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

**CONTENTS**



**Annexes**

## SECTION A. General description of the project

### A.1. Title of the project:

Technical re-equipment of Chelyabinsk CHPP-3 with putting into operation of a combined-cycle gas plant
Sectoral Scope: (1) Energy industries (renewable/non-renewable sources)[1]
Version: 7
Date: 25/11/2010.

### A.2. Description of the project:

**Situation existing prior to the starting date of the project**

The Chelyabinsk Combined Heat and Power Plant-3 (Chelyabinsk CHPP-3) put into operations April 01, 1996. CHPP-3 is located in the eastern part of Chelyabinsk city. Equipment: 2 unit PSU and 3 peak hot-water boiler. 100% of the fuel balance of the plant is natural gas. Installed power: Electric power of the plant - 360 MW, thermal power of the plant - 1092 Gcal/h.

**Project scenario**

The purpose of the project is to increase the reliability and quality of the heat and electricity supply of the residential and industrial sectors of Chelyabinsk using modern technology. This will also result in lesser green house gas emissions and environmental pollution.

The project provides extension of Chelyabinsk CHPP-3 with combined-cycle gas unit №3. Application of combined-cycle gas technology at power-generating unit №3 of Chelyabinsk TPP-3 as part of CCGP (combined-cycle gas plant)-220 is stipulated for by the following conditions:

1. The quality parameters of the supplied electrical and heat energy meet the requirements of the consumers.
2. The combined-cycle gas technology of generation of electrical and heat energy meets the requirements of the Technical Policy Concept in Power Engineering and the modern technological expansion level.

According to the project statement for Chelyabinsk TPP-3, provision is made for installation of a CCGP (combined-cycle gas plant)-220 MW.

CCGP 220 unit consists of:

- Gas turbine GTE-160 of JSC «Silovie mashiny» «LMZ»;
- Steam turbine T-50/70-6.8/0.12 of JSC «KTZ» Kaluga;
- Steam boiler P-134 of JSC «Engineering Company ZIOMAR».

The estimate cost of the construction according to the project in the predicted prices amounts to 9 036 mln. Rbl., VAT included.

The contribution of the project activity towards development of Chelyabinsk is discussed hereunder:

- Ensure the adequacy of the heat capacity and the increase of heat loads for the period up to 2015;
- Increased efficiency of electricity generation;

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

- Increased reliability of power supply in and around Chelyabinsk;
- The project leads to generation of employment.

Greenhouse gas emissions will be reduced due to the displacement of electricity from the grid produced by fossil fuel power plants by the electricity generated by Chelyabinsk CHPP-3 that will produce electricity with lower carbon intensity in comparison with electricity from the grid. The heat produced at the new unit in the form of hot water will be supplied by means of far district heating system in the heating networks of city Chelyabinsk. The additional amount of heat will allow refusing the construction of new boilers and extension of existing heat supply sources in city Chelyabinsk, which have no sufficient heat reserve.

**Baseline scenario**

The baseline scenario is based on the assumption that if the project is not implemented (i.e. additional electricity will not be supplied to the grid) third parties will cover the energy demand. The design amount of heat will be supplied by means of new heat supply sources determined on the basis of investment programs of heat supply companies of city Chelyabinsk. A description of the baseline scenario and confirmation thereof is presented in Section B.

**Brief history of the Project**

"UES of Russia" (Unified Energy System of the Russian Federation) RJSC has started to get prepared for implementing the mechanisms of Kyoto Protocol long before its ratification in Russia. "UES of Russia" RJSC has made every effort to cooperate with the UNFCCC (United Nations Framework Convention on Climate Change). For those purposes, the Energy Carbon Fund was established in 2001[2].

In 2007, the Energy Carbon Fund estimated whether it is possible to implement the project “Technical re-equipment of Chelyabinsk TPP-3 with putting into operation of a combined-cycle gas plant”[3].

On 24th August 2006 the Investment Commission of RAO “UES of Russia” approved the plan-timetable of realizing the investment project on construction of CCGT at Chelyabinsk CHPP-3[4]

On March 12, 2008 the Shareholders Agreement to realize the investment program was signed between RAO “UES of Russia”, OAO “SO UES” and Fortum Russia BV.

On March 20, 2008 the CJSC “Intertekhelektro” was chosen as the general subcontractor of constructing the power unit CCGT-220 at Chelyabinsk CHPP-3[5].

On September 25, 2008 Fortum, the Russian Territorial Generating Company No. 10 (TGC-10) and ECF Project Ltd. (subsidiary of Energy Carbon Fund) had signed an agreement according to which Fortum would purchase approximately 1.5 million tones of emission reduction units (ERU) from TGC-10.

The purchase agreement is based on the Memorandum of Understanding between Fortum and United Energy Systems of Russia (RAO UES) in 2006, and it is the biggest of its kind ever made in Russia. The ERUs purchased cover approximately half of Fortum’s annual $CO_2$ emissions and their value is approximately EUR 70 million based on the current market value of Certified Emission Units in developing countries.

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[2] http://www.carbonfund.ru/about/general_information
[3] Letter from the Director of Energy Carbon Fund Gorkov A.V. No. AG-36 dated 23.01.2007
[4] Protocol No12 of meeting of Investment Commission of RAO “UES of Russia” on 04.07.2006
[5] EPC Contract between TGK-10 and CISC “Intertekhelektro” No.2323 dated March 20, 2008

The ERUs will come from Joint Implementation projects conducted at TGC-10's production facilities during the Kyoto Period (2008-2012) of the European Emissions Trading Scheme. Fortum can use the received ERUs to cover part of its own emissions once these projects are completed and their emission reduction has been verified.

In 2006, "UES of Russia" RJSC developed "The Master Plan for placing power plants up to 2020". This Master Plan is virtually a consolidated investment that was prepared based on the plans developed by those plants themselves and was later approved by the Government of the Russian Federation (the Government of the Russian Federation Executive Order No. 215-r of February 22, 2008). JSC "TGC-10" (TGK stands for Territorial Generating Company) was founded in March 2005 as part of Russia's power industry reform. JSCs "Tyumenenergo", "Chelyabenergo" and "Kurganenergo" acted as founders of TGC-10. On October 1, 2005 the company started its operating activity. On December 2006 TGC-10 completed the merging of its assets and establishment of an integrated operating company, which is a legal successor in rights and obligations of the merged legal entities. In connection with closing down "UES of Russia" RJSC, the company inherited the investment plans of "UES of Russia" RJSC. However, it is not obliged to implement them. On March 2008 Finnish company Fortum became a strategic investor in TGK -10, acquiring 76.5% stakes through an auction conducted by RAO "UES of Russia" and the additional issue of shares. As a result of mandatory offer made by the minority shareholders under the requirements of Russian legislation, the share of Fortum in TGC-10 reached about 95% (including shares of 100% subsidiary TGC-10).

Even though the project is part of "The Master Plan for placing power plants up to 2020", JSC "Fortum" has no obligations to the state to implement it. The Master Plan does not provide a list of companies, the facilities of which are its part. Therefore, in case the schedule to put new power facilities in operation is not followed to, the state cannot impose penalties on any of such companies. It is also confirmed by the fact that actual deadlines and volumes for putting new power plants in operation considerably differs from those in the Master Plan.

**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) |
|---|---|---|
| Russian Federation (Host Party) | • Open Joint-Stock Company "Fortum" (OJSC "Fortum"); Production Branch of « Chelyabinsk TPP-3»<br>• ECF Project Ltd. | No<br><br>No |
| Finland | • Fortum Power and Heat Oy | No |

***Open Joint-Stock Company "Fortum" (OJSC "Fortum")***

Open Joint-Stock Company "Fortum" is a private electrical energy and heat generating company. Its strategic investor is the Finnish Electrical Energy Concern "Fortum", the share of which in the company capital amounts to approximately 93.4%. The enterprise is established based on the former OJSC «TGK-10», split-off from the Russian Joint-Stock Company "Unified Energy System of Russia" in 2008. The new name – "Fortum" – was assigned to the company in April 2009, resulting from the official renaming, a decision on which was made by the shareholders of the company.

The main type of activity of OJSC «Fortum» is generation and sale of heat and electrical energy. The installed capacity of "Fortum" in terms of electrical energy exceeds 2 785 MW, in terms of heat energy amounts to 10 014 Gcal/hour[6].

"Fortum" enterprises are situated in the Urals and in the Western Siberia. The company structure includes eight thermal power plants: 5 of them are situated in Chelyabinsk, 3 – in Tyumen Regions. Electrical energy generated by "Fortum" stations, is supplied to the wholesale market (WMEC[7]). Heat energy is sold in the local thermal markets in the cities of presence of OJSC «Fortum» and its subsidiary – Ural heat network company, specializing on heat supply of various groups of consumers. The company strategy is aimed at development of generation capacities and implementation of an extensive investment program, introduction of the state-of-the-art energy saving and environmentally compatible technologies.

## A.4. Technical description of the project:

### A.4.1. Location of the project:

Chelyabinsk TPP-3 is situated on the north-eastern outskirts of the City of Chelyabinsk.

Legal address of the enterprise: 454077, Russia, City of Chelyabinsk, Brodokalmaksky Tract, h.6.

References of TPP -3 location: $55^0$13'48'' of the northern latitude; $61^0$29'26'' of the eastern longitude.


**Fig. A.4.1.1. Project location**

#### A.4.1.1. Host Party(ies):

Russian Federation

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

Chelyabinsk Region

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

City of Chelyabinsk

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

[6] http://www.fortum.ru/production/
[7] WMEC – wholesale market for energy and capacities

Chelyabinsk TPP-3 is situated on the territory of the City of Chelyabinsk, the administrative center of Chelyabinsk Region. The Region is included to the structure of Ural Federal District, in the north it borders on Sverdlovsk Region, in the east – on Kurgan Region, in the south – on Orenburg Region, in the west – on Bashkiria, in the south-east – on Kazakhstan.

Chelyabinsk Region is the southern part of Ural. The Region mainly takes up the eastern slope of the South Ural and the parts of Trans-Ural Plain and the Western Siberian Lowland, which are adjacent to it. And it's only a small part of the territory in the north-west that gets as far as the western slopes of the South Ural.

Chelyabinsk is located on the eastern slope of the Ural Mountains, at the distance of 201 km to the south of Yekaterinburg. The city is situated on the Miass River, the city territory is washed by Shershnevskoye water storage reservoir and three lakes: Smolino, Sineglazovo, Pervoye. According to the information as of 2007, the municipal population amounted to 1 147 thousand people.

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

It is planned to use at the third unit of TPP-3 (CCGP-220) the combined-cycle gas technology, which is currently the most progressive in power engineering. Application of the combined-cycle gas technology at power-generating unit №3 of Chelyabinsk TPP-3 in the structure of CCGP-220 is substantiated by the following reasons:

1. For realization of the project, there are two independent gas supply sources;
2. The future quality parameters of the supplied electrical and heat energy meet the requirements of the consumers;
3. There is sufficient and sound experience of application of combined-cycle gas plants both in Russia and abroad;
4. The combined-cycle gas technology of production of electrical and heat energy meets the requirements of the Engineering Policy Concept of Russia and the modern technological expansion level;
5. A possibility of supply of electrical capacity to an energy deficient area of Chelyabinsk power system.
6. A possibility of supply of heat capacity, taking into consideration the growing needs of the City of Chelyabinsk for heat energy;

A combination of steam-turbine and gas-turbine plants, united by the common technological cycle, will allow reducing heat losses with exhaust gases of the gas-turbine plant (GTP) and generating an additional quantity of energy at the steam-turbine plant (STP).

According to the project statement for Chelyabinsk TPP-3, provision is made for installation of a CCGP (combined-cycle gas plant)-220.

CCGP 220 unit consists of:

- Gas turbine GTE-160 of JSC «Silovie mashiny» «LMZ»;
- Steam turbine T-50/70-6.8/0.12 of JSC «KTZ» Kaluga;
- Steam boiler P-134 of JSC «Engineering Company ZIOMAR».

The plant operation mode is basic, continuous, according to the diagram of the heat and electrical load with predominant loading of the power-generating unit during the non-heating period.

Application of combined burners, where diffusion combustion and premixing modes are united, makes it possible to considerably reduce hazardous emissions of nitrogen oxides and carbonic oxides and during operation on gaseous fuel, to refuse from using a water or steam injection. For unit №3 of Chelyabinsk CHPP-3, natural gas has been accepted as the main and backup fuel. The gas pressure behind the gas-distributing station (GDS) amounts to 1.2 MPa. Emergency fuel is not provided since gas is supplied from two independent sources.

The main technical characteristics of CCGP are presented in the below table[8]:

Gas turbine GTE-160

Produced by JSC «Silovie mashiny» «LMZ».

The gas turbine unit of high capacity with single shaft, cold drive and annular combustion chamber runs on gas fuel.

**Table A.4.2.1 Technical characteristics GTE-160**

| Name, unit of measurement | Characteristics |
|---|---|
| Nominal capacitance, MW | 155.3 |
| Efficiency output of gas-turbine units at generator terminals, % | 34.12 |
| Emissions, ppm | |
| - $NO_x$ | 50 |
| Life before decommissioning, h | 100 000 |

Steam boiler P-134

Produced by JSC «Engineering Company ZIOMAR».

Power generating steam boiler is intended for operation as a part of combined cycle plant with gas turbine GTE-160 produced by JSC «Silovie mashiny» «LMZ». The boiler with natural circulation, single-drum, gas-proof for operating under pressurization.

**Table A.4.2.2 Technical characteristics of Steam boiler P-134**

| Name, unit of measurement | Characteristics |
|---|---|
| The gas temperature at boiler inlet, 0C | 540.6 |
| Low pressure circuit: | |
| - pressure, MPa | 0.59 |
| - temperature, $^0C$ | 217 |
| -steam generating capacity, t/h | 43.3 |
| High pressure circuit: | |
| - pressure, MPa | 7.75 |
| - temperature, $^0C$ | 504 |
| -steam generating capacity, t/h | 226 |

Steam-turbine T-50/70-6.8/0.12

Produced by JSC «KTZ» Kaluga

Steam-turbine district heating plant T-50/70-6.8/0.12 is intended for operation as a part of steam gas power generating unit CCGT-220. The turbine represents tandem twin-cylinder unit consisted of single-flow cylinder with high pressure and double-flow cylinder with low pressure.

**Table A.4.2.3 Technical characteristics of steam - turbine T-50/70-6.8/0.12**

| Name, unit of measurement | Characteristics |
|---|---|
| Nominal capacitance, MW | |
| - in heat-extracting mode | 49.4 |

[8] Information of the Feasibility Study.

| | |
|---|---|
| - in condensation mode | 70.0 |
| Temperature of cooling water, $^0$C | 12 |

Technical indexes of the CCGT are represented in the Table A.4.2.4.

**Table A. 4.2.4 The main technical and economic performance of the project**

| № | Characteristic | Unit of measurement | Value |
|---|---|---|---|
| 1 | Installed average annual electrical capacity in the heat-extraction mode | MW | 220 |
| 2 | Installed heat capacity | GCal/hour | 146 |
| 3 | Electrical energy consumption for the balance-of-plant needs | % | 3.6 |
| 4 | Annual electrical energy output | mln. KW/hour | 1711.50 |
| 5 | Annual heat supply | thous.GCal/year | 625 |
| 6 | Annual consumption of fuel equivalent, | thousand t.c.e. | 464.3 |
| 7 | Specific oil equivalent consumption: | | |
| 8 | - for supplied electrical energy | g/KW*hour | 234 |
| 9 | - for supplied heat energy | kg/ GCal | 147.0 |

**Implementation schedule**

The project implementation schedule by the main positions is presented in the below table.

**Table A. 4.2.5 Implementation schedule[9]**

| № | List of inspection points | Month, year | Document proving achievement of the inspection point* |
|---|---|---|---|
| 1 | Obtaining an approval of the Business Plan of the Investment Project at the investment offer stage from the Commission on Investments. | August 2006 | Minutes No. 12 of the Commission on Investment dated 04/09/2006 |
| 2 | Conclusion of an agreement for the Pre-Feasibility Report. | The Pre-Feasibility Report was developed in 2006 | |
| 3 | Obtaining an approval of the Business Plan of the Investment Project at the Pre-Feasibility Report stage from the Commission on Investments of the Russian Joint-Stock Company "Unified Energy System of Russia". | August 2006 | Minutes No. 12 of the Commission on Investment dated 04/09/2006 |
| 4 | Notice of invitation to tender for supply of the equipment with a long production period (if necessary). | Notice of invitation<br>May 2007 – turbines, generators<br>July 2007 – boiler<br>September 2007 – transformers | |
| 5 | Conclusion of an agreement for supply of the equipment with a long production period. Entering into an agreement with the general Contractor for implementation of the Investment Project on a "turn-key" basis with a structure of obligatory components. | Agreement<br>October 2007 – turbines, generators<br>October 2007 – boiler<br>December 2007 – transformers<br>December 2007 – general contract on a «turn-key» basis | |
| 6 | Beginning of the site preparation (with disassembly of the equipment, removal of communications, etc.) | January 2008 | |
| 7 | Obtaining a positive conclusion for the Feasibility Study from the State Expert Assessment Department. | February 2008 | |

9 Source: OJSC "Fortum" (http://www.fortum.ru)

| № | List of inspection points | Month, year | Document proving achievement of the inspection point* |
|---|---|---|---|
| 8 | Supply of a steam turbine st. №3, a gas turbine. | March 2009 | |
| 9 | Supply of the waste heat recovery boiler. | March 2009 | |
| 10 | Supply of generators | April 2009 | |
| 11 | Supply of unit-connected transformers | April 2009 | |
| 12 | Completion of the civil and erection works | February 2010 | |
| 13 | Beginning of hook-up and start-up operations | February 2010 | |
| 14 | Completion of acceptance-handing-over tests | September 2010 | |
| 15 | Putting the object into pilot-industrial operation | November 2010 | |
| 16 | Putting the object into industrial operation | December 2010 | |

**In case if the inspection points has been already passed, a document proving the fact of reaching it shall be enclosed*

Using combined-cycle (CC) technology for electricity production is not widespread in the Russian Federation. The majority of big power plants are based on single-cycle operation. So the plant reconstruction by installing CC unit will have significantly better performance in comparison to the traditional steam-turbine technology.

**Training programme**

According to the contract with the supplier of equipment comprehensive training program is conducted for a selected number of Employer's shift engineers, operations and maintenance personnel. The training will be conducted at the Employer's site".

The training is included the following main courses: Gas Turbine Operation, Generator and Major Electrical equipment, Steam Turbine Operation, Heat Recovery Steam Generator and other.

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

The Uralian power system is deficient. In the absence of the project, the electrical energy deficiency will be covered, as it has already been mentioned above, either at the account of import from the neighbouring surplus power systems, or at the account of construction of a new power supply source with the equipment and technology, traditionally used in this economic area. Throughout Russia, the largest share of the installed capacity falls at the thermal power plants (67.3%) – a traditional technology (at CCGP+GTP 2.84%). In the future, the thermal power plants, the specific weight of which in the structure of the installed capacity of the branch will remain at the level of 60-70%, will also constitute the new power-engineering basis (Decree of RF Government dated 28 August 2003 № 1234-R. The Russian energy strategy for the period to 2020 year). Therefore, if the project is not realized, the emissions level, taking into consideration the mentioned information, will not be changed, as the technology will remain the same.

While implementing the project, constructing the combined-cycle gas unit, the result will be not only elimination of the deficient capacity, but also subsequent removal of inefficient equipment from operation. Switch to the combined-cycle gas technology will also make it possible to reduce greenhouse emissions at the account of a lower emission factor of carbon dioxide.

Hence, greenhouse gases emissions reduction will be achieved at the account of substitution of the electrical energy produced by the existing thermal power plants of the region, of the neighbouring energy systems, where the emissions level as per one unit of generated electrical energy is higher, as compared to the project, for the electrical energy generated by the new unit of Chelyabinsk CHPP-3.

In addition to electricity production, the new unit CCGT will be the additional heat source. The main customer of heat will be the housing-community facilities of city Chelyabinsk, where there is currently the deficit of thermal capacities. The construction and expansion of boilers is scheduled in the plans of heat supply system of Chelyabinsk up to 2012. The considerable part of deficit could be covered by the new unit CCGT of Chelyabinsk CHPP-3 that will allow refusing the realization of a part o marked plans on the construction of boilers. All sources of district heating system in Chelyabinsk as well as the new unit CCGT will burn the natural gas. Greenhouse gas emission reductions will also occur due to substitution of heat from district heating system by heat produced by the project.

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

| | Years |
|---|---|
| Length of the crediting period | 2 years |
| Year | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
| 2011 | 381 898 |
| 2012 | 381 898 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 763 796 |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 381 898 |

From 2013 to 2017

| Year | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
|---|---|
| 2013 | 381 898 |
| 2014 | 381 898 |
| 2015 | 381 898 |
| 2016 | 381 898 |
| 2017 | 381 898 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 1 909 490 |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 381 898 |

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

**A.5. Project approval by the Parties involved:**

The project will be approved by the Russian Federation after completion of the Russian procedure of the project registration as a JI project.

The Parties' Approval Letters will be received later.

## SECTION B. Baseline

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

**Indication and description of the approach chosen regarding baseline setting**

According to paragraph 9 of the "Guidance on criteria for the baseline setting and monitoring", version 02 (hereinafter referred to as "Guidance"), the project participants may select either:

(a) An approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or

(b) A methodology for baseline setting and monitoring approved by Executive Board of clean development mechanism (CDM).

During the preparation of PDD there was approved by Executive Board of CDM Methodology AM0048 "New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels". The Methodology AM0048 is applicable to new natural gas combined cycle power plants and could be used for development of the PDD. However the Guidance is not binding any restriction whether we must use Option (a) or (b). Take advantage of this right we use the Option (a) – JI specific approach, partially based on the following approved methodologies and methodological tools:

- AM0029[10] ("Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" (version 3)) is applicable to new natural gas combined cycle (NGCC) power plants that only produce electricity. The proposed project involves the use of some existing equipment as well as the installation of new NGCC equipment. Moreover, the proposed project would produce both electricity and heat. Thus AM0029 is not applicable for the proposed project.
- AM006111 ("Methodology for rehabilitation and/or energy efficiency improvement in existing power plants" (version 2.1)) is not applicable where new equipment is added.
- AM0062 12("Energy efficiency improvements of a power plant through retrofitting turbines" (version 1.1)) is not applicable where cogeneration is involved.
- ACM000713 ("Baseline methodology for conversion from single cycle to combined cycle power generation" (version 3)) is only applicable when the initial state was a gas turbine or internal combustion engines, and that the original equipment remains operational after project implementation. Neither is the case here. The initial state here was the use of steam turbines.
- "Combined tool for identification of baseline scenario and demonstration of additionality" (version 2.2),
- "Tool to calculate the emission factor for an electricity system" (version 2)

In the following text, we describe the methodological procedure step by step, followed by its application to the specific project.

**Application of the approach chosen**

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[10] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_15YH7UTNQ40J8MGMVX62CGNE0K49Y0
[11] http://cdm.unfccc.int/UserManagement/FileStorage/9K6GRQITX27OVG3CAS2MVDN1IWXJX1
[12] http://cdm.unfccc.int/UserManagement/FileStorage/PGZZ4XP5JIB9TSXN30YLQTRZQKO859
[13] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_5CJO927L0ASINNC90KWHKMM9X1RMVN

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

**Sub-step la: Identification and listing of plausible alternative baseline scenarios**

In the proposed project it is planned that new combined cycle gas turbine unit burning natural gas with total electricity capacity of 220 MW will be installed at Chelyabinsk CHPP-3 and commissioned in December 2010. As shown in the Section A.2 the other types of energy unit (for example, steam power unit) and other types of fuel were not considered as alternatives of the proposed project. After project implementation the new energy unit will supply electricity to the United Regional Energy System (URES) "Ural" grid.

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

Alternative scenario 1: The proposed project not developed as a JI project;

Alternative scenario 2: The electricity to be generated by project is provided by the other existing plants of URES "Ural" and URES "Mid Volga"[14]. The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP;

Alternative scenario 3: The electricity to be generated by project is provided by the other new energy units of URES "Ural" and URES "Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP.

Alternative scenario 4: The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural" and URES "Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP.

These four alternative scenarios are described below in more detail.

1) The proposed project not developed as a JI project

A combined cycle gas turbine unit with total electrical capacity of 220 MW will be constructed at Chelyabinsk CHPP-3 and commissioned in December 2010. Efficiency of new energy unit will be approximately 58%. The natural gas will be used as fuel. After project implementation electricity will be supplied by the new energy unit into grid of URES "Ural". It will replace electricity which otherwise will be generated at the other power plants of URES "Ural" and URES "Mid Volga".

2) The electricity to be generated by project is provided by the other existing plants of URES "Ural" and URES "Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP.

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[14] See. Обоснование границ проекта Приложение 2 и Раздел B.3

JSC «Fortum» does not install the new energy unit and project electricity generation would have to be covered by the other existing power plants within URES "Ural" and URES "Mid Volga" that exists in the particular year that the project is generating electricity. The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk that exists in the particular year that the project is generating heat. The existing heat power of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP is unable to cover progressive deficit of heat energy in the Chelyabinsk power system due to the fact that the capacity whether fully loaded (Chelyabinsk CHPP-3) or heating systems are not connected with the load (Chelyabinsk CHPP-1, Chelyabinsk CHPP-2 and Chelyabinsk TPP) which should cover a new block of CCGT 220.

3) The electricity to be generated by project is provided by the other new energy units of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP..

JSC «Fortum» does not install the new energy unit and project electricity generation will be covered by new energy units to be constructed by the other energy companies within URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk that exists in the particular year that the project is generating heat. The existing heat power of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP is unable to cover progressive deficit of heat energy in the Chelyabinsk power system due to the fact that the capacity whether fully loaded (Chelyabinsk CHPP-3) or heating systems are not connected with the load (Chelyabinsk CHPP-1, Chelyabinsk CHPP-2 and Chelyabinsk TPP) which should cover a new block of CCGT 220.

4) The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP.

JSC «Fortum» does not install the new energy unit and project electricity generation would have to be covered by the other existing power plants and by the new energy units to be constructed by the other energy companies within URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk that exists in the particular year that the project is generating heat. The existing heat power of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP is unable to cover progressive deficit of heat energy in the Chelyabinsk power system due to the fact that the capacity whether fully loaded (Chelyabinsk CHPP-3) or heating systems are not connected with the load (Chelyabinsk CHPP-1, Chelyabinsk CHPP-2 and Chelyabinsk TPP) which should cover a new block of CCGT 220. This alternative is a combination of alternative 2 and 3.

***Sub-step lb: Identification of the most plausible alternative scenario***

***Assessment of alternative scenario l: The proposed project is not developed as a JI project***

Projects using gas turbine technologies shall be exclusively applied during modernization and new construction at thermal power plants running on natural gas as indicated in "General Scheme of Allocation of Energy Objects up to 2020" (General Scheme further in the text) approved by the Government of the Russian Federation (Order of February 22 2008 No. 215p). The project has no technical barriers as natural gas is available, the technology as such has been implemented in many industrialized countries and electricity produced by the new energy unit can be supplied to the grid.

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

***Assessment of alternative scenario 2: The electricity to be generated by project is provided by the other existing plants of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk.***

Currently installed electricity capacity corresponds to the electricity market demand. But there are many old energy units in Russia. In accordance with CJSC "Agency of Energy Balances in the power industry" estimation approximately 10 GW of old capacities (life time expired several years ago) has to be dismantled by 2015 (3.9 GW by 2010). At the same time their forecast assumes the electricity demand growth will be 27.3 GW in 2012 in comparison with 2009[15].

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

***Assessment of alternative scenario 3: The electricity to be generated by project is provided by the other new energy units of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk.***

The installed capacity of the power plants within URES "Ural" is 42,758 GW[16] The existing power plants runtime factor of URES "Ural" varies from 0.47 to 0.75. The proper dispatching, network improvements and better energy unit operation (reduction of repair time, etc.) may result in better energy facilities performance thus increasing the net energy output of the existing plants.

Reconstruction of existing energy units can increase both the installed electrical capacity and the runtime factor. In accordance with CJSC "Agency of Energy Balances in the power industry" forecast the incremental (due to the renovation activities) installed capacity at the existing power plants will be approximately 2.3 GW by 2015[17].

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

It means that the electricity and heat to be generated by project is to be provided by the existing power plants in addition to new energy units and, therefore, this alternative scenario is not reasonable and feasible.

***Assessment of alternative scenario 4: The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk.***

As shown in the assessment of alternatives 2 and 3 the future electricity market demand would be covered by the combination of the other existing plants and the other new energy units.

Thus this alternative is reasonable and feasible.

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[15] http://www.e-apbe.ru/library/detail.php?ID=11106
[16] http://www.so-ups.ru/index.php?id=oes_ural
[17] http://www.e-apbe.ru/library/detail.php?ID=11106

**Conclusion**

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

**Step 2: Additionality demonstration**

Please see Section B.2.

**Step 3: Calculation of emissions of the baseline scenario**

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

**Project emissions**

The project activity is power and heat generation using CCGT. Old CHPP units and boilers will be used during the construction period. So combustion of natural gas (as primary fuel) in gas turbines to generate electricity and heat is main source of emissions. The $CO_2$ emissions from project activity ($PE_y$) are calculated as follows:

$$PE_y = \sum_{NG} FC_{NG,y} \cdot COEF_{NG,y} \tag{1}$$

where:

$FC_{NG,y}$: = the total volume of natural gas combusted in the project plant ($m^3$) in year(s) $y$

$COEF_{NG,y}$: = the $CO_2$ emission coefficient of natural gas in year $y$ ($tCO_2/m^3$) and obtained as:

$$COEF_y = NCV_{NG,y} \cdot EF_{CO_2,NG,y} \cdot OXID_{NG} \tag{2}$$

where:

$NCV_{NG,y}$ : = the net calorific value (energy content) per volume unit of natural gas in year $y$ ($GJ/m^3$) as determined from the fuel supplier;

$EF_{CO2,\ NG,y}$: = the weighted average $CO_2$ emission factor of natural gas in year $y$ ($tCO_2/GJ$) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

$OXID_{NG}$: = the oxidation factor of natural gas.

**Baseline emissions**

Baseline scenario includes the new boiler house construction in the city of Chelyabinsk' without construction of new electricity generating capacities.

For purposes of conservatism, it is assumed that natural gas will be the fuel for the new boiler house. For the estimation of baseline $CO_2$ emissions during the heat energy generation at the new boiler house we shall determine the efficiency factor of the new boilers. According to the Biysk boiler plant – the leading plant in terms of the steam and water heating boilers of medium and low power boilers for industrial and small-scale power generation in Russia – the water heating boilers' efficiency factor amounts to 90-93%. For the estimate of baseline emissions efficiency factor of the new Chelyabinsk boiler house accepted as maximum one in the range of similar boilers of the Biysk boiler plant – 93.3%.

The amount of energy, generated by the CCGT of Chelyabinsk CHPP-3 according to the project scenario, will be supplied from the URES "Ural" according to the baseline scenario.

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

**Emission Reductions**

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

Where:

$ER_y$ : = emission reductions in year *y* ($tCO_2e/yr$);

$BE_y$ : = baseline emissions in year *y* ($tCO_2e/yr$);

$PE_y$ : = project emissions in year *y* ($tCO_2/yr$);

$LE_y$ : = leakage emissions in year *y* ($tCO_2/yr$).

**Step 2. Application of the approach chosen**
**Not monitored data:**

| **Data/Parameter** | $\eta_{boiler}$ |
|---|---|
| Data unit | Non dimensional |
| Description | Efficiency of boilers |
| Time of determination/monitoring | Once for the commitment period |
| Source of data (to be) used | Data from supplier |
| Value of data applied (for ex ante calculations/determinations) | 93,3% |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | For purposes of conservatism, it is assumed that natural gas will be the fuel for the new boiler house. For the estimation of baseline $CO_2$ emissions during the heat energy generation at the new boiler house we shall determine the efficiency factor of the new boilers. According to the Biysk boiler plant – the leading plant in terms of the steam and water heating boilers of medium and low power boilers for industrial and small-scale power generation in Russia – the water heating boilers' efficiency factor amounts to 90-93%. For the estimate of baseline emissions efficiency factor of the new Chelyabinsk boiler house accepted as maximum one in the range of similar boilers of the Biysk boiler plant – 93.3%. |
| QA/QC procedures (to be) applied | |
| Any comment | |

| **Data/Parameter** | $OXID_f$ |
|---|---|
| Data unit | |
| Description | Oxidation factor |
| Time of | Once for the commitment period |

| | |
|---|---|
| determination/monitoring | |
| Source of data (to be) used | IPCC Guidelines |
| Value of data applied (for ex ante calculations/determinations) | 1 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines for National GHG Inventories (table 1.4) the oxidation factor equal 1 |
| QA/QC procedures (to be) applied | |
| Any comment | |

| **Data/Parameter** | $EF_{grid,\ OMsimple,\ y}$ |
|---|---|
| Data unit | $tCO_2$/MWh |
| Description | Simple operating margin $CO_2$ emission |
| Time of determination/monitoring | Determined ex-ante |
| Source of data (to be) used | Parameter is calculated according to the formula 1 of Annex 2 |
| Value of data applied (for ex ante calculations/determinations) | 0.6073 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The coefficient was designed for the period from 2010 to 2012. |
| QA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $EF_{grid,\ BM,\ y}$ |
|---|---|
| Data unit | $tCO_2$/MWh |
| Description | BM emission factor |
| Time of determination/monitoring | Determined ex-ante |
| Source of data (to be) used | Parameter is calculated according to the formula 2 of Annex 2 |
| Value of data applied (for ex ante calculations/determinations) | 0.4870 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The coefficient was designed for the period from 2010 to 2012. |
| QA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $EF_{grid,\ CM,\ y}$ |
|---|---|
| Data unit | $tCO_2$/MWh |
| Description | Combined margin emission factor |
| Time of determination/monitoring | Determined ex-ante |

| | |
|---|---|
| Source of data (to be) used | Parameter is calculated according to the formula 4 of Annex 2 |
| Value of data applied (for ex ante calculations/determinations) | 0.5772 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The coefficient was designed for the period from 2010 to 2012. |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $EG_{PJ,y}$ |
|---|---|
| Data unit | MWh |
| Description | Annual electricity supply in year *y* |
| Time of determination/monitoring | Annually |
| Source of data (to be) used | Official statistic data of project owner. |
| Value of data applied (for ex ante calculations/determinations) | 1 711 500 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Use energy meters. The consistency of metered electricity generation should be cross-checked with receipts from sales (if available) and the quantity of fuels fired. |
| QA/QC procedures (to be) applied | Cross check measurement results with invoices for sale of electricity if relevant. |
| Any comment | - |

| **Data/Parameter** | $HG_{PJ,y}$ |
|---|---|
| Data unit | Gcal |
| Description | Annual heat energy supply in year *y* |
| Time of determination/monitoring | Annually |
| Source of data (to be) used | Official statistic data of project owner. |
| Value of data applied (for ex ante calculations/determinations) | 625 000 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The consistency of metered net heat generation should be cross-checked with receipts from sales (if available) and the quantity of fuels fired. |
| QA/QC procedures (to be) applied | Cross check measurement results with invoices for sale of heat if relevant. |
| Any comment | - |

| **Data/Parameter** | $FC_{NG,y}$ |
|---|---|
| Data unit | t.c.e. |
| Description | Total quantity of natural gas consumed by the project activity plant in the year *y* |
| Time of determination/monitoring | Annually |
| Source of data (to be) used | Official statistic data of project owner. |

| | |
|---|---|
| Value of data applied (for ex ante calculations/determinations) | 464 300 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Use mass or volume meters |
| QA/QC procedures (to be) applied | In accordance with State Standard the allowed inaccuracy of gas consumption metering is ±0.3-4% (GOST R 8.618-2006). The gas flow meter is to be installed will provide necessary inaccuracy. The type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005. Calibration of the metering devices is made in accordance with the calibration schedule which approved by the Chief Engineer of Chelyabinsk CHPP-3 for one year. Supervision of calibration is performed by the Department of heat automatic and measurement. The metering devices are calibrated by an independent entity which has a state licence. The data from meters are automatically and regularly transferred to the computer system and archived. Supervision of data archiving is performed by the Department of heat automatic and measurement. |
| Any comment | |

| **Data/Parameter** | $NCV_{NG,y}$ |
|---|---|
| Data unit | GJ/mass or volume units |
| Description | Weighted average net calorific value of the of natural gas consumed by the plant in the year *y* |
| Time of determination/monitoring | Monthly |
| Source of data (to be) used | Supplier-provided data |
| Value of data applied (for ex ante calculations/determinations) | 33.46 GJ/m$^3$ |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. |
| QA/QC procedures (to be) applied | Verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Any comment | |

| **Data/Parameter** | $EF_{CO2,NG,y}$ |
|---|---|
| Data unit | $tCO_2$/TJ |
| Description | $CO_2$ emission factor of natural gas |
| Time of determination/monitoring | Yearly |
| Source of data (to be) used | Fuel supplier, measurements by the project participants, regional or national default values, IPCC default values |
| Value of data applied (for ex ante calculations/determinations) | 56.1 |

| | |
|---|---|
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Measurements should be undertaken in line with national or international fuel standards |
| QA/QC procedures (to be) applied | |
| Any comment | Time of determination depends on source |

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

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

(a) Provision of traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs;

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

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

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

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

***Sub-step 1a: Define alternatives to the project***

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

Alternative scenario 1: The proposed project not developed as a JI project;

Alternative scenario 2: The electricity to be generated by project is provided by the other existing plants of URES “Ural” and URES “ Mid Volga”. The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP;

Alternative scenario 3: The electricity to be generated by project is provided by the other new energy units of URES “Ural” and URES “ Mid Volga”. The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP;

Alternative scenario 4: The electricity to be generated by project is provided by the other existing plants and the other new energy units of URES "Ural" and URES " Mid Volga". The heat to be generated by project is provided by newly constructed boilers and by increasing the load on the existing boiler equipment heating network of the city of Chelyabinsk as well as by existing heat equipment of Chelyabinsk CHPP-1, Chelyabinsk CHPP-2, Chelyabinsk CHPP-3 and Chelyabinsk TPP.

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

***Sub-step 1b: Consistency with mandatory laws and regulations***

All the alternatives defined in sub-step 1a are in compliance with mandatory legislation and regulations.

***Step 2: Investment analysis***

The main goal of the investment analysis is to determine whether the proposed project is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of ERUs associated with the JI project.

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

***Sub-step 2a: Determine appropriate analysis method***

In principle, there are three methods applicable for an investment analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

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

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

***Sub-step 2b: Option III. Apply benchmark analysis***

The proposed project, installation of CCGT unit, shall be implemented by the project participant Open Joint-Stock Company «Fortum». The approach recommended in p. 6 (a) of Additionality Tool is applied —using "government bonds rates increased by a suitable risk premium". As Russia does not have long term governmental bonds, a conservative approach of using Central Bank RF interest rate of 10,5[18]% is proposed in the analysis including a county risk premium 3,00%[19]. Thus the overall IRR benchmark amounts to 13,50%. If the proposed project (not being implemented as JI project) has a less favorable indicator, i.e. a lower IRR, than the benchmark, then the project cannot be considered as financially attractive.

***Sub-step 2c: Calculation and comparison of financial indicators***

The financial analysis refers to the time of investment decision-making.

[18] http://www.cbr.ru/print.asp?file=/statistics/credit_statistics/refinancing_rates.htm
[19] http://pages.stern.nyu.edu/~adamodar/

The following assumptions have been used based on the information provided by the enterprise:

1. Investment decision: 04/09/2006, commissioning date: December 2010;
2. The project requires investments of approximately EUR 244 mln. (exchange rate of Central Bank of Russia 36.971 RUB/€ as of 1 July 2008);
3. The project lifetime is 25 years (lifetime of CCGT in line with contract);
4. Fuel consumption and electricity generation is taken into account in line with the technical specifications of the project design;
5. Natural gas is the biggest cost component constituting more than 80% of total operation cost.
6. The scrap value is calculated as CCGT weight (documented) multiplied by scrap price.

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

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

**Table B.2.1. Financial indicators of the project**

| Scenario | IRR (%) | Discounted PBP | Simple payback period (years)[20] |
|---|---|---|---|
| Base case | 11.03[21] | Out of project lifetime | 14 |

The cash flow analysis shows an IRR of 11.03%, which is well below the IRR benchmark identified as 13,50%. As a result a negative NPV is obtained. Hence, the project cannot be considered as financially attractive.

***Sub-step 2d: Sensitivity analysis***

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

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

**Table B.2.2. Sensitivity analysis[22]**

| Parameter | Fluctuation | | | | |
|---|---|---|---|---|---|
| | -10% | -5% | 0% | 5% | 10% |
| Investment costs | 12,28% | 11,63% | 11,03% | 10,48% | 9,97% |
| Fuel costs | 12,24% | 11,64% | 11,03% | 10,42% | 9,79% |
| Electricity price | 8,41% | 9,75% | 11,03% | 12,28% | 13,49% |

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

[21] Feasibility Study of Tyumen CHPP-1, CCGT No.2. Part 13

[22] Source: OJSC "Fortum"

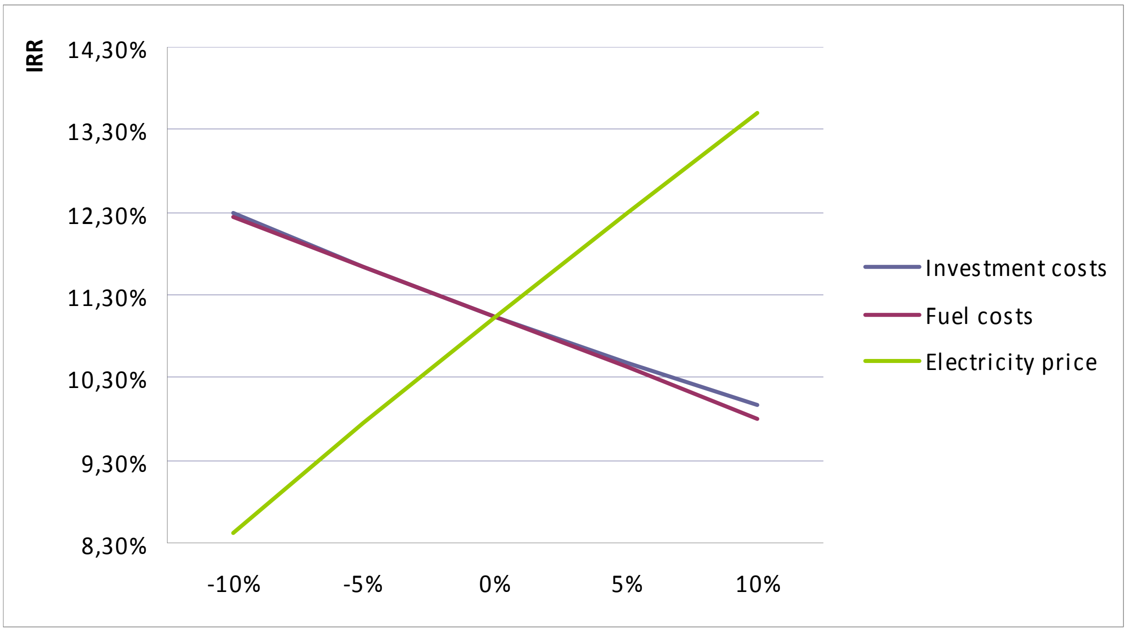


**Figure B.2.1. Sensitivity analysis**

Sensitivity analysis was applied to evaluate sensitivity of the project to changes that might occur during project implementation and operation.

Analysis of the investment cost within range -10% and +10% showed that IRR changes within 12.28%-9.97%.

Another factor that might influence project's IRR and NPV is change of fuel (natural gas) price above projected price range. Based on analysis, IRR ranges from 12.24% to 9.79% within +10% and -10% change of fuel price.

Electricity is produced by the project after its implementation, therefore changes of electricity selling price affect project's IRR the opposite way as it is in the case of investment cost change and natural gas price change. The range of IRR change (8.41% - 13.49%) indicates that project is most sensitive to change of electricity price. The results of calculation show that with an increase in electricity tariff by 10% IRR lower than the discount rate.

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

***Step 3: Barrier analysis***

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

***Step 4: Common practice analysis***

***Sub-step 4a: Analyze other activities similar to the proposed project activity:***

The project energy unit uses combined cycle (Rankine and Brayton (gas) thermodynamic cycles) for electricity generation (without heat generation). The installed capacity of this combine cycle gas turbine (CCGT) unit is 220MW.

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

GW (2007). It is approximately 1.7% of total thermal power plants installed capacity.

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

The new energy units are presented in the Table B.2.3.

**Table B.2.3: New energy units in URES « Ural »**

| Power plant/unit | Commissioning | Capacity, MW | Technology | Fuel | Cycle |
|---|---|---|---|---|---|
| Nizhne-Vartovsk TPP, No.2 | 2003 | 800 | Steam cycle | Gas | Cogeneration |
| Nizhne-Vartovsk TPP, No.1 | 1993 | 800 | Steam cycle | Gas | Cogeneration |
| Tyumen' CHPP-1 | 2003 | 190 | CC GT | Gas | Cogeneration |
| Chelyabinsk CHPP-3, No.2 | 2006 | 180 | Steam cycle | Gas | Cogeneration |
| Chelyabinsk CHPP-3, No.1 | 1996 | 180 | Steam cycle | Gas | Cogeneration |

Only one CCGT unit with comparable capacity was put into operation in last 10 years in UPS of Ural. The construction of unit CCGT-190 MW at Tyumen CHPP-1 being the second large combined cycle unit in Russia was completed in 2004. CCGT at Tyumen CHPP includes the boiler unit produces by JSC TKZ «Red boilermaker», the steam cogeneration (extraction) turbine T-130/160-12.8 of JSC «LMZ», gas turbine V64.3A of "Siemens".

The construction of combined cycle plant took place within the frameworks of program on reconstruction and engineering updating of Tyumen CHPP-1. Its main equipment operated since and depleted its life time. In the same time, the rapid growth of energy consumption connected mainly with the enterprises of fuel industry was observed in the Tyumen region. 64% of oil and 91% of gas in general Russian scale are produced just in this region. Therefore the problem of reliable securing of this energy consumption becomes the problem of Federal meaning.

This plant was constructed in the period of RAO UES existence. It was the largest energy company in Russia controlled by the State. This project had the high priority as the pilot project (EFT) directed to the demonstration of using the gas turbines manufactured in Russia. The project was realized due to the high political importance. In connection with that it couldn't be considered as the project realized in similar conditions, while it is necessary for carrying out the analysis of standard practice.

Consequently, there is not the project-analogue similar to the project under consideration; it is possible to conclude the suggested JIP doesn't concern the standard practice.

***Sub-step 4b: Discuss any similar Options that are occurring:***

The similar activities are not widely observed so this sub-step is not applicable.

**Conclusion**

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

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

**Project boundary**

The new CCGT unit combusts natural gas for electricity generation, most of which is supplied to the grid and minor part is used for internal needs (auxiliary equipment) and for heat generation which supplied to consumers through a heat distribution centre.

Project boundary embraces:

- New CCGT unit;
- Auxiliary equipment of the new CCGT unit;
- Power Plants of URES of Ural and URES of Mid Volga (See Annex 2).

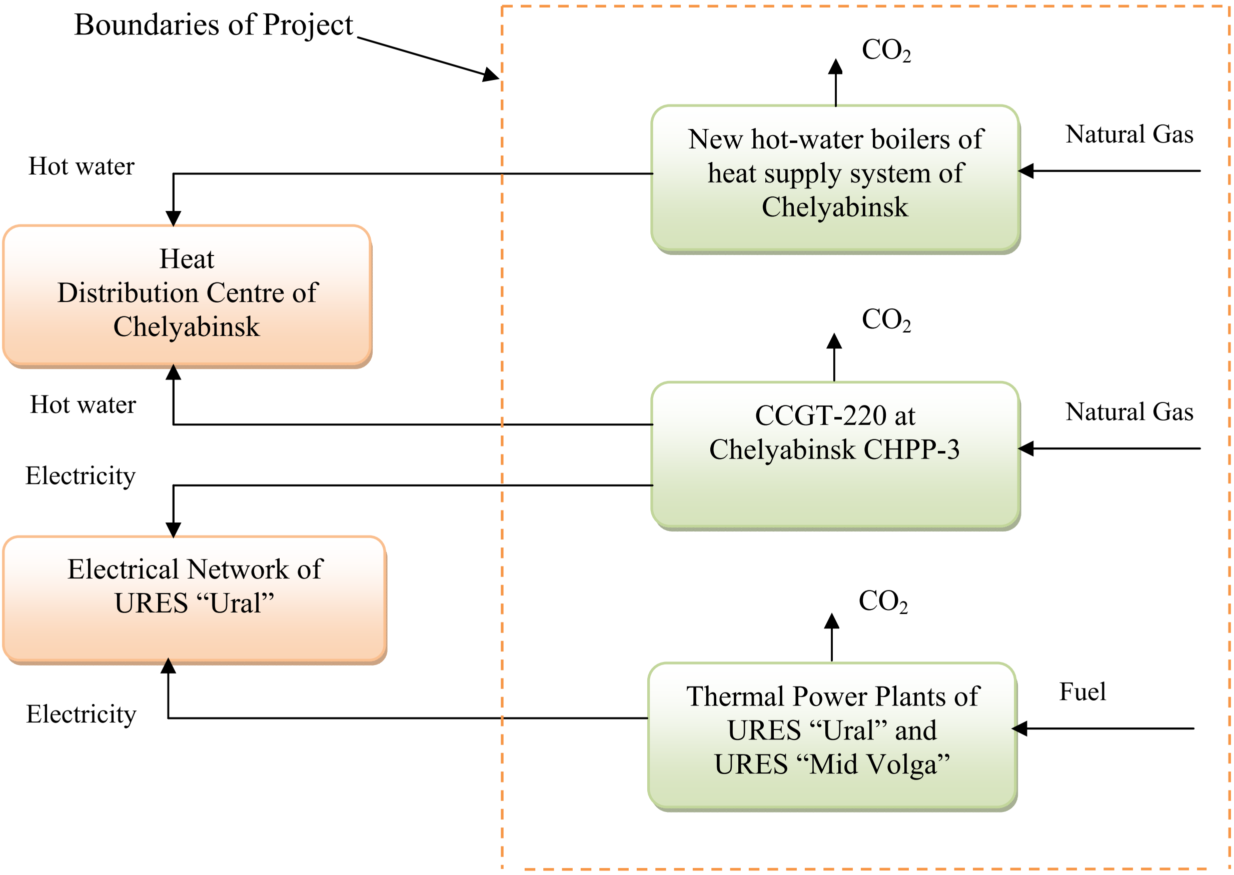


**Figure B.3.1 Project Boundary, including the project plant and all power plants in the URESs (URES of Ural and URES of Mid Volga[23]).**

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

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

| | Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Electricity generation in baseline (URES of Ural | $CO_2$ | Included | Main emission source |

[23] See Annex 2.

| | Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | and URES of Mid Volga) | $CH_4$ | Excluded | Excluding these emission from the baseline is conservative and in line with existing CDM methodologies[24] |
| | | $N_2O$ | Excluded | |
| | Heat generation in baseline | $CO_2$ | Included | Main emission source |
| | | $CH_4$ | Excluded | Excluding these emission from the baseline is conservative and in line with existing CDM methodologies |
| | | $N_2O$ | Excluded | |
| Project activity | On-site natural gas combustion | $CO_2$ | Included | Main emission source |
| | | $CH_4$ | Excluded | Exclusions is for simplification as the emission are negligible and in line with existing CDM methodologies[25] |
| | | $N_2O$ | Excluded | |

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

Date of completion of the baseline study: 28/08/2009

Name of person/entity setting the baseline:
ECF Project Ltd

ECF Project Ltd is a project participant. See Annex 1 for detailed contact information.

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

## SECTION C. Duration of the project / crediting period

### C.1. Starting date of the project:

Starting date of the project is 04/09/2006[26]

### C.2. Expected operational lifetime of the project:

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

### C.3. Length of the crediting period:

2 year (24 months, from 1 of January 2011 to 31 December 2012).

The starting date of the crediting period is 1st January 2011.

The status of emission reductions or enhancements of net removals generated by JI projects after the end of the first commitment period may be determined by any relevant agreement under the UNFCCC.

The second crediting period will be within agreement but not exceed life time of equipment at unit No.3 of Chelyabinsk CHPP-3.

[26] Minutes No. 12 of the Commission on Investment dated 04/09/2006

## SECTION D. Monitoring plan

### D.1. Description of monitoring plan chosen:

*The monitoring plan includes the measurement, maintenance, recording and calibration tasks that should be performed to fulfill the requirements of the selected monitoring methodology and guarantee traceability in emission reduction calculations. The main steps of the monitoring plan are described below.*

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

Project emissions monitoring is associated with the measurement of the natural gas volume, consumed at the Chelyabinsk CHPP-3 for steam and electricity generation and the natural gas net calorific value. Baseline emissions monitoring is associated with the heat energy and electricity supply from the plant. As data source, the reports according to the form of the Federal Statistical Observation 6-TP “Data on the heat power station operations” will be used. Such arrangement of the monitoring plan matches the practice of fuel use and energy generation at the power stations fixed in the Russian Federation.

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

- Used start-up fuel at the new CCGT unit is excluded[27];
- Project electricity is net electricity generation by the new CCGT unit defined as electricity generation minus electricity consumption for internal needs;
- Electricity and heat demand in the market is not influenced by the project (i.e. baseline net electricity generation = project net electricity generation);
- The baseline emissions of the grid are established using the combined margin emission factor as described in Annex 2;
- The combined margin emission factor is set ex-ante for the length of the crediting period;
- The new CCGT lifetime extends to 2020.

General remarks:

- Social indicators such as number of people employed, safety records, training records, etc, will be available to the Verifier upon request;
- Environmental indicators such as $NO_x$ and other will be available to the Verifier upon request; For the greenhouse gas emissions only the $CO_2$

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

emissions are taken into account. See section B.3.

**Data management system**

A person will be appointed by the project owner to take responsibility for data handling, preparing monitoring reports of greenhouse gas emission reductions and collecting the data for emission reduction verification. (See Section D.3.)

**Verification**

The verification of project emission reductions will be done annually. The project owner should be responsible for preparing documentation for verification by the Accredited Independent Entity (AIE).

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

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

| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| **P1** $PE_y$ | Project emission | Calculated under project activity | $tCO_2$ | c | Annually | 100% | Electronic | Defined according to formula 1 |
| **P2** $FC_{NG,y}$ | Annual quantity of natural gas consumed at the new CCGT unit | Fuel flow meter reading | $m^3$ | m | Continuously | 100% | Electronic | - |
| **P3** $COEF_{NG,y}$ | $CO_2$ emission coefficient | Calculated under project activity | $tCO_2/m^3$ | c | Annually | 100% | Electronic | Defined according to formula 2 |
| **P4** $NCV_{NG,y}$ | Net Calorific Value of natural gas | Fuel supplier/IPCC | $GJ/m^3$ | e | Monthly | 100% | Electronic | Fuel supplier provided data/ IPCC default |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | value can be used (that order of preference) |
| **P5** $EF_{CO2, NG, y}$ | Emission factor for natural gas | IPCC | $tCO_2/GJ$ | e | Annually | 100% | Electronic | Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006 |

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

The project activity is on-site combustion of natural gas to generate electricity and heat. The $CO_2$ emissions from electricity and heat generation ($PE_y$) are calculated as follows:

$$PE_y = FC_{NG,y} * COEF_{NG,y} \tag{4}$$

Where:

$PE_y$ Project emission in year *y* ($tCO_2$);
$FC_{NG,y}$ Is the total volume of natural gas combusted in the project plant ($m^3$) in year(s) 'y' ($m_3$)[28]
$COEF_{NG,y}$ Is the $CO_2$ emission coefficient ($tCO_2/m^3$) in year(s) for natural gas and is obtained

as:

$$COEF_{NG,y} = NCV_{NG,y} * EF_{CO2,NG,y} \tag{5}$$

Where:

---

[28] Data unit ($m^3$) means the volume of gas under standard conditions (temperature is $293^0$K Fc = 101,325 kPa).

$NCV_{NG,y}$ : Is the net calorific value per volume unit of natural gas in the year y (GJ/m3); See Data and parameters monitored in Section B.1.
$EF_{CO2,NG,y}$ : Is the weighted average $CO_2$ emission factor of natural gas in year *y* ($tCO_2$/GJ).

**D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:**

| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| **B1** $BE_y$ | Baseline emissions | Calculated under project activity | $tCO_2$ | c | Annually | 100% | Electronic | Defined according to formula 20 |
| **B2** $EG_{PJ\,y}$ | Annual electricity supply generated by CCGT | Form of Federal Statistical observation 6-TP | MWh /year | c | Annually | 100% | Electronic, Paper | Electricity supply is determined as the ratio between the amount of electricity generated and consumed for the plant internal needs |
| **B3** $EF_{CO2,\,grid,\,y}$ | Baseline emission factor | Annex 2 of PDD | $tCO_2$/MWh | c | Fixed ex ante | 100% | Electronic | Combine margin emission factor of United Regional Electricity System |
| **B4** $HG_{PJ\,y}$ | Annual heat energy supply generated by CCGT | Form of Federal Statistical observation 6-TP | Gcal/year | c | Annually | 100% | Paper | Heat supply is determined as the ratio between the amount of heat generated and consumed for the plant internal needs |

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

Total annual baseline $CO_2$ emissions (*BE*) are calculated as the aggregate of emissions due to the URESs (URES of Ural and URES of Mid Volga[29]) electricity generation and heat energy at the new Chelyabinsk city boiler house:

$$BE_y = BE_{grid\ y} + BE_{heat\ y} \quad (6)$$

where:

$BE_{grid\ y}$ is the annual baseline $CO_2$ emissions due to the URESs (URES of Ural and URES of Mid Volga) electricity generation, t $CO_2$/year;
$BE_{heat\ y}$ is the annual baseline $CO_2$ emissions due to the heat energy generation at the Chelyabinsk city new boiler house, t $CO_2$/year.

Annual baseline $CO_2$ emissions due to the URESs (URES of Ural and URES of MidVolga) electricity generation are calculated based on the project electricity generation at the Chelyabinsk CHPP-3 data:

$$BE_{grid\ y} = EG_{PJ\ y} \bullet EF_{CO2\ grid\ y} \quad (7)$$

where:

$EG_{PJ\ y}$ is the annual CCGT' of Chelyabinsk CHPP-3 electricity supply, obtained as a result of baseline monitoring (B2) ,MWh/year;
$EF_{CO2\ grid\ y}$ is the baseline emission factor during the URESs (URES of Ural and URES of Mid Volga)electricity generation, estimated during monitoring (See Annex 2), t $CO_2$/MWh.

Annual baseline $CO_2$ emissions due to the Chelyabinsk city new boiler house heat energy generation are calculated based on the project Chelyabinsk CHPP-3 heat energy generation data:

$$BE_{heat\ y} = HG_{PJ\ y} \bullet EF_{NG} \bullet 4.1868/\eta_{boiler} \quad (8)$$

where:

$HG_{PJ\ y}$ is the annual heat energy supply by the CCGT' of Chelyabinsk CHPP-3, calculated during monitoring (B4), Gcal/year;
$\eta_{boiler}$ is the new Chelyabinsk city boiler house efficiency, established in section B.1 of this PDD, equals to 93.3%;
$EF_{NG}$ is the natural gas emission factor, estimated during monitoring, t $CO_2$ /GJ;
*4.1868* is the energy units conversion factor from calories to joules.

[29] See Annex 2.

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

Not applicable

**D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:**

| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

Not applicable

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

Not applicable

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

There are fugitive $CH_4$ emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels in the grid in the absence of the project[30]. The project is the construction of CCGT 220 with higher efficiency than that of network power will reduce fossil fuel consumption compared with baseline. This means that require less fuel to produce the same amount of electricity and heat. Consequently, less fuel needed to produce and transport to the site of the project, then it will not increase emissions of greenhouse gases outside the project boundary. That means no leaks. These leaks have not been taken into account for simplicity and conservatism.

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

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

Not applicable

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

Not applicable

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

The following equation shall be applied for calculating the emission reductions:

$$ER_y = BE_y - PE_y \qquad (9)$$

Where:

$ER_y$ : emissions reductions in year y (t $CO_2$e)

$BE_y$ : emissions in the baseline scenario in year y (t $CO_2$e)

$PE_y$ : emissions in the project scenario in year y (t $CO_2$e)

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

The main relevant Russian Federation environmental regulations:

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

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

Emissions into the air are the only important source of pollution at Chelyabinsk CHPP-3 which has a negative impact on the local environment. They are: nitrogen oxides (NO and $NO_2$) and carbon oxide. And there are also noise pollution, water protection and hazardous waste.

The Ecology Division of Chelyabinsk CHPP-3 provides:

- Monitoring of clean equipment operation efficiency;
- Monitoring of pollutant emissions and sinks and waste products.

According to national requirements the Ecology Division collects and archives the data of pollutant emissions and sinks and waste products. It prepares the reports of pollutant emissions and sinks and waste products at Chelyabinsk CHPP-3 on quarterly and annually and submits the reports to State Organization of Environmental Supervision. Also Chelyabinsk CHPP-3 submits pollutant emission and sinks data to Rosstat RF in accordance with statistic forms.

**D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:**

| Data *(Indicate table and ID number)* | Uncertainty level of data (high/medium/low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| **P2** | Low | In accordance with State Standard the allowed inaccuracy of gas consumption metering is ±0.3-4% (GOST R 8.618-2006). The gas flow meter is to be installed will provide necessary inaccuracy. The type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005.<br>Calibration of the metering devices is made in accordance with the calibration schedule which approved by the Chief Engineer of Chelyabinsk CHPP-3 for one year. Supervision of calibration is performed by the Department of heat automatic and measurement. The metering devices are calibrated by an independent entity which has a state licence.<br>The data from meters are automatically and regularly transferred to the computer system and archived. Supervision of data archiving is performed by the Department of heat automatic and measurement. |
| **P4** | Low | Periodic accreditation of CHPP laboratory by authorised state certification/metrological body and data can be provided from a fuel supplier. |

| | | |
|---|---|---|
| **B2** | Low | The data of the electricity generated and the internal needs electricity consumption at the new CCGT unit are determined by standardized electricity meters. These meters will be a part of the commercial automatic system of energy accounting and will be provide to fulfil the accuracy requirements of the system. Calibration of the electricity meters is made in accordance with the calibration schedule which is approved by the Chief Engineer of Chelyabinsk CHPP-3 for one year. Supervision of calibration is performed by the Electrotechnical laboratory of the electrical department. The metering devices are calibrated by an independent entity which has a state licence.<br>The data from meters are automatically and regularly transferred to the computer system and archived. Supervision of data archiving is performed by the Department of heat automatic and measurement. |
| **B4** | Low | Heat energy supply will be calculated as the difference between the amount of heat energy generated and spent for the plant internal needs. The amount of heat energy generated and consumed for the plant internal needs, will be measured by heat meter. Types of meters will be specified at the monitoring stage. Meters' check and calibration procedures will be arranged in compliance with the requirements indicated in the corresponding passport of the monitoring equipment and with regulatory documents, active in the Russian Federation. |

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

The monitoring plan will be implemented by the OJSC "Fortum" to ensure that the project emission reductions during the crediting period are verifiable. Monitoring plan for the project activity includes the details of the operation and management of the project activity during the crediting period and the measurement of the parameters in baseline and project scenarios that will be used to calculate actual emission reductions. The basic management structure is shown below in the fig. D.3.1.

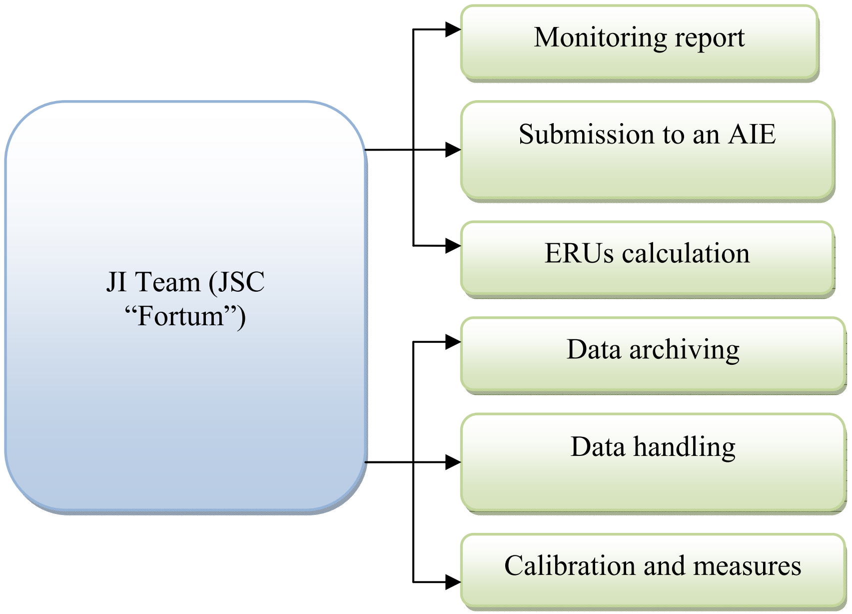


**Figure D.3.1 The management structure**

The management and operational structure for monitoring of the project activity is as follows. The project owner will set up a JI Team to take charge of preparing and archiving monitoring reports, checking obtaining data, support validation process. Also JSC "Fortum" establishes personnel who will be responsible for data support of JI Team at CHPP-3. The monitoring plan does not foresee any additional measures. All data collects from measurement equipment that will install with project implementation and standardized form of data handling are used. The personnel of CHPP-3 are responsible for calibration and maintenance of measurement equipment in accordance with national rules and standards and providing measurement of parameters. The project owner will organize the training of personnel for providing monitoring plan management and support of ERUs verification procedures.

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

Name of person/entity determining the monitoring plan:

- Open Joint-Stock Company «Fortum»,
  OJSC « Fortum » is a project participant. The contact information is presented in Annex 1.

- ECF Project Ltd.,
  ECF Project Ltd. a project participant. See Annex 1 for detailed contact information.

## SECTION E. Estimation of greenhouse gas emission reductions

### E.1. Estimated project emissions:

The project activity is electricity and heat generation using natural gas.

**Table E.1.1 Project GHG emissions**

| Year | 2011 | 2012 |
|---|---|---|
| $PE_y$, $tCO_2$/year | 763 381 | 763 381 |

**Table E.1.2 Project GHG emissions after 2012**

| Year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| $PE_y$, $tCO_2$/year | 763 381 | 763 381 | 763 381 | 763 381 | 763 381 |

### E.2. Estimated leakage:

Not applicable

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

**Table E.3.1 The sum of project GHG emissions and leakage (taken to be zero)**

| Year | 2011 | 2012 |
|---|---|---|
| $PE_y$,+ $LEy$ $tCO_2$/year | 763 381 | 763 381 |

**Table E.3.2 The sum of project GHG emissions and leakage (taken to be zero) after 2012**

| Year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| $PE_y$,+ $LEy$ $tCO_2$/year | 763 381 | 763 381 | 763 381 | 763 381 | 763 381 |

### E.4. Estimated baseline emissions:

**Table E.4.1 Baseline GHG emissions**

| Year | 2011 | 2012 |
|---|---|---|
| $BE_y$, $tCO_2$/year | 1 145 279 | 1 145 279 |

**Table E.4.2 Baseline GHG emissions after 2012**

| Year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| $BE_y$, $tCO_2$/year | 1 145 279 | 1 145 279 | 1 145 279 | 1 145 279 | 1 145 279 |

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

**Table E.5.1 GHG emission reductions**

| Year | 2010 | 2011 | 2012 |
|---|---|---|---|
| $BE_y$, - $PE_y$,+ $LEy$ $tCO_2$/year | 0 | 381 898 | 381 898 |

**Table E.5.2 GHG emission reductions after 2012**

| Year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| $BE_y$, - $PE_y$,+ $LEy$ $tCO_2$/year | 381 898 | 381 898 | 381 898 | 381 898 | 381 898 |

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

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

| Year | Estimated project emissions (tonnes of $CO_2$ equivalent) | Estimated leakage (tonnes of $CO_2$ equivalent) | Estimated baseline emissions (tonnes of $CO_2$ equivalent) | Estimated emission reductions (tonnes of $CO_2$ equivalent) |
|---|---|---|---|---|
| 2011 | 763 381 | 0 | 1 145 279 | 381 898 |
| 2012 | 763 381 | 0 | 1 145 279 | 381 898 |
| Total (tonnes of $CO_2$ equivalent) | 1 526 762 | 0 | 2 290 558 | 763 796 |

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

| Year | Estimated project emissions (tonnes of $CO_2$ equivalent) | Estimated leakage (tonnes of $CO_2$ equivalent) | Estimated baseline emissions (tonnes of $CO_2$ equivalent) | Estimated emission reductions (tonnes of $CO_2$ equivalent) |
|---|---|---|---|---|
| 2013 | 763 381 | 0 | 1 145 279 | 381 898 |
| 2014 | 763 381 | 0 | 1 145 279 | 381 898 |
| 2015 | 763 381 | 0 | 1 145 279 | 381 898 |
| 2016 | 763 381 | 0 | 1 145 279 | 381 898 |
| 2017 | 763 381 | 0 | 1 145 279 | 381 898 |
| Total (tonnes of $CO_2$ equivalent) | 3 816 905 | 0 | 5 726 395 | 1 909 490 |

## SECTION F. Environmental impacts

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

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

Thermal power plants with capacities of 150 MW and higher are considered to be dangerous, technical complicated and unique facilities in line with the Article 48.1 of the Construction Code RF. Design Document of such installations are subject to the state expertise at federal level. Open Joint-Stock Company «Fortum» submitted a Design Document for this project to the Federal State Institution "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) and received an approval (Expert Conclusion).

The main pollutants for CCGT burned natural gas are considered: nitrogen oxides and carbon oxide. The other negative effects are: the noise pollution, the water protection and the hazardous waste. All of them were considered in the section "Environmental Protection" of the Design Document.

The main conclusions of the Environmental Protection for this project and Expert Conclusion by FGU "Glavgosexpertiza"[31] are quoted below:

***Air protection***:

". the exceeding of the maximum allowable concentrations of all pollutants will not be .".

***Noise pollution:***

"... will be ensured within the required noise level limits regulated by the Sanitary regulation.".

***Water protection:***

"... the project technologies provide the water protection lows compliance and the exclusion of the negative impact on the region natural conditions ...".

***Hazardous waste:***

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

***Labour safety and welfare of inhabitants:***

"... The installation of CCGT-220 at Chelyabinsk CHPP-3 will not lead to the essential changes of biosphere state and population health ...".

***The main conclusions:***

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

[31] Approved by the state examination dated 24.08.2009, No. 515-09/GGE-6235/02

Transboundary impact.

Although the project on local level will lead to increasing $NO_x$ emission in country level the emission will be reduced due to increasing efficiency of fuel using. Therefore the project does not have transboundary impact.

**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:**

On the basis on analysis of the environmental impacts for project design documents it was concluded that there is no significant negative impact on the environment.

## SECTION G. Stakeholders' comments

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

The stakeholders identified for the project "Construction of a power-generating unit №3 CCGP-220 of Chelyabinsk CHPP-3" are the local population, which is represented by town Chelyabinsk and Region of Chelyabinsk as well as elected representatives and municipal bodies.

Under the Russian legislation (Federal Law No. 7 dated 10.01.2002 "On Environmental Protection" and Federal Law No. 174 dated 23.11.1995 "On Environmental Impact Assessment") the project was submitted for the environmental impact estimation to the Federal Service for Ecological, Technological and Atomic Supervision (RosTekhNadzor) and Ministry of Natural Resources, Federal Service for Supervision of Natural Resources (RosPrirodNadzor). Therefore, the official Orders from Regional Office of the Ecological and Technological Supervision of RosTekhNadzor and Regional Office of the Federal Nature Management Supervision Service of RosPrirodNadzor will be submitted as stakeholders' comments to the determinator during on-site visit.

Since July 14 until July 23, 2008 public hearings had been held under the Project[32]. Announcement of public hearings was published in the newspaper "Vecherniy Chelyabinsk" № 125 dated 07/07/2008. Representatives of environmental organizations, state and local authorities, mass media attended the public hearings. No negative comments were received on the project during the public hearings. Project information was published on the OJSC "Fortum" website[33].

[32] The conclusion about results of public hearings under the documentation, The report of discussion of the documentation.

[33] http://www.fortum.ru/production/investment/chel-cps/

Annex 1

## CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

**BASELINE INFORMATION**

**$CO_2$ baseline emission factor**

This baseline emission factor was defined in accordance with approved CDM "Tool to calculate the emission factor for an electricity system" (version 02) with some deviations, further referred as "The Tool". The full version of the Tool is published on the UFCCC website at the following address: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

**Scope and applicability**

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

The combined cycle gas turbine unit with electricity capacity of 220 MW will be constructed at Chelyabinsk CHPP-3 and commissioned in December 2010. After project implementation the new electricity energy unit will supply electricity to grid of United Regional Energy System (URES) "Ural". It will substitute electricity that would have been otherwise generated by the other power plants of URES "Ural" и will reduce the power deficit in the URES "Ural", which is covered by flows of electricity from the URES " Mid Volga"[34]. Therefore, this Tool can be used for determination of $CO_2$ baseline emission factor.

**Parameters**

The Tool provides procedures to determine the following parameters:

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

**Data source**

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

- Federal Service of State Statistics (RosStat RF). This is aggregated data provided by energy companies using the official statistical form 6-TP;
- JSC "Unified Energy System of Russia" (UES);
- OJSC <System Operator of Unified Energy System> (JSC "SO of UES");
- CJSC "Agency of Energy Balances in the power industry".

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

CHPPs produce electricity predominantly in the prescribed heat supply mode. Therefore they can be excluded from OM and BM calculation. However the reports (according to form 6-TP) do not contain any information about fired fuel amount for cogeneration or simple cycles and it is impossible to

[34] See. p.13 of "Report on the functioning of UES of Russia in 2009". http://so-ups.ru/fileadmin/files/company/reports/disclosure/2010/ues_rep_2009.pdf

exclude from calculation the fired fuel amount and electricity generation with cogeneration cycle. Therefore, the parameters of cogeneration energy units were taken into account in the OM and BM calculation. It is a deviation from the Tool but it is conservative because cogeneration cycles are more efficient than simple (or combined) cycles.

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

BM calculation is based on the data from:

- Official annual reports of JSC UES;
- Official annual reports of energy companies;
- Energy companies investment programs;
- Technical manual "Territorial Generating Companies", CJSC "IT energy analyst", 2007;
- Reports containing information on new power capacities put in operation in recent years, "General Scheme of Allocation of Energy Objects up to 2020" approved by the Government of the Russian Federation (Order of February 22 2008 No. 215p).

The "General Scheme" is not a legislative act but a research work which was implemented by a commission of the Government of the Russian Federation. OJSC "RAO UES of Russia" (and some research institutes) prepared the draft of "General Scheme" in 2007. It was based on the electricity consumption forecast and the inquiry of energy companies about their investment plans. The "General Scheme" is compilation of such information and doesn't contain any recommendations and is not responsible for where, when, what and who will construct energy units etc. The main aim of "General Scheme" is definition of the sufficiency of consumers power supply. In case of insufficiency of consumers power supply the Government of RF will prepare the arrangements on stimulation of new energy project implementation. The Government of RF approved this document in 2008 (Order of February 22 2008 No. 215p). It means that this work was done according to the commission of the Government of the Russian Federation.

Also according to the Order the Ministry of Energy organizes the monitoring of the GS implementation. Currently CJSC "Agency of Energy Balances in the power industry" is preparing a revised version of the "General Scheme"[35]. The new power consumption forecast and the revised investment plans of energy companies are taken into account. In comparison with the previous version of the "General Scheme" some supposed power projects are delayed and some supposed power projects are stopped.

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

**Methodology procedure**

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

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

**STEP 1: Identify the relevant electric power systems**

A *project electricity system* is the system defined by the spatial extent of the power plants that are

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

physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

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

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

Electric power industry in Russian Federation comprises nearly 400 power plants: thermal power plants (about 70% of total installed capacity), hydro power stations (20% of total installed capacity) and nuclear power stations (10% of total installed capacity). Power stations and consumers are connected by transmission lines. Power stations, consumers and regulatory organizations (JSC "SO of UES" for instance) constitute the national energy system (hereinafter referred to as UES of Russia). The UES of Russia is functioning centralized. JSC "SO of UES" contributes a great value to the operative-dispatching management. Power stations are unified by transmission lines in 60 area electricity systems (AESs), while these systems have in its turn the electric connections with the neighboring ones (excluding some isolated area systems). AESs are unified in seven united regional electricity systems (URESs), that are connected between each other through backbone and interconnection networks: "North-West", "Centre", "The South", "Mid Volga", "Ural", "Siberia" and "The East".

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

**Figure Anx.2.1: Scheme of UES of Russia**


*Source: JSC "SO of UES"( http://www.so-ups.ru/)*

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

Chelyabinsk CHPP-3 is located in URES "Ural". Installed capacity of this URES is 42 758 MW (status 2009). Project capacity (220 MW) is only 0.51% of the URES "Ural" total electric capacity, therefore project capacity '".can be dispatched without significant transmission constraints"[36].

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

URES "Ural" is located on the territory of the Urals and Mid Volga federal districts and 11 regions of the Russian Federation: the republics of Bashkortostan and Udmurtia, Khanty-Mansi and Yamalo-Nenets Autonomous District, Kirov, Kurgan, Orenburg, Perm, Sverdlovsk, Tyumen and Chelyabinsk regions.

The structure of installed capacity of URES "Ural" (status 2009) is as follows:

- 94.6.4% — TPPs (including combined heat and power plants and units);
- 4.0% — Hydro power stations (HPSs);
- 1.3% — Nuclear power stations (NPSs);
- 0.005% — Wind power stations (WPSs).

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

URES "Ural" receives some electricity from other URESs. The available date of consumption and power exchange of electricity of URES "Ural" for 2005 and 2009 is presented in Table Anx.2.1.

**Table Anx.2.1: The available date of consumption and power exchange of electricity of URES "Ural" for 2005 and 2009.**

| Year | 2005 г. | % | 2009 г. | % |
|---|---|---|---|---|
| Consumption of URES Ural | 228 186.00[37] | 100.00% | 236 210.30 | 100.00% |
| Power exchange to (of) URES Centre | 148.00 | 0.06% | 281.60 | 0.12% |
| Power exchange to (of) URES North-West | -21.00 | -0.01% | -23.60 | -0.01% |
| Power exchange to (of) URES Siberia | 145.40 | 0.06% | 176.40 | 0.07% |
| Power exchange to (of) URES Mid Volga | 8 600.00 | 3.77% | 8 660.10 | 3.67% |

The electricity import to URES "Ural" is mostly from URES " Mid Volga". Power exchange from other power systems do not consider as they make up less than 1%. Therefore URES " Mid Volga" is connected electricity system.

Taking into account that electricity consumption URES "Ural" annually increases by about 4% and assuming that the new CCGT 220MW unit at the Chelyabinsk CHPP-3 would not be constructed (alternatives - 2, 3, 4), hence the import of electricity from the URES " Mid Volga" increases in the estimated amount equal to the production of power by unit CCGT 220 MW (1 711.50 million kWh). Based on these calculations we conclude that the share of imported electricity from the URES " Mid Volga" in the URES "Ural" is 4.11 - 4.28%. URES "Ural" is energy deficient and it cannot increase production on existing power plants. Thus, some electricity would be imported from the URES " Mid Volga". The calculations assume that the import of electricity from the URES " Mid Volga" to the URES "Ural" would be 4.5%. This approach is conservative.

**STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)**

Some power plants can be considered as off-grid power plants. For Ural region they can be power plants of oil and gas companies (located on the remote oil and gas deposits) and power plants of villages located within sparsely populated area. Usually these power plants are based on the gas turbine and diesel-engine technologies with a small electric and heat capacity.

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

[37] http://www.ural.so-cdu.ru/odu_urala/data/consumption.php

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

Part of off-grid power plants electricity generation can be estimated using the URES "Ural" (branch of "SO UES" is superior body of operating-dispatching management in URES "Ural") operative data. The comparison of Rosstat RF and URES "Ural" data by 2008 are presented in Table Anx.2.2.

**Table Anx.2.2: The comparison of Rosstat RF and URES "Ural" data by 2008**

| Area (Republic) | Installed capacity. kW | | Diff[38] | Electricity generation. thous.kWh | | Diff |
|---|---|---|---|---|---|---|
| | Rosstat RF | URES "Ural" | % | Rosstat RF | URES "Ural" | % |
| Bashkiriya | 5 212 458 | 5 194 198 | 0,4% | 24 662 943 | 24 491 000 | 0,7% |
| Udmurtiya | 589 980 | 585 400 | 0,8% | 3 177 553 | 3 162 300 | 0,5% |
| Perm | 6 121 100 | 6 139 000 | -0,3% | 32 101 553 | 32 095 700 | 0,0% |
| Kirov | 966 980 | 940 300 | 2,8% | 4 685 264 | 4 610 300 | 1,6% |
| Orenburg | 3 655 000 | 3 655 000 | 0,0% | 16 678 094 | 16 677 300 | 0,0% |
| Kurgan | 482 800 | 480 000 | 0,6% | 1 990 018 | 1 982 600 | 0,4% |
| Sverdlovsk | 9 337 925 | 9 219 400 | 1,3% | 52 518 823 | 52 318 100 | 0,4% |
| Tyumen | 13 822 851 | 11 575 000 | 16,3% | 89 788 398 | 84 021 000 | 6,4% |
| Chelyabinsk | 5 108 855 | 4 997 000 | 2,2% | 28 639 308 | 28 583 900 | 0,2% |
| ***Total*** | ***45 297 949*** | ***42 785 298*** | ***5,5%*** | ***254 241 954*** | ***247 942 200*** | ***2,48%*** |

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

According to the Tool project participants may choose between the following two options:

- Option I: Only grid power plants are included in the calculation.
- Option II: Both grid power plants and off-grid power plants are included in the calculation.

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

**STEP 3: Select an operating margin (OM) method**

The Tool recommends calculating the $EF_{grid.\ OM.\ y}$ based on one of the following methods:

(a) Simple OM. or

(b) Simple adjusted OM. or

(c) Dispatch data analysis. or

(d) Average OM.

[38] Difference

Any of these listed methods can be used; however. the simple OM method (a) can only be used if low-cost/must run resources constitute less than 50% of total grid generation calculated:

1) As average of the five most recent years or.

2) Based on long-term averages for hydroelectricity production.

Low-cost/must run resources are defined as power plants with low marginal generation costs or that are dispatched independently of the daily or seasonal load of the grid. Typically they include hydro. geothermal. wind. low-cost biomass. nuclear and solar generation. In URES "Ural" geothermal. low-cost biomass. and solar generation are negligible for the power balance. Therefore nuclear stations (as "must-run") and wind (1 MW) and hydro plants (as "low-cost") are defined as low-cost/must run resources. Table Anx.2.3 represents" total electricity generation during the five last years and the five year average share of low-cost/must run resources in URES "Ural" (2003-2007).

**Table Anx.2.3: Total electricity generation during the last five years and share of RES's low-cost/must run net electricity generation (MWh)**

| URES "Ural" | 2004 | 2005 | 2006 | 2007 | 2008[39] | Five year average % of low-cost |
|---|---|---|---|---|---|---|
| All power plants | 215 800 000 | 220 827 000 | 216 623 216 | 233 136 584 | 238 373 664 | 4.2 |
| Hydro (with wind) | 5 000 000 | 5 426 500 | 4 564 149 | 6 493 146 | 6 226 915 | |
| Nuclear | 4 200 000 | 4 086 500 | 3 838 542 | 3 791 896 | 3 775 284 | |

*Source: JSC "SO of UES" and Rosstat RF*

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

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

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

The Tool suggests making calculations based on:

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

The Option A was chosen because the necessary data for Option A is available.

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

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (1)$$

Where:

$EF_{grid.OMsimple.y}$ = simple operating margin $CO_2$ emission factor in year y ($tCO_2$/MWh);

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in

[39] http://www.so-ups.ru/fileadmin/files/company/reports/disclosure/2010/ues_rep_2009.pdf

year $y$ (MWh);

$EF_{EL,m,y}$ = $CO_2$ emission factor of power unit $m$ in year $y$ ($tCO_2$/MWh);

m = all power plants / units serving the grid in year y except low-cost / must-run power plants / units;

y = the relevant year as per the data vintage chosen in Step 3

*Determination of $EF_{EL,m,y}$*

The emission factor of each power unit *m* should be determined using Option A1 from the Tool:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (2)$$

Where:

$FC_{i.m.y}$ = amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit);

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

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

i = all fossil fuel types combusted in power plant / unit m in year *y*;

*Determination of $EG_{m,y}$*

The net quantity of electricity generated and delivered to the grid ($EG_{m,y}$) by power unit at all TPPs of URES "Ural" and URES " Mid Volga" in 2003-2007 and fossil fuels consumed in the project electricity system are received from 6-TP form. See Annex 4.

**Table Anx.2.4: The net electricity generation and fuel consumption data excluding off-grid power plants**

| Indicator | Unit | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Net electricity generation | MWh | 132 536 045 | 216 708 478 | 222 662 178 |
| Natural gas | GJ | 988 496 754 | 1 847 423 418 | 1 896 324 000 |
| Heavy fuel oil | GJ | 2 392 219 | 20 252 427 | 16 952 224 |
| Coal | GJ | 331 758 695 | 254 112 781 | 301 935 465 |
| Peat | GJ | 0 | 2 130 388 | 1 619 371 |
| Other | GJ | 2 063 | 68 890 550 | 64 664 591 |

**Definition of other fuel types**

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

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

Chelyabinsk.

The amount of other fuel type consumption on the regional basis during 2005-2007 is presented in the Table Anx.2.5.

**Table Anx.2.5: The other fuel type consumption on the regional basis during 2005-2007**

| Area (Republic) | Unit | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Bashkiriya | GJ | n/a | 883 532 | 984 579 |
| Udmurtiya | GJ | | 0 | 0 |
| Perm | GJ | | 12 585 722 | 11 405 119 |
| Kirov | GJ | | 259 333 | 120 000 |
| Orenburg | GJ | | 8 433 172 | 8 423 833 |
| Kurgan | GJ | | 0 | 0 |
| Sverdlovsk | GJ | | 12 682 643 | 12 679 865 |
| Tyumen | GJ | | 1 344 | 5 111 |
| Chelyabinsk | GJ | | 34 044 805 | 31 046 083 |
| ***Total*** | GJ | ***2 063*** | ***68 890 550*** | ***64 664 591*** |

*Source: Rosstat RF*

In Perm area there is Solikamsk CHPP (163 MW) which used a wood waste from “Solikamskbumprom” (the pulp-and-paper mill) as fuel besides natural gas. Coke oven gas is burned at “Kizilovsk GRES” (26 MW, OJSC “TGK-9”) in proportion to 30%[40] (it is about 4% of the total “other” fuel type amount in Perm area) and they plan to increase this proportion up to 50-60%. Some power plants burn some oil waste types but data about the amount of these fuels is not available.

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

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

These metallurgical plants have blast-furnace production and by-product coke plant. The blast furnace and coke oven gases are utilized practically completely at the works for different purposes: for recuperation, in heating and for electricity and heat generation. The blast furnace gas part of Sverdlovsk area in the fuel balance is about 3%[41]. Usually the major part of coke oven gas is used for recuperation and in heating furnaces, not for electricity and heat generation as it has a higher calorific value than blast furnace gas. Percentages of blast furnace gas and coke oven gas in the fuel balance of “Ural Steel” CHPPs are about 37% and 20%, respectively[42].

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

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[40] http://www.tgk9.ru/publications_rus.html?id=873
[41] http://www.irvik.ru/company/media/detail.php?ID=74
[42] http://www.bureau-veritas.ru/wps/wcm/connect/bv_ru/local/home/about-us/our-business/certification/our_areas_of_expertise/environment_and_climate_change/news-cer-ural-steel-monitoring-report/?presentationtemplate=bv_master/news_full_story_presentation

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

For emission calculation the following assumptions were taken:

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

The data of total fuel balance and net electricity generation of URES "Ural" is presented in the Table Anx.2.6.

**Table Anx.2.6: The data of total fuel balance and net electricity generation of URES "Ural"**

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

**Calculation of emission at the TPPs of URES "Ural"**

The default fuel emission factors are presented in the Table Anx.2.7.

**Table Anx.2.7: The default fuel emission factors**

| Fuel type | Default emission factor[43] |
|---|---|
| | $tCO_2/GJ$ |
| Natural gas | 0.0561 |
| Heavy fuel oil | 0.0774 |
| Coal | 0.0961 |
| Peat | 0.1060 |
| Other fuel types[44] | 0.0 |

**Emission calculation of the net electricity consumption from a connected electricity system**

And the results of $EF_{grid\ OMsimple\ y}$ and the average electricity weighted OM emission factor calculation are presented in the Table Anx.2.8.

**Table Anx.2.8: Results of calculation $EF_{grid\ OM\ y}$ and the average electricity weighted OM emission factor**

| Indicator | Unit | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| OM emission factor URES "Ural" | $tCO_2/MWh$ | 0.6171 | 0.6124 | 0.6048 | 0.6146 | 0.6050 |
| OM emission factor URES " Mid Volga" | $tCO_2/MWh$ | 0.5492 | 0.5338 | 0.5253 | 0.5354 | 0.5262 |

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

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

| | | |
|---|---|---|
| Average electricity weighted OM emission | $tCO_2$/MWh | 0.6073[45] |

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

**STEP 5: Identify the cohort of power units to be included in the BM**

The Tool provides the recommendations on how to form the sample groups of power units used to calculate the BM. They consist of either:

(a) The set of five power units that most recently have been built. or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

If the recommended approach does not reasonably reflect the power plants that would likely be built in the absence of the project activity. the participants are encouraged to submit alternative proposals.

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

The main principle stated by the Tool is that "the build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed" project which means that the BM capacity is counterfactual and the power plants are assembled just to determine the parameters of such capacity to calculate GHG emissions.

In the Table Anx.2.9 lists all the plants/units commissioned recently (since 1991) in URES "Ural".

**Table Anx.2.9: URES "Ural". Power plants/units commissioned recently**

| N | Power plant/unit | Year of commissioning | Capacity MW | Technology | Fuel |
|---|---|---|---|---|---|
| Commissioned in 1993-2008 | | | | | |
| 1 | Nizhne-Vartovsk TPP, No.2 | 2003 | 800 | Steam cycle | Gas |
| 2 | Nizhne-Vartovsk TPP, No.1 | 1993 | 800 | Steam cycle | Gas |
| 3 | Tyumen CHPP-1 | 2003 | 190 | CC GT | Gas |
| 4 | Chelyabinsk CHPP-3, No.2 | 2006 | 180 | Steam cycle | Gas |
| 5 | Chelyabinsk CHPP-3, No.1 | 1996 | 180 | Steam cycle | Gas |

*Source: Energy companies*[46]

For the first commitment period of the Kyoto Protocol projects participants can choose between one of the two options:

(1) ex-ante based on the most recent information available on units already built;

(2) ex-post based on information updated during each relevant monitoring period.

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

**STEP 6: Calculate the build margin emission factor**

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

[45] See Annex 4.

[46] http://www.so-ups.ru/index.php?id=tech_disc

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (2)$$

Where:

$EF_{grid.BM.y}$ = Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$)

$EG_{m.y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL.m.y}$ = $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

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

$$EF_{EL.\ m.\ y} = b_{m.\ y} \times EF_{CO2.\ fuel} \quad (3)$$

Where:

$EF_{CO2.\ fuel}$ = fuel emission factor (fuel type weighted) in $tCO_2/MJ$ or $tCO_2$/t.c.e; the IPCC factors for main types of fuel values;

$b_{m.\ y}$ = specific fuel consumption by the unit *m* (MJ/MWh or t.c.e./MWh)

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

The background data for $EF_{grid.\ BM.\ y}$ calculation is presented in the Table Anx.2.10.

**Table Anx.2.10: Background data for $EF_{grid.\ BM.\ y}$ calculation**

| Indicator | Unit | Nizhne-Vartovsk TPP, No.1 | Nizhne-Vartovsk TPP, No.2 | CC GT at Tyumen CHPP-1 | Chelyabinsk CHPP-3,No.1 | Chelyabinsk CHPP-3,No.2 |
|---|---|---|---|---|---|---|
| Electric capacity | MW | 800 | 800 | 190 | 180 | 180 |
| Annual net generation of electricity | MWh | 11 326 030 | | 865 488 | 1 231 000 | |
| Specific fuel consumption | g c.e./kWh | 303.4 | | 239.9 | 267.4 | |
| | GJ/MWh | 8.899 | | 7.036 | 7.843 | |
| Fuel | - | Natural gas | | | | |
| | GJ | 100 787 192 | | 6 089 805 | 9 654 539 | |
| Fuel emission factor | $tCO_2/GJ$ | 0.0561 | | | | |

*Source: Rosstat RF*

The results of $EF_{grid.\ BM.\ y}$ calculation are presented in the Table Anx.2.11.

**Table Anx.2.11: Results of $EF_{grid.\ BM.\ y}$ calculation**

| Indicator | Unit | Nizhne-Vartovsk TPP, No.1 | Nizhne-Vartovsk TPP, No.2 | CCGT at Tyumen CHPP-1 | Chelyabinsk CHPP-3,No.1 | Chelyabinsk CHPP-3,No.2 |
|---|---|---|---|---|---|---|
| Power unit CO2 emission factor | $tCO_2$/MWh | 0.499 | 0.499 | 0.395 | 0.440 | 0.440 |
| Average weighted BM emission factor | $tCO_2$/MWh | 0.487 | | | | |

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

**STEP 7: Calculate combined margin emission factor**

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

$$EF_{grid.\ CM.\ y} = w_{0M} \times EF_{grid.\ 0M.\ y} + w_{BM} \times EF_{grid.\ BM.\ y} \quad (4)$$

Where:

$EF_{grid.\ CM.\ y}$ = CM emission factor in year y ($tCO_2$/MWh);

$EF_{grid.\ OM.\ y}$ OM emission factor in year y ($tCO_2$/MWh);

$EF_{grid.\ BM.\ y}$ = BM emission factor in year y ($tCO_2$/MWh);

$w_{0M}$ = weight of OM emission factor;

$w_{BM}$ = weight of BM emission factor.

In most cases the Tool recommends to apply $w_{0M} = w_{BM} = 0.5$. But developers may propose other weights. as long as $w_{0M} + w_{BM} = 1$.

As a starting point the weighting factor for $w_{0M}$ is taken as 0.5.

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

In accordance with General Scheme[47]. dated 22 February 2008. it was planned to approximately 33 GW of old capacity has to be dismantled by 2015. To meet the growth in demand for new energy units with total capacity of 120 GW will be commissioned by 2015. This means that the JI project will not only initiate the construction of new power plants. but also accelerate the decommissioning of existing capacities. Given the impact of the financial crises on demand growth and the capability to finance new projects. the new estimation[48] (September 2008) expects that out of the planned 120 GW only about 80 GW will be operational by 2015. Out of the 33 GW of old capacity only 10 GW will be dismantled. This means that 1 GW of any project delay leads to a delay of 0.5 GW of old capacity dismantling. So the effect of the JI project on the acceleration of decommissioning of existing capacities will only be stronger as result of the financial crisis.

The estimation. that the effect of the JI project on the decommissioning of power plants and the delays of new power plants construction is approximately 50% / 50%. For the avoidance of new power plants the emission factor of the BM is representative whereas for the accelerated decommissioning effect the

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

emission factor of the OM is representative. And it means that 0.25 of BM refers to the group of prospective power plants and another 0.25 of BM refers to the dismantling of existing capacities and can be related to OM.

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

The resulting grid factor is $EF_{grid.\ CM.\ y}$ = 0.5772 $tCO_2$/MWh.

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

**Table Anx.2.12: Key Information and Data used for Setting the Baseline.**

| ID number | Symbol | Data variable | Measuring unit | Value |
|---|---|---|---|---|
| ***b1*** | $FC_{NG,y}$ | Annual quantity of natural gas consumed at the new CCGT unit | Thous.$m^3$ | |
| ***b2*** | $EG_{PJ,y}$ | Annual electricity supply generated by CCGT | MWh/year | |
| ***b3*** | $HG_{PJ,y}$ | Annual heat energy supply generated by CCGT | Gcal/year | |
| ***b4*** | $NCV_{NG,y}$ | Natural gas net calorific value | GJ/$m^3$ | 33.46 |
| ***b5*** | $EF_{CO2,\ NG,\ y}$ | Natural gas emission factor | $tCO_2$/TJ | 56.1 |
| ***b6*** | $EF_{CO2,\ grid,y}$ | Baseline emission factor | $tCO_2$/MWh | 0.5772 |
| ***b7*** | $\eta_{boiler}$ | Efficiency of boilers | % | 93.3 |

Annex 3

## MONITORING PLAN

See Section D for monitoring plan.

Annex 4

## THE CALCULATION OF THE OPERATING MARGIN AND BUILD MARGIN EMISSION FACTORS

See file: table.xls