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:

"Installation of two CCGT-400 at Surgutskaya TPP-2, OGK-4, Tyumen area, Russia".

Sectoral scope 1: Energy industries[1].

PDD version 4.0.

02 March 2010.

A.2. Description of the project:

OJSC "Fourth Generation Company of the Wholesale Electricity Market" (further in the text - OGK-4 in line with the Russian abbreviation) is one of the six thermal OGKs established during the Russian electricity sector reform. OGK-4 was incorporated in 2005 and completed the process of its corporate reorganization in 2006. E.ON Russia Power became owner of around 69% stock by the end of 2007. E.ON Russia Power owned 76% of stock by the end of 2008.

OGK-4 core business is generation and wholesale of electricity. Generation, transmission and sale of heat are not crucial as it constitutes only around 2% of sales revenues.

The company operates five thermal power plants (TPP) throughout Russia: Berezovskaya TPP (1,500 MW, Sharypovo, Krasnoyarsk territory), Surgutskaya TPP-2 (4,800 MW, Surgut, Tyumen area), Yajvinskaya TPP (600 MW, Yajva, Perm area), Shaturskaya TPP (1,100 MW, Shatura, Moscow area) and Smolenskaya TPP (630 MW, Ozerny, Smolensk area) which are the branch of the Company since 1 July 2006.

Total installed generation capacity of OGK-4 is 8,630 MW (that accounts for about 4% of Russia's total installed power capacity) and total installed thermal generation capacity is 2,179 Gcal/h. OGK-4 produced 56,676 MWh of electricity and 2,261thous.Gcal of heat in 2008. Gas accounted for 79% of the energy balance.

Surgutskaya TPP-2 was built during 1981-1988. The first energy unit (800 MW) started operation in 1985. Currently Surgutskaya TPP-2 is the biggest branch of OGK-4 and the biggest power plant in Russia. The installed electricity capacity is 4,800 MW and the heat capacity is 840 Gcal/h. The TPP produced 60.7% of energy generated by OGK-4 in 2008 and operates (100%) on gas (dry associated gas from "Surgutneftegas" and natural gas from "NOVATEK"). The main technical data of the existing energy units is presented in the Table A.2.1 below.

Table A.2.1: Main technical data of existing energy units at Surgutskaya TPP-2

N	Type of energy unit	Amount	Unit capacity, MW	Commissioning year	Turbine type	Boiler type	Fuel
1-6	Boiler +steam turbine unit	6	800	1985-1988	K-800-245-5	TGMP - 204HL	Gas

Source: OGK-4

[1] http://ji.unfccc.int/Ref/Documents/List_Sectoral_Scopes_version_02.pdf

The project is implemented at Surgutskaya TPP-2. It is planned to build an additional electricity generating unit using Combined Cycle Gas Turbine (CCGT) technology which is the most energy efficient and environmentally sound way of energy generation as of today. The purpose of this project is to demonstrate the utilisation of a Best Available Technology (BAT) and to decrease the specific CO_2 emissions per MWh generated and other negative anthropogenic impacts.

Project scenario
Two combined cycle gas turbine units with total electricity capacity of 800 MW will be installed at Surgutskaya TPP-2 and commissioned in March 2011. The gross efficiency of new energy unit can reach up to 57.1%.

Currently the part of dry associated petroleum gas is 75% and the part of natural gas is 25% in the fuel balance of Surgutskaya TPP-2. Dry associated gas is main fuel. Natural gas to be used instead of dry associated petroleum gas when volume of APG is not enough to cover needs. Similar situation will be for CCGT. OJSC "OGK-4" concluded the contract of gas delivery with OJSC "NOVATEK" for additional natural gas deliveries in November 2007.

The dry associated petroleum gas is delivered by OJSC "Surgutneftegas". Associated petroleum gas is delivered from oil deposits to the gas cleaning station (GCS). After GCS associated petroleum gas is cleaned and dried (separated from condensate and benzene). Dry associated petroleum gas (APG - further in the text) composition is similar to the natural gas composition. Methane content is stable and equal to 95-97%. Net calorific value of APG is also stable and equal to 48.3-48.7 TJ/Gg. Emission factor of APG is 0.0560 tCO2/GJ (gas composition for 2009 and results of emission factor calculation are presented in Annex 2). Emission factor and net calorific value of APG are very similar to default emission factor (0.0561 tCO2/GJ) and default net calorific value (48.0 TJ/Gg) of natural gas[2].

After project implementation the new energy units will supply electricity to the United Regional Energy System (URES) "Ural" grid (description of URES is provided in Annex 2). Electricity produced by the new generating units, based on more efficient technology of energy generation, will replace electricity that would be generated using less efficient technology in case of the absence of the units.

Baseline scenario
The baseline scenario is based on the assumption that if the project is not implemented (i.e. additional electricity will not be supplied to the grid) third parties will cover the energy demand. The energy companies within the same regional energy system (URES "Ural") can increase electricity generation at the existing capacities by delaying decommissioning of outdated capacity and/or installing new energy units.

A JI specific approach was used for the baseline setting. Please see Section B for more detailed information.

Brief history of the project
The Russian United Energy Company (in Russian- RAO "UES") paid a lot of attention to the cooperation within Kyoto Protocol to UNFCCC. A GHG inventory has been made for all regional branches. The company seriously considered introduction of internal emission trading system (ETS). It created a special entity for PIN and PDD development being the Energy Carbon Fund (ECF). When investment programs or interventions were planned and approved by its Board the potential implications of this cooperation were taken into account. This was reflected in the titles of the investment projects.

[2] Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006

Most of the projects with CCGT installation were entitled as "Creating the Replacing Capacity by CCGT installation at…". It was expected that some old generating capacities would be replaced after 2020 or earlier. When OGK-4 was created in 2005 it inherited the old investment programs adjusting their scope and funding but not the titles of interventions and projects.

The decommissioning activities of some installations are not planned at Surgutskaya TPP-2 as it has the most modern recently installed (in comparison with the average age of this type of equipment in Russia) energy generating installations. The decision on funding and implementing the project under the title "Creating the Replacing Capacity by CCGT-800 (2×CCGT-400) Installation at the Branch Surgutskaya TPP-2 of OGK-4" was taken by the OGK-4 Committee Directors (approval of project feasibility study) in June 2007. The PIN for this project was developed by ECF in February 2007. After approval of the project feasibility study OGK-4 concluded a contract with consortium of "General Electric International" and "Gama Guc Sistemleri Muhendislik Ve Taahut A.S." for project implementation. OGK-4 waited for JI National Approval Procedure to be in place in Russia. After its launch in February 2008 OGK–4 and its new owner – E.ON Russia Power decided to update the PINs and to prepare prefeasibility study for those PINs in three OGK-4 affiliates including Surgutskaya TPP-2.

As a result of this study OGK-4 decided to start the full JI cycle but having the project under the title "Installation of CCGT-800 at Surgutskaya TPP-2, OGK-4, Tyumen area, Russia" that more precisely reflects the project scope and follows the rules of naming JI projects. In all JI cycle related documents this title will be used while supporting documents provided upon the request to the Determinator might refer to the previous title of the project.

A.3. 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)
Party A: Russia (Host party)	OJSC "Fourth Generation Company of the Wholesale Electricity Market"	No
Party B: Germany	E.ON Carbon Sourcing	No

Role of the Project Participants:

- OJSC "Fourth Generation Company of the Wholesale Electricity Market" (OGK-4) – will manage and partly fund JI project implementation at Surgutskaya TPP-2. It will own ERUs generated. OGK-4 is a project participant;
- E.ON is one of the biggest investor-owned companies, involved in production, supply and sales of different types of energy, heat and natural gas with operations in Germany, UK, Italy, Spain, Sweden, Russia and USA. Its Euro 87 billion sales were generated by around 94 thousand employees in 2008. E.ON is involved in the flexible mechanisms of the Kyoto Protocol and created special business unit "E.ON Carbon Sourcing", 100% subsidiary of "E.ON Climate & Renewables" for these purposes. It funds JI project investment cost and will use ERUs generated. "E.ON Carbon Sourcing" is a project participant.

JI consultant:
Global Carbon BV is a leading expert on environmental consultancy and financial brokerage services in international greenhouse emissions trading market under Kyoto Protocol. Global Carbon BV is a project

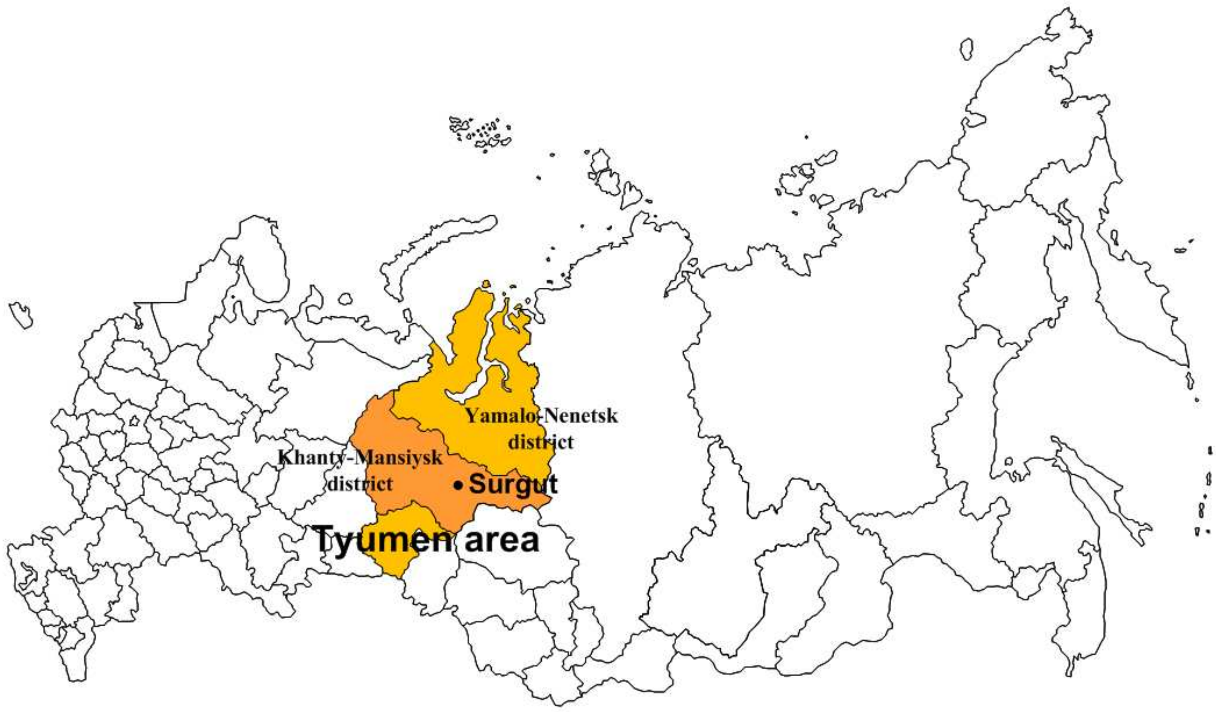
design document (PDD) developer including monitoring plan and baseline setting. Global Carbon BV has developed the first JI project that has been registered at United Nations Framework Convention on Climate Change (UNFCCC). The first verification under JI mechanism was also completed for Global Carbon BV project. The company focuses on Joint Implementation (JI) project development in Bulgaria, Ukraine, Russia, and the EU Emissions Trading Scheme. Global Carbon BV is responsible for the preparation of the investment project as a JI project including PDD preparation, obtaining Party approvals, monitoring and transfer of ERUs. Global Carbon BV is not a Project Participant.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located in Surgut town (61°15' longitude, 73°26' latitude) in the Tyumen area (in the Khanty-Mansiysk Autonomous district (historical name - Ugra)). The geographical location of the Surgut town in Russia is presented in Figure A.4.1.1 below.

Figure A.4.1.1: Map of Russia with location of Tyumen area



Source: http://ru.wikipedia.org/

A.4.1.1. Host Party(ies):

The Russian Federation.

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

Tyumen Area is located in West Siberia and includes Khanty-Mansiysk and Yamalo-Nenetsk districts. The population of area is approximately 3.5 mln. (11^{th} place in Russia) and the surface area is approximately 1.5 mln.km^2 (Third place in Russia).

Tyumen Area (in Russian language – oblast) is the biggest area (in terms of the Gross Regional Product (GRP)) in the Russian Federation. The main oil and gas deposits of Russia are in this region. The fuel industry (oil and gas) is 86% of GRP.

Next biggest industry is the energy industry. The Tyumen area energy system is the biggest system in Russia in terms of the electricity generation and consumption. Several big power plants (besides Surgutskaya TPP-2) are located in the Tyumen area:
- Surgutskaya TPP-1 (3280 MW, branch of OJSC “OGK-2”);
- Nizhnevartovskaya TPP (1600 MW, branch of OJSC “OGK-2”);
- Tyumenskaya CHP-2 (755 MW, branch of OJSC “TGK-10”);
- Tobolskaya CHP (452 MW, branch of OJSC “TGK-10”).

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

Surgut is located within Khanty-Mansiysk district and it is the capital of Surgut region. The coordinates of the town are 61°15'N, 73°26'E.

Surgut was founded in 1594. Surgut is the biggest town of Khanty-Mansiysk district with a population of approximately 300 thousand people. Some offices of biggest oil and gas companies are located in Surgut town: “Surgutneftegas”, “Gasprom transgas Surgut”. The town is non-official “oil capital” of Russia.

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

Surgutskaya TPP-2 is located within the Surgut town boundaries in its east part. The coordinates of TPP are 61°16'N, 73°30'E.

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

A combined cycle is characteristic of a power producing engine or plant that employs more than one thermodynamic cycle. Heat engines are only able to use a portion of the energy of their fuel generates (usually less than 50%). Normally the remaining heat (e.g. hot exhaust fumes) from combustion is wasted. Combining two or more "cycles", such as the Brayton cycle and the Rankine cycle, results in improved overall efficiency.

In a combined cycle power plant (CCPP), or combined cycle gas turbine (CCGT) plant, a gas turbine generator generates electricity and the waste heat is used to make steam to generate additional electricity via a steam turbine; this last step enhances the efficiency of electricity generation. Most of the new gas power plants in North America and Europe are of this type, whereas in Russia this is not the case. In a thermal power plant, high-temperature heat as input to the power plant, usually from burning of fuel, is converted to electricity as one of the outputs and low-temperature heat as another output. As a rule, in order to achieve high efficiency, the temperature difference between the input and output heat levels should be as high as possible. This is achieved by combining the Rankine (steam) and Brayton (gas) thermodynamic cycles.

Efficiency of CCGT plants
By combining both gas and steam cycles, high input temperatures and low output temperatures can be achieved. Efficiency of cycles sums up, because they have the same fuel source. So, a combined cycle plant has a thermodynamic cycle that operates between the gas-turbine's high firing temperature and the waste heat temperature from the condensers of the steam cycle.

If the CCGT plant produces only electricity, efficiencies of up to 60% theoretically may be achieved. Projected plant gross efficiency is expected 57% under nominal operational parameters.

The proposed project uses General Electric STAG™ (Steam and Gas) combine-cycle power system. The type of system is S109FA. The two energy units will be installed at Surgutskaya TPP-2. The electric capacity of one of the energy units is 400 MW. It includes one gas turbine (model is PG9351FA), one steam turbine (D10), one generator (390H), one triple pressure heat recovery steam generator (CMI) and auxiliary equipments.

The technical characteristics of the energy unit are described in the Table A.4.2.1 below.

Table A.4.2.1: Relevant technical data of energy unit

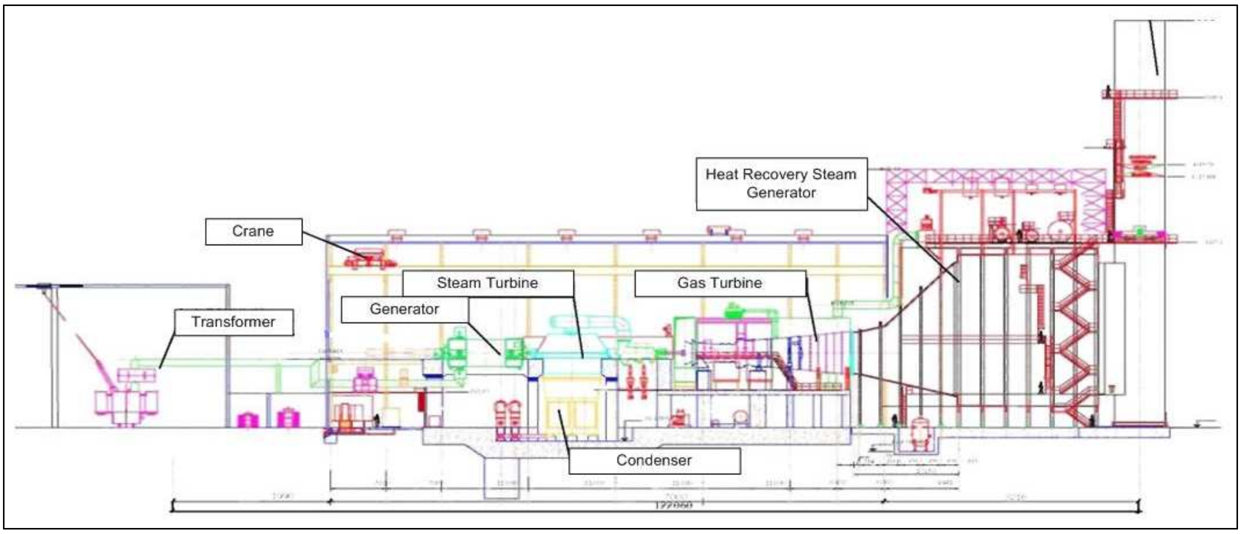
Indicator	Amount	Unit
S109FA		
Fuel	Gas (dry associated gas and natural gas)	-
Installed capacity	401	MW
Gross efficiency	57.1	%
	6,304	kJ/kWh
PG9351FA		
Installed capacity	270	MW
Turbine Speed	3,000	rpm
Gas consumption	52.7[3]	t/h
Exhaust Temperature	600	°C
CMI		
High pressure steam output	281.1	t/h
Intermediate pressure steam output	315.6	t/h
Low pressure steam output	48,4	t/h
D10		
Installed capacity	130	MW
390H		
Capacity	400	MW

Source: Data provided by OGK-4

The S109FA design at Surgutskaya TPP-2 (Figure A.4.2.1) and the heat scheme of S109FA at Surgutskaya TPP-2 (Figure A.4.2.2) are presented below.

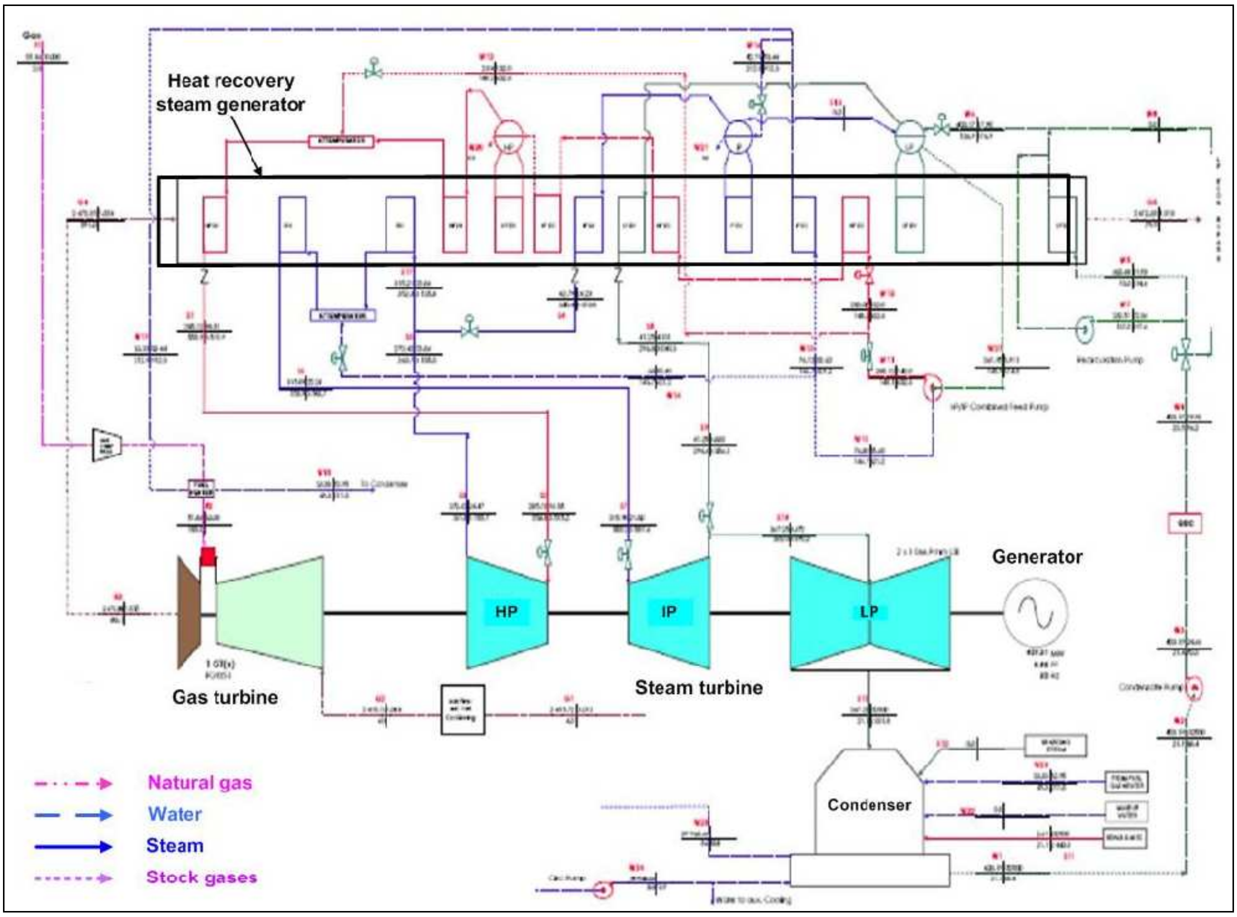
[3] Net calorific value is 48.6 GJ/t

Figure A.4.2.1: S109FA design at Surgutskaya TPP-2



Source: Data provided by OGK-4

Figure A.4.2.2: Heat scheme of S109FA at Surgutskaya TPP-2



Source: Data provided by OGK-4

Implementation schedule

Proposed project was included into the new capacity list of Order of RAO "UES" (March 23 2006 # 216) "About the first-priority sites of the generated capacity input within United Energy System of Russia" in 2006. Early 2006 the business plan of the project was prepared and the site preparation works started.

The Committee Directors of OGK-4 (06 June 2007, #61) approved the project implementation as priority for OGK-4 and the contract with consortium of "General Electric International" and "Gama Guc Sistemleri Muhendislik Ve Taahut A.S." was signed on 24 October 2007.

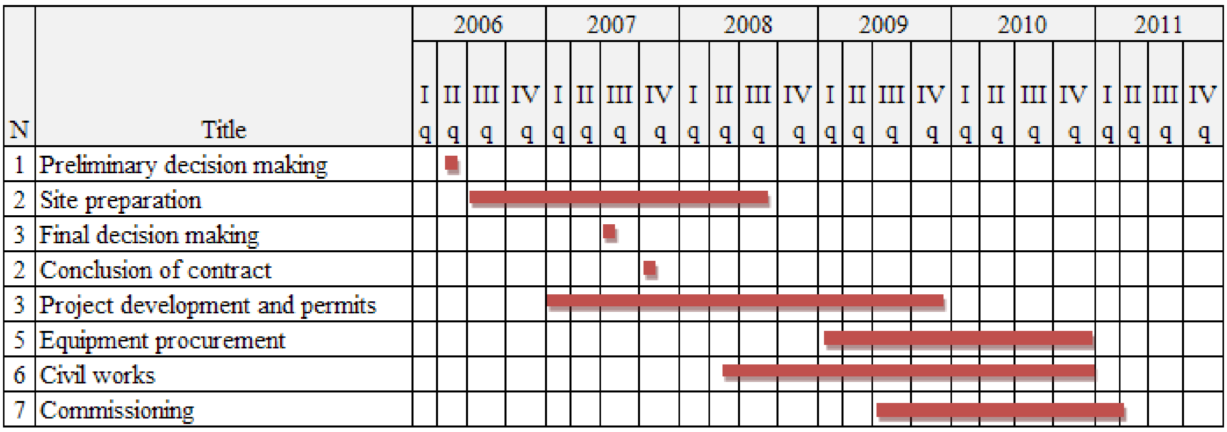
"The Engineer Centre of Ural Energy Industrial" finished the preparation of the Project Design "Creating the Replacing Capacity by CCGT-800 (2×CCGT-400) Installation at Surgutskaya TPP-2, OGK-4" in 2008.

After that the Project Design was approved by the Federal State Institution "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) in February 2009.

All main equipment for both new energy units (gas and steam turbines, generators and heat recovery steam generators) was delivered. Currently this equipment and the auxiliary equipment are being installed.

The first of CCGT-400 energy unit (power station number #7) will be commissioned by March 2011, the second (#8) - by April 2011 The project implementation schedule is presented in the Table A.4.2.2.

Table A.4.2.2: Project implementation schedule



Source: Data provided by OGK-4.

Training programme

According to contract with consortium of "General Electric International" and "Gama Guc Sistemleri Muhendislik Ve Taahut A.S." (the section 30 of the contract): "The comprehensive training program is conducted for a selected number of customer's engineers, operations and maintenance personnel. The training will be conducted at the customer's site".

The training is included the following main courses:

- Operation Training (57 days);
- Mechanical Maintenance Training (12 days);
- Controls Training (30 days).

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:

The project uses the best available technologies of electricity generation: Combined cycle electricity generation. Its gross efficiency is approximately 57% and the emission factor is 0.364 tCO_2/MWh. After the project implementation electricity generated by the two new energy units will be supplied to the grid of URES “Ural”. It will replace electricity which otherwise would have been generated by the existing power plants and/or other new energy units to be constructed by the third parties. The Combined Margin emission factor (existing power plants and new energy units) is 0.606 tCO_2/MWh.

The project does not look financially attractive as it is proved in Section B.2 through the application of the appropriate investment analysis as per the approved CDM “Tool for the demonstration and assessment of additionality” (version 05.2). The energy industry is a capital intensive industry and the proposed project requires a significant amount of funding (more than Euro 780 million). The IRR benchmark used in the investment analysis is 10.5%, while in the proposed project (not being implemented as a JI project) the IRR will be only 7.03%. For more detailed information on baseline setting and additionality, please refer to Section B.

Therefore if the project is not implemented, more greenhouse gases will be emitted to supply the same amount of electricity.

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

	Years
Length of the crediting period	1.795
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2011	1,008,405
2012	1,335,635
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	2,344,040
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1,305,872

	Years
Period after 2012, for which emission reductions are estimated	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	1,335,635
2014	1,335,635
2015	1,335,635
2016	1,335,635
2017	1,335,635
2018	1,335,635
2019	1,335,635
2020	1,335,635
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	10,685,083

Detailed calculation of project emission reductions is presented in Section E.

A.5. Project approval by the Parties involved:

The PDD and other relevant documents will be submitted to the Russian Ministry of Economic Development to follow the procedure of project approval as JI by the Government of the Russian Federation. Additionally, project approval from Germany will be sought.

SECTION B. Baseline

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

Indication and description of the approach chosen regarding baseline setting
According to paragraph 9 of the "Guidance on criteria for the baseline setting and monitoring", version 02 (hereinafter referred to as "Guidance"), the project participants may select either:
(a) An approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or
(b) A methodology for baseline setting and monitoring approved by Executive Board of clean development mechanism (CDM).

In the proposed project a JI specific approach to set the baseline scenario and the monitoring plan is used. This specific approach will use some elements of CDM methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas", version 3.

The proposed approach is being applied through the following three steps:
1. Identification of a baseline in accordance with paragraphs 23-29 of the Guidance;
2. Additionality demonstration in accordance with the most recent version (version 05.2) of the "Tool for the demonstration and assessment of additionality";
3. Calculation of emissions of the baseline scenario.

The detail theoretical description of the baseline is presented below.

Application of the approach chosen

Step 1: Identification of a baseline based on the selection of the most plausible alternative scenario

Sub-step1a: Identification and listing of plausible alternative baseline scenarios
In the proposed project it is planned that two combined cycle gas turbine units burning associated gas with total electricity capacity of 800 MW will be installed at Surgutskaya TPP-2 and commissioned in March 2011. As shown in the Section A.2 the other types of energy units (for example, steam power unit) and other types of fuel were not considered as alternatives of the proposed project. After project implementation the two new energy units will supply electricity to the United Regional Energy System (URES) "Ural" grid.

Therefore based on the JI specific approach presented above four plausible alternative baseline scenarios are identified:

Alternative scenario 1:	The proposed project not developed as a JI project;
Alternative scenario 2:	The electricity to be generated by project is provided by the other existing plants of URES "Ural";
Alternative scenario 3:	The electricity to be generated by project is provided by the other new energy units of URES "Ural",
Alternative scenario 4:	The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural".
Alternative scenario 5:	The electricity to be generated by project is provided by the import of electricity from connected grids.

These four alternative scenarios are described below in more detail.

1) The proposed project not developed as a JI project

Two combined cycle gas turbine units with total electrical capacity of 800 MW will be constructed at Surgutskaya TPP-2 and commissioned in March 2011. Gross efficiency of new energy units will be approximately 57%. The associated gas will be used as fuel. After project implementation electricity will be supplied by the new energy units into grid of URES “Ural”. It will replace electricity which otherwise will be generated at the other power plants of URES “Ural”.

2) The electricity to be generated by project is provided by the other existing plants of URES “Ural”

OGK-4 does not install the new energy units and project electricity generation would have to be covered by the other existing power plants within URES “Ural” that exists in the particular year that the project is generating electricity.

3) The electricity to be generated by project is provided by the other new energy units of URES “Ural”

OGK-4 does not install the new energy units and project electricity generation will be covered by new energy units to be constructed by the other energy companies within URES “Ural”.

4) The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES “Ural”

OGK-4 does not install the new energy units and project electricity generation would have to be covered by the other existing power plants and by the new energy units to be constructed by the other energy companies within URES “Ural”. This alternative is a combination of alternative 2 and 3.

5) The electricity to be generated by project is provided by the import of electricity from connected grids

OGK-4 does not install the new energy units and project electricity generation would have to be covered by the other existing power plants and by import of electricity from connected grids (in this case: from URES “Volga”).

Sub-step 1b: Identification of the most plausible alternative scenario

Assessment of alternative scenario 1: The proposed project is not developed as a JI project
Projects using gas turbine technologies shall be exclusively applied during modernization and new construction at thermal power plants running on natural gas as indicated in “General Scheme of Power Facilities’ Allocation by 2020” (General Scheme further in the text) approved by the Government of the Russian Federation (Order of February 22 2008 # 215p). The project has no technical barriers as natural gas is available, the technology as such has been implemented in many industrialized countries and electricity produced by the two new energy units can be supplied to the grid.

As is shown in Section B.2. this project is not economically attractive. Therefore this alternative is a not the most plausible scenario.

Assessment of alternative scenario 2: The electricity to be generated by project is provided by the other existing plants of URES “Ural”
Currently installed electricity capacity corresponds to the electricity market demand. But there are many old energy units in Russia. In accordance with CJSC “Agency of Energy Balances in the power industry” estimation approximately 10 GW of old capacities (life time expired several years ago) has to be

dismantled by 2015 (3.9 GW by 2010). At the same time their forecast assumes the electricity demand growth will be 27.3 GW in 2012 in comparison with 2009[4].

Therefore the existing power plants alone cannot cover the future electricity market demand and this alternative scenario is not reasonable and feasible.

Assessment of alternative scenario 3: The electricity to be generated by project is provided by the other new energy units of URES "Ural"

The planed new energy units to be constructed in URES "Ural" in 2011-2012 according to "General Scheme" are presented in Table B.1.1.

Table B.1.1: The planed new energy units to be constructed in URES "Ural" in 2011-2012

N	Power plant	Type of unit	Capacity unit, MW	Type of fuel
1	Ufimskaya CHP-2	Cogeneration (gas turbine)	170	Gas
2	Kurganskaya CHP	Cogeneration (gas turbine)	230	Gas
3	Yaivinskaya TPP	CCGT	400	Gas
4	Chaikovskaya CHP	Cogeneration (steam turbine)	50	Coal
5	Sredneuralsk TPP	CCGT	400	Gas
6	Nizneturinskaya CHP	Cogeneration (steam turbine)	115	Coal
7	Nyaganskaya TPP	CCGT	400	Gas
8	Chelyabinskaya CHP-3	Cogeneration (gas turbine)	220	Gas

Total electricity installed capacity of new energy units is 1,980 MW and it is enough for replacement of the project electricity generation.

However the installed capacity of the existing power plants within URES "Ural" is 42.8 GW The existing power plants runtime factor of URES "Ural" varies from 0.47 to 0.75. The proper dispatching, network improvements and better energy unit operation (reduction of repair time, etc.) may result in better energy facilities performance thus increasing the net energy output of the existing plants.

Reconstruction of existing energy units can increase both the installed electrical capacity and the runtime factor. In accordance with CJSC "Agency of Energy Balances in the power industry" forecast the incremental (due to the renovation activities) installed capacity at the existing power plants will be approximately 2.3 GW by 2015[5].

OJSC «System Operator of Unified Energy System» (JSC "SO of UES") is in charge of the management of the demand and supply side of the energy market. It satisfies the demand by the most efficient way, both from an economic and technical point of view. As soon as more than 87% of the forecasted energy demand is to be provided by the existing energy plants, it is unlikely that the system operator will ensure constant coverage of 0.8 GW (the project capacity) by new plants only.

It means that the electricity to be generated by project is to be provided by the existing power plants as well and therefore this alternative scenario is not reasonable and feasible.

[4] http://www.e-apbe.ru/library/detail.php?ID=11106

[5] http://www.e-apbe.ru/library/detail.php?ID=11106

Assessment of alternative scenario 4: The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural"
As shown in the assessment of alternatives 2 and 3 the future electricity market demand would be covered by the combination of the other existing plants and the other new energy units.

Thus this alternative is reasonable and feasible.

Assessment of alternative scenario 5: The electricity to be generated by project is provided by the import of electricity from connected grids
According to "Expected balance of power industry development for 2009-2015 and 2020" (Annex M.5, page 301)[6], electrical capacity redundancy in URES "Ural" will be approximately 1,000 MW starting from 2010. This value is enough to cover electrical capacity demand without importing any electricity from the other URESs in case if "the project is not implemented". Therefore this alternative is a not the most plausible scenario.

Conclusion
Only Alternative 4 is realistic and credible and is selected as the baseline scenario.

Step 2: Additionality demonstration
Please see Section B.2.

Step 3: Calculation of emissions of the baseline scenario
To establish the emissions associated with the baseline scenario a baseline emission factor has been calculated in accordance with article 21 of the Guidance and using the CDM Tool "Tool to calculate the emission factor for an electricity system", version 02 with some deviations. The using of this CDM Tool for baseline emission factor calculation is described in the Annex 2. And the baseline emission calculation methodology using the CDM is described in the Section D.1.1.4.

The key data and information used to establish the baseline are presented in tabular form below:

Data/Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Net quantity of electricity generated at the two CCGT units (electricity to be replaced by third parties under baseline scenario)
Time of determination/monitoring	Crediting period
Source of data (to be) use	Surgutskaya TPP data
Value of data applied (for ex ante calculations/determinations)	• 4,178,831 MWh in 2011 • 5,534,876 MWh in 2012
Justification f the choice of data or description of measurement methods and procedures (to be) applied	Calculated according to formula 5 of Section D.4.1.1 as the difference between the electricity generated and the internal needs electricity consumption at the two CCGT units
OA/QC procedures (to be) applied	The data of the electricity generated and the internal needs electricity consumption at the two CCGT units are determined by standardized electricity meters. Please see Table D.2 for more detail information
Any comment	-

[6] http://www.e-apbe.ru/5years/

Data/Parameter	$FC_{i,y}$
Data unit	Tonne of coal equivalent (t.c.e.)
Description	Amount of fossil fuel *i* (coal, heavy fuel oil, natural gas, peat, blast furnace gas, coke even gas and other fuels) consumed in the project electricity system in year *y* (for 2006-2008)
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	The data was received with according to the contract between Global Carbon and Federal State Unitary Enterprise "The Main Inter-regional Centre of Processing and Distribution of the Statistical Information of Federal Agency of the State Statistics" (Rosstat RF - further in the text)
Value of data applied (for ex ante calculations/determinations)	Please see Table Anx.2.5 in Annex 2
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$NCV_{i,y}$
Data unit	GJ/t.c.e.
Description	Net calorific value of fossil fuel type *i* in year *y*
Time of determination/monitoring	Constant for all type of fuel
Source of data (to be) use	-
Value of data applied (for ex ante calculations/determinations)	29.33 GJ/t.c.e.
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$EF_{CO2,i,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006
Value of data applied (for ex ante calculations/determinations)	Please see Table Anx.2.9 in Annex 2
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-

OA/QC procedures (to be) applied	-
Any comment	The four main types of fuels are considered: coal, heavy fuel oil, natural gas, peat, blast furnace and coke even gases. The emission factor of the other types of fuels were assumed zero. It is conservative.

Data/Parameter	$EG_{m,y}$
Data unit	MWh
Description	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y*
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	Rosstat RF
Value of data applied (for ex ante calculations/determinations)	Please see Table Anx.2.8 in Annex 2
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	

Data/Parameter	$EF_{grig, OMsimple, y}$
Data unit	tCO_2/MWh
Description	Simple operating margin CO_2 emission
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	Parameter is calculated according to the formulae 1 of Annex 2
Value of data applied (for ex ante calculations/determinations)	0.645
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$EF_{grig, BM, y}$
Data unit	tCO_2/MWh
Description	BM emission factor
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	Parameter is calculated according to the formulae 2 of Annex 2
Value of data applied (for ex ante calculations/determinations)	0.487

Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin emission factor
Time of determination/monitoring	Determined ex-ante
Source of data (to be) use	Parameter is calculated according to the formulae 4 of Annex 2
Value of data applied (for ex ante calculations/determinations)	0.606
Justification f the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

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:

According to paragraph 2 of Annex 1 of the Guidance, additionality can be demonstrated, inter alia, by using one of the following approaches:

(a) 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;

(b) Provision of traceable and transparent information that an accredited independent entity has already positively determined that a comparable project (to be) implemented under comparable circumstances (same GHG mitigation measure, same country, similar technology, similar scale) would result in a reduction of anthropogenic emissions by sources or an enhancement of net anthropogenic removals by sinks that is additional to any that would otherwise occur and a justification why this determination is relevant for the project at hand.

(c) Application of the most recent version of the “Tool for the demonstration and assessment of additionality” approved by the CDM Executive Board;

In this PDD, the most recent version of the “Tool for the demonstration and assessment of additionality” (version 05.2) (hereinafter referred to as “Additionality Tool”) is applied to prove that the emission reductions by the proposed JI project are additional to any that would otherwise occur.

Step 1: Identification of alternatives to the project consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project

Plausible alternatives to the project were identified in Section B.1 above:

Alternative scenario 1:	The proposed project is not developed as a JI project;
Alternative scenario 2:	The electricity to be generated by project is provided by the other existing plants of URES "Ural";
Alternative scenario 3:	The electricity to be generated by project is provided by the other new energy units of URES "Ural";
Alternative scenario 4:	The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural".
Alternative scenario 5:	The electricity to be generated by project is provided by the import of electricity from connected grids.

Only alternatives 1 and 4 were identified as realistic and credible.

Sub-step 1b: Consistency with mandatory laws and regulations
All the alternatives defined in sub-step 1a are in compliance with mandatory legislation and regulations.

Step 2: Investment analysis
The main goal of the investment analysis is to determine whether the proposed project is not:
(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of ERUs associated with the JI project.

To conduct the investment analysis, the following sub-steps have to be applied.

Sub-step 2a: Determine appropriate analysis method
In principle, there are three methods applicable for an investment analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

A simple cost analysis (Option I) shall be applied if the proposed JI project and the alternatives identified in step 1 generate no financial or economic benefits other than JI related income. The proposed JI project results in additional sales revenues due to the electricity that will be generated. Thus, this analysis method is not applicable.

The Additionality Tool allows for an investment comparison analysis which compares suitable financial indicators for realistic and credible investment alternatives (Option II) or a benchmark analysis (Option III). For this project a benchmark analysis (Option III) is appropriate in accordance with the attached guidance to the Additionality Tool (paragraph 15).

Sub-step 2b: Option III. Apply benchmark analysis
The proposed project, installation of the two CCGT units, shall be implemented by the project participant OGK-4. The approach recommended in p. 6 (a) of Additionality Tool is applied – using "government bonds rates increased by a suitable risk premium". As Russia does not have long term governmental bonds a conservative approach of using Central Bank RF discount rate of 10.5% only is proposed in the analysis not including a risk premium. Thus the overall IRR benchmark amounts to 10.5%. If the proposed project (not being implemented as JI project) has a less favourable indicator, i.e. a lower IRR, than the benchmark, then the project cannot be considered as financially attractive.

Sub-step 2c: Calculation and comparison of financial indicators
The financial analysis refers to the time of investment decision-making.

The following assumptions have been used based on the information provided by the enterprise:
1. Investment decision: June 2007, commissioning date: 15 March 2011;
2. The project requires investments of approximately EUR 785 million during five years;

3. The forecast for electricity and natural gas tariffs in the "Concept of social-economical development of RF for the period up to 2020" approved by the Russian Federation Government Decree #1662-p dated 17/11/2008;
4. The exchange rate (EUR/RUR) is rounded up to 1/34.89 in accordance with the enterprise's conversion practice;
5. The project lifetime is 25 years (lifetime of CCGT in line with GE documents);
6. The project does not foresee any replacement, so cash flows only for new capacities are considered;
7. Fuel consumption and electricity generation is taken into account in line with the technical specifications of the project design;
8. The annual installed capacity utilisation is 7,100 hours per year that corresponds to the run time factor of 0.81;
9. Fuel (dry associated gas and natural gas) is the biggest cost component constituting more than 80% of total operation cost.
10. The scrap value is calculated as CCGT weight (documented) multiplied by scrap price.

The project cash flow focuses, in addition to investment-related outflows, on revenue flows generated by additional sales of electricity produced by the two new CCGT units.

The project's financial indicators are presented in the Table B.2.1 below.

Table B.2.1. Financial indicators of the project

Scenario	IRR (%)	Discounted PBP	Simple payback period (years)[7]
Base case	7.03	Out of project lifetime	10

The cash flow analysis shows an IRR of 7.03%, which is well below the IRR benchmark identified of 10.5%. As a result a negative NPV[8] is obtained. Hence, the project cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis shall be conducted to show whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.

The following four key factors were considered in the sensitivity analysis: electricity and gas tariffs and investment cost. The other cost components account for much less than 20% of total cost and therefore are not considered in the sensitivity analysis. In line with the guidance to the Additionality Tool (par. 17) the sensitivity analysis should be undertaken within the corridor of ±10% for the key indicators.

Scenario 1 considers a 10% investment cost growth. Scenario 1 shows that this assumption worsened the cash flow performance due to significant cost increase.

Scenario 2 is based on the assumption of a 10% investment cost decrease that improves cash flow and performance indicators a little with IRR remaining below the benchmark.

Scenario 3 implies electricity tariff raise 10%. The effect is similar to that described in S*cenario 2.*

[7] The discounted payback period would be outside of the project lifetime.

[8] Net present value

Scenario 4 implies electricity tariff decrease 10%. That means that sales revenues drop worsening the cash flow performance.

Scenario 5 assumes 10% natural gas tariff growth. The result is similar to *Scenario 1*.

Scenario 6 assumes natural gas tariff decrease by 10%, increasing operation cost and decreasing the cash flow outcome.

In all scenarios NPV is negative. The simple payback period is more than 8 years and discounted payback period exceeds project life time.

A summary of the results is presented in the Table B.2.2 below.

Table B.2.2: Sensitivity analysis (summary)

Scenario	IRR (%)	Discounted PBP (years)	Simple payback period (years)[9]
Scenario 1	5.97%	Out of project lifetime	11
Scenario 2	8.26%	Out of project lifetime	9
Scenario 3	10.37%	21	8
Scenario 4	2.64%	Out of project lifetime	15
Scenario 5	4.39%	Out of project lifetime	13
Scenario 6	9.21%	Out of project lifetime	9

Hence, the sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the project is unlikely to be financially/economically attractive.

Step 3: Barrier analysis

In line with the Additionality Tool, a barrier analysis is not conducted.

Step 4: Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:
The project energy units use combined cycle (Rankine and Brayton (gas) thermodynamic cycles) for electricity generation (without heat generation). The installed capacity of one of these combine cycle gas turbine (CCGT) units is 400MW. The total project installed capacity is 800 MW (2×400).

In Russia almost all power plants use the Rankine (steam) cycle (fossil fuel fired boiler(s) with steam turbines). The total installed capacity of all CCGT units (including with cogeneration cycle) is about 2.6 GW (2007). It is approximately 1.7% of total thermal power plants installed capacity.

The Tool recommends to provide an analysis of any other activities if they are in the same country/region and rely on similar technology, are of a similar scale, and take place in the comparable environment.

The new energy units (of more than 50 MW having been installed during the last 16 years) are presented in the Table B.2.3.

[9] The discounted payback periods would be outside of the project lifetime.

Table B.2.3: New energy units (more 50MW) in URES "Ural"

Power plant/unit	Commissioning	Capacity, MW	Technology	Fuel	Cycle
Nizhne-Vartovsk TPP, #2	2003	800	Steam-power	Gas	Steam cycle
Nizhne-Vartovsk TPP, #1	1993	800	Steam-power	Gas	Steam cycle
Tyumen CHP-1	2003	190	CC GT	Gas	Cogeneration
Chelyabinsk CHP-3, #2	2006	180	Steam-power	Gas	Cogeneration
Chelyabinsk CHP-3, #1	1996	180	Steam-power	Gas	Cogeneration
Tchaikovsky CHP	2007	50	Steam-power	Gas	Additional steam turbine

The cogeneration energy units (including CCGT cogeneration units) generate and supply both heat and electricity. Heat is the most important product especially in cold climate while electricity is of secondary use. CCGT in the proposed project is being constructed to produce only electricity. Therefore CCGT units with cogeneration cycle are excluded from the analysis.

Therefore there are no other activities similar to the proposed project activity. Hence, the proposed JI project is not common practice.

Sub-step 4b: Discuss any similar Options that are occurring:
The similar activities are not widely observed so this sub-step is not applicable.

Conclusion
The application of the CDM Additionality Tool demonstrates that the emission reductions by the proposed JI project are additional to any that would otherwise occur.

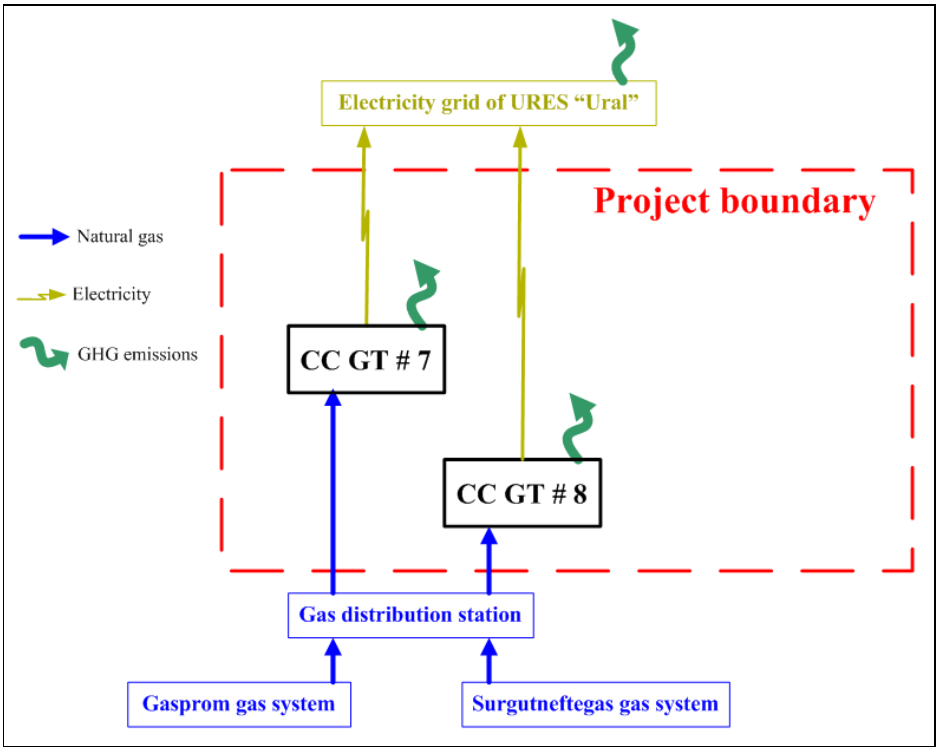
B.3. Description of how the definition of the project boundary is applied to the project:

The two new CCTG units combusts dry associated petroleum gas and natural gas for electricity generation, most of which is supplied to the grid and minor part is used for internal needs (auxiliary equipment).

Project boundary embraces:
- Two new CCTG units;
- Auxiliary equipment of the two CCTG units.

The project boundary is presented in Figure B.3.1.

Figure B.3.1: Project boundary



Emissions sources and greenhouse gases types included in or excluded from the project boundary are presented in the Table B.3.1.

Table B.3.1: Emissions sources included or excluded from the project boundary

№	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (URES "Ural")	CO_2	Included	Main emission source
		CH_4	Excluded	Excluding these emission from the baseline is conservative and in line with existing CDM methodologies[10]
		N_2O	Excluded	
Project activity	On-site dry associated petroleum gas and natural gas combustion	CO_2	Included	Main emission source
		CH_4	Excluded	Exclusions is for simplification as the emission are negligible and in line with existing CDM methodologies[11]
		N_2O	Excluded	

[10] Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas, AM0029/version 03, Approved Methodology, CDM Executive board

[11] Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas, AM0029/version 03, Approved Methodology, CDM Executive board

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

Date of completion of the baseline study: 21/01/2010

Name of person/entity setting the baseline:
Global Carbon BV
Phone: +31 30 850 6724
Fax: +31 70 891 0791
E-mail: info@global-carbon.com

Global Carbon BV is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of the project is 06/06/2007.

C.2. Expected operational lifetime of the project:

The operational lifetime of the proposed JI project is 25 years or 300 months.

C.3. Length of the crediting period:

Start of crediting period: 15/03/2011.
Length of crediting period within Kyoto commitment period: one year and 9.5 months or 21.5 months.

Length of crediting period within any relevant agreement under the UNFCCC from 2013 onwards: The length of the second commitment period where 2013 – 2020 (8 years is assumed).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In this project a JI specific approach regarding monitoring is used. As elaborated in Section B.3, the project activity only affects the emissions related to the natural gas combustion. To establish the baseline emissions and to monitor the project emissions, only these emissions will be monitored.

The following assumptions for calculation of both baseline and project emissions were used:

- Used start-up fuel at the two new CCGT units is excluded[12];
- Project electricity is net electricity generation by the new CCGT units defined as electricity generation minus electricity consumption for internal needs;
- Electricity demand in the market is not influenced by the project (i.e. baseline net electricity generation = project net electricity generation);
- The baseline emissions of the grid are established using the combined margin emission factor as described in Annex 2;
- The combined margin emission factor is set ex-ante for the length of the crediting period;
- The new CCGT lifetime extends to 2020.

General remarks:

- Social indicators such as number of people employed, safety records, training records, etc, will be available to the Verifier if required;
- Environmental indicators such as NO_x and other will be available to the Verifier if required;

For the greenhouse gas emissions only the CO_2 emissions are taken into account. See section B.3.

[12] Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas, AM0029/version 03, Approved Methodology, CDM Executive board

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
P1 PE_y	Project emission	Calculated under project activity	tCO_2	c	Annually	100%	Electronic	Defined according to formula 1
P2 $FC_{i,y}$	Annual quantity of fuel type *i* (dry associated petroleum gas or natural gas) consumed at the two CCGT units	Fuel flow meter reading	Nm^3	m	Continuously	100%	Electronic	-
P3 $COEF_y$	CO_2 emission coefficient	Calculated under project activity	tCO_2/Nm^3	c	Annually	100%	Electronic	Defined according to formula 2
P4 $NCV_{NG,y}$	Net Calorific Value of natural gas	Natural gas certificate of fuel supplier	GJ/Nm^3	e	Monthly	100%	Electronic	Fuel supplier provided data
P5 $NCV_{APG,y}$	Net Calorific Value of dry associated petroleum gas	Dry associated petroleum gas certificate of fuel supplier	GJ/Nm^3	e	Monthly	100%	Electronic	Fuel supplier provided data
P6 $EF_{CO2,NG,y}$	Emission factor for natural gas	IPCC	tCO_2/GJ	e	Annually	100%	Electronic	Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter

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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
								2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006

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

The project activity is combustion of natural gas to generate electricity at the two new CCGT units. The CO_2 emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = \sum_i FC_{i,y} \times COEF_{i,y} \qquad (1)$$

Where:

PE_y Project emission in year y (tCO_2);

$FC_{i,y}$ Is the total volume of fuel type i (dry associated petroleum gas or natural gas) combusted at the two CCGT units in year y (Nm^3)[13];

$COEF_{i,y}$ Is the CO_2 emission coefficient of fuel type i (dry associated petroleum gas or natural gas) in year y (tCO_2/Nm^3).

$COEF_{i,y}$ is obtained as:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,NG,y} \qquad (2)$$

[13] Data unit (Nm^3) means the volume of gas under normal conditions (temperature is 273^0K and pressure is 101325 Pa).

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Where:

$NCV_{i,y}$	Is the average net calorific value per volume unit of fuel type *i* (dry associated petroleum gas or natural gas) in the year *y* (GJ/Nm^3);
$EF_{CO2,NG,y}$	Is the default IPCC CO_2 emission factor per unit of energy of natural gas in year *y* (tCO_2/GJ). Please see the justification of its using for dry associated petroleum gas in Section A.2 and Annex 2.

$NCV_{i,y}$ is obtained as:

$$NCV_{i,y} = \sum_m (NCV_{i,m} \times FC_{i,m,y}) / \sum_i FC_{i,y} \qquad (3)$$

Where:

$NCV_{i,m}$	Is the net calorific value per volume unit of fuel type *i* (dry associated petroleum gas or natural gas) in the month *m* in year *y* (GJ/Nm^3);
$FC_{i,m}$	Is the total volume of fuel type *i* (dry associated petroleum gas or natural gas) combusted at the two CCGT units in month *m* in year *y* (Nm^3)
m	Is the month *m* in year *y*;
$FC_{i,y}$	Is the total volume of fuel type *i* (dry associated petroleum gas or natural gas) combusted at the two CCGT units in year *y* (Nm^3).

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
B1 BE_y	Baseline emissions	Calculated under project activity	tCO_2	c	Annually	100%	Electronic	Defined according to formula 3
B2 $EG_{PJ,y}$	Net quantity of electricity generated at the two CCGT units	Calculated under project activity	MWh	c	Annually	100%	Electronic	Defined according to formula 4

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:								
B3 $EF_{BL,CO2,y}$	Baseline emission factor	Annex 2 of PDD	tCO_2/MWh	c	Fixed ex ante	100%	Electronic	Combine margin emission factor of United Regional Electricity System "Ural". See Annex 2.
B4 $EG_{PJ,GEN,y}$	Quantity of electricity generated at the two CCGT units	Electricity meter reading	MWh	m	Continuously	100%	Electronic	-
B5 $EG_{PJ,AUX,y}$	Quantity of electricity for the two CCGT units internal needs	Electricity meters reading	MWh	m	Continuously	100%	Electronic	-

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

The baseline emission is defined as:

$$BE_y = EG_{PJ,y} \times EF_{BL,CO2,y} \quad (4)$$

Where:

BE_y	Are the baseline emissions in the year y (tCO_2);
$EG_{PJ,y}$	Is the net quantity of electricity generated at the two CCGT units in the year y (MWh);
$EF_{BL,CO2,y}$	Is the baseline emission factor in year y (tCO_2/MWh) and is an ex-ante fixed value, see Annex 2.

The net quantity of electricity generated at the two CCGT units is defined as:

$$EG_{PJ,y} = EG_{PJ,GEN,y} - EG_{PJ,AUX,y} \quad (5)$$

Where:

$EG_{PJ,GEN,y}$ Is the quantity of electricity generated at the two CCGT units in the year y (MWh);

$EG_{PJ,AUX,y}$ Is the quantity of electricity for the two CCGT units internal needs (auxiliary equipment) in the year y (MWh).

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

Not applicable.

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

Not applicable.

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 applicable.

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

There are fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels in the grid in the absence of the project[14]. These emissions have not been taken into account for simplicity and conservatism.

[14] Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas, AM0029/version 03, Approved Methodology, CDM Executive board

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

Not applicable.

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

Not applicable.

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):

$$ER_y = BE_y - PE_y \qquad (6)$$

Where:

ER_y JI project emission reduction in year *y* (tCO_2);

BE_y Baseline emissions in year *y* (tCO_2);

PE_y Project emissions in year *y* (tCO_2).

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:

The main relevant Russian Federation environmental regulations:

- Federal law of Russian Federation “On Environment Protection” (10 January 2002, N 7-FZ);
- Federal law of Russian Federation “On Air Protection” (04 May 1999, N 96-FZ).

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These laws and other national decrees establish the order and the frequency of the pollution sources inventory, standards of the pollutant emissions and the monitoring.

Emissions into the air are the only important source of pollution at Surgutskaya TPP-2 which have a negative impact on the local environment. They are: nitrogen oxides (NO and NO_2), carbon oxide and sulphur dioxide. And there are also noise pollution, water protection and hazardous waste.

The Ecology Division of Surgutskaya TPP-2 provides:
- Monitoring of clean equipment operation efficiency;
- Monitoring of pollutant emissions and sinks and waste products.

According to national requirements the Ecology Division collects and archives the data of pollutant emissions and sinks and waste products formation. It prepares the reports of pollutant emissions and sinks and waste products formation at Surgutskaya TPP-2 on quarterly and annually and submits the reports to State Organization of Environmental Supervision. Also Surgutskaya TPP-2 submit pollutant emission and sinks data to Rosstat RF in accordance with statistic forms.

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.
P2	Low	In accordance with State Standard the allowed inaccuracy of gas consumption metering is ±0.3-4% (GOST R 8.618-2006). The flow gas meter to be installed will provide necessary inaccuracy. This type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005. Calibration of the metering devices is made in accordance with the calibration schedule which is approved by the Chief Engineer of Surgutskaya TPP-2. Supervision of calibration is performed by the Department of heat automatic and measurement. The metering devices are calibrated by an independent entity which has a state licence. The data from meters are automatically and regularly transferred to the computer system and achieved. Supervision of data archiving is performed by the Department of the automatic control system of technological processes.
P4	Low	Natural gas NCV is measured by chromatographic gas analyzer. Procedure of calibration devices and data archiving is similar for P2 parameter. In other cases the on-site chemical-analysis laboratory (CAL) can measure the NCV or data can be provided from fuel supplier data.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
B4	Low	The data of the electricity generated and the internal needs electricity consumption at the two CCGT units are determined by standardized electricity meters. The accuracy class of electricity meters are better than 0.5S. These meters will be a part of the commercial automatic system of energy accounting and will be provide to fulfil the accuracy requirements of the system. Calibration of the electricity meters is made in accordance with the calibration schedule which is approved by the Chief Engineer of Surgutskaya TPP-2 for two years. Supervision of calibration is performed by the Department of heat automatic and measurement. The metering devices are calibrated by an independent entity which has a state licence. The data from meters is automatically and regularly transferred to the computer system and archived. Supervise of the data archiving is Department of the automatic control system of technological processes.
B5	Low	

This data is further being processed by the Production and Technical Department which prepares the monitoring data and keeps archives.

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

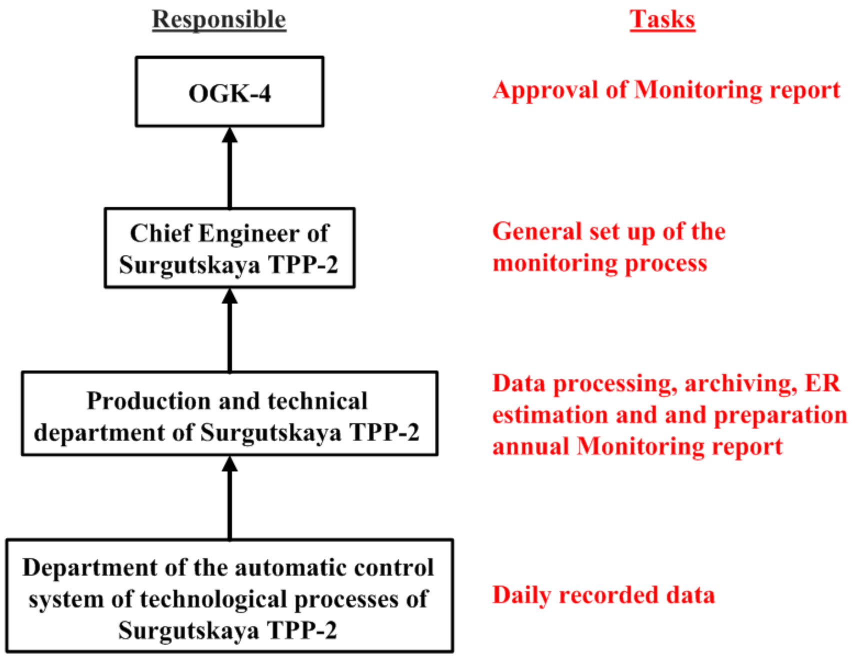
Division of responsibilities for Monitoring Plan implementation and Monitoring Report preparation is presented in the Table D.3.1.

Table D.3.1: Division of responsibilities for Monitoring Plan implementation and Monitoring Report preparation

N	Responsible	Task
1	Surgutskaya TPP-2: • Department of heat automatic and measurement; • Department of the automatic control system of technological processes; • Production and technical department; • Chief Engineer	Quality control of measuring devices; Daily recorded data; Collection, data processing, archiving, and data preparation; General organization of the monitoring process.
2	OGK-4	Preparation and approval of monitoring process internal regulations; Approval of Monitoring report; General supervision.
3	Global Carbon BV	Staff training on monitoring procedures and reporting; ERU calculation and preparation of annual monitoring report

The scheme of the operational and management structure in implementing the monitoring plan is presented in Figure D.3.1.

Figure D.3.1: The organisational structure of the Monitoring plan implementation



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

Name of person/entity determining the monitoring plan:

- OJSC "OGK-4",

OJSC "OGK-4" is a project participant. The contact information is presented in Annex 1.

- Global Carbon BV,

Phone: +31 30 850 6724

Fax: +31 70 891 0791
E-mail: info@global-carbon.com

Global Carbon BV is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Table E.1.1: Estimated project emissions within the crediting period

Indicator	Unit	2011	2012
Annual natural gas consumption	1000 m^3	743,256	984,445
Net calorific value of natural gas	GJ/1000 m^3	36.52	36.52
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561
Project emission	tCO_2	1,522,716	2,016,842
Total 2010 - 2012	tCO_2	3,539,558	

Table E.1.2: Estimated emissions after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Annual natural gas consumption	1000 m^3	984,445	984,445	984,445	984,445	984,445	984,445	984,445	984,445
Net calorific value of natural gas	GJ/ 1000 m^3	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561
Project emission	tCO_2	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842
Total 2013 - 2020	tCO_2	16,134,738							

E.2. Estimated leakage:

Not applicable.

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

Table E.3.1: Estimated project emissions inclusive leakage within the crediting period

Indicator	Unit	2011	2012
Annual natural gas consumption	1000 m^3	743,256	984,445
Net calorific value of natural gas	GJ/1000 m^3	36.52	36.52
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561
Project emission	tCO_2	1,522,716	2,016,842
Total 2010 - 2012	tCO_2	3,539,558	

Table E.3.2: Estimated project emissions inclusive leakage after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Annual natural gas consumption	1000 m^3	984,445	984,445	984,445	984,445	984,445	984,445	984,445	984,445
Net calorific value of natural gas	GJ/ 1000 m^3	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561	0.0561
Project emission	tCO_2	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842	2,016,842
Total 2013 - 2020	tCO_2	16,134,738							

E.4. Estimated baseline emissions:

Table E.4.1: Estimated baseline emissions within the crediting period

Indicator	Unit	2011	2012
Annual electricity output	MWh	4,178,831	5,534,876
Electricity EF of URES "Ural"	tCO_2/MWh	0.606	0.606
Baseline emission	tCO_2	2,531,121	3,352,478
Total 2010 - 2012	tCO_2	5,833,598	

Table E.4.2: Estimated baseline emissions after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Annual electricity output	MWh	5,534,876	5,534,876	5,534,876	5,534,876	5,534,876	5,534,876	5,534,876	5,534,876
Electricity EF of URES "Ural"	tCO_2/MWh	0.606	0.606	0.606	0.606	0.606	0.606	0.606	0.606
Baseline emission	tCO_2	3,352,478	3,352,478	3,352,478	3,352,478	3,352,478	3,352,478	3,352,478	3,352,478
Total 2013 - 2020	tCO_2	26,819.821							

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

Table E.5.1: Difference representing the emission reductions within the crediting period

Reductions	Unit	2011	2012
Total	tCO_2	1,008,405	1,335,635
Total 2010 - 2012	tCO_2	2,344,040	

Table E.5.2: Difference representing the emission reductions after the crediting period

Reductions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Total	tCO_2	1,335,635	1,335,635	1,335,635	1,335,635	1,335,635	1,335,635	1,335,635	1,335,635
Total 2013 - 2020	tCO_2	10,685,083							

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

Table E.6.1: Project, baseline, and emission reductions within the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2011	1,522,716	0	2,531,121	1,008,405
Year 2012	2,016,842	0	3,352,478	1,335,635
Total (tonnes of CO_2 equivalent)	3,539,558	0	5,883,598	2,344,040

Table E.6.2: Project, baseline, and emission reductions after the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2013	2,016,842	0	3,352,478	1,335,635
Year 2014	2,016,842	0	3,352,478	1,335,635
Year 2015	2,016,842	0	3,352,478	1,335,635
Year 2016	2,016,842	0	3,352,478	1,335,635
Year 2017	2,016,842	0	3,352,478	1,335,635
Year 2018	2,016,842	0	3,352,478	1,335,635
Year 2019	2,016,842	0	3,352,478	1,335,635
Year 2020	2,016,842	0	3,352,478	1,335,635
Total (tonnes of CO_2 equivalent)	16,134,738	0	26,819,821	10,685,083

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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:

The necessity of an Environmental Impact Assessment (EIA) in Russia is regulated by the Federal Law "On the Environmental Expertise" and consists of two stages: EIA (OVOS –in Russian abbreviation) and state environmental expertise (SEE). Significant changes into this procedure were made by the Law in Amendments to the Construction Code which came into force on the 1st of January 2007. This Law reduced the scope of activities subject to SEE transferred them to the so called State Expertise (SE) done in line with the Article 49 of the Construction Code of the Russian Federation. In line with the Construction code the Design Document should contain the Section "Environment Protection" (Environmental Protection)[15]. Compliance with the environmental regulations (so called technical regulation in Russian on Environmental Safety) should be checked during the process of SE.

Thermal power plants with capacities of 150 MW and higher are considered to be dangerous, technical complicated and unique facilities in line with the Article 48.1 of the Construction Code RF. Design Document of such installations are subject to the state expertise at federal level. OGK-4 submitted a Design Document for this project to the Federal State Institution "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) in December 2008 and received an approval in February 2009 (Expert Conclusion)[16].

Currently CCGT is the most environmentally sound electricity generation technology. The main pollutants for CCGT burned associated gas are considered: nitrogen oxides, sulphur dioxide and carbon oxide. The other negative effects are: the noise pollution, the water protection and the hazardous waste. All of them were considered in the section "Environmental Protection" of the Design Document.

The main conclusions of the Environmental Protection for this project and Expert Conclusion by FGU "Glavgosexpertiza" are presented below.

Air protection:
"… after project implementation the ground level concentration will not exceed the maximum allowable concentrations …".

Noise pollution:
"... will be ensured within the required noise level limits regulated by the Sanitary regulation…".

Water protection:
"the chemical composition of the reservoir will not be changed… and...water from the two new energy units will not influence on surface and underground water bodies ...".

Hazardous waste:
All hazardous waste will be utilized by the special accredited organization.

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[15] Project Design "Creating the Replacing Capacity by CCGT-800 (2×CCGT-400) Installation at Surgutskaya TPP-2, OGK-4", Volume 8: "Environment Protection", OJSC "Engineer Centre of Ural Energy Industry", 2008

[16] Positive Conclusion of State Expertise on the Project Design "Creating the Replacing Capacity by CCGT-800 (2×CCGT-400) Installation at Surgutskaya TPP-2, OGK-4" by FGU "Glavgosexpertiza", dated, 16 February 2009, № 079 - 09/GGE-5714/02

Labour safety and welfare of inhabitants:
"Concerning the project decisions and the arrangements for the guaranteeing of sanitary-and-epidemiologic welfare of inhabitants and power station staff, the project complies with the requirements of the Sanitary and Epidemiologic Rules and Guidance...".

The main conclusions:
The proposed project "…complies with the environment protection requirements of the Russian Federation" and the project impact is considered insignificant.

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:

Not applicable

SECTION G. Stakeholders' comments

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

OGK-4 prepared reports "Corporative Stability and Social Responsibility" in 2005, 2006 and 2007. These reports contain information about the proposed project. Representatives of environmental organizations, state and local authorities, mass media attended the public hearings (http://www.ogk-4.ru/?obj=res_otch). No comments were received on the project during the public hearings.

Project information was published on the OGK-4 website: http://www.ogk-4.ru/?obj=id4894&id=5161.

OGK-4 had publications about the project in mass media. The short list of publications is presented below.

- RIANOVOSTI: http://ural.rian.ru/economy/20080717/81634628.html;
- FINAM: http://www.finam.ru/analysis/newsitem2FB6B/default.asp;
- ROSFINCOM: http://rosfincom.ru/news/24201.html.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	E.ON Carbon Sourcing GmbH
Street/P.O.Box:	Völklinger Str. 4
Building:	2
City:	Düsseldorf
State/Region:	
Postal code:	40219
Country:	Germany
Phone:	
Fax:	
E-mail:	
URL:	www.eon.com
Represented by:	
Title:	Head
Salutation:	
Last name:	Frenzel
Middle name:	
First name:	Sonja
Department:	JI/CDM Processes
Phone (direct):	+49-89-1254-4064
Fax (direct):	+49-89-1254-1443
Mobile:	+49-160-531 8702
Personal e-mail:	Sonja.Frenzel@eon.com

Organisation:	OJSC “the Fourth Wholesale Energy Generating Company” (OGK-4)
Street/P.O.Box:	Bolshaya Ordynka
Building:	40
City:	Moscow
State/Region:	-
Postal code:	119017
Country:	Russia
Phone:	+7 495 411 5055
Fax:	+7 495 411 8760
E-mail:	ogk@ogk-4.ru
URL:	www.ogk-4.ru
Represented by:	
Title:	Specialist
Salutation:	
Last name:	Vasilkonov
Middle name:	Sergeevich
First name:	Egor
Department:	Production and technical
Phone (direct):	+7 495 411 7037 *4988
Fax (direct):	+7 495 411 7037 *4880
Mobile:	
Personal e-mail:	vec@ogk-4.ru

Annex 2

BASELINE INFORMATION

Composition and emission factor of dry associated gas

The dry associated gas composition for 2009 and results of emission factor calculation are presented in the Table Anx.2.1.

Table Anx.2.1: Composition and emission factor of dry associated gas

2009/Month			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Dry associated gas composition	CH_4	%	95.06	96.37	97.08		95.67	95.78	96.56	95.78	96.75	96.45	96.16	96.60
	C_2H_6	%	0.90	0.85	0.88		1.17	1.12	1.01	1.02	0.78	1.00	1.01	0.96
	C_3H_8	%	1.39	0.90	0.54		1.14	0.92	0.74	0.99	0.72	0.76	0.85	0.76
	C_4H_{10}	%	1.22	0.45	0.16		0.49	0.53	0.24	0.46	0.29	0.34	0.48	0.27
	C_5H_{12}	%	0.15	0.11	0.05		0.13	0.18	0.07	0.18	0.12	0.10	0.11	0.09
	C_6H_{14}	%	0.06	0.05	0.03		0.08	0.10	0.04	0.11	0.08	0.05	0.04	0.04
	CO_2	%	0.40	0.39	0.84		0.44	0.47	0.46	0.48	0.43	0.50	0.49	0.42
	N_2	%	0.82	0.87	0.42		0.87	0.89	0.87	0.96	0.83	0.79	0.85	0.86
	O_2	%	0.00	0.01	0.00		0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00
	Total	%	100.00	100.00	100.00		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Net value calorific		kJ/Nm^3	37,815	36,776	36,232		37,082	37,046	36,461	36,978	36,488	36,619	36,682	36,529
Emission factor		tCO_2/GJ	0.0562	0.0559	0.0559		0.0560	0.0561	0.0558	0.0560	0.0560	0.0559	0.0561	0.0558
Average emission factor		tCO_2/GJ	**0.0560**											

The composition and the net calorific value of dry associated gas are presented according to supplier's gas certificates. The accredited central basic laboratory of OJSC "Surgutneftegas" analyzes the composition and defines the net calorific value of dry associated gas in point between the gas-distributing station and Surgutskaya TPP-2.

CO_2 baseline emission factor

This baseline emission factor was defined in accordance with approved CDM "Tool to calculate the emission factor for an electricity system" (version 02) with some deviations, further referred as "The Tool".

The full version of the Tool is published on the UFCCC website at the following address: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Scope and applicability

This Tool "…may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid…".

Two combined cycle gas turbine units with electricity capacity of 400 MW each will be constructed at Surgutskaya TPP-2 and commissioned in July 2011. After project implementation the new electricity energy units will supply electricity to grid of United Regional Energy System (URES) “Ural”. It will substitute electricity that would have been otherwise generated by the other power plants of URES “Ural”. Therefore, this Tool can be used for determination of CO_2 baseline emission factor.

Parameters
The Tool provides procedures to determine the following parameters:

Parameter	**SI Unit**	**Description**
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year ***y***
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for grid connected power generation in year ***y***
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for grid connected power generation in year ***y***

Data source
The following sources of information were used for the OM development:

- Federal State Unitary Enterprise “The Main Inter-regional Centre of Processing and Distribution of the Statistical Information of Federal Agency of the State Statistics” (Rosstat RF - further in the text). This is aggregated data provided by energy companies using the official statistical form 6-TP;
- JSC “Unified Energy System of Russia” (UES);
- OJSC «System Operator of Unified Energy System» (JSC “SO of UES”);
- CJSC “Agency of Energy Balances in the power industry”.

The combined heat and power plants (CHP) can operate as cogeneration and as simple (only electricity generation) cycles and some TPPs have cogeneration energy units. Each power plant submits the electricity and heat generation and fuel consumption data in Rosstat RF according to the annually statistic report (6-TP).

CHPs produce electricity predominantly in the prescribed heat supply mode. Therefore they can be excluded from OM and BM calculation. However the reports (according to form 6-TP) do not contain any information about fired fuel amount for cogeneration or simple cycles and it is impossible to exclude from calculation the fired fuel amount and electricity generation with cogeneration cycle. Therefore, the parameters of cogeneration energy units were taken into account in the OM and BM calculation. It is a deviation from the Tool but it is conservative because cogeneration cycles are more efficient than simple (or combined) cycles.

The reports contain information about the total fired fuel amount (for each fuel type), fired amount fuel for electricity and heat generation (separately). The part of the fired amount fuel for electricity generation was used in the OM and BM emission factors calculation.

BM calculation is based on the data from:

- Official annual reports of JSC UES;
- Official annual reports of energy companies;
- Energy companies investment programs;
- Technical manual “Territorial Generating Companies”, CJSC “IT energy analyst”, 2007;
- Reports containing information on new power capacities put in operation in recent years, “General Scheme of Power Facilities’ Allocation by 2020” approved by the Government of the Russian Federation (Order of February 22 2008 # 215p).

The “General Scheme” is not a legislative act but a research work which was implemented by a commission from the Government of the Russian Federation. OJSC “RAO UES of Russia” (and some research institutes) prepared the draft of "General Scheme" in 2007. It was based on the electricity consumption forecast and the inquiry of energy companies about their investment plans. The "General Scheme" is compilation of such information and doesn't contain any recommendations and is not responsible for where, when, what and who will construct energy units etc. The main aim of "General Scheme" is definition of the sufficiency of consumers power supply. In case of insufficiency of consumers power supply the Government of RF will prepare the arrangements on stimulation of new energy project implementation. The Government of RF approved this document in 2008 (Order of February 22 2008 # 215p). It means that this work was done according to the commission of the Government of the Russian Federation.

Also according to the Order the Ministry of Energy organizes the monitoring of the GS implementation. Currently CJSC "Agency of Energy Balances in the power industry" is preparing a revised version of the "General Scheme"[17]. The new power consumption forecast and the revised investment plans of energy companies are taken into account. In comparison with the previous version of the "General Scheme" some supposed power projects are delayed and some supposed power projects are stopped.

As stated above the "General Scheme" is not an obligatory document especially for private energy companies but data from the "General Scheme" can be used for emission factors calculation in accordance with the Tool.

Methodology procedure
The Tool determines the CO_2 emission factor for an electricity, generated by power plants, displacement in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). Operating margin refers to a cohort of power plants that reflects the existing power plants whose electricity generation would be affected by the proposed project activity. Build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed project activity.

In line with the Tool the following steps presented in detail below should be followed. Possible deviations should be identified and justified.

STEP 1: Identify the relevant electric power systems
A *project electricity system* is the system defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

Similarly, a *connected electricity system* is defined as a system that is connected by transmission lines to the project electricity system. Power plants within connected system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

If the Designated National Authority of the host country (in Russia it is the Ministry of Economic Development RF) has published a delineation of the project electricity system and connected power systems, these delineations should be used. The Designated Focal Point (DFP) of the Russian Federation didn't publish a delineation of the project electricity system and connected electricity systems. In this case the Tool recommends: "… to use a regional grid definition in case of large countries with layered dispatch systems (e.g. provincial / regional / national)".

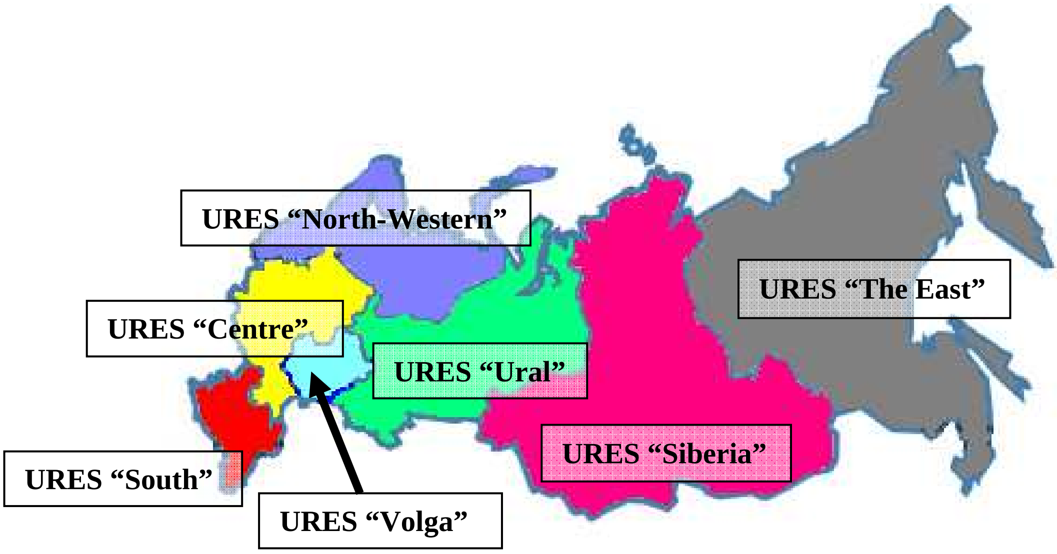
Electric power industry in Russian Federation comprises nearly 400 power plants: thermal power plants (about 70% of total installed capacity), hydro power stations (20% of total installed capacity) and nuclear

[17] http://www.e-apbe.ru/scheme/

power stations (10% of total installed capacity). Power stations and consumers are connected by transmission lines. Power stations, consumers and regulatory organizations (JSC "SO of UES" for instance) constitute the national energy system (hereinafter referred to as UES of Russia). The UES of Russia is functioning centralized. JSC "SO of UES" contributes a great value to the operative-dispatching management. Power stations are unified by transmission lines in 60 area electricity systems (AESs), while these systems have in its turn the electric connections with the neighbouring ones (excluding some isolated area systems). AESs are unified in seven united regional electricity systems (URESs), that are connected between each other through backbone and interconnection networks: "North-Western", "Ural", "South", "Volga", "Ural", "Siberia" and "The East".

The scheme of UES of Russia is presented in Figure Anx.2.1.

Figure Anx.2.1: Scheme of UES of Russia



Source: JSC "SO of UES"

The status of these URESs is defined in State Standard (GOST) 21027-75 "Power systems. Terms and definitions" as: "the group of some area energy systems with common operating conditions and dispatching management".

Surgutskaya TPP-2 is located in URES "Ural". Installed capacity of this URES is 42,758.4 MW (status 2009). Project capacity (800 MW) is only 1.9% of the URES "Ural" total electric capacity, therefore project capacity '"…can be dispatched without significant transmission constraints"[18].

As a result URES "Ural" is selected as a *project electricity system*.

Power plants located at areas of Kirov, Kurgan, Orenburg, Perm, Sverdlovsk, Tyumen, Chelyabinsk and Republics of Bashkiriya and Udmurtiya.

The structure of installed capacity of URES "Ural" (status 2008) is as follows:

- 94.6% – TPPs (including combined heat and power plants and units);

[18] Tool to calculate the emission factor for an electricity system, version 02, Methodological Tool, CDM Executive board

- 4.0% – Hydro power stations (HPSs);
- 1.3% – Nuclear power stations (NPSs);
- 0.005% - Wind power stations (WPSs).

NPSs operate as "must-run" resources and HPSs and WPSs – as "low-cost".

URES "Ural" receives some electricity from other URESs. The most recently available date of annual URES "Ural" electricity import is presented in Table Anx.2.2.

Table Anx.2.2: The recently date of annual URES "Ural" electricity generation, consumption and import

Indicator	Unit	2004[19]	2005[20]	2008[21]	Average
Generation	mln. MWh	215.8	220.8	248.1	228.2
Consumption	mln. MWh	222.7	228.1	251.0	233.9
Electricity import	mln. MWh	6.9	7.3	2.9	5.7
	%	3.2	3.3	1.2	2.5

The electricity import to URES "Ural" is mostly from URES "Volga"[22]. Therefore URES "Volga" is *connected electricity system*.

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)
Some power plants can be considered as off-grid power plants. For Ural region they can be power plants of oil and gas companies (located on the remote oil and gas deposits) and power plants of villages located within sparsely populated area. Usually these power plants are based on the gas turbine and diesel-engine technologies with a small electric and heat capacity.

As shown above in the Russian Federation the individual plant data is considered strictly confidential and only aggregate data on the regional basis are available. The off-grid power plants report according to statistic form also. Therefore Rosstat RF data includes off-grid power plants data.

Part of off-grid power plants electricity generation can be estimated using the "ODU Ural" (branch of "SO UES" is superior body of operating-dispatching management in URES "Ural") operative data[23]. The comparison of Rosstat RF and "ODU Ural" data by 2008 are presented in Table Anx.2.3.

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[19] http://www.e-apbe.ru/analytical/doklad2005/doklad2005_4.php#p5

[20] http://www.e-apbe.ru/analytical/doklad2005/doklad2005_4.php#p5

[21] http://www.ural.so-cdu.ru/odu_urala/data/

[22] http://www.e-apbe.ru/5years/detail.php?ID=19193

[23] For example, http://www.ural.so-cdu.ru/chelyabinsk_rdu/parameters.php

Table Anx.2.3: The comparison of Rosstat RF and "ODU Ural" data by 2008

Area (Republic)	Installed capacity, kW		Diff[24]	Electricity generation, thous.kWh		Diff
	Rosstat RF	ODU Ural	%	Rosstat RF	ODU Ural	%
Bashkiriya	5,212,458	5,194,198	0.4	24,662,943	24,491,000	0.7
Udmurtiya	589,980	585,400	0.8	3,177,553	3,162,300	0.5
Perm	6,121,100	6,139,000	-0.3	32,101,553	32,095,700	0.0
Kirov	966,980	940,300	2.8	4,685,264	4,610,300	1.6
Orenburg	3,655,000	3,655,000	0.0	16,678,094	16,677,300	0.0
Kurgan	482,800	480,000	0.6	1,990,018	1,982,600	0.4
Sverdlovsk	9,337,925	9,219,400	1.3	52,518,823	52,318,100	0.4
Tyumen	13,822,851	11,575,000	16.3	89,788,398	84,021,000	6.4
Chelyabinsk	5,108,855	4,997,000	2.2	28,639,308	28,583,900	0.2
Total	***45,297,949***	***42,785,298***	***5.5***	***254,241,954***	***247,942,200***	***2.5***

The off-grid power electricity generation of URES "Ural" is only two and half percent of total electricity generation.

According to the Tool project participants may choose between the following two options:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

In accordance with the Tool, "option II aims to reflect that in some countries off-grid power generation is significant and can partially be displaced by CDM project activities, e.g. if off-grid power plants are operated due to an unreliable and unstable electricity grid.". As the off-grid power generation is not significant, option I was chosen.

STEP 3: Select an operating margin (OM) method
The Tool recommends calculating the $EF_{grig,OM,y}$ based on one of the following methods:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis, or
(d) Average OM.

Any of these listed methods can be used; however, the simple OM method (a) can only be used if low-cost/must run resources constitute less than 50% of total grid generation calculated:
1) As average of the five most recent years or,
2) Based on long-term averages for hydroelectricity production.

Low-cost/must run resources are defined as power plants with low marginal generation costs or that are dispatched independently of the daily or seasonal load of the grid. Typically they include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. In URES "Ural" geothermal, low-cost biomass, and solar generation are negligible for the power balance. Sterlitomakskaya CHP partially burning wood waste was not considered as low-cost plant because it uses natural gas as fuel as well. Therefore nuclear stations (as "must-run") and wind (2.2 MW) and hydro plants (as "low-cost") are defined as low-cost/must run resources. Table Anx.2.4 represents" total electricity generation during the five last years and the five year average share of low-cost/must run resources in URES "Ural (2003-2007).

[24] Difference

Table Anx.2.4: Total electricity generation during the last five years and share of RES's low-cost/must run net electricity generation (MWh)

URES "Ural"	2004	2005	2006	2007	2008	Five year average % of low-cost
All power plants	215,800,000	220,827,000	216,623,216	233,136,584	238,373,664	4.2
Hydro (with wind)	5,000,000	5,426,500	4,564,149	6,493,146	6,226,915	
Nuclear	4,200,000	4,086,500	3,838,542	3,791,896	3,775,284	

Source: JSC "SO of UES" and Rosstat RF

As this indicator is lower than 50% the nuclear and hydro energy generation may not be taken into account. Therefore simple OM (method "a") can be used and is selected for calculation of emission factor of URES "Ural".

STEP 4: Calculate the operating margin emission factor according to the selected method

The Tool specifies how simple OM is calculated - as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must run plants/units (e.g. hydro and nuclear).

The Tool suggests making calculations based on:

- the net electricity generation and CO_2 emission factor of each power unit (Option A);
- total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

The Option B was chosen because:

(a) The necessary data for Option A is not available;
(b) Only nuclear and renewable power generation are considered as low-cost/must run power sources and the quantity of electricity supplied to the grid by these sources is known;
(c) Off-grid power plants are not included in the calculation.

Under this option the simple OM emission factor is defined by the following formula:

$$EF_{grig,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (1)$$

Where:

$EF_{grig,OMsimple,y}$ – simple operating margin CO_2 emission factor in year y (tCO_2/MWh);

$FC_{i,y}$ – amount of fossil fuel i consumed in the project electricity system in year y (mass or volume unit);

$NCV_{i,y}$ – net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ – CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ);

$EG_{m,y}$ – net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh);

i – all fossil fuel types combusted in power sources in the project electricity system in year *y*;

y – three most recent years for which data is available (2006-2008).

The net electricity generation and fossil fuels consumed in the project electricity system are received from Rosstat RF. The amount of fossil fuels are expressed in tonne of coal equivalent with net calorific value is equal to 7,000 kcal/kg c.e. or 29.33 GJ/t.c.e.

The net electricity generation and fuel consumption data at all TPPs of URES "Ural" in 2006-2008 are presented in the Table Anx.2.5.

Table Anx.2.5: The net electricity generation and fuel consumption data[25]

Indicator	Unit	2006	2007	2008
Net electricity generation	MWh	135,934,405	222,265,106	228,371,465
Natural gas	t.c.e	33,740,941	63,050,220	64,719,198
	GJ	989,621,797	1,849,262,966	1,898,214,087
Heavy fuel oil	t.c.e	145,938	795,762	686,134
	GJ	4,280,348	23,339,689	20,124,303
Coal	t.c.e	11,311,241	8,663,920	10,294,424
	GJ	331,758,695	254,112,781	301,935,465
Peat	t.c.e	0	72,635	55,212
	GJ	0	2,130,388	1,619,371
Other	t.c.e	70	755,646	966,516
	GJ	2,063	22,163,103	28,347,914

Source: Rosstat RF

Exclusion off-grid power plants data

The above mention data includes net electricity generation and fuel consumption of the off-grid power plants. And the individual data of off-grid power plants is not available by this source. To exclude the off-grid power plants the following conservative assumptions were taken:

- The net electricity generation of the off-grid power plants is two and half percent (as shown in the Table Anx.2.3) of total net electricity generation of URES "Ural" in year *y*;
- Efficiency factor of the off-grid power plants was defined according to the Annex 1 of the Tool.

The off-grid power plants fuel consumption is defined based on the analysis of OJSC "Zvezda Energetika" (the biggest company constructing such type of power plant in Russia). The results of the analysis are presented in Table Anx.2.6.

[25] This and further the fuel consumption for electricity generation only

Table Anx.2.6: The analysis results of OJSC "Zvezda Energetika" activity and value of default efficiency factors of the energy unit types

Type of power units (CAP is nominal capacity in MW)	Total capacity	Percentage	Default efficiency factor[26]
	MW	%	%
Diesel-engine units (10<CAP<50)	105.4	49.3	33.0
Diesel-engine units (CAP<10)	34.0	15.9	28.0
Gas turbine units (10<CAP<50)	24.0	11.2	32.0
Gas turbine units (CAP<10)	50.3	23.5	28.0
Total	***213.7***	***100.0***	-

Source: http://www.energostar.com/activity/activity_map.php

The net electricity generation and fuel consumption data at TPPs of URES "Ural" excluding off-grid power plants in 2006-2008 are presented in the Table Anx.2.7.

Table Anx.2.7: The net electricity generation and fuel consumption data excluding off-grid power plants

Indicator	Unit	2006	2007	2008
Net electricity generation	MWh	132,536,045	216,708,478	222,662,178
Natural gas	GJ	988,496,754	1,847,423,418	1,896,324,000
Heavy fuel oil	GJ	2,392,219	20,252,427	16,952,224
Coal	GJ	331,758,695	254,112,781	301,935,465
Peat	GJ	0	2,130,388	1,619,371
Other	GJ	2,063	68,890,550	64,664,591

Definition of other fuel types

According to statistic form 6-TP the electricity and heat producers must indicate following fuel types: natural gas (including associated gas), heavy fuel oil, coal, peat, oil-shales (slate), firewood and other fuels are indicated as other fuel types.

In the Ural region some power stations use such type of fuel as blast furnace and coke even gases (power plants at the metallurgical works) and wood waste (Solikamskaya CHP). These types are reflected in statistic form 6-TP as other fuel types. The "other" fuel type (see table above) is third fuel of URES "Ural" power plants for last years. The most relevant areas are Perm, Orenburg, Sverdlovsk and Chelyabinsk.

The amount of other fuel type consumption on the regional basis during 2006-2008 is presented in the Table Anx.2.8.

[26] Tool to calculate the emission factor for an electricity system, version 02, Annex I, Methodological Tool, CDM Executive board

Table Anx.2.8: The other fuel type consumption on the regional basis during 2006-2008

Area (Republic)	Unit	2006	2007	2008
Bashkiriya	GJ	n/a	883,532	984,579
Udmurtiya	GJ		0	0
Perm	GJ		12,585,722	11,405,119
Kirov	GJ		259,333	120,000
Orenburg	GJ		8,433,172	8,423,833
Kurgan	GJ		0	0
Sverdlovsk	GJ		12,682,643	12,679,865
Tyumen	GJ		1,344	5,111
Chelyabinsk	GJ		34,044,805	31,046,083
Total	GJ	2,063	68,890,550	64,664,591

Source: Rosstat RF

In Perm area there is Solikamsk CHP (163 MW) which used a wood waste from “Solikamskbumprom” (the pulp-and-paper mill) as fuel besides natural gas. Coke oven gas is burned at “Kizilovsk GRES” (26 MW, OJSC “TGK-9”) in proportion to 30%[27] (it is about 4% of the total “other” fuel type amount in Perm area) and they plan to increase this proportion up to 50-60%. Some power plants burn some oil waste types but data about the amount of these fuels is not available.

Orenburg, Sverdlovsk and Chelyabinsk areas are relevant metallurgical regions in Russia. The big metallurgical works are located within these regions:

- “Magnitogorsk Iron&Steel Works” (Chelyabisk area) has power units with about 650 MW of total electrical capacity;
- “Chelyabinsk Metallurgical Plant” (Chelyabisk area) has power units with about 250 MW of total electrical capacity;
- “Nizhniy Tagil Iron and Steel Works” (Sverdlovsk area) has power units with about 150 MW of total electrical capacity;
- “Ural Steel” (Orenburg area) has power units with about 170 MW of total electrical capacity.

These metallurgical plants have blast-furnace production and by-product coke plant. The blast furnace and coke oven gases are utilized practically completely at the works for different purposes: for recuperation, in heating and for electricity and heat generation. The blast furnace gas part of Sverdlovsk area in the fuel balance is about 3%[28]. Usually the major part of coke oven gas is used for recuperation and in heating furnaces, not for electricity and heat generation as it has a higher calorific value than blast furnace gas. Percentages of blast furnace gas and coke oven gas in the fuel balance of “Ural Steel” CHP are about 37% and 20%, respectively[29].

There are some energy units at other metallurgical and machine building plants: “Uralvagonzavod”, “Sinarsky trubny zavod”, “Ashinsky metallurgichesky zavod”.

[27] http://www.tgk9.ru/publications_rus.html?id=873

[28] http://www.irvik.ru/company/media/detail.php?ID=74

[29] http://www.bureau-veritas.ru/wps/wcm/connect/bv_ru/local/home/about-us/our-business/certification/our_areas_of_expertise/environment_and_climate_change/news-cer-ural-steel-monitoring-report/?presentationtemplate=bv_master/news_full_story_presentation

Besides these gases coke breeze, refinery waste and other can be burned for electricity and heat generation at TPPs and CHPs.

For emission calculation the following assumptions were taken:

- The proportion of coke oven gas in the fuel balance of Perm area is 4% and the emission factor of other fuel types in Perm area was considered as zero;
- Other type of fuel is blast furnace and coke oven gases in the fuel balance of Orenburg, Sverdlovsk and Chelyabinsk areas. The proportion of these gases is 50%/50%;
- Emission from the other fuel type consumption in Bashkiria, Kirov, Tyumen areas were not taken into account in the calculation (hence emission factor for this amount is considered as zero).

The data of total fuel balance and net electricity generation of URES "Ural" is presented in the Table Anx.2.9.

Table Anx.2.9: The data of total fuel balance and net electricity generation of URES "Ural"

Indicator	Unit	2006	2007	2008
Net electricity generation	MWh	132,536,045	216,708,478	222,662,178
Natural gas	GJ	988,496,754	1,847,423,418	1,896,324,000
Heavy fuel oil	GJ	2,392,219	20,252,427	16,952,224
Coal	GJ	331,758,695	254,112,781	301,935,465
Peat	GJ	0	2,130,388	1,619,371
Coke oven gas	GJ	0	28,083,739	26,531,095
Blast furnace gas	GJ	0	27,580,310	26,074,890
Other	GJ	2,063	13,226,502	12,058,605

Calculation of emission at the TPPs of URES "Ural"

The default fuel emission factors are presented in the Table Anx.2.10.

Table Anx.2.10: The default fuel emission factors

Fuel type	Default emission factor[30]
	tCO_2/GJ
Natural gas	0.0561
Heavy fuel oil	0.0774
Coal	0.0961
Peat	0.1060
Coke oven gas	0.0444
Blast furnace gas	0.2596
Other fuel types[31]	0.0

The results of CO_2 emissions calculation at the TPPs of URES "Ural" in 2006-2008 are presented in the Table Anx.2.11.

[30] Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006

[31] Emission factor for other types of fuel is taken as zero. It is conservative

Table Anx.2.11: Results of CO_2 emission calculation at the TPPs of URES "Ural"

Indicator	Unit	2006	2007	2008
Natural gas	tCO_2	55,454,668	103,640,454	106,383,776
Heavy fuel oil	tCO_2	185,158	1,567,538	1,312,102
Coal	tCO_2	31,882,011	24,420,238	29,015,998
Peat	tCO_2	0	225,821	171,653
Coke oven gas	tCO_2	0	1,245,982	1,177,096
Blast furnace gas	tCO_2	0	7,159,848	6,769,042
Other fuel types	tCO_2	0	0	0
Total	**tCO_2**	**87,521,836**	**138,259,881**	**144,829,668**

Emission calculation of the net electricity consumption from a connected electricity system
According to the Tool recommendation the emission from net electricity imports from a connected electricity system (in this case URES "Volga") should be included into OM emission factor calculation.

The amount of net electricity imports is defined as multiplication of the net electricity generation in URES "Ural" in year *y* and portion of net electricity imports in year *y* (Table Anx.2.3, 2.5 % for 2006-2007 and 1.2% for 2008).

The CO_2 emission factor for net electricity imports was supposed 0.506 tCO_2/MWh[32].

The calculation results of CO_2 emission from net electricity imports from URES "Volga" in 2006-2008 are presented in the Table Anx.2.12.

Table Anx.2.12: The calculation results of CO2 emission from net electricity imports from URES "Volga" in 2006-2008

Indicator	Unit	2006	2007	2008
Import electricity	MWh	3,313,401	5,417,712	2,671,946
Emissions	tCO_2	1,676,581	2,741,362	1,352,005

And the results of $EF_{grig,OMsimple,y}$ and the average electricity weighted OM emission factor calculation are presented in the Table Anx.2.13.

Table Anx.2.13: Results of $EF_{grig,OM,y}$ and the average electricity weighted OM emission factor calculation

Indicator	Unit	2006	2007	2008
OM emission factor	tCO_2/MWh	0.657	0.635	0.649
Average electricity weighted OM emission factor	**tCO_2/MWh**	**0.645**		

The OM emission factor is fixed ex-ante for the period 2008-2012.

[32] "Development of grid GHG emission factors for power systems of Russia", Carbon Trade and Finance, 2008

STEP 5: Identify the cohort of power units to be included in the BM
The Tool provides the recommendations on how to form the sample groups of power units used to calculate the BM. They consist of either:
(a) The set of five power units that most recently have been built, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The option (b) was chosen for identification of the cohort of power units to be included in the BM.

Capacity additions from retrofits of power plants should not be included in the calculations of BM.

The total installed capacity of the proposed project is 800 MW (2×400). Therefore the energy units with installed capacity less than 100 MW were excluded from the group of prospective power plants. Such energy units are: at Tchaikovsky CHP (50 MW, commissioned 2007), at "Kizilovsk GRES" (26 MW, 2006), at Berezniky CHP-2 (30 MW, 2005), at "Uralkaly" (2×24 MW, 2007), at "Lukoil-West Siberia" (6×12 MW, 2007) and others.

In the Table Anx.2.14 lists the five power units that most recently have been built (since 1993) in URES "Ural".

Table Anx.2.14: The five power units that most recently have been built in URES "Ural"

N	Power plant/unit	Year of commissioning	Capacity, MW	Technology	Fuel
Commissioned in 1993-2008					
1	Nizhne-Vartovsk TPP, #2	2003	800	Steam cycle	Gas
2	Nizhne-Vartovsk TPP, #1	1993	800	Steam cycle	Gas
3	Tyumen CHP-1	2003	190	CC GT	Gas
4	Chelyabinsk CHP-3, #2	2006	180	Steam cycle	Gas
5	Chelyabinsk CHP-3, #1	1996	180	Steam cycle	Gas

Source: Energy companies

For the first commitment period of the Kyoto Protocol projects participants can choose between one of the two options:
(1) ex-ante based on the most recent information available on units already built;
(2) ex-post based on information updated during each relevant monitoring period.

The approach presented above is based upon ex-ante option.

STEP 6: Calculate the build margin emission factor
In line with the Tool the BM emission factor is the generated-weighted average emission factor of all power units *m* during the year y and is calculated as follows:

$$EF_{grig,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{5} EG_{y}} \qquad (2)$$

Where:

$EF_{grig,BM,y}$ – BM emission factor in year y (tCO_2/MWh);

$EG_{m,y}$ – net quantity of electricity generated and delivered to the grid by the power unit *m* in year *y* (MWh);

$\sum_{5} EG_y$ – net quantity of electricity generated and delivered to the grid by the cohort of 5 units in year y;
$EF_{EL,m,y}$ – CO_2 emission factor of the power unit *m* in year *y* (tCO_2/MWh);
m – power units included in the BM;
y – most recent historical year for which power generation data is available.

Method of $EF_{EL,m,y}$ calculation here is the same as for $EF_{grig,OMsimple,y}$ described under Step 4, i.e. by using specific fuel consumption per 1 kWh of energy output $b_{m,y}$ (kg c.e./kWh).

$$EF_{EL,m,y} = b_{m,y} \times EF_{CO2,\,fuel} \tag{3}$$

Where:
$EF_{CO2,\,fuel}$ – fuel emission factor (fuel type weighted) in tCO_2/MJ or tCO_2/t.c.e; the IPCC factors for main types of fuel values;
$b_{m,y}$ – specific fuel consumption by the unit *m* (MJ/MWh or t.c.e./MWh).

In the Russian Federation individual plant based data is considered strictly confidential. Therefore the specific factors of the power units (or similar power units) from open sources were used.

The background data for $EF_{grig,BM,y}$ calculation is presented in the Table Anx.2.15.

Table Anx.2.15: Background data for $EF_{grig,BM,y}$ ***calculation***

Indicator	Unit	Nizhne-Vartovsk TPP, #1*	Nizhne-Vartovsk TPP, #2*	CC GT at Tyumen CHP-1**	Chelyabinsk CHP-3, #1***	Chelyabinsk CHP-3, #2***
Electric capacity	MW	800	800	190	180	180
Annual net generation of electricity	MWh	11,326,030		865,488	1,231,000	
Specific fuel consumption	g c.e./kWh	303.4		239.9	267.4	
	GJ/MWh	8.899		7.036	7.843	
Fuel	-	Associated petroleum gas		Natural gas		
	GJ	100,787,192		6,089,805	9,654,539	
Fuel emission factor	tCO_2/GJ	0.0561[33]				

Source: * *http://www.ogk1.com/?ch=pl&id=5&art=new&nid=970;*
** *according to the standards from the Concept of Technical policy of JSC UES;*
*** *Manual "Territorial Generate Companies", CJSC "IT Energy Analytics", 2007*

[33] The emission factor of the associated petroleum gas (APG) is considerably higher than the one of the natural gas which consists mainly of methane. APG consists mainly of propane and other higher hydro-carbons, thus the carbon content is higher. Using lower emission factor for setting of the baseline is a conservative approach leading to lower baseline emission estimation.
And probably, Nizhnevartovsk TPP-1 and TPP-2 are using dry associated petroleum gas without higher hydrocarbon fractions as fuel. As shown in PDD the emission factor of such dry associated petroleum gas is very similar to emission factor of natural gas.

The results of $EF_{EL,m,y}$ calculation are presented in the Table Anx.2.16.

Table Anx.2.16: Results of $EF_{grig,BM,y}$ calculation

Indicator	Unit	Nizhne-Vartovsk TPP, #1	Nizhne-Vartovsk TPP, #2	CC GT at Tyumen CHP-1	Chelyabinsk CHP-3, #1	Chelyabinsk CHP-3, #2
Power unit CO_2 emission factor	tCO_2 /MWh	0.499	0.499	0.395	0.440	0.440
Average weighted BM emission factor	tCO_2 /MWh	0.487				

BM emission factor is ex-ante for period 2008-2012.

STEP 7: Calculate combined margin emission factor
The combined margin emission factor (CM) is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (4)$$

Where:

$EF_{grid,CM,y}$ CM emission factor in year *y* (tCO_2/MWh);
$EF_{grid,OM,y}$ OM emission factor in year *y* (tCO_2/MWh);
$EF_{grid,BM,y}$ BM emission factor in year *y* (tCO_2/MWh);
w_{OM} weight of OM emission factor;
w_{BM} weight of BM emission factor.

In most cases the Tool recommends to apply $w_{OM} = w_{BM} = 0.5$. But developers may propose other weights, as long as $w_{OM} + w_{BM} = 1$.

As a starting point the weighting factor for w_{OM} is taken as 0.5.

When looking at the factor for w_{BM} the specific of the Russian power system have to be taken into account. The Russian power system has a big quantity of old, worn-out, low efficient power plants being in operation for decades. According to the JSC "UES of Russia" average turbines operational life time is around 30 years. Most of these capacities were put in operation in 1971-1980 that corresponds to 31.4% of the whole installed capacities.

In accordance with General Scheme[34], dated 22 February 2008, it was planned to approximately 33 GW of old capacity has to be dismantled by 2015. To meet the growth in demand for new energy units with total capacity of 120 GW will be commissioned by 2015. This means that the JI project will not only avoid the construction of new power plants, but also accelerate the decommissioning of existing capacities. Given the impact of the financial crises on demand growth and the capability to finance new

[34] http://www.e-apbe.ru/library/detail.php?ID=11106

projects, the new estimation[35] (September 2008) expects that out of the planned 120 GW only about 80 GW will be operational by 2015. Out of the 33 GW of old capacity only 10 GW will be dismantled. This means that 1 GW of any project delay is a delay of 0.5 GW of old capacity dismantling. So the effect of the JI project on the acceleration of decommissioning of existing capacities will only be stronger as result of the financial crisis.

The estimation, that the effect of the JI project on the decommissioning of power plants and the delays of new power plants construction is approximately 50% / 50%. For the avoidance of new power plants the emission factor of the BM is representative whereas for the accelerated decommissioning effect the emission factor of the OM is representative. And it means that 0.25 of BM refers to the group of prospective power plants and another 0.25 of BM refers to the dismantling of existing capacities and can be related to OM.

Therefore effective $w_{OM} = 0.50 + 0.25 = 0.75$ and $w_{BM} = 0.25$.

The resulting grid factor is $EF_{grid,CM,y} = 0.606$ tCO_2/MWh.

CM emission factor is ex-ante for period 2008-2012, because OM and BM emission factors are ex-ante as well. This emission factor is the baseline emission factor ($EF_{BL,CO2,y}$) which is used to establish the baseline emissions of the baseline scenario.

[35] http://www.e-apbe.ru/library/detail.php?ID=11106

Annex 3

MONITORING PLAN

See Section D for monitoring plan.