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

CONTENTS

SECTION A. General description of the project

A.1. Title of the project:

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Title: Reconstruction of the units at the Structure Unit "Luhanskaya TPP" of the "Skhidenergo" ltd.

Sectoral scope 1: Energy industries (non-renewable sources).

Version: 2.2.1

Date: 12 February 2010

A.2. Description of the project:

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Luhanskaya TPP exploited by energy generating company Skhidenergo ltd. Installed power capacity of the Luhanskaya TPP is 1400 MW. As the Unit#12 is in conservation – 1125MW. All energy equipment was installed in the 1960's. The list of installed equipment:

- boilers TP-100 (Ep-140-640G) (units ## 9-13); boilers TP-100A (units ##14-15), produced by the Taganrog boiler factory.
- turbines K-210-130-1, produced by the "Leningrad metal works.
- power generators TGB-200, produced by the "Kharkov SPC Electrotyazhmash" (units ## 9-13);
- power generators TGB-200M, produced by the "Kharkov SPC Electrotyazhmash" (units ##14-15).

Electricity consumption for own needs –10.24% (2007).
Main, (reserve) fuel - coal, (heavy fuel oil / natural gas).
The Unit #12 is in conservation (out of work), the Unit #8 is written-off.
Project foresees modernization of the main and the auxiliary equipment of the all power generating units of the TPP according to the attached schedule.

Table 1. Project Schedule.

All Units Servicing and Preparations for the Reconstruction	2004 - 2017
Unit №8	2014-2017
Unit №9	2014-2015
Unit №10	2009-2010
Unit №11	2011-2012
Unit №12	2014-2017
Unit №13	2010-2011
Unit №14	2013-2014
Unit №15	2012-2013

It includes replacement of outdated turbine equipment, control, automatic systems, and electro-technical system, modernization of the boiler equipment, electric separation system, cooling system, optimisation of the working regimes, the fuel preparation, servicing of the equipment, etc.
At the Units #8 and #12 the installation of the new equipment is expected to be made. The main objective of the reconstruction is the installation of the new boilers based on the technology with the atmosphere circulating boiling bed. The expected installed power capacity of the units is 225 MW.
After the reconstruction of 6 (8) units the technical characteristics of the TPP are expected to be:

Installed power capacity – 1230 (1680) MW;
Electricity consumption for the own needs - 8.9%.
Main (reserve) fuel - coal (natural gas / heavy fuel oil).
Thermal energy delivery is minor and getting lower (from 1.3% of the energy produced in 2003 to 0.6% in 2008) only because of the energy efficiency measures and lowering of the loses (the demand for the thermal energy is constant – heating for the Schastye town). We make a conservative assumption that in the project scenario the thermal energy delivery and production will remain around 1% of the fuel consumption and do not take it into account in the calculations. The Specific Fuel Rate (SFRy) coefficient (see Annex 1) is also calculated for the electricity and thermal energy separately. So, the emissions and the emission reductions are also calculated separately for the electricity and the thermal energy.
The main objective of the Project is to make the existing power equipment of the TPP more efficient and reliable. The increased efficiency will provide a higher output and lower fuel consumption.
The increased capacity of the TPP is due to the better efficiency of the existing equipment. It will reduce the fuel consumption per unit of the energy produced by the station. Thus the GHG emission per the energy unit produced will be lowered.
Other goals of the project are to:
• lower greenhouse gases emission;
• improve stability and reliability of generation and transmission of electricity;
• implement safety measures;
• improve health and safety on site.

A.3. Project participants:

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Party involved (*)	Legal entity project participants (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Party)	Skhidenergo Ltd.	No
Ukraine	ELTA JSC	No
* Please indicate if the Party involved is a host Party.		

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

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Ukraine

Figure 1. Ukraine[1]

[1] www.maps.com

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

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Luhansk region, Eastern Part of Ukraine

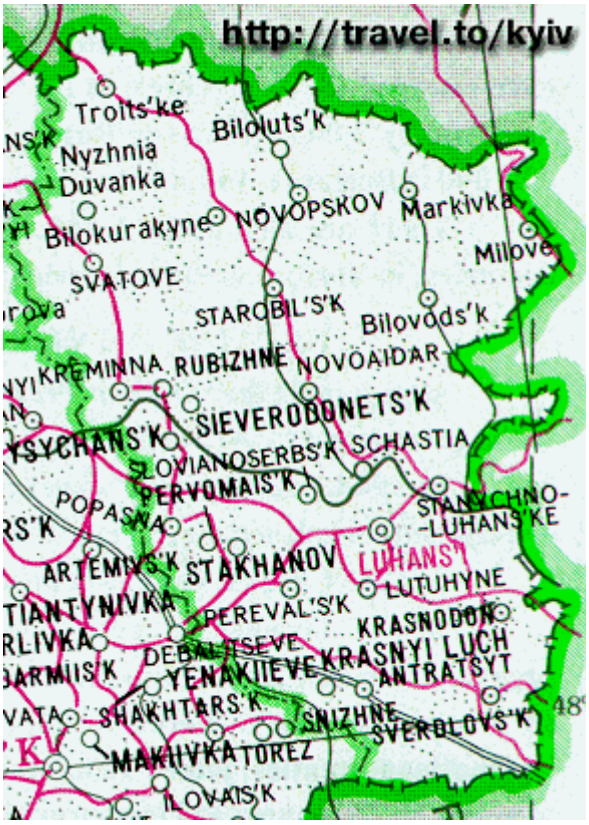

Figure 2. Luhansk region[2]

[2] http://travel.kyiv.org/map/e_lug.htm

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

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Schastye town, Luhansk region, Ukraine

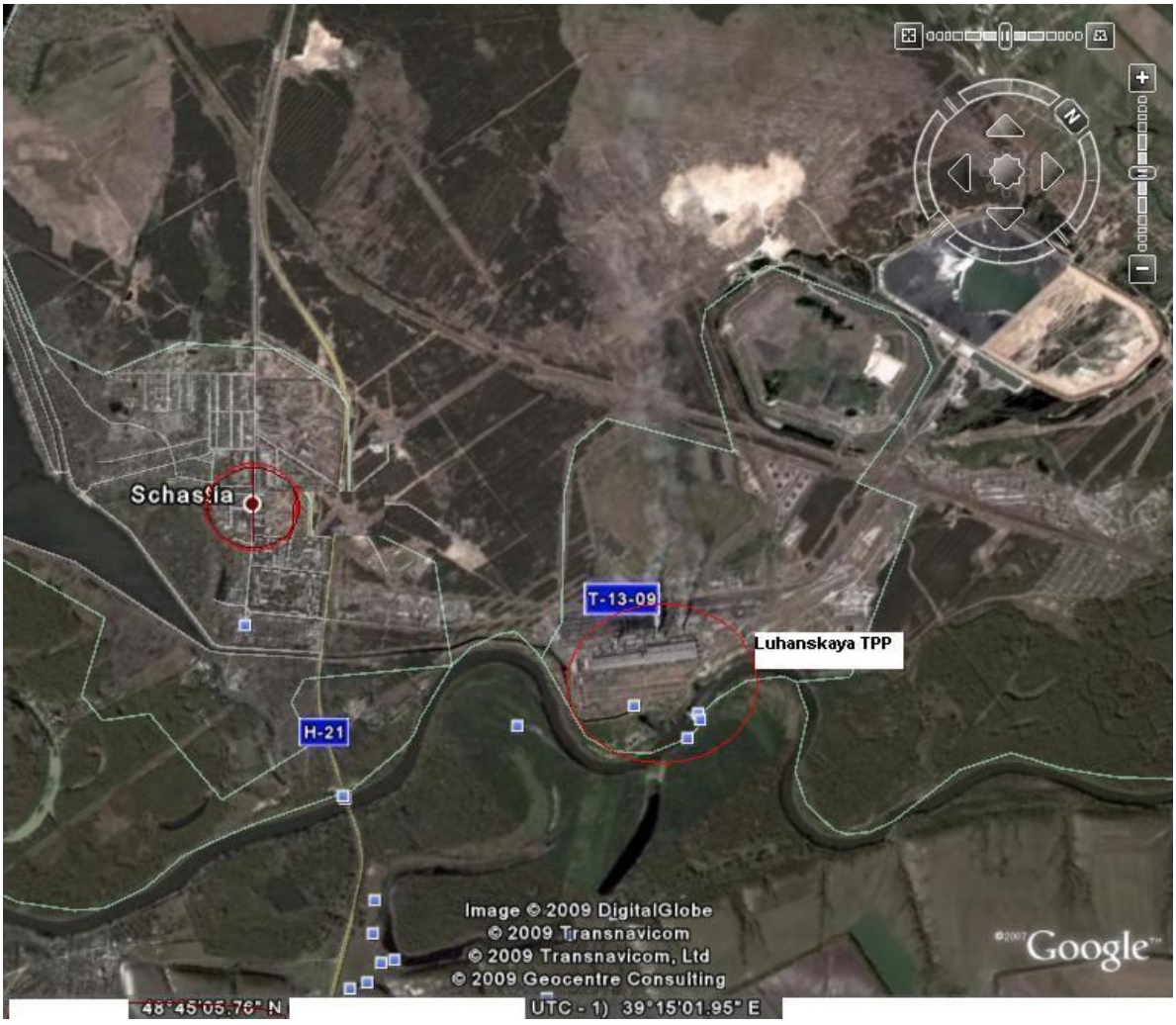

Figure 3. Schastye town and Luhanskaya TPP[3]

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

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The project is located in Luhansk region in Schastye town, 25 km from Luhansk on the left bank of the Severskiy Donets river. Schastye town is located at the following coordinates: 48°45'N and 39°15'E

[3] Google Earth

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

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Units ##9,10,12,13 at the Luhanskaya Thermal Power Plant have a design capacity of 175MW. Units ##11,14,15 have a design capacity of 200 MW. The Units ##8 and 12 are out of operation. Each unit consists of a boiler, steam turbine, electric generator, feedwater heaters, condensate and boiler feed pumps, condenser, circulating water pumps, steam generator, main and auxiliary electrical transformer and auxiliaries. The steam generator is designed to operate on coal. The electricity generated is conveyed to the grid via 110 kV and 220 kV transmission lines. All major equipment was manufactured in the former Soviet Union.

The Skhidenergo ltd. became an owner of the Luhanskaya TPP in 2003. Straight after that several urgent energy efficiency and ecological measures were implemented on the TPP. In 2005 the preparation actions for the TPP Units rehabilitation and the rehabilitation itself were started (in 2005 efficiency measures were implemented on the Unit #15 - Contracts ## 03/2005/244 dated 18.03.2005; 269 dated 21.03.2005 and more). Also, the measures for the JI registration and the potential ERUs calculations were started. Within this project the following packages of measures will be undertaken on the each unit:

• the preparations for the rehabilitation, including repairs, servicing, optimisation of the regimes and the fuel preparation;
• the rehabilitation of the turbine equipment to restore its initial efficiency and modernize its command & control system;
• the renovation of the designed parameters of the turbine equipment;
• the rehabilitation (reconstruction) of the regulation system;
• the rehabilitation (reconstruction) of the boiler;
• the boiler binding reconstruction to use natural gas as reserve fuel instead of the heavy fuel oil;
• the reconstruction (change) of the control system of the of the Unit;
• the reconstruction of the generator and the cooling system;
• the rehabilitation (reconstruction) of the electric filters with the change of the electric and control systems;
• the rehabilitation of the feed-pump;
• the rehabilitation (reconstruction) of the electric equipment of the Unit (including unit transformer).
• the rehabilitation of the Units ##8 and 12 also includes the substitution of the existing boiler with the new one, based on the technology of the atmosphere circulating boiling bed.

More detailed description of the rehabilitation:

A. Turbine equipment

1. Steam turbine
   - Low pressure cylinder modernization with the rotor change;
   - Change of the end seals;
   - Change of the diaphragms, end and diaphragm seals;
   - Casings change;
   - Overhaul and change of bearings;
   - Feed and exhaust pipe retrofit;
   - Retrofit of the LPC support;
   - Generator and Middle pressure cylinder half-couplings reconstruction;
   - Rotor hydrolifting system installation.
2. Steampipelines
   - overhaul and repairs.
3. Pumping equipment
   - change of the inner casing of the feed pump;
   - overhaul and repair of all pumping equipment.
4. Fittings
   - overhaul and in case of need – repair and change of the fittings.
5. Insulation
   - overhaul and rehabilitation of the high and middle pressure equipment insulation;

- repair of the feed-water pipeline insulation.

6. Control system
   - equipping of the turbine with the electronic control, monitor and regulation system.

7. Electric filters
   - change of the electrodes;
   - change of the gas distribution gates;
   - change of the filter control system;
   - overhaul and repair of the filter system.

B. Boiler equipment
- repair of the boiler unit and supporting equipment;
- replacement of the metal housing;
- repair of the steam pipelines;
- replacement of the coiled pipes;
- total replacement of the water-wall tubes and water economizer;
- repair of the separation equipment;
- overhaul and repair of the all pipelines and steam pipelines;
- cleaning and repair of the tubular air heater;
- overhaul and replacement of the winding and thermal insulation;
- repair and replacement of fittings.

C. Electric generator and electric equipment
- replacement of the stator winding;
- modernization of the cooling system of the generator with the replacement of the gas condensers;
- repair of the transformer;
- modernization of the cooling system of the transformer.

For the reconstruction and rehabilitation at Luhanskaya TPP the technology that is common in Europe will be used. The Project is one of the first projects of this kind in Ukraine. The TPP has one of the best fuel consumption coefficients among the coal-fired TPPs in Ukraine now and the rehabilitation will lower the GHG emission coefficient of the TPP. The technology is unlikely to be substituted during the lifetime of the Project. No special training for the personnel is needed.

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

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Energy generation is one of the most important sectors of the Ukrainian economy. It has been showing a significant growth since 1999. The Nuclear power plants and Thermal power plants are generating the main part of the energy produced in Ukraine[4]. Nuclear power plants are able to work only with the fixed (basic) load whereas TPPs are mainly work with the flexible (manoeuvre) load.

That is why, one of the main targets of the energy system development is to increase the reliability of the existing equipment with the increase of its installed capacity.

The proposed Project provides emission reductions by lowering of the amount of fuel used per energy unit produced (MW, Gcal, etc.). This Project would never have occurred without JI registration and a good will of the Project owner. There are several legal acts in Ukraine to regulate the energy sector. The main ones are described below with the description of the existing situation.

SECTOR BACKGROUND

[4] http://ukrrudprom.com/data/htmls/cvjfddh09012008.php

Ukrainian Law on Power Industry from 16 October 1997, N 575/97-BP[5] is the basic law in Ukraine that determines legal, economic, and organizational activities relevant to electricity and regulates the relationships linked with generation, distribution and consumption of power, energy security of Ukraine, competition and other aspects of power industry. The law stimulates and ensures sustainability issues related to the power industry: such as rational fuel consumption, technological development, and environmental safety.
In 1996, Ukraine adopted the National Energy Program until 2010[6], designed to rehabilitate working thermal power plants to allow them to continue operating for the next 25 years. As a way to reach this objective, the program's mandate specified technological improvements, use of renewable energy sources and modernization of the power plants, including making them more environmentally friendly. The program also specified that combined cycle-gas turbine equipment- as well as most of the auxiliary equipment - needed to be improved to reach acceptable safety levels. Good-quality coal was to be used to reduce environmental damage. However, many of these reconstruction and modification projects have been seriously delayed because of the shortage of state budget financing, weak legislation, and the lack of private investment.
To make the country less dependent on energy imports, the President has issued a Decree on measures to increase energy security of Ukraine (21 October 2005), and called for the elaboration of an Energy Strategy covering the period until 2030. The Cabinet of Ministers Resolution No. 145-p approved the new Energy Strategy up to 2030 in March 2006[7]. Its main objectives are:

- Increasing the level of the country's energy security;
- Reducing energy intensity in industrial production;
- Integrating Ukrainian Power Grid with the European Power Grid System and increasing electricity exports;
- Strengthening Ukraine's position as a transit country for oil and natural gas flows;
- Creating conditions to reliably meet the energy demand;
- Reducing environmental impact from the fuel and energy sector and ensuring human safety;

The Strategy focuses on traditional energy sectors, i.e. gas, oil, nuclear and coal. It briefly mentions renewable energies, and does not cover new energy technologies.
The Strategy mentioned covers many of the Ukrainian TPPs with the plans of the rehabilitation and energy efficiency increase. Nevertheless, only few of the TPPs mentioned in the Strategy have been implementing the measures described in it. One of the main reasons that the Project "Reconstruction of the units at SU "Luhanskaya TPP" of the "Skhidenergo" ltd." is implemented is that the Project has been developed as a JI project. All the energy generated by the TPP is sold to the State network and the government is setting the price of the energy. It means that the price does not show the real situation for the energy sector. It does not cover any repair and particularly, rehabilitation. Only additional cash flow can help the project to be implemented. Furthermore, in the conditions of the world financial crisis and the change in the cost of money, the JI development and possibility of the additional cash flow from the selling of the ERUs were the main reasons to not to cancel the Project implementation.
If project is not implemented, the baseline scenario would look like 'business-as usual" scenario – The continuation of the existing situation. That means, that the Luhanskaya TPP would continue to operate as before or would increase the production of the energy by the extension of the operating time. In this case a slight decrease in energy efficiency each year would occur. This situation is the most plausible.

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

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During the Project crediting period, monitoring data will be used to determine the actual realized emission reductions in compliance with the annual energy production value. For the period 2003 – 2009 the actual data of the electricity supply, Specific Fuel Rate, the fuel consumption and the net caloric values of the different

[5] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=575%2F97-%E2%F0

[6] http://www.uazakon.com/document/spart91/inx91184.htm

[7] http://zakon.rada.gov.ua/signal/kr06145a.doc

fuel types was used. To calculate the emissions and emission reductions during 2010 – 2022 the planned data from the DTEK Development Strategy 2009 was used.
The calculations provided for the three periods: 2006-2008 (24 months), 2008-2012 (60 months) and 2013-2022 (120 months). The calculations for 2006-2008 covers the energy efficiency measures implemented on the TPP in these years. These measures allowed achieving the lowering of the specific fuel rate and, as the result, the emission reductions. The calculations for 2013-2022 were made with the assumption of the continuation of the JI mechanisms in these years.

Table 2. Annual estimation of emission reductions in the early credits period

	Years
Length of the period	2
Years	Estimate of annual emission reductions in tonnes of CO2 equivalent
2006	308 135
2007	388 337
Total estimated emission reductions over the period (tonnes of CO2 equivalent)	696 472
Annual average of estimated emission reductions over the period (tonnes of CO2 equivalent)	348 236

The total amount of emissions reduction is 696 472 tCO2eq.
The annual average amount of GHG emissions is 348 236 tCO2eq.

The example of the Emission Reduction calculation for the 2007:

In 2007 LuhanskayaTPP supplied 5 777 455 of the electricity to the Ukrainian Grid. The Specific Fuel Rate (SFRy) in this year was 12,125 GJ per MW (or 0,4134 tons of the equivalent fuel per MW). The fuel used was combusted in such a proportion (SFiy): coal – 98,2%, heavy fuel oil – 0,1%, natural gas – 1,7%.
The values of the emission factor (EFi) and the oxidation coefficient (OXIDi) defined in the IPCC Guidelines for National Greenhouse Gas Inventories were used[8]:
EFi for the coal – 0,096 tons of CO2per GJ;
EFi for the heavy fuel oil – 0,0774 tons of CO2per GJ;
EFi for the natural gas – 0,0561 tons of CO2per GJ.
OXIDi for the coal is 0,98;
OXIDi for the heavy fuel oil is 0,99;
OXIDi for the natural gas is 0,995.
These coefficients show the amount of the CO2 emission from the combustion of the specific fuel type and the oxidation level of the specific fuel type when combusted.
According to the Baseline defined in the Annex 2, the Specific Fuel Rate in the Baseline Scenario was 12,8446 GJ per MW (0,4379 tons of the equivalent fuel per MW).
In that way the Baseline emission in 2007 was:
BEy = 12.8446 * ((0.982*0.096*0.98)+(0.001*0.0774*0.99)+(0.017*0.0561*0.995)) * 5 777 455 =
= 1.1998 * 5 777 455 = 6 932 021 tons of CO2.
Project emission in 2007 was:
PEy = 12,125 * ((0.982*0.096*0.98)+(0.001*0.0774*0.99)+(0.017*0.0561*0.995)) * 5 777 455 =
= 1.1326 * 5 777 455 = 6 543 684 tons of CO2.
Emission Reductions on 2007 were:
ERy = 6 932 021 – 6 543 684 = 388 337 tons of CO2

[8] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

Table 3. Annual estimation of emission reductions for the crediting period

	Years
Length of the crediting period	5
Years	Estimate of annual emission reductions in tonnes of CO2 equivalent
2008	392 775
2009	217 434
2010	198 866
2011	369 012
2012	525 963
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	1 704 051
Annual average over the crediting period of estimated reductions (tonnes of CO2 equivalent)	340 810

The total amount of emissions reduction is 1 704 051 tCO2eq.
The annual average amount of GHG emissions is 340 810 tCO2eq.

The example of the Emission Reduction calculation for the 2010::

In 2010 Luhanskaya TPP plans to supply 4 283 000 MW of the electricity to the Ukrainian Grid. The Specific Fuel Rate (SFRy) in this year is planned to be 12,3479 GJ per MW (or 0,421 tons of the equivalent fuel per MW). The fuel is planned to de combusted in such a proportion (SFiy): coal – 98.4%, heavy fuel oil – 0.1%, natural gas – 1.5%.

The values of the emission factor (EFi) and the oxidation coefficient (OXIDi) defined in the IPCC Guidelines for National Greenhouse Gas Inventories were used[9] for the calculations:

EFi for the coal – 0,096 tons of CO2per GJ;
EFi for the heavy fuel oil – 0,0774 tons of CO2per GJ;
EFi for the natural gas – 0,0561 tons of CO2per GJ.
OXIDi for the coal is 0,98;
OXIDi for the heavy fuel oil is 0,99;
OXIDi for the natural gas is 0,995.

These coefficients show the amount of the CO2 emission from the combustion of the specific fuel type and the oxidation level of the specific fuel type when combusted.

According to the Baseline defined in the Annex 2, the Specific Fuel Rate in the Baseline Scenario was 12,8446 GJ per MW (0,4379 tons of the equivalent fuel per MW).

In that way the Baseline emission in 2010 has to be:

BEy = 12,8446 * ((0.971*0.096*0.98)+(0.023*0.0774*0.99)+(0.006*0.0561*0.995)) * 4 283 000 =
= 1.2008 * 4 283 000 = 5 143 123 tons of CO2.

Project Emission in 2010 will be:

PEy = 12,3479 * ((0.971*0.096*0.98)+(0.023*0.0774*0.99)+(0.006*0.0561*0.995)) * 4 283 000 =
= 1.1544 * 4 283 000 = 4 944 257 tons CO2.

Emission Reductions in 2010 are planned to be:

ERy = 5 143 123 – 4 944 257 = 198 866 tons of CO2

[9] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

Table 4. Annual estimation of emission reductions for the post-Kyoto period

	Years
Length of the period	10
Years	Estimate of annual emission reductions in tonnes of CO2 equivalent
2013	709 139
2014	914 399
2015	1 061 066
2016	1 248 867
2017	1 248 867
2018	1 248 867
2019	1 248 867
2020	1 248 867
2021	1 248 867
2022	1 248 867
Total estimated emission reductions over the period (tonnes of CO2 equivalent)	11 426 677
Annual average over the period of estimated reductions (tonnes of CO2 equivalent)	1 142 667

The total amount of emissions reduction is 11 426 677 tCO2eq.
The annual average amount of GHG emissions is 1 142 667 tCO2eq.

A.5. Project approval by the Parties involved:

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The Letter of Endorsement has been received from the National Environmental Investments Agency of Ukraine (attached to the PDD).

After finishing of project determination report, the PDD and Determination Report will be presented to National Environmental Investments Agency of Ukraine for receiving of the Letter of Approval. The Letter of Approval from the country - investor will be provided after approval of project by Ukraine.

National Environmental Investment Agency of Ukraine

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SECTION B. Baseline

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

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The Project activity does not correspond properly to any of the Approved Methodologies. The methodology, which is very much similar to the Project activity, is AM 0061, but there is a difference in calculations. The main difference in the methodologies is that in the AM 0061 the Project boundary includes the National electricity grid whereas in the methodology used for the Project activity the grid is outside of the Project boundary. It can be explained by the fact that in AM 0061 reference project the TPP described covers about 95% of the electricity production of the country. It means that the emission factor of the TPP is similar to the Grid emission factor and any measures leading to the TPP emission factor lowering at the same time lead to the Grid emission factor lowering. In Ukraine, where the proposed Project takes place, it is impossible to apply, because the Grid emission factor is being calculated taking into account that about the half of the electricity production is being covered by the NPPs and HPPs. In that case the Grid emission factor is lower then the emission factor of the electricity produced by the coal-based TPP. But the TPPs cannot be excluded from the energy sector of Ukraine, because they provide electricity in the manoeuvre load.

For the Project the own Approach will be provided. Project will use a baseline and monitoring plan in accordance with "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 02.2)[10].

In the proposed project CO_2 emissions to atmosphere will be reduced through the efficiency increase of power generation at the Luhanskaya TPP after the optimisation of the regimes, servicing, fuel preparations, reconstruction of the boiler, the turbine equipment, the control and regulation system, the electro-generation and the cooling system.

The energy production depends on the demand of the market. The station can increase the energy production at any time. It means that all the additional energy produced during the Project period will substitute the energy, which would have been produced by the TPP, but with the less efficiency and higher GHG emission.

The proposed Approach for the emission reductions' calculation uses the specific fuel rate (SFRy) parameter. This parameter (described in the Annex 2) shows the efficiency level of the fuel combustion at the TPP and, consequently, the emissions from the fuel combustion. This parameter is being calculated in the energy units and allows seeing the actual picture of the energy efficiency measures provided on the Station.

Identification of the most plausible baseline scenario for the rehabilitation and/or energy efficiency improvement of the power plant through the application of the following steps:

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

Sub-step 1a. Define alternatives to the project activity

The alternatives to the project activity's energy efficiency measures are:

Alternative 1. The proposed project activity not undertaken as a JI project (the technical description of the activities within this alternative is shown in the section A.4.2.);

Alternative 2. The reconstruction of the boiler equipment without the rehabilitation of the turbine and power generator:

- repair of the boiler unit and supporting equipment;
- replacement of the metal housing;
- repair of the steam pipelines;
- replacement of the coiled pipes;
- total replacement of the water-wall tubes and water economizer;
- repair of the separation equipment;

[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v2.2.pdf

- overhaul and repair of the all pipelines and steam pipelines;
- cleaning and repair of the tubular air heater;
- overhaul and replacement of the winding and thermal insulation;
- repair and replacement of fittings.

Alternative 3. The reconstruction of the steam turbine without the rehabilitation of the generator and the boiler:

1. Steam turbine
   - Low pressure cylinder modernization with the rotor change;
   - Change of the end seals;
   - Change of the diaphragms, end and diaphragm seals;
   - Casings change;
   - Overhaul and change of bearings;
   - Feed and exhaust pipe retrofit;
   - Retrofit of the LPC support;
   - Generator and Middle pressure cylinder half-couplings reconstruction;
   - Rotor hydrolifting system installation.
2. Steampipelines
   - overhaul and repairs.
3. Pumping equipment
   - change of the inner casing of the feed pump;
   - overhaul and repair of all pumping equipment.
4. Fittings
   - overhaul and in case of need – repair and change of the fittings.
5. Insulation
   - overhaul and rehabilitation of the high and middle pressure equipment insulation;
   - repair of the feed-water pipeline insulation.
6. Control system
   - equipping of the turbine with the electronic control, monitor and regulation system.
7. Electric filters
   - change of the electrodes;
   - change of the gas distribution gates;
   - change of the filter control system;
   - overhaul and repair of the filter system.

Alternative 4. The rehabilitation of the power generator without the rehabilitation of the boiler and the turbine equipment:

- replacement of the stator winding;
- modernization of the cooling system of the generator with the replacement of the gas condensers;
- repair of the transformer;
- modernization of the cooling system of the transformer.

Alternative 5. Servicing of the equipment, optimisation of the working regimes, and optimisation of the fuel parameters without the rehabilitation. These measures include minor changes in the technology, the replacement of some details and components. The fuel parameters optimisation means higher level of the incoming inspection of the fuel parameters: oxidation, ash content, net caloric value, etc. The optimisation of the working regimes is the most efficient working regime of the Unit (the temperature, the load, etc.)

Alternative 6. Investments in new generation capacity. This alternative includes the termination of the existing equipment operation and it's conservation with the installation of the absolute new boiler, turbine and generating equipment on the same site;

Alternative 7. Continuation of the existing situation. The existing situation is the situation of the equipment usage without any major investments in the reliability and repairs. The repairs are being provided on occasion, if some emergency accidents occur. There would not be any schedule for the repairs or major repairs. The fuel consumption would consist of a low-grade coal use with a view to achieve the financial economy. But the

usage of the low-grade fuel results in the lower efficiency and the equipment lifetime. In this situation the TPP would continue it's operation with the constant lowering of the efficiency.

Outcome of Step 1a:
Alternative 1. The proposed project activity not undertaken as a JI project;
Alternative 2. The reconstruction of the boiler equipment without the rehabilitation of the turbine and power generator;
Alternative 3. The reconstruction of the steam turbine without the rehabilitation of the generator and the boiler;
Alternative 4. The rehabilitation of the power generator without the rehabilitation of the boiler and the turbine equipment;
Alternative 5. Servicing of the equipment, optimisation of the working regimes, and optimisation of the fuel parameters without the rehabilitation.
Alternative 6. Investments in new generation capacity;
Alternative 7. Continuation of the existing situation.

Sub-step 1b. Consistency with mandatory applicable laws and regulations
All the alternatives to the project outlined in Step 1a above are in compliance with applicable laws and regulations. Any major reconstructions in the energy sector of Ukraine have to consist the environmental impacts assessments and all the measures, described as the alternatives should also have such an assessment.
Generally, the power sector of Ukraine is being regulated by such laws:
Ukrainian Law on Power Industry from 16 October 1997, N 575/97-BP[11] is the basic law in Ukraine that determines legal, economic, and organizational activities relevant to electricity and regulates the relationships linked with generation, distribution and consumption of power, energy security of Ukraine, competition and other aspects of power industry. The law stimulates and ensures sustainability issues related to the power industry: such as rational fuel consumption, technological development, and environmental safety.
In 1996, Ukraine adopted the National Energy Program until 2010[12], designed to rehabilitate working thermal power plants to allow them to continue operating for the next 25 years. As a way to reach this objective, the program's mandate specified technological improvements, use of renewable energy sources and modernization of the power plants, including making them more environmentally friendly. The program also specified that combined cycle-gas turbine equipment- as well as most of the auxiliary equipment - needed to be improved to reach acceptable safety levels. Good-quality coal was to be used to reduce environmental damage. However, many of these reconstruction and modification projects have been seriously delayed because of the shortage of state budget financing, weak legislation, and the lack of private investment.
To make the country less dependent on energy imports, the President has issued a Decree on measures to increase energy security of Ukraine (21 October 2005), and called for the elaboration of an Energy Strategy covering the period until 2030. The Cabinet of Ministers Resolution No. 145-p approved the new Energy Strategy up to 2030 in March 2006[13].

Outcome of Step 1b:
Alternative 1. The proposed project activity not undertaken as a JI project;
Alternative 2. The reconstruction of the boiler equipment without the rehabilitation of the turbine and power generator;
Alternative 3. The reconstruction of the steam turbine without the rehabilitation of the generator and the boiler;

[11] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=575%2F97-%E2%F0

[12] http://www.uazakon.com/document/spart91/inx91184.htm

[13] http://zakon.rada.gov.ua/signal/kr06145a.doc

Alternative 4. The rehabilitation of the power generator without the rehabilitation of the boiler and the turbine equipment;
Alternative 5. Servicing of the equipment, optimisation of the working regimes, and optimisation of the fuel parameters without the rehabilitation.
Alternative 6. Investments in new generation capacity;
Alternative 7. Continuation of the existing situation.

Step 2. Barrier Analysis

Sub-step 2a. Identify barriers that would prevent the implementation of type of alternative scenarios.
1.The most important barrier that would prevent the implementation of the project is an investment barrier. During past 15 years only 2 projects for the TPP rehabilitation were implemented in Ukraine on the state-owned TPPs and were financed by the grants and the government financing (the rehabilitation of unit #8 of Zmievskaya TPP co-financed by the WB in 1998[14] and the rehabilitation of unit #4 of Starobeshevskaya TPP financed by the EBRD during 2000 to 2004[15]). The proposed Project is being implemented by the private company and all the financial risks are put on the Project owner. Only the possibility of the JI registration could push it forward.
2. Another significant barrier for the Project implementation is that the proposed Project is the first of it's kind in the Host Country (Ukraine). The above-mentioned projects, financed by the grants and government financing, contained absolutely different packages of measures in comparison with the "Reconstruction of the units at the Structure Unit "Luhanskaya TPP" of the "Skhidenergo" ltd." Project. So, there are no historical data concerning the consequences of such a large-scale projects.
3. Another significant barrier is the technical one. The TPP is a very complicated system, which consists of the groups of equipment and only if these groups work coherently the result will be positive. It means that all of the groups of measures implemented on the TPP should be coordinated with the other parts of the system. Besides, some new equipment will be implemented on the Units and there is no experience or historical data that could show the possibility of the effective work of such a systems.
4. The fourth barrier for the Project implementation is the world financial crisis and the unstable political and economical situation in the Host Country (Ukraine). Ukraine has one of the lowest electricity tariffs in Europe[16]. That is why, it is really hard invest some cost for the Reconstruction or the rehabilitation of the equipment. All the electricity produced by the TPP is supplied to the National Grid of Ukraine and the state pays for it. But in the financial crisis situation the state pays for the supplied electricity with the delays. The other thing is that "Skhidenergo" is the private company. All the rest of the electricity generated in Ukraine is produced by the state-owned companies. And first of all, the state pays for the electricity produced on the state-owned companies and only after that – to the others. This situation brings a significant uncertainty into the long-term investment projects.

Outcome of Step 2a:
1. Investment barrier.
2. Lack of prevailing practice.
3. Technical barrier.
4. Unstable financial and political situation in the Host Country plus financial crisis.

Sub-step 2b. Eliminate alternative scenarios, which are prevented by the identified barriers:

[14] http://pdf.usaid.gov/pdf_docs/PNADD867.pdf

[15] http://www.ebrd.com/new/pressrel/1996/107dec17.htm

[16] "Nasha gazeta", №35, July, 2009 - http://dtek.com/press/corp_newspaper/

1. The investment and other barriers are eliminating the *Alternative 1* (see ***Sub-step 2a***). Only a JI registration can push the rehabilitation forward and allow the Project to be implemented. It also can stimulate the project owner to provide this kind of projects on the other TPPs.
2. The *Alternative 2* will allow the Project Owner to save financial resources for the Project implementation and the efficiency of the boiler part of the Power-Generating Unit will be improved. But, at the same time, the boiler cannot be rehabilitated without getting the whole Power-Generating Unit off the operation. It means that the loses will be the same as for the whole unit rehabilitation. And the efficiency of the unit after this kind of partial rehabilitation will be significantly lower then after the whole Unit rehabilitation. So, the *Alternative 2* is technically possible, but not reasonable and feasible.
3. The *Alternative 3* will also allow the Project Owner to save financial resources for the Project implementation and the efficiency of the steam turbine within the Power-Generating Unit will be improved. But, at the same time, the steam turbine, just as the boiler or the power generator cannot be rehabilitated without getting the whole Power-Generating Unit off the operation. It means that power-generating unit will be out of the operation during the time of the steam turbine rehabilitation. And the efficiency of the unit after this kind of partial rehabilitation will be significantly lower then after the whole Unit rehabilitation. So, the *Alternative 3* is technically possible, but not reasonable and feasible.
4. The *Alternative 4* is not feasible for the same reasons as the *Alternatives 2 and 3*.
5. The *Alternative 5* allows saving the finances in the short-term perspective but the effectiveness of these measures without the rehabilitation will be limited. Optimisation of the working regimes is limited by the technical condition of the equipment. Without the rehabilitation, the work at the optimal regime and manoeuvring is possible in a very small range. Consequently, it results in the fuel consumption and GHG emission increase. Thus, the *Alternative 5* is only possible in a short-term perspective and is not feasible or reasonable.
6. The financial barrier also eliminates the *Alternative 6*. The cost of the new power generating plant with the same approximate capacity would cost around 1 000 USD/kW[17]. It means that the construction of the new TPP with the same loading capacity as Luhanskaya TPP will cost around 1.5 Billion USD. Even the JI registration does not allow accumulating the amount of money to build a new generation capacity.
7. The continuation of the existing situation is the most plausible alternative (*Alternative 7*). The existing situation in the Ukrainian Power Sector has already been described in the "SECTOR BACKGROUND" in section A.4.3. of the PDD. It shows that even the existence of the National Programs or other official documents can't guarantee the implementation of the energy efficiency measures in the Power sector. The main part of them remains on paper.

Outcome of Step 2b:

There is only one alternative scenario that is not prevented by any barrier, and this alternative is not the proposed project activity undertaken without being registered as a JI project. This scenario is *Alternative 7.* Continuation of the existing situation. The existing situation is the situation of the equipment usage without any major investments in the reliability and repairs. The repairs are being provided on occasion, if some emergency accidents occur. There would not be any schedule for the repairs or major repairs. The fuel consumption would consist of a low-grade coal use with a view to achieve the financial economy. But the usage of the low-grade fuel results in the lower efficiency and the equipment life time. In this situation the TPP would continue it's operation with the constant lowering of the efficiency.
This alternative scenario is identified as the baseline scenario.
The most significant impact of JI registration is that the additional hard currency revenue stream from the ERUs enables the company to accept the debt burden and hence allows the project to go ahead.
According to the "Combined tool to identify the baseline scenario and demonstrate additionality"[18]

[17] http://www.necin.com.ua/teplo_elektro_energy/parogaz.htm

[18] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v2.2.pdf

(Version 02.2) we proceed to Step 4.

Step 4. Common practice analysis

Currently in Ukraine, there are the following energy efficiency improvement initiatives underway at the country's various power producing facilities.
During past 15 years only 2 projects for the TPP rehabilitation were implemented in Ukraine on the state-owned TPPs and were financed by the grants and the government financing (the rehabilitation of unit #8 of Zmievskaya TPP co-financed by the WB in 1998[19] and the rehabilitation of unit #4 of Starobeshevskaya TPP financed by the EBRD during 2000 to 2004[20]).
The main measures of the governmental policy have already been described in the Sector Background in Section A.4.3. Main activities described in the Strategy are similar to the Project Activity with minor differences. All these activities are not implemented because of the lack of financial resources. The situation in the energy sector of Ukraine leads to the situation, when most of the TPPs are going to be privatised, but no special targets or activities are going on because of the political and financial uncertainty. The Reconstruction of the Units of the Luhanskaya TPP is one of few projects implementing only because the TPP is a private enterprise and the possibility of the development as JI Project.

Sub-step 4 is satisfied because the similar activities are observed but there are essential distinctions between the proposed JI project activity and similar activities occurs. Then the proposed project activity is additional.

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

>>
The Baseline Scenario is the amount GHG that would have otherwise been generated by the Luhanskaya TPP at the absence of the Project and it was described in the Section B.1. The national regulations for the energy production are described in the "SECTOR BACKGROUND" in section A.4.3. of the PDD.
The Project consists of the full rehabilitation of the Power-Generating Units of the TPP (detailed description is provided in the section A.4.2.).
The greenhouse gases emission in the Project Scenario is reduced by the more efficient use of the fuel. The provision of the TPP rehabilitation will reduce the amount of the fuel combusted for production of the energy unit (MW, Gcal). That means that each MW of energy produced will contain less fuel that means that the greenhouse gases emission per MW (or Gcal) will be less than it would have occurred in the absence of the JI project.
For the first two year period (2006 – 2007), a total of **12 171 444 tonnes of CO2eq** is expected to be produced in the project activity.
For the first two year period (2006 – 2007), a total of **12 867 916 tonnes of CO2eq** is expected to be produced in the baseline scenario.
The total emission reductions of the first two year period (2006 - 2007) are **696 472 tonnes of CO2eq.**
For the five year period (2008 - 2012), a total of **27 277 796 tonnes of CO2eq** is expected to be produced in the project activity.
For a five (2008 - 2012) year period, a total of **28 981 847 tonnes of CO_2 eq** is expected to be produced in the baseline scenario.
The total emission reductions of the five year period are **1 704 051 tonnes of CO2eq**.
For the ten year period (2013 - 2022), a total of **57 544 978 tonnes of CO2 eq** is expected to be produced in the project activity.

[19] http://pdf.usaid.gov/pdf_docs/PNADD867.pdf

[20] http://www.ebrd.com/new/pressrel/1996/107dec17.htm

For a ten year period, a total of **68 971 655 tonnes of CO2eq** is expected to be produced in the baseline scenario.
The total emission reductions of the ten year period are **11 426 677 tonnes of CO2eq**.
The detailed calculations for each year are provided in the Appendix 1.

Table 5. Annual estimation of emission and emission reductions in the early credits period

Year	Estimation of project activity emissions (tonnes CO2 e)	Estimation of baseline emissions (tonnes CO2 e)	Total emission reduction (tonnes CO2 e)
2006	5 627 760	5 935 895	308 135
2007	6 543 684	6 932 021	388 337
Total (tonnes of CO2)	12 171 444	12 867 916	696 472

Table 6. Annual estimation of emission and emission reductions for the crediting period

Year	Estimation of project activity emissions (tonnes CO2 e)	Estimation of baseline emissions (tonnes CO2 e)	Total emission reduction (tonnes CO2 e)
2008	6 705 278	7 098 053	392 775
2009	5 182 666	5 400 100	217 434
2010	4 944 257	5 143123	198 866
2011	5 274 855	5 643 867	369 012
2012	5 170 740	5 696 702	525 962
Total (tonnes of CO2)	27 992 340	29 688 325	1 704 051

Table 7. Annual estimation of the emission emission reductions for the post-Kyoto period

Year	Estimation of project activity emissions (tonnes CO2 e)	Estimation of baseline emissions (tonnes CO2 e)	Total emission reduction (tonnes CO2 e)
2013	5 168 888	5 878 027	709 139
2014	5 349 092	6 263 491	914 399
2015	5 284 081	6 345 147	1 061 066
2016	5 963 274	7 212 141	1 248 867
2017	5 963 274	7 212 141	1 248 867
2018	5 963 274	7 212 141	1 248 867
2019	5 963 274	7 212 141	1 248 867
2020	5 963 274	7 212 141	1 248 867
2021	5 963 274	7 212 141	1 248 867
2022	5 963 274	7 212 141	1 248 867
Total (tonnes of CO2)	57 544 978	68 971 655	11 426 677

Assumptions:

- The calculations of the Baseline Emissions, Project Emissions and the Emission Reductions for the 2006 – 2009 were based on the actual data for these years. The calculations for the 2010 – 2022 are based on the planned data. During the project the actual data for will be used for the calculations.

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

>>

The project activity encompasses efficiency improvements in the Luhanskaya Power Plant. The spatial extent of the project boundary includes the project site and all the Units of the Luhanskaya TPP.

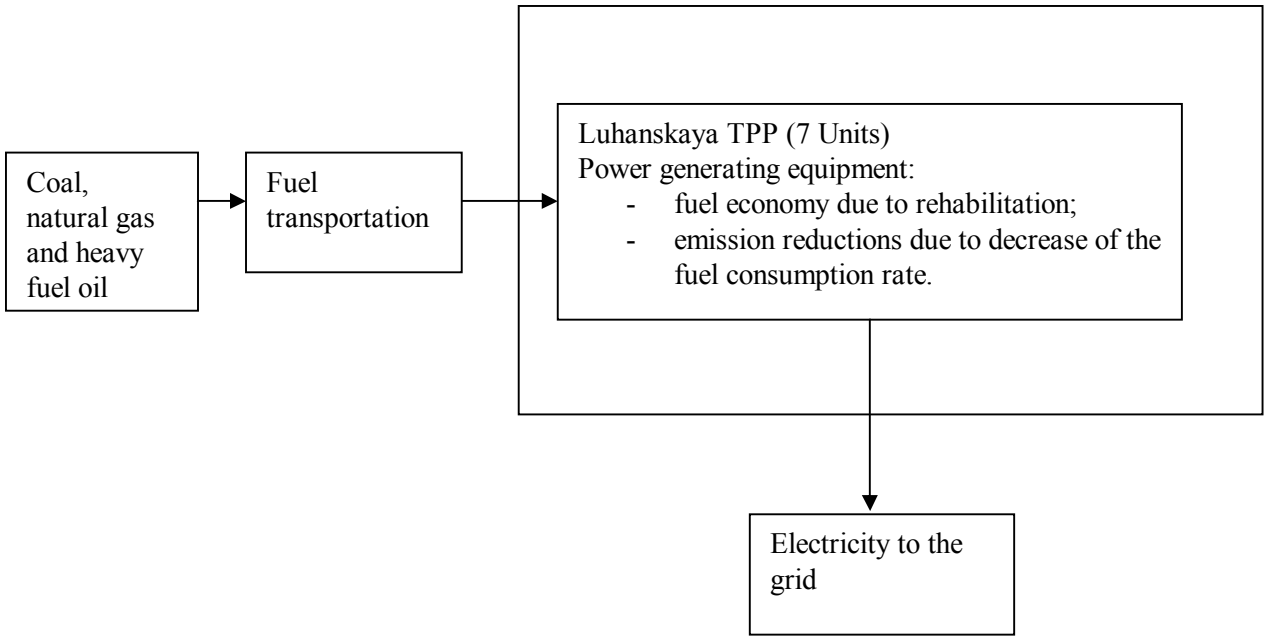

Figure 3. Project boundary

Sources and gases included in the project boundary are indicated in the table below.

Table 6. Sources of emission in the Baseline Scenario and in the Project

	Source	Gas	Included	Justification / Explanation
Baseline	Baseline Power plant emission	CO_2	Yes	CO_2 is formed with the combustion of fuels.
		CH_4	No	Minor source, can be neglected (conservative approach).
		N_2O	No	Minor source, can be neglected.
Project Activity	Project Power Plant emission	CO_2	Yes	CO_2 is formed with the combustion of fuels.
		CH_4	No	Minor source, can be neglected (conservative approach).
		N_2O	No	Minor source, can be neglected

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 the baseline setting: 15/07/2009

Name of the person(s)/entities setting the baseline: JSC IEA "Elta"

Detailed contact information in Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>
18/03/2005 (Contract № 03/2005/244 dated 18.03.2005).

C.2. Expected operational lifetime of the project:

>>
20 years (240 months).
The rehabilitations provided as the Project Scenario provides the operational lifetime increase for 20 years.

C.3. Length of the crediting period:

>>
17 years (204 months). 2006 – 2022 (or other, according to the actual UNFCCC decision).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

>>

Monitoring plan according to the Baseline chosen supposes the measurement of the fuel (coal, natural gas, heavy fuel oil) consumption, electricity production, supply and heat supply during a year with the monthly calculation of the emission reductions. Thermal energy delivery is minor and getting lower (from 1,3% of the energy produced in 2003 to 0,6% in 2008) only because of the energy efficiency measures and lowering of the loses (the demand for the thermal energy is constant – heating for the Schastye town). We make a conservative assumption that in the project scenario the thermal energy delivery and production will remain around 1% of the fuel consumption and do not take it into account in the calculations. The Specific fuel rate (SFRy) coefficient is also calculated separately for the electricity and the thermal energy. The calculations of the fuel consumption by the TPP are being made in the tons of the equivalent fuel (According to the GKD-34.09.103-96, approved by the Ministry of Energy and Electrification of Ukraine in 1996). One ton of the equivalent fuel is 7 Gcal or 29,33 GJ (see Annex 2). This method takes the NCV of the fuel into account and allows comparison of the parameters for the different years. The SFR coefficient shows the fuel consumption per the electricity supplied to the grid. It means, that the own consumption of the TPP is taken into account. For the period of 2003 – 2005 (before the start of the Project) the SFR coefficient changed in a very small range and we make a conservative assumption and take the average rate as the Baseline SFRb coefficient (see Annex 2).

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 PEy	Project emission in year y	calculations	t of CO_2 eq	c	yearly	100%	electronic, paper	Calculated by formulae (1) in chapter D.1.1.2., see below
P2	Specific Fuel	calculations	GJ/MW	c	monthly	100%	electronic, paper	Measured, then

SFRy	Rate in year y							calculated monthly (see. Annex 2, formula (4))
P3 SFiy	The share of fuel i consumed for energy production in year y	Scales, gas meter, fuel meter	-	m/c	monthly	100%	electronic, paper	The meters measure the amount of fuel used in a real time, then the parameter is calculated according to the NCV of the fuel i.
P4 OXIDiy	Oxidation factor of the fuel i in year y	IPCC Guidelines for RGGI[21]		e	Before start	100%	electronic, paper	estimated: coal – 0.98; heavy fuel oil – 0.99; natural gas – 0.995.
P5 EFiy	Emission factor of the fuel i in year y	IPCC Guidelines for RGGI	t CO2/TJ	e	Before start	100%	electronic, paper	estimated: coal – 96 tCO2/TJ; heavy fuel oil – 77 tCO2/TJ natural gas – 56 tCO2/TJ
P6 AELSy	The amount of the electricity supplied to the grid in year y	Electricity meters	MW	m	Continuously	100%	electronic, paper	Monitored constantly and archived daily, monthly and

[21] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

								annually

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 calculation of the Project Emissions is provided by the getting of the specific greenhouse gas emission factor of the energy unit supplied to the Grid and then by the multiplication of this parameter by the annual electricity supply to the Grid in the accounting year. The emissions from the combustion of each fuel type (coal, heavy fuel oil and natural gas) is calculated by the multiplication of the Specific Fuel Rate (SFRy) parameter (in energy units), the share of this specific fuel combusted in the accounting year (SFiy), the defined emission factor of this fuel type (EFi) and the oxidation coefficient of the fuel type (OXIDiy)[22]. The greenhouse gas emissions coefficients achieved for the each fuel type are summed up and then multiplied by the annual electricity supplied o the grid in the accounting year.

The Project emission is being calculated as follows:

$PEy = \sum(SFRy * SFiy * OXIDi * EFi) * AELS_y$ **(1),**

where:
PEy – Project emission in year y (tons CO_2);
SFRy – specific fuel rate of the station in year y (GJ/MW)
SFiy – share of fuel i (coal, natural gas or a heavy fuel oil), consumed in year y;
OXIDi - oxidation factor of the fuel i;
EFi - emission factor of the fuel i consumed (tons CO_2/GJ);
$AELS_y$ - the amount of the electricity supplied to the grid in year y (MW)

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*	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?	Comment

[22] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

cross-referencing to D.2.)							(electronic/ paper)	
B1 BEy	Baseline emission	monitoring	t of CO_2 eq	c	Yearly	100%	electronic, paper	Calculated by formulae (2) in chapter D.1.1.4., see below
B2 SFRb	Specific Fuel Rate in the Baseline Scenario	Historical data	GJ/MW	c	Before start	100%	electronic, paper	Measured, then calculated using the historical data (Annex 2, formula (4))

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

>>

The calculation of the Baseline Emissions is provided by the getting of the specific greenhouse gas emission factor of the energy unit supplied to the Grid and then by the multiplication of this parameter by the annual electricity supply to the Grid in the accounting year in the case of the absence of the Project. The emissions from the combustion of each fuel type (coal, heavy fuel oil and natural gas) is calculated by the multiplication of the Specific Fuel Rate (SFRy) parameter (in energy units) in the Baseline Scenario, the share of this specific fuel combusted in the accounting year (SFiy), the defined emission factor of this fuel type (EFi) and the oxidation coefficient of the fuel type (OXIDiy)[23]. The greenhouse gas emissions coefficients achieved for the each fuel type are summed up and then multiplied by the annual electricity supplied o the grid in the accounting year.
The Baseline emission is being calculated as follows:

$BEy = \Sigma (SFR_b * SFiy * OXIDi * EFi) * AELS_y$ **(2),**
where:
BEy – Baseline emission in year y (tons CO_2);
SFR_b – specific fuel rate of the station in the Baseline Scenario (GJ/MW)
SFiy – share of fuel i (coal, natural gas or a heavy fuel oil), consumed in year y;
OXIDi - oxidation factor of the fuel i in year y;

[23] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

EFi - emission factor of the fuel i consumed in year y (tons CO_2/GJ);
$AELS_y$ - the amount of the electricity supplied to the grid in year y (MW)

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

This section left blank. No direct monitoring expected.

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

See sec. D.1.2.

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):

>>
See sec. D.1.2.

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

This section is left blank, as due to the Project implementation the fuel consumption is lowered, so the Leakages due to the fugitive CH_4 emission are also lowered[24]. Moreover, this value is vanishingly small and we use the conservative assumption, that the leakage is left the same as in the Baseline Scenario.

[24] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

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

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

>>
See sec. D.1.3

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 emission reductions achieved during the project period are calculated as a difference between annual baseline emission and annual project emission. It is shown by the formula:

ERy = BEy – PEy, **(3)**

Where:
ERy – emission reductions achieved by the project activity in year y;
BEy – baseline CO2 emission in year y;
PEy – project CO2 emission in year y.

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:

>>
For the purposes of the safe and reliable operation and monitoring of the installed equipment the quality control and quality assurance measures are implemented on the TPP in accordance with the current legislation and requirements. According to these requirements of the quality control system regular servicing and test mode

of the instrumentation is provided. All the measurement equipment is being regularly calibrated. The information of the calibration is being stored and to be checked by the independent entity annually. The check for the data accuracy and calculation of the emission reductions shall be made and collected monthly. According to the current Ukrainian laws and requirements the measurement of the pollution of dust, soot, NOx, CO, etc. should be monitored and documented. These parameters are reflected in the standard form 2TP-Air (the latest edition was approved by the National Statistics Committee of Ukraine Order #223 dated 30.06.2009). The TPP also receives the Pollution Permission from the Ministry of the Environmental Protection of Ukraine.

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.
P3 SFiy The amount of fuel used for energy production	Low	The data from the belt-conveyer weigher (for coal) are controlled after installation and regularly controlled and verificated in accordance with the service instruction of the producer. All defects should be rectified with the consequent calibration. The gas meter is controlled and calibrated by the gas supplying company in accordance with its procedures and current legislation. The defected meter should be replaced. The Levels of the accuracy of the meters are shown in the Annex 3.
P6 AELSy The annual electricity supply	Low	The data from the electric counters are controlled after installation and regularly controlled and verificated in accordance with the service instruction of the producer and the legislation requirements. The defected counter should be replaced.

Regardless of Monitoring Plan all the data from the meters and weighs should be controlled daily. In addition to the parameters mentioned, other data should be read to control the operation of the equipment.
Any defective equipment should be replaced or repaired as soon as possible.
According to the current Ukrainian laws and requirements the measurement of the pollution of dust, soot, NOx, CO, etc. should be monitored and documented.
The monitoring of the Fuel Consumption is provided daily and reflected in the reports.
The monitoring of the NCV of the fuel is provided in the certified TPP laboratory.
The monitoring of the electricity supply to the Grid is provided continuously and reflected in the daily reports.
All the data measured and the SFR calculated value is reflected in the monthly reports and in the yearly “3-tech” form.

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

>>

The project is implemented on the TPP in accordance with technical standards of Ukraine. All the equipment has monitoring and security equipment according to the national energy sector requirements. All the data, needed for the monitoring is collected in the production department of the TPP and accumulated in a specific standard table called "3-tech Form" and also the data from the meters will be collected. The main parameters of the Station are measured by the meters and shown in graphs in a real time. The data of the fuel consumption is measured and collected for the whole TPP and the energy produced is measured per each unit separately. This allows to measure the average emission for all the TPP and to see the influence of the Project activity while some of the units are out of operation. All the starts and stops of each Unit are monitored and also shown in the technical documentation alongside with the working time hours for each Unit of the TPP. That means, that even when some unit will be out of operation, all the measures will continue to be collected and the overall project emission will still be calculated. All the calibrations and checks of the equipment are also documented.

The electricity supply is being monitored by the Electricity Department of the TPP at the central electric pane of the TPP and sent to the Technical Production Department (TPD).

The coal consumption is being monitored daily by the Fuel-Transport Department. The reports are also sent to the TPD.

The heavy fuel oil consumption is being monitored daily by the Boiler-Turbine Department of the TPP. The reports are sent to the TPD.

The natural gas consumption is being monitored by the Gas Distribution System. The daily reports are also sent to the TPD.

The data of the Net Caloric Value of the fuel is being provided to the TPD by the certified laboratory of the TPP daily.

The TPD collects all the data and calculate the Specific Fuel Rate daily. After that, the data is being summarized in the monthly reports and in the annual report called "3-tech" Form.

All the measures will be send to the project manager of the "ELTA" company, who will collect the data, calculate emission, emission reductions and create a monitoring report.

All the data shall be stored in the paper and electronic form at the TPP and in the data base of the "ELTA" company during all lifetime of the project.

The project manager from the «ELTA» company checks the reliability of the data and calculates emission reductions at least monthly. The project manager of the "ELTA" prepares the annual report to be confirmed by the Independent Entity.

The Project operator - «Skhidenergo», provides all the maintenance work and services. The Project manager of the "ELTA" company provides monitoring and data collection.

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

>>

Date of the completion of the Monitoring plan: 15.08.2009.

Mr. Maksym Rogovoy
ELTA JSC
14/3, Stadionny proezd str.

Kharkov, Ukraine
61091
Telephone: + 38 050 5950311
Fax: + 38 057 392 0045
M_rogovoy@elta.kharkov.ua

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

The following calculations are based on the baseline determined in the Section B.2. and formulas (1), (2) and (3) in the Sections D.1.1.2, D.1.1.4. and D.1.4. The energy produced after the rehabilitation has a lower emission factor compared to the one before the rehabilitation. Higher efficiency of the TPP Units reflects in lower fuel consumption per GJ of the energy produced by the TPP. We calculate emission per MW of the electricity supplied to the grid. The conservative assumptions are used in all the calculations. All the data used for the calculations are lowered by the precision and accuracy level of the measuring equipment.

As the Project uses the own Approach, all the formulas used to calculate the Project emissions, the Baseline emissions and the Emission reductions are original. Some aspects from the AM0061 Methodology were used.

*Table **E-1.** Estimated project emissions (see formula (1) in Section D.1.1.2)*

Estimated project emissions [t CO2 eq / year], early credits period		
Year	2006	2007
Emission	5 627 760	6 543 684

Estimated project emissions [t CO2 eq / year], crediting period					
Year	2008	2009	2010	2011	2012
Emission	6 705 278	5 182 666	4 944 257	5 274 855	5 170 740

Estimated project emissions [t CO2 eq / year], post-Kyoto period										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Emission	5 168 888	5 349 092	5 284 081	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274

E.2. Estimated leakage:

>>

This section is left blank. See. Section D.1.3.

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

>>

*Table **E-3.** Estimated project emissions plus leakages.*

Estimated project emissions plus leakage [t CO2 eq / year], early credits period		
Year	2006	2007
Emission	5 627 760	6 543 684

Estimated project emissions plus leakage [t CO2 eq / year], crediting period					
Year	2008	2009	2010	2011	2012
Emission	6 705 278	5 182 666	4 944 257	5 274 855	5 170 740

Estimated project emissions plus leakage [t CO2 eq / year], post-Kyoto period										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022

Emission	5 168 888	5 349 092	5 284 081	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274	5 963 274

E.4. Estimated baseline emissions:

>>

*Table **E-4.** Estimated baseline emissions (see formula (2) Section D.1.1.4)*

Estimated baseline emissions [t CO2 eq / year], early credits period		
Year	2006	2007
Emission	5 935 895	6 932 021

Estimated baseline emissions [t CO2 eq / year], crediting period					
Year	2008	2009	2010	2011	2012
Emission	7 098 053	5 400 100	5 143123	5 643 867	5 696 702

Estimated baseline emissions [t CO2 eq / year], post-Kyoto period										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Emission	5 878 027	6 263 491	6 345 147	7 212 141	7 212 141	7 212 141	7 212 141	7 212 141	7 212 141	7 212 141

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

>>

*Table **E-5.** Emission reductions of the project (formula (3) from Section D.1.4)*

Estimated emission reductions of the project [t CO2 eq / year], early credits period		
Year	2006	2007
Emission reductions	308 135	388 337

Estimated emission reductions of the project [t CO2 eq / year], crediting period					
Year	2008	2009	2010	2011	2012
Emission reductions	392 775	217 434	198 866	369 012	525 962

Estimated emission reductions of the project [t CO2 eq / year], post-Kyoto period										
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Emission reductions	709 139	914 399	1 061 066	1 248 867	1 248 867	1 248 867	1 248 867	1 248 867	1 248 867	1 248 867

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

>>

*Table **E-6.** Project emissions, Baseline emissions and emission reductions of the early credits period*

Year	Estimated project emissions (tonnes CO2 equivalent)	Estimated leakage (tonnes CO2 equivalent)	Estimated baseline emissions (tonnes CO2 equivalent)	Estimated emission reductions (tonnes CO2 equivalent)
2006	5 627 760	0	5 935 895	308 135

2007	6 543 684	0	6 932 021	388 337
Total (tonnes of CO2 equivalent)	12 171 444	0	12 867 916	696 472

*Table **E-7.** Project emissions, Baseline emissions and emission reductions of the crediting period*

Year	Estimated project emissions (tonnes CO2 equivalent)	Estimated leakage (tonnes CO2 equivalent)	Estimated baseline emissions (tonnes CO2 equivalent)	Estimated emission reductions (tonnes CO2 equivalent)
2008	6 705 278	0	7 098 053	392 775
2009	5 182 666	0	5 400 100	217 434
2010	4 944 257	0	5 143123	198 866
2011	5 274 855	0	5 643 867	369 012
2012	5 170 740	0	5 696 702	525 962
Total (tonnes of CO2 equivalent)	27 992 340	0	29 688 325	1 704 051

*Table **E-8.** Project emissions, Baseline emissions and emission reductions of the post-Kyoto period.*

Year	Estimated project emissions (tonnes CO2 equivalent)	Estimated leakage (tonnes CO2 equivalent)	Estimated baseline emissions (tonnes CO2 equivalent)	Estimated emission reductions (tonnes CO2 equivalent)
2013	5 168 888	0	5 878 027	709 139
2014	5 349 092	0	6 263 491	914 399
2015	5 284 081	0	6 345 147	1 061 066
2016	5 963 274	0	7 212 141	1 248 867
2017	5 963 274	0	7 212 141	1 248 867
2018	5 963 274	0	7 212 141	1 248 867
2019	5 963 274	0	7 212 141	1 248 867
2020	5 963 274	0	7 212 141	1 248 867
2021	5 963 274	0	7 212 141	1 248 867
2022	5 963 274	0	7 212 141	1 248 867
Total (tonnes of CO2 equivalent)	57 544 978	0	68 971 655	11 426 677

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 rehabilitation of each Unit of the TPP consists the description of the Environmental impacts. For today only the Unit #10 has been developed.

The environmental impacts of the Project are described in the Explanatory Note "Draft Environmental Impact Assessment of the Project of the Unit#10 of the Luhanskaya TPP", which is the part of the Technical and Economical Substantiation of the Project.
No transboundary or adverse environmental impacts are expected.

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:

>>
No negative environmental impacts of the project are expected and there are no special procedures required by the host Party (Ukraine) for this Project.

SECTION G. Stakeholders' comments

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

>>
The Project was presented to the Government of Ukraine and to the Local Authorities as a Project Idea and, later, as the Technical Documentation. The Government and Local Authorities have approved the Project. The Letter of Endorsement has been received from the National Environmental Investments Agency of Ukraine. The
The information concerning the Project was published in the magazine «NASH VYBOR» №2 (14) ' 2008 (http://www.nash-vybor.com.ua/claus.php?id=322).
All the comments received were positive.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

The Project emission reductions are achieved due to lowering of the fuel consumption per MW of the energy supplied. The rehabilitation of the equipment allows increasing the efficiency of the fuel usage by the TPP. This allows lowering the emission coefficient of the energy supplied from 1,1953 t CO2/MW to 1,0187 t CO2/MW (0.283 t CO2 per GJ).

In calculations the data from the IPCC Guidelines for RGGI used:
The emission factors of the fuel used (EFiy) are 26.8 t C/TJ (98 t CO2/TJ) for coal; 15.3 t C/TJ (56 t CO2/TJ) for natural gas: 21.1 t C/TJ (77 t CO2/TJ) for heavy fuel oil.
The oxidation coefficient (OXIDi) of the fuel used is 0.98 for coal, 0.995 for natural gas and 0.99 for heavy fuel oil.

For calculations of the baseline emissions the historical data of the years 2003, 2004 and 2005 was used.
During these years the all Units were in operation and this data allows seeing the average parameters of the TPP in the baseline scenario:

Annual electricity supply by the TPP:
AELS2003 = 3 423 814 MW;
AELS2004 = 3 237 669 MW.
AELS2005 = 3 835 673 MW
AELSbl = (3 423 814 + 3 237 669 + 3 835 673)/3 = **3 499 052 MW**

For the Calculations of the Baseline emission the value of the Specific Fuel Rate (SFR) was used. This parameter is commonly used in energy sector and it shows the fuel (energy) consumption per the electric energy supplied to the grid.
$SFRy = \sum (Fiy * NCViy) / 7 / AELSy$ **(4)**
Where
SFRy – specific fuel rate in year y (tef);
Fiy – the amount of the fuel i consumed in year y (tons(th.m3));
NCViy – net caloric value of the fuel i in year y (Gcal/ton(th.m3));
AELSy – annual energy supply in year y.

All the data achieved in the calculations is being lowered by the uncertainties and accuracy level of the measuring equipment. (According to the GKD-34.09.103-96, approved by the Ministry of Energy and Electrification of Ukraine in 1996).
It is usually measured in the grams of the equivalent fuel per kW (tons per MW) of the energy supplied to the grid. One ton of the equivalent fuel (tef) is 29.33 GJ or 7 Gcal. The calculation of the SFR shows the fuel consumption irrelative of the type of the fuel. All the amount of the natural fuel is multiplied by the net caloric value of the fuel (specifically consumed) and these values are summed up. The use of the SFR parameter shows the real fuel efficiency of the TPP independent of the fuel quality and the net caloric value and allows comparing the fuel efficiency data of the different time periods.
For the purposes of the Baseline emission calculation such a data was used:
SFR2003 = 0.4485 tef/MW (13.1545 GJ/MW)
SFR2004 = 0.4401 tef/MW (12.9081 GJ/MW)
SFR2005 = 0.4252 tef/MW (12.4711 GJ/MW)

SFRb = (SFR2003 + SFR2004 + SFR2005)/3 = **0.4379 tef/MW (12.8446 GJ/MW)**

The calculations are based on the historical data:
Coal consumption 2003 – 1 881 000 tons with the net caloric value 5.639 GCal / t;
Coal consumption 2004 – 1 742 000 tons with the net caloric value 5.637 GCal / t;
Coal consumption 2005 – 1 936 797 tons with the net caloric value 5.787 GCal / t.

Heavy fuel oil 2003 – 18 700 tons with the net caloric value 8,589 GCal / t;
Heavy fuel oil 2004 – 22 100 tons with the net caloric value 9,129 GCal / t;
Heavy fuel oil 2005 – 25 100 tons with the net caloric value 9,391 GCal / t.

The shares of the different types of the fuel (SFi) are also used for 2003 – 2005: coal – 97.27%, heavy fuel oil –0.13% and natural gas – 2.6%.

The Baseline Emissions are calculated for each year in accordance with the electricity supply and the changes of the fuel mix. The fixed parameters are the IPCC default values and the Specific Fuel Rate for the Baseline Scenario, which is defined for the TPP without the Project activities.

Annex 3

MONITORING PLAN

As emission reductions from the project are determined by the amount of each fuel used, and the electricity supplied to the grid by the power plant a monitoring system to monitor the fuel usage and the electricity production implemented on the TPP will be used. All the data will be documented and stored in electronic and paper view during the lifetime of the project.

Meter reading and calculation of the emission reductions is carried out on a monthly basis.

The meters will be examined, tested, debugged and calibrated every, lead sealed after checking and accepting and must not unseal without the permission. As the instruments are calibrated and marked at regular intervals, the accuracy of measurement can be assured at all times.

The fuel usage system involves measuring of the coal, natural gas, and heavy fuel oil consumption. All measurements will use calibrated measurement equipment.

Coal supply metering is provided by two belt-conveyer weighers VK-230-1400 with the accuracy class 0.5 ÷ 1 and relative precision of ± 0.5 ÷ 1%.

The natural gas supply metering to the project is provided using the meter "Leader-VG-1" with the accuracy class 0.2 and relative precision of ± 0.2%. The meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the gas supply company.

The electricity measuring system involves several meters, which are located at the power plant side on the transformer substation. The types of meters are EA02RAL-P4C (27 units), SL-7000 (2 units), F68700V (1 unit) and AIR – 3OL – C4-T (23 units) with accuracy of 0.2 %.

The heat supply to the Kurakhovo town network is measured by the ergometer Type 125 «A» with the accuracy class 2.5 and relative precision of ± 1%.

All the uncertainties are taken into account in the calculations.

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