle No.15

Number	Metering instrument	Work parameter kWh, kVA	Manufacturer	Type	Serial Number	Accuracy	Data of installation	Data on 01.06.2011	Data on 30.04.2012	Difference	Data of calibration	Data of next calibration	Remarks
E11	Electrical power meters at individual SS CHP modules (6 kV) No.2	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117848	0.2S	N/A	13 021,0771	14 923,1989	1 902,1218	12.04.2010	12.04.2016	Double side. Cubicle No.6
E12	Electrical power meters at individual SS CHP modules (6 kV) No.4	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01122645	0.2S	N/A	9 586,7755	9 897,5097	310,7342	12.04.2010	12.04.2016	Double side. Cubicle No.8
E13	Electrical power meters at individual SS CHP modules (6 kV) No.6	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01122650	0.2S	N/A	13 456,0563	15 216,2645	1 760,2082	14.04.2010	14.04.2016	Double side. Cubicle No.10
E14	Electrical power meters at individual SS CHP modules (6 kV) No.8	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01117845	0.2S	N/A	15 446,6688	16 088,5724	641,9036	07.04.2010	07.04.2016	Double side. Cubicle No.12
E15	Electrical power meters at individual SS CHP modules (6 kV) No.10	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01132765	0.2S	N/A	14 594,1947	16 693,5044	2 099,3097	13.04.2010	13.04.2016	Double side. Cubicle No.14
E16	Electrical power meters at individual SS CHP modules (6 kV) No.12	Electrical power generated by SS CHP system P,Q	"Elster-Metronika" Russia	Electronic	№ 01132766	0.2S	N/A	11 109,1123	12 408,7016	1 299,5893	14.04.2010	14.04.2016	Double side. Cubicle No.16

Table 5. Electrical power meters arranged at individual SS CH unit

As it is impossible to use meters data directly to check electrical power generated we have to take into account special coefficients which appear from multiplying of coefficients transformation for current and voltage transformers connected to each meter. Their data is presented in table below.

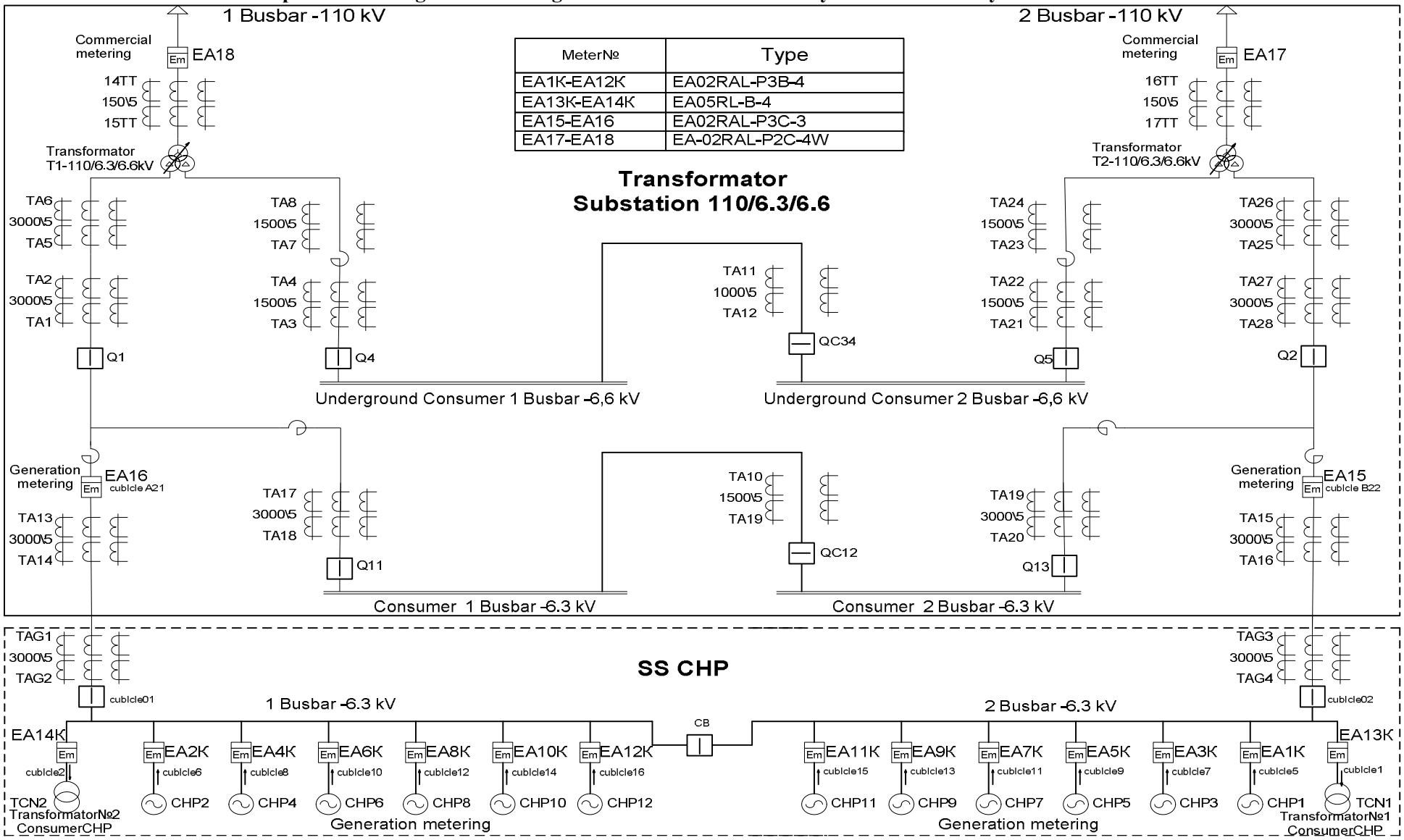
In view of high voltage and currents, it is impossible to obtain direct data from electrical power meters on generation and consumption of electrical power without current and voltage transformers, for accounting of equipment operation. The calculation method is following example for meter No. 01116374: Current -3000/5= 600 A; voltage-6300/100=63 V (gross factor -600 x 63 =37800 VA). ***Data on meter -1 022,9554. Electrical power to be accounted with this meter makes up: 1 022,9554x 600 x 63=38 667 714,12 VA = 38 667 714,12 kW***

Number	Metering instrument	Work parameter kWh, kVA	Type	Serial Number	Current transformer	Voltage transformer	Coefficient for calculations	Electrical power amount
E1	Electrical power meter at SS CHP system (6 kV) Wireway	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01116374	3000/5	6300/100	37800	38 667 714,12
E2	Electrical power meter at SS CHP system (6 kV) Wireway	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01116376	3000/5	6300/100	37800	38 260 143,18
E3	Electrical power meter at SS CHP system (6 kV) Auxiliary transformer	Electrical power consumed by SS CHP system, P, Q	Electronic	№ 01103251	200/5	6300/100	2520	1 512 353,56
E4	Electrical power meter at SS CHP system (6 kV) Auxiliary transformer	Electrical power consumed by SS CHP system, P, Q	Electronic	№ 01103208	200/5	6300/100	2520	1 532 510,78
E5	Electrical power meters at individual SS CHP modules (6 kV) No.1	Electrical power generated by SS CHP system, P,Q	Electronic	№ 01117846	400/5	6300/100	5040	6 431 932,08
E6	Electrical power meters at individual SS CHP modules (6 kV) No.3	Electrical power generated by SS CHP system P,Q	Electronic	№ 01117849	400/5	6300/100	5040	6 459 720,12
E7	Electrical power meters at individual SS CHP modules (6 kV) No.5	Electrical power generated by SS CHP system P,Q	Electronic	№ 01117851	400/5	6300/100	5040	7 594 925,69
E8	Electrical power meters at individual SS CHP modules (6 kV) No.7	Electrical power generated by SS CHP system P,Q	Electronic	№ 01117852	400/5	6300/100	5040	6 961 975,27
E9	Electrical power meters at individual SS CHP modules (6 kV) No.9	Electrical power generated by SS CHP system P,Q	Electronic	№ 01117855	400/5	6300/100	5040	6 016 458,17
E10	Electrical power meters at individual SS CHP modules (6 kV) No.11	Electrical power generated by SS CHP system P,Q	Electronic	№ 01117856	400/5	6300/100	5040	6 458 979,74
E11	Electrical power meters at individual SS CHP modules (6 kV) No.2	Electrical power generated by SS CHP system P,Q	Electronic	№ 1117848	400/5	6300/100	5040	9 586 693,87
E12	Electrical power meters at individual SS CHP modules (6 kV) No.4	Electrical power generated by SS CHP system P,Q	Electronic	№ 01122645	400/5	6300/100	5040	1 566 100,37
E13	Electrical power meters at individual SS CHP modules (6 kV) No.6	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01122650	400/5	6300/100	5040	8 871 449,33
E14	Electrical power meters at individual SS CHP modules (6 kV) No.8	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01117845	400/5	6300/100	5040	3 235 194,14

Number	Metering instrument	Work parameter kWh, kVA	Type	Serial Number	Current transformer	Voltage trans-former	Coefficient for calculations	Electrical power amount
E15	Electrical power meters at individual SS CHP modules (6 kV) No.10	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01132765	400/5	6300/100	5040	10 580 520,89
E16	Electrical power meters at individual SS CHP modules (6 kV) No.12	Net electrical power generated by SS CHP system, P,Q	Electronic	№ 01132766	400/5	6300/100	5040	6 549 930,07
E17	Commercial electrical power meter 110 kV	Consumption of electrical power from or supply Ukrainian grid with	Electronic	№ 01194835	150/5	110000/100	33000	17 473 518,20
E18	Commercial electrical power meter 110 kV	Consumption of electrical power from or supply Ukrainian grid with	Electronic	№ 01194834	150/5	110000/100	33000	19 461 768,20

Table 6. Electrical power calculation

Electrical power Metering Device Arrangement Scheme for Vostochnaya SS CHP Facility and 110 kV Substation



MeterNo	Type
EA1K-EA12K	EA02RAL-P3B-4
EA13K-EA14K	EA05RL-B-4
EA15-EA16	EA02RAL-P3C-3
EA17-EA18	EA-02RAL-P2C-4W

Figure 1: Electrical power Metering Device Arrangement Scheme for Vostochnaya SS CHP and 110 kV Substation

Heat Power Meter

Heat Power measurements

For this monitoring period, only heat power is considered that was directly fed by Vostochnaya SS CHP, as described in paragraph A.7. Therefore, for this monitoring period, only one variable is measured that expresses heat power amount fed by SS CHP system to heat power supply pipelines, and is equal to heat power amount consumed by Vostochnaya site.

Metering instrument	Work parameter Gcal	Manufacturer	Type	Serial number	accuracy	Data of installation	Data on 01.06.2011 Gcal	Data on 30.04.2012 Gcal	Difference	Data of calibration	Data of next calibration	Remarks
Heat Power meter SA 94/2M[8]	Amount of heat power delivered to site system	ASWEGA	Mechatronic	22903	Heat power - 4 Flow - 2	N/A	165 149,89	186 875,55	21 725,66	05.05.11	05.05.13	Principal Metering System

Table 7. Heat Power meters arranged at SS CHP site.

[8] For heat power metering system SA 94/2M DN=300mm; Q=1000m^3/h

Heat Power Metering Scheme for Vostochnaya SS CHP Facility

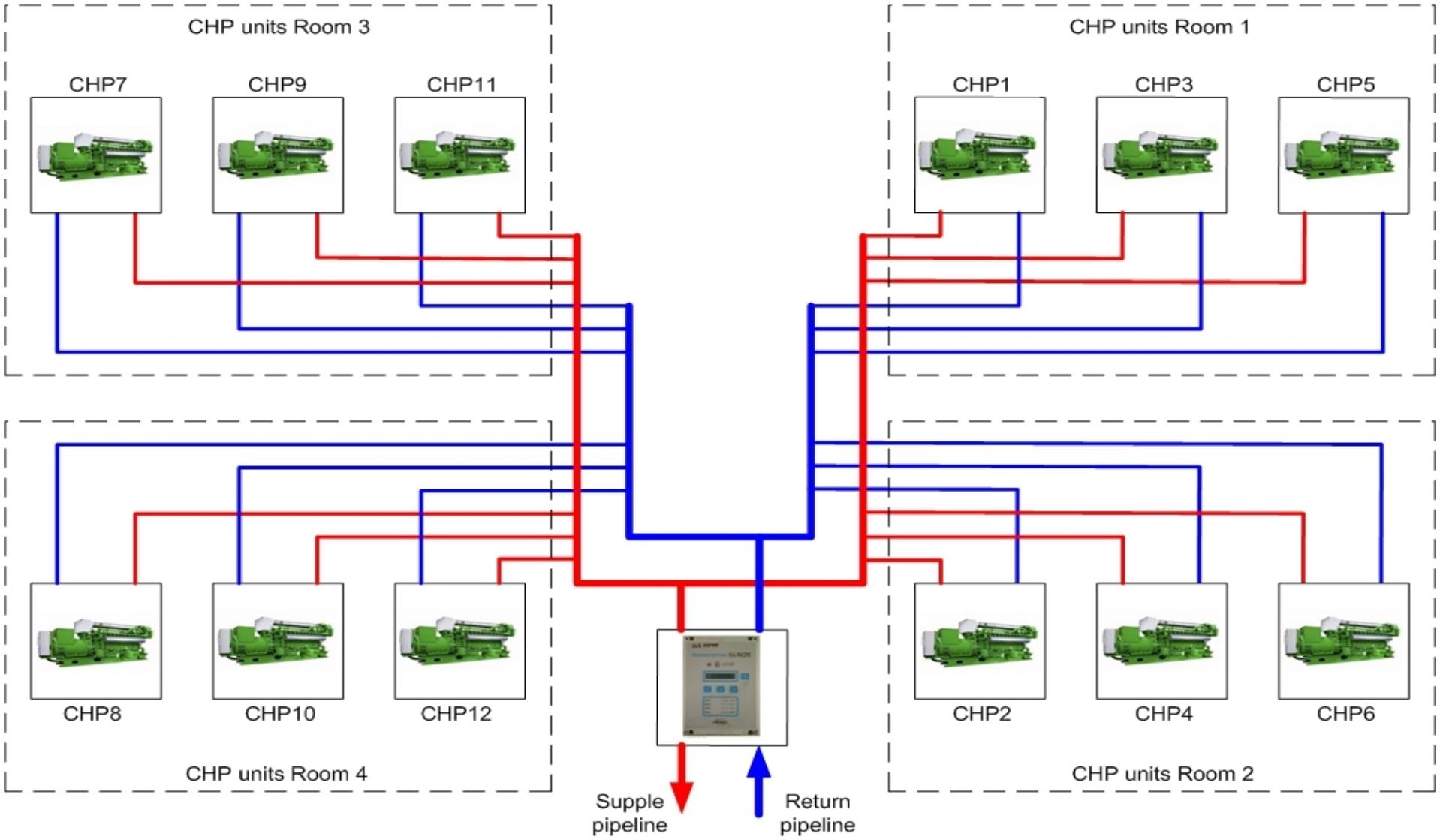


Figure 2: Heat Power Metering Scheme for Vostochnaya SS CHP Facility

CMM Meters

Measurement of CMM consumption

According to monitoring plan, two variables are measured:

- MM_{CHP} - measured amount of methane consumed by SS CHP units (tCH_4);
- MM_{GAS} - measured amount of methane fuelled in vehicles at new automotive gas filling stations (tCH_4).

Variable MM_{CHP} has two components: fuel gas consumption and ignition gas consumption. To determine the amount of pure consumed CH_4 consumed by SS CHP (in tonnes) the amount of pure CH_4 (in m^3) has to be measured under normal conditions[9]. The amount of pure CH_4 (in m^3) can be measured (or more correctly - calculated) based on four parameters:

- Concentration (%) of CH_4 in the air and gas mixture;
- Flow (m^3) of air and gas mixture;
- Temperature (°C) of air and gas mixture;
- Pressure (bar) of air and gas mixture.

In the schemes below*(Figure 3 and Figure 4)* the different meters and sensors are indicated that are installed at the Vostochnaya site. We can classify the different meters/sensors:

- Scheme of location of main primary meters/sensors *(Figure 3)* that supply the data for determining the emission reductions as provided in section D of the Monitoring Report;
- General scheme of location of meters/sensors (with addition of secondary meters/ sensors) (*Figure 4)* used for cross-checking the data of the primary meters, as well as meters/sensors used to operate and control the installation.

The secondary meters/sensors are not of interest for monitoring purposes and are not mentioned further. In the table 8 the primary and secondary meters/sensors are indicated with their numbers which are listed in the scheme.

	Primary meters/sensors	Secondary meters/sensors
Fuel gas		
Concentration (%)	ABB AO 2040 (A1)	K1-K6
Flow (V)	G1-G12	Gn1-Gn6
Temperature (T)	T6-T17	Gn5 sensor
Pressure (P)	P11-P22	P6(Gn5's sensor)
Amount and volumetric gas flow (m^3)	BKT.M[10] metering system	DBT equipment
Ignition gas		
Concentration (%)	ABB AO 2040 (A2)	ABB AO 2040 (A2)
Flow (V)	G13	
Temperature (T)	T2	
Pressure (P)	P10	
Amount and volumetric gas flow (m^3)	"Universal" [11] metering system	Pressure sensors on pipeline
AGFCP gas		
Concentration (%)	ABB AO 2040 (A2)	ABB AO 2040 (A2)
Flow (V)	G14	Calculations according to pressure difference
Temperature (T)	T1	
Pressure (P)	P5	Manometers at AGFCS
Amount and volumetric gas flow (m^3)	"Universal" [9] metering system	Calculations

Table 8: Primary and secondary coal mine methane metering devices

[9] Normal conditions=273K and 760 mm Hg.

[10] BKT.M is designed for conversion of input data of gas parameters and calculation on the base thereof of amount and volumetric gas flow brought to standard conditions, in the composition of DRG.M 10000 consumption metering device.

[11] Universal is designed for conversion of input data of gas parameters and calculation on the base thereof of amount and volumetric gas flow brought to standard conditions.

MM_{CHP} – is a summary amount of fuel and ignition gas consumption, represented as following:

$$MM_{CHP} = (\sum_{1}^{12} VM_n \times C_1 + V_1 \times C_2) \times 0,7167 \times 0,93, \quad (3.)$$

where:

VM_n — fuel gas consumption by separated SS CHP unit, brought to standard[12] conditions (m^3);
$C_{1,2}$ — CH_4 concentration sensors (%);
V_1 — amount of methane consumed as ignition gas (m^3);
0,7167 — methane density in normal conditions subject to the standard DIN ISO 6976 (1995) (кg/m^3);
0,93 — standard conditions to normal conditions conversion ratio.

Variable MM_{GAS} to be calculated as following:

$$MM_{GAS} = V_2 \times C_2 \times 0,7167 \times 0,93, \quad (4.)$$

where:

V_2 — amount of methane fed as fuel for vehicles, in standard conditions (m^3);
C_2 — CH_4 concentration sensor (%);
0,7167 — methane density in normal conditions subject to the standard DIN ISO 6976 (1995) (кg/m^3);
0,93 — standard conditions to normal conditions conversion ratio.

Sensors represented in tables, shown after general description of methane flow process description and measurement of parameters thereof.

Crosschecking

Amount of methane used as fuel gas for SS CHP units undergoes crosschecking. This operation is performed by way of measurement of total amount of gas consumption (m^3), that is defined by flow meter Gn5 (Keuter, ADM Metering system). Data about flow meter are shown in table 10. This device has structure as block of velocity, pressure and temperature sensors that measure volumetric flow of gas consumed by SS CHP units and data on methane concentration in point A1 with gas analyzer AO 2040 (ABB). Amount of methane to be calculated on the base of these data, but it is not used for database formation; it is used only together with technological purposes and for crosschecking and control of SS CHP operation systems. This procedure is carried out on regular basis -daily. Summary results of the internal cross checkings from 01.06.2011 until 30.04.2012 are presented in the table 9

01.06.2011 - 30.04.2012				
month	**Q Fuel Gas Consumption, m^3/month**	**F Fuel Gas, Net Consumption, m^3/month**	**Q Fuel Gas, Net Consumption, m^3/month**	**Relative Difference in Readings Gn5*CH4/100 and ∑ BKT.M1- BKT.M4, %**
	Gn5	***Gn5 * CH4/100***	***∑ BKT.M1-BKT.M4***	
June 2011	**12 854 486,60**	**3 946 294,25**	**3 946 647,20**	**-0,01**
July 2011	**8 323 806,24**	**2 532 418,62**	**2 532 957,12**	**-0,02**
August 2011	**6 397 775,56**	**1 909 074,17**	**1 908 285,17**	**0,04**
September 2011	**4 933 854,11**	**1 419 147,38**	**1 418 946,32**	**0,01**
October 2011	**5 135 326,05**	**1 499 252,26**	**1 499 246,28**	**0,00**
November 2011	**3 256 187,24**	**940 544,87**	**940 027,71**	**0,06**
December 2011	**5 709 941,99**	**1 717 180,84**	**1 717 982,27**	**-0,05**
January 2012	**6 976 023,40**	**2 121 377,89**	**2 122 092,93**	**-0,03**
February 2012	**6 948 964,28**	**2 094 627,77**	**2 094 235,02**	**0,02**
March 2012	**6 860 464,61**	**2 059 409,63**	**2 059 637,87**	**-0,01**
April 2012	**7 060 541,83**	**2 171 304,63**	**2 171 115,16**	**0,01**
Total	**74 457 371,91**	**22 410 632,31**	**22 411 173,05**	**0,00**

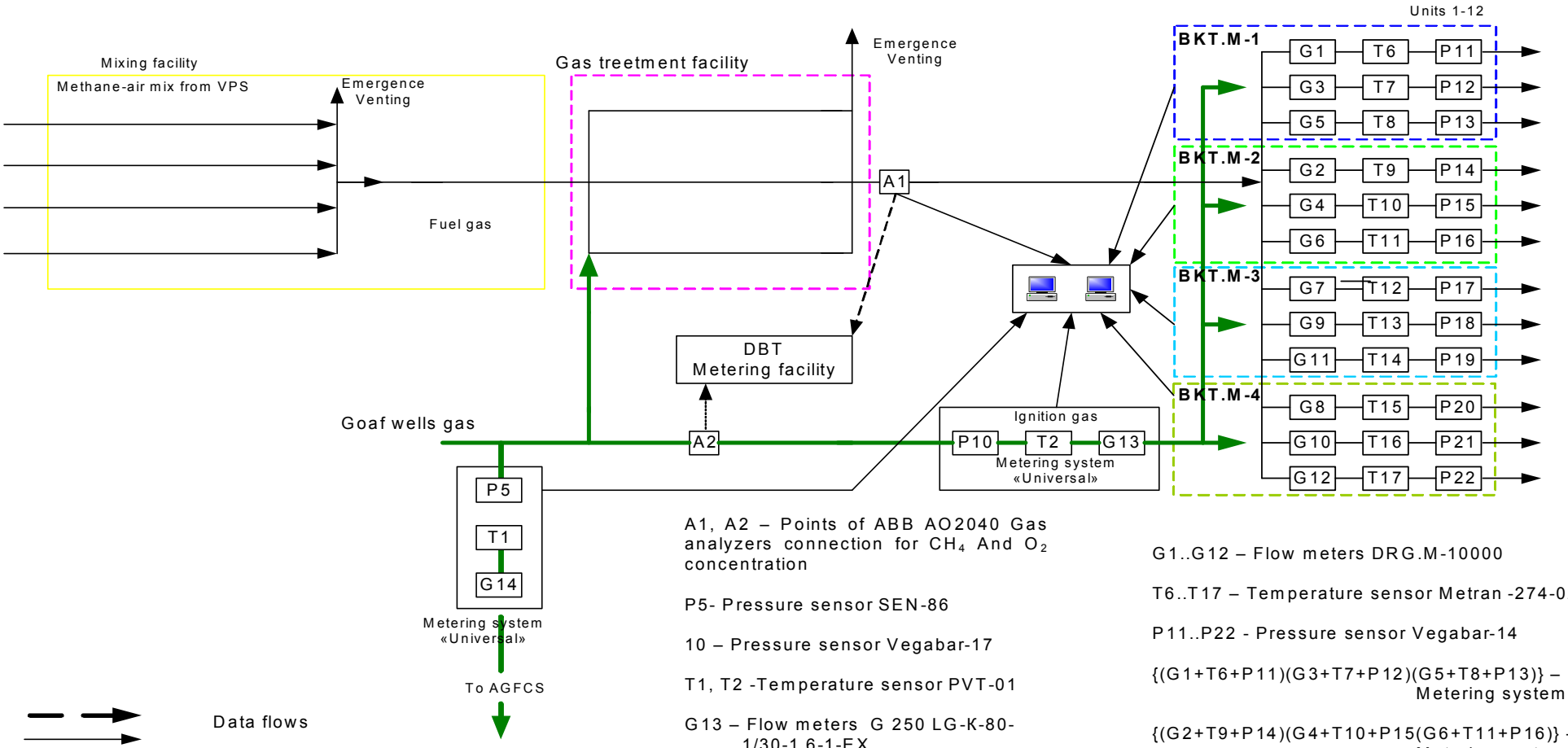
Table 9. Summary results of cross checking

[12] Standard conditions=293K and 760 mm Hg.

Measurement System	Manufacturer	Type	Serial Number	Allowable uncertainty	Data of calibration	Data of next calibration
ADM	Keuter	Electronic	167	heat – 0,25% pressure – 0,5%	08.06.11	08.06.12

Table 10. Metering Device Gn5

Scheme of location of main meters /sensors at Vostochnaya SS CHP in 2011 - 2012



A1, A2 – Points of ABB AO2040 Gas analyzers connection for CH_4 And O_2 concentration

P5- Pressure sensor SEN-86

10 – Pressure sensor Vegabar-17

T1, T2 -Temperature sensor PVT-01

G13 – Flow meters G 250 LG-K-80-1/30-1,6-1-EX

G14 – Flow meters G 400 LG-K-100-1/30-1,6-1-EX

G13+P10+T2- Metering system «Universal»

G14+ P5+T1 - Metering system «Universal»

G1..G12 – Flow meters DRG.M-10000

T6..T17 – Temperature sensor Metran -274-02

P11..P22 - Pressure sensor Vegabar-14

{(G1+T6+P11)(G3+T7+P12)(G5+T8+P13)} – Metering system BKT.M-1

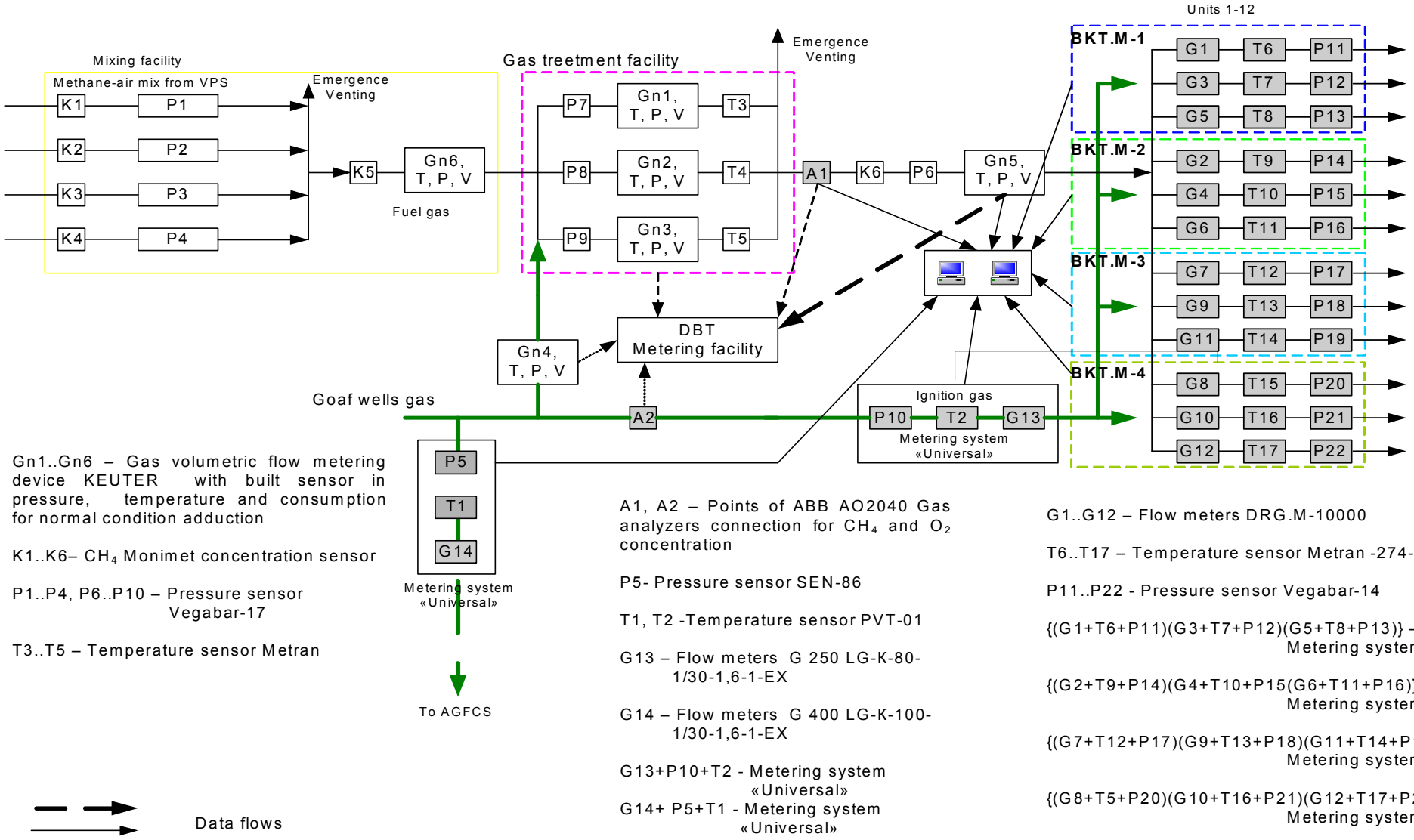
{(G2+T9+P14)(G4+T10+P15(G6+T11+P16)} – Metering system BKT.M-2

{(G7+T12+P17)(G9+T13+P18)(G11+T14+P19)} – Metering system BKT.M-3

{(G8+T5+P20)(G10+T16+P21)(G12+T17+P22)} – Metering system BKT.M-4

Figure 3: Scheme of location of primary meters/ sensors

General scheme of location of meters /sensors at Vostochnaya SS CHP in 2011 - 2012



Gn1..Gn6 – Gas volumetric flow metering device KEUTER with built sensor in pressure, temperature and consumption for normal condition adduction

K1..K6– CH_4 Monimet concentration sensor

P1..P4, P6..P10 – Pressure sensor Vegabar-17

T3..T5 – Temperature sensor Metran

A1, A2 – Points of ABB AO2040 Gas analyzers connection for CH_4 and O_2 concentration

P5- Pressure sensor SEN-86

T1, T2 -Temperature sensor PVT-01

G13 – Flow meters G 250 LG-K-80-1/30-1,6-1-EX

G14 – Flow meters G 400 LG-K-100-1/30-1,6-1-EX

G13+P10+T2 - Metering system «Universal»

G14+ P5+T1 - Metering system «Universal»

G1..G12 – Flow meters DRG.M-10000

T6..T17 – Temperature sensor Metran -274-02

P11..P22 - Pressure sensor Vegabar-14

{(G1+T6+P11)(G3+T7+P12)(G5+T8+P13)} – Metering system BKT.M-1

{(G2+T9+P14)(G4+T10+P15(G6+T11+P16)} – Metering system BKT.M-2

{(G7+T12+P17)(G9+T13+P18)(G11+T14+P19)} – Metering system BKT.M-3

{(G8+T5+P20)(G10+T16+P21)(G12+T17+P22)} – Metering system BKT.M-4

Figure 4: General scheme of location of meters/ sensors including secondary meters/sensors

The general flow of CMM and the metering can be described as follows.[13]

Coal mine gas of degassing and gas-suction is supplied through four lines to gas mixing section of the SS CHP. The concentration of methane in coal mine gas and pressure are different in each pipeline. These parameters are measured by K1…K4 (Monimet) concentration sensors and P1…P4 (Vegabar-17) pressure sensors. Measurements data of these sensors are not used in coal mine gas metering and have technological meaning; these data are channelled to automatic control system of the dispatch and used only for controlling purposes in order to obtain at the output homogeneous fuel methane with necessary concentration.

Concentration of methane that is fed to the gas treatment facility is measured by the sensor K5 (Monimet); temperature, pressure and flow are measured by flow meters Gn6 (Keuter, ADM metering system), a unit of velocity, pressure, and temperature sensors. Surface well methane is mixed with fuel gas, if increase of its concentration is required. Gas methane parameters (flow, temperature, and pressure) to be fed to admix section by flow meter Gn4 (Keuter, ADM metering system). The concentration of methane is measured by gas analyser AO 2040 (ABB) in A2 point (concentrations of methane in admix and ignition gas are equal as these are included in common system of surface degasification- surface well gas methane). Having all this data, the automatic control system of the dispatch can calculate "net" amount of methane in the coal mine gas (or air and mixture as referred hereafter).

At the gas treatment section of facility, methane is distributed between three lines where it is dried, cooled, cleaned and warmed. Acting flow measurements is provided by Gn1 - Gn3 (Keuter) flow meters together with velocity, pressure and temperature sensors. They transmit information to calculation equipment developed by DBT which is installed in separate premise. This unit calculates the values of actual consumption for normal conditions and channeled them to automatic control system of the dispatch computer system for operation and saving in database. For checking and reserve, pressure sensors P7 – P9 (Vegabar-17) and temperature sensors T3 – T5 (Metran) have been installed in pipelines.

At the outflow of gas treatment section the processing discharge valve is installed which levels out e pressure swings at abrupt changes of SS CHP operation regime. Pressure at the outflow of the section is controlled by processing sensor P6 (Vegabar-17).

With the purpose of fuel gas concentration definition, gas testing is made at the outflow of gas treatment section of facility in point A1 which is fed to gas analyzer AO 2040 (ABB) mounted at gas metering unit. Concentration measured is checked for the compliance with sensor K6 (Monimet). Flow meter Gn5 (Keuter) as a unit with velocity, pressure and temperature sensors, measures the gas amount used by SS CHP units. The methane amount is calculated based on the data of methane concentration but is not used for database establishment and metering, it is used only for technological purposes and establishment of crosscheckings.

Further, fuel gas is supplied to the units of SS CHP engine rooms. The flow meters G1- G12, type (DRG.M-10000), temperature sensors T6 - T17 (Metran 274-02), and pressure sensors P11 - P22 (Vegabar -14) are mounted on the line of each 12 units. Their data are transmitted to micro- processing control system BKT.M designed for transformation of input information about gas parameters and for calculation of the base thereof of amount and volumetric amount of gas flow brought to standard conditions to calculate fuel gas amount which is used by each unit, and total amount in each engine room. Fuel gas amount is calculated based on the data of methane concentration in it. Fuel gas amount calculation is performed on the base of data received from control units for gas record BKT.M1-BKT.M4, and concentration of methane therein as received from gas analyzer AO 2040 (ABB) in point A1. Total amount of fuel gas is calculated by way of addition of figures of all gas record units BKT.M, and serves as a figure of SS CHP gas methane utilized. This information is entered into database and logs.

Ignition gas is supplied to SS CHP units from gas pipes of surface degasification wells where surface degasification wells are combined. Total ignition gas consumption is metered by system Universal designed for transformation of input information about gas parameters and for calculation of the base thereof of amount and volumetric amount of gas flow brought to standard conditions, which included gas metering device G13 (G 250 LG-K-80-1/30-1,6-1-Ex), temperature sensor T2 (PVT-01-1), and pressure sensor P10 (Vegabar-17). Gas concentration is metered by gas analyzer AO 2040 (ABB) with gas test in the point A2. Based on data received from metering system Universal, ignition gas automatic control system is kept, which gas is supplied to SS CHP units and recorded in database and log.

[13] From 2008, DBT equipment is used as equipment for operation and control of stations, as well as for crosschecking. Main meters and sensors which are installed at each SS CHP unit, transmit data to metering systems of the gas record units BKT.M (amount and volumetric flow of gas measurement). This gas record system transmits data to computer. Each BKT.M system unites three SS CHP modules. These systems are run with fuel gas. Ignition gas for all SS CHP units is measured with a new metering system Universal. All this data are stored and are transmitted to SS CHP computer system.

Gas for vehicle fuelling is also supplied to SS CHP units from gas pipes of surface degasification wells where surface degasification wells are combined. Total vehicle fuelling gas consumption is metered by system Universal designed for transformation of input information about gas parameters and for calculation of the base thereof of amount and volumetric amount of gas flow brought to standard conditions, which included gas metering device G14 (type G 400 LG-K-100-1/30-1,6-1-Ex), temperature sensor T1 (PVT-01-1), and pressure sensor P5 (SEN-8601). Because the gas being fed for vehicle fuelling and ignition gas to feed to SS CHP units is a gas of uniform system of surface degasification wells, control of the gas concentration is performed by gas analyzer AO 2040 (ABB) with gas test in the point A2. Based on these data, amount of methane consumed at AGFCP as vehicle fuel is fixed in database and log.

Methane volume which is supplied with fuel gas and ignition gas gives total amount of methane supplied to SS CHP Units.

Methane volume which is supplied with fuel gas and ignition gas, and methane for vehicle filling give total amount of methane consumed by Vostochnaya site of Zasyad'ka Coal Mine.

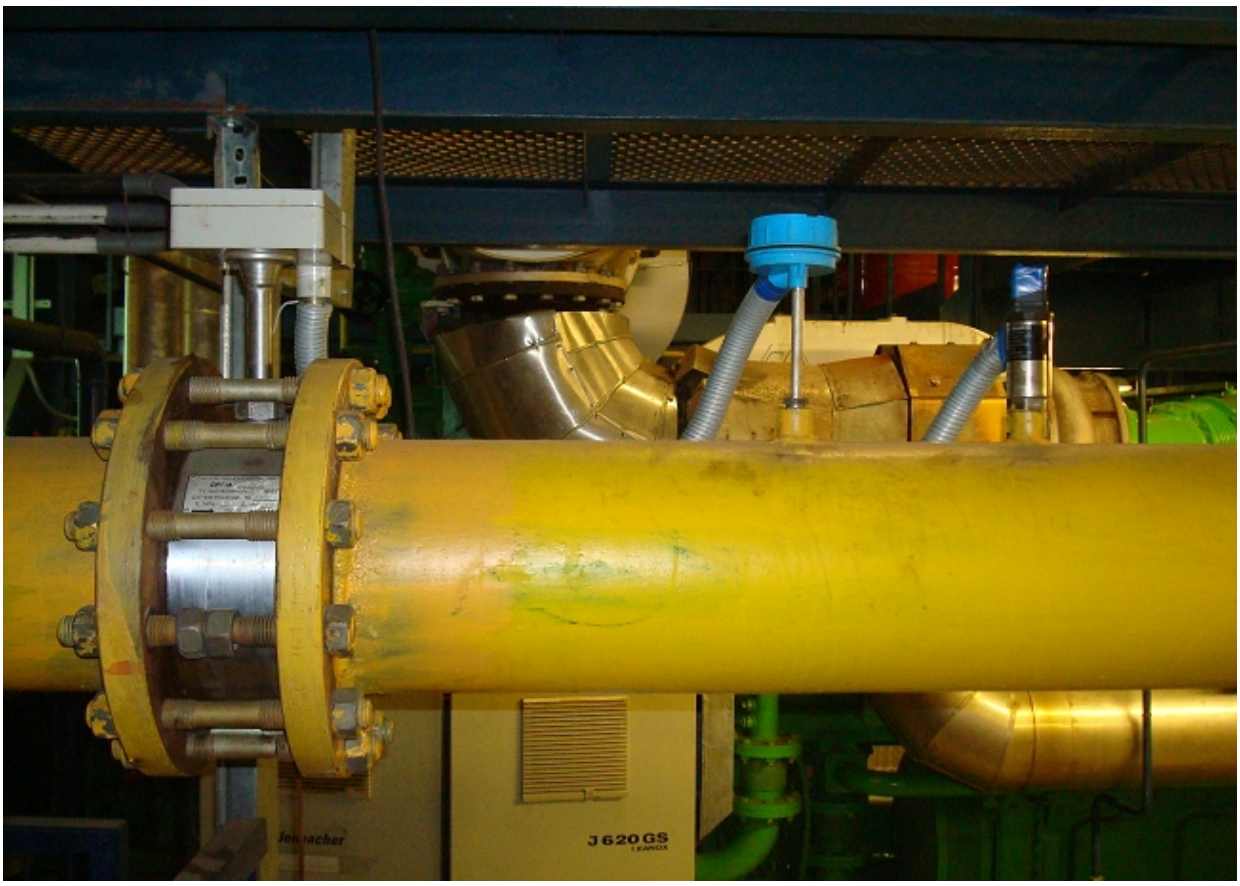


Figure 5: Gas flow meter DRG.M-10000[14] temperature sensor Metran 274-02 and pressure sensor Vegabar-14 of metering system for gas record BKT.M at fuel gas pipeline of SS CHP unit.

[14] DRG.M – 10000 — gas flow meter designed for transformation of volumetric flow of gas (at operational pressure) into numeric and impulsive signal.

In the tables 11-20 the description of the meters/sensors of metering systems for gas record that are part of monitoring report drawing, are given:

CHP gas metering equipment

Item No.	Metering instrument design	Work parameter	Manufacturer	Type	Serial number	Uncertainty level of data	Date of installation	Date of calibration	Date of next calibration	Remarks
C1	Concentration of fuel gas	%	ABB	AO 2040 Electronic	3.244705.5	± 1%	2005	09.07.10 14.06.11	14.06.12	Connection A1
C2	Concentration of ignition gas	%	ABB	AO 2040 Electronic	3.244704.5	± 1%	2005	09.07.10 14.06.11	14.06.12	Connection A2

Table 11. Gas analyzers.

Item No.	Gas to be measured	Metering instrument design	Work parameter	Manufacturer	Type	Serial number	Uncertainty level of data	Date of installation	Date of calibration	Date of next calibration	Remarks
V1	Ignition	Ignition gas amount measurement	m^3	NVP "GREMPIS" ltd	G 250 LGK-80-1/30-1,6-1-Ex	9771	± 1% 60 to 400 m^3/h	4 quarter 2007	10.03.11	10.03.13	Connection G13
		Ignition gas temperature measurement	^oC	NVP "GREMPIS" ltd	PVT-01-1	6480	± 0.5%	4 quarter 2007	10.03.11	10.03.13	Connection T2
		Ignition gas pressure measurement	bar	"VEGA" Germany	Vegabar-17	12307278	± 0.5%	4 quarter 2007	09.03.11 09.03.12	09.03.13	Connection P10

Table 12. Ignition gas record system Universal meters/sensors.

Item No.	Gas to be measured	Metering instrument design	Work parameter	Manufacturer	Type	Serial number	Uncertainty level of data	Date of installation	Date of calibration	Date of next calibration	Remarks
V2	Gas for motor vehicle filling	Gas for motor vehicle filling amount measurement	m^3	NVP "GREMPIS" ltd	G 400 LGK-100-1/30-1,6-1-Ex	9786	± 1% 97,5 to 650 m^3/h	4 quarter 2007	15.07.09 10.06.11	10.06.13	Connection G14
		Gas for motor vehicle filling temperature measurement	^oC	NVP"GREMPIS" ltd	PVT-01-1	211	± 0.5%	4 quarter 2007	28.07.10 10.06.11	10.06.12	Connection T1
		Gas for motor vehicle filling pressure measurement	bar	"COBOLD" Germany	SEN-8601	45	± 0.5%	4 quarter 2007	28.07.10 10.06.11	10.06.12	Connection P5

Table 13. Motor vehicle filling gas metering system Universal meters/ sensors for recording of amount and volumetric flow of gas consumed as AGFCP fuel

Item No.	Metering system	Work parameter: m^3 /h	manufacturer	Type	Serial number	Uncertainty level of data and accuracy	Date of installation	Data as of 01.06.2011 m^3	Data as of 30.04.2012 m^3	Difference	Date of calibration	Date of next calibration	Remarks
V_1	Universal	Ignition gas amount	NVP"GREMPIS" ltd	Universal - 2	6023	± 0.2 %	4 quarter 2007	6 753 520,5	7 666 827,5	913 307,0	10.03.11	10.03.13	Main metering block
V_2	Universal	Motor vehicle fuelling gas amount	NVP"GREMPIS" ltd	Universal - 2	327	± 0.2 %	4 quarter 2007	8 177 118	9 496 234	1 319 116	28.07.10 09.06.11	09.06.13	Main metering block

Table 14. Gas amount and volumetric flow computing block

Item No.	Metering system	Work parameter: m^3	Manufacturer	Serial number	Uncertainty level of data and accuracy	Date of installation	Unit No.	Data as of 01.06.2011 m^3	Data as of 31.12.2011 m^3	Difference	Date of calibration	Date of next calibration	Remarks
V_3	BKT.M - 1	Fuel gas amount	Sibnefteavtomatika, Russia	**094**	• Pressure channels, not exceeding ±0.3 %; • Temperature channels, not exceeding ±0.5 %; • Consumption channels, not exceeding ±0.1 %; • Gas consumption definition status brought to standard conditions, not exceeding ±0.35 %; • Gas amount defintion status brought to standard conditions, not exceeding ±0.35 %; • Change of running time, not exceeding ±0.1 %.	**N/A**	**M1** **M3** **M5**	Data on the testimony BKT.M see below			05.05.09	05.05.12	Main metering block
V_4	BKT.M - 2	Fuel gas amount	Sibnefteavtomatika, Russia	**095** **099**		**N/A**	**M1** **M3** **M1**	Data on the testimony BKT.M see below			20.01.09 27.10.11	20.01.12 27.10.14	Main metering block
V_5	BKT.M - 3	Fuel gas amount	Sibnefteavtomatika, Russia	**5668** **095**		**N/A**	**M7** **M9** **M11**	Data on the testimony BKT.M see below			17.03.09 01.03.12	17.03.12 01.03.15	Main metering block
V_6	BKT.M - 4	Fuel gas amount	Sibnefteavtomatika, Russia	**099** **100**		**N/A**	**M8** **M10** **M12**	Data on the testimony BKT.M see below			05.08.08 19.04.11	05.08.11 19.04.14	Main metering block

Table 15. Gas amount and volumetric flow computing blocks BKT.M -1 — BKT.M - 4

Item No	Metering system	Serial number	Unit No.	Data as of 01.06.2011 m^3	Data as of 01.08.2011 m^3	Difference	Serial number	Data as of 01.08.2011 m^3	Data as of 30.04.2012 m^3	Difference	**∑ fuel gas**
V_6	**ВКТ.М-4**	**099**	**М8**	37 452 000	39 557 104	2 105 104	**100**	0	1 091 139	1 091 139	3 196 243
			М10	36 585 252	38 485 824	1 900 572		0	8 676 080	8 676 080	10 576 652
			М12	25 149 112	27 430 544	2 281 432		0	4 099 539	4 099 539	6 380 971

Table 16. Records of BKT.M-4 (before and after substitution)

Item No	Metering system	Serial number	Unit No.	Data as of 01.06.2011 m^3	Data as of 03.01.2012 m^3	Difference	Serial number	Data as of 03.01.2012 m^3	Data as of 30.04.2012 m^3	Difference	**∑ fuel gas**
V_4	**ВКТ.М-2**	**095**	**М2**	23 074 776	29 139 744	6 064 968	**099**	0	3 562 989	3 562 989	9 627 957
			М4	23 852 614	25 401 938	1 549 324		0	0	0	1 549 324
			М6	31 962 758	37 444 664	5 481 906		0	3 381 390	3 381 390	8 863 296

Table 17. Records of BKT.M-2 (before and after substitution)

Item No	Metering system	Serial number	Unit No.	Data as of 01.06.2011 m^3	Data as of 17.03.2012 m^3	Difference	Serial number	Data as of 17.03.2012 m^3	Data as of 30.04.2012 m^3	Difference	**∑ fuel gas**
V_5	**ВКТ.М-3**	**5668**	**М7**	4 402 882	10 502 612	6 099 730	**095**	0	736 003,3	736 003,3	6 835 733,3
			М9	4 249 490	9 545 961	5 296 471		0	847 509,6	847 509,6	6 143 980,6
			М11	4 000 159	9 124 484	5 124 325		0	1 277 736	1 277 736	6 402 061

Table 18. Records of BKT.M-3 (before and after substitution)

Item No	Metering system	Serial number	Unit No.	Data as of 01.06.2011 m^3	Data as of 29.03.2012 m^3	Difference	Serial number	Data as of 29.03.2012 m^3	Data as of 30.04.2012 m^3	Difference	**∑ fuel gas**
V_3	**ВКТ.М-1**	**094**	**M1**	10 630 702	17 030 176	6 399 474	**094**	0	18 171 1	18 171,1	6 417 645,1
			M3	11 831 409	17 040 544	5 209 135		0	1 208 092	1 208 092	6 417 227
			M5	11 208 443	17 756 216	6 547 773		0	1 176 910	1 176 910	7 724 683

Table 19. Records of BKT.M-1 (before and after nulling)

Item No.	Gas to be metered	Symbol on scheme	Metering device designation	Work parameter	Manufacturer	Type	Serial number	Allowed uncertainty	Data of installation	Data of calibration	Data of next calibration	Remarks
M1	Fuel	G1	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	102	± 1.0%	N/A	19.08.09 26.07.11	26.07.14	Fuel gas metering system BKT.M- 1
		T6	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510745	± 0,5%	N/A	22.07.10 04.06.11	04.06.12	
		P11	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536534	± 0,5%	N/A	04.06.10 04.06.11	04.06.12	
M3	Fuel	G3	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	109	± 1.0%	N/A	19.08.09 26.07.11	26.07.14	
		T7	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510753	± 0,5%	N/A	02.07.10 04.06.11	04.06.11	
		P12	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536342	± 0,5%	N/A	04.06.10 04.06.11	04.06.12	
M5	Fuel	G5	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	103	± 1.0%	N/A	19.08.09 26.07.11	26.07.14	
		T8	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	509669	± 0,5%	N/A	22.07.10 04.06.11	04.06.11	
		P13	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14447569	± 0,5%	N/A	04.06.10 04.06.11	04.06.12	

Table 20. Meters/sensors of fuel gas metering system BKT.M-1

Item No.	Gas to be metered	Symbol on scheme	Metering device designation	Work parameter	Manufacturer	Type	Serial number	Allowed uncertainty	Data of installation	Data of calibration	Data of next calibration	Remarks
M2	Fuel	G2	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	108	± 1.0%	N/A	28.04.11	28.04.14	Fuel gas metering system BKT.M - 2
		T9	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510735	± 0.5%	N/A	21.07.10 02.06.11	02.06.12	
		P14	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14568471	± 0.5%	N/A	02.06.10 02.06.11	02.06.12	
M4	Fuel	G4	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	104	± 1.0%	N/A	28.04.11	28.04.14	
		T10	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	509670	± 0.5%	N/A	21.07.10 02.06.11	02.06.12	
		P15	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536186	± 0.5%	N/A	02.06.10 02.06.11	02.06.12	
M6	Fuel	G6	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	097	± 1.0%	N/A	28.04.11	28.04.14	
		T11	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510733	± 0.5%	N/A	02.06.10 02.06.11	02.06.12	
		P16	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536368	± 0.5%	N/A	02.06.10 02.06.11	02.06.12	

Table 21. Meters/ sensors of fuel gas metering system BKT.M – 2

Item No.	Gas to be metered	Symbol on scheme	Metering device designation	Work parameter	Manufacturer	Type	Serial number	Allowed uncertainty	Data of installation	Data of calibration	Data of next calibration	Remarks
M7	Fuel	G7	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	098	± 1.0%	N/A	17.07.09 14.07.11	14.07.14	Fuel gas metering system BKT.M - 3
		T12	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510744	± 0.5%	N/A	21.07.10 03.06.11	03.06.12	
		P17	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14568573	± 0.5%	N/A	03.06.10 03.06.11	03.06.12	
M9	Fuel	G9	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	099	± 1.0%	N/A	17.07.09 14.07.11	14.07.14	
		T13	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510742	± 0.5%	N/A	21.07.10 03.06.11	03.06.12	
		P18	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536304	± 0.5%	N/A	03.06.10 03.06.11	03.06.12	
M11	Fuel	G11	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	101	± 1.0%	N/A	17.07.09 14.07.11	14.07.14	
		T14	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510738	± 0.5%	N/A	21.07.10 03.06.11	03.06.12	
		P19	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14568610	± 0.5%	N/A	03.06.10 03.06.11	03.06.12	

Table 22. Meters/ sensors of fuel gas metering system BKT.M – 3

Item No.	Gas to be metered	Symbol on scheme	Metering device designation	Work parameter	Manufacturer	Type	Serial number	Allowed uncertainty	Data of installation	Data of calibration	Data of next calibration	Remarks
M8	Fuel	G8	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	105	± 1.0%	N/A	01.07.09 27.06.11	27.06.14	Fuel gas metering system BKT.M - 4
		T15	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510754	± 0.5%	N/A	23.07.10 04.06.11	04.06.12	
		P20	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14568589	± 0.5%	N/A	04.06.10 04.06.11	04.06.12	
M10	Fuel	G10	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	096	± 1.0%	N/A	01.07.09 27.06.11	27.06.14	
		T16	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510755	± 0.5%	N/A	23.07.10 04.06.11	04.06.12	
		P21	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14536306	± 0.5%	N/A	04.06.10 04.06.11	04.06.12	
M12	Fuel	G12	Fuel gas consumption measurement	m^3	Sibnefteavtomatika, Russia	DRG.M-10000 Electronic	100	± 1.0%	N/A	01.07.09 27.06.11	27.06.14	
		T17	Fuel gas temperature measurement	°C	Metran Industrial Group, Russia	Metran - 274-02	510747	± 0.5%	N/A	23.07.10 04.06.11	04.06.12	
		P22	Fuel gas pressure measurement	bar	"VEGA" Germany	Vegabar 14	14568606	± 0.5%	N/A	04.06.10 04.06.11	04.06.12	

Table 23. Meters/ sensors of fuel gas metering system BKT.M – 4

The monitoring system for the emission reductions achieved in the course of the project implementation has been integrated in the Zasyadko Coal Mine existing controlling and reporting system. That allows for obtaining reliable and easy verifiable data related to the project performance, ensuring thus the quality and efficiency of the monitoring system.

All source information on performance parameters and calculations have been obtained directly on site and after that reported to the Coal Mine dispatching office. The work parameters of CMM flows as well as heat power and electrical power generated were crosschecked to provide quality and reliability of monitored data. To ensure reliable and non-stop performance of SS CHP the inputs of natural gas from the natural gas pipeline are envisaged.

CMM gas flow filling stations

Each gas filling station keeps records in the register. Calculations of methane fuelled are executed according to data pressure difference of manometers. Concentration of methane is measured monthly with ABB AO 2040 at SS CHP and surface well gas analysis. Besides, the concentration of methane is measured locally with an interferometer. Temperature and pressure meters are installed too. The amount and volumetric consumption of methane is measured by "Universal" metering system.

B.1.3. Calibration procedures

QA/QC (Quality Assurance/ Quality Control) procedures	Body responsible for calibration and certification
Calibration interval of such meters is six years. Calibration procedures for meters are implemented in compliance with calibration methodology developed for "Elster-Metronika" meters, Ukraine.	Donetsk Centre for Standardization, Metrology and Certification

Table 24. For Electrical power meters

QA/QC (Quality Assurance/ Quality Control) procedures	Body responsible for calibration and certification
Calibration interval of such meters is two years. Calibration procedures for meters are implemented in compliance with calibration methodology developed for ASWEGA meters, Ukraine.	Donetsk Centre for Standardization, Metrology and Certification

Table 25. For Heat Power meters

QA/QC (Quality Assurance/ Quality Control) procedures	Body responsible for calibration and certification
Keuter ADM1 Electronic. Calibration interval of such meters is 12 months[15]	Donetsk Centre for Standardization, Metrology and Certification
Gas Analyzer A0 2040 (ABB). Calibration interval of such meters is 12 months [16].	Donetsk Centre for Standardization, Metrology and Certification
Gas Record Unit BKT.M for amount and volumetric flow of gas record. Calibration interval amounts once per 36 months.	Tyumen Centre for Standardization, Metrology and Certification
«Universal» Metering System for amount and volumetric flow of gas record. Calibration interval amounts once per 24 months.	Donetsk Centre for Standardization, Metrology and Certification

Table 26. For CMM meters

[15] As there is no state regulation for such kind of equipment, there was a decision of Ukrainian Centre for Standardization and Metrology for one -year calibration period.

[16] All metering equipment shall be calibrated subject to provisions and methods as defined by regulations of this centre.

B.1.4. Involvement of Third Parties:

- Donetsk Centre for Standardization, Metrology and Certification;
- Ivano-Frankovsk Scientific and Generation Centre Standardization, Metrology and Certification;
- Tyumen Centre for Standardization, Metrology and Certification;
- Respirator Mining Scientific and Research Institute.
- Limited Liability Company Mitallservice- Central Geological and Chemical Laboratory

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

For the operational and management structure of the project see PDD Version 4.4, Figure 9: *Monitoring and quality control system for Vostochnaya and Yakovlevskaya sites*

B.2.1. List of fixed default values:

ID number	Data variable	Source of data	Data unit	Comment
P6 CEF_{CH4}	Carbon emission factor for combusted methane	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy Chapter 4: Fugitive Emissions	tCO_2e/tCH_4	Set at 2.75 tCO_2e /tCH_4 See also table CMM meters
P12 Eff_{CHP}	Efficiency of methane destruction/oxidation in SS CHP	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy Chapter 4: Fugitive Emissions	%	Set at 99.5%
P14 Eff_{GAS}	Overall efficiency of methane destruction/oxidation at the vehicles	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy Chapter 4: Fugitive Emissions	%	Set at 98.5%
P15 GWP_{CH4}	Global warming potential of methane	2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy Chapter 4: Fugitive Emissions	tCO_2e/tCH_4	Set at 21

Table 27. Project Variable Values

ID number	Data variable	Source of data	Data unit	Comment
B13 $EF_{grid, produced, y}$	Emissions factor of electrical power of replaced grid electrical power generation by the project activity in year	Order Nr. 75 dd. 12.05.2011 issued by State Environmental Investment Agency of Ukraine	tCO_2/MWh	Set at 1,063
B14 $EF_{grid,reduced,y}$	Emissions factor of electrical power of replaced on-site electrical power consumption by the project activity	Order Nr. 75 dd. 12.05.2011 issued by State Environmental Investment Agency of Ukraine	tCO_2/MWh	Set at 1,090
B20 $EF_{heat,vost}$	Emissions factor for heat power at Vostochnaya site in the baseline scenario	See Annex 2 PDD	tCO_2/GJ	Boiler efficiency 90% Set at 0,063
B22 $EF_{heat,yak}$	Emissions factor for heat power at Yakovlevskaya site in the baseline scenario	See Annex 2 PDD	tCO_2/GJ	Boiler efficiency 90% Set at 0,063
B24 $EF_{heat,centr}$	Emissions factor for heat power at Centralnaya site in the baseline scenario	See Annex 2 PDD	tCO_2/GJ	Boiler efficiency 90% Set at 0,143
B25 $VFUEL_y$	Vehicle fuel provided by the project activity	Fuel Meters	GJ	This value will be calculated based MM_{GAS} of the project scenario multiplied with LHV of methane
B26 EF_v	Emissions factor for vehicle operation replaced by the project activity	IPCC Default Value	tCO_2/GJ	See annex 2 PDD. Set at 0,072

Table 28. Baseline Default Values

B.2.2. List of variables:

Project emissions variables to be measured:

- MM_{CHP} — Methane measured consumed by SS CHP units (tCH_4);
- MM_{GAS} — Methane measured consumed as a fuel at new AGFCPs (tCH_4).

Baseline emissions variables to be measured:

- GEN_{CHP} — Net electrical power generated by the project activity by the SS CHP (MW*h);
- $El_{Cconsumed}$ — Net electrical power consumed by the mine;
- $HEAT_{consumed, vost, y}$ — Heat Power consumed at Vostochnaya site delivered by the project

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

Year	MM_{GAS} (tCH_4)
01.06.2011 – 30.04.2012	*879*

Table 29. Data to be collected in the project scenario

Year	MM_{CHP} (tCH_4)
01.06.2011 – 30.04.2012	*16 671*

Table 30. Data to be collected in the project scenario

For Methane analysis data refer please to Annex 1 document.

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

Year	GEN_{CHP} (MWh)	El_{Cons} (MWh)	$HEAT_{cons, vost, y}$ (GJ)
01.06.2011 – 30.04.2012	*76 927,819*	*189 329,138*	*90 961*

Table 31. Data collected in the baseline scenario

B.2.5. Data concerning leakage:

Not Applicable.

B.2.6. Data concerning environmental impacts:

Activity under the project is performed subject to Ukrainian current environmental law. At construction of SS CHP and AGFCP, Environmental Impact Assessment has been performed. Pursuant to Atmospheric Air Protection Law of Ukraine, as approved by Decree of Ukrainian Cabinet of Ministers on March 13, 2002 # 302 and Order of Ukrainian Ministry of Environmental Protection dd. 09.03.2006 # 108. Mine obtains permits for emission of contaminating substances. Pollutant emissions inventory conducted with the assistance of third-party certified company that provides screening and analysis of samples contaminants pollutant substance with own standard equipment.

Reporting an monitoring of emissions is performed constantly; all statistical reports are prepared and submitted pursuant to Guide to Filling In the State Statistical Control Statements for Atmospheric Air # 2 - TP (air) (annual) and # 2- TP (air) (quarterly) Atmospheric Air Protection Report issued by Derzhkomstat (State Committee of Statistics) # 674 dd. 30.12.2004.

The impact of the project to the condition of waters is insignificant due tot use of water for domestic needs only. At SS CHP, Grid Water Consumption Metering Device Reading Log is kept; data therefrom are used for preparation of statistical reports. Environmental Impact monitoring for water condition is performed and all statistic report statements are submitted pursuant to the current law of Ukraine.

During project implementation, waste is established that relate to domestic activity only (service and repair of equipment), and household activity. Monitoring of waste is performed, and statistical report statements are submitted: # 1-VT "Waste and Package and Tare Accounting pursuant to the current law of Ukraine.

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

All dispatchers are responsible for data management. Besides, dispatchers prepare standard daily, weekly, monthly, and annual repots. All appropriate data are collected daily, and archived both in electronic and paper

form (see calculation CO_2). All data will be saved in electronic data carriers and in paper form at least two years after completion of final transaction of emission reduction units. Passwords on servers are subject to monthly change, and each server has its own person in charge who has access thereto.

Commissioning of modern computer control system will provide efficient online monitoring and performance efficiency analysis. Data from all controlling equipment are automatically transferred to database with the aid of appropriate software:

1. Checker 8 (integrated software developed and written by the manufacturer; to be supplied with the Universal control unit) – ignition gas and AGFCP gas record -keeping;
2. Alfa- Center measuring and computing complex integrated into ASKUE (common mine automatic system of electrical power commercial record -keeping) - electrical power record -keeping;
3. DIA.NE.XT (software delivered with CHP units)– control, regulation, indication, setting, and saving of data for CHP unit.

For calculation of Greenhouse Gas (GHG) Emission Reductions, the SS CHP TP ACS Service has developed own Data Gathering and Processing Automated System (ASZPD) which maintains calculation of fuel gas and heat power. This system is based on the database being created with licensed software that is included into measuring system kit.

B.4. Special event log:

On 01.08.2011, the BKT.M # 099 has been substituted by BKT.M # 100 because of sending thereof to state calibration at Tyumen Centre for Standardization, Metrology and Certification.

On 03.01.2012, the BKT.M # 095 has been substituted by BKT.M # 099 because of sending thereof to state calibration at Tyumen Centre for Standardization, Metrology and Certification.

On 17.03.2012, the BKT.M # 5668 has been substituted by BKT.M # 095 because of sending thereof to state calibration at Tyumen Centre for Standardization, Metrology and Certification.

On 29.03.2012 BKT.M # 094 unit was nulled. Based on the results of examination failure in operation was caused with electro-static discharges. BKT.M # 094 unit is functionally operative, its further operation in a regular mode is allowed.

SECTION C. Quality assurance and quality control measures:

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

General project management is implemented by the Deputy General Director of the PJSC «Shakhta im. O.F.Zasyadka» through supervising and coordinating activities of his subordinates, such as deputy director on surface degasification, chief electricity engineer, chief heating engineer, and deputy director on safety engineering.

On-site day-to-day management is implemented by the Director of SS CHP of PJSC «Shakhta im. O.F.Zasyadka» and two shift dispatchers responsible for cogeneration modules and gas treatment plant performance. During the daytime, workers of group of mechanic, power engineer, heat engineer, and SS CHP TP ACS perform preventive measures and maintenance of all technological equipment, metering instruments as well as of automation tools and telemechanics. On-line information transmitted directly to the shift dispatcher. The combined heat and power plant is in 24 hours operation.

At the main facilities, the responsibilities are as follows:

- AGFCP operator controls and prepares data and transmits them to SS CHP dispatching office, and performs day-to-day gas record keeping log;
- Two SS CHP dispatchers control data on CHP unit inputs (gas treatment plant), operational process parameters, and heat power and electrical power output; they perform daily keeping of logs for consumption of fuel, ignition, and surface degasification well gas consumed by AGFCP.
- 110/6.3/6.6 kV operator controls data about amount of electrical power fed into main and received from main and also auxiliary electrical power consumption by the mine.

All information is transferred to SS CHP dispatching office, and is controlled in online mode by shift foreman. Based on information provided by dispatching office, monitoring engineer prepares monthly and annual reports about monitoring of electrical power, gas, heat power and emissions, and provides them to SS CHP Director and PJSC «Shakhta im. O.F.Zasyadka» General Director Deputy. General supervision over monitoring system is carried out by management of Zasyadko Coal Mine according to control and reporting system in place.

Monitoring Dataflow Chart is shown below.

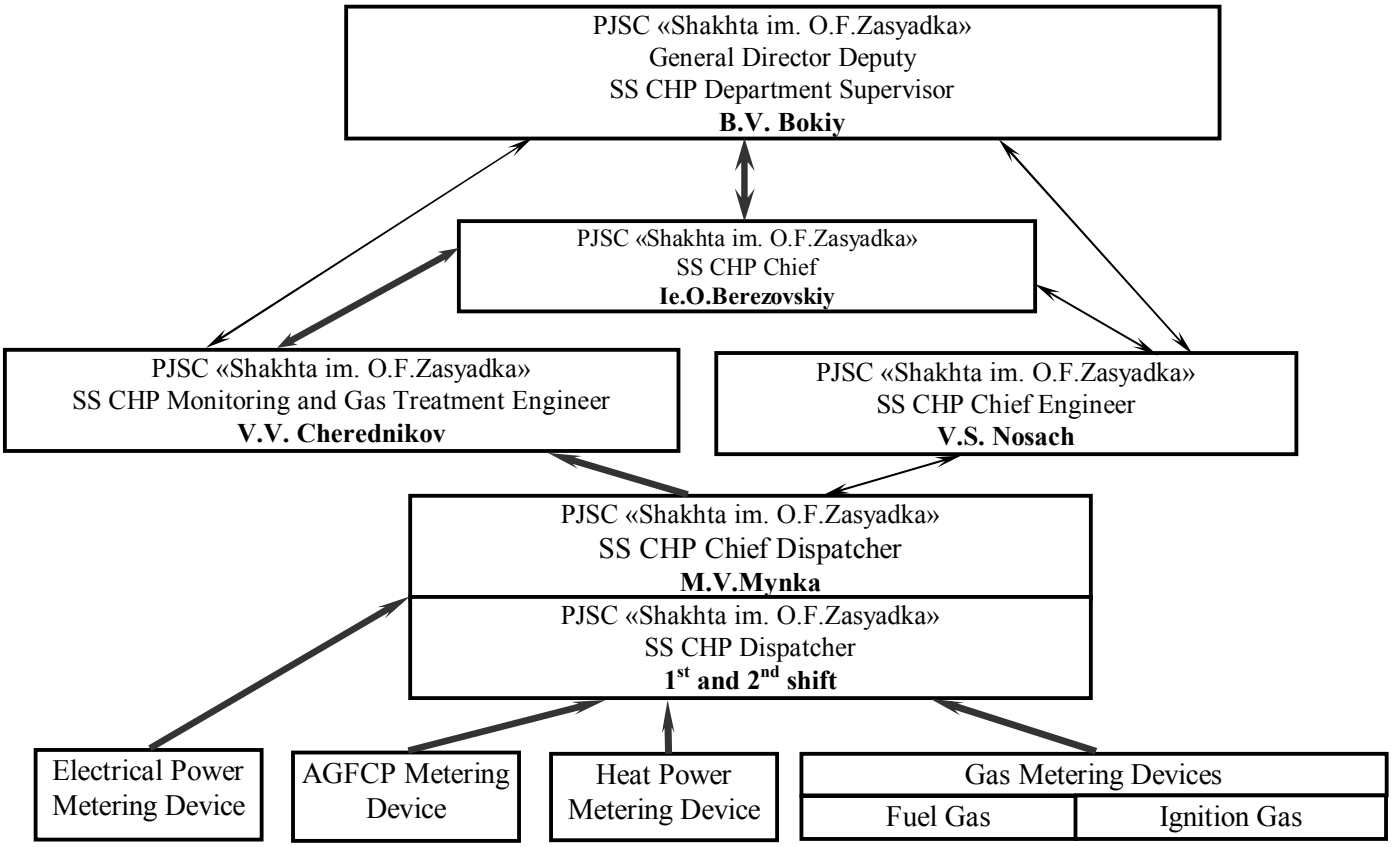


Figure 6. Monitoring Dataflow Chart

C.1.2. Trainings:

GE Jenbacher (Austria) has delivered SS CHP main equipment being CHP units. As specified in the contract, training of staff that operates these units was performed in Austria. GE Jenbacher technicians have performed extra training during installation and commissioning works. Employees in charge for monitoring control have also passed training during installation of the said system.

Extra training is performed during equipment operation. SS CHP and VPS staff training program, as well as emergency training, are submitted as separate document represented as EMISSION MONITORING MANUAL for SS CHP of PJSC «Shakhta im. O.F.Zasyadka» (Manual 4), which also includes structural diagram of technical maintenance provision and state calibration of meters of automated metering system. SS CHP Chief Dispatcher is responsible for training program development. Training programs required approval of SS CHP Director.

Safety measure training is performed once every three months, all employees pass an exam in safety measures once a year. Staff and visitors are provided with individual protection devices for protection from harmful factors of activity.

C.2. Involvement of Third Parties:

The Donetsk Centre for Standardization, Metrology and Certification, Ivano-Frankovsk Centre for Standardization, Metrology and Certification, and Tyumen Centre for Centre for Standardization, Metrology and Certification are Third Parties involved.

C.3. Internal audits and control measures:

Introduction of a modern computerized control system allows for efficient on-line monitoring and reviewing work process performance at the Public Joint-Stock Company «Shakhta im. O.F.Zasyadka» Central Dispatching office (in particular, for fuel and ignition gas consumption, their parameters and electrical power and heat power generated, data can be obtained every 10 seconds if requested). Any considerable deviation of monitored data from given work parameters will be promptly noticed and source of such deviation will be easily identified. In turn, this enables the head of shift to coordinate efficiently the adjustment actions of his shift subordinates including on-duty technical staff that eliminates such deviations and repairs equipment. This system improved operational process and eliminated lacks in control of SS CHP gas consumption.

C.4. Troubleshooting procedures

See C .1.2

In case of a breakdown of CMM supply system (either whole system or separate feeding pipe) methane-air mixture will be urgently released into the atmosphere through the emergency gas vent stack. The shut-off valves will automatically close CMM supply pipes, natural gas will be fed into gas treatment plant and consequently into the inlets of engines and into pre-chambers. As the main gas record blocks (Figure 3) are after the venting stack, only combusted CMM will be accounted for.

SECTION D. Calculation of GHG emission reductions

D.1. Project emissions

The project emissions of the project are given by the following equation. The emissions at capturing and utilization of methane PE_{ME} have not been taken for calculation as the use of electrical power for vacuum pumps is outside the project boundary (see section B.3 of PDD) and the annual electrical power consumption of the gas filling station results in emission below 2,000 tCO_2e.

$$PE_y = PE_{MD} + PE_{UM}, \quad (5.)$$

where:

- PE_y — project emission in year y (tCO_2e)
- PE_{MD} — project emissions from methane destroyed (tCO_2e);
- PE_{UM} — project emissions from un-combusted methane (tCO_2e)

The project emissions from methane destroyed

The project emissions from methane destroyed are given by the equation below. Methane will be destroyed at SS CHP; thus, MD_{ELEC} and MD_{HEAT} are combined into MD_{CHP}. No flaring takes place so $MD_{FL} = 0$.

$$PE_{MD} = (MD_{CHP} + MD_{GAS}) \times (CEF_{CH4} + r \times CEF_{NMHC}), \quad (6.)$$

At $r=PC_{NMHC} / PC_{CH4}$

where:

- PE_{MD} — project emissions from CMM destroyed (tCO_2e);
- MD_{CHP} — methane destroyed in the SS CHP units by generation of heat power and electrical power (tCH_4);
- MD_{GAS} — methane destroyed by the vehicles supplied by the new gas filling stations (tCH_4);
- CEF_{CH4} — carbon emission factor for combusted methane (2.75 tCO2e/tCH_4).
- CEF_{NMHC} — carbon emission factor for combusted non-methane hydrocarbons (the concentration varies, and, therefore, to be obtained through periodical analysis of captured methane) (tCO_2eq/tNMHC)[17];
- r — relative proportion of NMHC compared with methane;
- PC_{CH4} — concentration (in mass) of methane in extracted gas (%);
- PC_{NMHC} — concentration (in mass) of NMHC in extracted gas (%).

The relative proportion of NMHC was monitored, and their concentration is less than 1%. Therefore, NMHC were excluded from calculation. So:

$$PE_{MD} = (MD_{CHP} + MD_{GAS}) \times CEF_{CH4}, \quad (7.)$$

Emissions of SS CHP units

The emissions of SS CHP units are given by following equations:

$$MD_{CHP} = MM_{CHP} \times Eff_{CHP}, \quad (8.)$$

where :

- MD_{CHP} — methane destroyed in the SS CHP at heat power and electrical power generation (tCH_4);
- MM_{CHP} — measured methane consumed by SS CHP units (tCH_4);
- Eff_{CHP} — efficiency of methane destruction/ oxidation at CHP (taken as 99.5% of IPCC).

[17] At the moment, non-methane hydrocarbons are not included in calculation because of concentration less than 1%. Their concentration is checked quarterly with laboratory analyses. In case of concentration more than 1%, it will be considered in calculations.

D.2. Emissions of gas utilization

Some methane will be supplied to the gas filling stations that will supply the vehicles. The emissions as a result are given by the following equations.

$$MD_{GAS} = MM_{GAS} \times Eff_{GAS}, \quad (9.)$$

where:

- MD_{GAS} — methane destroyed by the vehicles supplied by the new AGFCPs (tCH_4);
- MM_{GAS} — methane measured supplied to vehicles supplied by new AGFCPs ($тCH_4$);
- Eff_{GAS} — overall efficiency of methane destruction/ oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user (taken as 98.5% of IPCC).

Emissions from un-combusted methane.

$$PE_{UM} = GWP_{CH4} \times (MM_{CHP} \times (1 - Eff_{CHP}) + MM_{GAS} \times (1 - Eff_{GAS})), \quad (10.)$$

where:

- PE_{UM} — project emissions from un-combusted methane (tCO_2e);
- GWP_{CH4} — global warming potential of methane (21 tCO_2e/tCH_4);
- MM_{CHP} — methane consumed by SS CHP units (tCH_4);
- Eff_{CHP} — efficiency of methane destruction in SS CHP (taken as 99.5% of IPCC);
- MM_{GAS} — methane measured consumed as a fuel for vehicle fuelling at new AGFCPs (tCH_4);
- Eff_{GAS} — efficiency of methane destruction in vehicle usage (taken as 98.5% of IPCC).

D.3.1. Project emissions:

Year	[$тCO_2e$/year]	
Total: 01.06.2011 – 30.04.2012	[$тCO_2e$]	*50 024*

Table 33 Project emissions

D.3.2. Baseline emissions:

The baseline emissions are given by following equation. There is no destruction of methane in baseline scenario at the mine, $BE_{MD,y} = 0$

$$BE_y = BE_{MR,y} + BE_{Use,y}, \quad (11.)$$

where:

- BE_y — baseline emissions in year y (tCO_2e);
- $BE_{MR,y}$ — baseline emissions from release of methane into the atmosphere that are avoided by the project activity in year y (tCO_2e);
- $BE_{Use,y}$ — baseline emissions from the generation of electrical power , heat power replaced by the project activity in year y (tCO_2e).

Baseline emissions of methane avoided by the project activity.

As there is neither CBM (coal bed methane) nor CMM (coal mine methane) at the mine, the emissions equal the amount of post-mining CMM captured in the project activity that is sent to SS CHP and AGFCPs.

$$BE_{MR,y} = GWP_{CH4} \times (CMM_{PJ,CHP,y} + CMM_{PJ,GAS,y}), \quad (12.)$$

where :

- $CMM_{PJ,CHP,y}$ — post-mining CMM captured, sent to and destroyed in the SS CHP in the project activity in year y (tCH_4);

- $CMM_{PJ,GAS,y}$ — pre-mining CMM captured, supplied to the net gas filling stations and destroyed by the vehicles in the project activity in year y (tCH_4);
- GWP_{CH4} — global warming potential for methane (= 21 tCO_2e/tCH_4).

Baseline emissions as result of electrical power and heat power generation, and vehicle fuel by the project activity

As there is only post-mining CMM involved the baseline emissions are giver in the following equation:

$$\boldsymbol{B_{Use,y} = BE_{Use,el,y} + BE_{Use,heat,y} + BE_{Use,gas}}, \qquad (13.)$$

where:

- $BE_{Use,y}$ — potential total baseline emissions from the generation of electrical power , heat power, and vehicle fuels replaced by the project activity in year y (tCO_2);
- $BE_{Use,el,y}$ — total baseline emissions from the generation of electrical power , replaced by the project activity in year y (tCO_2);
- $BE_{Use,heat\ power,y}$ — total baseline emissions from the generation of heat power, replaced by the project activity in year y (tCO_2);
- $BE_{Use,gas}$ — total baseline emissions of vehicle fuels, replaced by the project activity in year y(tCO_2e).

Baseline emissions of replacement of electrical power generation

Baseline emissions of replacement of electrical power generation by the project activity are given by two equations. If net electrical power amount supplied under project by SS CHP is less than total amount of electrical power consumed by the mine for the year, the baseline emissions will be following:

$$\boldsymbol{BE_{Use.el.y} = GEN_{CHP,y} \times EF_{grid,reduced}}, \qquad (14.)$$

If net electrical power amount supplied under project by SS CHP is greater than total amount of electrical power consumed by the mine for the year (i.e. the electrical power will be fed into grid), the baseline emissions will be following:

$$\boldsymbol{BE_{Use,el,y} = (GEN_{CHP,y} - EL_{Consumed,y}) \times EF_{grid,produced,y} + EL_{Consumed,y} \times EF_{grid,reduced,y}}, \qquad (15.)$$

where:

- $BE_{Use,el,y}$ — total baseline emissions from the generation of electrical power , replaced by the project activity in year y (tCO_2);
- $GEN_{CHP,y}$ — net electrical power supplied by the project activity of the SS CHP units (MWh);
- $EF_{grid,produced,y}$ — emission factor of electrical power of replaced grid electrical power generation by the project activity in year y (tCO_2/ MWh);
- $EL_{Consumed,y}$ — net electrical power consumed by mine on-site in year y (MWh);
- $EF_{grid,reduced,y}$ — emissions factor for electrical power of replaced on-site electrical power consumption by the project activity (tCO_2/MWh)

For this monitoring period, the net electrical power supplied under project by SS CHP is less than net electrical power consumed (see section B.1.2). Therefore, formula 14 was used.

Baseline emission of replacement of heat power

Heat Power produced by CHP supplies Vostochnaya site. Baseline emissions are given by following equation:

$$\boldsymbol{BE_{Use,\ Heat,\ y} = HEAT_{cons,\ vost,\ y} \times EF_{Heat,\ vost}}, \qquad (16.)$$

where:

- $HEAT_{cons,vost,y}$ — heat power consumed at Vostochnaya site, supplied by the project activity in year y (GJ);
- $EF_{Heat,vost}$ — emission factor for heat power at Vostochnaya site in the baseline scenario (tCO_2/GJ).

Baseline emissions of replacement of vehicle fuels

The baseline emissions of the replacement of vehicle fuel by the project activity are given by the following equation:

$$BE_{Use.Gas} = VFUEL_y \times EF_v \qquad (17.)$$

where:

- $VFUEL_y$ — vehicle fuel provided by the project activity (GJ);
- EF_v — emission factor for vehicle operation replaced by the project activity (tCO_2/GJ).

Emission factor for vehicle fuels

Emission factor for vehicle fuel is given by following equation:

$$EF_V = \frac{EF_{cos\lambda}}{Eff_V} \times \frac{44}{12} \times \frac{1TJ}{1000GJ} \qquad (18.)$$

where:

- EF_v — emission factor for vehicle fuel replaced by the project activity (tCO2/GJ);
- $EF_{cos\lambda}$ — emission factors for CO_2 four fuels used for vehicle operation replaced by the project activity (tCO_2/GJ);
- Eff_v — efficiency of vehicle motors (%);
- *44/12* — carbon to Carbon Dioxide conversion factor;
- *1/1000* — TJ to GJ conversion factor.

Year	[тCO_2e/year]	
Total: 01.06.2011 – 30.04.2012	[тCO2e]	*461 297*

Table 33. Baseline emissions

D.3.3. Leakages:

Not Applicable

D.3.4. Emission reductions summary in monitoring period:

Year	[тCO_2e/year]	
Total: 01.06.2011 – 30.04.2012	[тCO2e]	*411 273*

Table 34. Emission reductions

Gas sample analysis – 3d quarter 2011[18]

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P.S.Pashkovskiy
First Director Deputy
Science Activity
Dr. Sc.
Respirator MSRI
<signature>
Seal
October 10, 2011

Percentage of matters in samples of gas taken on 19.09.11
at Public Joint-Stock Company «Shakhta im. O.F.Zasyadka»

Main Components	Sampling Point		
	Vacuum Pump Station-1	Vacuum Pump Station -2	
	Second group Longwall 18^{w} seam m_3	First group Longwall 18^{w} seam m_3	Second group Longwall 18^{w} seam m_3
	concentration, %	concentration, %	
Methane CH_4	15,3	15,3	35,8
Ethan C_2H_6	0,05	0,05	0,5
Propane C_3H_8	0,04	0,04	0,04
Butane C_4H_{10}	0,003	0,003	0,004
Pentane C_5H_{12}	0,005	0,005	0,0007
Hexane C_6H_{14}	n/a	n/a	n/a
Carbon Oxide CO	n/a	n/a	n/a
Hydrogen H_2	n/a	n/a	n/a
Carbon Dioxide CO_2	0,07	0,07	0,07
Nitrogen N_2	66,2	66,2	49,2
Oxygen O_2	17,5	17,5	13,8
Argon Ar	0,07	0,07	0,28
Micro-Components*	**mg/m^3**		
Ammonia NH_3	4,7	4,8	4,7
Chlorine Cl_2	n/a	n/a	n/a
Fluorine F_2	n/a	n/a	n/a
hydrogen sulfide H_2S	4,0	5,0	4,0
Sulfide dioxide SO_2	n/a	n/a	n/a
Dust, mg/m^3	<1	<1	<1
Moisture, %	100	100	100

VPS 1 (first group) includes first and VPS 2(second group) set combined in common degasification line.
* re-calculated per dry gas

Analysis results person in charge _____ B.I. Koshovskiy
(signature)

[18] Gas sampling analysis is performed by RESPIRATOR Mining Scientific and Research Institute

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First Director Deputy
Science Activity
Dr. Sc.
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October 10, 2011

Percentage of matters in samples of gas taken on 19.09.11
at Public Joint-Stock Company «Shakhta im. O.F.Zasyadka»

Main components	Fuel Gas, concentration, %	Ignition Gas, concentration, %
Methane CH_4	29,4	97,4
Ethan C_2H_6	0,25	0,62
Propane C_3H_8	0,08	0,08
Butane C_4H_{10}	0,04	0,004
Pentane C_5H_{12}	0,007	0,008
Hexane C_6H_{14}	0,0005	0,0006
Carbon Oxide CO	0,0005	0,008
Hydrogen H_2	0,07	0,06
Carbon Dioxide CO_2	0,03	n/a
Nitrogen N_2	52,2	1,3
Oxygen O_2	16,3	0,9
Argon Ar	0,46	0,32
Micro-Components*	**mg/m^3**	
Ammonia NH_3	3,2	n/a
Chlorine Cl_2	n/a	n/a
Fluorine F_2	n/a	n/a
Hydrogen sulfide H_2S	6,0	n/a
Sulfide dioxide SO_2	n/a	n/a
Dust, mg/m^3	<1	<1
Moisture, %	100	100

* re-calculated per dry gas

Analysis results person in charge _____ B.I. Koshovskiy
(signature)

Gas sample analysis –4th quarter 2011

APPROVED

A.S. Chumak,
Cand. Sc.
Director Deputy, Science,
Respirator MSRI
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Seal
December 22, 2011

Percentage of matters in samples of gas taken on 14.12.11
at Public Joint-Stock Company «Shakhta im. O.F.Zasyadka»

Main Components	Sampling Point		
	Vacuum Pump Station-4		Vacuum Pump Station-2
	First Group 19^0 Longwall seam m_3	Second Group 19^0 Longwall seam m_3	Second Group 18^w Longwall seam m_3
	concentration, %		concentration, %
Methane CH_4	23,8	8,9	20,7
Ethan C_2H_6	0,4	0,29	0,07
Propane C_3H_8	0,07	0,022	0,06
Butane C_4H_{10}	0,006	0,0015	0,007
Pentane C_5H_{12}	0,006	0,008	0,005
Hexane C_6H_{14}	0,0006	0,0007	n/a
Carbon Oxide CO	n/a	n/a	n/a
Hydrogen H_2	n/a	n/a	n/a
Carbon Dioxide CO_2	0,09	0,06	0,07
Nitrogen N_2	61,2	70,8	63,8
Oxygen O_2	13,7	19,1	15,3
Argon Ar	0,05	0,73	0,08
Micro-Components*	mg/m^3		
Ammonia NH_3	n/a	5,0	6,0
Chlorine Cl_2	n/a	n/a	n/a
Fluorine F_2	n/a	n/a	n/a
hydrogen sulfide H_2S	n/a	6,0	8,0
Sulfide dioxide SO_2	n/a	n/a	n/a
Dust, mg/m^3	<1	<1	<1
Moisture, %	100	100	100

VPS-4 — (First Group) combined in common line: degasification + gas suction
VPS-2 — (Second Group) combined in common line: degasification + gas suction
* re-calculated per dry gas

Test conducted by
Engineer, VBEP SHPV[19] _____ O.M. Luganskiy
(signature)

Analysis results person in charge
Lead Scientist, VBEP SHPV, Cand.of.Chem.Sc. _____ B.I. Koshovskiy
(signature)

[19] Department of Breeding Fire Fighting in Mines and Waste Rock Dumps

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A.S. Chumak,
Cand. Sc.
Director Deputy, Science,
Respirator MSRI
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Seal
December 22, 2011

Percentage of matters in samples of gas taken on 14.12.11
at Public Joint-Stock Company «Shakhta im. O.F.Zasyadka»

Main components	Fuel Gas, concentration, %	Ignition Gas, concentration, %
Methane CH_4	29,4	97,4
Ethan C_2H_6	0,25	0,62
Propane C_3H_8	0,08	0,08
Butane C_4H_{10}	0,04	0,004
Pentane C_5H_{12}	0,007	0,008
Hexane C_6H_{14}	0,0005	0,0006
Carbon Oxide CO	0,0005	0,008
Hydrogen H_2	0,07	0,06
Carbon Dioxide CO_2	0,03	n/a
Nitrogen N_2	52,2	1,3
Oxygen O_2	16,3	0,9
Argon Ar	0,46	0,32
Micro-Components*	**mg/m^3**	
Ammonia NH_3	8,0	n/a
Chlorine Cl_2	n/a	n/a
Fluorine F_2	n/a	n/a
Hydrogen sulfide H_2S	7,0	n/a
Sulfide dioxide SO_2	n/a	n/a
Dust, mg/m^3	<1	<1
Moisture, %	100	100

* re-calculated per dry gas

Test conducted by
Engineer, VBEP SHPV _____ O.M. Luganskiy
(signature)

Analysis results person in charge
Lead Scientist, VBEP SHPV, Cand.of.Chem.Sc. _____ B.I. Koshovskiy
(signature)

Gas sample analysis– 1st quarter 2012[20]

Customer: **PJSC«Shakhta im.O.F.Zasyadka»**
Sampling Point: **VPS-4. First Group, 19⁰ Longwall, seam m_3, dd. 14.03.2012**

Results of Laboratory Analysis of Gas Components

Item	Description of Parameters		Content, % vol.
	Component	Sign	
1	2	3	4
1	Helium	He	0,03
2	Hydrogen	H_2	n/a
3	Oxygen	O_2	10,30
4	Nitrogen	N_2	54,3
5	Carbon Dioxide	CO_2	0,09
6	Carbon Monoxide	CO	n/a
7	Methane	CH_4	33,5
8	Ethane	C_2H_6	0,5
9	Propane	C_3H_8	0,07
10	Iso- Butane	i-C_4H_{10}	0,002
11	N- Butane	n-C_4H_{10}	0,004
12	Iso- Pentane	i-C_5H_{12}	0,003
13	N- Pentane	n-C_5H_{12}	0,003
14	Iso- Hexane	i-C_6H_{14}	n/a
15	N- Hexane	n-C_6H_{14}	n/a
16	Heptane	C_7H_{16}	n/a

VPS – 4 (First Group) — combined pipeline: degasification + gas suction

Date of performance: 19.03.2012

Lead Engineer _____ O.O. Kozlitin
(signature)

Head of Central
Geological and Chemical Laboratory _____ T.M. Makeieva
(signature)

[20] Analysis of gas samples performed by CENTRAL GEOLOGICAL AND CHEMICAL LABORATORY (Certificate No. BJI-276/2011 dd. 14.11.2011.)

Customer: **PJSC«Shakhta im.O.F.Zasyadka»**
Sampling Point: **VPS-2. First Group, 18^{w} Longwall, seam m_3, dd. 14.03.2012**

Results of Laboratory Analysis of Gas Components

Item	Description of Parameters		Content, %vol.
	Component	Sign	
1	2	3	4
1	Helium	He	traces
2	Hydrogen	H_2	n/a
3	Oxygen	O_2	16,20
4	Nitrogen	N_2	65,50
5	Carbon Dioxide	CO_2	0,09
6	Carbon Monoxide	CO	n/a
7	Methane	CH_4	17,10
8	Ethane	C_2H_6	0,70
9	Propane	C_3H_8	0,08
10	Iso-Buthane	i-C_4H_{10}	0,002
11	N-Buthane	n-C_4H_{10}	0,003
12	Iso-Penthane	i-C_5H_{12}	0,002
13	N-Penthane	n-C_5H_{12}	0,005
14	Iso-Hexane	i-C_6H_{14}	n/a
15	N-Hexane	n-C_6H_{14}	n/a
16	Heptane	C_7H_{16}	n/a

Date of performance: 19.03.2012

Lead Engineer _____ O.O. Kozlitin
(signature)

Head of Central
Geological and Chemical Laboratory _____ T.M. Makeieva
(signature)

Customer: **PJSC«Shakhta im.O.F.Zasyadka»**
Sampling Point: **SS CHP, Fuel Gas, dd. 14.03.2012**

Results of Laboratory Analysis of Gas Components

Item	Description of Parameters		Content, %vol.
	Component	Sign	
1	2	3	4
1	Helium	He	0,023
2	Hydrogen	H_2	0,06
3	Oxygen	O_2	14,10
4	Nitrogen	N_2	53,50
5	Carbon Dioxide	CO_2	0,05
6	Carbon Monoxide	CO	0,0005
7	Methane	CH_4	31,50
8	Ethane	C_2H_6	0,18
9	Propane	C_3H_8	0,07
10	Iso-Butane	i-C_4H_{10}	0,01
11	N-Butane	n-C_4H_{10}	0,03
12	Iso- Pentane	i-C_5H_{12}	0,002
13	N-Pentane	n-C_5H_{12}	0,004
14	Iso-Hexane	i-C_6H_{14}	0,0003
15	N-Hexane	n-C_6H_{14}	0,0005
16	Heptane	C_7H_{16}	n/a

Date of performance: 19.03.2012

Lead Engineer _____ O.O. Kozlitin
(signature)

Head of Central
Geological and Chemical Laboratory _____ T.M. Makeieva
(signature)

Customer: **PJSC«Shakhta im.O.F.Zasyadka»**
Sampling Point: **SS CHP, Ignition Gas, dd. 14.03.2012**

Results of Laboratory Analysis of Gas Components

Item	Description of Parameters		Content, %vol.
	Component	Sign	
1	2	3	4
1	Helium	He	n/a
2	Hydrogen	H_2	0,06
3	Oxygen	O_2	1,30
4	Nitrogen	N_2	1,90
5	Carbon Dioxide	CO_2	n/a
6	Carbon Monoxide	CO	0,004
7	Methane	CH_4	96,80
8	Ethane	C_2H_6	0,43
9	Propane	C_3H_8	0,05
10	Iso-Butane	i-C_4H_{10}	0,003
11	N-Butane	n-C_4H_{10}	0,005
12	Iso-Pentane	i-C_5H_{12}	0,003
13	N-Pentane	n-C_5H_{12}	0,004
14	Iso-Hexane	i-C_6H_{14}	0,00025
15	N-Hexane	n-C_6H_{14}	0,00030
16	Heptane	C_7H_{16}	n/a

Date of performance: 19.03.2012

Lead Engineer _____ O.O. Kozlitin
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Head of Central
Geological and Chemical Laboratory _____ T.M. Makeieva
(signature)