The chief engineer
JSC "RITEK"

________________ **/A.A. Maslanov/**

"05" ____12____ **2012**

JOINT IMPLEMENTATION PROJECT

3rd MONITORING REPORT

Name of the Project:

Utilization of Associated Petroleum Gas at the Serginskoye Oil Field

Monitoring period: 1 January 2012 to 31 October 2012

Version 2.eng
23 November, 2012

3rd Monitoring report:

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Moscow, 2012

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JI Project Utilization of APG at the Serginskoye Oil Field
3rd Monitoring Report

Introduction

The purpose of this monitoring report is to calculate Greenhouse gas (GHG) emission reductions achieved by the Joint Implementation (JI) project Utilization of Associated petroleum gas (APG) at the Serginskoye oil field, Western Siberia, Russia during the period from 1 January 2012 to 31 October 2012.

3rd monitoring report is developed by specialists of JI working group, confirmed by internal order of JSC RITEK #73 from 05 june 2009. All functions and responsibilities of the JI working group are stated in the "Plan of action of JSC RITEK JI working group" (Annex #4).

1. General project activity information

1.1. Title of the project activity

"Utilization of Associated petroleum gas (APG) at the Serginskoye oil field".

1.2. Short description of the project

The aim of the project is utilization of associated petroleum gas (APG) on the modern power station with gas piston power generation units Cummins QSV 91G with the total installed capacity 7,5 MW (see figure 1) located on Serginskoye oil field (Serginskoye county, Okt'abrsky district, Khanty-Mansijsky autonomous Okrug (KhMAO) - Yugra, Tyumen oblast, 2,100 km from Moscow (see figure 2) with the purpose to supply electric energy for own needs of the oil field.

Figure 1. Project Gas Power Plant (GPP).	**Figure 2. The location of Project.**
	

The main components of the GPP are:

- QSV 91G Cummins gas-reciprocating engines produced by *JSC Zvezda Energetika* (fig.3);
- Stamford HV824C;
- Fuel gas supply system.

Five -18 cylinders, four stroke, high speed gas engines with electric spark ignition have been chosen, in part, because of their tolerance for lower quality APG-fuel and because of low pollutant emissions in the exhaust gas. The fuel gas supply system of the GPP, including gas pipelines (isolated for leakage minimization) and the APG treatment plant, is designed to support normal operation of the power generating units using APG. Each unit is equipped with a device that switches off fuel supply sources in emergency cases. The fuel gas flow rate at 100% load is 293 nm^3/MW per hour. The fuel gas (APG) is taken from the gas pipeline of the APG treatment plant into the engine's gas mixer where air is added. The mix is then transported by pipe into the turbo-blower. Then, the compressed gas-air mixture goes through the cooler into the fuel suction line that distributes the mixture among the engine's cylinders. Design pressure at the fuel supply inlet is 3.5 Bars with temperatures from 10 to 20 degrees Celsius. The fuel used at the GPP is APG that is separated at the booster pumping station. Minimal CH_4 index without decreasing power is 52 %. APG after separation is devided in two flows with one part directed to the GPP and the other flared at the existing stack of the booster pumping station.

Before use in gas-engines, APG must be processed at the treatment plant by:

- □Drying from dropping liquids while being heated up from +10 to +20°C,
- □Reducing pressure from 0,5 MPa to 0,35-0,4 MPa,
- □Gas filtration.

No incremental electric use is needed for gas treatment and transport due to the Project. The pressure at which gas comes into the APG treatment plant is sufficient to push it through the system. Heating of the gas is fully covered through use of waste heat from the gas engines.

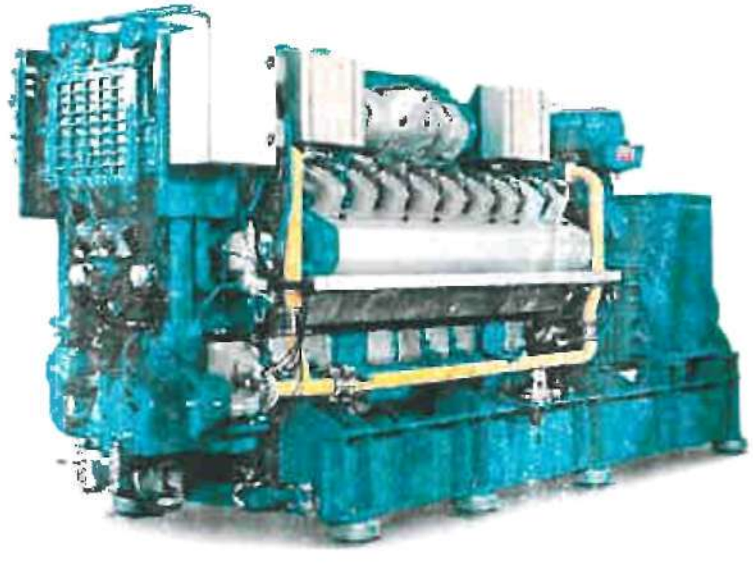


Figure 3. Block of QSV 91G Cummins

Electrical Interconnection Systems

The GPP includes the following electrical equipment:

- 5 generators;

- 6 & 0,4 kV gears;
- 0,4 kV transformers;
- in-house transformer substation with 0.4 kV distributor switch gear (for self consumption).

Delivery of the electricity to power consumers is provided from transforming station, voltage 10 kV. Total annual consumption from the given substation is estimated as 18.300 MWh/year, with presupposed growth up to 39.200 MWh in 2012. Own power consumption of the station is approximately 0,3 GWh/year. Power supply for own needs is provided from external feeders on voltage 360 V. Electricity delivering in external grid metering on transforming station on voltage - 110 kV. Losses connect with transmission by 10 kV cable line taking into account.

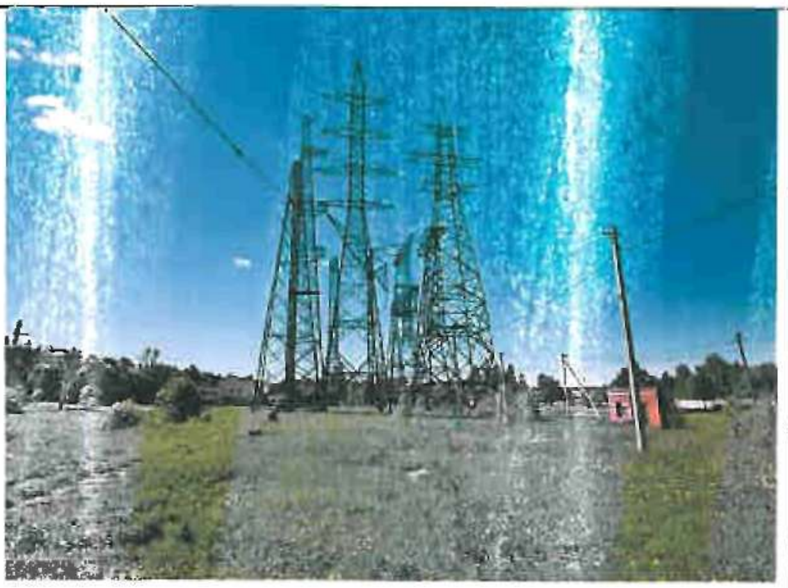
Delivery of the electric power is carried out by 10 kV cables to the related transformers and facilities. The average distance to local consumers 0,2-12 km. In case of emergency switch-off of a gas supply system, or in other cases of absence of gas in APG processing facilities, consumers will be supplied from emergency diesel-generator. Transition to emergency operation of work in GPP occurs in case of critical pressure drop in the gas pipeline.

In case of GPP transition to work the emergency diesel fuel the emissions are calculated according to the actual expense of fuel and nameplate data on received emissions.

As electric power transfer occurs on low voltage grid, it assumes rather high level of losses. The existing national norms (that may be considered obsolete) presume 2% losses for high voltage grids, and 9% losses for low-voltage grids in Russia, regardless of the distance for power transmission. High voltage grids of "Tyumenenergo" presumes 5-6 % losses (depends upon circumstances). Necessary to notice that mentioned figures include also commercial losses. Energy auditing and metrology is necessary for an estimation of practical losses. At the state level works on metrology have started in 2005, and will be possibly finished in 2016. Therefore using the existing norms for the assessment of losses may seem to be the only legitimate way for their estimation.

Besides, as the GPP works in an autonomous mode, the regime of operation of the power facilities may be characterized as (rather) unstable sinusoid mode, that results in is, decrease of cos φ, and in respective growth of losses.

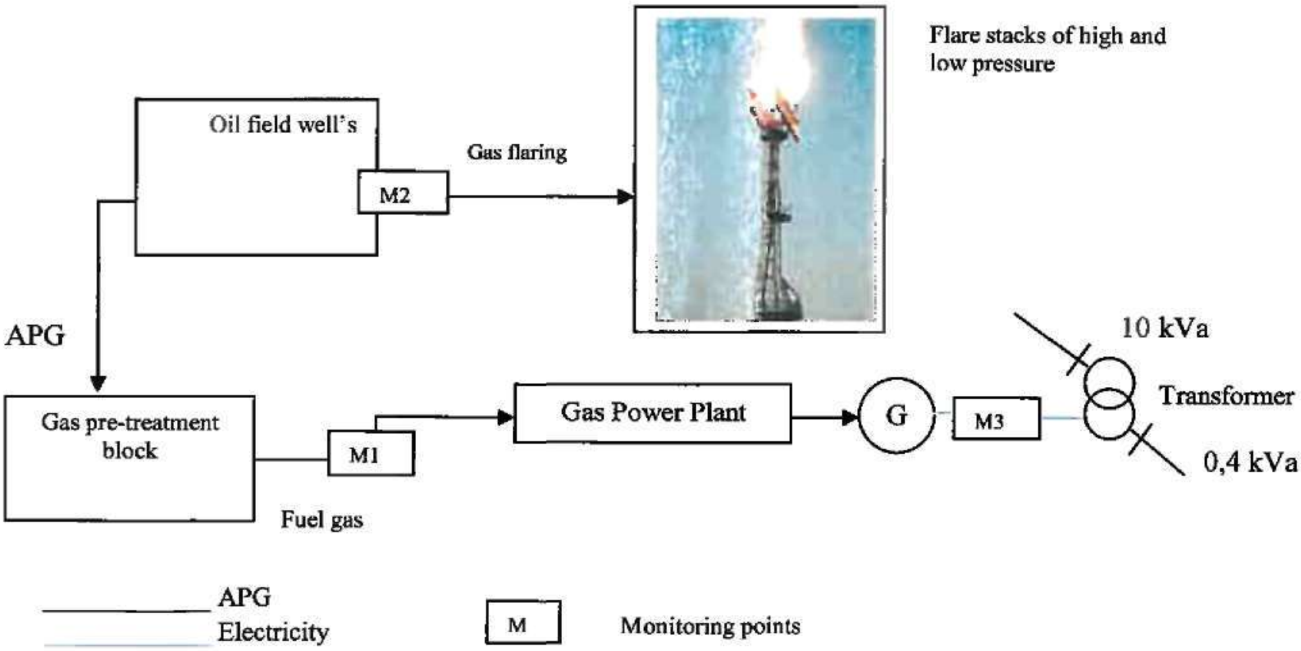
In the absence of the Project, the whole volume of the utilized APG would be flared (Figure 4). Electric energy used for needs of the Serginskoye oil field, would be bought in networks of "Tyumenenergo" (see figure 5).

Figure 4. Associated petroleum gas flaring at Serginskoye oil field.	Figure 5. Networks of "Tyumenenergo"
	

The termination of using the electric energy, produced by "Tyumenenergo" and utilization of APG will result in the GHG emissions reduction during the crediting period (2009-2012) in volume of 107 876 tones of CO2-equivalent.

Actual investment in the Project amounted 6,14 mln euros.

1.3. General scheme of the Project.



1.4. Monitoring period

1 January 2012 – 31 October 2012

1.5. Implementation of the project

Table 1. Main milestones in project implementation

Milestone	Date
UNFCCC JI procedures:	
Project Design Document submitted to Accredited Independent Entity	14 August 2009
Letter of Approval from the Ministry for Economic development of the Russian Federation as a legal and authorised representative of the Government of RF	17 January 2011
Final determination of the JI project	24 January 2011
Construction and operation of gas power station	
Gas power station starts operating	06 April 2009

1.6. JI Project and Monitoring report designers

JI Project Utilization of APG at the Sredne-Khulymsk Oil Field is developed by:

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2. Monitoring activities implemented

2.1. Description of monitoring plan chosen

The Project will contribute to sustainable development of the host country by promoting the utilization of a wasted energy resource and will achieve two goals:

- □Reducing CH4 emissions due to more complete APG combustion in gas engines relative to APG flaring;
- □Substitution of grid power generation to power from GPP with more efficient engine and reduced GHG emissions.

At present, no approved CDM monitoring methodology that would allow estimating CH4 emissions mitigation from APG flaring reduction projects is available. On the other hand, the "Methodology of calculation of emissions of hazardous substances into the atmosphere due to the flaring of the associated petroleum gas at flaring stacks" developed by the Saint-Petersburg Scientific Research Institute for Protection of Atmosphere (NII Atmosfera) endorsed by State Committee for Environmental

Protection (GosKomEcologiya) is designed for practical usage when estimating such emissions during APG flaring. This methodology is widely used by Russian oil and gas sector in calculations of hazardous atmospheric emissions.

Therefore, modalities relating to CH4 emission reductions estimation contained in the methodology of NII "Atmosfera" are used in the monitoring plan of this Project. Estimation of CO2 reductions due to the displacement of electricity generation from grid power plants uses the "Tool to calculate the emission factor for an electricity system" for the calculation of the Combined Margin emission factor on the basis of the Operating and Build Margin factors. Accordingly, the monitoring plan includes the elements of the "Tool to calculate the emission factor for an electricity system" used for the Project:

- □The simple OM emission factors are calculated *ex-ante* using the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission;
- □The Build Margin emission factor is calculated *ex-ante* based on the most recent information available on GPP (technical data) and on plants already built for sample group *m* at the time of PDD submission. The sample group consists of five power plants that have been built most recently.

2.2. Monitoring of environmental impacts of the project.

According to the Order of the State Committee of the Russian Federation for Environmental protection as of 15.05.2000 # 372 "On the approval of the regulations on the assessment of the impact of the planned economic and other activity on the environment of the Russian Federation" the project developers must include in the project documentation the clause on assessment of environmental impact.

On assignment with *RITEK*, a scientific research institute, *NIPIGasPererabotka*, has elaborated the environmental impact assessment (EIA) for the Project.

EIA consists of the following chapters:

- general part;
- physical-geographical characteristics of the Project site;
- characteristics of the Project GPP as a polluting source;
- water disposal and water usage;
- waste management;
- impact on atmospheric air;
- protection and sound management of land;
- scope of environmental protection works;

2.3. Deviation from the Monitoring Plan.

2.3.1. Parameter σCH_4 (total hydrocarbons in CH_4 equivalent) was used for calculation for ERU's in PDD table 11, BE3. This parameter was calculated by means of APG, including the whole number gas hydrocarbons (from methane to octane). Using the sum of hydrocarbons gases equivalent isn't correct, because only methane is GHG. The equation was corrected with adjusted for methane in MR. Final calculation of ERU's based on corrected equation.

2.3.2. Accordingly to the Volume 1, Chapter 7, box 7.2 page 7.6 "2006 IPCC Guidelines for National Greenhouse Gas Inventories" Calculating CO_2 inputs to the atmosphere from emissions of carbon-containing compounds carbon monoxide (CO) emissions will eventually be oxidised to CO_2 in the atmosphere. These CO_2 inputs could be included in national inventories. They can be calculated from emissions of CO. Thus, this specification to be reflected in calculation in equation BE4 positions 6 and 10. Value of positions 6 and 10 goes to zero. Final calculation of ERU's based on corrected BE4 equation.

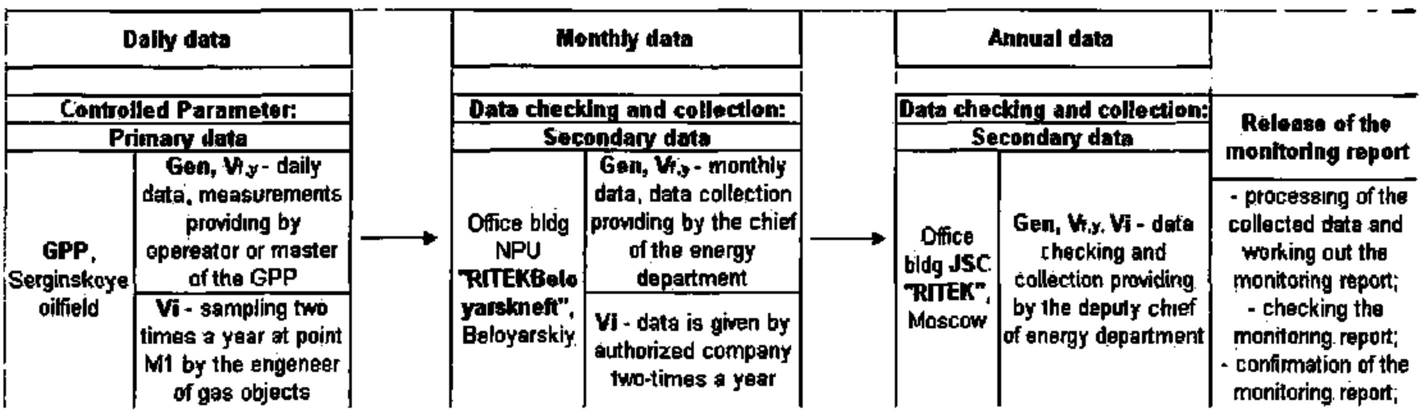
2.3.3. Transmission loss in high-voltage grid stated at PDD as a coefficient 1,053. It is stated as a most conservative volume. For the displacement the calculation of this coefficient for the present MR we use the same conservative coefficient.

2.3.4. Monitoring plan, stated in section D PDD "Utilization of Associated petroleum gas (APG) at the Sergino oilfield", defines the frequency of APG sampling as twelve times a year. APG componental structure analyses were carried out once a year. To proof of stability of structure of APG in Table 4 cited the data of structure of APG at 2011 year.

The calculations of ERU's were carried out with three figures of componental structure of APG (2011 and 2012) and given to the verifier. For the present Monitoring Report we use the most conservative result.

2.4. Data collection

2.4.1. Algorithm of data collection



2.4.2. Fixed values

Table 1.

Parameter	Default value	Description
EF	0,522 tCO2/MWh	Emission factor for grid connected plants

The calculation of Emission factor for grid connected plants are executed at Annex #2 for PDD Utilization of APG at Serginskoye oilfield. Calculation estimated according to the "Tool to calculate the emission factor for an electricity system" taken as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors. Calculation for this combined margin is based on the study and data on Tyumen power system provided by the Energy Scientific Research Institute named after G.M. Krzhizhanovskiy (OAO "ENIN") and the calculation was performed for 2004 for RAO "UES". In frameworks of preparing "Energy Strategy Development until 2015", According to ENIN, Tyumen power grid is assumed to be a largely separable entity.

2.4.3. Data for calculation

All measurements are executed automatically by means of the checked devices according to the Monitoring plan, stated in section D PDD "Utilization of Associated petroleum gas (APG) at the Serginskoye oil field".

Collecting and archiving of all measurements are executed by qualified personal of TPP «RITEKBeloyarskneft» according to the internal order about appointment of responsible persons in directions (Annex №3).

All data is presented in an electronic and paper kind on object GPP Serginskoye oilfield, and also in office building TPP «RITEKBeloyarskneft» (Beloyarsk).

2.4.4. Using the IT technology at the data collection

At the GPP level, the shift operators will be responsible, on day-to-day basis for monitoring the variables, including taking the readings from electricity meters, APG flow meters and the fuel tank contents and deliveries. The monitoring and reporting of most of these data (volume, capacity and electricity flows) has been already adopted under the routine operation regime of the GPP.

On the basis of the received daily data from the electricity meters of GPP operators enters figures to the spreadsheets in the Microsoft Excel program. The operator will transfer them via the internet to the Energy Department in the office bldg TPP «RITEKBeloyarskneft».

At the TPP «RITEKBeloyarskneft» the head of the energy department checks and processes the daily data received from operator of GPP of Serginskoye oilfield to the monthly and annual reports. These reports are:

- saved on the computers at the Energy department;
- printed and archived in paper kind at the Energy department and GPP of Serginskoye oilfield:

- sent by internal e-mail with the protected channel to the head office of JSC RITEK in the Energy Department.

At the head office of JSC RITEK all received reports take place in limited access at the public directory. All interested persons have access, protected by password, for reports to check and verify it. Verified reports will be saved at the server of JSC RITEK until 2015 year.

After the internal verification of received reports, annual data is entered into the program for calculation ERU's. This program is developed on base of Monitoring plan (PDD section D). Microsoft Excel program will make the necessary calculations with the use of formulas.

Table 2. Information on key parameter monitored

Data/Parameter	Gen
Data unit	MWh
Description	Electricity supply to consumers at Serginskoye oil-field on voltage 10 kV, and electricity supplied for self consumption 0,4 kV.
Time of determination/monitoring	Monthly
Source of data (to be) used	Electric meters **«СЭТ 4ТМ»**
Value of data applied (for ex ante calculations/determination)	MWh, shown below in Table 3
Justification of the choice of data or description of the measurement methods and procedures to be applied	Electric meters are installed at the 10 kV (0,4 kV) in-door switch gears, data will be archived electronically and in monitoring workbook.
QA/QC procedures (to be) applied	**QA**: measurements from the electricity meters is screened on monitors at the operator's desk; readings are taken by the trained staff according to the requirements of the technical specifications; **QC**: periodic calibration by the regional representatives of the State Office for Metrology and Standardization
Any comment	-
Data/Parameter	Vi
Data unit	%
Description	Composition of recovered gas measured at point M1, after pretreatment, during the period .
Time of determination/monitoring	Once a month (table 4 below)
Source of data (to be) used	Measurement providing by authorized company with the license for the given kind of activity. Uncertainty level of data – 0,5%
Value of data applied (for ex ante calculations/determination)	Vi shown below in Table 4
Justification of the choice of data or description of the measurement methods and procedures to be applied	By authorized company at the junction point and at exit from KONGV pre-treatment two-times a year figures (winter and summer season). The structure of APG will be used for calculation, that will allow to receive the most conservative result.
QA/QC procedures (to be) applied	**QA**: measurements are taken by the trained staff according to the requirements of the technical specifications; **QC**: periodic calibration by the regional representatives of State Office for Metrology and Standardization
Any comment	M APG and density calculating on the base of available APG composition.
Data/Parameter	$V_{F,y}$
Data unit	Nm^3
Description	Volume of the total recovered gas measured at points M1, during the period *y*

Time of determination/monitoring	Monthly (table 5 below)
Source of data (to be) used	Flow-meters – "ИРВИС-РС4», DYMETIC 9421
Value of data applied (for ex ante calculations/determination)	Nm3, shown below in Table 5
Justification of the choice of data or description of the measurement methods and procedures to be applied	Measurements effectively show volume of APG that would be flared in frames of baseline. It is typical procedure using for settlements between Project's owner GPP's exploiting company (Zvezda Energetika).
QA/QC procedures (to be) applied	Volume of APG will be completely metered with regular calibration of metering equipment. The measured volume should be converted to the volume at normal temperature and pressure using the temperature and pressure at the time to measurement.
Any comment	-

Table 3. Data on electricity supplied by GPP to the consumers at Serginskoye oil-field in 2011:

Month	**Electricity supply to consumers at *Serginskoye* oil-field, MWh**
January	**2 176,403**
February	**2 002,890**
March	**1 967,330**
April	**1 947,690**
May	**1 731,780**
June	**1 539,580**
July	**1 634,170**
August	**1 657,880**
September	**1 694,600**
October	**1 983,870**
Total over the monitoring period	**18 336,193**

Table 4. The componental structure of APG, used for electricity development at GPP Serginskoye Oil Field

Component	***1***	***2***	***3***	***Value used in calc.***
N_2	1,62	1,74	1,44	1,44
CO_2	1,19	1,292	1,28	1,28
CH_4	83,95	81,91	81,93	81,93
C_2H_6	3,25	3,31	3,36	3,36
C_3H_8	5,16	5,73	5,77	5,77
nC_4H_{10}	1,45	1,80	1,85	1,85
iC_4H_{10}	2,29	2,75	2,77	2,77

nC_5H_{12}	0,31	0,42	0,47	0,47
iC_5H_{12}	0,47	0,63	0,67	0,67
C_6H_{14}	0,21	0,30	0,33	0,33
C_7H_{16}	0,08	0,01	0,11	0,11
C_8H_{18}	0,02	0,02	0,02	0,02

Table 5. Volume of the total recovered gas measured, after pretreatment, during the monitoring period.

Month	***Volume of the total recovered APG, mln. Nm3***
January	0,681
February	0,650
March	0,675
April	0,762
May	0,787
June	0,786
July	0,799
August	0,800
September	0,787
October	0,800
Total over the monitoring period	**7,526**

2.4.5. Description of formulae used to estimate project emissions

The equations used to calculate Project emissions are summarized in Table 6 below.

The project uses the approach from the previously approved CDM methodology AM0009 version 3 and assumes full oxidization.

*PE,y = (Vy*Py) * Wcarbon,A,y *44/12 (PE1)*

where:

PE,y - the baseline emissions during the period y in tons of CO2 equivalents.

Vy - volume of gas recovered from the oil field during the period *y*, explicated in (000) nm3.

Py - density of APG, kg/ncm (c.2 BE1).

Wcarbon,A,y - the average content of carbon in the gas recovered during the period y.

The carbon content in the gas $W_{carbon,A,y}$ is determined from Table 7, 1.

Table 6:

1. **Project emissions calculation equations**

PE1	1	2 from 9, BE1	3	4	5	6=1*2*3*4/5
	Mass amount of APG flared	Carbon mass fraction in APG		Molecular mass of CO2	Molecular mass of C	Total CO2 emissions project
	M APG	σ c_APG	scalar	μ CO2	μ C	ECO2_combustion project
unit	t	% mass		kgCO2/mole	Kg C/kg mole	tCO2e
	7 254,714	74,733	0,01	44,011	12,011	19 866

Thus, total project emissions 19 866 tCO2e/01-10.2012 year.

As explained in PDD Section B.2, emissions based on leakages and/or accidents are likely to be greater in the baseline delivery of APG to the flare than they will be in the operation of the new GPP. Therefore, potential leaks and accident emissions in the Project scenario have been ignored to assure that the emission reduction estimates are based on conservative assumptions.

2.4.6. Description of formulae used to estimate baseline

Baseline emissions at the Serginkoye flare are calculated using equations *BE2* through *BE6* below in combination with *BE1* as shown in Table 7.

Columns (6) in equation *BE4* and column (1) in equation *BE3* are parameters that are specified in the Rosgidromet methodology for calculating emissions from flaring of APG in Russia. The factors shown assume that the Serginskoye flare will continue to operate in black-firing mode. The monitoring plan addresses the photo evidence that will support this assumption going forward. The key input parameters for present monitoring report are volume of APG used by the GPP (column (1) in equation BE5, the density of that APG and the volumetric composition of the APG.

Table 7: Equations for local baseline emissions at the APG flare

1. **Calculation of mass fraction of APG components**

BE1		1	2	3	4	5	6	7	8=1*5/100	9=6*7	10=7*3/miCH4	11	12=11*7
	index	Vi	Py	mi	μi	ki	σc-i	σi	k APG	σc_APG	σ CH4	σн-i	σн_APG
		Volume fraction, weighted average of monitored	Density of hydrocarbons and elements	Molecular mass of components	Molecular mass of i-compnent in APG	Adiabatic index of i-component of APG	Mass content of carbon of i-compnent in APG	Mass ratio	Adiabatic index of APG	Mass fraction of Carbon in APG	Hydrocarbons in CH4 equivalent	Mass content of Hydrogen of i-component in APG	Mass fraction of Hydrogen in APG
unit		%	Py, kg/ncm	Mi	kg/mole	μi	% масс	%				% масс	
	CH_4	81,930	0,716	16,043	13,144	1,31	74,87	0,6086	1,0733	45,5634	0,608566	25,13	15,2933
	C_2H_6	3,360	1,342	30,07	1,010	1,21	79,89	0,0468	0,0407	3,7413	0,087678	20,02	0,9365
	C_3H_8	5,770	1,969	44,097	2,544	1,13	81,71	0,1179	0,0652	9,6305	0,323964	18,29	2,1557
	nC_4H_{10}	1,850	2,595	58,124	1,075	1,1	82,66	0,0498	0,0204	4,1168	0,180439	17,34	0,8636
	iC_4H_{10}	2,770	2,595	58,124	1,610	1,1	82,66	0,0746	0,0305	6,1640	0,270171	17,34	1,2931
	nC_5H_{12}	0,470	3,221	72,151	0,339	1,08	83,24	0,0157	0,0051	1,3073	0,070631	16,76	0,2632
	iC_5H_{12}	0,670	3,221	72,151	0,483	1,08	83,24	0,0224	0,0072	1,8636	0,100687	16,76	0,3752
	C_6H_{14}	0,330	3,842	86,066	0,284	1,07	83,73	0,0132	0,0035	1,1013	0,070562	16,27	0,2140
	C_7H_{16}	0,110	4,468	100,08	0,110	1,06	84,01	0,0051	0,0012	0,4283	0,031807	15,99	0,0815
	C_8H_{18}	0,020	6,230	114,23	0,023	1,05	84,12	0,0013	0,0002	0,1089	0,009204	15,79	0,0204
	CO_2	1,280	1,965	44,011	0,563	1,3	27,29	0,0261	0,0166	0,7121	xxxxxxxxxxx	0	0,0000
	N_2	1,440	1,251	28,016	0,403	1,4			0,0202		1,753710	0	0,0000
	Total	100,000			21,590			0,9813	1,2840	74,7374			21,4965
			0,9639										

2. Quantity of carbon atoms in molecular formula of APG

BE2	1 from 9, BE1	2 from 4, BE1	3	4	5=(1*3/4)*2
	Mass fraction of Carbon in APG	Molecular mass of APG		Molecular mass of carbon	Quan. of carbon atoms in molecular APG
	σ c_APG	µ APG		µ c	Kc
units	% mass	kg/mole	Scalar	kg/mole	carbon atoms
	74,7374	21,590	0,01	12,0110	1,343

3. CH_4 emission factor for APG flaring

BE3	1	2 from L17, BE1	3=1*2	4 from L6, BE1	5=1*4
	Under firing coefficient	σ CH4 $_{equivalent}$	e CH4_baseline	σ GHG CH_4	GHG CH4_baseline
		Total hydrocarbons in CH4 equivalent	CH4 equivalent emission factor_baseline	Total hydrocarbons in GHG CH4	Mass fraction of CH4
units	scalar	% mass	Kg CH4/kg APG	% mass	Kg CH4/kg APG
	0,035	1,754	0,0614	0,609	0,0213

4. CO_2 emission factor for APG flaring

BE4	1	2 form 5, BE2	3 from 4, BE1	4 from 3, BE3	5	6	7	8=2/3	9=4/5	10=6/7	11=1*(8-9-10)
	Molecular mass of CO2	Quan. of carbon atoms in molecular APG	Molecular mass of APG	CH4 equivalent emission factor_baseline	Molecular mass of CH4	CO emission factor_baseline (black firing)	Molecular mass of CO	C emission factor_baseline	Molecular mass of CH4 equivalent	Molecular mass of CO in APG	CO2 emission factor based on methane equivalent
	µ CO2	Kc	µ APG	e CH4_baseline	µ CH_4	e CO_baseline	µ CO	e C_baseline			e CO2
Units	kgCO2/mole	Carbon atoms	kg APG/mole	Kg CH4/kg APG	Kg CH4/kg mole	Kg CO/kg APG	kgCO/mole APG		Kg CH4/mole APG	Kg CO / mole APG	Kg CO2/kg APG
	44,011	1,343	21,590	0,0614	16,043	0	28	0,0622	0,0038	0,0000	2,5702

5. Mass amount of APG flared

BE5	1	2 form 2, BE1	3=1*2
	Annual volumetric flow of APG to be flared	Density of APG	Mass amount of APG flared
	V_{APG}	ρ_{APG}	M_{APG}
units	ncm (1000)	kg/nCM	t
	7 526,141	0,964	7 254,714

6. Total emissions from APG flare

BE6	1 from 3, BE5	2 from 11, BE4	3 from 5, BE3	4	5=1*2	6=1*3*4	7=5+6
	Mass amount of APG flared	CO2 emission factor_baseline	CH4 emission factor_baseline	CH4 global warming potential	CO2 emissions from complete burning	Total GHG CH4 emissions in terms of tCO2e	Total CO2 emissions from APG flaring
	M_{APG}	$e_{CO2\_baseline}$	$e_{CH4\_baseline}$	GWP_{CH4}	$E_{CO2\ complete\ baseline}$	$E_{CH_4\ baseline}$	$E_{CO2e\ flaring\ baseline}$
Units	t	Kg CO2/kg APG	Kg CH4/kg APG	scalar	tCO2e	tCO2	tCO2
	7 254,714	2,5700	0,0213	21	18 644	3 245	21 890

The second major component of baseline emissions is the GHG to be released by grid power plants in course of generating power equal to the power amount to be generated by the GPP within the Project. Table 12 shows equation *(BE8)* that used to calculate baseline emissions from grid power plants.

That includes step up transformation from generation voltage, line losses and step down transformation to the delivery points. Grid plant input to the delivery system represents net output of the grid plants. Gross generation determines the actual fuel consumption. Current data shows that gross generation exceed net generation in the Tyumen grid by a factor of 1.053.

The grid emission factor is developed in Annex 2 using "Tool to calculate the emission factor for an electricity system". The operating margin and build margin emission factors are very similar since the gas plants serving this region are all fired with gas or APG and operate at similar efficiencies. New plants in this area, if any, will almost certainly use natural gas. A simple average of the OM and BM has been used.

The Table 8 combines local and grid power plants fuel consumption and emissions to calculate the total annual *ex-ante* estimate of baseline emissions.

Table 8: Baseline grid power plants emission equations electricity generation, and total baseline emission

1. **Electricity generation by GPP**

2. Electricity generation by GPP

	1	2	3	4	5=3*4
PE2	Electricity supplied by GPP to the consumers of oilfield	Transmission loss in high-voltage grid	Displacement of gross grid generation	Margin emission factor	Total CO2 emeission grid
	Elec_gen1	*trans loss*	*Gross disp*	*EF CM*	*ECO2_grid*
Units	MWh		MWh	tCO2/MWh	tCO2
	18 336,193	0,053	19 308,011	0,522	10 079

2. **Gross grid baseline emissions**

	1	2	3=1+2
PE3	Total CO2 emissions from APG flaring	Total CO2 emeission grid	Total baseline emissions
	E CO2e flaring baseline	*ECO2_grid*	*ECO2e_total_baseline*
Units	tCO2	tCO2	tCO2
	21 890	10 079	31 968

2.4.7. Treatment of leakage in the monitoring plan:

No leakages were identified that correspond to net changes of emissions which occur outside the project boundary and are measurable and attributable to the Project activity. (Gas pipeline from oil field to pre-treatment block is about 1 km, and has doubled insulation). Emissions related to the supply of fuel for the emergency diesel unit and the emissions from installing the new equipment will not be significant. Much greater emissions could be associated with delivery of gas to grid power plants situated in region (Surgut), which does not occur in the Project that presumes local on-site power generation and consumption. Therefore, the exclusion of leakages from the Project will assure conservatism in the estimation of emission reductions within the Project.

2.4.8. Description of formulae used to estimate emission reductions for the project.

Ex ante estimates of the total annual emission reductions for the Project have been derived in equation *PE4* as a difference between the total baseline emissions estimated by equation *PE3* in Table 8 and total Project emissions estimated by equation *PE1* in Table 6.

Table 9: Emission reductions

PE4	1 from 3, PE6	2 from 6, PE1	3=1-2
	Total baseline emissions	Total CO2 emissions project	Total emissions reduction
	ECO2e_total_baseline	*ECO2_combustion project*	*ER CO2e_total*
Units	tCO2	tCO2e	tCO2e
	31 968	19 866	12 102

Thus, the replacement of electric grid capacities by the production of electric energy on APG will r esult in the GHG emissions reduction during the monitoring period in volume of 12 102 tonnes of CO2-equivavlent.