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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Expansion of Krasnodar CHPP with installation of CCP-410, LLC "LUKOIL-Kubanenergo", Russian Federation

Sectoral scope[1]: (1) Energy industries (renewable/non-renewable sources)

Version: 1.2

Date: August 25, 2011

A.2. Description of the project:

Objective of the project

The project proposes to expand Krasnodar CHPP (KCHPP) of LLC "LUKOIL-Kubanenergo" with a view to enhancing efficiency and increasing electricity and heat generation as well as reducing greenhouse gas (GHG) emissions through introduction of up-to-date energy generation technologies based on a combined-cycle plant (CCP).

The project replaces a significant amount of electricity generated at less efficient power generating capacities of the Integrated Energy System of the South of Russia (IES South) and also makes it possible to discontinue heat production in the boiler houses.

Situation before the project

Krasnodar CHPP was put into operation in 1954 and was intended to cover heat and power demand of Krasnodar and the surrounding area. Currently, the installed electrical generating capacity of the CHPP is 744 MW, and the installed thermal generating capacity – 781 Gcal/h. The main fuel for Krasnodar CHPP is natural gas (98-99%), the backup fuel is heavy fuel oil (mazut).

The main energy generating equipment of Krasnodar CHPP features: a non-modular section consisting of six boilers and five steam turbines with the installed capacity of 159 MW, and a modular section consisting of four outdoor modules (a steam boiler and a turbine) with the installed capacity of 585 MW. The equipment of the non-modular section of KCHPP is heavily worn out.

Krasnodar Krai has a deficit power system; there are considerable power flows from the neighboring regions. The growth of heat demand is attributed to development of new residential areas.

Baseline scenario

The baseline scenario involves decommissioning of the most extensively worn-out equipment of the non-modular section of KCHPP.

The lacking amount of electricity (lacking, that is, in comparison with the project scenario) would have been provided by third parties. Energy companies within IES South could have increased their power output by running their existing capacities and by building new power generating units. The lacking amount of heat (lacking, that is, in comparison with the project scenario) would have been provided by third parties with the help of their existing capacities and newly constructed gas boiler houses.

[1] In accordance with the list of sectoral scopes adopted by the Joint Implementation Supervisory Committee. http://ji.unfccc.int/Ref/Documents/List_Sectoral_Scopes.pdf

Project scenario

The CHPP is expanded through construction of a combined-cycle plant of CCP-410 type. The plant has the installed electrical capacity of 416.5 MW and the thermal capacity of steam turbine heat extraction of 220 Gcal/h.

The CCP-410 generating unit is a single-unit combined-cycle plant with three steam pressure circuits and intermediate superheating, intended for production of heat and electricity under base-load operation.

The main equipment of CCP-410 consists of:

- M701F4 gas turbine unit (GTU), 303.5 MWe, manufactured by Mitsubishi Heavy Industry, Ltd., Japan;
- three-pressure heat recovery boiler of Ep-307/350/47-13.0-565/560/247 type manufactured by OJSC “EMAlliance”, Russia;
- T-113/145-12.4 steam turbine manufactured by CJSC “Uralsky Turbine Manufacturing Plant”, Russia.

Upon commissioning of CCP-410, two of the five turbines (No.3 and No.5) of the non-modular section of the CHPP with the total generating capacity of 64 MW are to be decommissioned; the other three turbines remain functioning to allow for the operation of the plant’s common 8-13 ata steam header (there will be only one of the turbines running at a time). Thus, the new energy generating unit will substitute up to 64 MW of electrical capacity and up to 190 Gcal/h of thermal capacity of KCHPP in terms of hot water.

Natural gas will be the main and backup fuel for the CCP. The design electrical efficiency of the CCP when running in condensation mode is 57.4%. The implemented technologies meet up-to-date environmental standards.

Upon implementation of the project the new energy generating unit will start supplying energy to the grid of the IES South. Electricity generated by the new and more technologically efficient energy unit will substitute electricity that without the project would have been generated using less efficient technologies.

Heat produced by the new energy unit, besides substituting heat supply from KCHPP’s retired capacities, will be also intended to cover the growing heat demand of Krasnodar in 2011-2025. The demand is rising (based on the number of connections to the CHPP) by 21-160 Gcal/h in terms of hot water.

The expected results of the project:

- optimization of the energy generation scheme at the CHPP, enhancement of its reliability and cost effectiveness;
- re-equipment of the CHPP with installation of new and more efficient units which meet up-to-date environmental and technical requirements;
- increase in electricity and heat supply from KCHPP;
- higher efficiency of natural gas combustion;
- mitigation of negative environmental impact, including reduction in greenhouse gas emissions by 1130 ktCO_2e per year.

Connection of CCP-410 to the grid and completion of the comprehensive testing of the equipment is scheduled for August 30, 2011.

Project history

RAO "UES of Russia" (United Energy Systems of Russia) had started gearing up for implementation of the Kyoto mechanisms long before the Protocol was ratified by the Russian Federation. To this end a Non-Commercial Investment and Environmental Organization "Energy Carbon Fund" was set up in 2000[2].

The main results of the Fund's operation are as follows:

- Together with RAO "UESR" it took a comprehensive survey of greenhouse gas emissions from energy sector covering the period from 1990 in accordance with the world standards, an emission inventory was created;
- A greenhouse gas emission monitoring system, including an accounting and reporting system, is up and running; emission inventories are developed;
- A number of joint implementation (JI) projects were prepared for approval by government authorities, some of these projects already have positive determination by international auditors; foreign investments were attracted for these projects;
- Together with regional energy generators, the Fund participated in international tenders for purchase of GHG emissions;
- "Greenhouse Gases", an information analysis system, was developed and introduced at a number of regional energy companies;
- Projections of emission reductions of the Unified Energy System of Russia have been made;
- Several regulatory and methodological guidelines were issued and are in effect in the energy sector, including the method for calculation of GHG emissions from thermal power plants.

In 2006-2007 the Fund evaluated several projects in terms of their potential for JI. The Krasnodar CHPP expansion project was put on the list of the investment projects of S&A[3] of OJSC RAO "UES of Russia" that are implemented jointly in accordance with Article 6 of the Kyoto Protocol to the UNFCCC[4] as of 25.06.2007.

In 2007 a preliminary estimation of the GHG emission reduction potential of the project "Expansion of Krasnodar CHPP with installation of CCP-410" was made and an inventory of GHG emissions originating from OJSC "SGC TGC-8" from 1990 through 2005 was taken [R6].

The project is included in the "Power Sector Facilities Allocation Scheme up to 2020"[5] (Master Plan), developed by RAO "UES of Russia" in 2006. In the resolution part of the Order No.215-r dated 22.08.2008 the Russian Government approves the proposed Master Plan which is in fact a summarized investment programme based on the power sector facilities' own plans.

Open Joint Stock Company "Southern Generating Company – TGC-8" was established on March 22, 2005. The sole founder of the Company was OJSC RAO "UES of Russia". After completion of the restructuring of OJSC RAO "UES of Russia", LUKOIL Group consolidated the controlling interest in OJSC "Southern Generating Company – TGC-8" and became the company's strategic investor. Since May 4, 2008 OJSC "SGC TGC-8" is a part of LUKOIL Group. LLC "LUKOIL-Kubanenergo" was established in 2009 in the course of restructuring of TGC-8.

Since RAO "UES of Russia" ceased to operate, the company inherited the investment plans of RAO "UES of Russia", however it is not under any obligation to follow them through. The Master Plan does not specify which companies' facilities are included. Therefore if the commissioning of power capacities

[2] http://www.carbonfund.ru/about/general_information
[3] Subsidiaries and affiliates
[4] http://www.carbonfund.ru/projects/pso/
[5] http://www.e-apbe.ru/scheme/

is not on schedule, the government cannot impose any penalties against any of these companies. This is further confirmed by the fact that actual commissioning dates and the capacities to be commissioned differ significantly from those specified in the Master Plan.

On April 28, 2008 (considered to be the starting date of the project) the company management signed a turnkey contract with OJSC "Group E4" No.163-08 [R7] for works on "Expansion of Krasnodar CHPP with installation of CCP-410" Project.

At the time of decision making the planned cost of the project implementation was estimated at RUR 16 753.87 million.

As shown above, when the company management decided to implement the project it considered from the very start a possibility to develop it as a carbon project in order to attract required financial resources and to ensure acceptable return on investments. The issues related to preparation of the JI project documentation were discussed with different companies, and eventually in 2011 a contract was signed with CCGS.

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)
Russia (Host Party)	Limited Liability Company "LUKOIL-Kubanenergo"	No
One of the parties of Annex B to the Kyoto Protocol	To be determined within 12 months after approval of the project by the Russian Government	No

LLC "LUKOIL-Kubanenergo"

Within the framework of implementation of a strategic development programme at OJSC "LUKOIL" in 2008 a new business sector was created – "Electric Power Sector". The new sector incorporated all dimensions of energy business, starting with generation and ending with transportation and sale of heat and electricity.

The Electric Power Business Sector includes (apart from OJSC "SGC TGC-8" acquired in 2008, its own power plants at oilfields in Russia and generating companies in Bulgaria, Romania and Ukraine) electricity and heat transportation and sale organizations operating in Russia.

In accordance with the target structure of the Electric Power Business Sector, 7 companies were set up (4 of them– LLC "LUKOIL-Astrakhanenergo", LLC "LUKOIL-Volgogradenergo", LLC "LUKOIL-Kubanenergo" and LLC "LUKOIL-Rostovenergo"— are generating companies) and started their operations in 2009. The power plants are located in Astrakhan, Volgograd and Rostov Regions, and in Krasnodar and Stavropol Krai, as well as in the Republic of Dagestan.

LLC "LUKOIL-Kubanenergo"[6] is 100% owned by OJSC "LUKOIL" and was established in 2009 in the course of restructuring of TGC-8. Its electricity and heat generating facilities are located in Krasnodar Krai and in the Republic of Adygeya. The combined installed electrical capacity of LLC "LUKOIL-Kubanenergo" is 744 MW, the installed thermal capacity is 781 Gcal/h. In 2009 the total of 4 773 million kWh of electricity were generated and the total of 1 003 thousand Gcal of heat supplied. The Company employs around 700 staff.

[6] http://www.kubanenergo.lukoil.ru/

The Company has an operative and constantly improved integrated quality management system, environmental management system, occupational health and safety management system according to international standards ISO 9001, ISO 14001, OHSAS 18001.

Fig. A.3-1. Krasnodar CHPP of LLC "LUKOIL-Kubanenergo"

A.4. Technical description of the project:

A.4.1. Location of the project:

Location of the project: Russian Federation, Krasnodar Krai, Krasnodar, LLC "LUKOIL-Kubanenergo", premises of Krasnodar CHPP (See Fig.A.4-1 and Fig.A.4-2).

Fig. A.4-1. Location of Krasnodar Krai and the City of Kransodar on the map of Russia

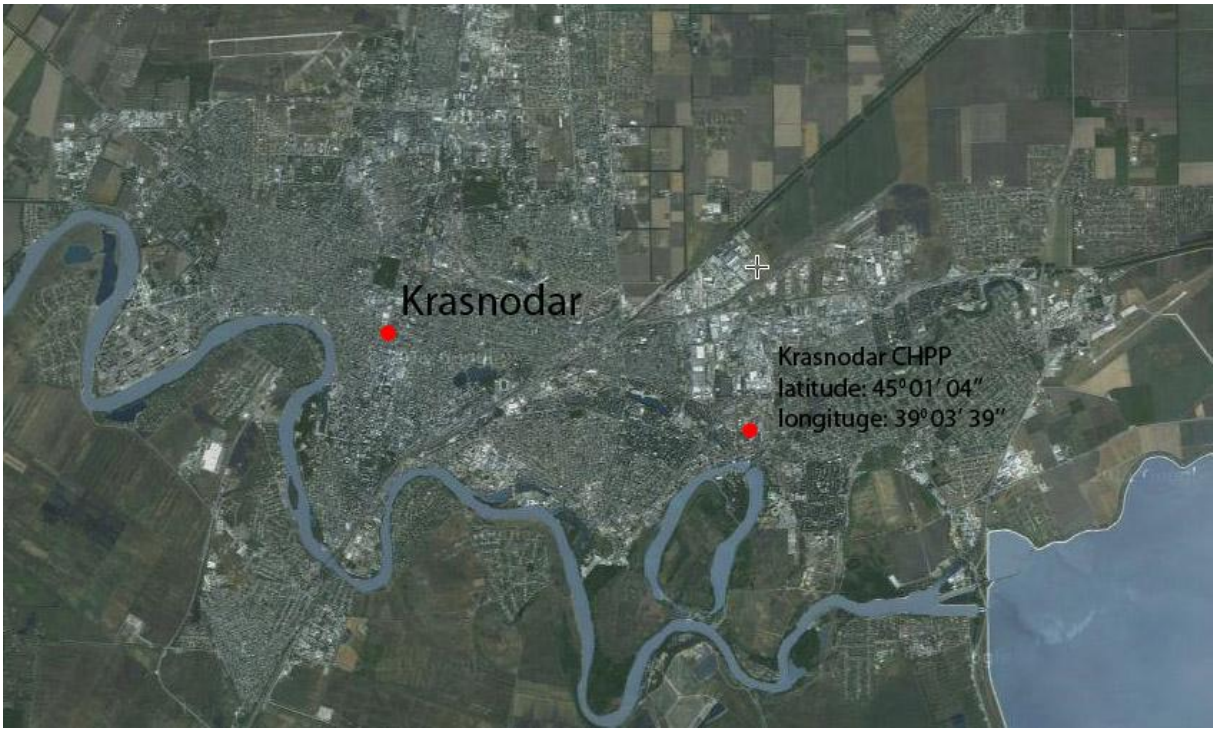

Fig. A.4-2. Google Planet Earth map pinpointing the project activity

A.4.1.1. Host Party(ies):

Russian Federation

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

Krasnodar Krai

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

City of Krasnodar

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

Krasnodar Krai lies in the South of Russia, south-west of the North Caucasus Region, and is included the Southern Federal District. In the north-east it borders Rostov Region, in the east – Stavropol Krai and in the south – Abkhazia. In the north-west and south-west its coast is washed by the Azov and the Black Seas.

Total length of the borderline is 1540 km, of which 740 km is the coastline. Krasnodar Krai is 327 km wide from north to south and 360 km wide from west to east at its widest. The area covers 75.5 square meters. The population is 5.2 million people, of which urban population accounts for 52.5% and rural population accounts for 47.5%. The administrative center of Krasnodar Krai is the city of Krasnodar.

Krasnodar is located in the moderate climatic zone. Summers are hot here, winters are mild with unstable snow cover. Average monthly temperature is between -5 and +2 ^{0}C in January and between +21 and +25 ^{0}C in July. Average annual air humidity is 71 %.

Geographical coordinates of the project activity: latitude 45°01′N, longitude 39°03′E. Time zone GMT: +3:00.

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

Overview of the existing main equipment of Krasnodar CHPP

Krasnodar CHPP features the following groups of equipment:

- a non-modular section (boiler and turbine hall No.1) with the installed electrical capacity of 159 MW;
- a modular section (boiler and turbine hall No.2) with the installed electrical capacity of 585 MW;
- two gas-turbine units (GTU), 100 MW each, commissioned in 1970-1975 and serving to cover peak loads. The GTUs were taken out of operation in 1996 and 2004. The generator of the second GTU is operated as a synchronous compensator for generation of reactive power.

Equipment of the non-modular section is listed in Table A.4-1.

Table A.4-1. Main equipment of the non-modular section of CHPP

No.	Equipment type	Year of manufacture	Rated steam flow, temperature, capacity/output
Steam boilers (100 ata)			
1	PK-19	October 1954	130 t/h, 510 °C
2	PK -19	December 1954	130 t/h, 510 °C
3	PK -19	September 1955	130 t/h, 510 °C
4	TP-230	January 1958	230 t/h, 510 °C
5	TP-15	December 1958	220 t/h, 540 °C
6	TP-15	May 1959	220 t/h, 540 °C
Steam turbines (90 ata)			
1	VPT-25-3	October 1954	167 t/h, 500 °C; 25 MW, 60 Gcal/h
2	R-20-90/1.2	July 1955 In 1975 VK-25-1 was converted to R-20-90/1.2	130 t/h, 500 °C; 20 MW, 54.5 Gcal/h
3	R-22-90/10	October 1957 In 1979 VK-50-1 was converted to R-22-90/10	230 t/h, 500 °C; 22 MW, 108 Gcal/h
4	VTP-50-2	January 1959	337 t/h, 535 °C; 50 MW, 149.5 Gcal/h
5	T-42-90	October 1961 In 1981 VK-50-3 was converted to T-42-92 with steam extraction at 1.2-2.5 ata	205 t/h, 535 °C; 42 MW, 64 Gcal/h

The equipment of the non-modular section has nearly outlived its useful lifespan by now.

Since March 1963 the energy generating units of the second phase (modular section of the CHPP), 150 MW each, started to be put into operation. The main generating equipment of the modular section consists of:

- K-150-130 steam turbine No.6;
- T-145/160-130 steam turbines No.No.7,8 and 9;
- TGM-94 steam boilers No.No.7,8,9 and 10.

The main fuel of Krasnodar CHPP is natural gas (98-99.3%), the backup fuel is heavy fuel oil (mazut).

Gas is supplied to Krasnodar CHPP via three gas pipelines.

As of early 2011 the total installed electrical capacity of Krasnodar CHPP is 744 MW, the installed thermal capacity is 781 Gcal/h.

Description of the project measures

The process technology introduced under the project is state-of-the-art. All technological parameters meet environmental standards and requirements.

The project measures enable significant reduction in GHG emissions due to enhancement of fossil fuel (natural gas) combustion efficiency and due to increase in heat and electricity generation efficiency.

The CHPP is planned to be expanded by building a combined-cycle plant of CCP-410 type with the installed electrical capacity of 416.5 MW (303.5+113) with heat extraction from the steam turbine of 220 Gcal/h.

The CCP-410 generating unit is a single-unit combined-cycle plant with three steam pressure circuits and intermediate superheating, designed for generation of heat and power under base-load operation.

The main equipment of CCP-410 consists of:

- M701F4 gas turbine unit (GTU), 303.5 MWe, manufactured by Mitsubishi Heavy Industry, Ltd., Japan;
- three-pressure heat recovery boiler of Ep-307/350/47-13.0-565/560/247 type manufactured by OJSC "EMAlliance", Russia;
- T-113/145-12.4 steam turbine manufactured by CJSC "Uralsky Turbine Manufacturing Plant", Russia.

The main and backup fuel of the CCP is natural gas.

The main technical and economic parameters of the CCP are given in Table A.4-2 below.

Table A.4-2. The main technical and economic performance parameters of CCP

#	Parameter	Value
1.	Installed electrical capacity	416.5 MW
2.	Specific consumption of heat for electricity supply in condensation mode	6300 kJ/kWh
3.	Specific consumption of equivalent fuel for electricity supply in condensation mode	203 g e.f./kWh
4.	Installed capacity of heat extraction from the steam turbine	220 Gcal/h
5.	Efficiency of the energy generating unit (gross) in condensation mode	57.4%

Principles of combined-cycle plant operation

The classic version of a combined cycle plant operates as follows: it is based on combined operation of a gas turbine and a steam turbine. Atmospheric air is fed to the inlet of the GTU's air compressor, which is an axial-flow turbo-machine. The compressor rotor is driven by the gas turbine. The flow of pressurized air is fed to the combustion chamber also charged with fuel. The fuel of the gas turbine unit is natural gas. When fuel is fired, combustion gases with the temperature of over 1000 °C are produced. Working gas is supplied to the flow path of the gas turbine where it expands nearly to the atmospheric pressure, thus generating mechanical power. Most of this power is spent to drive the compressor, the remaining power being spent to drive the electric generator. This is the so-called first or gas-turbine cycle of the power plant operation, efficiency at this stage is 35-39%.

The high-temperature exhaust gases from the GTU are fed to a special heat recovery boiler, and at this point the steam-turbine plant comes into play. The steam is heated by the exhaust gases to the temperature of 500-600^{o}C, building up pressure and flow which are quite sufficient for operation of a steam turbine whose shaft is connected to the second electric generator. This enables the GTU to generate extra 20% of power. Thus the overall efficiency of a power plant based on the combined-cycle technology reaches almost 60%.

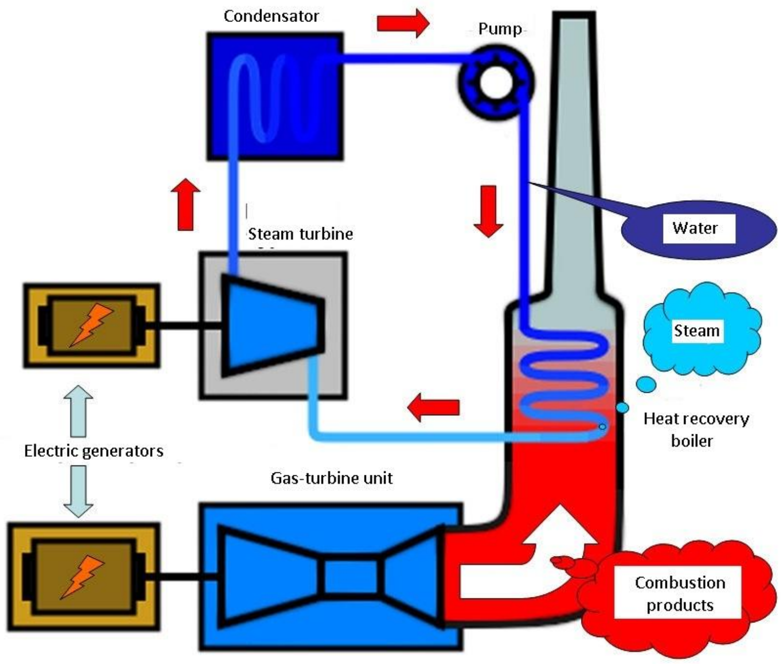

Fig. A.4-3. Principle of the combined-cycle plant operation

The same amount of fuel gives considerably higher power output when fired in a CCP compared with steam-turbine plants (STP). Thermodynamically this is explained by the fact that in a CCP the average inlet temperature of heat in the cycle is higher than in a STP, whereas the average outlet temperature of heat is practically the same.

In a CCP heat input (fuel combustion) is generally provided only in the combustion chamber of the GTU, where the high temperature of the working fluid is maintained. The heat recovery boiler uses the heat of exhaust gases from the CCP for steam production. Heat is removed in the CCP (similar to STP scheme) with the spent steam via extraction valves and steam turbine condenser.

The main advantages of the CCP over the STP are its high cost effectiveness, lower cooling water demand and low harmful emissions. Power plants based on the combined cycle process are not only very efficient but also meet the strictest environmental standards. For example, the level of NOx emissions from such plants is two to three times lower.

Description of the main equipment of the installed generating unit

Gas-turbine unit

The project involves installation of one GTU of M701F4 type manufactured by Mitsubishi Heavy Industry Ltd. (MHI) to be operated as a part of CCP. The GTU consists of a 17-stage high output axial-flow compressor, a combustion chamber consisting of 20 chambers located circumferentially around the gas turbine, and a 4-stage reactive turbine. The gas turbine is directly connected to the generator on the compressor side.

The GTU is planned to be supplied with gaseous fuel (natural gas) from the existing high-pressure distribution gas pipeline, 530x8 mm in diameter, entering the CHPP’s premises.

General view of the gas-turbine engine manufactured by MHI, series F, is shown in Fig.A.4-4.

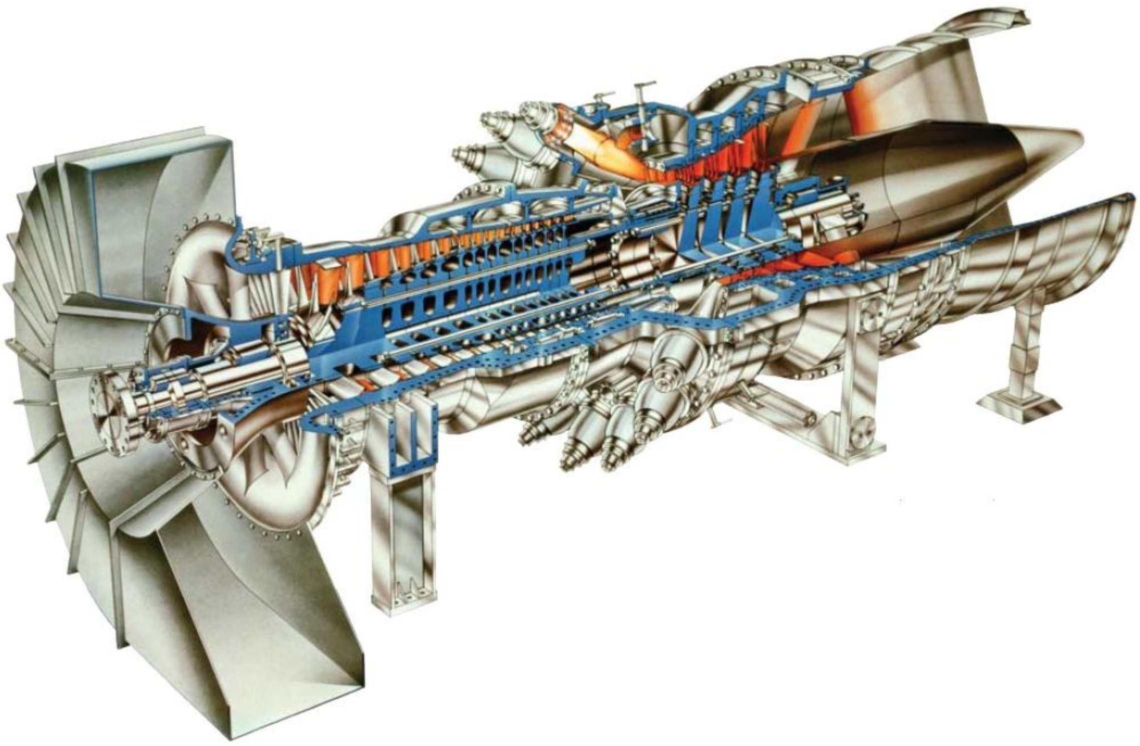

Fig. A.4-4. General view of the gas-turbine engine manufactured by MHI, series F

Main performance parameters of the GTU are given in Table A.4-3 below.

Table A.4-3. Main performance parameters of the GTU

Parameter	Unit	Value
Electric capacity on generator terminals	MW	303.9
Effective electric efficiency	%	38.88
Temperature of exhaust gases	°C	602
Consumption of exhaust gases at ambient temperature +15 °C	t/h	2572
Compressor pressure ratio	-	18
Generator rotation speed	rmp	3000

Heat recovery boiler

Heat recovery boiler (HRB) serves to utilize heat of exhaust gases coming from GTU and cooling against the heating surfaces placed consecutively along the gas flow. There will be installed a three-pressure heat recovery boiler without afterburning manufactured by OJSC "EMAlliance" of Ep-307/350/47-13.0-565/560/247 type.

The main performance parameters of the heat recovery boiler are shown in Table A.4-4 below.

Table A.4-4. Main performance parameters of the heat recovery boiler

Parameters of the heat recovery boiler	Unit measure	Value
High pressure duct at the outlet from the HRB		
Steam flow	t/h	300...320
Steam pressure	MPa (absolute)	13.0
Steam temperature	°C	550...565
Medium pressure duct at the outlet from the HRB		
Steam flow	t/h	355...375
Steam pressure	MPa (absolute)	3.1
Steam temperature	°C	540...560

Low pressure duct at the outlet from the HRB		
Steam flow	t/h	45...50
Steam pressure	MPa (absolute)	0.5
Steam temperature	°C	250
Flue gases at the outlet from the HRB		
Gas temperature at the inlet to the flue stack	°C	85...110

Steam turbine

The steam from the heat recovery boilers is fed to the steam turbine. The steam turbine has heat extraction and a compensator. The steam extracted from the turbine is fed to the steam-water heaters of delivery water. The delivery water is supplied to the city for heating and hot water supply. When the heat demand is low some electricity can be generated in a condensation mode.

The project CCP features a 145 MWe steam turbine of T-113/145-12.4 type manufactured by CJSC "Uralsky Turbine Manufacturing Plant". The steam turbine is a three-cylinder unit consisting of high- and medium-pressure cylinders and a double-flow low-pressure cylinder.

The turbine is fitted with two delivery water heaters of PSG-2300 type, having 2300 m^2 of heat exchange surfaces each.

Main performance characteristics of the turbine are given in Table A.4-5 below.

Table A.4-5. Main performance characteristics of T-113/145-12.4 turbine

Characteristics	**Operation mode**	
	Average winter heat extraction	**Condensation**
High-pressure steam parameters: - pressure, MPa (kgf/cm); - temperature, °C - flow rate, t/h	 12.35 (125.9) 557.5 308.7	 12.35 (125.9) 562.6 299.3
Medium-pressure steam parameters: - pressure, MPa (kgf/cm); - temperature, °C - flow rate, t/h - steam flow of the second circuit, t/h	 2.95 (30.1) 553.0 360.2 57.7	 2.90 (29.6) 559.0 352.4 59.3
Low-pressure steam parameters: - pressure, MPa (kgf/cm); - temperature, °C - flow rate, t/h	 0.475 (4.8) 248.1 49.8	 0.475 (4.8) 248.6 46.4
Cooling water temperature, °C	12	15
Thermal load, GJ/h (Gcal/h) Electrical capacity, MW	921 (220) 113	- 145.7

Fig.A.4-5 shows the schematic flow diagram of the turbine unit featuring T-113/145-12.4 steam turbine.

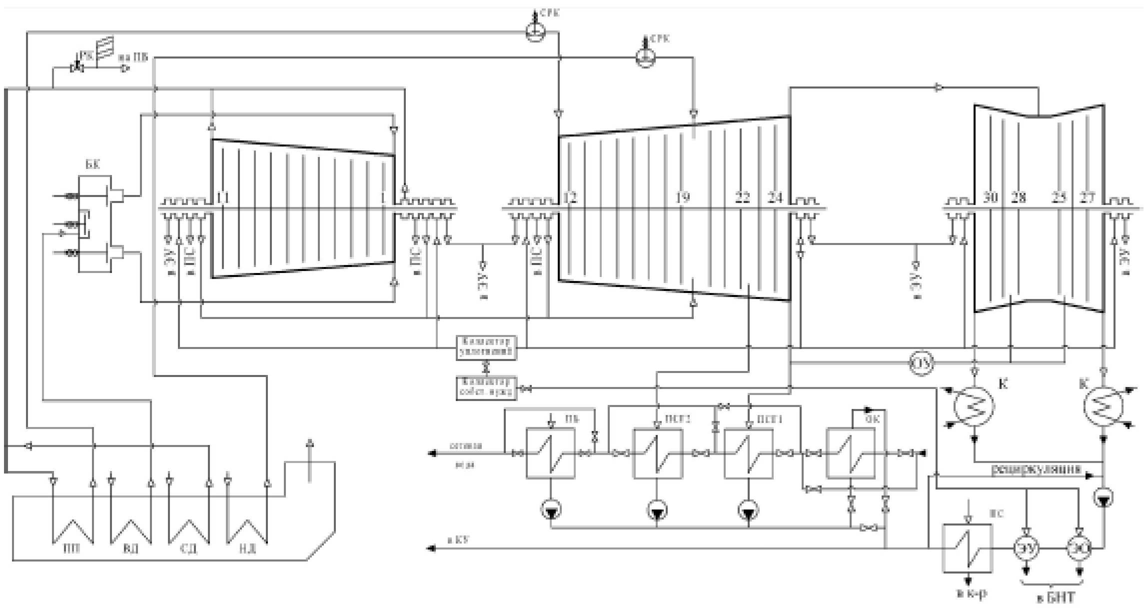

Fig. A.4-5. Flow diagram of the turbine unit featuring T-113/145-12.4 turbine

Fig. A.4-6 shows the flow diagram of the power plant after the project implementation.

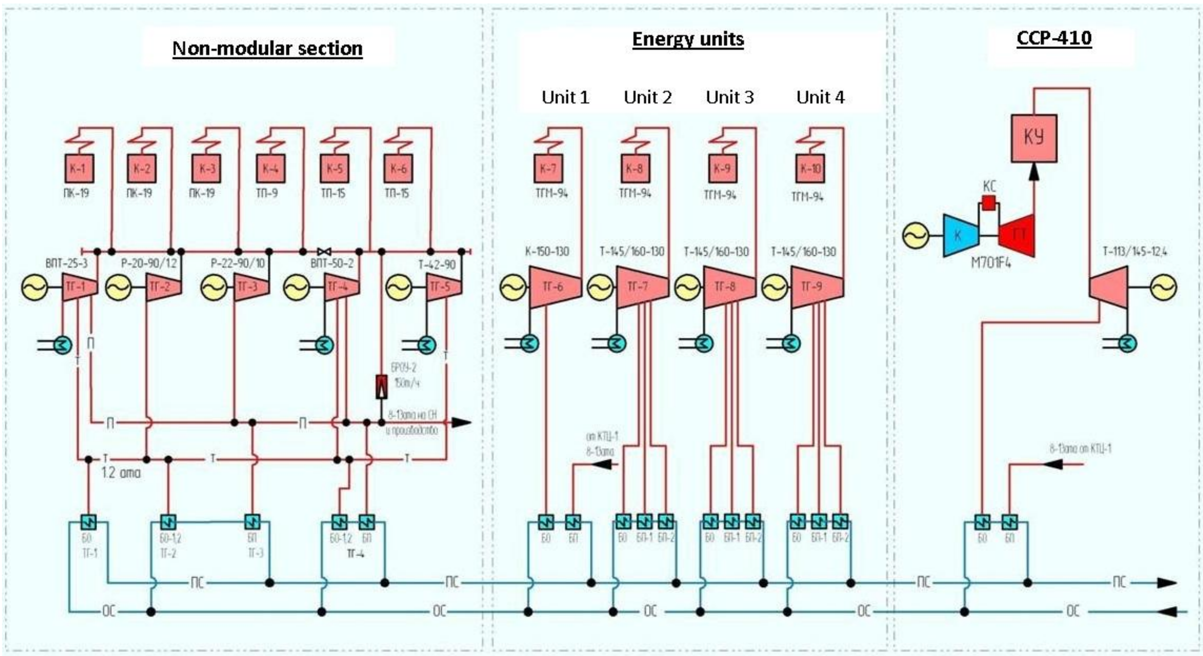

Fig. A.4-6. Flow scheme of Krasnodar CHPP after the project implementation

Project implementation period

The general turnkey contractor for installation of the CCP at Krasnodar CHPP is OJSC “Group E4” with which a contract was signed in April 2008 [R7]. According to the available schedule of works [R5] the main construction period lasts from July 2009 through August 2011, connection of CCP-410 to the grid and completion of comprehensive testing of the equipment is scheduled for August 30, 2011.

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:

Fossil fuel combustion is a major source of GHG emissions. The main greenhouse gas from fossil fuel combustion is CO_2. Emissions of N_2O and CH_4 from combustion are negligible compared with CO_2 emissions.

The project GHG emission reductions will be mainly due to the growth of efficiency and electricity production at Krasnodar CHPP achieved by using state-of-the-art combined-cycle technology and respective substitution of grid electricity that is generated within the IES South mainly using less efficient steam-turbine technology.

Besides electricity generation the new CCP-410 will become an additional source of heat. The principal consumer of heat will be the housing and utilities sector of Krasnodar, which currently suffers from a shortage of available thermal capacities. The Master Plan of Krasnodar heat supply system development towards 2025 (developed in 2007 prior to the start of the project) envisaged construction, rehabilitation and expansion of boiler houses. However a substantial proportion of the shortage of available thermal capacities can be covered by the project CCP, and so some of the plans to scale up heat supply from boiler houses could be dropped.

Hence emission reductions will be also achieved due to substitution of less efficient (compared with the co-generation of heat and electricity in CCP) gas-fired boiler houses which otherwise would be built or expanded in the absence of the project.

Without the project the said GHG emission reductions would not be achieved because the lacking amount of electricity and heat (lacking that is compared with the project scenario) would be covered by third parties by using less efficient technologies.

Energy generators even within the IES South could increase electricity generation at their existing capacities and by building new generating units. The existing and newly commissioned heat production facilities in Krasnodar (gas-fired hot water boiler houses) are capable of satisfying the growing heat demand.

It is unlikely that the project would be implemented in the absence of the joint implementation mechanism, considering the following circumstances:

- the project implementation requires serious investments whereas the return on investments without additional revenues from sale of emission reductions is not sufficiently high for this project;
- the project employs a fairly new CCP-based heat and electricity generation technology with which Krasnodar CHPP has no previous experience;
- there are no caps on GHG emissions for companies in Russia;
- it is not expected that there will be any significant changes in Russian environmental legislations that might force the company to stop using the existing steam turbine technology of heat and electricity generation.

Without the project significant investment risks could be avoided. The investment risks can be such as, for instance, higher than originally planned project investments. This could be due to mistakes in design, need to purchase additional equipment or undertake unscheduled works, rising prices for equipment, mounting and setup works, etc.

To mitigate the said risks and to increase the financial profitability of the project the company management has been looking to sell emission reduction units (ERUs) in the international market.

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

	Years
Length of the crediting period	1.33
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2011	376 744
2012	1 130 232
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**1 506 976**
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1 130 232

A.5. Project approval by the Parties involved:

The letters of approval by the Parties will be received later.

SECTION B. Baseline

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

Choice of the baseline setting approach

When setting the baseline the developer applied a JI-specific approach based on paragraph 9 (a) "Guidance on criteria for baseline setting and monitoring" [R1].

The baseline was set in accordance with Appendix B to the JI Guidelines[7]. Justification of the baseline scenario was made in accordance with paragraphs 23-29 of the Guidance on criteria for baseline setting and monitoring.

The most likely baseline scenario was chosen on the basis of the analysis of several heat and electricity generation alternatives to the project. The baseline scenario was justified taking into account Annex 1 to the "Guidance on criteria for baseline setting and monitoring".

All key data, factors and suppositions which affect GHG emission reductions are considered on a transparent and conservative basis.

Identification of the likely future scenarios and choice of the baseline scenario

The project CCP will generate electricity and produce heat in the form of hot water. The electricity supply system and heat supply system can be regarded as independent from each other and therefore for each of them an individual set of alternative scenarios is developed.

Groups of scenarios were considered separately for the following project activities:

- Generation of the required amount of electricity (such amount being equal to the amount of electricity supplied from the CCP);
- Production of the required amount of heat (such amount being equal to the amount of heat supplied from the CCP).

The following alternatives which allow generation of the required amount of electricity have been identified:

- Alternative E1. Generation of electricity by other existing power plants within the IES South;
- Alternative E2. Generation of electricity by other new energy generating units within the IES South;
- Alternative E3. Generation of electricity by other existing and newly commissioned power plants within the IES South;
- Alternative E4. The project activity without the joint implementation mechanism.

The following alternatives which allow production of the required amount of heat have been identified:

- Alternative H1. Production of heat by the existing heat production sources of Krasnodar;
- Alternative H2. Production of heat by new heat production sources of Krasnodar;
- Alternative H3. Production of heat by the existing and new heat production sources of Krasnodar;
- Alternative H4. The project activity without the joint implementation mechanism.

The analysis of each alternative is given further below.

[7] Annex to Decision 9/CMP.1 (known as JI Guidelines) includes Appendix B which specifies criteria for baseline setting and monitoring.

Generation of the required amount of electricity

Alternative E1. Generation of electricity by other existing power plants within the IES South

Today the installed electrical capacity matches the demand in the electricity market. However there are many old energy generating units in operation in Russia. According to the assessment made by CJSC "Energy Forecasting Agency" in 2008, around 10GW of outdated capacities (whose operation lifespan expired several years ago) should be taken out of operation by the year 2015, including – 3.9 GW to be decommissioned by the year 2010. At the same time these forecasts suggest that in 2012 the electricity demand will increase by 27.3 GW against the year 2009[8].

The expected electricity demand in the Southern Federal District will grow by 6.72 million MWh by 2012 compared with 2009, whereas the capacity deficit according to the forecast balance of electric sector development for 2009-2015 will be 452.2 MW in 2012[9].

Thus, the existing power plants alone cannot cover the future demand in the electricity market, and *this alternative cannot be a likely future scenario.*

Alternative E2. Generation of electricity by other new energy generating units within the IES South

The installed capacity of power plants within the IES South is 13.8 GW. The plant factor of the existing power plants of the IES South is between 0.47 and 0.75. Smart dispatching, modernization and improvement of operation of energy generating units (reduction in shutdown time) may improve performance parameters of the existing energy equipment which in its turn will increase electricity generation at the existing power plants.

Reconstruction of the existing energy generating units may increase both the installed electrical capacity and the capacity utilization factor. According to the projections of CJSC "Energy Forecasting Agency" (see the above reference), the increment in the installed electrical capacity at the existing power plants (due to upgrade measures) may amount to around 2.3 GW by 2015.

The energy demand and consumption management in the electric power market is technically performed by OJSC "System Operator of the Unified Energy System" (OJSC "SO UES"). The System Operator ensures that the demand is satisfied most effectively both from economic and technical points of view. Since over 87% of the projected electricity demand will be met by the existing power plants, it is unlikely that the System Operator will ensure that 0.4 GW (capacity of the project CCP) are constantly provided merely by commissioning of new energy generating units.

This means that electricity (the amount of which is equal to the project generation) will be also supplied to the grid by the existing power plants, and therefore *this alternative is not a likely future scenario.*

Alternative E3. Generation of electricity by other existing and newly commissioned power plants within the IES South

This alternative is a combination of alternatives E1 and E2.

This alternative is quite realistic and can be considered as a likely future baseline scenario for electricity generation since the future demand in the electricity market as shown above can be covered only by combined operation of the existing power plants and new energy generating units.

Alternative E4. The project activity without the joint implementation mechanism

"The Power Sector Facilities Allocation Scheme up to 2020" approved by the Russian Government (Resolution dated February 22, 2008 No.215-r) states that modernization and construction of new thermal power plants running on natural gas should only be based on the projects involving gas-turbine technologies.

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

[9] http://www.kwexpert.ru/files/porgnozniy_balanc_razwitiya_eletroenergetiki_09-15g_gg_2009g.pdf

The CCP construction project is technically viable; there is sufficient natural gas available for Krasnodar CHPP. However the economic parameters of this project without the joint implementation mechanism are not sufficiently attractive (See the Investment Analysis in Section B.2). Besides construction and operation of CCP is not common practice for Russian energy generating companies. *Therefore this alternative can hardly be a likely future scenario.*

Production of the required amount of heat

Alternative H1. Production of heat by the existing heat production sources of Krasnodar

Krasnodar has a mixed heat supply structure: heat is supplied by 5 major heat sources, 4 of which with the installed thermal capacity of up to 31.6 MW, and by about 750 boiler houses running predominantly on natural gas.

The city's leading position in construction volumes in Russia's Southern Federal District justify the estimation made in the Master Plan of Heat Supply Development in Krasnodar (developed in 2007 before the start of the CCP construction project), which assumes that the heating loads in the Housing and Utilities Sector (HUS) will almost double to reach 5360 MW by 2025. This being said, at present only 62.9% of Krasnodar's HUS is covered by district heating, which suggests an estimate that the heating load may potentially grow by 690 MW.[10]

The leading company in the sector of heat production, delivery, distribution and sale in Krasnodar Krai is OJSC "Krasnodarteploenergo". The overall installed thermal capacity of its generating assets is 1645 MW, the length of the double-pipe heating network is over 1000 km. Krasnodar accounts for about 80% of the company's total net heat supply[11].

This alternative does not envisage any investment in installation of new heat production equipment at Krasnodar CHPP nor any additional operating costs related to construction and operation of sophisticated energy equipment.

The capacity of the existing CHPP's turbines cannot satisfy the rising heat demand. Besides, the installed equipment of the plant's non-modular section has outlived its useful life and anyway must be taken out of service some time soon.

It is possible that in the first few heating seasons the growth of heating loads could be compensated (with allowance for the KCHPP's non-modular section being taken out of operation) by boosting heat supply from the existing boiler houses and by developing the heating network. However later on, the existing capacities will obviously cease to satisfy further growth of the city's heat demand.

Taking into account the aforesaid, *this alternative cannot be a likely future scenario*.

Alternative H2. Production of heat by new heat production sources of Krasnodar

OJSC "Krasnodarteploenergo" is in the process of implementing a phased investment programme (see the above reference) which aims at a 50% growth of the installed capacity of the boiler houses by the year 2014 (the growth of the installed capacity shall be in the order of 820 MW). At the first phase of this programme it is planned to build new boiler houses and heating networks in different city districts, to increase the installed capacity of the existing boiler houses and also to partially replace equipment which is past its useful life. The measures of the first phase are planned to be implemented by 2011-2012. The measures of the second and third phases suggest increase in capacity of the existing heat production assets, replacement of outdated equipment and setting up an effective heat metering system. The measures of the second phase are scheduled for 2011-2013, and the third phase is scheduled for 2012-2014.

[10] http://st.finam.ru/ipo/comments/_KTE_flash_1Q2010.pdf

[11] http://www.galleoncapital.ru/docs/kte/kte_flash-020910.pdf

Considering the company's position as a leader in the heat sale market in Krasnodar's HUS, it has good chances of both new capacities commissioning and relatively inexpensive rehabilitation of the existing ones.

As follows from the above, OJSC "Krasnodarteploenergo" does not place its stake solely on construction of new heat sources with complete decommissioning of the existing ones. The existing heat sources though, be they after reconstruction, must also take part in ensuring the city's heat demand with allowance for its further growth.

As for LLC "LUKOIL-Kubanenergo", it has not considered installation of new water-steam cycle heat production equipment at Krasnodar CHPP. Even if there were any such plans, it would be hardly possible to implement them because the Power Sector Facilities Allocation Scheme approved by the Russian Government (Resolution dated February 22, 2008 No.215-r) states that modernization and construction of new thermal power plants running on natural gas should be based only on gas-turbine technologies.

Therefore, *this alternative cannot be a likely future scenario*.

<u>Alternative H3. Production of heat by the existing and new heat production sources of Krasnodar</u>

This option is a combination of alternatives H1 and alternative H2.

This alternative *is quite realistic and can be considered the most likely scenario of heat production* because the growing demand, as shown above, can be covered only by co-operation of the existing and new heat sources, which would mainly be gas-fired boiler houses.

<u>Alternative H4. The project activity without the joint implementation mechanism</u>

Most of the plans for modernization and construction of new gas-fired boiler houses could be dropped because of commissioning the CCP-410. However according to what was said in regards Alternative E4, the CCP construction project at Krasnodar CHPP in the absence of the joint implementation mechanism is not sufficiently attractive in terms of economics. Besides, introduction of a CCP is not common practice in Russia. Therefore *this alternative can hardly be a likely future scenario*.

Thus, based on the above Analysis of Alternatives and with allowance for the Investment Analysis, we chose as the most likely baseline scenario the following combination of Alternatives: Alternative E3 which assumes electricity generation and supply to the grid by the existing and new energy generating units within the IES South, and Alternative H3 which assumes heat production by the existing and new heat sources (boiler houses) of Krasnodar.

<u>Justification and description of the GHG emission evaluation method</u>

The following emission sources are considered further below.

For the baseline scenario:

- heat production by gas-fired boiler houses, CO_2 emissions from natural gas combustion;
- electricity generation by power plants of the IES South, CO_2 emissions from fossil fuel combustion.

For the project scenario:

- electricity and heat generation by the CCP, CO_2 emissions from natural gas combustion.

Potential leakages due to the project include:

- fugitive emissions of CH_4 from production, processing, storage, transportation and distribution of fossil fuel.

GHG emission reductions

In general case GHG emission reductions during the year *y* is calculated as follows, tCO_2e:

$$ER_y = BE_y - PE_y - LE_y, \qquad \text{(B.1-1)}$$

where BE_y is the baseline GHG emissions during the year *y*, tCO_2e;

PE_y is the project GHG emissions during the year *y*, tCO_2e;

LE_y is the leakages due to the project activity during the year *y*, tCO_2e.

GHG emissions under the baseline scenario

In accordance with the sources specified above, the baseline GHG emissions during the year *y* are calculated by the following formula, tCO_2e:

$$BE_y = BE_{HS,y} + BE_{ES,y}, \qquad \text{(B.1-2)}$$

where $BE_{HS,y}$ is the baseline emissions of CO_2 due to combustion[12] of natural gas for heat production (supply to the grid) by gas-fired boiler houses during the year *y*, tCO_2e;

$BE_{ES,y}$ is the baseline emissions of CO_2 due to combustion of fossil fuel for electricity generation (supply to the grid) by power plants of the IES South during the year *y*, tCO_2e.

The baseline emissions of CO_2 due combustion of natural gas by gas-fired boiler houses during the year *y* are calculated by the following formula, tCO_2e:

$$BE_{HS,y} = FC_{NG,BL,y} \times EF_{CO2,NG}, \qquad \text{(B.1-3)}$$

where $FC_{NG,BL,y}$ is the baseline consumption of natural gas for heat production by gas-fired boiler houses during the year *y*, GJ;

$EF_{CO2,NG}$ is the CO_2 emission factor for natural gas, tCO_2/GJ.

The method for estimation of fuel consumption is described below.

The baseline emissions of CO_2 due combustion of fossil fuel for electricity generation by the power plants of the IES South during the year *y* are calculated by the following formula, tCO_2e:

$$BE_{ES,y} = ES_{BL,y} \times EF_{CO2,grid}, \qquad \text{(B.1-4)}$$

where $ES_{BL,y}$ is the baseline electricity supply to the grid (equal to the project electricity supply from the CCP) by the power plants of the IES South during the year *y*, MWh;

$EF_{CO2,grid}$ is the CO_2 emission factor for grid electricity, tCO_2/MWh.

The CO_2 emission factor for natural gas was assumed according to the IPCC Guidelines [R3] to be constant over years and numerically equal to $EF_{CO2,NG}$ = 0.0561 tCO_2/GJ.

The CO_2 emission factor for electricity supplied to the grid by the existing power plants and new energy generating units of the IES South is assumed in accordance with the justification given in Annex 4 to be constant over years and numerically equal to $EF_{CO2,grid}$ = 0.6745 tCO_2/MWh.

12 Emissions of CH_4 and N_2O resulting from fuel combustion are considered negligibly small compared with CO_2 emissions and were not taken into account in development of the project design documentation.

Heat production under the baseline scenario

The baseline scenario assumes that the demand in the heat market of Krasnodar would be covered by means of increasing heat supply from both existing and newly commissioned gas-fired boiler houses.

It is assumed that under the baseline scenario gas-fired boiler houses would supply the same amount of heat as would be supplied by the CCP under the project scenario, that is:

$$HS_{BL,y} = HS_{PJ,y}, \quad \text{(B.1-5)}$$

where $HS_{BL,y}$ is the baseline heat supply from gas-fired boiler houses during the year *y*, GJ;

$HS_{PJ,y}$ is the project heat supply from the CCP during the year *y* GJ.

Electricity generation under the baseline scenario

The baseline scenario assumes that the electricity demand in the electricity market of Krasnodar would be satisfied by generation and supply of electricity to the grid by the existing and new energy generating units of the IES South.

It is assumed that under the baseline scenario the existing power plant and new energy generating units of the IES South would generate and supply the same amount of electricity as the CCP under the project, that is:

$$ES_{BL,y} = ES_{PJ,y}, \quad \text{(B.1-6)}$$

where $ES_{PJ,y}$ is the project supply of electricity from the CCP during the year *y*, MWh.

Consumption of natural gas in the boiler houses under the baseline scenario

The main fuel of the boiler house in Krasnodar is natural gas. Consumption of other fuels is marginal. Conservatively we assume that under the baseline scenario the new boiler houses would fire only natural gas for heat production, the consumption of natural gas during the year *y* is calculated by the following formula, GJ:

$$FC_{NG,BL,y} = \frac{HS_{BL,y}}{\eta_{GB}}, \quad \text{(B.1-7)}$$

where $FC_{NG,BL,y}$ is the baseline consumption of natural gas for heat production by gas-fired boiler houses during the year *y*, GJ;

η_{GB} is the efficiency of new gas boilers.

Although some heat under the baseline scenario could have been supplied by the existing (old) boiler houses, it is conservatively assumed that natural gas would have been fired only in new boiler houses. The efficiency of new gas boilers in accordance with recommendations of [R4] was assumed at $\eta_{GB} = 0.92$. By the same token, consumption by the boiler houses for auxiliary needs under the baseline scenario was conservatively excluded from consideration.

For the sake of simplicity, natural gas consumption values for the baseline and project scenarios are given in energy units (GJ) in the description of GHG emission calculation methodology.

GHG emissions under the project scenario

The project GHG emissions during the year *y* are calculated by the following formula, tCO_2e:

$$PE_y = FC_{NG,PJ,y} \times EF_{CO2,NG}, \quad \text{(B.1-8)}$$

where $FC_{NG,PJ,y}$ is the project consumption of natural gas by the CCP for electricity and heat generation during the year y, GJ.

The fuel consumption estimation method is described further below.

Heat and electricity supply from the CCP under the project

In projections for 2011-2012 we assumed the annual supply of electricity and heat from the CCP in accordance with the design documentation for the CCP [R8] and the project works schedule [R5]: $ES_{PJ,2011} = 1\ 070\ 000$ MWh; $ES_{PJ,2012} = 3\ 210\ 000$ MWh; $HS_{PJ,2011} = 998\ 669$ GJ; $HS_{PJ,2012} =$ = 2 996 008 GJ (connection of CCP-410 to the grid and completion of the comprehensive testing of the equipment is scheduled for August 30, 2011).

These values are used only for projections and shall not affect the actual monitored value of emission reductions, and neither shall other projected parameters of the project scenario specified below.

Fuel consumption under the project

Natural gas is combusted in the project CCP during a year for generation and supply of heat and electricity under the project, the total projected consumption of natural gas during the year *y* is calculated by the following formula, GJ:

$$FC_{NG,PJ,y} = FC_{NG,ES,PJ,y} + FC_{NG,HS,PJ,y}, \qquad \text{(B.1-9)}$$

where $FC_{NG,ES,PJ,y}$ is the project consumption of natural gas by the CCP for electricity supply during the year *y*, GJ;

$FC_{NG,HS,PJ,y}$ is the project consumption of natural gas by the CCP for heat supply during the year *y*, GJ.

Consumption of natural gas by the project CCP for electricity supply under the project during the year *y* is calculated by the following formula, GJ:

$$FC_{NG,ES,PJ,y} = ES_{PJ,y} \times \delta_{ES} \times \frac{29.31}{1000}, \qquad \text{(B.1-10)}$$

where δ_{ES} is the specific consumption of equivalent fuel for electricity supply from the CCP, kg e.f./MWh;

29.31 is the factor for conversion of tonnes of equivalent fuel to GJ.

Consumption of natural gas by the project CCP for heat supply under the project during the year *y* is calculated by the following formula, GJ:

$$FC_{NG,HS,PJ,y} = HS_{PJ,y} \times \delta_{HS} \times \frac{29.31}{1000}, \qquad \text{(B.1-11)}$$

where δ_{HS} is the specific consumption of equivalent fuel for heat supply from the CCP, kg e.f./GJ.

In projections for 2011-2012 we assumed that the specific consumptions of equivalent fuel for heat and electricity supply of in accordance with the design documentation for the CCP [R8] are constant and equal to: δ_{HS} = 28.94 kg e.f./GJ and δ_{ES} = 203.67 kg e.f./MWh respectively.

During the monitoring period the project consumption of natural gas shall be determined by direct measurements of natural gas volumes consumed in the CCP which are then multiplied by an average calorific value of natural gas (See Section D).

Leakages

Leakages resulting from the project include fugitive emissions of CH_4 from production, processing, storage, transportation and distribution of fossil fuel.

The main type of fuel for production of heat and electricity both under the project and under the baseline scenarios is natural gas[13]. The project results in enhancement of energy generation efficiency (due to operation of the CCP) which will lead to reduction in natural gas consumption per unit of energy generated, and to reduction in fugitive emissions, respectively. For conservative reasons and in order to simplify calculations, leakages have been excluded from consideration.

Application of the chosen approach

All necessary parameters for the baseline and project scenarios were determined using the methodology described above.

The data projected for the years 2011-2012 for the baseline and project scenarios are presented in Tables B.1-1 and B.1-2 respectively. All key data and parameters are described in a tabular form below.

Table B.1-1. Baseline parameters

Parameters	Designation	Unit	2011	2012	2011-2012
Electricity supply to the grid by power plants of the IES South	$ES_{BL,y}$	MWh	1 070 000	3 210 000	4 280 000
Supply of heat by gas-fired boiler houses	$HS_{BL,y}$	GJ	998 669	2 996 008	3 994 677
Consumption of natural gas in boiler houses	$FC_{NG,BL,y}$	GJ	1 086	3 257	4 342

Table B.1-2. Parameters of the project scenario

Parameter	Designation	Unit	2011	2012	2011-2012
Electricity supply from the CCP	$ES_{PJ,y}$	MWh	1 070 000	3 210 000	4 280 000
Heat supply from the CCP	$HS_{PJ,y}$	GJ	998 669	2 996 008	3 994 677
Specific consumption of equivalent fuel for electricity supply from the CCP	δ_{ES}	kg e.f./MWh	203.67	203.67	203.67
Specific consumption of equivalent fuel for heat supply from the CCP	δ_{HS}	kg e.f./GJ	28.94	28.94	28.94
Natural gas consumption by the CCP, including:	$FC_{PJ,y}$	GJ	7 234 724	21 704 172	28 938 896
For electricity supply	$FC_{ES,PJ,y}$	GJ	6 387 587	19 162 761	25 550 348
For heat supply	$FC_{HS,PJ,y}$	GJ	847 137	2 541 411	3 388 549

Data/Parameter	$EF_{CO2,NG}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor for natural gas
Time of determination/monitoring	Determined once at the stage of the PDD development
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2, Table 2.2. [R3]

[13] According to [R2] the main type of fuel at power plants of the IES South is natural gas (in 2007 – 87% of the total fuel consumption). Almost all heat production sources in Krasnodar are also running on natural gas.

Value of data applied (for ex ante calculations/determinations)	0.0561
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	Determined based on reference data
Any comment	Assumed as a constant both in estimations and during monitoring period 2011-2012

Data/Parameter	$EF_{CO2,grid}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor for grid electricity
Time of determination/monitoring	Determined once at the stage of the PDD development
Source of data (to be) used	Assumed in accordance with the justification given in Annex 4 of the PDD
Value of data applied (for ex ante calculations/determinations)	0.6745
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated on the basis of actual data on operation of power plants of the IES South. The emission factor allows for the existing power plants and new energy generating units of the IES South, Russian Federation
QA/QC procedures (to be) applied	Determined based on reference data
Any comment	Assumed as a constant both in estimations and during monitoring period 2011-2012

Data/Parameter	η_{GB}
Data unit	-
Description	Efficiency of the new gas boilers
Time of determination/monitoring	Determined once at the stage of the PDD development
Source of data (to be) used	Tool to determine the baseline efficiency of thermal or electric energy generation systems. Version 01. CDM Executive Board. P.7, Table 1. [R4]
Value of data applied (for ex ante calculations/determinations)	0.92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Recommended value for new gas boilers
QA/QC procedures (to be) applied	Determined based on reference data
Any comment	Assumed as a constant both in estimations and during monitoring period 2011-2012

Data/Parameter	δ_{ES}

Data unit	kg e.f./MWh
Description	Specific consumption of equivalent fuel for electricity supply from the CCP
Time of determination/monitoring	Determined once at the stage of the PDD development
Source of data (to be) used	Design data for the CCP [R8]
Value of data applied (for ex ante calculations/determinations)	203.67
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In projections for the years 2011-2012 specific consumption of equivalent fuel for electricity supply from the CCP is assumed to be constant over years and equal to the value specified in the design for this CCP [R8].
QA/QC procedures (to be) applied	Determined based on the design data
Any comment	This value is used only for projection purposes and shall not affect the actual emission reduction value based on monitored data.

Data/Parameter	δ_{HS}
Data unit	kg e.f./GJ
Description	Specific consumption of equivalent fuel for supply of heat from the CCP
Time of determination/monitoring	Determined once at the stage of the PDD development
Source of data (to be) used	Design data for the CCP [R8]
Value of data applied (for ex ante calculations/determinations)	28.94
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In projections for the years 2011-2012 specific consumption of equivalent fuel for heat supply from the CCP is assumed to be constant over years and equal to the value specified in the design for this CCP [R8].
QA/QC procedures (to be) applied	Determined based on the design data
Any comment	This value is used only for projection purposes and shall not affect the actual emission reduction value based on monitored data.

Data/Parameter	$HS_{PJ,y}$
Data unit	GJ
Description	Heat supply from the CCP under the project
Time of determination/monitoring	Annually
Source of data (to be) used	Design data for the CCP
Value of data applied (for ex ante calculations/determinations)	2011: 998 669 2012: 2 996 008
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In projections for the years 2011-2012 heat supply from the CCP is assumed to be constant over years and equal to the value specified in the design data for the CCP [R8]. In 2011 heat supply is determined based on the assumption that the CCP will operate only for 4 months (1/3 of the supply in 2012) according to the works implementation schedule for the project

	[R5]. In the course of monitoring this parameter shall be determined on the basis of heat meter readings.
QA/QC procedures (to be) applied	Projected on the basis of design data. During monitoring heat meters shall be subject to regular checking.
Any comment	-

Data/Parameter	$ES_{PJ,y}$
Data unit	MWh
Description	Electricity supply from the CCP under the project
Time of determination/monitoring	Annually
Source of data (to be) used	Design data for the CCP
Value of data applied (for ex ante calculations/determinations)	2011: 1 070 000 2012: 3 210 000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In projections for the years 2011-2012 electricity supply from the CCP is assumed to be constant over years and equal to the value specified in the design data for the CCP [R8]. In 2011 electricity supply is determined based on the assumption that the CCP will operate only for 4 months (1/3 of the supply in 2012) according to the works implementation schedule for the project [R5]. In the course of monitoring this parameter shall be determined on the basis of electric meter readings.
QA/QC procedures (to be) applied	Projected on the basis of design data. During monitoring electric meters shall be subject to regular checking.
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:

The approach described in paragraph 2 (a) of Annex 1 to the “Guidance on criteria for baseline setting and monitoring” [R1] was chosen to demonstrate that the project-induced reduction in GHG emissions from sources are additional to those that might have otherwise occurred in the absence of the project.

Within the framework of the chosen approach the additionality of the project is proved using the project alternatives analysis, investment analysis and common practice analysis.

Analysis of the project alternatives

The alternatives for electricity generation and heat production have been identified and looked at separately. Description of the alternatives and their analysis can be found in Section B.1.

Based on the analysis of the project alternatives it was concluded that the most likely baseline scenario should be the scenario which assumes that electricity would be supplied to the grid by the existing power plants and new energy generating units of the IES South and heat would be supplied by the existing and new heat sources (boiler houses) of Krasnodar.

This analysis refers to the below investment analysis which demonstrates that the project activity without the joint implementation mechanism is not a viable baseline scenario.

Investment analysis

The investment analysis considers the following main economic parameters of the project without selling ERUs: internal rate of return (IRR) and net present value (NPV).

The investment analysis was carried out using data and assumptions relevant as of the starting date of the project (April 2008).

The overall capital investment in the project was estimated at 16 753.87 million RUR.

The time horizon of the analysis is limited to 2030.

Calculations were made using the general inflation rate, rate of growth of heat and electricity tariffs and rate of increase in natural gas prices for the IES South. The said macroeconomic parameters were assumed in accordance with the "Development Scenarios for the Russian Electric Power Sector for the years 2009-2020" developed by the Energy Forecasting Agency in 2008.

The source of revenues from the project implementation is sale of heat and electricity. The expenses consist of fuel costs and other process costs (salary, maintenance and repair costs, payments for permissible emissions and for use of water bodies).

The discount rate was determined using the "Guidelines on estimation of investment projects efficiency …"[14]. According to this methodology the discount rate in efficiency calculations may include an allowance for risk.

The inflation-free or real discount rate p_{real} used for estimation of commercial efficiency of the project on the whole can be set in accordance with the requirements to the minimum permissible future inflation-free return on investments, in practice - 4-6%. We shall assume the average value of real risk-free rate of 5%.

With the help of the Fisher equation $1+p_{nom}=(1+p_{real})\cdot(1+i)$ we get an equation to determine the sought nominal risk-free discount rate with allowance for inflation:

$$p_{nom}=(1+p_{real})\cdot(1+i)-1, \qquad \text{(B.2-1)}$$

where p_{nom} is the nominal risk-free discount rate with allowance for inflation, %;

p_{real} is the inflation-free or real risk-free discount rate;

i is the level of inflation.

The projected average level of inflation over the considered planning period was calculated using the above-mentioned "Development Scenarios for the Russian Electric Power Sector…" and amounted to around i = 4.5%.

Thus, the nominal risk-free discount rate is:

$$p_{nom}= (1+0.05)\cdot(1+0.045)-1=9.7\%.$$

The risk of failure to generate revenues envisaged by the project is estimated not to be lower than average (in accordance with Table 11.1 from the "Guidelines on estimation of investment projects efficiency…"). The recommended premium for this risk is between 8 and 10%. Other risks were decided to be neglected.

The final discount rate was assumed at the level of 18%.

[14] Guidelines on estimation of investment projects efficiency. Approved by the Russian Ministry of Economics, the Russian Ministry of Finance and the Russian Gosstroi dated 21 June 1999 N BK 477

The results of calculations of the project's net present value (NPV) and internal rate of return (IRR) are given in Table B.2-1.

As is clear from the Table, the project implementation without selling GHG emission reductions has a negative NPV and the IRR is less than 18%.

Table B.2-1. Comparison of NPV and IRR

Parameter	Unit	Project without sale of GHG emission reductions
NPV	Million RUR	-2 986
IRR	%	14.50%

Further below is the analysis of the project sensitivity to changes in main parameters (See Table B.2-2) within the range of ±10%. In all considered cases the NPV is negative and the IRR is below 18%. Thus the project implementation under usual commercial practice remains unprofitable.

Table B.2-2. Sensitivity analysis

Parameter	Unit	Project without sale of GHG emission reductions
An increase of 10% in the investment costs		
NPV	Million RUR	-4 388
IRR	%	13.22%
A reduction of 10% in the investment costs		
NPV	Million RUR	-1 584
IRR	%	15.99%
An increase of 10% in the revenues from sale of heat		
NPV	Million RUR	-2 775
IRR	%	14.77%
A reduction of 10% in the revenues from sale of heat		
NPV	Million RUR	-3 197
IRR	%	14.23%
An increase of 10% in the revenues from sale of electricity		
NPV	Million RUR	-1 116
IRR	%	16.74%
A reduction of 10% in the revenues from sale of electricity		
NPV	Million RUR	-4 856
IRR	%	12.03%
An increase of 10% in the planned fuel costs		
NPV	Million RUR	-4 327
IRR	%	12.73%
A reduction of 10% in the planned fuel costs		
NPV	Million RUR	-1 646
IRR	%	16.14%

Common practice analysis

The Russian electric power sector is characterized by a high proportion of natural gas (around 70%) consumption at CHPPs. Nonetheless, the combined-cycle technology has not spread widely. All combined-cycle plants account for around 2% of the total installed capacity of all thermal power plants in Russia. Nearly all thermal power plants are using the Rankine cycle (boilers running on fossil fuel and steam turbines).

The CCP-410 built under the project is one of the largest plants of this type and does not have any counterparts anywhere in Russia. The distinctive feature of the CCP at Krasnodar CHPP is Russia's largest gas-turbine unit capable of generating 304 MW and the CCP itself is built as per a more compact scheme 1×GTU+1×HRB+1×CCP (usually CCPs have a 2×GTU+2×HRB+1×CCP scheme).

At the time when the decision to implement the project was taken there were no similar projects implemented in Russia without the joint implementation mechanism and publicly available or known to the project developers.

Thus the considered project is not common practice.

Proceeding from the above, GHG emission reductions resulting from the project are additional to those that might have otherwise occurred.

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

Fig.B.3-1 and B.3-2 show main GHG emission sources, energy and fuel flows for the baseline and project scenarios respectively. Table B.3-1 shows emission sources included in and excluded from the project boundary.

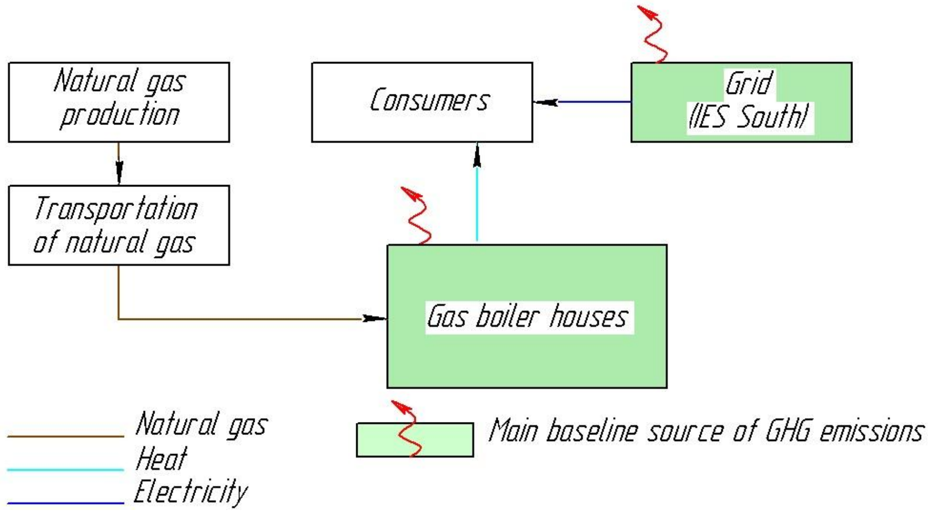

Fig. B.3-1. Main emission sources and flows for the baseline scenario

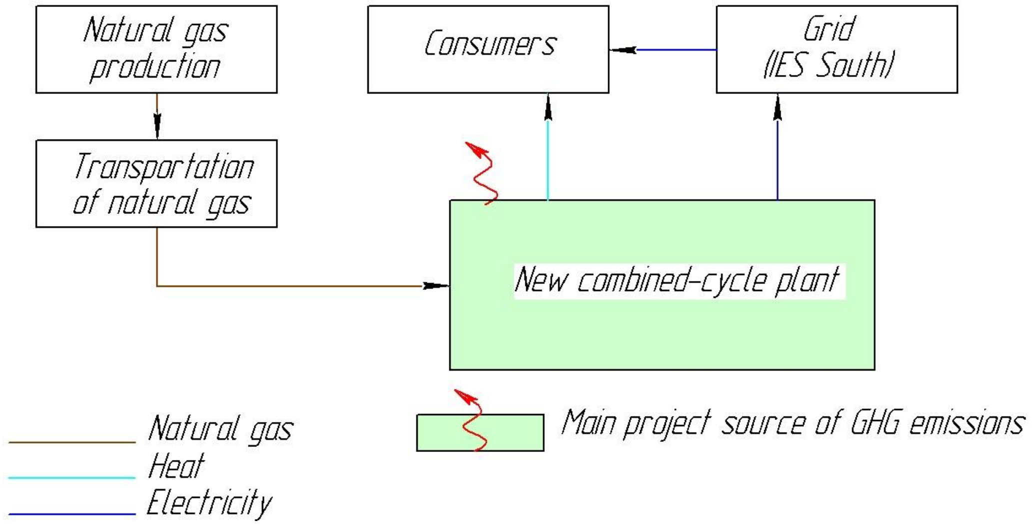

Fig. B.3-2. Main emission sources and flows for the project scenario

Table B.3-1. Emission sources included in and excluded from the project boundary

	Source	Gas	Incl./Excl.	Justification / Explanation
Baseline scenario	Gas-fired boilers, combustion of natural gas	**CO_2**	**Incl.**	**Main emission source**
		CH_4	Excl.	Negligible. This is conservative.
		N_2O	Excl.	Negligible. This is conservative.
	Power plants of the IES South, combustion of fossil fuel	**CO_2**	**Incl.**	**Main emission source**
		CH_4	Excl.	Negligible. This is conservative.
		N_2O	Excl.	Negligible. This is conservative.
Project	CCP, combustion of natural gas	**CO_2**	**Incl.**	**Main emission source**
		CH_4	Excl.	Negligible
		N_2O	Excl.	Negligible
Leakages	Production, processing, storage, transportation and distribution of fossil fuel, fugitive emissions	CO_2	Excl.	Negligible. This is conservative.
		CH_4	Excl.	Excluded from consideration because fossil fuel consumption is reduced due to the project. This is conservative.
		N_2O	Excl.	Negligible. This is conservative.

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

The date of baseline setting: 05/07/2011

The baseline was developed by CCGS LLC (CCGS LLC is not a project participant and is not listed in Annex 1 of this PDD).

Contact person: Dmitry Potashev

E-mail: d.potashev@ccgs.ru

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

April 28, 2008 (signing of the contract with OJSC “Group E4” for implementation of works on the project “Expansion of Krasnodar CHPP with installation of CCP-410”)

C.2. Expected operational lifetime of the project:

20 years / 240 months (life expectancy of the main equipment)

C.3. Length of the crediting period:

1.33 years / 16 months (from August 30, 2011 till December 31, 2012)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

For development of the monitoring plan a JI-specific approach was applied on the basis of paragraph 9 (a) of the “Guidance on criteria for baseline setting and monitoring” [R1].

Data required for calculation of GHG emission reductions are to be collected at Krasnodar CHPP in any case and the data collection process complies with the best sectoral standards and practices of fuel and energy accounting and environmental impact assessment.

All data required for monitoring shall be kept in the company’s archive in electronic and hard copy for at least two years after the end of the crediting period or the last transfer of ERUs.

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
1. $FC^{\upsilon}_{NG,PJ,y}$	Volumetric consumption of natural gas by the CCP under the project	Readings of the meters measuring gas supply to the CCP	Thousand m^3	m, c	Continuously	100%	Electronic and paper	Gas consumption is adjusted to standard conditions 20°C and 0.1013 MPa
2. $NCV_{NG,y}$	Average net calorific value of natural gas combusted in the CCP	Certificates of fuel suppliers, readings of the calorimeter at KCHPP	GJ/thousand m^3	m, c	Twice per month (certificates), Continuously (calorimeter)	100%	Electronic and paper	Calorific value of natural gas is adjusted to standard conditions 20°C and 0.1013 MPa

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

GHG emissions under the project are due to combustion of fossil fuel (natural gas) in the CCP for generation and supply of heat and electricity during the year *y*, tCO_2e:

$$PE_y = FC_{NG,PJ,y} \times EF_{CO2,NG}, \quad (D.1\text{-}1)$$

where $FC_{NG,PJ,y}$ is the consumption of natural gas by the CCP under the project during the year *y*, GJ;

$EF_{CO2,NG}$ is the CO_2 emission factor for natural gas, tCO_2/GJ. In accordance with the IPCC Guidelines [R3] $EF_{CO2,NG}$ = 0.0561 tCO_2/GJ.

$$FC_{NG,PJ,y} = FC^{\upsilon}_{NG,PJ,y} \times NCV_{NG,y}, \quad (D.1\text{-}2)$$

where $FC^{\upsilon}_{NG,PJ,y}$ is the volumetric consumption of natural gas by the CCP under the project during the year *y* (this value is to be monitored), thousand m^3;

$NCV_{NG,y}$ is the average net calorific value of natural gas combusted in the CCP during the year *y* (this value is to be monitored), GJ/thousand m^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
3. $HS_{PJ,y}$	Heat supply from the CCP under the project	Heat meter readings	GJ	m, c	Continuously	100%	Electronic and paper	Heat supply is calculated based on the measured flow, temperature and pressure of heat medium

4. $ES_{PJ,y}$	Electricity supply from the CCP under the project	Electric meter readings	MWh	m	Continuously	100%	Electronic and paper	-

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

GHG emissions under the baseline scenario are calculated as a sum of emissions from combustion of natural gas by boiler houses for heat production and emissions due to combustion of fossil fuel for generation and supply of electricity to the grid by the existing power plants and new power generating units of the IES South during the year *y*, tCO_2e:

$$BE_y = BE_{HS,y} + BE_{ES,y}, \quad \text{(D.1-3)}$$

where $BE_{HS,y}$ is the baseline CO_2 emissions due to combustion of natural gas for production (supply to the heating network) of heat by gas-fired boiler houses during the year y, tCO_2e;

$BE_{ES,y}$ is the baseline CO_2 emissions due to combustion of fossil fuel for generation (supply to the grid) of electricity by power plants of IES South during the year *y*, tCO_2e.

$$BE_{HS,y} = FC_{NG,BL,y} \times EF_{CO2,NG}, \quad \text{(D.1-4)}$$

where $FC_{NG,BL,y}$ is the baseline consumption of natural gas for production of heat by gas-fired boiler houses during the year y, GJ.

$$FC_{NG,BL,y} = \frac{HS_{BL,y}}{\eta_{GB}}, \quad \text{(D.1-5)}$$

where η_{GB} is the efficiency of new gas-fired boilers. Following the recommendations [R4] for new gas boilers $\eta_{GB} = 0.92$;

$HS_{BL,y}$ is the baseline heat supply (equal to the heat supply from the CCP) by gas-fired boiler houses during the year *y*, GJ.

$$HS_{BL,y} = HS_{PJ,y}, \quad \text{(D.1-6)}$$

where $HS_{PJ,y}$ is the heat supply from the CCP under the project during the year *y* (this value is to be monitored), GJ.

$$BE_{ES,y} = ES_{BL,y} \times EF_{CO2,grid}, \quad (D.1-7)$$

where $EF_{CO2,grid}$ is the CO_2 emission factor for grid electricity during the year *y*, tCO_2/MWh. In accordance with the justification given in Annex 4 it is assumed constant over years and numerically equal to $EF_{CO2,grid,y}$ = 0.6745 tCO_2/MWh;

$ES_{BL,y}$ is the baseline electricity supply to the grid (equal to the electricity supply from the CCP) by power plants of the IES South during the year *y*, MWh.

$$ES_{BL,y} = ES_{PJ,y}, \quad (D.1-8)$$

where $ES_{PJ,y}$ is the electricity supply from the CCP under the project during the year *y* (this value is to be monitored), MWh.

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

This option is 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

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):

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

As shown in Section B.1, leakage is assumed equal to zero.

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

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

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):

GHG emission reduction during the year *y* is calculated as the difference between the baseline and project emissions, tCO_2e:

$$ER_y = BE_y - PE_y, \quad \text{(D.1-9)}$$

where BE_y is the baseline GHG emissions during the year *y*, tCO_2e;

PE_y is the project GHG emissions during the year *y*, tCO_2e.

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:

Industrial environmental control within LLC "LUKOIL-Kubanenergo" is carried out by the Environmental Management Group of the Industrial Safety, Health and Environment Department (ISH&ED).

The programme of industrial environmental monitoring currently implemented by Krasnodar CHPP will not undergo any significantly changes after the project implementation and will be fulfilled according to the scheme and schedule approved by the Committee for Natural Resources of Krasnodar Krai.

Similarly to the way it is now, the monitoring will be performed by the Environmental Management Group of ISH&ED.

The industrial environmental control covers the following:

– Analytical control of compliance with the prescribed pollutant emission standards in accordance with the laboratory control charts;

– Monitoring of the impact of waste disposal sites on underground and surface waters, atmospheric air and soil;

– Control of pollution content in the atmospheric air on the border of the sanitary protection zone, etc.

The enterprise has the following reporting obligations as per official annual statistic forms:

– 2-tp (air) "Data on Atmospheric Air" containing information on the quantities of trapped and destroyed air pollutants, detailed emissions of specific pollutants, number of emission sources, emission reduction actions and emissions from separate groups of pollutant sources;

– 2-tp (water) "Data on Water Use", containing information on water consumption from natural sources, discharges of effluents and their pollutant content, capacity of wastewater treatment facilities, etc.;

– 2-tp (wastes) "Data on generation, utilization, destruction, transportation and disposal of production and consumption residues", containing an annual balance of wastes flows by their types and hazard classes.

In compliance with the Russian law, the company annually develops and implements environment protection measures.

Quality, environment, occupational health and safety management systems that comply with international standards ISO 9001, ISO 14001, OHSAS 18001 have been implemented and are constantly improved at the company.

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.
Table D.1.1.1 ID 1	Low	Volumetric consumption of natural gas is measured continuously by flow meters. Flow meters are checked regularly in compliance with the instrumentation and control verification schedule and procedure adopted by the company.
Table D.1.1.1 ID 2	Low	Calorific value of natural gas is determined by the fuel supplier's certified laboratories, the fuel certificates are submitted to the CHPP twice per month. At the end of the year an average value is calculated. Besides, a cross-check with the help of a calorimeter installed at the CHPP is carried out. This calorimeter calculates the calorific value of gas on a real-time basis by means of its compositional analysis.
Table D.1.1.3 ID 3	Low	Heat medium flow meters, temperature and pressure gauges are used for monitoring of heat supply from the CCP. Measuring devices are checked regularly in compliance with the instrumentation and control verification schedule and procedure adopted by the company. All current signals from the measuring devices are transmitted to the automatic control system where the heat supply is automatically calculated.

Table D Г.1.1.3 ID 4	Low	Electricity supply from the CCP is measured continuously by electric meters. Electric meters are checked regularly in compliance with the instrumentation and control verification schedule and procedure adopted by the company.

Actions undertaken during calibration of measuring devices

The measuring devices are calibrated during the periods of scheduled shutdown of the equipment. If necessary the removed measuring device is replaced with a backup calibrated instrument. Operation of the equipment without instrumentation and control equipment is not allowed.

Monitoring procedure in case of emergency

In case of an emergency arising at the company and affecting the project monitoring system (breakdown of equipment, failure of measuring devices, etc.), the specialists of LLC "LUKOIL-Kubanenergo" and CCGS LLC shall analyze the situation, develop alternative monitoring and measuring procedures for the duration of such circumstances and suggest corrective actions for the equipment and/or monitoring plan.

Cross-check

The input data are reviewed by cross-checking various sources where such data are recorded.

The project monitoring reports are checked by the specialists of both LLC "LUKOIL-Kubanenergo" and CCGS LLC.

The primary review of monitoring reports is made by the Director of Energy and GHG Emissions Management Department of CCGS LLC or, on his instructions, by a specialist of the same Department who is not directly involved in preparation of this report.

Additional cross-check is made by the Director of the Project Development Department of CCGS LLC or, on his instructions, by another specialist of this Department.

As soon as all comments made by the Project Development Department are closed, the monitoring report is submitted for internal check out to the company that implements the project.

Internal check

Internal check by the company includes checking primary data provided to CCGS LLC during information collection period as well as checking the project monitoring reports.

Test verifications

Regularly, but not less than once per year, specialists of CCGS LLC shall carry out test verifications with a view to verifying the observance of the monitoring plan.

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

Information transfer

The initial request for input GHG emission reduction monitoring data is made by the Director of Energy and GHG Emissions Management Department of CCGS LLC to the Head of the Environmental Management Group of ISH&ED of LLC “LUKOIL-Kubanenergo”, the latter in turn advises of such request to provide data the person responsible for collection, checkout, archiving and transfer of emission monitoring data – the Deputy Head of the Tune-up and Test Shop of LLC “LUKOIL-Kubanenergo”. The company has a working group responsible for collection, checkout and transfer of monitoring data. The responsibility of these persons is stipulated in corresponding orders.

The information collected at the enterprise is transferred to the Head of the Environmental Management Group of ISH&ED of LLC “LUKOIL-Kubanenergo”, the latter in his turn transfers it further to the Director of Energy and GHG Emissions Management Department of CCGS LLC. All information is transferred via email.

Based on the received data, the Energy and GHG Emissions Management Department of CCGS LLC prepares a project monitoring report and submits it for additional cross-check to the Project Development Department of CCGS LLC. As soon as all comments made by the Project Development Department have been incorporated, the project monitoring report is transferred to the company where the project is implemented.

At CCGS LLC the procedures for checking the project monitoring reports are laid out in the “CCGS LLC’s internal regulation on the procedure for quality control of the project documentation and monitoring reports developed for GHG emission reduction projects”.

After checking and making required corrections to the report, the Director of the Energy and GHG Emissions Management Department at CCGS LLC shall inform the Head of the Environmental Management Group of ISH&ED of LLC “LUKOIL-Kubanenergo” about the preliminary results of monitoring and if there are no objections on his part, the Director General of CCGS LLC shall make a final decision to submit the project monitoring report for verification by an independent auditor.

Registration and collection of monitoring data

The information required for calculation of GHG emission reductions is collected in accordance with the procedures for resources monitoring and accounting adopted at the company.

Location of monitoring points is shown in Fig. D.3-1.

The procedure for collection and transfer of information that is required by the monitoring plan is shown in Fig.D.3-2

The procedures for input data registration and storage, as well as persons responsible for monitoring are specified in Table D.3-1.

GHG emission reducctions are calculated in the end of each reporting period by the specialists of CCGS LLC.

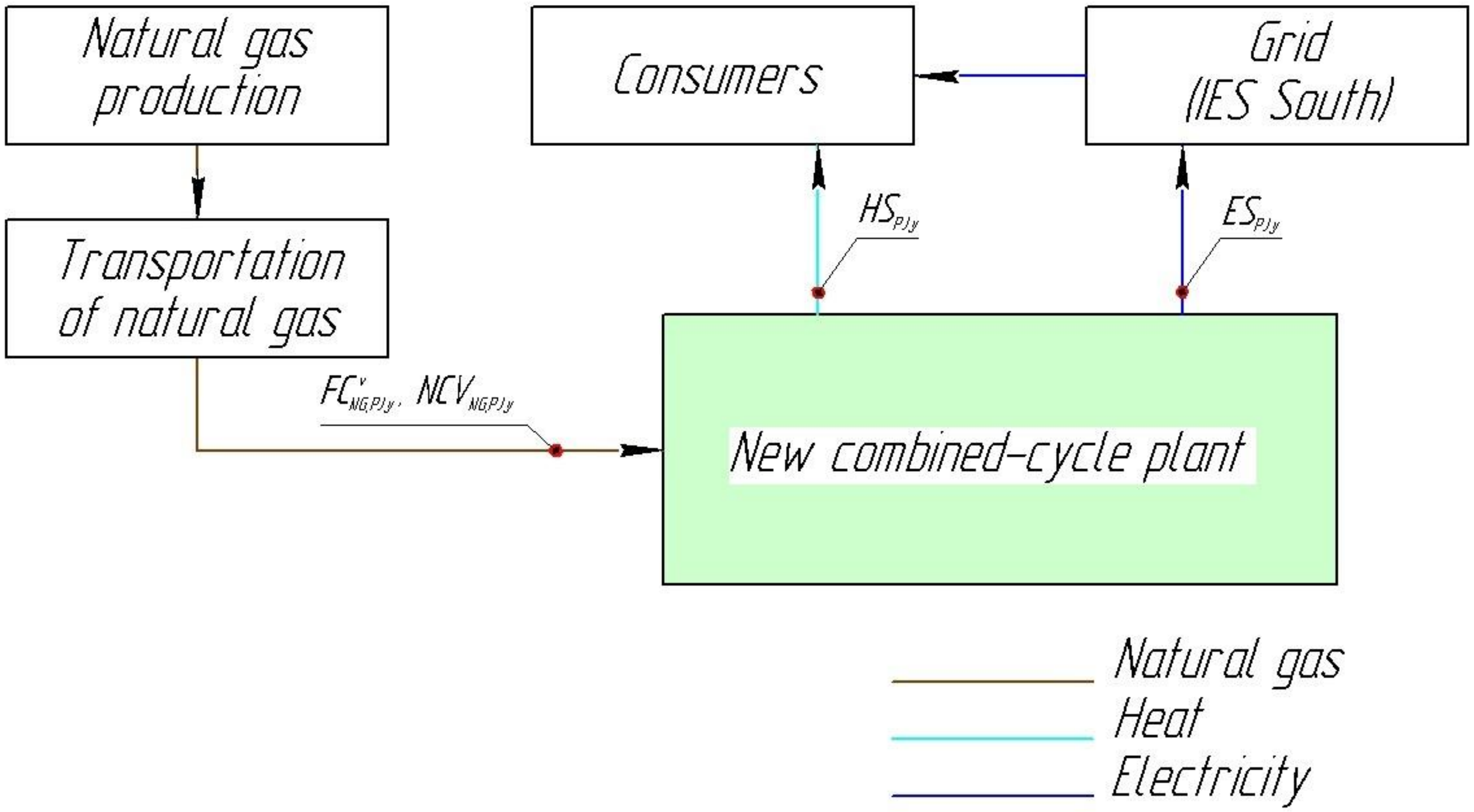

Fig. D.3-1. Location of monitoring points

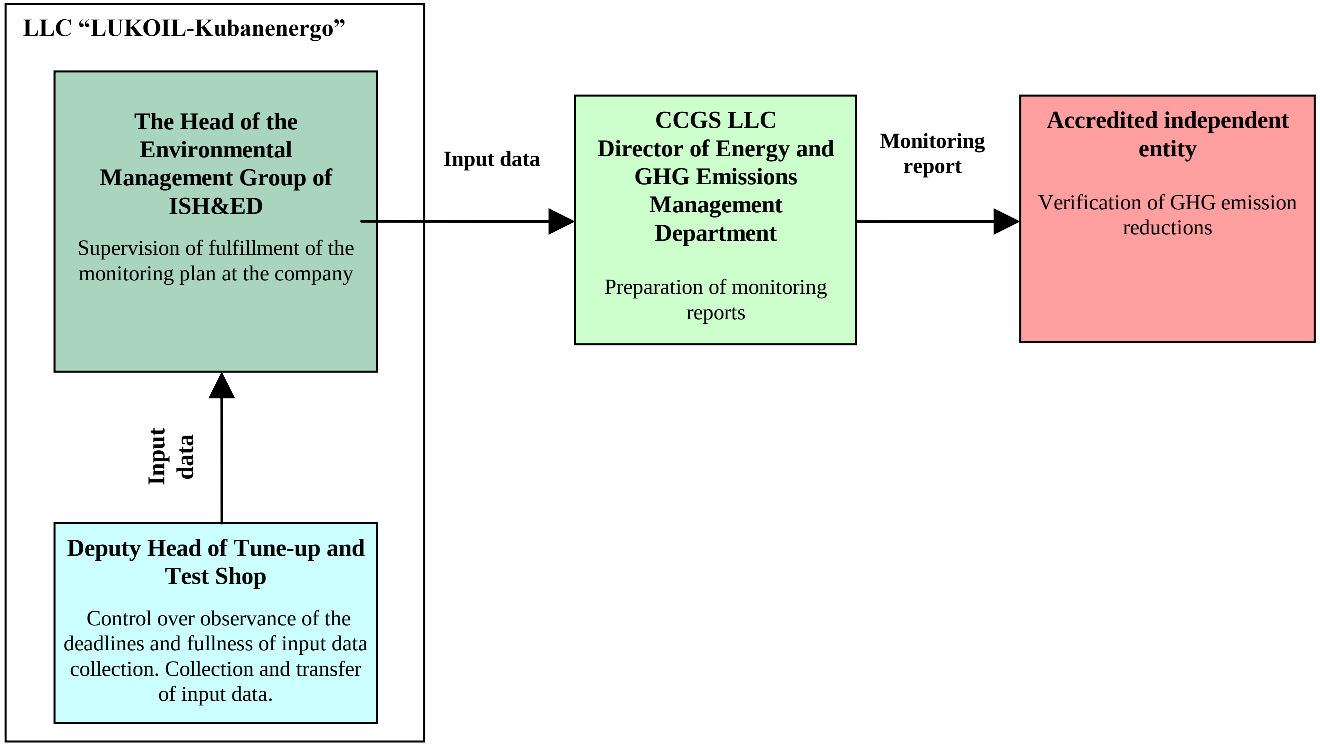

Fig. D.3-2. Monitoring information collection and transfer structure

Table D.3-1. Monitoring procedure

Monitored parameter	Procedures for registration, monitoring, accounting/record and storage of data (including everyday monitoring)	Person responsible for monitoring
Heat supply from the CCP	1. Sensors and transmitters that continuously measure flow, temperature and pressure of heat medium are used for monitoring of heat supply. 2. Readings of the measuring devices are recorded in the automatic control system and are displayed on all computers which have relevant software. Data are printed on paper and are stored in the computer memory. 3. Data are recorded by the operators on a daily basis in daily records and logs and are then summarized in monthly and annual reports. 4. Heat supply data shall be archived at the CHPP electronically and in hard copy and shall be kept for at least 2 years after the end of the crediting period or the last issue of ERUs.	Deputy Head of Tune-up and Test Shop
Electricity supply from the CCP	1. The amount of electricity supplied from the CCP is measured continuously by electric meters. 2. Readings of the measuring devices are recorded in the automatic control system and are displayed on all computers which have relevant software. Data are printed on paper and are stored in the computer memory. 3. Data are recorded by the operators on a daily basis in daily records and logs and are then summarized in monthly and annual reports. 4. Electricity supply data shall be archived at the CHPP electronically and in hard copy and shall be kept for at least 2 years after the end of the crediting period or the last issue of ERUs.	Deputy Head of Tune-up and Test Shop
Volumetric flow of natural gas to the CCP	1. Sensors and transmitters that continuously measure flow, temperature and pressure are used for monitoring of natural gas consumption volume. 2. Readings of the measuring devices are recorded in the automatic control system and are displayed on all computers which have relevant software. Data are printed on paper and are stored in the computer memory. 3. Data are recorded by the operators on a daily basis in daily records and logs and are then summarized in monthly and annual reports. 4. Natural gas consumption data shall be archived at the CHPP electronically and in hard copy and shall	Deputy Head of Tune-up and Test Shop

	be kept for at least 2 years after the end of the crediting period or the last issue of ERUs.	
Average net calorific value of natural gas	1. Natural gas calorific value is determined by certified laboratories of fuel suppliers, the fuel certificates are submitted to the CHPP by gas suppliers twice per month. Besides, a cross-check is made with the help of a calorimeter installed at the CHPP. The calorimeter calculates calorific value of natural gas on a real-time basis by measuring its componential composition. 2. Calorific value data are recorded in logs and are entered into the electronic data base. In the end of each year an average calorific value is calculated. 3. Calorific value data shall be archived at the CHPP electronically and in hard copy and shall be kept for at least 2 years after the end of the crediting period or the last issue of ERUs.	Deputy Head of Tune-up and Test Shop

The monitoring system complies with the requirements of the international standard for the integrated quality and environmental management system ISO 9001, and with the requirements of state laws and rules:

- Federal Law No.102-FZ “On measurements uniformity assurance” dated 26.06.2008;

-“Rules for electricity metering” dated September 26, 1996;

- RD 34.09.102 “Rules for heat metering” dated 31.08.1995.

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

The monitoring plan was developed by CCGS LLC (CCGSC LLC is not a project participant and is not listed in Annex 1 of this PDD).

Contact person: Dmitry Potashev

E-mail: d.potashev@ccgs.ru

SECTION E. Estimation of greenhouse gas emission reductions

Emission reductions were estimated using the formulae in accordance with the methodology described in detail in Section B.1. In the same section all necessary input data are given in a tabular form. Below are the results of the emissions estimation for both scenarios with a breakdown by sources over 2011-2012.

E.1. Estimated project emissions:

Table E.1-1. Project emissions, tCO_2e

Parameter	2011	2012	2008-2012
GHG emissions from the CCP	**405 868**	**1 217 604**	**1 623 472**

E.2. Estimated leakage:

Leakages are considered to be zero.

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

Since there are no leakages: E.1 + E.2 = E.1.

E.4. Estimated baseline emissions:

Table E.4-1. Baseline emissions, tCO_2e

Parameter	2011	2012	2008-2012
GHG emissions, total	**782 612**	**2 347 836**	**3 130 448**
CO_2 from grid electricity	721 715	2 165 145	2 886 860
CO_2 from combustion of natural gas by boiler houses	60 897	182 691	243 588

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

Table E.5-1. GHG emission reductions, tCO_2e

Parameter	2011	2012	2008-2012
GHG emission reductions	**376 744**	**1 130 232**	**1 506 976**

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

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)
2011	405 868	0	782 612	376 744
2012	1 217 604	0	2 347 836	1 130 232
Total (tonnes of CO_2e)	**1 623 472**	**0**	**3 130 448**	**1 506 976**

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:

Enhancement of efficiency and increase in the amount of heat and electricity generated due to construction of the CCP at Krasnodar CHPP leads to substitution of the respective amount of electricity generated at less efficient power generating capacities (thermal power plants) of the Integrated Energy System of the South (IES South), and also makes it possible to discontinue less efficient heat production by boiler houses. On the regional level all of this causes reduction in pollutant and greenhouse gas emissions.

The environmental impact of the CCP was assessed in accordance with the requirements of the Russian legislation and is laid out in the design documentation [R9].

Impact upon surface waters

Increase in the water volume in the cooling system of Krasnodar CHPP will not cause visible changes in hydrochemical composition of the water in the water reservoir. All noticeable fluctuations in concentration of ingredients will be due to natural factors (the latter stands true if all the other economic activities at the catchment basin and water area will not change).

The expansion of Krasnodar CHPP with installation of CCP-410 does not affect the plant’s process water supply scheme which remains a direct-flow and recycling system with the water reservoir “Staraya Kuban” being used for cooling purposes.

The total consumption of cooling water with the existing section of the CHPP and auxiliary facilities will amount to 130 000 m^3/h (36.11 m^3/s) in summer, and to 120 000 m^3/h (33.3 m^3/s) in winter and is ensured by the existing facilities.

Water intake from the Kuban River for the project will not exceed the level of 480 000.0 thousand m^3/year agreed in the Water Use Agreement dated 30.08.2010 No.23-06.02.00.014-R-DZVO-S-2010-00864/00.

Thus, the planned economic operations do not affect the reserves and quality of surface waters.

Impact upon atmospheric air

As a result of the project activity the gross emission of pollutants from Krasnodar CHPP will increase by 1564.568 t/year and will amount to 9990.908 t/year. Compared with the situation before the project implementation (8426.34 t/year), this represents an increase in emissions of 16%.

It should be noted that the rate of pollutant emissions from the CCP complies with the up-to-date environmental standards accepted in EU countries. Specific emissions from CCP-410 (per unit of capacity) will be several times lower than those from the existing equipment of the CHPP.

The emission dispersion modeling shows that after commissioning of CCP-410 the impact of the CHPP at the boundary of the sanitary protection zone and of the nearest residential development shall hardly change at all.

Environment monitoring

Environment (air and water) monitoring will continue to be carried out by the company in accordance with the schedule approved by the deputy director general – chief power engineer and agreed with the supervisory authorities.

Environmental consequences of the project implementation

The most significant environmental effect of the project implementation is the improvement of the environment in Krasnodar due to reduction in pollutant emissions (compared with the baseline scenario).

Although the pollutant emissions from the CHPP itself will somewhat increase, the overall emissions in Krasnodar should decrease because in the absence of the project other less efficient sources of heat (boiler houses) would have been more intensely operated.

No less important is the reduction in fossil fuel consumption and the corresponding reduction in greenhouse gas emissions to the atmosphere, which will contribute to the fulfillment by the Russian Federation of its commitments to enhance energy efficiency and cut greenhouse gas (CO_2) emissions. GHG emission reductions due to the project are estimated at around 1130 thousand tCO_2e per year.

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:

The project meets the environmental requirements set by the Russian law and does not have any significant impact upon the environment. The design documentation for “Expansion of Krasnodar CHPP with installation of CCP-410” project complies with the requirements of the regulatory technical documents which is confirmed by positive reviews of the state expert committee:

- Opinion on the project “Expansion of Krasnodar CHPP with installation of CCP-410”. The Main Department of the State Expert Committee FSI “GLAVGOSEKSPERTIZA ROSSIYI”, No.00-1-4-3331-09 dated 26.08.2009.

Besides, on the regional level the project leads to reduction in pollutant emissions, fossil fuel consumption and greenhouse gas emissions.

SECTION G. Stakeholders' comments

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

The public hearings were sanctioned by the resolution of Krasnodar Municipal Administration No.2873 dated 17.08.2009 "On sanctioning of public hearings in Krasnodar Municipality". Format: meeting of the commission for public hearings regarding assessment of the impact of the proposed expansion of Krasnodar CHPP through installation of CCP-410 on the environment and residents of Krasnodar. The number of comments made in oral and written form – 5. Based on the comments additional environmental research was undertaken and later on reviewed and approved by Glavgosexpertiza of the Russian Federation.

The list of commentators, comments and suggestions, as well as corrective actions are presented in Annex 5.

The project measures were widely covered by the mass media, including "Krasnodarskyie Izvestiya" (regional newspaper, Krasnodar), issue dated 20.05.09, "Volnaya Kuban'" (regional newspaper, Krasnodar), issue dated 21.05.09, and "Kubanskyie Novosti" (municipal newspaper, Krasnodar), issue dated 20.05.09. Only positive feedback was received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	
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Annex 2

BASELINE INFORMATION

Efficiency of new gas boilers	-	0,92
CO2 emission factor for grid electricity	kg CO_2/MWh	674,5
CO2 emission factor for natural gas	kg CO2/GJ	56,1

	Parameter	Unit	Value in		
			2011	2012	2011-2012
	Project scenario				
1	Electricity supply from the CCP	MWh	1 070 000	3 210 000	**4 280 000**
2	Heat supply from the CCP	GJ	998 669	2 996 008	**3 994 677**
3	Per unit consumption of equivalent fuel for electricity supply from the CCP	kg e.f./MWh	203,67	203,67	**203,67**
4	Per unit consumption of equivalent fuel for heat supply from the CCP	kg e.f./GJ	28,94	28,94	**28,94**
5	Natural gas consumption in the CCP, including:	GJ	7 234 724	21 704 172	**28 938 896**
	for electricity supply	GJ	6 387 587	19 162 761	**25 550 348**
	for heat supply	GJ	847 137	2 541 411	**3 388 549**
6	Project emissions of CO2, total	tCO_2	405 868	1 217 604	**1 623 472**
	Baseline scenario				
7	Electricity supply to the grid by power plants of the IES South	MWh	1 070 000	3 210 000	**4 280 000**
8	Heat supply by gas boiler houses	GJ	998 669	2 996 008	**3 994 677**
9	Natural gas consumption by boiler houses	GJ	1 085 510	3 256 530	**4 342 040**
10	Baseline emissions of CO2, total	tCO_2	782 612	2 347 836	**3 130 448**
	CO2 from grid electricity	tCO_2	721 715	2 165 145	**2 886 860**
	CO2 from natural gas combustion by boiler houses	tCO_2	60 897	182 691	**243 588**
	Emission reduction				
11	Emission reduction, total	tCO_2	**376 744**	**1 130 232**	**1 506 976**

Annex 3

MONITORING PLAN

See Section D

Annex 4

Calculation of emission factor for the IES South

See calculation in Excel file “EFgrid of the IES South”.

Annex 5

COMMENTS AND SUGGESTIONS MADE DURING THE PUBLIC HEARINGS

#	Comments and suggestions	Made by	Corrective actions or reasons for dismissing the comments
1.	Atmospheric pollution estimation was made using the programme which does not allow for housing development within the impact zone. Therefore the maximum permissible concentrations are too low, and at the same time estimated values for individual pollutants is 0.8.	Non-profit-making organization “Krasnodar Regional Department of the International Academy of Ecology, Human and Nature Safety”. V.V.Litvin	Atmospheric pollution estimation was made with allowance for housing development. Positive opinion was issued by Glavgosexpertiza of Russia. MPCs are high because of the background concentration of other pollution sources. The share of emissions from CHPP is minimum.
2.	The design does not include calculations of changes in the levels of soil and surface water pollution.	Non-profit-making organization “Krasnodar Regional Department of the International Academy of Ecology, Human and Nature Safety”. V.V.Litvin	Additional environmental research was undertaken to analyze the soil and water within the site of Krasnodar CHPP and adjacent urban area. The undertaken research was reviewed and approved by Glavgosexpertiza of Russia.
3.	Does the project documentation include a comparative analysis of CPP equipment of various manufacturers in terms of their environmental performance?	Pensioner E.A.Boiko	The conclusion based on the results of the review of “Kransodar CHPP expansion through construction of CPP-410” project by Glavgosexpertiza, contains a screening of options of CPP equipment by different manufactures.
4.	There is no estimation of the changes in the thermal conditions of “Staraya Kuban” condensation basin and its impact upon biotopes.	Non-profit-making organization “Krasnodar Regional Department of the International Academy of Ecology, Human and Nature Safety”. S.A.Levichev	Based on the feedback from Glavgosexpertiza RF the project materials have been refined and currently a possibility is considered of using cooling towers in the process water supply of Krasnodar CHPP. Materials on process water supply of CPP-410 will undergo an additional expert review by Glavgosexpertiza.
5.	The project does not envisage works to ensure industrial safety of equipment which is not subject to replacement or modernization and which will operate in a more intense mode. For example this refers to gas delivery pipeline. The project design only specifies when its schedule inspection will start – March 2010.	Non-profit-making organization “Krasnodar Regional Department of the International Academy of Ecology, Human and Nature Safety”. S.A.Levichev	A new gas pipeline will be built for CPP-410 at Krasnodar CHPP (d=500мм). New gas processing equipment will be installed. Reconstruction of Krasnodar CHPP will be carried out with allowance for the findings of the already undertaken survey of buildings and structures used by the plant.

Annex 6

LIST OF REFERENCES

[R1] Guidance on criteria for baseline setting and monitoring, Version 02, The Joint Implementation Supervisory Committee

(http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf)

[R2] Projected balance of electric power sector development for the period 2009-2015 and for 2020. Energy Forecasting Agency. Moscow, 2009.

[R3] 2006 IPCC Guidelines on National Greenhouse Gas Inventories. Volume 2, Energy. (http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.htm)

[R4] Methodological tool to determine the baseline efficiency of thermal or electric energy generation systems". Version 01. CDM Executive Board

(http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf)

[R5] Works implementation schedule for the project "Expansion of Krasnodar CHPP with installation of CCP-410MW"

[R6] Report "Inventory of GHG emissions for the years 1990-2005 from OJSC "SGC TGC-8". Energy Carbon Fund. Moscow 2007.

[R7] Turnkey contract for works on the project "Expansion of Krasnodar CHPP with installation of CCP-410", No.163-08 dated 28 April 2008.

[R8] Design documentation. "Expansion of Krasnodar CHPP with installation of CCP-410". Section 1. Executive Summary. Volume 1. Novosibirsk 2009.

[R9] Design documentation. "Expansion of Krasnodar CHPP with installation of CCP-410". Section 8. List of environment protection measures. Volume 1. Novosibirsk 2009.

[R10] Positive review of the project "Expansion of Krasnodar CHPP with installation of CCP-410". Main Department of the State Expert Committee of FSI "GLAVGOSEXPERTIZA ROSSIYI" No.00-1-4-3331-09 dated 26.08.2009.