JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

>>
Associated petroleum gas flaring reduction and electricity generation at the Khasyrey oil field.

Sectoral scope(es): 1, 10
Version 05 of August 5, 2009

A.2. Description of the project:

>>
The project stipulates the utilization of associated petroleum gas (APG), which would otherwise be flared, to produce electric power at new 33 MW Gas Power Center installed at Khasyrey oil field, located on Gamburtsev Swell in the Nenets Autonomous Okrug (area).

Fig. A.2.1. Khasyrey Gas Power Center

The company "RN-Severnaya Neft" LLC (hereinafter referred to as the "Company"), owned by the OJSC "Oil Company Rosneft", is the operator of Gamburtsev swell oil fields. At the same time, this company is the operator of the Project. Two gas turbine units (GTU) of 4.7 MW each and three GTU of 7.9 MW each are already operational within the Project. Generated electric power is being provided to the booster pump stations (BPS) and oil production facilities, located in the oil fields of Gamburtsev Swell (including Khasyrey, Nyadeyu and Cherpayu oil fields) and thereby substitutes the electric power, which would otherwise be produced by local diesel power plants.

Situation existing prior to the starting date of the project.

Severnaya Neft began the development of these remote oil fields in 2001, when these fields had not been yet owned by the OJSC "Rosneft". Since the fields are located remotely from the mainland (above the Arctic Circle), they can not be supplied with electric power from centralized power grid. The traditional solution, which has passed down from Soviet times foresses the using of local diesel power plants (DPP). The first 11 (eleven) local power plants with a total capacity of 9.5 MW installed in the given three oil fields ran on diesel fuel. The Company has developed an efficient system of logistic, which allows supply of diesel fuel to their facilities on an ongoing basis and without fail. Diesel is supplied from the refinery situated in 350 km, in the Baganskoye town as well as from the Kuibyshev refinery, which is also owned by the OJSC "Oil Company Rosneft". Diesel fuel was transported by fuel trucks 24 hours a day on winter roads. The oil fields are equipped with reservoirs with a capacity sufficient to meet their needs in summer period (from May till December), when diesel fuel can not be conveyed to oil fields.

Associated petroleum gas (APG) is released in the process of oil separation at Khasyrey booster pump station (BPS) located nearby Power Center. Prior to the Project activity all APG except small part used for own needs (for heating of the oil separation complex and buildings at Khasyrey site) had been burned in flare stacks of Khasyrey BPS. That caused emissions of carbon dioxide and methane (because of incomplete combustion of APG). Before the implementation of the Project, the Company has never used APG to produce electric power.

Baseline scenario.

As oil production at Gamburtsev fields develops, demand for electric power grows too. This demand is projected to approach the maximum of 26 MW in 2011.

Table A2.1 Demand for electric power in Gamburtsev oil fields

Khasyrey	Cherpayu	Nyadeyu	Total
13 MW	8 MW	5 MW	26 MW

To meet this demand, the Company would be forced, in the absence of the project activity, to increase on-site diesel generating capacities at Gamburtsev Swell fields with the respective increase of the capacity of the diesel fuel reservoirs. The APG which in the project scenario is consumed by the turbines of Khasyrey power center would be flared together with other APG separated from the oil in Khasyrey BPS (consumption for own needs both in the project scenario and in the baseline scenario remains equial).

Project scenario

Being of possession of a smoothly running system of diesel supply, which would allow developing power supply system by means of introducing new local DPPs, the Company took decision to install new gas turbine units (GTUs) fuelled by associated petroleum gas in Khasyrey oil field. They are intended to supply power in a centralized way to all the three Gamburtsev oil fields. One of the main objectives of the Project is to cut greenhouse gas emissions, which comply with the clauses of Kyoto Protocol. This fact has been reflected in the technical documentation, prepared for the Project in 2004[1].

The commissioning of GTU is scheduled as follows:

1 phase: GTU №1 «Typhoon» – 11.2005.
GTU №2 «Typhoon» – 11.2005.

2 phase: GTU №3 «Tempest» – 09.2006.
GTU №4 «Tempest» – 06.2007.

3 phase: GTU №5 «Tempest» – 01.2009

[1] Annex 5 of this PDD contains the extract from description part of technical documentation developed for this project that holds a notion of adherence to Kyoto Protocol requirements/

In 2009, total installed capacity of Khasyrey Power Center will be amounting to 33 MW. Taking into account the necessity to have stand-by capacity a 26 MW can be actually provided to electric power system of Gamburtsev Swell. Electric power will be dispatched to oil fields through switch gear devices of 6/6.3 kV (for supplying facilities at Khasyrey oil fields) and of 6/35 kV (for supplying Cherpayu and Nyadeyu oil fields). Transmission will be made via lines built under the given Project.

The customers of electric power are facilities of oil lifting, treatment and transportation, as well as the systems intended to sustain seam pressure, which requires continuous around-the-clock delivery of electricity.

In the period of 2008-2012 Khasyrey Power Center will supply on the average about 165 GWh of electric power per year through the local isolated electrical network.

Table A2.2 Electric power provided to the oil fields of Gamburtsev Swell.[2]

Parameter	Unit	2006	2007	2008	2009	2010	2011	2012
Electric power produced by on-site DPPs	GWh	33	14	3				
Electric power produced by Khasyrey Power Center	GWh	77	132	176	162	163	200	198

During initial stages of the Project (2006-2007), Power Center operated concurrently with diesel-generators. After the fourth turbine has been commissioned, diesel-generators were shut off and switched to standby/emergency mode.

The data concerning the utilization of APG in Khasyrey oil field are summarized in the following table:

Table A.2.3. Utilization of APG in Khasyrey oil field[3]

Khasyreyskoye oil field	**Factual**			**Expected**	**Expected according to the Business Plan**				
Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013
APG used, mln. m3:	**106**	**148**	**204**	**160**	**161**	**160**	**168**	**168**	**168**
- own needs	72	101	106	88	89	89	89	89	89
- Khasyrey Power Center	34	47	108	73	72	71	79	79	79

According to the estimates made by the specialists of the “RN-Severnaya Neft” LLC, APG reserves and production will be decreasing since 2011. To meet the demand of Khasyrey Power Center for gas fuel in the period of 2011-2012 and onward the gas pipelines are planned to be constructed for supply of APG

[2] Information source: «RN-Severnaya Neft» LLC

[3] Source: Forecast for APG balance in Khasyrey oil field. «RN-Severnaya Neft» LLC November 20, 2008

from Nyadeyu and Cherpayu oil fields. It should be noted that the forecast of APG reserves made in 2005 provided for APG shortage after the year 2012[4].

The Project will result in the useful utilization of APG, which would otherwise be flared. This will reduce CO_2 and CH_4 emissions from two sources:

- CO_2 emissions from diesel fuel combustion will be prevented due to displacement of electricity generated by on-site diesel power plants under the baseline scenario by electricity produced by the APG-fired Power Center under the Project.

- Local emissions of CH_4 will be reduced due to the more complete/efficient combustion of APG in gas turbines as compared with that in flares.

Estimated reductions of GHG emissions amount to 165 thousand tonnes of CO_2 equivalent, in the period 2006-2007 and 711 thousand tonnes of CO_2 equivalent in the period 2008-2012.

List of abbreviations used in this PDD:

ACS	- Automatic Control System
APG	- Associated petroleum gas
BL	- Baseline scenario
BPS	- Booster pump station
CO_2	- Carbon dioxide
CH_4	- Methane
DF	- Diesel fuel
DPP	- Diesel power plant
ERU	- Emission reduction unit
F	- Flare
GTU	- Gas turbine unit
PTL	- Power transmission line
PJ	- Project
Ref.	- Refinery
VER	- Voluntary emission reductions

A.3. Project participants:

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Table A3.1. Project participants

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Russian Federation (Host Country)	OJSC "Rosneft"	No
Netherlands	Carbon Trade and Finance SICAR S.A.	No

[4]Technical project. Construction of gas turbine electric power station of Power Center at BPS Khasyrey. Volume1. Section. 1.5. Data on raw materials, fuel demand. ©ILF Rusland, 2005

The OJSC "Oil Company Rosneft" is the leader of the Russian petroleum industry, and ranks among the world's top publicly traded oil and gas companies. The Company is primarily engaged in hydrocarbon exploration and production, production of petroleum products and petrochemicals and marketing of these outputs. In 2007 the Rosneft Company was included in the Russian Government's List of Strategic Enterprises and Organizations. The state holds a little over 75% in the Company, while approximately 15% of shares are free-floated.

The Rosneft Company performs large-scale exploration and production activities in all key hydrocarbon rich regions of Russia — West Siberia, Southern and Central Russia, Timano-Pechora, East Siberia, and the Far East. In addition, the Company participates in several exploration projects in Kazakhstan, Algeria, and Turkmenistan. The Rosneft Company's seven major refineries enjoy convenient locations throughout the country, from the Black Sea coast to the Russian Far East, while the Company's retail network covers 36 regions of the Russian Federation[5].

The main oil production unit of the Rosneft Company in Timano-Pechora basin is the "RN-Severnaya Neft" LLC. The Rosneft Company acquired a 100% stake of this Company in June 2003. At present, it constitutes an inherent part of the main production base of the Company.

The "RN-Severnaya Neft" LLC is the operator of development and oil production in 17 oil fields of Timano-Pechora oil-and-gas province. The resource base of the "Severnaya Neft" LLC is highly concentrated: 70% proven oil reserves account for only 2 groups of oil fields: Baganskoye (Baganskoye, South-Baganskoye and North-Baganskoye) and the group of oil fields of Gamburtsev Swell (Nyadeyuskoye, Khasyreyskoye и Cherpayuskoye). The "RN-Severnaya Neft" LLC accounts for 3% of proven oil reserves of the OJSC "Rosneft".

Presently 11 out of 17 oil fields of the Company are operational. As of 2007 the "RN-Severnaya Neft" LLC contributed 5.6% of the total oil production of the OJSC "Oil Company Rosneft" (including the share in production of subsidiary companies). The "RN-Severnaya Neft" LLC is mainly involved in the development of three oil fields of Gamburtsev Swell, where the average output of wells amounts to 160 t (1,170 barrels) per day, which is considerably higher than average indexes in Russia.

In 2006 the Rosneft Company won an auction of the mineral license to the Osoveisky block, which is located in close proximity to the Gamburtsev oil fields. The OJSC "Oil Company Rosneft" believes this acquisition will enable it to increase oil production in this region already in the near future. The Company also intends to develop the Vorgamusyursky block located in the Intinsky region of the Komi Republic. The infrastructure currently in place fully satisfies the Company's production growth plans.

In 2007 the "RN-Severnaya Neft" LLC produced 5.6 mln. t of oil which is equal to the level of 2006.
The major oil fields are: group of Gamburtsev Swell oil fields and Baganskoye group of oil fields.

Carbon Trade and Finance SICAR S.A. – is a joint venture between Dresdner Bank (via its investment bank Dresdner Kleinwort) and Gazprombank to invest in the rapidly developing carbon emissions trading market. The joint venture based in Luxembourg invests in primary projects generating CO_2 certificates with a focus on Russia and the Commonwealth of Independent States.

Carbon Trade and Finance SICAR S.A. provides clients with integrated carbon solutions – from risk management, project advisory in carbon finance to the actual purchase of emission reduction units. The Company develops derivatives for financial institutions, governments and buyers which have commitment as to emission reductions. Carbon Trade and Finance SICAR S.A. has established a subsidiary company in Moscow named the "CTF Consulting" LLC which is intended to provide comprehensive consulting services in PDD development, monitoring and follow-up of Joint Implementation projects.

[5] http://www.rosneft.ru/about/Glance/

Large client base of Gazprombank in Russia and its competency in the field of energy industry, combined with a large experience of Dresdner Bank in the field of emissions trading and solid connections with the largest European companies, allow Carbon Trade and Finance SICAR S.A. to provide clients with unique comprehensive solutions in the carbon market.

A.4. Technical description of the project:

A.4.1. Location of the project:

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A.4.1.1. Host Party(ies):

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The Russian Federation

A.4.1.2. Region/State/Province etc.:

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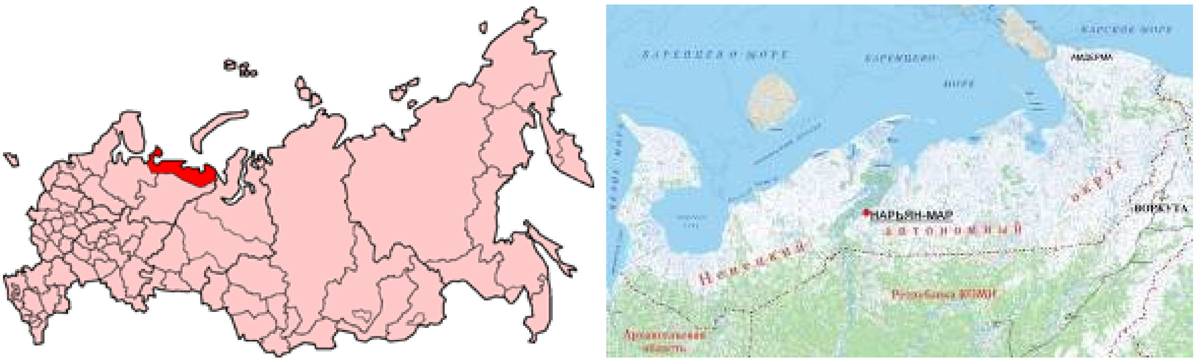
The Nenets Autonomous Okug (Polar Urals), Arkhangelsk Oblast

Fig. A.4.1.2.1 The Nenets Autonomous Okrug on the map of the Russian Federation



The Nenets Autonomous Okrug is a federal subject of the Russian Federation, which is administratively subordinated to Arkhangelsk Oblast. The Nenets Autonomous Okrug is located on the northern part of the East European Plain. Almost all its area is situated above the Arctic Circle. The area extends in a belt along the Arctic coast, with shorelines on the White, Barents, and Kara seas and includes Kolguev and Vaigan islands. The Nenets Autonomous Area borders on the Komi Republic in the south, Arkhangelsk Region in the southwest, and the Yamalo-Nenets Autonomous Okrug in the northeast.

The population of the Nenets Autonomous Okrug is estimated at 41 thousand inhabitants. The capital of the Okrug is Naryan-Mar, which is situated 2,230 km northeast of Moscow. The area has a harsh climate with average January temperatures ranging from -12 °C in the southwest to -22 °C in the northeast and average July temperatures from +6 °C in the north to +13 °C in the south; average annual precipitation is about 350 mm; permafrost zones are encountered.

The Nenets Autonomous Okrug is the only region which has a high potential for oil production growth in Northwestern Federal District and the European part of Russia on the whole.

Currently, more than 80 oil and gas fields have been explored in the Nenets Autonomous Okrug. Potential reserves in explored oil fields amount to 2 bln. t of oil and 500 bln. m^3 of gas.

Fig. A.4.1. The Nenets Autonomous Okrug

A.4.1.3. City/Town/Community etc.:

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Khasyrey oil field, Gamburtsev Swell, Nenets Autonomous Okrug.

The "RN-Severnaya Neft" LLC develops highly concentrated proven resource base, 86% of resources account for 2 groups of oil fields – Gamburtsev Swell and Baganskoye. Gamburtsev Swell includes Nyadeyu, Khasyrey and Cherpayu oil fields. They were discovered in 1984 and they became operational in 2002. Gamburtsev Swell is a part of local mountain ridge, 100 km long and 2-3 km wide. It is separated from the main ridge by structural flexures. This ridge comprises tectonically screened traps with large vertical partitions, as well as oil collectors in carbonate strata of lower Devonian and Silurian Periods located in a depth of 2 000-2 500m.

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

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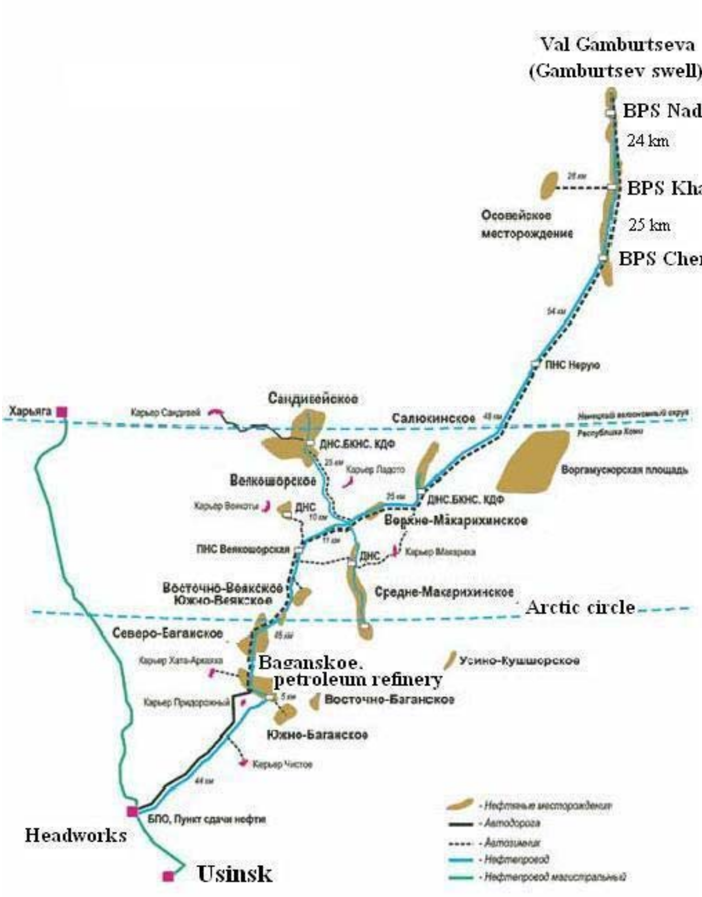
Fig. A.4.1.4.1. Layout of oil fields of the «RN-Severnaya Neft» LLC



Gamburtsev oil fields are located on the territory of High Lands tundra. Oil fields are rather remote from developed infrastructure. The nearest location is the city of Usinsk. In the period from December till April (inclusive), the communication is possible on *zimniks* (winter roads), in summer – by helicopters. The nearest power transmission lines (PTL) of KomiEnergo are situated in 350 km (Usinsk) from oil fields that makes impossible to provide power to oil fields from the centralized power grid.

During 2006-2007 the maximum crude oil production has been observed at Khasyrey oil field. The APG extraction accordingly reached its maximal level at the same period. The forecasted recovery of associated petroleum gas should amount to 300 mln.m^3 per year[6]. Associated petroleum gas typically contains approximately 70% methane, which allows using it as a fuel in power generating equipment.

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

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The Project includes the production of electric power by means of 2 TYPHOON gas turbines and 3 TEMPEST turbines manufactured by SIEMENS, located in a turbine room. They are intended to provide electric power to oil fields of Gamburtsev Swell (Nyadeyu, Khasyreya, Cherpayu):

[6] According to the technical documentation for the project construction of Power Center at BPS "Khasyreyskaya", Volume 4, page.24

Gas turbine unit №1 «TYPHOON» - 4.7 MW – commissioning in 11. 2005
Gas turbine unit №2 «TYPHOON» - 4.7 MW - commissioning in 11. 2005
Gas turbine unit №3 «TEMPEST» - 7.9 MW - commissioning in 09. 2006
Gas turbine unit №4 «TEMPEST» - 7.9 MW - commissioning in 06. 2007
Gas turbine unit №5 «TEMPEST» - 7.9 MW - commissioning in 01. 2009

Installed power capacity of gas turbines totals 33 MW, output voltage of gas turbines generator is 6 kV.

Khasyrey Power Center includes the following facilities:[7]

1) Turbine room with gas turbines «SIEMENS»,
2) Gas handling systems equipped with compressor station, delivered by «PETRECO», Canada;
3) High-voltage equipment area 0.4 kV, 3.3 kV, 6 kV and 35 kV;
4) 350 mm gas pipeline to deliver associated petroleum gas from technological separation area at BPS «Khasyrey» to Power Center.
5) 100 mm water pipelines from BPS «Khasyrey» to Power Center.
6) Flare line equipped with combined high and low pressure flare stack;
7) Fire fighting pump station;
8) Warehouse to store petroleum products and working liquids.

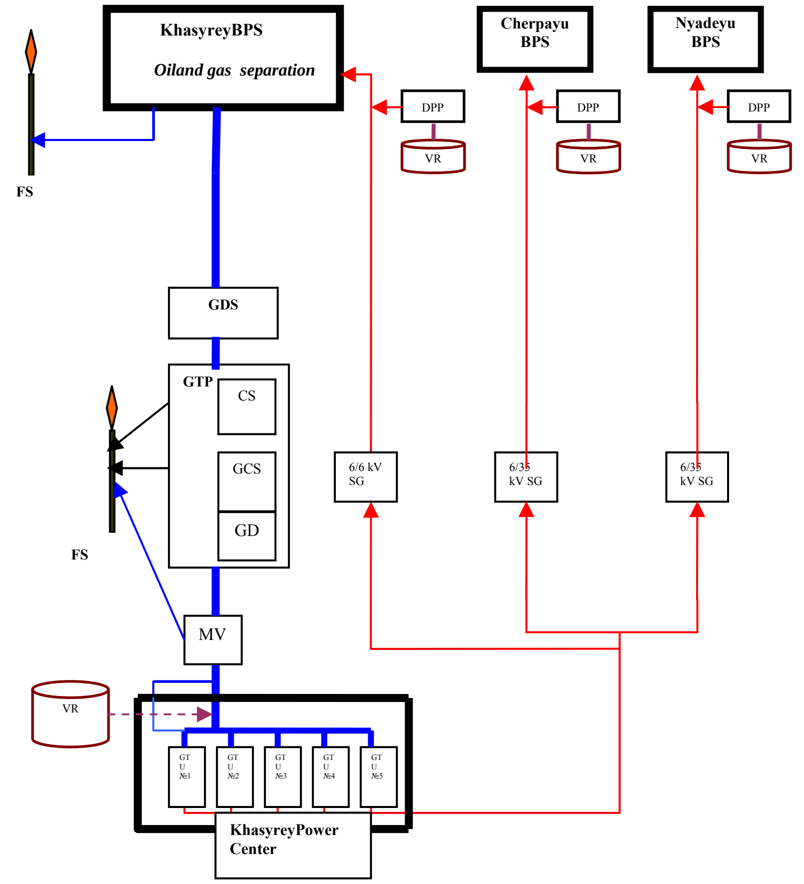
Table A.4.2. Characteristics of equipment of Khasyrey Power Center

Equipment Type	Quantity	Parameters	Description
Gas turbine «TYPHOON», Siemens	2	Power – 4.7 MW	Single shaft industrial gas turbines «Typhoon» and «Tempest» are used to produce electric power. These reliable gas turbines have high efficiency and are able to operate on many gaseous and liquid fuels. The turbines are compact in design; their maintenance may be performed on-site. These turbines are used on sea platforms and Floating Production, Storage and Offloading systems (FPSO) all over the world. This Project stipulates the use of environmentally friendly turbines Siemens equipped with DLE combustion system that allows to completely burned down pollutants contained in exhaust gases
Gas turbine «TEMPEST», Siemens	3	Power – 7.9 MW	
Compressor unit «PETRECO»	4	Output -6,758.7 nm3/h	Compressor units are intended to compress the gas delivered under separation pressure from Khasyrey BPS to Power Center.
Gas glycolic dehydration unit «PETRECO»	3	Output- 13,488.0 nm3/h	The unit is intended to remove liquids from associated petroleum gas, ensure dehydration and obtain fuel gas suitable for GTUs. The content of liquids in purified fuel gas should be less than 65 mg/m3.
Nitrogen station	1	Output-50 l/min.	Intended for blowing compressors down if the content of hydrogen sulphide in associated petroleum gas exceeds 1%
Centralized compressor station for automatic	1	Output- 75 nm^3\h	Air compressor station is intended to provide devices and control systems of fuel gas

[7] As to the description of Power Generating Center, see Annex 4.

control system (screw compressors DEN-75)			treatment plant with compressed air of set properties.
High voltage equipment with distribution switchgear devices and transforming substations.	5	- 35 kV switch gear; - 6 kV switch gear; - transforming station 6/35 kV; - transforming station 6/6.3 kV; - transforming station 6/0.4 kV.	Intended to transform generated voltage and to distribute it among consumers
Ramps and pipelines on site	-	They are from 25 to 350 mm in diameter, laid along the constructions of steel ramps. All technological pipelines are laid over the ground. They are mounted on free standing supports or multi-stage ramps.	Technological pipelines comprise fuel gas supply pipelines, diesel fuel supply pipelines; flare gas pipelines, drainage system pipelines, water supply pipes and sewage, pneumatic pipelines, gaseous nitrogen supply pipes and fire fighting system pipelines. All technological pipelines have thermal insulation, some pipelines are provided with electric radiators equipped with self-regulating heating cables «TERMON».
Flare stack	2	-	Flare stack is intended to burn excess amount of APG supplied from Khasyrey BPS to Power Center, as well as to utilize gas fractions, produced during treatment of APG at the gas dehydration plant (see above).
Fire fighting station	1	Water flow rate up to 100 m^3/h.	Fire fighting system includes water and foam fire extinguishing pump station, reservoirs containing water, pipelines, and alarms and warning system.
Reserve fuel capacity which comprises reservoir PBC-400 and a pump station	1	Reservoir capacity is 400 m^3	Vertical reservoir is intended to store diesel fuel. Diesel reserved should be sufficient to feed TYPHOON turbine during 111 h or 4.5 days. The pump station is intended to provide diesel fuel to gas turbines TYPHOON installed during the first phase. The pump station provides diesel fuel with a working pressure ranged from 1.03 to 2.05 bars.

Fig. A.4.2.1. APG utilization and power generation at Khasyrey Power Center



Legend

GCS – gas compressor station

GD – glycolic dehydration of gas

DPP – diesel power plant

CS – centrifugal separator

MV – main valve

GDS – gas distribution system

GDP – gas dehydratation plant

VR – vertical reservoir

FS – flare stacks at Khasyrey BPS and PGC

6/35 kV SG – 6/35 kV switch gear devices to dispatch electricity for Cherpayu and Nyadeyu consumers

6/6 kV SG – 6/6 kV switch gear devices to dispatch electricity for Khasyrey consumers

Associated petroleum gas (fuel gas)

Diesel fuel

Electric power

Description of the technological process

The Project stipulates the following scheme of APG utilization with a subsequent production of electric power:

From the second stage of oil separation of Khasyrey BPS APG comes through a pipeline Dn=350mm (under a pressure of 4.78 kPa) to the main high pressure flare stack for gas combustion. From the same gas pipeline APG is directed to meet the own needs of BPS site, as well as for the needs of Power Center through 0.6 km long pipeline thermo-insulated and electrically heated.

Then APG passes through the electro-driven ball plug valve to the fuel gas centrifugal pre-separator in order to separate heavy hydrocarbons. After the preliminary separation the fuel (under 400 kPa of pressure) is provided to the compressor station. After compression the gas is supplied to the station of fuel gas glycolic dehydration. After that a purified and dehydrated gas is conveyed through the safety shut-off valves of gas turbines and the filters to the inlets of GTU.

If required fuel gas could be cut off at the inlet and the outlet of fuel gas treatment plant, compressor unit and dehydration units, as well as at the inlets of gas turbines. The inlet of gas turbine units is equipped with a by-pass line to convey gas to the main valve. If required inlet fuel gas may be directed to the combined flare stack. From the third stage of oil separation of Khasyrey BPS the gas is supplied to the low pressure flare stack.

Electric power produced by Khasyrey Power Center, is dispatched via transformers and switch gear devices. Through 6/35 kV switch gear and 50 km long transmission lines electricity is provided to customers of Nyadeyu and Cherpayu oil fields. The Khasyrey oil field production facilities are supplied through 6/6 kV switch gear and 6 kV transmission line.

Automatic control system (ACS) Khasyrey Power Center:
To ensure a technological process the Project stipulates the use of automatic control system for generation of electric power. The system is intended to:
- Regulate the parameters of Power Center within allowance limit (in real time mode), depending on the needs in electric power;
- Forecast, prevent and remedy to emergency situations;
- Ensure operational communication.

Automatic control system is made by application of computers and modern software.
The control system uses Allen-Bradley ControlLogix unit which provides engine control, turbine sequence and protection, faults detection, turbines' speed regulation and temperature control. All necessary parameters are displayed on ACS monitors in real time mode.

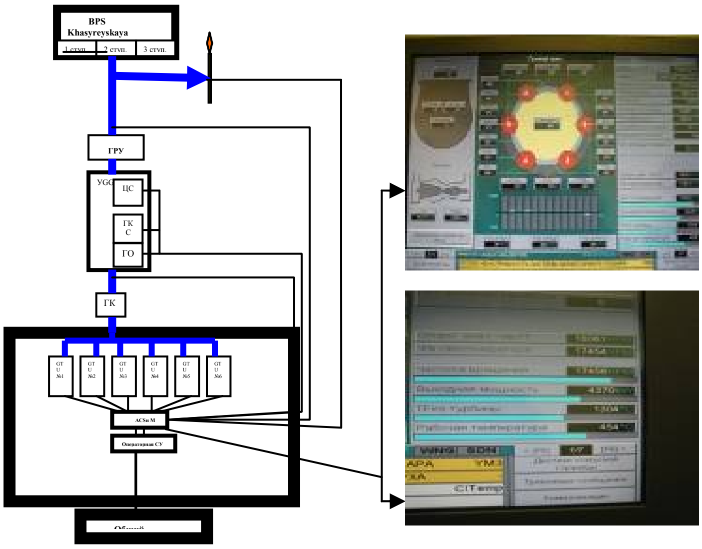
Power supply for automatic control system:
The automatic control system requires continuous power supply in 24V DC. The power is provided by accumulator system delivered by the company "ALSTOM POWER".

Electronic Data Exchange Network (EDEN):
This system is used to collect data and provide prompt support, should a problem occur. Resistance thermometers and sensors check the equipment for "off-scale swing" and "break in circuit" on an ongoing basis. Should a fault be detected, an opportune warning of yellow color is displayed, which will remain until the fault is remedied.

Software verification:
The control system comprises software modules made of prefabricated units, which have undergone a complete testing program. The controller software of power-generating unit complies with ISO 9002 requirements. The licences for software, necessary to operate turbines, are available.

The automatic control diagram of electric power generation technological process is shown below:

Fig. A.4.2.2. Automatic control diagram of electric power generation technological process



A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

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According to the baseline scenario, the needs of electric power (165 GWh per year on the average) of Gamburtsev Swell oil fields including Khasyrey, Nyadeyu and Cherpayu are met through the use of diesel power plants located exactly on-site.

Actually the baseline scenario is the development of the situation, which has been before the realization of the project. By the time of the Project start, electric power at Gamburtsev oil fields was produced by 11 diesel power plants with a total capacity of 9.5 MW. To meet increasing demand of Gamburtsev Swell facilities, the Company would have purchased additional 24 MW diesel-generator modules bringing thus the total capacity of diesel generation up to 33 MW.

To meet the needs of local on-site diesel power plants, approximately 42 thousand tonnes of diesel fuel would have been delivered annually. The Company is in possession of a smoothly running diesel fuel supply system (discussed in Section «B» in more details), which would allow to them to ensure a reliable fuel supply.

Along with that the APG, which is currently being combusted in gas turbines of Khasyrey Power Center under the Project activity, would have been flared (together with the rest part of APG) in the flare stacks of Khasyrey booster pump station.

According to the baseline scenario, greenhouse gas emissions would be caused by the following sources:

- Diesel power plants located on-site at Gamburtsev oil fields, which would emit CO_2 during combustion of diesel fuel.

- Flare stacks used for APG combustion and thus emits CO_2 and CH_4 (due to incomplete burning).

The on-going Project is aimed at supplying of Gamburtsev oil fields with electric power, produced in 5 gas turbine units (GTU) of Khasyrey Power Center by using APG.

Therefore, GHG emissions to the atmosphere will be reduced due to:

- The avoidance of using diesel fuel and hence CO_2 emission reductions.

- More complete (as compared with flare stacks) combustion of APG in gas turbines resulting in CH_4 emission reductions.

Gas turbines ensure almost complete combustion. Flare stacks are not able to provide complete combustion and non-oxidized hydrocarbons including methane contained in APG are partially released to the atmosphere. For the estimates of incompleteness of APG combustion at flare stacks, the 2006 IPCC Guidelines recommend to consider the efficiency of such combustion equal to 98%.

In the absence of Project activity, the above-mentioned reductions would not be achieved, because increasing consumption of diesel fuel would give rise the CO_2 emissions. At the same time the APG combustion with a flare stack due to its underburning, would cause methane emissions.

The development of the situation according to the baseline scenario is proved by the following facts:

- Lack of sufficient incentives to realize the Project.

The "RN-Severnaya Neft" has a reliable system of diesel supply for remote oil fields. Diesel is supplied from the refinery situated in 350 km from Gamburtsev Swell (capable of producing 40,000 t of diesel fuel per year) as well as from the Kuibyshev refinery owned by the OJSC "NK "Rosneft". Given the definite gains due to saving on diesel fuel costs the Project nevertheless is not feasible from investor's point of view (for more details, see section «B») without additional revenue from the trading of GHG emission reductions.

- Low penalties for environment pollution from APG combustion.

According to the Resolution of the Russian Government №344 of 12.06.2003, approved in July 2005, the payment for APG methane emissions from stationary sources accounts for 250 roubles (equal to 10 USD) per one ton of methane.[8] Such level of penalties does not contribute to oil company decision to undertake emission reduction measures.

- License agreement for the development of Gamburtsev oil fields signed by Rosneft does not contain any clause forcing them to efficiently utilize APG obtained during oil recovery.

As provided in section B.2 the economic efficiency of the Project remains inadequate without additional revenues obtained from selling of CO_2 emission reductions under JI mechanism..

Even if one can assume that Rosneft Company would implement APG utilization project anyway based on latest developments of state policy aimed at increasing pressure on oil companies to make them utilize APG, a real period of the Project realization (including designing, construction and commissioning phases) would require at least 3 years. Considering the world financial crisis and oil prices fall the realization of the Project would be delayed even longer. Associated gas flaring would be really ceased after 2012, i.e. beyond the crediting period of Kyoto Protocol. It is emission reduction units (ERU) were among driving factors for the Company to implement the Project at an early date, when economic realities and barriers did not create sufficient motivation to them for efficient use of APG except flaring (for more details, see section B.2.).

All above-mentioned facts, as well as the analysis provided in Section B, indicate that the RN-Severnaya Neft Company would not reduce the amount of APG burned in flares other than under the Project activity.

[8] This value may be used for the estimates of methane emissions, exceeding maximum permissible emissions (MPE). For the emissions which are within the limits of MPE, in 2005 the value was equal to 50 roubles/1000 m3.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

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	Years
Length of crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	138,476
2009	128,931
2010	129,687
2011	157,784
2012	156,399
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	711,277
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	142,255

A.5. Project approval by the Parties involved:

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The Chairman of the Government of the Russian Federation M. E. Fradkov signed on May 28, 2007 the Resolution № 322 “On the order of approval and verification of the realization of projects implemented in accordance with Article 6 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

According to Resolution, a project is registered after the submission, *inter alia*, of a positive opinion issued by an independent expert entity (determinator).

Hence, the registration of a project occurs in two stages:

- Determination of a project
- Consideration of a project by the assigned ministries for compliance with Russian legislation, technical regulations and rules and project registration.

Finally, subject to passing above stages, the project is included by the Governmental Decree in the list of registered projects and considered as officially approved by the host country – Russian Federation.

SECTION B. Baseline

Description of methodology applied for baseline choosing and additionality justification.

Our own methodology was used for justification of baseline. This methodology uses from one hand barriers analysis and investment analysis from the other hand. Also we take into consideration common practice analysis for additionality justification.

First of all we identificate alternative scenarios (three in our case). After that we apply barrier analysis. The main barrier for project implementation is technological barrier. This barrier has some facets: technical feasibility, availability of fuel resources, availability of skilled personnel, difficulties in maintenance.

Moreover, for baseline justification is used investment analysis. This analysis is made in order to show that the Project is not attractive alternative from an investment viewpoint. The Project efficiency may be demonstrated by internal rate of return (IRR) which is considered as criterion of investment attractiveness. According to the guidelines and rules established in the "RN-Severnaya Neft" LLC for choosing investment projects, the project becomes attractive for investment, if IRR of the proposed project is equal to or exceeds 15%.

The given Project is aimed at cost reduction, first of all, at reduction of fuel cost. For conducting investment analysis the Company expenses borne in connection to the Project (capital and operation expenses) are compared, therefore, with the expenses that would have been in the baseline scenario (installation of local diesel power plants and operation). Saving on diesel fuel purchase and on cheaper operation of Project equipment is considered as Project's revenue. Cash flow from trading of CO_2 emission reductions are estimated as additional revenue.

As the Project has mainly been realized, investment analysis addresses the situation, which existed at the moment of decision making in 2003.

Investment analysis includes two parts:

1. Estimate of investment efficiency of capital expenditures in the Project determined by internal rate of return (IRR) without consideration of the impact from sales of CO_2 emission reductions.

2. Impact of cash flow from trading of CO_2 emission reductions on the investment efficiency of the Project.

This analysis applyes for to demonstrate that without cash flow from trading of CO2 Project's internal rate of return woud be less than 15% . If it were demonstrated, the Project implementation would be impossible without JI and Project activity is not a baseline and therefore is additional. Moreover sensitivity analysis for the project activity is performed.

For additionality justification we analyse common practice. Common practice analysis aims of asking whether Project activity is common practice. In our case we consider situation with APG utilization in Russian Federation. And two main aspects were taken into account: whether Project activity to the moment of decision taking and realization were not widespread in the oil sector of Russia; whether this activity didn't result from the state policy as to providing incentives to oil companies for APG utilization. If the answers to this questions are positive, one can say that Project activity is not a common practice in Russia and it proves additionality of the Project.

Applying this own methodology in the PDD we justify baseline choosing and additionality of the Project.

B.1. Description and justification of the baseline chosen:

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Description of methodology applied for baseline choosing and additionality justification.

According to the JISC's guidance on criteria for baseline setting and monitoring and the Guidelines for users of the Joint Implementation project design document form (version 3) the JI specific approach regarding baseline setting is used and own baseline methodology is developed.

Applying this own methodology in the PDD we justify baseline choosing and additionality of the Project. For the additionality justification the methodology applies both barriers analysis and investment analysis. Also we take into consideration common practice analysis for additionality justification. As a result of the conducted stages makes the conclusion about the Project additionality criterion availability.

Baseline description

According to the baseline the management team of Severnaya neft wouldn't decide to build up a Khasyrey power center and utilize accordingly the part of APG formed at Khasyrey BPS in the gas turbine units. The APG would be burnt in flares as before causing the CO_2 and CH_4 emissions. For the production of electricity needed for Khasyrey, Nyadeyu and Cherepayu oil fields of Gamburtsev swell the company would use diesel power plants and their number would grow following the demand of electricity (this demand is projected to approach the maximum of 26 MW in 2011).

Diesel power plants Cammins and Williams with individual power capacity 1 MW will be used for the electricity generation. All APG will be burnt on flares of Khasyrey BPS e and calculations of baseline emissions are based on the volume of APG actually consumed by power center and CO_2 and CH_4 emission factors estimated considering the volumetric fraction of components in APG. Amount of diesel fuel consumption according to baseline is calculated considering electicity generation on GPP for different customers that equals the amount of electricity actually supplied in the project from Khasyrey power center.

The table with the key data and the variables used for the baseline definition is presented below:

Data/Parameter 1	Electricity generation on GPP Khasyrey
Data unit	MWh
Description	Electricity generation on Gas Power Plant Khasyreiskaya that would otherwise be produced by diesel power plant.
Time of determination/monitoring	End of every month
Source of data (to be) used	Electricity meter SET – 4 TM 02/2
Value of data applied (for ex ante calculations/determinations)	105 209 MWh (expected for 2008)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is monitored as the quantity of diesel fuel is calculated considering electricity generation on GPP
QA/QC procedures (to be) applied	Equipment is tested in accordance with regulations and quality control procedures in JSC “RN – Severnaya Neft”
Any comment	Electricity meters are installed at 6kV switch gear of Power Center substation. For measurements are used five meters:

	cell #2 GPP#1; cell #23 GPP#2; cell #3 GPP#3; cell #22 GPP#4; cell #4 GPP#5; Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month.

Data/Parameter 2	Electricity generation for customers of Nyadeyu oil field
Data unit	MWh
Description	Electricity generation for customers of Nyadeyu oil field that would otherwise be produced by diesel power plant.
Time of determination/monitoring	End of every month
Source of data (to be) used	Electricity meter SET – 4 TM 02/2
Value of data applied (for ex ante calculations/determinations)	37 335 MWh (expected for 2008)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is monitored as the quantity of diesel fuel is calculated considering electricity generation on GPP
QA/QC procedures (to be) applied	Equipment is tested in accordance with regulations and quality control procedures in JSC "RN – Severnaya Neft"
Any comment	Electricity meters are installed at 35kV switchgear of Power Center substation. For measurements are used two meters: cell #2 (line 3502); cell #8 (line 3508); Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month.

Data/Parameter 3	Electricity generation for customers of Cherpayu oil field
Data unit	MWh
Description	Electricity generation for customers of Cherpayu oil field that would otherwise be produced by diesel power plant.
Time of determination/monitoring	End of every month
Source of data (to be) used	Electricity meter SET – 4 TM 02/2
Value of data applied (for ex ante calculations/determinations)	33 915 MWh (expected for 2008)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is monitored as the quantity of diesel fuel is calculated considering electricity generation on GPP
QA/QC procedures (to be) applied	Equipment is tested in accordance with regulations and quality control procedures in JSC

	"RN – Severnaya Neft"
Any comment	Electricity meters are installed at 35kV switchgear of Power Center substation. For measurements are used two meters: cell #5 (line 3505); cell #11 (line 3511); Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month.

Data/Parameter 4	Electricity generation for GPP's own needs
Data unit	MWh
Description	Electricity generation for own needs of GPP is necessary for calculation of output of electricity to Khasyrey oil field that would otherwise be produced by diesel power plants.
Time of determination/monitoring	End of every month
Source of data (to be) used	Electricity meter SET – 4 TM 02/2
Value of data applied (for ex ante calculations/determinations)	8 500 MWh (expected for 2008)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is monitored as the quantity of diesel fuel is calculated considering electricity generation on GPP
QA/QC procedures (to be) applied	Equipment is tested in accordance with regulations and quality control procedures in JSC "RN – Severnaya Neft"
Any comment	Electricity meters are installed at 6kW switch gear of Power Center substation. For measurements are used meters: two for KTP SN EC #1 (input #1 cell 10 and input #2 cell 15); two for KTP SN EC #2 (input #1 cell 1 and input #2 cell 24); two for electricity engine compressors: cell #6 ED #1 and cell #20 ED #2. Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month.

Data/Parameter 5	Chemical composition of APG
Data unit	%
Description	Chemical composition is volumetric fraction of different gases in associated petroleum gas.
Time of determination/monitoring	Once per quarter
Source of data (to be) used	Chromatograph
Value of data applied (for ex ante calculations/determinations)	

Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is monitored for calculation of CO2 and CH4 emission factors.
QA/QC procedures (to be) applied	Measurements are made by the laboratory Nauka II
Any comment	Measurements are made during the first month of every quarter.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

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According to Guidance on criteria for baseline setting and monitoring Version 01, Annex 1 additionality can be demonstrated using the following approach (iii) Provision of traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs.

To describe and justify the chosen baseline a procedure based on the consideration of alternative scenarios in a light of the analysis of the following stages is used in this PDD:

1. Identification of alternative scenarios.
2. Analysis of barriers.
3. Investment analysis.
4. Common practice analysis.

Step.1. Identification of alternative scenarios

Substage. 1a. Identification of alternative scenarios to the proposed JI activity

Since alternative scenarios should be aimed at providing Gamburtsev oil fields with electric power, possible alternatives are limited to following three possible options :

1. Continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields.

2. Continuation of APG flaring at Khasyrey BPS and construction of power transmission lines (PTL) for connecting to centralized power grid.

3. The Project itself, i.e. APG flaring reduction and its utilization at Khasyrey Power Center in order to supply electric power to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields without being registered as JI project activity.

Substage. 1b. Compliance of the chosen alternatives with the effective legislation and regulation

According to the Russian legislation, environmental payments for APG combustion with a flare stack are regulated by the federal government. Since 2005 the companies which flare APG shall pay 50 roubles per ton of methane within the limits of maximum admissible emissions and 250 roubles as payments for temporarily approved emission limits[9].

To reduce flaring on regional level, local administrations pursues a policy aimed at providing incentives to oil companies for APG utilization. For example, the authorities of another Russian oil-bearing province, Khanty-Mansi Autonomous Okrug include in licence agreements the provisions on mandatory 95% utilization of APG. It should be noted that the licence agreement for developing Gamburtsev Swell does not provide such a commitment. The projects related to PTL construction and connection to a centralized grid system, as well as the implementation of alternative sources of electric power, comply with the effective legislation.

Conclusion: None of the alternatives is in contradiction with the effective legislation and may be discussed in the further analysis.

Step 2. Analysis of barriers

At this step, the barriers, which would prevent the realization of alternative scenarios are considered.

Substage 2a. Identification of barriers, which would prevent the realization of alternative scenarios.

In this section, the impact of *technological barriers* on the above-mentioned alternatives are being analysed. These barriers include:

- *Technical feasibility.* Under this barrier the realization of the alternative is analyzed from technical and economic viewpoints, considering the remoteness of facilities, investment cost, availability and development of infrastructure. In case if one of above alternatives cannot overcome this barrier*,* this alternative will not be considered in the further analysis.
- *Availability of fuel resources.* The given barrier may question the realization of the alternative.
- *Availability of skilled personnel.* This barrier (the lack of qualified personnel) may present a significant obstacle on a way of the alternative implementation.
- *Difficulties in maintenance*. Under the barrier a"bottlenecks" in service and repair of technological equipment are considered. When comparing alternatives, this barrier may be a decisive factor for choosing the less problematic option.

Substage 2b. Exclusion of alternative scenarios, which may be prevented from realization by the identified barriers

Technological barrier: technical feasibility

Alternative scenario № 1. Continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields

Actually this alternative is the continuation of the situation, which has been before the realization of the Project. By the Project start date, electric power at Gamburtsev oil fields was produced by 11 on-site diesel power plants with a total capacity of 9.5 MW.

[9] Resolution of the Government of the RF № 344 of July 12, 2003 (as amended on July 1, 2005 г.)

Table B.2.1: Distribution of diesel power plants across Gamburtsev oil fields before Project implementation

Oil field	Capacity, MW	Quantity of plants	Total capacity, MW
Khasyrey			
	1.00	4	4.000
	0.292	1	0.292
	0.200	1	0.200
Total	**-**	**6**	**4.492**
Nyadeyu			
	1,000	1	1.000
Total	**-**	**1**	**1.000**
Cherpayu			
	1,000	4	4.000
Total	**-**	**4**	**4.000**
Total Gamburtsev Swell:		**11**	**9.492**

Electric power is generated by compact module-type diesel power plants, which are simple to mount because they do not need foundations and separate production premises (plug and play), reliable in operation and simple to maintain. The installation of new module diesel power plants under this option is cheaper than that of gas turbines: 1 kW of installed capacity of diesel-generator accounts for 280 Euros, whereas commissioning of Khasyrey Power Center costs up to 1,600 Euros per 1 kW. [10]

All the oil fields of the "RN-Severnaya Neft" LLC, including Gamburtsev Swell, have a reliable and regular system of diesel fuel supply, which will be analyzed below.

Based on said above the development of this alternative scenario envisages the following:

- Purchase and commissioning of additional 24 MW module diesel power plants to meet increasing energy needs of Gamburtsev oil fields. The total capacity of diesel power plants at Gamburtsev Swell would amount to 33.5 MW (including stand-by capacity). Total investment cost would amount to 6,705 thousand Euros (24 MW*280 Euros/kW).

Table B.2.2. Commissioning of additional diesel power plants at oil fields of Gamburtsev Swell[11] under alternative scenario 1

Oil fields	Source of electric power	Total capacity before development MW	Additional capacity installed MW	Total capacity after development MW
Khasyrey	DPP	4.50	12.0	16.50
Nyadeyu	DPP	1.00	6.00	6.00
Cherpayu	DPP	4.00	6.00	10.0
Total	-	9.500	24.0	33.50

- Incease of diesel fuel supply to local electric power plants of Gamburtsev Swell by 27 thousand tones of diesel per year, from 15 thousand tonnes (9.5 MW * 8,760 h *228 kg/MWh[12]$*10^{-3}$) up

[10] Data source: «RN-Severnaya Neft» LLC

[11] Data source: «RN-Severnaya Neft» LLC

[12] Specific consumption of diesel fuel to produce electric power at DPP

to 42 thousand tonnes (26 MW[13] *0.8* 8,760 h*228 kg/MWh *10^{-3}) per year. It should be noted that peak consumption of diesel fuel at «Severnaya Neft» facilities in winter amounted to 60 thousand tonnes.[14]

- To store 42 thousand tonnes of diesel the capacity of storage reservoirs should be expanded by 25,000 m^3, from available 14,500 m^3 (before the project start) up to 39,500 m^3. This would require investment of additional 2,026 thousand Euros.

Thus total investment cost for the development of the given alternative scenario would amount to 8,740 thousand Euros (7.5 times less than the Project cost, which account for 66,160,000 Euros).

Above presented facts provide the clear evidence that the further development of diesel energy generation would be quite feasible from technical and economic viewpoints.

Alternative scenario № 2. Continuation of APG flaring at Khasyrey BPS and construction of power transmission lines (PTL) for connecting to centralized power grid.

This scenario is highly improbable, because the realization of the given alternative would require the construction of 110 kW power transmission lines for distance of 350 km and infrastructure (including transforming substations, switch gear devices, safety systems and the establishment of a special maintenance and repair division) in difficult weather conditions of polar region and tundra (permafrost, bogs, water barriers, etc). In addition, due to large investments amounting to 146 mln. Euros (compared with the Project cost of 66 mln. Euros)[15] needed for the construction of PTL and substations, the implementation of the alternative is also impossible.

Based on that, this alternative is excluded from the further analysis.

Alternative scenario № 3. The Project itself, i.e. APG flaring reduction and its utilization at Khasyrey Power Center in order to supply electric power to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields without being registered as JI project activity.

From a technical viewpoint this alternative is feasible, which is evidenced by the fact that Khasyrey Power Center became operational. Presently Khasyrey Power Center has four gas turbine units in operation. The fifth will be commissioned in 2009. Power Center has a well developed infrastructure, including inlet gas pipelines from BPS, gas treatment plant, turbine room, standby diesel fuel reservoirs, transformer substations and switch gear devices. As a shortage of APG is expected from the year 2011, additional gas pipelines from Nyadeyu and Cherpayu oil fields are planned to be constructed. The evident advantage of the given scenario is money saving due to stoppage of diesel fuel purchase. But the investment analysis presented below demonstrates that the Project is not economically feasible without the selling of generated CO_2 emission reductions.

There are also a range of significant technological barriers, which will be discussed below.

Technological barrier: Availability of fuel resources

Alternative scenario № 1. Continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields

[14] Data source : «RN-Severnaya Neft» LLC

[15] Information source as to capital expenditure in transmission lines: http://www.mrsk-1.ru/news/paper/num6/page4/

To provide on-site diesel power plants and oil fields with diesel fuel, the "RN-Severnaya Neft" LLC has built a well developed supply system which is an integral part of the OJSC "Rosneft" logistic system. Diesel fuel is provided from two refineries owned by the OJSC "Rosneft":

- Refinery in Bagansk town situated about 350 km to the south from Khasyrey oil field.
- Kuibyshev refinery (located in Samara).

From Bagansk refinery (capable of producing 40,000 tonnes of diesel fuel per year) diesel is transported by fuel trucks to the oil fields of the "RN-Severnaya Neft" LLC. From the Kuibyshev refinery, diesel fuel is transported by rail to Usinsk. Then, through oil loading racks, the fuel trucks are filled-up and diesel is delivered on-site. It should be noted that diesel is transported by fuel trucks 24 hours a day from December till May on so called *zimnik* (winter road). During this period, oil production and generating facilities are provided with reserves of diesel fuel, which allow them to continue their operations in the period when the transportation of diesel is impossible: i.e. from May to December.

The estimate below shows that "RN-Severnaya Neft" LLC owns sufficient transport capacity to deliver diesel fuel to on-site power plants of Gamburtsev Swell in case of realization of this alternative. For instance, to transport the peak amount of 46,000 tonnes of diesel fuel in 2011, 34 fuel trucks are required with a capacity of 15 t each, which should make 112 trips in winter period.

Table B2.3. Transport capacity of the "RN-Severnaya Neft" LLC to implement scenario 1[16]

Item	Unit	2006	2007	2008	2009	2010	2011	2012
Annual Diesel Fuel Consumption	Thousand tonnes	24.98	33.33	40.86	36.95	37.19	45.58	45.14
Winter road availability	days	112	112	112	112	112	112	112
Daily amount of diesel fuel to be transported	Ton-trips	223	298	365	330	332	407	403
Daily number of 15 t trucks required (considering truck availability rate of 0.8)	unit	19	25	30	27	28	34	34
Available transport fleet of fuel trucks, including	unit	48	48	48	48	48	48	48
- own trucks	unit	8	8	8	8	8	8	8
- hired trucks	unit	40	40	40	40	40	40	40

Both fuel trucks and winter road are maintained in good working condition by Transport Department which is a structural division of the "RN-Severnaya Neft" LLC. This division comprises of 4 truck convoys, road transport group, machinery and repair shops. Also, the Company subcontracts the other transportation companies to deliver diesel fuel to remote oil fields.

Gamburtsev oil fields are equipped with above-ground storage reservoirs with a capacity of 400, 1,000, 2,000, 3,000 m^3.

Availability of reliable and developed logistics system that allows the Company to regularly deliver diesel fuel to on-site power plants in winters (and has the spare capacity to cover the growth of diesel supplies) evidences that this barrier can be overcome in a case of this scenario.

Alternative scenario № 3. The Project itself, i.e. APG flaring reduction and its utilization at Khasyrey Power Center in order to supply electric power to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields without being registered as JI project activity.

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[16] Source: «Severrnaya Neft» LLC

The Project implementation after the year 2010 is exposed to the risk of APG shortage in Khasyrey oil field, because its deposits are exhausting. The forecasts provided by the experts of the "RN-Severnaya Neft" LLC show a decline in oil production, which of course will cause the decrease of APG recovery with subsequent deficit of this fuel to produce electricity at Khasyrey Power Center. To prevent this situation, 50 km gas pipelines will be built from Nyadeyu and Cherpayu oil fields to Khasyrey Power Center in 2011-2012. That will require additional investments in ampont of 15.5-16.0 mln. Euros[17].

Therefore, the risk of APG shortage in Khasyrey oil field is the significant barrier for the Project.

The trading of CO_2 emission reductions will allow to re-invest the gained money for covering the above-mentioned expenses that will positively contribute to overcoming this barrier.

Technological barrier: Availability of skilled personnel.

Alternative scenario № 1. Continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields.

The use of module diesel power plants is a traditional method of producing electric power in remote oil fields. These modules are simple to use and do not require specially trained personnel, in contrast to GTU running on APG. For this reason, the given risk factor is not significant for this scenario.

Alternative scenario № 3. The Project itself, i.e. APG flaring reduction and its utilization at Khasyrey Power Center in order to supply electricity to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields without being registered as JI project activity.

The centralized production of electric power of such a large capacity as 33 MW with using APG of unstable chemical composition at the explosion hazardous site to meet energy demand of three oil fields is the first-of-the kind project not only for the "RN-Severnaya Neft" LLC but for the OJSC "Rosneft" on the whole. These conditions placed more stringent requirements upon the personnel intended to maintain the Power Center. It is obvious that the Company involved mainly in oil production by the start of the Project had not been in possession of highly skilled personnel capable of servicing this equipment. It was another one significant barrier the Company had to face.

Technological barrier: Difficulties in maintenance

Alternative scenario № 1. Continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields

The use of module diesel power plants is a traditional method of electric power production at remote oil fields. These modules are simple to use and to maintain. For this reason, this risk factor is not significant for this scenario.

Alternative scenario № 3. The Project itself, i.e. APG flaring reduction and its utilization at Khasyrey Power Center in order to supply electricity to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields without being registered as JI project activity.

The operation of gas turbine units using APG at Khasyrey Power Center is accompanied by the number of risks, including:

[17] Information source: «Severnaya Neft» LLC

1. APG from Khasyrey oil field is rough “fat” gas with unstable methane content (CH_4 mean content is about 77%). For this reason, it can not be supplied directly to the turbine. This requires additional solutions for installation of technological equipment designed for dehydratation and removal of “fat” fractions from APG.
2. The lack of experience in APG utilization for producing electric power sometimes result into the unexpcted stoppage of gas turbines operation at Power Center.
3. The use of more reliable (compared with traditional ones) turbines equipped with automatic afterburning of NOx and SOx system requires more time for turbine maintenance. To ensure efficient operation of GTU, a shutdown of 8 h is needed to perform turbine maintenance (6 h for traditional turbines).
4. GTU life time untill the overhaul is equal to 60,000 h. To conduct the overhaul, it is necessary to transport the turbine to a specialized repair plant of the manufacturer. In conditions of impassable tundra and remoteness of Khasyrey oil field from the mainland, this transportation is expensive and problematic.

Conclusion: The completed analysis of impact of the complex technological barrier on the development of alternative scenarios showed that scenarios № 2 и № 3 were not able to overcome the given barrier. Only scenario № 1 (that is continuation of APG flaring at Khasyrey BPS and development of local on-site diesel based power generation at Khasyrey, Nyadeyu and Cherpayu oil fields) did not have this obstacle to overcome while being implemented. Hence, the given alternative scenario constitutes the *baseline scenario* and the level of greenhouse gas emissions within the framework of this scenario represents the *baseline emissions.*

However, the Company started to develop this Project reducing APG flaring for its utilizing at Khasyrey Power Center in order to supply electricity to facilities located at Khasyrey, Nyadeyu and Cherpayu oil fields. The reason for that was the Company intention for minimization of hazardous impact on the environment and reduction of greenhouse gas emissions according to Kyoto Protocol. This fact is reflected in the technical documentation of the Project prepared before installation of GTUs in 2005[18]. The expenses incurred to overcome the barriers will be compensated by cash flows earned from sales of ERUs resulted from the implementation of the Project. Besides, supplementary revenue from carbon trade will raise investment attractiveness of the Project, which will be shown at the following step.

Step 3. Investment analysis

General

This analysis is made in order to show that the Project is not attractive alternative from an investment viewpoint. The Project efficiency may be demonstrated by internal rate of return (IRR) which is considered as criterion of investment attractiveness. According to the guidelines and rules established in the “RN-Severnaya Neft” LLC for choosing investment projects, the project becomes attractive for investment, if IRR of the proposed project is equal to or exceeds 15%.

The given Project is aimed at cost reduction, first of all, at reduction of fuel cost. For conducting investment analysis the Company expenses borne in connection to the Project (capital and operation expenses) are compared, therefore, with the expenses that would have been in the baseline scenario (installation of local diesel power plants and operation). Saving on diesel fuel purchase and on cheaper operation of Project equipment is considered as Project’s revenue. Cash flow from trading of CO_2 emission reductions are estimated as additional revenue.

As the Project has mainly been realized, investment analysis addresses the situation, which existed at the moment of decision making in 2003. Initially, it was planned to install 6 GTUs with a total capacity of 41

[18] The text is provided in Annex 5

MW. But later on, after necessary experience has been acquired, project owner decided to install not more than 5 GTUs.

Investment analysis includes two parts:

1. Estimate of investment efficiency of capital expenditures in the Project determined by internal rate of return (IRR) without consideration of the impact from sales of CO_2 emission reductions.

2. Impact of cash flow from trading of CO_2 emission reductions on the investment efficiency of the Project.

Assumptions

The value of discount rate is taken equal to 10%. This value is used by the experts of the «RN-Severnaya Neft» LLC for economic estimations.

Lifetime for the Project is limited by 20 years, from 2004 to 2023.

Estimates:

The outcomes of estimates are summarized in the following table:

Table B2.4. Impact of cash flow from sales of CO_2 emission reductions on the Project investment efficiency

Item	Without considering CO_2 emission reduction sales	With considering CO_2 emission reduction sales
IRR	11.79%	15.29%

If the Project would have been realized beyond JI mechanism IRR had been lower than acceptable 15% profitability level. Additional revenue from selling of CO_2 emission reductions allows to the Company to increase IRR rate up to 15.29%.

Conclusion:

The Project becomes attractive in case of earning of supplementary revenue from selling of CO_2 emission reductions. Thus, it is one more evidence of the fact that the Project is not the *baseline* and therefore is *additional*.

Sensitivity analysis

The sensitivity analysis is done to evaluate the influence on the Project IRR of the deviation of such parameters as operation cost, capital investments and electricity generation (internal factors). The analysis embraces the consideration of IRR (without considering CO_2 emission reduction sales) in the case of simultaneous influence on both scenarios: baseline and Project activity.

The estimates were made on the base of the spreadsheet model used for the calculation of IRR provided in the table B.2.4. The results are presented in below table.

Table B 2.5. The results of the sensitivity analysis

Factors	IRR				
	-20%	-10%	0	+10%	+20%
Operational costs	8,3%	10,1%	11,79%	13,4%	14,9%
Capital investments	15,7%	13,6%	11,79%	10,3%	8,9%
Power generation	7,6%	9,7%	11,79%	13,8%	15,7%

Conclusion:

The Project is sensitive to the adverse deviation of almost all internal factors as IRR value is decreasing below 11,79%. These factors stay under control of the Company and can be manageable to prevent their negative development.

Stage 4. Common practice analysis

Situation in the sector

In 2003-2004 the practice of APG use for producing electric power was not widespread in Russia. According to the estimates of the Ministry of the Trade and Energy of Russian Federation (Minpromenergo), the amount of APG flared in 2005 in Russia accounted for 15 bln.m^3. To reduce flaring, the Russian state pursues a policy aimed at providing incentives to oil companies for utilization of APG in efficient manner. For example, authorities of Khanty-Mansi Autonomous Area include in licence agreements to be signed with oil field developers a provision on mandatory 95% utilization of APG. The most illustrative example in connection with that is the OJSC “Surgutneftegas”, which realized their gas-energy program in 1999- 2007 guided by the above-mentioned license provision. Under the given program, 11 gas turbine power plants were built with total capacity of 156 MW and 600 mln. m^3 of APG are utilized to produce electric power[19]. However, in that time it was only 4% of the total APG burned in flares, which clearly evidences that such a kind of project were rare among Russian oil companies.

According to official data for 2002[20]., 34.2 bln. m3 of APG were recovered in the Russian Federation, 28.2 bln. m3 out of this amount were utilized. Thus, the APG utilization rate accounted for 82.5%, about 6 bln. m3 (17.5%) were burned in flares.

According to Minpromenergo [21], total amount of APG recovered in 2006 was 57.9 bln. m3, of which 43,8 bln m3 (75.7) were utilized and 14.1 bln. m3 (24.3%) were burned in flares.

So it may be concluded from above stated, that Russian oil production growth in 2002-2006 was followed by increase in APG flaring, without any improvements in APG utilization rate. In opinion of experts, Russia looses annually up to $15 bln. due to a low level of APG utilization. According to International Energy Agency (IEA), Russia remains the leader in APG flaring. A large amount of associated gas is also burned in Iran, Iraq and Nigeria.

[19] The revue «Neftegazovaya Vertical», http://www.ngv.ru/article.aspx?articleID=22896

[20] www.technologycentre.org/upload_files/Gas%20Flaring_summary_R_19.04.05.doc

[21] http://www.deloros.ru/projects/gaz_effect/gaz_effect.php

The determination of the level of APG utilization is a principal issue in Russia. For instance, the Surgutneftegas Company utilizes up to 95% associated gas. No precise statistics are available as to the real situation with APG flaring and utilization. "LUKOIL" and "Surgutneftegas" argue that associated gas is utilized at 80-95% in Russia. Minpromenergo insists on the figure of 40-50%.

Penalties are the most popular method to struggle against APG flaring. Some experts believe that it is necessary to forbid flaring by law, as it was done in Kazakhstan.

In any case, the problem of expanding APG utilization in the RF is presently one of the most pressing problems of the fuel and energy complex.

Essential Distinctions

In spite of the fact that the Project activity performed by the "RN-Severnaya Neft" LLC is identical to the activities of the OJSC "Surgutneftegas" and both are aimed at developing the local energy sector through the use of APG, these two projects can be distinguished by the following:

When expanding gas energy projects, the OJSC "Surgutneftegas" was pursuant to the provisions of license agreement as to mandatory APG utilization. Hence its projects are realized in order to meet concrete commitments of the license holder. In contrast the license granted to the "RN-Severnaya Neft" LLC for the development of Gamburtsev oil fields does not have provisions for mandatory APG utilization, i.e. the project constitutes voluntary activities. In its technical document developed in 2005 the Company declared the execution of the given Project, taking into account the Kyoto Protocol requirements as to reducing greenhouse gas emissions. Being realized within the framework of Joint Implementation, the Project will attract additional revenue to the Project giving rise to its investment attractiveness (see above step 3 "Investment analysis").

Conclusion: The existing facts indicate that:

- The Project activities to the moment of decision taking and realization were not widespread in the oil sector of Russia.
- These activities did not result from the state policy as to providing incentives to oil companies for APG utilization.

Thus, the Project activity may not be classified as *common practice,* which proves that proposed project activity is additional.

The analysis shown above demonstrates clearly that the Project is not the baseline scenario. The Project activities are additional in relation to the situation, which would occur in case the baseline scenario is realized – that is to say continuation of APG flaring and development of local energy sector at Khasyrey, Nyadeyu and Cherpayu oil fields using diesel fuel.

The reduction of greenhouse gas emissions are defined as follows:

Baseline GHG emissions

According to the *baseline scenario*, electric power at Khasyrey, Nyadeyu and Cherpayu oil fields is generated by local diesel power plants (DPPs), because there is no access to the centralized power grid.

Associated petroleum gas captured during the oil production is generally flared and partially used for internal technological needs, i.e. heating of the oil and residential premises. Due to increase in oil watering and oil production (and consequently in power inputs) the existing capacity of DPPs at 3 oil fields would have been increased from 9.5 MW up to 33 MW. Under this scenario the annual consumption of diesel fuel for the needs of DPP at oil fields would amount to 42,000 tonnes on the average.

Along with that, APG in the amount to be used in gas turbines of Khasyrey Power Center under the Project activity would have been flared (together with the remaining part of recovered APG) in the stacks of Khasyrey booster pump station.

The baseline greenhouse gas emissions would occur due to diesel fuel combustion when generating electric power at on-site DPPs and burning associated petroleum gas with a flare stack.

To calculate the emissions from flaring of associated petroleum gas and the use of diesel fuel at DPP, the following methodological approaches are used:

GHG emission source	Calculation methodology
Combustion of diesel fuel at DPPs	Approved CDM tool “Tool to calculate project or leakage emissions from fossil fuel combustion (Version 2)”
APG flaring	2006 IPCC Guidelines for National Greenhouse Gas Inventory (Subsection 4.2. “Fugitive emissions from oil and natural gas systems”, adapted equations 4.2.4 and 4.4.5).

Project GHG emissions

Project activities include developing of power supply system for Gamburtzev oil fields on a base of Khasyrey Power Center with the use of significant part of APG recovered at the local booster pump station (BPS). APG will be burned in gas turbines (instead of being flared as in the baseline scenario) to produce electric power and to provide it to customers at oil fields of Khasyrey, Nyadeyu and Cherpayu. The flaring of the rest of APG at flare stacks of Khasyre BPS will be continiuing.

Khasyrey Power Center includes 5 Siemens gas turbine units (GTU) with 33MW of total installed capacity (2 turbines «Typhoon» of 4.7 MW each and 3 turbines «Tempest» of 7.9 MW each).
These turbines are environmental-friendly because of D.L.E combustion system that allows to fully use the energy potential of fuel and the complete combustion (thermal destruction) of hazardous substances, including methane.Associated petroleum gas provided from Khasyrey oil field will be the main fuel for Power Center till 2011. After 2011, APG will be also supplied from Nyadeyu and Cherpayu oil fields.

Khasyrey Power Center is equipped with a technological combined high and low pressure flare stack at which the surplus APG and gas fractions from Center’s gas treatment plant are burned. Since the equivalent amount of APG would otherwise be burned in flare of BPS, greenhouse gas emissions generated by the flare stack of Power Center are equal to the emissions from BPS flare stack. For this reason they are not considered in the estimation of emission reductions. During construction of Khasyrey Power Center and scheduled commissioning of GTUs in 2005-2008, a part of electricity are provided by diesel power plants. Thus, according to the development plan of the Project, GHG emissions occur due to:

- APG combustion in gas turbines of Khasyrey Power Center,
- Diesel fuel combustion during commissioning stage in the period of 2005-2008.

GHG emission reductions

Under the Project scenario the GHG emissions to the atmosphere will be reduced due to the following effects:

- CO_2 emission reductions due to avoidance of using diesel fuel at local on-site DPPs with a consequent use of APG to generate electric power in gas turbines at Khasyrey Power Center.

- CH_4 emission reduction resulting from practically complete combustion of APG in gas turbines. As a consequence, a complete oxidation of CH_4 occurs. Otherwise methane would be contained in the underburned APG in the event of combustion in the BPS flare stacks in the baseline scenario.

The mechanism applied to estimate emission reductions for the period 2008-2012 is shown in the following table (please also refer to the calculations in the section E.).

Table B 2.1. Mechanism of estimate of emission reductions resulting from the Project activities

Parameter	Unit	Baseline	Project	Reduction
APG* consumption	thousand. nm^3	367,898	367,898	
CO_2 emission factor	tCO_2/ ths. nm^3	2.22	2.27	
CO_2 emissions	t CO_2	817,525	834,209	-16,684
CH_4 emission factor	tCO_2e/ths.nm^3	0.217	0	
CH_4 emissions (in terms of CO_2)	tCO_2e	79,771	0	79,771
Diesel fuel consumption	t	205,728	868	
CO_2 emission factor for diesel fuel	tCO_2/t	3.16	3.16	
CO_2 emissions from diesel fuel	CO_2 t	650,938	2,747	648,191
Results:	CO_2 t	1,548,234	836,957	711,277

** Note: Only APG amount to be used in gas turbines under the Project scenario is applied for calculation of baseline and project emissions. The remaining part of APG is equally flared at the stacks of Khasyrey BPS leading thus to the same emissions in both scenarios. Therefore, the remaining part is not taken into account for simplification reason.*

Thus GHG emission reductions from Project activity are obvious.

B.3. Description of how the definition of the project boundary is applied to the project:

>>

The Project boundary includes the following GHG emission sources related to the Project activities:

- Flare stacks at Khasyrey BPS
- Gas turbine units of Khasyrey Power Center
- Diesel power plants at Khasyrey, Cherpayu, Nyadeyu oil fields

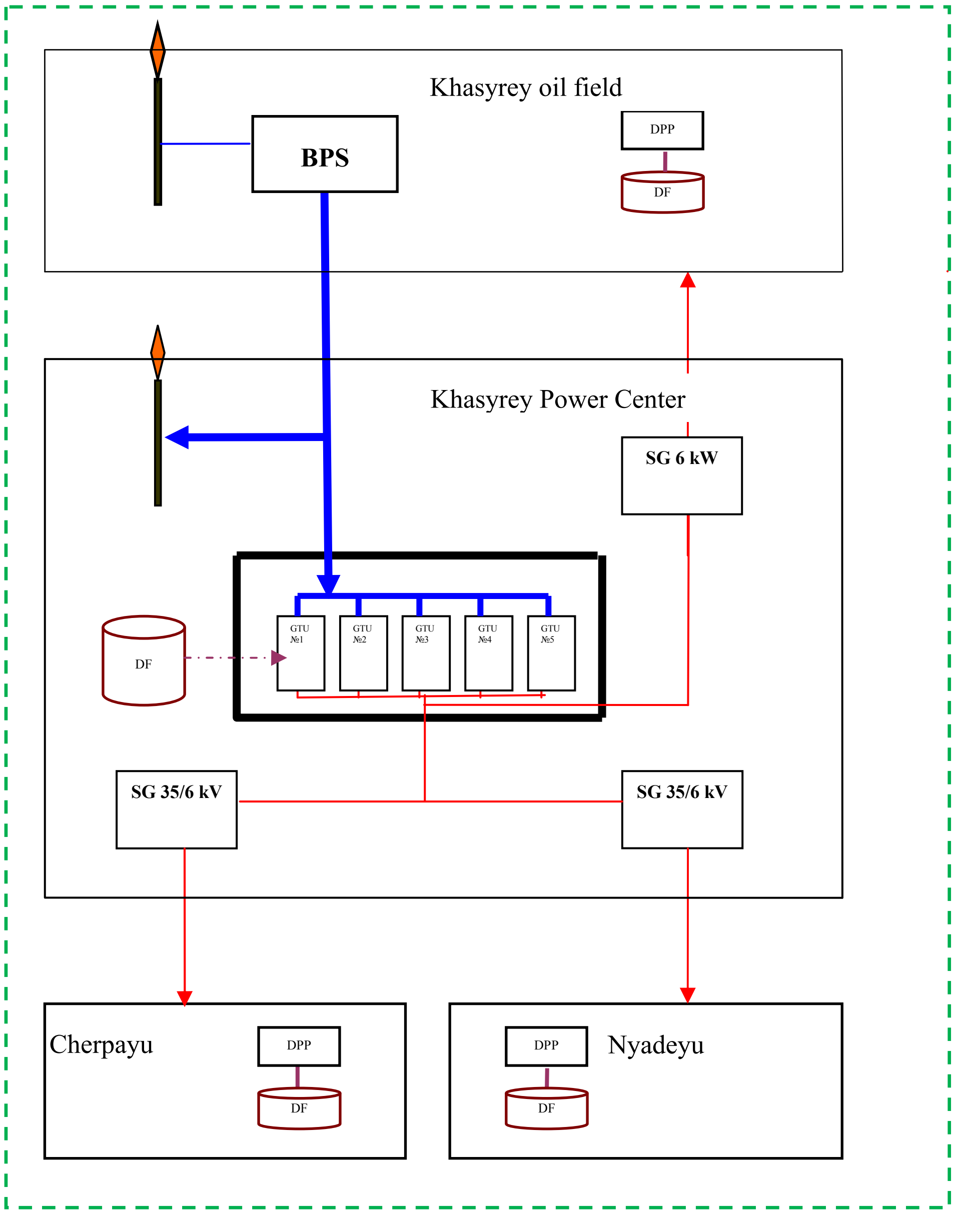
In the following table the emission sources and GHG types are considered as to including them in the Project boundary. Only greenhouse gases, which contribute significantly (more than 1%) in total GHG emissions are included into the estimation of emission reductions.

Table B3.1. GHG emissions under the baseline scenario and Project activities

№	Source	GHG type	Included in the boundary/ not included	Commentary
Baseline	Diesel fuel burned by DPPs at Khasyrey, Cherpayu and Nyadeyu oil fields	CO_2, CH_4	CO_2 – included CH_4 – not included because they are negligible	Output of electric power by DPPs is taken equal to its amount produced by Khasyrey Power Center
	APG (in the amount which is used by GTUs under Project) flared at Khasyrey BPS	CO_2, CH_4	CO_2 – included CH_4- included	CO_2 emissions caused by 98% combustion of APG in a flare stack. CH_4 emissions caused by 2% under burning resulted from this combustion.
Project activities	Combustion of APG in GTUs of Khasyrey Power Center	CO_2 CH_4,	CO_2 – included CH_4 – not included because they are negligible	Efficiency of APG combustion in GTU is taken equal to 100%.
	Diesel fuel combusted at DPPs of Khasyrey, Nyadeyu and Cherpayu oil fields, and GTU of Khasyrey Power Center	CO_2	Included	Estimate at commissioning stage in 2006-2008 is made *ex-post*. Emergency use of diesel fuel when the project is operational should be also estimated *ex-post*.

Thus, the Project boundary is graphically shown in the following figure.

Fig. B.3.1. Project Boundary



Symbols:

– – – – – – Project boundary	———— APG
———— Electric power	———— Diesel fuel

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

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Date of baseline setting: 28/11/2008.

The baseline has been designed by CTF Consulting and National Carbon Sequestration Foundation

CTF Consulting and National Carbon Sequestration Foundation are not participants of the Project.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>

Construction and assembly works started in the first quarter of 2005.

C.2. Expected operational lifetime of the project:

>>

Taking into consideration commissioning dates of GTUs, the operational lifetime of the Project is 17 years: 2005 – 2022.

C.3. Length of the crediting period:

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5 years, 60 months: from 1 January 2008 till 31 December 2012

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SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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The Project is aimed at supplying electric power to Gamburtsev oil fields including Khasyrey, Nyadeyu and Cherpayu. Electric power is produced in conformity with sustainability principles with replacement of fossil fuel (diesel fuel) by associated petroleum gas (APG) intended previously to be flared at the stack of Khasyrey booster pump station (BPS).

The realization of the Project will reduce GHG emissions to the atmosphere:

- CO_2 emission reduction due to replacement of diesel fuel consumed (in the baseline scenario) by diesel power plants (DPPs) located at three oil fields of Gamburtsev Swell by associated petroleum gas while producing electric power at Khasyrey Power Center.The amount of APG used at GTUs would have otherwise been flared in the baseline scenario.
- CH_4 emission reduction due to more efficient combustion of APG in GTU compared with the flare of Khasyrey BPS.

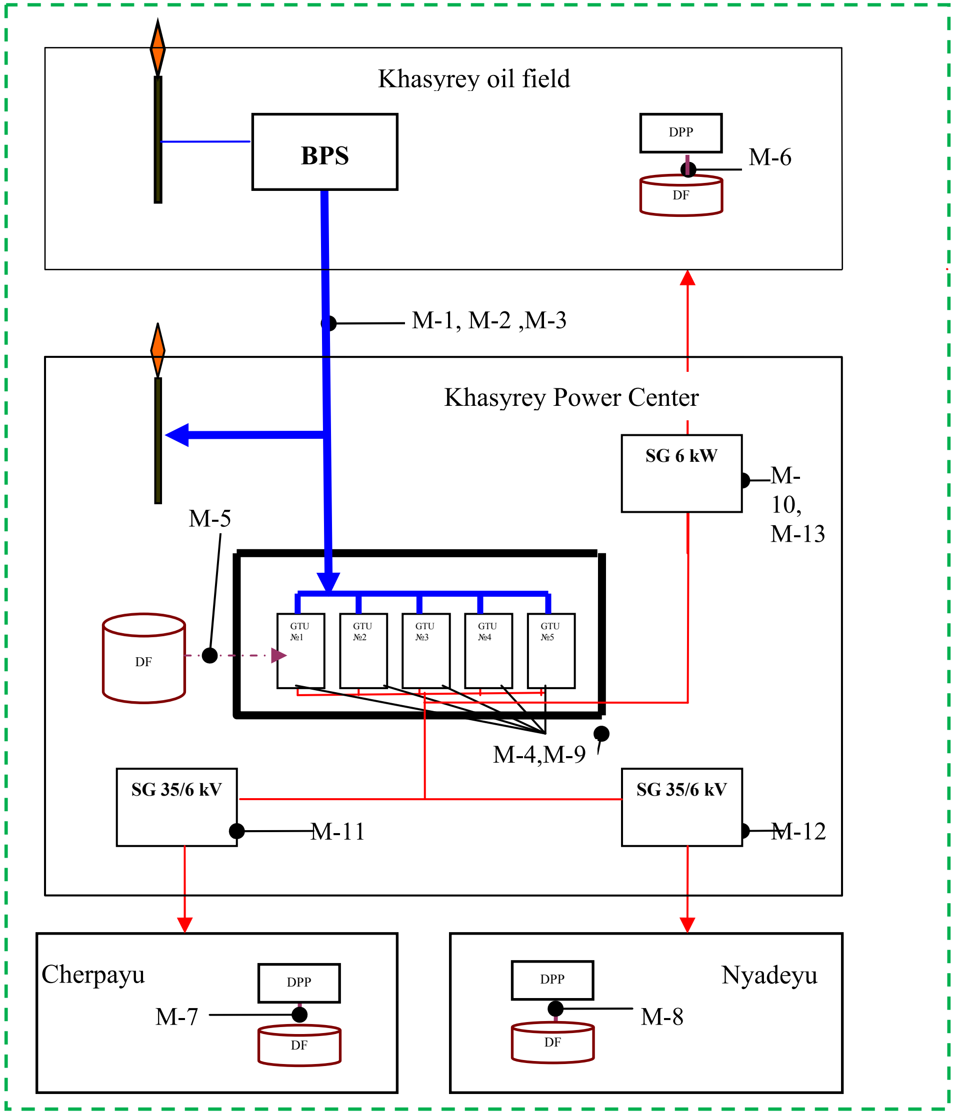
The sources of GHG emissions included in the Project are following:

- flare stacks of BPS Khasyrey
- gas turbines of KhasyreyPower Center
- diesel power plants at Khasyrey, Cherpayu and Nyadeyu oil fields.

According to the paragraph 37 of the JI monitored data and required for determination will be kept for two years after the last transfer of ERUs for the project.

The monitoring points of GHG emission sources are shown in the following figure.

Fig. D1.1. Monitoring points.



Monitoring point	Function
M-1	Amount of APG, supplied from BPS to Khasyrey Power Center
M-2	Chemical composition of APG
M-3	Net calorific value of APG
M-4,M-9	APG consumption in GTUs of Power Center; operation time of GTU_i
M-5	Consumption of diesel fuel in GTUs of Power Center (in case of emergency)
M-6, M-7, M-8	Consumption of diesel fuel at DPP of Khasyrey, Cherpayu and Nyadeyu oil fields (if required and in case of emergency)
M-10, M-11, M-12,M-13	Electricity generation for customers at Khasyrey, Cherpayu and Nyadeyu oil fields and for own needs of GPP

Calculation of GHG emissions are made in the following order:

1. CO_2 emission factors are defined for APG burned in GTUs and for diesel fuel burned in DPPs.
2. Project GHG emissions are calculated.
3. CO_2 emission factors is defined for APG burned in flares.
4. Baseline GHG emissions are calculated.
5. GHG emission reductions are calculated.

The method proposed by methodological tool "Tool to calculate project or leakage emissions from fossil fuel combustion" (Version 2) is used to estimate GHG emissions caused by the project and baseline activities. This tool defines emission amount as a product of fuel consumption and appropriate CO_2 emission factor.

For defining CO_2 and CH_4 emission factors of APG burned in flares, the approaches proposed in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Subchapter 4.2. Fugitive emissions from oil and natural gas systems) are applied. CO_2 and CH_4 emissions are defined as a product of APG amount consumed in GTUs and appropriate CO_2 or CH_4 emission factor.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
M-1.	$FC_{APG,PJ}$ Amount of APG provided to Power Center	Flow meter Rosemount 3095MFA	nm^3	m	daily	100%	Paper and electronic	Data is registered with gas consumption log at Khasyrey BPS. This parameter is monitored for cross-checking.
M-2.	V% Volumetric fraction of	Chromatograph	%	m	once per quarter	100%	Paper and electronic	Measurements are performed by third

	component							party laboratory "Nauka II" . Measurements are made during the first month of every quarter.
M-3	NCV_{APG} Net calorific value of APG	Chromatograph	kcal/nm3	m	once per quarter	100%	Paper and electronic	Measurements are performed by third party laboratory "Nauka II". Measurements are made during the first month of every quarter.
M-4	$HC_{APG,GTi,PJ}$ Instant consumption of APG in i-GTU of Power Center	Power Center gas log book	kW	m	every hour	100%	Paper and electronic	This parameter is displayed on monitors (screens) at the operator room of Power Center. Every hour data are averaged out automatically by special Siemens programme. And this data will be stored for two years.
M-5	$FC_{GPC\_DF,PJ}$ diesel fuel consumption by gas-turbine unit	Petroleum inventory report	tonnes	m	Once per month	100%	Paper and electronic	Diesel fuel consumption is defined by measuring the reservoir level three times per month (data are put into the special inventory book). And at the end of the shift (once a month) petroleum inventory

								report is composed. Additional fuel portions in the reservoir will be considered too.
M-6.	$FC_{DF,PJ,Khas}$ diesel fuel consumption by Khasyrey DPP (in emergency situations at Power Center)	Flow meter PPO40-06SU	tonnes	m	Once per month	100%	Paper and electronic	On the DPP there is inventory book for daily diesel fuel consumption. From this book data are aggregated in total inventory book for monthly diesel fuel consumption.Flow meter data is registered with invoice at the end of each month
M-7.	$FC_{DF,PJ,Nyad}$ diesel fuel consumption by Nyadeyu DPP (in emergency situations at Power Center)	Flow meter PPO40-06SU	tonnes	m	Once per month	100%	Paper and electronic	On the DPP there is inventory book for daily diesel fuel consumption. From this book data are aggregated in total inventory book for monthly diesel fuel consumption.Flow meter data is registered with invoice at the end of each month.
M-8.	$FC_{DF,PJ,Cherp}$ diesel fuel consumption by Cherpayu DPP (in emergency situations at Power Center)	Flow meter PPO40-06SU	tonnes	m	Once per month	100%	Paper and electronic	On the DPP there is inventory book for daily diesel fuel consumption. From this book data are aggregated in total

								inventory book for monthly diesel fuel consumption.Flow meter data is registered with invoice at the end of each month.
M-9	T operation time of GTU_i during a month	Power Center gas logbook	seconds	m	every hour	100%	Paper and electronic	This parameter is displayed on monitors (screens) at the operator room of Power Center.

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

>> **Calculation of CO_2 emission factors for consumption of APG and diesel fuel in GTU**

CO_2 emission factor for consumption of APG

(D.1) $EF_{CO2,GTU} = \sum_i y_i * Nc * \rho_{CO2} * E_{GTU}$

Table 1.Calculation of CO_2 emission factor for burning of APG in GTU

Column №	1	2	3	4	**5=1*2*3*4**
Item	Volumetric fraction of component	Quantity of carbon moles in a mole of a component (fixed parameter)	Density of CO_2 (fixed parameter)	Efficiency of APG burning in GTU (fixed-parameter)	CO_2 emission factor for burning of APG in GTU
Index	y_i	Nc	ρ_{CO2}[22]	E_{GTU}[23]	$EF_{CO2,GTU}$
unit	%		Kg/m^3	-	tCO_2/thous. m^3
Carbon dioxide, CO_2	0,00%	1	1.831	1	Calculation according to

[22] As a source can be used http://www.welding.su/articles/gaz/gaz_95.html.

[23] 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Chapter 2. Stationary combustion, p.2.14

					formula (D.1)
methane, CH_4	0,00%	1	1.831	1	
ethane, C_2H_6	0,00%	2	1.831	1	
propane, C_3H_8	0,00%	3	1.831	1	
isobutene, C_4H_{10}	0,00%	4	1.831	1	
n-butane, C_4H_{10}	0,00%	4	1.831	1	
isopentane, C_5H_{12}	0,00%	5	1.831	1	
n-pentane, C_5H_{12}	0,00%	5	1.831	1	
hexane, C_6H_{14}	0,00%	6	1.831	1	
heptane, C_7H_{16}	0,00%	7	1.831	1	
octane, C_8H_{18}	0,00%	8	1.831	1	
hydrogen sulphide, H_2S	0,00%		1.831	1	
nitrogen, N_2	0,00%		1.831	1	
oxygen, O_2	0,00%		1.831	1	
					Sum

CO_2 emission factor for consumption of diesel fuel

(D.2) $EF_{CO2,DF} = NCV_{DF} * COEF_{CO2}$

Table 2. Calculation of CO_2 emission factor for consumption of diesel fuel

Column №	1	2	**3=1*2*1000**
Item	Net calorific value of diesel fuel (fixed parameter)	CO_2 emission coefficient (IPCC) for diesel fuel	CO_2 emission factor for used diesel fuel
Index	NCV_{DF}	$COEF_{CO2}$	$EF_{CO2,DF}$
Unit	TJ/thousand tonnes	tCO_2/TJ	tCO_2/tonne
Month 1	42,7	74,1	Calculation according to formula (D.2)
Month 1	42,7	74,1	
Month 2	42,7	74,1	
…….	42,7	74,1	

Consumption of APG in GTUs at Khasyrey Power Center

(D.3) $FC_{APG,GTU1} = HC_{APG,GTU1} * T/(NCV_{APG}*4,1868)*0,001$[24]

Table 3. APG consumption in GTU №1 (Typhoon)

Column N	1	2	3	4	**5=1*2/(3*4)*0,001**
Item	Average instant consumption of APG in GTU 1	Work load of GTU 1 during a month	Net calorific value of APG	Conversion factor (fixed parameter)	APG consumption in GTU № 1
Index	$HC_{APG,GTU1}$	T	NCV_{APG}	-	$FC_{APG,GTU1}$
Unit	kW	Sec	Kcal/nm3	kJ/Kcal	thousand nm3
Month1				4.1868	Calculation according to formula (D.3)
Month2				4.1868	-
………………..				4.1868	-
Total for a year					-

(D.4) $FC_{APG,GTU2} = HC_{APG,GTU2} * T/(NCV_{APG}*4,1868)*0.001$

Table 4. APG consumption in GTU № 2 (Typhoon)

Column N	1	2	3	4	**5=1*2/(3*4)*0,001**
Item	Average instant consumption of APG in GTU 2	Work load of GTU 2 during a month	Net calorific value of APG	Conversion factor (fixed parameter)	APG consumption in GTU № 2
Index	$HC_{APG,GTU2}$	T	NCV_{APG}	-	$FC_{APG,GTU2}$
Unit	kW	sec	Kcal/nm3	kJ /Kcal	th. nm3
Month1				4.1868	Calculation according to formula (D.4)
Month2				4.1868	-

[24] For the detailed description of monitoring of APG consumption in GTU see Annex 3 Monitoring plan.

………………..				4.1868	-
Total for a year	=				-

(D.5) $FC_{APG,GTU3} = HC_{APG,GTU3} * T/(NCV_{APG}*4,1868)*0.001$

Table5. APG consumption in GTU№ 3 (Tempest)

Column N	1	2	3	4	**5=1*2/(3*4)*0,001**
Item	Average instant consumption of APG in GTU 3	Work load of GTU 3 during a month	Net calorific value of APG	Conversion factor (fixed parameter)	APG consumption in GTU № 3
Index	$HC_{APG,GTU3}$	T	NCV	-	$FC_{APG,GTU3}$
Unit	kW	sec	Kcal/nm3	kJ/Kcal	thousand. nm3
Month1				4.1868	Calculation according to formula (D.5)
Month2				4.1868	-
………………..				4.1868	-
Total for a year	=				-

(D.6) $FC_{APG,GTU4} = HC_{APG,GTU4} * T/(NCV_{APG}*4,1868)*0.001$

Table 6. APG consumption in GTU № 4 (Tempest)

Column N	1	2	3	4	**5=1*2/(3*4)*0,001**
Item	Average instant consumption of APG in GTU 4	Work duration of GTU 4 during a month	Net calorific value of APG	Conversion factor (fixed parameter)	APG consumption in GTU № 4
Index	$HC_{APG,GTU4}$	T	NCV	-	$FC_{APG,GTU4}$
Unit	kW	sec	Kcal/nm3	kJ/Kcal	th. nm3
Month1				4.1868	Calculation according to formula (D.6)
Month2				4.1868	-

………………..				4.1868	-
Total for a year	=				-

(D.7) $FC_{APG,GTU5} = HC_{APG,GTU5} * T/(NCV_{APG}*4,1868)*0.001$

Table 7. APG consumption in GTU № 5 (Tempest)

Column N	1	2	3	4	**5=1*2/(3*4)*0,001**
Item	Average instant consumption of APG in GTU 5	Work duration of GTU 5 during a month	Net calorific value of APG	Conversion factor (fixed parameter)	APG consumption in GTU № 5
Index	$HC_{APG,GTU5}$	T	NCV	-	$FC_{APG,GTU5}$
Unit	kW	sec	Kcal/nm3	kJ/Kcal	thousand nm3
Month1				4.1868	Calculation according to formula (D.7)
Month2				4.1868	-
………………..				4.1868	-
Total for a year	=				-

(D.8) $FC_{APG,GTUs} = FC_{APG,GTU1} + FC_{APG,GTU2} + FC_{APG,GTU3} + FC_{APG,GTU4} + FC_{APG,GTU5}$

Table 8. Total APG consumption in GTUs of Khasyrey Power Center

Column N	1	2	3	4	5	**6=1+2+3+4+5**
Item	APG consumption in GTU 1	APG consumption in GTU 2	APG consumption in GTU 3	APG consumption in GTU 4	APG consumption in GTU 5	Total APG consumption in GTUs
Index	$FC_{APG,GTU1}$	$FC_{APG,GTU2}$	$FC_{APG,GTU3}$	$FC_{APG,GTU4}$	$FC_{APG,GTU5}$	$FC_{APG,GTUs}$
Unit	th. nm3	th. nm3	th. nm3	th. nm3	th. nm3	th. nm3
Month1						Calculation according to formula (D.8)
Month2						-
………………..						-
Total for a year						-

Calculation of CO2 emissions from APG consumption in GTUs at Khasyrey Power Center

(D.9) $PE_{GTUs} = FC_{APG,GTUs} * EF_{CO2,GTU}$

Table 9. CO_2 emissions from APG consumption in GTUs at Khasyrey Power Center

Column N	1	2	**3=1*2**
Item	Total APG consumption in GTUs	CO_2 emission factor for APG consumption in GTU	CO_2 emissions from APG consumption in GTUs
Index	$FC_{APG,GTUs}$	$EF_{CO2,GTU}$	PE_{GTU}
Unit	thousand nm3	tCO_2/thousand nm3	tonnes CO2
Month 1			Calculation according to formula (D.9)
Month 2			-
………………..			-
Total for year			-

Calculation of CO_2 emissions from diesel fuel consumption in course of Project activity

(D.10) $PE_{DF} = (FC_{DF,DPP,PJ} + FC_{DF,PC}) * EF_{DF}$

Table10. CO2 emissions from consumption of diesel fuel in course of Project acticity

Column N	1	2	3	**4=(1+2)* 3**
Item	Total diesel fuel consumption at DPPs of Khasyrey, Nyadeyu, Cherpayu oil fields	Consumption of diesel fuel in GTUs of Khasyrey Power Center	CO_2 emission factor for diesel fuel	Total CO_2 emissions from consumption of diesel fuel in course of Project activity
Index	$FC_{DF,DPP,PJ}$	$FC_{GPC\ DF}$	EF_{DF}	PE_{DF}
Unit	tonnes	tonnes	tCO_2/tonne	tonnes CO_2
Month 1			-	Calculation according to formula (D.10)
Month 2			-	-
………………..			-	-

Total for year				-

Calculation of total CO_2 project emissions

(D.11) $PE = PE_{GTUs} + PE_{DF}$

Table 11. Total CO_2 project emissions

Column N	1	**2**	**3=1+2**
Feature	Amount of CO2 emissions from combustion of APG in GTUs	Amount of CO2 emissions from total diesel fuel consumption in course of Project activity	Total CO_2 project emissions
indication	$PE_{CO2,GTUs}$	PE_{DF}	PE
unit	Tonnes of CO_2	Tonnes of CO_2	Tonnes of CO_2
Month1			Calculation according to formula (D.11)
Month2			-
………………..			-
Total for a year			-

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

M-10	$EG_{PJ,GPP}$ Electricity generation on GPP Khasyreiskaya	Electricity meters SET-4TM02/2	MWh	m	monthly	100%	Paper and electronic	Electricity meters are installed at 6kV switch gear of Power Center substation. For measurements are used five meters: cell #2 GPP#1; cell #23 GPP#2; cell #3 GPP#3; cell #22 GPP#4; cell #4 GPP#5; Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month. This sort of data is stored not less than 2 years.
M-11	$EG_{PJ,Nad}$ Electricity generation for customers of Nyadeyu oil field	Electricity meter SET-4TM02/2	MWh	m	monthly	100%	Paper and electronic	Electricity meters are installed at 35kV switchgear of Power Center substation. For measurements are used two meters: cell #2 (line 3502); cell #8 (line 3508); Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month. This sort of data is stored not less than 2 years.

M-12	$EG_{PJ,Cherp}$ Electricity generation for customers of Cherpayu oil field	Electricity meter SET-4TM02/2	MWh	m	monthly	100%	Paper and electronic	Electricity meters are installed at 35kV switchgear of Power Center substation. For measurements are used two meters: cell #5 (line 3505); cell #11 (line 3511); Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month. This sort of data is stored not less than 2 years.

M-13	$EG_{PJ,own}$ Electricity generation for GPP's own needs	Electricity meter SET-4TM02/02	MWh	m	monthly	100%	Paper and electronic	Electricity meters are installed at 6kW switch gear of Power Center substation. For measurements are used meters: two for KTP SN EC #1 (input #1 cell 10 and input #2 cell 15); two for KTP SN EC #2 (input #1 cell 1 and input #2 cell 24); two for electricity engine compressors: cell #6 ED #1 and cell #20 ED #2. Data from meters are collected by electrician from 6 to 12 p.m. at the end of every month. This sort of data is stored not less than 2 years.

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>

Calculation of CO_2 and CH4 emission factors for APG burned in flares

Calculation of CO_2 emission factor

(D. 13) $EF_{CO2,F} = y_i * Nc * \rho_{CO2} * FE_F$

Table 13. Calculation of CO_2 emission factor for APG burned in flares

Column №	1	2	3	4	**5=1*2*3*4**
Item	Volumetric fraction of component	Quantity of carbon moles in a mole of a component (fixed parameter)	Density of carbon dioxide (fixed parameter)	Efficiency of APG combustion in flares (fixed-parameter)	CO_2 emission factor for APG burned in flares
Index	y_i	Nc	ρ_{CO2}	FEGTU[25]	$EF_{CO2,F}$
unit	%		Kg/m^3	-	tCO2/thousand. m3
Carbon dioxide, CO_2	0,00%	1	1.831	0.98	Calculation according to formula (D.13)
methane, CH_4	0,00%	1	1.831	0.98	-
ethane, C_2H_6	0,00%	2	1.831	0.98	
propane, C_3H_8	0,00%	3	1.831	0.98	
isobutene, C_4H_{10}	0,00%	4	1.831	0.98	
n-butane, C_4H_{10}	0,00%	4	1.831	0.98	
isopentane, C_5H_{12}	0,00%	5	1.831	0.98	
n-pentane, C_5H_{12}	0,00%	5	1.831	0.98	
hexane, C_6H_{14}	0,00%	6	1.831	0.98	
heptane, C_7H_{16}	0,00%	7	1.831	0.98	
octane, C_8H_{18}	0,00%	8	1.831	0.98	
hydrogen sulphide, H_2S	0,00%		1.831	0.98	
nitrogen, N_2	0,00%		1.831	0.98	
oxygen, O_2	0,00%		1.831	0.98	
					Sum

Calculation of CH_4 emission factor (in terms of CO_2) due to incomplete burning of APG in flare

(D.14) $EF_{CH4,f} = y_{CH4} * \rho_{CH4} * (1-FE) * GWP_{CH4}$

[25] 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Chapter 4. Fugitive emissions, p.4.45

Table 14. Calculation of CH_4 emission factor due to incomplete combustion of APG in flares

Column N	1	2	3	4	**5=1*2*3*4**
Item	Volumetric fraction of methane in APG	Methane density (fixed parameter)	Incomplete burning correction factor	Global warming potential for methane	Methane emission factor (in terms of CO_2)
Index	y_{CH4}	ρ_{CH4}[26]	(1-FE)	GWP_{CH4}	$EF_{CH4,F}$
Unit	%	kg/m3	-	tCO_2/tCH_4	tCO_2e/thousand. m^3
Month1	0.00%	0.667	0.02	21	Calculation according to formula (D.14)
Month2		0.667	0.02	21	-
……………..		0.667	0.02	21	-
Month 12		0.667	0.02	21	-

Calculation of baseline CO_2 emissions from APG burned in flares

(D.15) $BE_{CO2,F} = FC_{APG,GTU} * EF_{CO2,F}$

(D.16) $BE_{CH4,F} = FC_{APG,GTU} * EF_{CH4,F}$

Table 15. Calculation of emissions (provided in CO_2 equivalent) from APG flaring at Khasyrey BPS

Column N	1	2	3	4=1*2	**5=1*3**
Item	APG volume that would have been burned in flare of BPS (instead of being burned in GTU at Power Center)	CO_2 emission factor for APG burned in flare	CH_4 emission factor (in terms of CO_2) due to incomplete burning of APG in a flare	Amount of CO_2 emissions from APG burning in Khasyrey BPS flare	Amount of CH_4 emissions due to incomplete burning of APG in Khasyrey BPS flare
Index	$FC_{APG, GTU}$	$EF_{CO2,F}$	$EF_{CH4,F}$	$BE_{CO2,F}$	$BE_{CH4,F}$
Unit	thousand nm^3	t.CO2/th. nm3	t.CO2e/th.nm3	tonnes of CO_2	tonnes of CO_2e
Month1				Calculation according to formula (D.15)	Calculation according to formula (D.16)
Month2					-
……..					-
Total for a year					**-**

[26] As a source can be used http://fas.su/index.php?page=150

Calculation of electricity output to Khasyrey oil field

(D.17) $GEN_{6kV,Khas,PJ} = EG_{PJ,GPP} - EG_{PJ,own} - (EG_{PJ,Nad} + EG_{PJ,Cherp})$

Table 16 Calculation of electricity output to Khasyrey oil field

Column N	1	2	3	4	**5=1-2-(3+4)**
Item	Electricity generation on GPP Khasyreyskaya	Electricity generation for own needs of GPP	Electricity generation to Cherpayu oil field	Electricity generation to Nyadeyu oil field	Output of electricity to Khasyrey oil field
Index	$EG_{PJ,GPP}$	$EG_{PJ,own}$	$EG_{PJ,Cherp}$	$EG_{PJ,Nad}$	$GEN_{6кB,Khas,PJ}$
Unit	MWh	MWh	MWh	MWh	MWh
Month 1					
Month 2					
…					
Total for a year					Sum

Calculation of CO_2 emissions from consumption of diesel fuel at on-site DPPs

Definition of electricity output to customers of Gamburtsev swell oil fiels

(D.18) $GEN = GEN_{6kV,Khas,PJ} + GEN_{35kV,Nad,PJ} + GEN_{35kV,Cherp,PJ}$

Table 17. Output of electricity to customers of Gamburtsev swell oil fields

Column N	1	2	3	**4=1+2+3**
Item	Output of electricity to Khasyrey oil field customers	Output of electricity to Nyadeyu oil field customers	Output of electricity to Cherpayu oil field customers	Total output of electricity from Khasyrey Power Center to customers of Gamburtsev oil fields
Index	GEN6kV,Khas,PJ	GEN35kV,Nad,PJ[27]	GEN35kV,Cherp,PJ[28]	GEN

[27] This parameter is monitored and it is the same as $EG_{PJ,Nad}$ in Table D.1.1.3.

[28] This parameter is monitored and it is the same as $EG_{PJ,Cherp}$ in Table D.1.1.3.

Unit	MWh	MWh	MWh	MWh
Month1				Calculation according to formula (D.17)
Month2				-
……..				-
Total for a year				-

Calculation of CO_2 emissions from consumption of diesel fuel

(D.19) $FC_{DF,BL} = GEN * SFC_{DF,DPP}$

(D.20) $BE_{DF} = FC_{DF,BL} * EF_{DF}$

Table18. Calculation of CO_2 emissions from consumption of diesel fuel at on-site DPPs

Column N	1	2	3=1*2	4	**5=3*4**
Item	Total output of electricity from Khasyrey Power Center to customers of Gamburtsev oil fields	Specific consumption of diesel fuel at on-site DPPs (fixed parameter)	Consumption of diesel fuel at on-site DPPs	CO_2 emission factor for diesel fuel	CO_2 emissions from consumption of diesel fuel at on-site DPPs
Index	GEN	SFCDF,DPP	FCDF,BL	EFDF	BEDF
Unit	MW/h	t/MWh	tonnes	tCO2/tonne	**t CO2**
Month1		0.228	Calculation according to formula (D.18)		Calculation according to formula (D.19)
Month2		0.228			-
……..		0.228			-
Total for a year					-

Calculation of total CO_2 baseline emissions

(D.21) $BE = BE_{CO2} + BE_{CH4} + BE_{DF}$

Table 19. Total baseline CO_2 emissions

Column N	1	2	3	4=1+2+3
Item	CO_2 emissions from APG burning in Khasyrey BPS flare	CH_4 emissions due to incomplete burning of APG in Khasyrey BPS flare	CO_2 emissions from consumption of diesel fuel at on-site DPPs	Total amount of CO_2 baseline emissions
Index	BE_{CO2}	BE_{CH4}	BE_{DF}	BE
Unit	Tonnes of CO_2	Tonnes of CO_2e	Tonnes of CO_2	Tonnes of CO_2
Month1				Calculation according to formula (D.20)
Month2				-
……..				-
Total for a year				-

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

Option is not used

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

>>

Not used

D.1.3. Treatment of leakage in the monitoring plan:

Leakages are not identified for this project

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>

Leakages are not identified

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

(D. 22) ER = BE - PE

Table 20. CO_2 emission reductions

Column N	1	**2**	**3=1-2**
Item	Total amount of CO_2 baseline emissions	Total amount of CO_2 project emission	Total amount of CO_2 emission reductions
Index	**BE**	**PE**	**ER**
Unit	Tonnes of CO_2	Tonnes of CO_2	Tonnes of CO_2
Month1			
Month2			
……..			
Total for a year			

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

>>

In May 2006 «RN-Severnaya Neft» company has received a certificate proving that its environmental and industrial safety management system corresponds to requirements of international standards ISO14001 and OHSAS 18001.

The environmental service of the Company performs research, designing and environmental monitoring, cooperate with state ecological expertise. Together with experts of scientific institutes environmental service performs comprehensive research of all environment components and the research results become the basis for the further improvement of the Company activities.

To control the quality of the used diesel fuel the Company performs monthly sampling. On the basis of the sampling results, PCRL (Physical Chemical Research) laboratory (structural unit of the "RN-Severnaya Neft" LLC) performs analyses resulting in a report. The report includes all necessary physicochemical fuel characteristics (cetane number, breakup, impurity content and other).

To control the quality of APG supplied to Power Center, samples are taken as well. The laboratory of the "Nauka II" LLC that belongs to analytical sector and has accreditation for technical competence and independence[29], performs analysis. All analyses are performed in accordance with State Standards(GOSTs), such as GOST 23781 - 87, GOST 22387.2 – 97, GOST 22667 – 82, GOST 5580 – 56. The reports presented in paper include fuel chemical composition and other physical-chemical characteristics (humidity, net calorific value, Vobbe's number) as well as the time and place of sampling.

All reports on the used types of fuel as well as information on environmental impact are sent directly to the production and to ecological department at the head office of the Company.

In accordance with the Production Control Committee of the OJSC "Rosneft" recommendations in April, 2007 it was decided to include into year 2009 business plan the installation on GTU of an automated ecological unit for on-line control of pollutants emission with screening parameters on the operator's monitor.

[29] Acreditation certificate POCC RU.0001.512009 dated 21.10.02.

169711 Komi Republic, Usinsk, ul. Transportnaya 1.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
M-1 Amount of APG provided to Power Center	Low Instrumental error 1%	Equipment is tested in accordance with regulations and quality control procedures.
M-2, M-3. Chemical composition of APG, Net calorific value of APG	Low Inaccuracy of measurements 0.3 %	Laboratory “Nauka II” that is contracted to perform research activities, has all necessary certificates and provides high accuracy of results.
M-4. Instant consumption of APG in i-GTU of Power Center	Low Instrumental error 1%	Equipment is tested in accordance with regulations and quality control procedures.
M-6, M-7, M-8. Diesel fuel consumption by on-site DPPs at Khasyrey, Nyadeyu and Cherepayu oil fields	Low Instrumental error 0.25%	Equipment is tested in accordance with regulations and quality control procedures.
M-9, M-10, M-11, M-12 Electricity generation for customers at Khasyrey, Cherpayu and Nyadeyu oil fields and for own needs of GPP	Low Instrumental error 0.2%	Equipment is tested in accordance with regulations and quality control procedures.

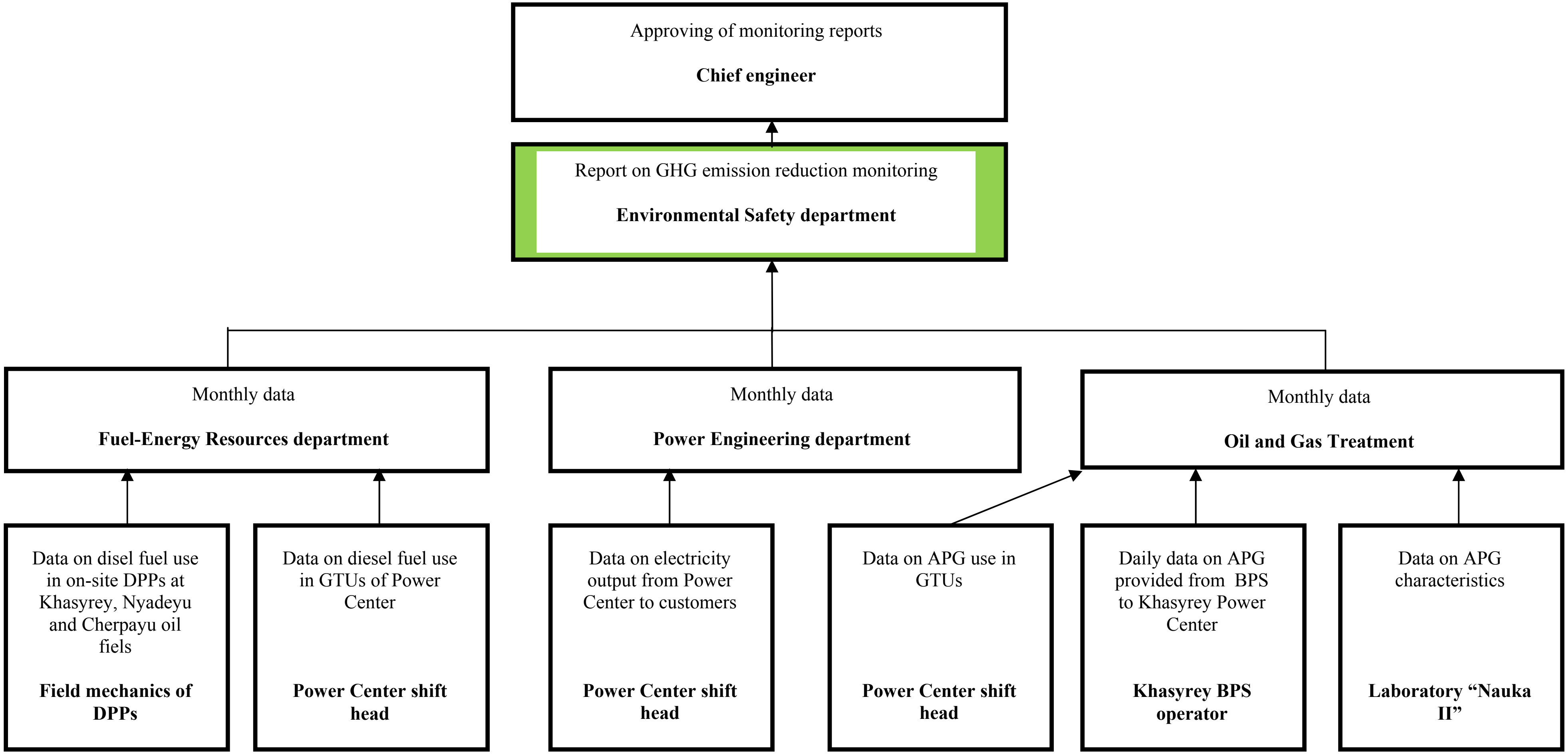
D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

>>

Management structure of monitoring plan execution in course of Project realization will be adapted to the present accounting and reporting system of the "RN-Severnaya Neft" LLC. Roles and responsibilities of people and departments performing the monitoring are presented in the following table:

№№	Companies	Position/department	Tasks	Goals
1.	"RN-Severnaya Neft" LLC	Chief engineer	General administration of monitoring plan execution	Approval of monitoring reports
2.	"RN-Severnaya Neft" LLC	Environment Protection department (EP department)	Processing of data for preparation of monitoring report	Development of monitoring report for the reporting period
3.	"RN-Energo" LLC	Fuel-Energy Resource department	Preparation of monthly data on consumption of diesel fuel in the project activity	Processing and presentation of data to Environment Protection department
4.	"RN-Severnaya Neft" LLC	Power Engineering department	Preparation of monthly data on electric energy production at Khasyrey Power Center	Processing and presentation of data to Environment Protection department
5.	"RN-Severnaya Neft" LLC	Oil and Gas Treatment department (OGT)	Preparation of monthly data on APG consumption at Khasyrey Power Center	Processing and presentation of data to Environment Protection department. Presentation of data on APG characteristics to Environment Protection department
6.	"RN-Energo" LLC	Mechanics of DPPs	Preparation of measurements results on diesel fuel consumption in on-site DPPs at Khasyrey, Nyadeyu and Cherpayu field	Presentation of data in Fuel-Energy Resources department
7.	"RN-Energo" LLC	Khasyrey Power Center shift head	Preparation of measurements results on diesel fuel consumption at Khasyrey Power Center	Presentation of data in Fuel-Energy Resources department
8.	"RN-Energo" LLC	Khasyrey Power Center shift head	Preparation of results on output of electricity from Power Center to customers	Presentation of data in Power Engineering department
9.	"RN-Energo" LLC	Khasyrey Power Center shift head	Preparation of measurements results on APG consumption in GTUs of Power Center	Presentation of data in Oil and Gas Treatment department
10.	"RN-Severnaya Neft" LLC	Khasyrey BPS operator	Preparation of results on APG provided to Power Center from BPS	Presentation of data in Oil and Gas Treatment department
11.	"Nauka II" "LLC	Head of Analytical Department	Preparation of APG characteristics (chemical composition, net calorific value and density)	Presentation of data in Oil and Gas Treatment department

Principal scheme of monitoring of greenhouse gases emission reduction in the “RN-Severnaya Neft” LLC



D.4. Name of person(s)/entity (ies) establishing the monitoring plan:

>>

CTF Consulting and National Carbon Sequestration Foundation

CTF Consulting and National Carbon Sequestration Foundation are not participants of the Project.

SECTION E. Estimation of greenhouse gas emission reductions

The methods proposed by methodological tool "Tool to calculate project or leakage emissions from fossil fuel combustion" (Version 02) were used for estimating greenhouse gas emissions from the project and baseline activities. According to this tool emissions are defined as product of fuel consumption and greenhouse gas emission factor. GHG emission factor for each source including a flare, GTU of Power Center, DPP is defined separately. For example, for APG burned in the flare and in GTU of Power Center, emission factors are calculated as follows (please also refer to the section D above):

$$\text{(E.1.)}\ \mathbf{EF_{CO2,f} = (y_{CO2} + (Nc_{CH4}*y_{CH4}+Nc_{VOC}*y_{VOC}))*\rho_{CO2}*FEf}$$ [30]

$EF_{CO2,f}$ – CO_2 emission factor for APG flaring, tCO_2/thousand m^3

y_{CO2}, y_{CH4} $y_{ЛНОС}$ – volumetric fractions of carbon, methane and volatile organic compounds VOC[31] in APG.

Nc_{CH4}, Nc_{VOC} – quantity of carbon moles in a mole of methane and VOC accordingly.

ρ_{CO2} – CO_2 density at 20°C is taken equal to 1.831 kg/m3.

FE – efficiency of APG combustion in a flare is taken equal to 0.98, for GTU it is equal to 1.

Table E1.Calculation of CO_2 emission coefficients for a flare and GTU

Parameter	Volumetric fraction of component	Quantity of carbon moles in a mole of a component (fixed parameter)	Density of carbon dioxide	Efficiency of APG combustion in a flare	Efficiency of APG combustion in GTU	CO_2 emission factor for APG burned in the flare	CO_2 emission factor for APG burned in GTU
Index	y_i	Nc	ρCO_2	FE	E_{GTU}	$EF_{CO2,F}$	$EF_{CO2,GTU}$
Unit	%		kg/m3	-	-	tCO_2/th. m3	tCO_2/th. m3
Carbone dioxide, CO2	0,22%	1	1.831	0.98	1	0.004	0.004
methane, CH4	77,40%	1	1.831	0.98	1	1.389	1.417
ethane, C2H6	10,71%	2	1.831	0.98	1	0.384	0.392
propane, C3H8	4,86%	3	1.831	0.98	1	0.262	0.267
isobutene, C4H10	0,65%	4	1.831	0.98	1	0.047	0.048
n-butane, C4H10	1,24%	4	1.831	0.98	1	0.089	0.091
isopentane, C5H12	0,27%	5	1.831	0.98	1	0.024	0.025
n-pentane, C5H12	0,18%	5	1.831	0.98	1	0.016	0.016
hexane, C6H14	0,06%	6	1.831	0.98	1	0.006	0.007
heptane, C7H16	0,00%	7	1.831	0.98	1	0.000	0.000
octane, C8H18	0,00%	8	1.831	0.98	1	0.000	0.000
hydrogen sulphide, H2S	0,05%		1.831	0.98	1	0.000	0.000
nitrogen, N2	4,00%		1.831	0.98	1	0.000	0.000
oxygen, O2	0,36%		1.831	0.98	1	0.000	0.000
						2.2221512	**2.2675012**

[30] This formula was derived from simplification of formula 4.4.5 on calculation of CO_2 emissions from APG burning at a flare, presented in 2006 IPCC Guidelines, Subchapter 4.2 "Fugitive emissions in oil and gas systems". Order of simplification is presented in Appendix 1 of this PDD.

[31] Volatile organic compounds

Due to incomplete burning of APG in the flare part of the gas is realesed in the atmosphere without being oxidized. 2006 IPCC Guidelines defines flare effeciency at 98%, it means that 2% does not burn completely causing methane emissions into the atmosphere. Methane emission factor in terms of CO_2 is defined according to formula:

$$(E.2)\ \mathbf{EF_{CH4,F} = y_{CH4} * \rho_{CH4} * (1-FE) * GWP_{CH4}}$$

y_{CH4}– volumetric fraction of CH_4 in APG.

ρ_{CH4}– density CH_4 at 20 °C is equal to 0.667 kg/m3

GWP_{CH4} – global warming potential for methane is taken equal to 21 tCO_2/tCH_4

Table E2. Calculation of CH_4 emission factor for incomplete burning of APG in the flare

Parameter	Volumetric fraction of CH_4 in APG	Methane density	Correction on incomplete burning	Global warming potential for methane	CH_4 emission factor (in terms of CO_2)
Index	y_{CH4}	ρ_{CH4}	(1-FE)	GWP_{CH4}	$EF_{CH4,F}$
Unit	%	kg/m^3	-	tCO_2/tCH_4	Tonnes of CO_2
Values	77.40%	0.667	0.02	21	0.2168284

CO_2 emission factor for diesel fuel conbustion in on-site DPPs is defined as a product of the net calorific value and CO_2 emission coefficient for diesel fuel.

$$(E.3.)\ \mathbf{EF_{CO2,DF} = NCV_{DF} * COEF_{CO2,DF}}$$

NCV_{DF} - net calorific value of diesel fuel, 42.7 TJ/thousand tonnes.

$COEF_{CO2,DF}$ –CO_2 emission coefficient for diesel fuel, is taken equal to 74.1 tCO_2/TJ

Table E3. Calculation of CO_2 emission factor from diesel fuel burning

Parameter	Net calorific value of diesel fuel	CO_2 emission coefficient for diesel fuel	CO_2 emission factor for diesel fuel
Index	NCV_{DF}	$COEF_{CO2}$	$EF_{CO2,DF}$
Unit	TJ/thousand tonnes	tCO_2/TJ	tCO_2/tonne
Values	42.70	74.1	3.16407

Oxidation coefficient for diesel fuel is taken equal to 1 in accordance with Guidelines recommendations. CH_4 emissions from DPP's operation are not considered due to insignificant value – less than 1 %.

E.1. Estimated project emissions:

>>Greenhouse gases emissions from project activitiy are caused by APG consumption in gas turbines units (GTU) of Power Center and as a result of diesel fuel combustion in DPPs during commissioning period of 2006-2008.

Emissions from APG consumption in GTUs of Power Center is defined as following:

$$\text{(E.4.)} \quad \mathbf{PE_{GTU} = FC_{APG,GTU} \cdot EF_{CO2,GTU}}$$

$\mathbf{FC_{APG,GTU,PJ}}$ – amount of APG burned in GTUs during project scenario, thousand m^3

$\mathbf{EF_{CO2,GTU}}$ – CO_2 emission factor for burning APG in GTU , tCO_2/thousand m^3

Table E1.1. CO_2 emission from APG burning in GTU of Power Center

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
Consumption of APG in GTU	$FC_{APG,GTU}$	th. nm^3	42,426	94,921	69,542	70,080	70,080	79,098	79,098
CO2 emission factor	$EF_{CO2,GTU}$	tCO2/th.m^3	2.2675012	2.2675012	2.2675012	2.2675012	2.2675012	2.2675012	2.2675012
Emission from APG burning in GTU	$\mathbf{PE_{GTU}}$	tonnesCO_2	**96,201**	**215,233**	**157,687**	**158,906**	**158,906**	**179,355**	**179,355**

CO_2 emissions from diesel fuel consumption in on-site DPPs

$$\text{(E.5.)} \quad \mathbf{PE_{DPP}=FC_{DF,DPP,PJ} \cdot EF_{CO2,DF}}$$

$\mathbf{FC_{DF,DPP,PJ}}$ – total actual amount of burned diesel fuel in DPPs, tonnes

$\mathbf{EF_{DF}}$ –CO_2 emission factor for diesel fuel burning, tCO_2/tonnes

Table E 1.2. Calculation of CO_2 emissions from consumption of diesel fuel in project activity

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
Diesel fuel consumption	$FC_{DF,DPP,PJ}$	tonnes/year	10 044	3414	868	0	0	0	0
Diesel fuel CO_2 emission factor	$EF_{CO2,DF}$	tCO2/tonnes	3.16407	3.16407	3.16407	3.16407	3.16407	3.16407	3.16407
CO_2 emissions	$\mathbf{PE_{DPP}}$	**tonnes CO2**	**31,781**	**10,803**	**2,747**	**0**	**0**	**0**	**0**

Total CO_2 emissions from project activity:

(E.6) $\mathbf{PE = PE_{GTU} + PE_{DPP}}$

Table E 1.3. Total CO_2 emissions from project activity

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
CO_2 emissions in GTU	PE_{GTU}	tonnes CO2	96,201	215,233	157,687	158,906	158,906	179,355	179,355
CO_2 emissions from diesel fuel use	PE_{DPP}	tonnes CO2	31,781	10,803	2,747				
Total CO_2 project emissions	**PE**	**tonnes CO2**	**127,982**	**226,037**	**160,434**	**158,906**	**158,906**	**179,355**	**179,355**

E.2. Estimated leakage:

>>
Not identified

E.3. The sum of E.1. and E.2.:

>>
Due to absence of leakages E.1 is not changed

E.4. Estimated baseline emissions:

>>
In the absence of project activity the situation would develop according to the baseline scenario that envisages electricity supply of Gamburtsev swell fields customers from on-site DPPs and APG (in amount equal to that of being used in GTUs under Project) flaring at stack.

CO_2 emissions from APG combustion at Khasyrey BPS flare:

(E.7.) $\mathbf{BE_{CO2,F} = FC_{APG,GTU} * EF_{CO2,F}}$

$FC_{APG,GTU}$ – APG consumption at Khasyrey BPS flare under the baseline scenario is taken equal to APG consumption in GTUs at Khasyrey Power Center according to project activity, th. m^3.

$EF_{CO2,F}$ –CO_2 emission factor of APG burned in the flare (see section E.1.), tCO_2/th. m^3

Table E 4.1. CO_2 emissions from burning APG in Khasyrey BPS flare

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
APG burning in Khasyrey BPS flare	$FC_{APG,GTU}$	th. nm^3	42,426	94,921	69,542	70,080	70,080	79,098	79,098
CO_2 emission factor	$EF_{CO2,F}$	tCO2/th.m3	2.2221512	2.2221512	2.2221512	2.2221512	2.2221512	2.2221512	2.2221512
CO_2 emission from flaring	$\mathbf{BE_{CO2,F}}$	**tonnes CO2**	**94,277**	**210,929**	**154,533**	**155,728**	**155,728**	**175,768**	**175,768**

CH_4 emissions due to incomplete burning of APG in Khasyrey BPS flare:

(E.8.) $\mathbf{BE_{CH4,F} = FC_{APG,GTU} * EF_{CH4,F}}$

$EF_{CH4,F}$ –CH_4 emission factor (see section E.1.) in terms of CO_2, tCO_2e/th. m^3

Table E 4.2. CH_4 emissions (in terms of CO_2) due to incomplete burning of APG in the BPS flare

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
APG burning in Khasyrey BPS flare	$FC_{APG,GTU}$	th. nm^3	42,426	94,921	69,542	70,080	70,080	79,098	79,098
CH_4 emission factor (in terms of CO_2)	$EF_{CH4,F}$	tCO_2e/th m3	0.2168284	0.2168284	0.2168284	0.2168284	0.2168284	0.2168284	0.2168284
CH_4 emissions (in terms of CO_2)	$BE_{CH4,F}$	tCO_2e	9,199	20,582	15,079	15,195	15,195	17,151	17,151

CO_2 emissions from consumption of diesel fuel in DPPs at Khasyrey, Nyadeyu and Cherpayu oil fields:

(E.9.) $\mathbf{BE_{DPP} = FC_{DF,BL} * EF_{CO2,DF}}$

$FC_{DF,BL}$ – diesel fuel consumption in DPPs at Kkasyrey, Nyadeyu and Cherpayu oil fields, tonnes.

$EF_{CO2,DF}$ –CO2 emission factor for diesel fuel combustion (see section E.1.), tCO_2/tonnes

(E.10) $\mathbf{FC_{DF,BL} = GEN * SCF_{DF,DPP}}$

GEN – output of electricity to customers at Khasyrey, Nyadeyu and Cherpayu oil fields from Khasyrey Power Center according to project activity, MWh

$SCF_{DF,DPP}$ – specific rate of diesel fuel consumption for production of one kWh of electric energy on diesel-generator at DPP is taken equal to 0.228 kg/kWh[32]

Table E 4.3. CO_2 emissions from consumption of diesel fuel at DPPs

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
Electric energy ouput	GEN	MWh	109,580	146,167	179,231	162,063	163,111	199,916	197,995
Diesel fuel rate	$SCF_{DF,DPP}$	kg/ kWh	0.228	0.228	0.228	0.228	0.228	0.228	0.228
Diesel fuel use	$FC_{DF,BL}$	tonnes	24,984	33,326	40,865	36,950	37,189	45,581	45,143
CO_2 emission factor for diesel fuel	$EF_{CO2,DF}$	tCO_2/tonnes	3.16407	3.16407	3.16407	3.16407	3.16407	3.16407	3.16407
CO_2 emissions from diesel fuel use at DPPs	**BE_{DPP}**	**tonnes CO_2**	**79,052**	**105,446**	**129,299**	**116,914**	**117,670**	**144,221**	**142,835**

Total CO_2 baseline emissions:

(E.11.) $\mathbf{BE = BE_{CO2,F} + BE_{CH4,F} + BE_{DPP}}$

---

[32] According to information from “RN-Severnaya Neft” experts

Table E 4.4. Total amount of CO_2 emissions in accordance with the baseline scenario

Parameter	Index	Unit	2006	2007	2008	2009	2010	2011	2012
CO_2 emissions from APG burning in BPS flare	$BE_{CO2,F}$	tonnes CO_2	94,277	210,929	154,533	155,728	155,728	175,768	175,768
CH_4 emissions due to incomplete burning of APG in BPS flare	$BE_{CH4,F}$	tonnes CO_2e	9,199	20,582	15,079	15,195	15,195	17,151	17,151
CO_2 emissions from diesel fuel use	BE_{DPP}	tonnes CO_2	79,052	105,446	129,299	116,914	117,670	144,221	142,835
Total CO_2 baseline emissions	**BE**	**tonnes CO_2**	**182,528**	**336,956**	**298,910**	**287,837**	**288,593**	**337,139**	**335,754**

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

>>

Emission reductions are calculated as follows:

(E.12) **ER=BE – PE**

BE – baseline emissions, tons CO2/year;

PE – project emissions, tons CO2/year;

E.6. Table providing values obtained when applying formulae above:

>>

Year	Estimated project emissions (tonnes of CO_2-equivalent)	Estimated leakages (tonnes of CO_2-equivalent)	Estimated baseline emissions (tonnes of CO_2-equivalent)	Estimated emission reductions (tonnes of CO_2-equivalent)
2008	160,434	0	298,910	138,476
2009	158,906	0	287,837	128,931
2010	158,906	0	288,593	129,687
2011	179,355	0	337,139	157,784
2012	179,355	0	335,754	156,399
Total (tonnes of CO_2 equivalent)	836,956	0	1,548,233	711,277

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

>>

In accordance with Decree of State Committee for Ecology and Natural Resources of the Russian Federation dated 15.04.2000 № 372 "On approval of directions on execution of planned economical and other activities and their ecological impact" developers must include environmental impact assessment into the project documentation.

Technical documentation developed for construction of Khasyrey Power Center developed by *ILF Russland LLC, Engineering and Project Management* includes environmental expertise of the Project (Volume 4). Such expertise consists of three parts relating to an impact of the project activity on the soil, atmosphere and animal world.

Results of the above-mentioned expertise are the following:

Impact on soil resources:

Filling was performed on the plot of the project construction to minimize negative impact on the lower layer. Banked earth is a mixture of sands of different sizes mostly of small sizes, banked earth capacity is up to 1.8m.
Due to presence of permafrost soils, pipelines are laid overhead on bearings with at least 1-1.5 m below the pipe lower part beyond the transport lines that allows minimizing thermal and mechanical impact on soils.
Water protection zone of water sites are not affected.
Soil protection from the site impact also includes rational usage of lands when storing industrial and domestic wastes.

Impact on air:

The performed analyses of the impact on atmospheric air, showed that for the operation period after the execution of the planned construction, the surface concentration created by projected gas turbine power station emission sources on the border of suggested sanitary protected zone and in the area of living buildings do not exceed maximum permissible concentration for inhabited zones. Also, payments are made for pollutants emission that does not exceed established maximum permissible emission norms, at the rate of 281,766.98 rubles/year.

Impact on vegetation:

To minimize the site impact on tundra vegetation in winter transportation to the site will be performed on winter snow road and in summer by the helicopters and also with usage of vehicles with low specific pressure on soil that are permitted by local authorities for travelling along tundra (LOS based on VAZ-1922 produced by SPKTB "Neftegasmach", Ufa).

To examine equipment cross-country vehicles with reinforced tires and extra low specific pressure on soil (from 0,005 to 0,03 MPa) – "Quality control and wells technical maintenance" laboratories LOS based on VAZ-1922 produced by SPKTB "Neftegasmach", Ufa that have permits for operation in tundra from Naryan-Marskiy environmental protection committee .

Impact on animal world:

Project decisions suggest the following conditions of wild animals and domestic reindeers population habitat while construction and operation of the oil pipeline:

- minimization of areas of temporary and permanent allotments of land, performance of construction work only in winter time, execution of construction works and industrial processes only inside industrial grounds that have special fencing,
- taking away scraps of materials, structures and construction garbage after the end of construction,
- Auto vehicles travelling only on winter snow roads and constructed field roads,
- Installation of deterrent devices and area illumination, provision of full sealing of oil transport system, prohibition of non –purified sewage discharge into surface waters and territory,
- Arrangement of special ways for raindeers along the oil pipeline, installation of stop and cut off valves on the bank parts of above-water guy crossings.

Mammals, registered in the Red Books do not live in the region of Project sites.

The considered earth plot does not interfere with traditional ways of raindeers migration.

In general, expertise stated that site impact on the animal world is insignificant both in construction and operation period.

The performed ecological expertise shows that the Project does not negatively affect atmosphere, soil and animal world.

Environmental impact of project activities (on a global scale) is estimated as positive as CO_2 emission into the atmosphere will be reduced by 877,000 of tonnes CO_2, for the period from 2006 to 2012.

Environmental impact of project activities (on a local scale) is also estimated as positive CH_4 emission reduction will be reduced by 5,217 tonnes of CH_4 during years 2006-2012 as a result of more thorough combustion of purified APG in the GTU with ecological afterburning gas fuel system D.L.E.

The present project positively effects aboriginal population that is mostly engaged in deer-raising by food support and free medical care and medicine support.

Construction of Hasyreiskiy Power Generating Center allowed creating 18 new working places. Projects provides for general staff number of:
- one shift = 18 people
- total, considering 3- shift, continuous regime = 54 people.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Expert conclusion for the Khasyrey Power Center project №8-61/18 dated December 25, 2006, is done by Russian Scientific Institute of Organization, Management and Economics of Oil and Gas Industry . Experts' opinion confirms that environmental impact assessment developed under technical documentation with regard to the project is performed in conformity with effective norms and standards.

Section G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

>>

Information on the construction and the commissioning of the Khasyrey Power Center was published in the article "Power Center- heart of the Swell" of local newspaper "Nash noviy sever" (Our new North) №32 (244) 31.08.2006, Information includes the description of both technical and environmental issues regarding to the project. Publication did not raise any readers' comments.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Calculation of CO_2 emission factor for associated petroleum gas flare combustion

Calculation of CO_2 emission factor for APG combustion in the flare device is done according to formula 4.4.5 proposed in Subchapter 4.2, “Fugitive emissions in oil and gas systems” of 2006 IPCC Guidelines :

$$E_{CO2,\ oil\ prod,\ flaring} = GOR*Q_{oil}*(1-CE)*X_{Flared}*M_{CO2}*\{y_{CO2} + (Nc_{CH4}*y_{CH4}+Nc_{NMVOC}*y_{NMVOC})(1-X_{Soot})\}*42.3*10^{-6}$$

Where:

$E_{CO2,\ oil\ prod,\ flaring}$ – direct amount of CO_2 emitted due to flaring at oil production facilities, gg/year;

GOR – average ratio gas-to-oil referenced at 15^0C and 101.325kPa, m^3/m^3;

Q_{oil} – total annual oil production ($10^3 m^3$/year);

CE – gas conservation effeciency factor;

X_{Flared} – fraction of waste gas (APG) that is flared rather than vented ;

M_{CO2} – molecular weight of carbon dioxide (equal to 44);

y_{CO2} – Molar or volume fraction of APG that is composed of CO_2;

Nc_{CH4} – number of moles of carbon per mole of methane (equal to 1);

y_{CH4} –Mol or volume faction of APG that is composed of CH_4;

Nc_{VOC} – number of moles of carbon per mole of non-methanic volatile organic compounds

y_{NMVOC} – molar or volume fraction of APG that is composed of non-methanic volatile organic compunds;

X_{Soot} – fraction of the non-CO_2 carbon in the input waste gas stream that is converted to soot or particulate matter during flaring. In the absence of any applicable data this value may be assumed to be 0 as a conservative approximation;

$42.3*10^{-6}$ – is the number of kmol per m^3 of gas referenced at 101.325 kPa and 15^0C (i.e. $42.3*10^{-3}$) times a unit conversion factor of 10^{-3} Gg/Mg which brings the results of each applicable equation to units of Gg/y.

To adopt above formula for the calculations of CO2 emissions in the PDD, further simplifications were considered:

In the right part of the above equation the product $GOR*Q_{oil}$ is the volume of resulting APG. Associated gas is not conserved that is why **CE** is equal to 0. Product of M_{CO2} and $42.3*10^{-6}$ is the density of CO_2 taken at 15^0C. As the volumes of all burned gases are given at 20^0C in further calculation, CO_2 density will be given at this temperature. X_{Soot} – in this case is underburning. Therefore above formula is converted into the following:

$$EF_{CO2,F} = X_{APG,F}*\rho_{CO2}*\{y_{CO2} + (Nc_{CH4}*y_{CH4}+Nc_{C2H6}*y_{C2H2}+Nc_{C3H8}*y_{C3H8}+Nc_{iC4H10}*y_{iC4H10} + Nc_{C4H10}*y_{C4H10} + Nc_{C5H12}*y_{C5H12} + Nc_{C6H14}*y_{C6H14} + Nc_{C7H16}*y_{C7H16} + Nc_{C8H18}*y_{C8H18} + Nc_{H2S}*y_{H2S})(1-X_{ub})\}$$

Where:

$X_{APG,F}$ - APG amount burned in flares but not vented;

ρ_{CO2} –CO_2 density at 20^0C, kg/m3;

X_{ub} – underburning coefficient;

y_{CO2} – volume fraction of APG that is composed of CO_2;

Nc_{CH4} – number of moles of carbon per mole of methane;

y_{CH4} – volume faction of APG that is composed of CH_4;

Nc_{NMVOC} – number of moles of carbon per mole of non-methane volatile organic compounds including ethane C_2H_6, butane C_3H_8, propane C_4H_{10}, pentane C_5H_{12}, hexane C_6H_{14}, heptanes C_7H_{16}, octane C_8H_{18}) ;

Annex 3

MONITORING PLAN

APG utilization in GTUs is determined by the monitoring of average instant consumption of APG in GTUi that is multiplied on work duration of GTU during a month, divided on net calorific value of APG multiplied on conversion factor. It can be described by equation:

(An.3.1.) $FC_{APG,GTUi} = HC_{APG,GTUi} * T/(NCV_{APG}*4,1868)*0.001$

Average instant consumption measured in kWs is monitored on every GTU by special program developed and introduced by Siemens company while implementation of turbines on power plant. This program is supported by annual quality control procedure made by Siemens specialists. The program registers instant consumption of APG per second and averages it out hourly. This parameter is displayed on monitors (screens) at the operator room of Power Center.

Special program Master PC uses value of average instant consumption in formula An 3.1. for calculation of fuel consumption in GTUi.

Besides the main fuel (APG) there exists reserve fuel (diesel). So in case of any accidents GTU can operate using diesel as a fuel. Diesel fuel consumption is defined by measuring the reservoir level three times per month. Data are put into the special inventory book of machine man. And at the end of the shift (once a month) petroleum inventory report is composed and lead to head of fuel energy resource department.

Calculation of CH4 emission factor for incomplete burning of APG in flare is determined by the formulae:

(An.3.2.) $EF_{CH4,f} = y_{CH4} * \rho_{CH4} *(1-FE)* GWP_{CH4}$

Where:

y_{CH4} – volumetric fraction of methane in APG,%;

ρ_{CH4} – methane density, kg/m3;

FE – incomplete burning correction factor;

GWP_{CH4} – global warming potential for methane, t CO2/tCH4;

Specimens of APG are collected by specialists of JSC “RN-Severnaya Neft” on the oil field and transported by the helicopter/vehicle in Usinsk where volumetric fraction of methane and methane density are measured by special third party laboratory “Nauka II”. In summer time in the conditions of impassable tundra specimens carrying on helicopter is hazardous. So measurements can be performed during the first month of every quarter.

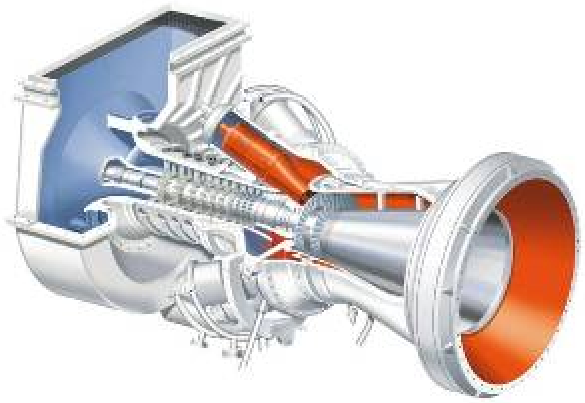
Annex 4

General description of «Tempest 7,9 MW» turbine

Description

Single shaft industrial gas turbine units «Typhoon» and «Tempest» proved themselves in single power generation and as well as in combined heat and power generation.
Gas turbine units have high efficiency and reliability and can work using a wide range of gas and liquid fuels. The turbines have compact design and their maintenance can be performed on-site. These turbines are used on sea platforms and Floating Production, Storage and Offloading systems (FPSO) all over the world.

Turbine unit.
The turbine has 2-stage design that includes a high pressure stage and a low pressure stage. The high pressure stage generates the power necessary to drive the compressor, and low pressure stage generates output power. Both transonic stages are provided with all blade rows having supersonic inlet and subsonic outlet.



General characteristics

Axial-flow compressor 10-stage axial-flow compressor with transonic rotation speed

- Regulated inlet guide vanes and stators
- Cp/Cv: (ISO) 14.0
- Air consumption: (ISO) 29.5 kg/s
- Nominal rotation speed: 14,010 rpm

Combustion system

- 6 tubular combustion chambers, counter flow type
- One igniter (high voltage ignition spark) per chamber
- Dry Low Emission (DLE) combustion system or common combustion system
- Vapor injection option for power increase

Turbine

- 2-stage turbine, cantilever type
    - The first stage is air-cooled
- Exhaust system options – radial or axial

Fuel system

- Natural gas – liquid fuel – runs on two types of fuel
- Other fuels customized on request
- Automatic transition from the main to reserve fuel at any load conditions

Exhaust control

- Dry Low Emission (DLE) combustion system
  - Regulated inlet guide vanes to control exhaust under low load conditions
- When DLE is operational, levels of nitrogen oxides exhausts do not exceed 10 and 50 parts per million for gas and liquid fuel correspondingly

Bearings

- Bearings with self-alignment segments and thrust bearings
- Vibration and temperature control

Reducer

- Drive on the cold end of the unit through a planetary reducer
- Output rotation speed 1500 & 1800 rpm can be used to operate on 50 or 60 Hertz frequency

Lubrication system

- Built-in lubrication oil system
- Main pump drived through the reducer
- Auxiliary pump drived from AC electric motor
- Emergency pump drived from DC electric motor

Starting system

- Frequency regulated electric motor

Compressor cleaning

- Cleaning under high pressure both in operation and in case of shutdown

Control system

- programmable logic controller (PLC) supporting function of distributed control and data processing, installed at the basement frame

This Project stipulates the use of ecological turbines Siemens with D.L.E combustion system.

D.L.E. combustion system

When running on gas and liquid fuel, DLE combustion system uses premix burners intended to lower flame temperature which reduces the generation of NOx. The pilot burner installed in the top part of the combustion chamber feeds fuel for ignition and is operational throughout transition processes. The fuel in the pilot burner is distributed so that its little amount is used under high load conditions to ensure flame stability in the event of load changes.

D.L.E system generally regulates nitrogen oxides, but it is also used for regulating carbon oxide exhausts. Regulation of carbon oxide exhausts under low load conditions is performed due to modulation of regulated inlet guide vanes that regulates air\fuel ratio.
All D.L.E systems run on two fuels and D.L.E gas system that needs exhaust regulation under low load conditions will use an algorithm of “T-ignition”. The algorithm of “T-ignition” is also used for fuel distribution between pilot and main burners.

The pump down system is used for removing fuel from all the channels which are not in use in order to prevent burners clogging. While the turbine is running or when it is shut off, the cooled air is used to pump down procedures. After the turbine is turned off, ambient air is used for cooling.
The turbine is provided with sound pressure sensors, their signals go to resistive temperature transducers. Sensors are used to control pressure in combustion chamber and casing as well as to detect the onset of combustion dynamics.
Generally, thermocouples are installed in a pilot burner. Typically, they are used to control and register the temperature at the pilot burner end. They are also used to detect ignition and transition reactions.

Traditional combustion system.
The combustion system six counter flow combustion chambers that have 30 degree inclination to the machine axis are used. These chambers are symmetrically placed around the turbine.
Combustion chambers are connected to a high pressure injector unit through transit channels.
Traditional combustion system is equipped with multichannel MPI injector. This injector has internal channels for injection of gas and liquid fuel as of well as vapor and water. But channel for water injection for the turbine TEMPEST is not needed and is permanently closed on the injector framework.
Vapor injection is used as an option in two types: injection of the primary vapor to lower exhausts and injection of the secondary vapor to increase the power. Primary vapor injection is presently limited to vapor-fuel ratio 1.5:1, and for the secondary vapor ratio 2:1 is used.
Combustion chambers placement result to impracticality of cross-cut pipes. Each combustion chamber has its own high-energy igniter unit. Notwithstanding the fact that there are six igniters, only one igniter power unit is used. All six igniters are fed from this unit. Igniters' power unit is certified in accordance with CENELEC standard.

Main characteristics of the used equipment:

Construction and putting into operation includes a priority complex with the following units:
1) GTU machinery hall with «SIEMENS» gas turbine units,
2) a complex of fuel gas treatment units with a compressing station made by "PETRECO", Canada;
3) a platform of high-voltage equipment 0,4 kV, 3,3 kV, 6 kV and 35 kV;
4) Gas pipeline with d. 350 mm for transportation of APG from technological separation platform at BPS "Khasyreyskaya" to Power Generating Center platform.
5) Sluices with d. 100 mm from BPS "Khasyreyskaya" to Power Generating Center platform.
6) Flare line with a combined flare unit of high and low pressure;
7) Firefighting pump unit;
8) combustive-lubricating materials and operation liquids and chemicals storage;

1) GTU machinery hall

Table An6.1. GTU machinery hall

Operation start stage	Name, producer	number	Total power, MW	Calculated fuel consumption for 1 GTU unit	
				gas, Nm^3/h	DT, l/min
I-st stage	GTU TYPHOON, Siemens	2	2 units x 4.7 MW	2,060	60
II-nd stage	GTU TEMPEST, Siemens	1	7.9 MW	3,000	-
III-rd stage	GTU TEMPEST, Siemens	2	2 units x 7.9 MW	3,000	-

Project capacity	Siemens	5	33.1 MW	16,120	60

2) Fuel gas compressing units machinery hall

Fuel gas compressing units are designed for compression of petroleum gas coming to Power Generating Center from BPS Khasyreyskaya under pressure.
Main characteristics of compressing units are presented in table A5**.**

Table An6.2.Main characteristics of compressing units

Operation start stage	Name, producer	Number	Productivity, Nm3/h	
			Unit inlet	Outlet from compressor
I-st stage	Compressors unit, PETRECO	2	13,517.4 (2 units x 6,758.7)	13,488.0 (2 units x 6,744.0)
II-nd stage	Compressors unit, PETRECO	1	6,758.7	6,744.0
III-rd stage	Compressors unit, PETRECO	1	6,758.7	6,744.0
Project capacity	"PETRECO"	4	27,034.8	26,976.0

2.1) Fuel gas treatment and purification complex (glycol-drying unit).

It is designed to remove liquids from APG, its drying to receive fuel gas for GTU with liquid percentage not less than 65 mg/m^3.

Table An6.3. Main characteristics of glycol gas drying units

Operation start stage	Name, producer	number	Productivity, Nm3/h	
			Untreated gas input for drying	Treated gas input to GTU
I-st stage	glycol gas drying unit, PETRECO	1	13,488.0	13,457.1
II-nd stage	glycol gas drying unit,, PETRECO	1	13,488.0	13,457.1
III-rd stage	glycol gas drying unit,, PETRECO	1	13,488.0	13,457.1
Project capacity		3	40,464.0	40,371.3

Table An6.4Main technological instruments of Power Center plants

Plant name	Description of flow	Temperature (^{0}C)	Pressure (kPa)	Consumption (Nm3/h)	Electric lines (MW/kV)
Gas drying unit	Gas coming out from the fuel gas treatment sector	from 20 to 55	from 1,800 to 2,580	13,460	
Compressor "Petreco"	Gas coming out from the fuel gas compressor	35	3,065 max	6,744	
	Gas on the inlet	from15 to 105	2,500 max	2,060 max	

Plant name	Description of flow	Temperature (^{0}C)	Pressure (kPa)	Consumption (Nm3/h)	Electric lines (MW/kV)
	Used power/voltage				600/3,3
GTU «TYPHOON»	Gas on the inlet	from 2,5 to 105	2,500 max	2,060 max	
	Diesel fuel on the inlet	from 0 to 60	from 103 to 205	60л/м	
	Compressed air	from 0 to 70	from 550 to 690	193	
	Entry power/voltage				4,7/6
	Used gases	from 486 to 547		from 17 to 21 kg/s	
GTU «TEMPEST»	Gas on the inlet	from 2,5 to 105	2,500 max	3,000 max	
	Diesel fuel on the inlet	-	-	-	-
	Compressed air	from 0 to 70	from 550 to 690	310	
	Entry power/voltage				7,9/6
	Used gases	from 486 to 547		from 25 to 34 kg/s	

2.2) Centralized compressing station for automatic machinery and equipment control
Instrumental air compressor is designed to feed compressed air with given parameters to equipment and systems of fuel gas treatment complex control.
For the 1st stage development, period one air compression unit will be put into operation.
For the entire Power Generating Center development – project includes centralized compressor station construction.
Centralized air compressing station with screw compressors DEN-75 with capacity 75 n.m^3\h and total construction area of 38,3 m^2.

2.3) Nitrogen station.
Is designed to blow out compressing units at the increase of hydrogen sulphide specific content in APG more than 1%.
Nitrogen station of gas nitrogen for technological needs with capacity 50 l\min, construction area 18 m^2.

3) Complex of high voltage equipment with distributional units and transforming stations.
Includes high voltage equipment, cable lines and racks designed for transformation of the generated voltage ant its distribution to consumers.
Main high voltage equipment:
- 35 kV switchgear device;
-6 kV switchgear device;
- transforming station 6/35 kV;
- transforming station 6/3,3 kV;
- transforming station 6/0,4 kV.

Besides 0,4 kV switchgear device will be installed.

4-5) Platform viaducts and pipelines.
Power Center technological pipelines are planned with conditional diameter from 25 to 350 mm, and placed on the steel overpass structures. According to Project all technological pipelines are place above the ground on the separately standing support units or viaducts in several layers.
Technological pipelines include fuel gas input pipelines, diesel fuel input pipelines, flare gas pipelines, drainage system pipelines, water supply and sewage, pneumatic pipeline for instrumental air input and gas nitrogen input, firefighting pipelines.
All technological pipelines have thermal insulation; separate pipelines have electrical heating system with temperature self-regulating cables produced by «TERMON».

6) Flare unit of high and low pressure.
Flare unit is designed for burning of excess amounts of gas coming from BPS "Khasyreyskaya" to Power Generating Center platform, and for utilization of gas fractions created during fuel gas treatment equipment complex work.

Table An6.5. Parameters of flows going to the flare

Flow number	**1**	**2**		**3**
		To the high pressure flare		**To the low pressure flare**
Flow description	**Gas after UPG separator to the duty burner**	**Emergency gas emissions**	**Emission of gas excess from compressor at regulation**	**APG from UPG, permanent flow to the flare**
Temperature (^0C)	35	41	35	108
Pressure (kPa)	405	2,580	2,580	101
Consumption (nm3/h)	Factual consumption	20,232	6,744 (max. Productivity of one compressor)	31.2

7) Fire fighting station
Project foresees firefighting station including water and foam pump station, water storing reservoirs, pipelines, alarm system.
Firefighting pump station with total area of 700 m^2 and water productivity 100 m^3/h

8) Complex of reserve liquid fuel supply with a reservoir PBC-400 and a pump station
Vertical reservoir is designed for diesel fuel storage. Diesel fuel stock supply of 400 m^3 must provide one TYPHOON unit work during 111 hours or 4,5 days.
Diesel fuel pump unit is designed for diesel fuel feeding to GTU TYPHOON of the 1st stage. Diesel fuel pump unit provides diesel fuel feeding with working pressure in the interval of 1,03…2,05 bar.

Annex 5

Extract from the description part of technical documentation of Khasyrey Power Center Project. Chapter "Complex utilization of APG, secondary energy resources. Adherence to Kyoto Protocol requirements":

"ILF Rusland" **Project A229.**
Construction of gas turbine power station of Khasyrey BPS

Volume 1 – General explanatory note.

1.7 Complex utilization of APG, secondary energy resources.
Adherence to Kyoto Protocol requirements.

The technical concept that serves as a basis of decision-making fully corresponds to Federal Law № 28-FL dated April 3, 1996. "On energy saving" aimed for state regulation of relations created in the process of effective usage of energy resources at their production, manufacturing, processing, transportation, storing and consumption.
Project aim is to create and use the most effective technologies, use of the less fuel and energy consuming equipment, modern construction and isolating materials, equipment for energy resources consumption registration and their usage control, energy consumption automatic control systems.
Turbines «Typhoon» and «Tempest» manufactured by «Siemens» and designed for power production are used in the Project. Turbines have high efficiency (~30%) and hign reliability.

It is necessary to note that industrial combined heat and power generation is the most efficient mode of these turbines application. Efficiency of installations where high temperature turbine' exhaust gases are utilized in the heat recovery boiler or heat exchanger may reach overall "heat" efficiency up to 95%. Produced steam or hot water can be used for technological processes of raw oil treatment and for sites central heating networks. Produced superheated steam can be used in the small generating units applying combined cycle together with steam turbine to produce additional power.

This project is developed taking into account the necessity of meeting the targets of Kyoto Protocol to United Nations Framework Convention on Climate Change requirements (hereinafter referred to as the Protocol).

The most up-to-date technical solutions are used to increase efficiency of natural resources usage that directly contributes to meeting of the quantitive obligations on limitation and reduction of emissions in accordance with article 3 of the Protocol within the bounds of this project.

In the respective parts of the project all measures necessary for assistance to rational method of preservation and permanent renewal of uniq local environment are taken.

The processes foreseen by this project directly limit and reduce methane emissions due to methane usage as a fuel in power production with possible additional useful utilization of waste heat increasing the overall efficiency of the process.

For actual registration of clear changes of emission reduction values achieved as a result of the implementation of a specific project aimed at reduction of anthropogenic emissions, measuring equipment and complexes used in this project are able to provide necessary accuracy and authenticity and unity of measurements of the distributed and consumed energy resources, combined into a common ACS.