JOINT IMPLEMENTATION PROJECT

"Reconstruction of the power units at the "Zaporizka TPP" of the "Dniproenergo" JSC."
(project title)

Position of the head of the company, project developer

Director "Elta-Eco" LLC
(position)

(signature)

seal

Rogoviy Maksym Ivanovich
(surname, name and patronymic of the person)

Position of the head of the company, project owner, owner of the source

General Director
"Dniproenergo" JSC.
(position)

(signature)

seal

Код №00130872

Magera Yuriy Mikhaylovych
(surname, name and patronymic of the person)

Kharkiv, January 2012

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

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SECTION A. General description of the project

A.1. Title of the project:

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Title: **"**Reconstruction of the power units at the "Zaporizka TPP" of the "Dniproenergo" JSC.**"**

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

Version: 1.3.1

Date: 31 January 2012

A.2. Description of the project:

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The Zaporizka TPP was put into operation in 1977, and since 1995 it is a structure unit of the "Dniproenergo" JSC. This TPP is one of the largest in Ukraine.
The construction of the Zaporizka TPP was implemented in 2 lanes:
I lane – 4 generating units with the capacity of 300 MW each (1200 MW total);
II lane – 3 generating units with the capacity of 800 MW each (2400 MW total).

Figure 1. The Turbine Hall of the Zaporizka TPP.

The overall project-installed capacity of the TPP was 3600 MW.
The generating units of the I lane were constructed for the gas coal combustion.
The energy units of the II lane were constructed for the heavy fuel oil and natural gas combustion and today they are put into conservation.

The list of the installed equipment of the TPP (II lane):
4 boilers of the TPP-312 type (one boiler per Unit), produced by the Taganrog Boiler Plant “Krasnyi Kotelschik”.
4 steam turbines of the K-300-240-2 type, produced by the Kharkiv SPC “Turboatom”.
The installed capacity of the turbines is 300 MW.
4 turbogenerators of the TGB-300 type, produced by the Kharkiv SPC “Electrovazhmash”with the capacity of 300 MW.
The generating units № 5 – 7 (part II) have the TGMP-204 type boilers (by the Taganrog Boiler Plant “Krasnyi Kotelschik”) and the steam turbines of K-800-240-3 type (by the Kharkiv SPC “Turboatom”).
Project foresees modernization of the main and the auxiliary equipment of the all working power generating units of the TPP according to the attached schedule.

Table 1. Project Schedule.

All Units Servicing and Preparations for the Reconstruction	2004 - 2016
Unit №1	2011
Unit №2	2014
Unit №3	2012
Unit №4	2013
Unit №5	-
Unit №6	-
Unit №7	-

The measures include replacement of the out-dated control, automatic systems, electro-technical system, modernization of the boiler equipment, turbine equipment, electric separation system, cooling system, etc.
Thermal energy delivery in project scenario will remain the same as in the baseline scenario. We make the conservative assumption and don’t take the thermal energy delivery into consideration.
The main field of the TPP operation is the electricity production.
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, which will lead to the GHG emission lowering per the energy produced. The specific fuel rate parameter (see Annex 2) is being calculated separately for the electricity and thermal energy. Thus, the emissions and the emission reductions can also be calculated separately.
The increased capacity of the TPP is due to the better efficiency of the existing equipment.
Prior to the starting date of the Project the Zaporizka TPP had been working using it’s equipment without any major repairs or reconstructions. That kind of working lead to the continious working parameters deterioration. The continuation of this situation would have been the Baseline Scenario and the Project Scenario foresees the full-scale reconstruction of all generating equipment, and the all working parameters improvement.
For this purpose in 2006 the contract for the TEA of the on of the Units’ reconstruction was signed. That was the first major step under way to the Project implementation and, as Ukraine was the party of the Kyoto Protocol, one of the main arguments in favor of the Project was the possibility of it’s registration as the JI Project.
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)	Dniproenergo JSC.	No
Ukraine	Elta-Eco LLC.	No
Netherlands	ING Bank N.V.	No

* Please indicate if the Party involved is a host Party.

- Dniproenergo JSC.
  Project Owner, Owner of the emission reduction units

- Elta-Eco LLC.
  Project Developer.

- ING Bank N.V.
  The potential buyer of the emission reduction units.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

>>
Ukraine

Figure 2. Ukraine

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

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Zaporizhzha region, South-East Part of Ukraine

Figure 3. Zaporizhzha region[1]

[1] http://www.mapzones.com/maps/ukraine/zaporizhzhya.php

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

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Energodar town, Zaporizhzha region, Ukraine

Figure 4. Energodar town and the Zaporizka TPP[2]

[2] http://google.earth.com

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 Zaporizhzhya region, Energodar town, Promyslova street 43. Energodar town is located at the following coordinates: 47°30'N and 34°37'E[3].

Figure 5: Zaporizka TPP.

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

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4 of the units at the Zaporizka Thermal Power Plant have a design capacity of 300MW. Each unit consists of a boiler, steam turbine, electric generator, feed-water 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 330 kV and 150 kV transmission lines. All major equipment was manufactured in the former Soviet Union.

[3] http://google.earth.com

In 1995 the Zaporizka TPP became a part of the Dniproenergo JSC.
In 2006, after the signing of the Contract №7-727-2854-DPO/05 dated 14.12.2006 for the technical and economic assessment of the Unit №1 Rehabilitation, the preparation actions for the TPP Units rehabilitation and the rehabilitation itself were started. Also, the measures for the JI registration and the potential ERUs calculations were started.
Project foresees modernization of the main and the auxiliary equipment of the all working power generating units of the TPP according to the attached schedule (see Table 2).

Table 2. Project Schedule.

All Units Servicing and Preparations for the Reconstruction	2004 - 2016
Unit №1	2011
Unit №2	2014
Unit №3	2012
Unit №4	2013
Unit №5	-
Unit №6	-
Unit №7	-

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 improvement 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 it's 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 Project consists not only of the reconstruction and the rehabilitation measures. The unscheduled maintenance within the current, medium or a major repairs is also should be taken into account. The mandatory list of the measures within the repairs is given in the GKD 34.20.661-2003 "The Rules for the Organization of the Power Plants and the Networks Equipment, Buildings and Constructions Servicing and Repairs" approved by the Ministry of the Fuel and Energy of Ukraine in 2004. The measures outside the list should be taken into account when calculating the Project, Baseline Emission and the Emission Reductions.

The detailed description of the rehabilitation:

A. Turbine equipment

1. Steam turbine
   - Replacement of the nozzle blocks of the high- and mid-pressure cylinders;
   - Working blades replacement in the low-pressure cylinder;
   - Barring gear replacement;
   - Turbine steam-distribution system modernization;
   - Automatic control system installation;
   - Overhaul and repair of the defective spots in the high-pressure cylinder pass pipelines, live steam pipelines, evaporation dams;

- Reconstruction of the steam turbine automatic regulation hydraulic system into electro-hydraulic system;
- Condenser pumps replacement;
- Replacement of the feed turbo-pump setting;
- Booster feed-pumps replacement;
- Drainage pump replacement in the turbine building;
- Modernization of the drainage-scavenging system;
- Modernization of the turbine steam-distribution system: replacement of the high pressure cutout valve, high and middle pressure regulative valve, shut-off valves, valve safety devices and drivers, regulating diaphragms, pipelines and fittings;
- Modernization of the oil system: oil cooler repair, oil container and oil-duck replacement, bearing case and oil fittings replacement, overhaul of the working and broken oil pumps of the oil system;
- Turbine water-work system modernization: circulation pumps repair, service water pump replacement, water-jet pumps replacement, circulating flumes repair;
- Overhaul and replacement of the supporting and thrust bearings;
- Overhaul and repair of the cooler generator system: the chiller of the circulating pump, gas coolers replacement, gas cooler generator pump replacement.

2. Steam-pipelines
   - Overhaul and repairs.
3. Pumping equipment
   - Replacement 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 replacement 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
   - Replacement of the corona-forming and precipitation electrodes;
   - Carriage and bracket girder replacement;
   - Bearing insulator and insulator boxes replacement;
   - Corona-forming and precipitation electrode jog units replacement;
   - Corona-forming and precipitation electrode jog drivers replacement;
   - Replacement of the gas distribution grates;
   - Replacement of the high-voltage units of the electric field and replacement control regulator of the system;
   - High-voltage cables replacement;
   - Revision of the thermal insulation and anti-corrosion protection of the cases metal construction renewal;
   - Bunkers and cases defects removal;
   - Ashes level indicator installation;
   - Dusting sensors, gas analysers and smoke fumes sensors installation;
   - Fire-warning and fire-fighting system installation.

B. Boiler equipment

- Heating surface modernization of the burners and convection shaft;
- Lower radiation part replacement;
- Boiler collectors replacement;
- Total replacement of the water economizer coils;
- Injection and drainage pipelines replacement;

- Blasting nozzle diaphragms and explosive valve diaphragms replacement;
- Repair of the boxes, air-pipelines, main intercepting valve, steam heat exchangers;
- Replacement of the exiting burners on the swirl powder-gas burners with aerodynamic regulation of separate valves;
- Replacement (repair) oa the slag-removal bunkers and slag duct screw;
- Modernization of the boiler convention shaft setting;
- Dust bunkers replacement;
- Repair of different equipment in the boiler unit: repair of the separator, injection attemperator, reduction-cooler equipment, main safety valves, cyclones, etc.;
- Modernization of the main equipment of the boiler unit powder-gas-air flow track;
- Replacement of the oil system rattle, dust-system separators repair, mill fan and hot blast fans replacement;
- Draft system replacement, cleaning of the regenerative air-heater with oil-stations;
- Replacement of the raw coal and dust feeding device, replacement of the blow fans and of the induced-draught fans with oil-stations;
- Repair of the powder-gas-air flow duct parts and of the separate units;
- Overhaul and repair of the hydraulic ash removal system;
- Replacement of the spray-water and removal-water pipelines;
- Overhaul and repair of the live steam pipelines, cool and hot reheat pipelines;
- Overhead-bearing system replacement.

C. Electric generator and electric equipment

- Replacement of the stator winding;
- Reconstruction or replacement of the rotor;
- Modernization of the cooling system of the generator with the replacement of the gas condensers;
- Modernization of the unit transformer;
- Modernization of the cooling system of the transformer.

In 2008 - 2010 the advanced repairs of the Units #1, 2, 3 and 4 were implemented at the TPP as the Servicing and Preparation for the Reconstruction. The main packages of measures of these repairs are (more detailed explanation will be provided in the Monitoring Report for this period):

- the repairs of the heating surfaces of the boiler units:
- the inspection and repairs of the High-, Mid-, and Low-Pressure Cylinders;
- the control and the replacement of the fittings;
- the inspection and the replacement of the pipelines;
- the repairs and the replacement of the burners at the boiler unit;
- the advanced repairs of the pumping equipment;
- the control and the replacement of the blades of the turbine;
- the repairs of the dust system;
- the repairs of the generator winding.

The duration of the repairs is practically the same for every year and the influence of the off-operation time on the TPP's working parameters can be neglected.

For the reconstruction and rehabilitation at Zaporizka 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 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

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].
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 power units at the "Zaporizka TPP" of the "Dniproenergo" JSC.**"** 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. That means, that the Zaporizka 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

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

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

occur. This situation is the most plausible.
The common practice in Ukraine includes repairs of the generating equipment and the scope of these repairs is given in the GKD 34.20.661-2003 "The Rules for the Organization of the Power Plants and the Networks Equipment, Buildings and Constructions Servicing and Repairs" approved by the Ministry of the Fuel and Energy of Ukraine in 2004. All the measures described as the Project Scenario are beyond them.

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 emission reductions achieved in compliance with the annual energy production value. For the period 2006 – 2010 the factual data of the electricity supply, Specific Fuel Rate, the fuel consumption and the net caloric values of the different fuel types was used. To calculate the emissions and emission reductions during 2010 – 2029 the planned data was used.
The period of 20 years was taken because the reconstruction of the generating equipment extends its operational lifetime to 20 years.
The calculations are provided for the two periods: 2010-2012 (36 months) and 2013-2029 (204 months). The calculations for 2010-2012 covers the energy efficiency measures implemented on the TPP in these as long as the previous years. These measures allowed achieving the lowering of the specific fuel rate and, as the result, the emission reductions. The calculations for 2013-2029 were made with the assumption of the continuation of the JI mechanisms in these years.

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

	Years
Length of the crediting period	3
Years	Estimate of annual emission reductions, tonnes of CO2 equivalent
2010	30 611
2011	60 163
2012	77 426
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	168 200
Annual average over the crediting period of estimated reductions (tonnes of CO2 equivalent)	56 067

The total amount of emissions reduction is 168 200 tonnes of CO2 equivalent.
The annual average amount of GHG emissions is 56 067 tonnes of CO2 equivalent.

The example of the Emission Reduction calculation for the 2011:

In 2011 Zaporizka TPP plans to supply 4 534 959 MWh of the electricity to the Ukrainian Grid. The Specific Fuel Rate (*SFRy*) in this year is planned to be 10,6213 GJ per MWh (0,3625 tonnes of the equivalent fuel per MWh). The fuel is planned to de combusted in such a proportion (*SFiy*): coal – 99.2%, heavy fuel oil – 0.0%, natural gas – 0.8%.
The values of the emission factor (*EFiy*) and the oxidation coefficient (*OXIDiy*) defined in the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[8] and the "National GHG Inventory Report" (Inventory)

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

of Ukraine for 1990 - 2009[9] were used for the calculations:
***EFiy* for the coal – 0,09167** tonnes of CO2 per GJ (according to the Inventory, the carbon emission factor of the coal, used at the Zaporizka TPP in 2009 (the latest reported year) was **25,0** tonnes of C / TJ[10]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **91,67** tonnes of CO2/TJ, or **0,09167** tonnes of CO2/GJ was used for the coal);
***EFiy* for the heavy fuel oil – 0,0774** tonnes of CO2 per GJ (according to the IPCC 1996 Workbook, the carbon emission factor of heavy fuel oil is **21,1** tonnes of C / TJ. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **77,366** tonnes of CO2/TJ, or **0,0774** tonnes CO2/GJ was used for the heavy fuel oil);
***EFiy* for the natural gas – 0,0554** tonnes of CO2per GJ (according to the Inventory, the carbon emission factor of natural gas used in Ukraine in 2009 (the latest reported year) was **15,11** tonnes of C / TJ[11]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **55,4** tonnes of CO2/TJ, or **0,0554** tonnes CO2/GJ was used for the natural gas).
According to the Inventory ***OXIDiy*** for the coal used at the Zaporizka TPP in 2009 (the latest reported year) was **0,933**[12];
OXIDiy for the heavy fuel oil is **0,99** (IPCC data);
OXIDiy for the natural gas is **0,995** (IPCC data).
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.
In that way the Baseline emission in 2011 has to be:
BEy = 10,767 * ((0,992*0,09167*0,996) + (0,008*0,0554*0,995)) * 4 534 959 = 0,9799 * 4 534 959 =
= 4 443 865 tonnes of CO2 equivalent.
Project Emission in 2011 will be:
PEy = 10,6213 * ((0,992*0,09167*0,996) + (0,008*0,0554*0,995)) * 4 534 959 = 0,9666 * 4 534 959 =
= 4 383 702 tonnes CO2 equivalent.
Emission Reductions in 2011 are planned to be:
***ERy* = 4 443 865 – 4 383 702 = 60 163 tonnes of CO2 equivalent**

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

	Years
Length of the period	17
Years	Estimate of annual emission reductions in tonnes of CO2 equivalent

9 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

10 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 379, table. P2 10

11 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 376, table. P2 6

12 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

2013	142 969
2014	214 964
2015	279 816
2016	261 449
2017	271 141
2018	307 406
2019	320 886
2020	365 854
2021	365 854
2022	365 854
2023	365 854
2024	365 854
2025	365 854
2026	365 854
2027	365 854
2028	365 854
2029	365 854
Total estimated emission reductions over the period (tonnes of CO2 equivalent)	5 457 169
Annual average over the period of estimated reductions (tonnes of CO2 equivalent)	321 010

The total amount of emissions reduction is **5 457 169** tonnes of CO2 equivalent.
The annual average amount of GHG emissions is **321 010** tonnes of CO2 equivalent.

A.5. Project approval by the Parties involved:

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The Letter of Endorsement #8/23/7 dated 05 January 2011 has been received from the National Environmental Investments Agency of Ukraine.

After finishing of project determination report, the PDD and Determination Report will be presented to State 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.

State Environmental Investment Agency of Ukraine

35, Urytskogo str.

03035 Kiev
Ukraine
Email: info.neia@gmail.com

SECTION B. Baseline

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

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Step 1: Indication and description of the approach chosen regarding baseline setting

A baseline for a JI project has to be set in accordance with Appendix B of the Annex to decision 9/CMP.1 (JI guidelines), and with the "Guidance on criteria for baseline setting and monitoring, version 0.3" [13] developed by the Joint Implementation Supervisory Committee (JISC) (hereinafter referred to as "Guidance"). A JI specific approach regarding baseline setting and monitoring has been developed in accordance with Appendix B of the JI Guidelines and with the JISC Guidance.

For the Project the own JI specific approach will be used. Project will use a baseline in accordance with the "Tool for the demonstration and assessment of additionality" (Version 05.2.1) [14].

In the proposed project the CO2 emissions to the atmosphere will be reduced through the efficiency increase of the power generation at the Zaporizka TPP (units #1 - 4) 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 TPP 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 at the TPP.

$$SFRy = \frac{\sum (Fiy * NCViy)}{7} / AELSy \qquad \textbf{(1)}$$

Where

SFRy – specific fuel rate of the power plant in year *y*, t.e.f./MWh. (GJ/MWh);

Fiy – the amount of the fuel *i* consumed by the power plant for the electricity production in year *y*, tonnes (th.m3);

NCViy – net caloric value of the fuel *i* in year *y*, Gcal/tonne (th.m3);

7 - the net caloric value of one ton of the equivalent fuel, Gcal;

AELSy - annual energy supply of the power plant in year *y*, MWh.

The Baseline Scenario for the Project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases (GHG) that would occur in the absence of the proposed project activity. For the proposed Project activity the JI specific approach was used.

For the proposed Project the Baseline Scenario is the continuation of the TPP operation without any major repairs or reconstructions of the generating equipment. The calculation of the Baseline Emission is based on the assumption that the Specific Fuel Rate parameter of the TPP will remain the same for the whole Project lifetime.

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13 http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

14 http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.1.pdf

$BEy = \Sigma (SFR_b * SFiy * OXIDiy * EFiy) * AELS_y$ **(2)**

where:

BEy – Baseline emission in year *y*, tonnes of CO2 equivalent;

SFR_b – specific fuel rate of the power plant in the Baseline Scenario, GJ/MWh;

SFiy – share of fuel *i* (coal, natural gas or a heavy fuel oil), consumed by the project activity power plant in year *y* in comparative units;

OXIDiy – oxidation factor of the fuel *i* in year *y* in comparative units;

EFiy - emission factor of the fuel *i* consumed in year *y*, tonnes of CO2 /GJ;

$AELS_y$ - the amount of the electricity supplied by the power plant to the electricity grid in year *y*, MWh.

It is determined in the Annex II according to the data for four years prior to the Project (2006, 2007, 2008 and 2009). The data for the units # 1 – 4 (included to the Project Boundary) of the TPP was used.

$$SFRb = \frac{\sum_{i=1}^{n} SFRyi}{n} \quad , \quad \textbf{(3)}$$

Where:

SFRb – a specific fuel rate of the power plant in the baseline scenario, GJ/MWh;

SFRyi – a specific fuel rate of the power plant in years, prior to the Project Implementation, GJ/MWh;

n - number of years ($n \geq 3$).

The other parameters, such as Annual Electricity Supply (*AELSy*), Share of the each fuel type in the fuel mix (*SFiy*), the Carbon Emission Factor of the each fuel type (*EFiy*), the Oxidation Factor of the each fuel type (*OXIDiy*) are the same in the Baseline and the Project Scenarios.

Step 2: Application of the approach chosen.

Sub-step 2a: Identification and listing of plausible alternative baseline scenarios

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:

- Heating surface modernization of the burners and convection shaft;

- Boiler collectors replacement;
- Total replacement of the water economizer coils;
- Injection and drainage pipelines replacement;
- Blasting nozzle diaphragms and explosive valve diaphragms replacement;
- Repair of the boxes, air-pipelines, main intercepting valve, steam heat exchangers;
- Replacement of the exiting burners on the swirl powder-gas burners with aerodynamic regulation of separate valves;
- Replacement (repair) of the slag-removal bunkers and slag duct screw;
- Modernization of the boiler convention shaft setting;
- Dust bunkers replacement;
- Repair of the different equipment in the boiler unit: repair of the separator, injection attemperator, reduction-cooler equipment, main safety valves, cyclones, etc.;
- Modernization of the main equipment of the boiler unit powder-gas-air flow track;
- Replacement of the oil system rattle, dust-system separators repair, mill fan and hot blast fans replacement;
- Draft system replacement, cleaning of the regenerative air-heater with oil-stations;
- Replacement of the raw coal and dust feeding device, replacement of the blow fans and of the induced-draught fans with oil-stations;
- Repair of the powder-gas-air flow duct parts and of the separate units;
- Overhaul and repair of the hydraulic ash removal system;
- Replacement of the spray-water and removal-water pipelines;
- Overhaul and repair of the live steam pipelines, cool and hot reheat pipelines;
- Overhead-bearing system replacement.

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

1. Steam turbine

- Replacement of the nozzle blocks of the high- and mid-pressure cylinders;
- Working blades replacement in the low-pressure cylinder;
- Barring gear replacement;
- Turbine steam-distribution system modernization;
- Automatic control system installation;
- Overhaul and repair of the defective spots in the high-pressure cylinder pass pipelines, live steam pipelines, evaporation dams;
- Reconstruction of the steam turbine automatic regulation hydraulic system into electro-hydraulic system;
- Condenser pumps replacement;
- Replacement of the feed turbo-pump setting;
- Booster feed-pumps replacement;
- Drainage pump replacement in the turbine building;
- Modernization of the drainage-scavenging system;
- Modernization of the turbine steam-distribution system: replacement of the high pressure cutout valve, high and middle pressure regulation valve, shut-off valves, valve safety devices and drivers, regulating diaphragms, pipelines and fittings;
- Modernization of the oil system: oil cooler repair, oil container and oil-duck replacement, bearing case end oil fittings replacement, overhaul of the working and broken oil pumps of the oil system;
- Turbine water-work system modernization: circulation pumps repair, service water pump replacement,water-jet pumps replacement, circulating flumes repair;
- Overhaul and replacement of the supporting and thrust bearings;
- Overhaul and repair of the cooler generator system: chiller of the circulating pump gas coolers replacement, gas cooler generator pump replacement.

2. Steam-pipelines
   - 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 replacement 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
   - Replacement of the corona-forming and precipitation electrodes;
   - Carriage and bracket girder replacement;
   - Bearing insulator and insulator boxes replacement;
   - Corona-forming and precipitation electrode jog units replacement;
   - Corona-forming and precipitation electrode jog drivers replacement;
   - Replacement of the gas distribution grates;
   - Replacement of the high-voltage units of the electric field and replacement control regulator of the system;
   - High-voltage cables replacement;
   - Revision of the thermal insulation and anti-corrosion protection of the cases metal construction renewal;
   - Bunkers and cases defects removal;
   - Ashes level indicator installation;
   - Dusting sensors, gas analysers and smoke fumes sensors installation;
   - Fire-warning and fire-fighting system installation.

Alternative 4. The rehabilitation of the power generator without the rehabilitation of the boiler and the turbine equipment:
   - Replacement of the stator winding;
   - Reconstruction or replacement of the rotor;
   - Modernization of the cooling system of the generator with the replacement of the gas condensers;
   - Modernization of the unit 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. The investments in the 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. The 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 to achieve the financial economy. But

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

Sub-step 2b. Assessment of the alternative scenarios

All the alternatives to the project outlined in Step 2a above are in compliance with applicable laws and regulations.

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1. The financial parameters are eliminating the *Alternative 1* (see ***section B.2***). 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. It means that the construction of the new TPP with the same loading capacity as Zaporizka TPP will cost around 1.2 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.* The 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 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 its operation with the constant lowering of the efficiency.

Demonstration of additionality

Please, see section B.2.

Key Parameters used to identify the Baseline Scenario:

Data/ Parameter	***SFiy***
Data unit	Comparative data
Description	The share of fuel *i* combusted by the power plant for the electrical energy production in year *y*, taken in the energy units.
Time of determination/monitoring	Should be calculated at least once a year. Monitored throughout the Crediting Period.
Source of data (to be) used	Scales, gas meters, fuel meters. The calculations are made by the power plant management on the basis of the natural fuel consumption and it's net caloric value. 3-tech form.
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	All measurement equipment should be calibrated and regularly maintained and checked for its functioning according to manufacturer's specification and relevant national or international standards. Measurement accuracies or other uncertainties in all of the variables need to be taken into account in calculating emission reductions.
Any comment	-

Data/ Parameter	***AELSy***
Data unit	MWh

Description	The amount of the electricity supplied by the power plant to the electricity grid in year *y*
Time of determination/monitoring	Should be calculated at least once a year. Monitored throughout the Crediting Period.
Source of data (to be) used	Electricity meters. 3-tech form.
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	All measurement equipment should be calibrated and regularly maintained and checked for it's functioning according to manufacturer's specification and relevant national or international standards. Measurement accuracies or other uncertainties in all of the variables need to be taken into account in calculating emission reductions.
Any comment	-

Data/ Parameter	***OXIDiy***
Data unit	Comparative data
Description	Oxidation factor of the fuel *i* in year *y*
Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	The values of the oxidation coefficient (*OXIDiy*) were defined in the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[15] and the "National GHG Inventory Report" (Inventory) of Ukraine for 1990 - 2009[16]
Value of data applied (for ex ante calculations/determinations)	According to the Inventory ***OXIDiy*** for the coal used at the Zaporizka TPP in 2009 (the latest reported year) was **0,996**[17]; According to the Inventory The ***OXIDiy*** coefficient for the coal for the previous years was:

15 http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

16 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

17 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

	2006 – 0,994; 2007 – 0,997; 2008 – 0,996[18]. The value from the latest version of the Inventory will be used for the Monitoring Reports. ***OXIDiy*** for the heavy fuel oil is **0,99** (IPCC data); ***OXIDiy*** for the natural gas is **0,995** (IPCC data).
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The *OXIDiy* parameter shows the share of the fossil fuel fully oxidised during the combustion
QA/QC procedures (to be) applied	-
Any comment	-

Data/ Parameter	***EFiy***
Data unit	tonnes of CO2/TJ
Description	CO2 emission factor of the fuel *i* in year y
Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	The values of the emission factor (*EFiy*) were defined in the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[19] and the "National GHG Inventory Report" (Inventory) of Ukraine for 1990 - 2009[20]
Value of data applied (for ex ante calculations/determinations)	***EFiy* for the coal – 0,09167** tonnes of CO2 per GJ (according to the Inventory, the carbon emission factor of the coal, used at the Zaporizka TPP in 2009 (the latest reported year) was **25,0** tonnes of C / TJ[21]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **91,67** tonnes

18 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

19 http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

20 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

21 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 379, table. P2 10

	of CO2/TJ, or **0,09167** tonnes of CO2/GJ was used for the coal); Acoording to the Inventory, the emission factor of the coal cobusted at the Zaporizka TPP in the previous years was: 2006 – 0,09167 tonnes of CO2/GJ; 2007 – 0,09167 tonnes of CO2/GJ; 2008 – 0,09167 tonnes of CO2/GJ [22]. For the other years the latest value of the parameter was used. The value from the latest version of the Inventory will be used for the Monitoring Reports. ***EFiy* for the heavy fuel oil – 0,0774** tonnes of CO2 per GJ (according to the IPCC 1996 Workbook, the carbon emission factor of heavy fuel oil is **21,1** tonnes of C / TJ. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **77,366** tonnes of CO2/TJ, or **0,0774** tonnes of CO2/GJ was used for the heavy fuel oil); ***EFiy* for the natural gas – 0,0554** tonnes of CO2 per GJ (according to the Inventory, the carbon emission factor of natural gas used in Ukraine in 2009 (the latest reported year) was **15,11** tonnes of C / TJ[23]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **55,4** tonnes of CO2/TJ, or **0,0554** tonnes of CO2/GJ was used for the natural gas). Acoording to the Inventory, the emission factor of the natural gas cobusted at the Zaporizka TPP in the previous years was: 2006 – 0,05566 tonnes of CO2/GJ; 2007 – 0,0554 tonnes of CO2/GJ; 2008 – 0,05544 tonnes of CO2/GJ[24]. For the other years the latest value of the parameter was used. The value from the latest version of the Inventory will be used for the Monitoring Reports.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The *EFiy* parameter shows the CO2 emission from the combustion of the fossil fuel of different types.
QA/QC procedures (to be) applied	-
Any comment	-

22 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 379, table. P2 10

23 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 376, table. P2 6

24 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 376, table. P2 6

Data/ Parameter	*SFRb*
Data unit	tonnes of the equivalent fuel per MWh or GJ/MWh
Description	Specific Fuel Rate of the power plant in the Baseline Scenario
Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	Historical data for at least three years prior to the project implementation. The power plant management usually calculates the data. For the Project the data about four previous years was used.
Value of data applied (for ex ante calculations/determinations)	For the Baseline Scenario the value is **0,3743 tef/MWh (10,9670 GJ/MWh)**
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is commonly used in energy sector and it shows the fuel (energy) consumption per unit of the electric energy supplied to the electricity grid. 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.
QA/QC procedures (to be) applied	The calculation of the SFR parameter is being made in accordance with the GKD-34.09.103-96, approved by the Ministry of Energy and Electrification of Ukraine in 1996 and the GKD 34.08.108-98, approved by the Ministry of the Fuel and Energy of Ukraine in 1998. These documents are the basic ones for the calculation and monitoring of the work parameters of the power plants in Ukraine. All measurement equipment should be calibrated and regularly maintained and checked for its functioning according to manufacturer's specification and relevant national or international standards. Measurement accuracies or other uncertainties in all of the variables need to be taken into account in calculating emission reductions.
Any comment	-

Data/ Parameter	*n*
Data unit	Years
Description	The number of years of the period, previous to the project to calculate the average data of the parameters to set the Baseline Scenario.

Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	Historical data for at least three years prior to the project implementation.
Value of data applied (for ex ante calculations/determinations)	4 years ($n \geq 3$)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data for the at least 3 years allows seeing the main tendencies and the dynamic of the parameters values.
QA/QC procedures (to be) applied	-
Any comment	-

Data/ Parameter	***Fiy***
Data unit	tonnes, thousand of m3
Description	The amount of the fuel *i* consumed by the power plant for the electricity production in year *y*
Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	Historical data for at least three years prior to the project implementation.
Value of data applied (for ex ante calculations/determinations)	The data for the each fuel type (coal, natural gas and the heavy fuel oil) is taken from the meters and scales (see Annex 3)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data for the at least 3 years allows seeing the main tendencies and the dynamic of the parameters values.
QA/QC procedures (to be) applied	All measurements will use calibrated measurement equipment.
Any comment	-

Data/ Parameter	***NCViy***
Data unit	Gcal/tonne(th.m3)
Description	The net caloric value of the fuel *i* in year *y* of the Baseline Scenario.
Time of determination/monitoring	Determined in the PDD. Not monitored throughout the Crediting Period. Available at the Determination.
Source of data (to be) used	Historical data for at least three years prior to the project implementation. For this Project – four years period.

Value of data applied (for ex ante calculations/determinations)	The data for the each fuel type (coal, natural gas and the heavy fuel oil) is taken from the supplier of the fuel and checked by the TPP's accredited chemical laboratory (see Annex 3)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data for the at least 3 years allows seeing the main tendencies and the dynamic of the parameters values.
QA/QC procedures (to be) applied	All measurements will use calibrated measurement equipment.
Any comment	-

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

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For the Project the own JI Specific approach is used. The Project will use a baseline in accordance with the "Tool for the demonstration and assessment of additionality" (Version 05.2.1) [25].

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

See section B.1

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;

[25] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.1.pdf

Alternative 5. Servicing of the equipment, optimisation of the working regimes, and optimisation of the fuel parameters without the rehabilitation.

Alternative 6. The investments in the new generation capacity;

Alternative 7. The 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 dated 16 October 1997, N 575/97-BP[26] 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[27], 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[28].

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;

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;

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

27 http://www.uazakon.com/document/spart91/inx91184.htm

28 http://zakon.rada.gov.ua/signal/kr06145a.doc

Alternative 6. The investments in the new generation capacity;

Alternative 7. The continuation of the existing situation.

Step 2. Investment Analysis

The purpose of the investment analysis is to determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of emission reductions.

The investment analysis has been carried out by the project participants in accordance with the "Guidance on the Assessment of Investment Analysis" (Version 05) [29].

Sub-step 2a: Determine appropriate analysis method

The proposed project generates cost savings, so cost analysis (sub-step 2b Option I) of the Additionality Tool cannot be used.
In line with the CDM Additionality Tool version 05.2.1 Option III – benchmark analysis – has been chosen. The project participants have chosen to use Project NPV as the assessment indicator. In order to select a proper benchmark for the indicator chosen project participants have assessed options contained in the Additionality Tool.
The 4b approach of the Option III was selected. Project participants have taken the average commercial lending rates (factual data for the TPP rehabilitation projects in 2007-2008) relevant for the decision making context of this project as a benchmark for the Project NPV.

Sub-step 2b. Application of the benchmark analysis

The benchmark for this project's NPV is the average commercial lending rate in Ukraine. This means that the project owner would not consider the investment if the project is generating cash flow with an NPV less than the benchmark.

Sub-step 2c. Calculation and comparison of the indicators

The project's cash flow was calculated using the following assumptions:

- The benchmark is the average commercial lending rate in Ukraine due in 2007-2008. It is equal to 15%.
- Cash flow calculation was made for the period 2007-2020 (14 years).
- The total investment costs of the Project are 4 189 274 000 UAH.

The decision to start the reconstruction was made in 2006.
The calculations are made, taking into account only the price of the coal, as it is the main fuel for the TPP and the investment decision was made for the fuel mix, where the part of the coal was about 98 – 99%. Thus, the parameters of the other fuel types could have been neglected.
Due to a higher expected electrical efficiency of the unit after the reconstruction, less fuel would be spent to generate the same amount of electricity, thus the project generates cost saving resulting from fuel saving.

The resulting **Project NPV is equal to – 876 769 000 UAH (- 83 997 797 Euro).** The project would not have been financially attractive without the JI component. Even the JI registration of the Project would not make the Project financially attractive. If the ERU price is 10 Euro, the Project NPV is **– 775 690 210 UAH (-74 314 065 Euro).**

[29] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Sub-step 2d. Sensitivity analysis

In the Sensitivity Analysis two most important factors fluctuations were considered:
- Scenario 1 - Coal (the main type of fuel at the TPP) price up 20%.
- Scenario 2 - Investment costs down 20%.

The result of the Sensitivity Analysis:

Scenario 1: NPV – 782 326 000 UAH.

Scenario 2: NPV – 505 893 740 UAH.

Outcome of Step 2: After the sensitivity analysis it is concluded that the proposed JI project activity is unlikely to be financially/economically attractive. Proceeding to Step 4 (Common practice analysis).

Step 3. Barrier analysis (optional)
Not applicable

Step 4. Common practice analysis

During past 15 years only few projects for the TPP rehabilitation were implemented in Ukraine.
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 Zaporizka TPP is one of few projects implementing only because the TPP is a partly private enterprise and the possibility of the development as JI Project.
The common practice in Ukraine includes repairs of the generating equipment and the scope of these repairs is given in the GKD 34.20.661-2003 "The Rules for the Organization of the Power Plants and the Networks Equipment, Buildings and Constructions Servicing and Repairs" approved by the Ministry of the Fuel and Energy of Ukraine in 2004. All the measures described as the Project Scenario are beyond them.

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.

The Baseline Scenario is the amount GHG that would have otherwise been generated by the Zaporizka 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 (MWh, Gcal). That means that each MWh of energy produced will contain less fuel that means that the greenhouse gases emission per MWh (or Gcal) will be less than it would have occurred in the absence of the JI project.
For the three year period (2010 - 2012), a total of **12 935 231 tonnes of CO2 equivalent** is expected to be produced in the project activity.
For a three (2010 - 2012) year period, a total of **13 103 431 tonnes of CO2 equivalent** is expected to be

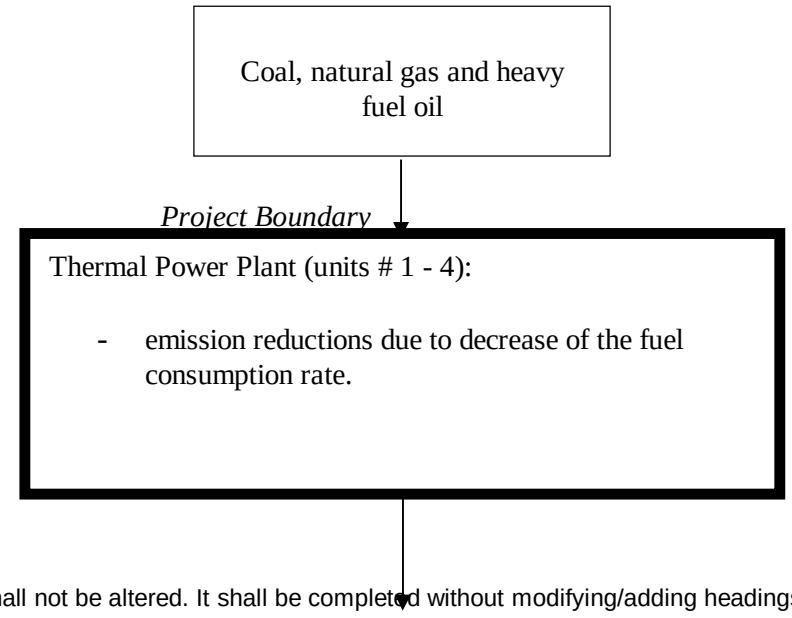
produced in the baseline scenario.
The total emission reductions of the three year period are **168 200 tonnes of CO2 equivalent**.
For the seventeen year period (2013 - 2029), a total of **97 355 839 tonnes of CO2 equivalent** is expected to be produced in the project activity.
For a seventeen year period, a total of **102 813 008 tonnes of CO2 equivalent** is expected to be produced in the baseline scenario.
The total emission reductions of the seventeen year period are **5 457 169 tonnes of CO2 equivalent**.
The detailed example of the calculations is provided in the A.4.3.1.

Assumptions:
- The calculations of the Baseline Emissions, Project Emissions and the Emission Reductions for the 2010 were based on the actual data for that year. The calculations for the 2011 – 2029 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 at the Zaporizka Power Plant. The spatial extent of the project boundary includes the project site and all the working Units of the Zaporizka TPP.

Figure 6. Project boundary



Electricity to the grid

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

Table 5. Sources of emission in the Baseline Scenario and in the Project

	Source	**Gas**	**Included**	**Justification / Explanation**
Baseline	Baseline Power plant emission (Under control of the Project Owner)	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 (Under control of the Project Owner)	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: 12/05/2011.

Name of the person(s)/entities setting the baseline: “Elta-Eco” LLC (not a Project Participant)
Rogovoy Maksym Ivanovich, Director.
Tel: +38 050 595 0311
Fax: +38 057 713 41 02
E-mail: m_rogovoy@elta.kharkov.ua

Detailed contact information in Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>

The starting date of the Project is 28/12/2006 (Contract for the TEA №7-727-2854-DPO/05 dated 28.12.06).

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:

>>

The beginning of the crediting period is 01/01/2010 – the first day of the ERUs generation by the Project.
The end date is 31/12/2012.
The crediting period after the end of the first commitment period of the Kyoto Protocol is 17 years (204 months).
Starting date of the period is – 01/01/2013.

The end date of the period is – 31/12/2029.
The status of the emission reductions made by project in post Kyoto period will be determined by respective decision of the UNFCCC parties.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

>>

The JI specific approach is used for monitoring in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring". According to the Baseline chosen the Monitoring plan 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 only because of the energy efficiency measures and lowering of the loses (the demand for the thermal energy is constant – heating for the Energodar 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 tonnes 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 29,3076 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. The average rate for the period of 2006 – 2009 (before the start of the Project) was taken 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	tonnes of CO2 equivalent	c	yearly	100%	electronic, paper	Calculated by formulae (4) in chapter D.1.1.2., see below
P2 *SFRy*	Specific Fuel Rate in year *y*	Calculations, 3-tech form	GJ/MWh	c	monthly	100%	electronic, paper	Measured, then calculated monthly in accordance with

								the GKD-34.09.103-96, approved by the Ministry of Energy and Electrification of Ukraine in 1996. (see. Annex 2, formula (7)) and fixed in the "3-tech" form.
P3 *SFiy*	The share of fuel *i* consumed for energy production in year *y*	Scales, gas meter, fuel meters, 3-tech form	Comparative units	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*	the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[30] and the "National GHG	Comparative units	e	Before start	100%	electronic, paper	According to the Inventory ***OXIDiy*** for the coal used at the Zaporizka TPP in 2009 (the latest reported year) was **0,996**[32];

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

[32] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

		Inventory Report" (Inventory) of Ukraine for 1990 - 2009[31]						For the previous years was: 2006 – 0,994; 2007 – 0,997; 2008 – 0,996[33]. The value from the latest version of the Inventory will be used for the Monitoring Reports. ***OXIDiy*** for the heavy fuel oil is **0,99** (IPCC data); ***OXIDiy*** for the natural gas is **0,995** (IPCC data).
P5 *EFiy*	CO2 emission factor of the fuel *i* in year *y*	the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[34] and the "National GHG Inventory Report"	tonnes of CO2/TJ	e	Before start	100%	electronic, paper	See Chapter B.1.

[31] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

[33] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

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

		(Inventory) of Ukraine for 1990 - 2009[35]						
P6 *AELSy*	The amount of the electricity supplied to the grid in year *y*	Electricity meters, 3-tech form	MWh	m	Continuously	100%	electronic, paper	Monitored constantly and archived daily, monthly and 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 (*EFiy*) and the oxidation coefficient of the fuel type (*OXIDiy*)[36]. 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:

$$PEy = \sum(SFRy * SFiy * OXIDiy * EFiy) * AELS_y \quad \textbf{(4),}$$

where:

PEy – Project emission in year *y*, tonnes of CO2 equivalent;

SFRy – specific fuel rate of the station in year *y*, GJ/MWh;

SFiy – share of fuel *i* (coal, natural gas or a heavy fuel oil), consumed in year *y*, comparative values;

[35] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

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

OXIDiy – oxidation factor of the fuel *i*, comparative values;

EFiy – emission factor of the fuel i consumed, tonnes of CO2/GJ;

$AELS_y$ – the amount of the electricity supplied to the electricity grid in year *y*, MWh.

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 *BEy*	Baseline emission	calculations	tonnes of CO2 equivalent	c	Yearly	100%	electronic, paper	Calculated by formulae (5) in chapter D.1.1.4., see below
B2 *SFRb*	Specific Fuel Rate in the Baseline Scenario	Historical data	GJ/MWh	c	Before start	100%	electronic, paper	Measured, then calculated using the historical data (Annex 2, formula (8))

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 (*EFiy*)

and the oxidation coefficient of the fuel type (*OXIDiy*)[37]. 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:

$$BEy = \Sigma (SFR_b * SFiy * OXIDiy * EFiy) * AELS_y \quad \textbf{(5)}$$

where:

BEy – Baseline emission in year *y*, tonnes of CO2 equivalent;

SFR_b – specific fuel rate of the power plant in the Baseline Scenario, GJ/MWh;

SFiy – share of fuel *i* (coal, natural gas or a heavy fuel oil), consumed by the project activity power plant in year *y* in energy units;

OXIDiy – oxidation factor of the fuel *i* in year *y*;

EFiy - emission factor of the fuel *i* consumed in year *y*, tonnes of CO2/GJ;

$AELS_y$ - the amount of the electricity supplied by the power plant to the electricity grid in year *y*, MWh.

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

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

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

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[38]. Moreover, this value is vanishingly small and we use the conservative assumption, that the leakage is left the same as in the Baseline Scenario.

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

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

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:

$$ERy = BEy - PEy \quad \textbf{(6)}$$

where:

ERy – emission reductions achieved by the project activity in year *y*, tonnes of CO2 equivalent;

BEy – baseline CO2 emission in year *y*, tonnes of CO2 equivalent;

PEy – project emission in year *y*, tonnes of CO2 equivalent.

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 measuring 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.
The main legal acts ruling the Project activities are: The Law of Ukraine "For the Environmental Protection" #1264-XII issued 25.06.1991[39];
The Law of Ukraine "For the Atmosphere Air Protection" #2707-XII issued 16.10.1992[40];
International Standart "Environmental Management System" ISO 14001-2004[41].

[39] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1264-12

[40] http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2707-12

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 weighers (for coal) are controlled after installation and regularly controlled and calibrated 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 calibrated 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

[41] http://www.iso.org/iso/catalogue_detail?csnumber=31807

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).

For the electricity supply data collection 35 electricity meters SL761B071-type (accuracy class – 0,5) are used. All the meters are regularly calibrated by the approved organizations. The calibration date and the next calibration date will be provided at the Monitoring Reports for every reporting period.

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

The weighers used for the coal consumption monitoring are regularly calibrated by the approved organizations. The calibration date and the next calibration date will be provided at the Monitoring Reports for every reporting period.

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 Gas Distribution System is monitoring the natural gas consumption. 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.

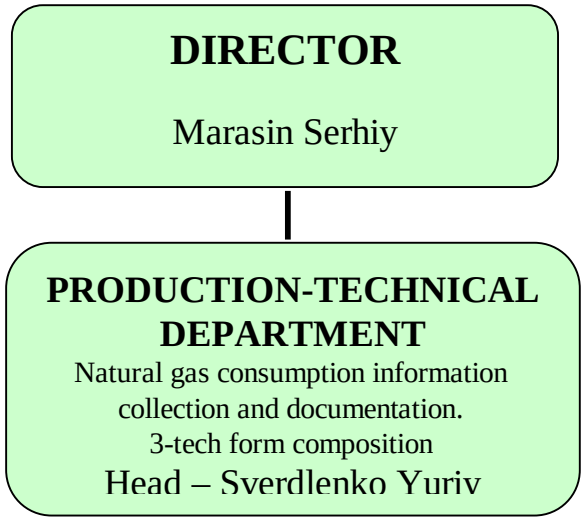
The TPD collects all the data and calculate the Specific Fuel Rate daily. After that, the data is being summarized in the monthly reports and in the annual report called “3-tech” Form.

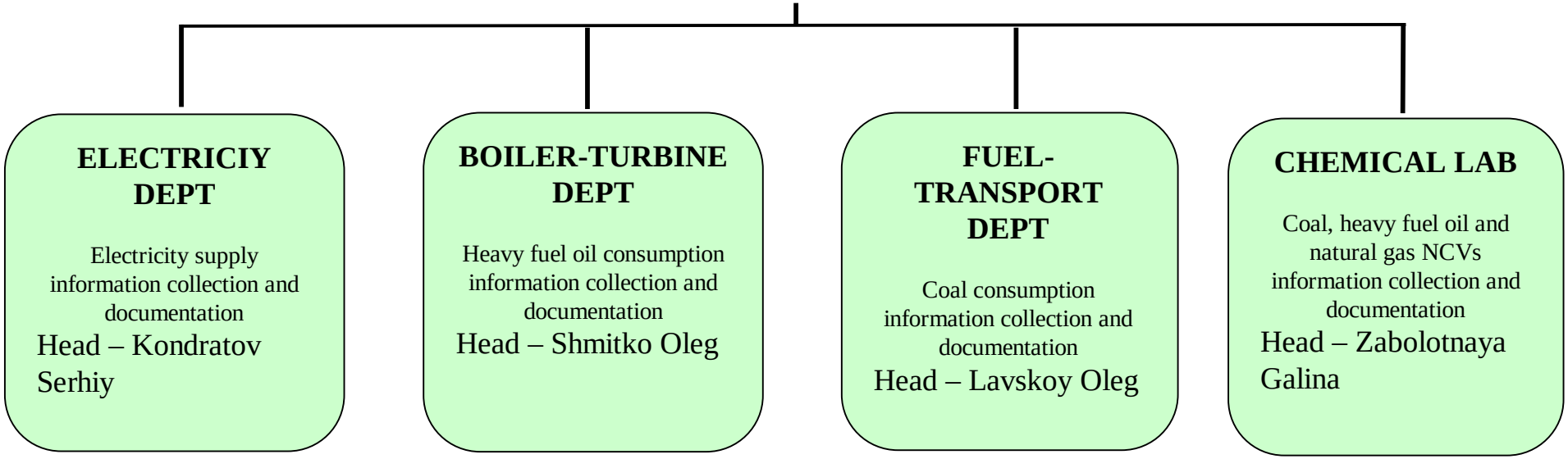
All the measures will be send to the project manager of the “Elta-Eco” company, who will collect the data, calculate emission, emission reductions and create a monitoring report.

All the data shall be stored in the paper and electronic form at the TPP and in the data base of the “Elta-Eco” company during all lifetime of the project and for at least two years after the last transfer of ERUs for the Project.

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

The Project operator - «Dniproenergo», provides all the maintenance work and services. The Project manager of the “Elta-Eco” company provides monitoring and data collection.


DIRECTOR
Marasin Serhiy
PRODUCTION-TECHNICAL DEPARTMENT
Natural gas consumption information collection and documentation.
3-tech form composition
Head – Sverdlenko Yuriy



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

>>

Date of the completion of the Monitoring plan: 15.08.2011

Mr. Maksym Rogovoy
ELTA-ECO LLC (Not a Project Participant)
14/3, Stadionny proezd str.
Kharkov, Ukraine
61091
Telephone: + 38 050 5950311
Fax: + 38 057 392 0045
M_rogovoy@elta.kharkov.ua

The detailed contact information see in the Annex 1.

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 (4), (5), and (6) 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 MWh of the electricity supplied to the grid. The conservative assumptions are used in all the calculations. All the uncertainties of the measures were taken into account in the calculation of the Specific fuel rate of the TPP in accordance with the Ukrainian laws and regulations. All the data used for the calculations consists the precision and accuracy of the measuring equipment.
For the Project the JI Specific Approach will be used.

*Table **E-1.** Estimated project emissions (see formula (4) in Section D.1.1.2)*

Estimated project emissions [tonnes of CO2 equivalent], crediting period	
Year	Estimated project emission (tonnes of CO2 equivalent)
2010	4 514 422
2011	4 383 702
2012	4 037 107
Total 2010 – 2012	12 935 231

Estimated project emissions [tonnes of CO2 equivalent], post-Kyoto period	
Year	Estimated project emission (tonnes of CO2 equivalent)
2013	4 516 679
2014	4 384 388
2015	5 742 163
2016	5 465 882
2017	5 302 982
2018	5 645 900
2019	5 552 974
2020	6 074 487
2021	6 074 487
2022	6 074 487
2023	6 074 487
2024	6 074 487
2025	6 074487
2026	6 074 487
2027	6 074 487
2028	6 074 487
2029	6 074 487
Total 2013 - 2029	97 355 839

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-2.** Estimated project emissions plus leakages.*

Estimated project emissions plus leakage [tonnes of CO2 equivalent], crediting period	
Year	Estimated project emission plus leakage (tonnes of CO2 equivalent)
2010	4 514 422
2011	4 383 702
2012	4 037 107
Total 2010 – 2012	12 935 231

Estimated project emissions plus leakage [tonnes of CO2 equivalent], post-Kyoto period	
Year	Estimated project emission plus leakage (tonnes of CO2 equivalent)
2013	4 516 679
2014	4 384 388
2015	5 742 163
2016	5 465 882
2017	5 302 982
2018	5 645 900
2019	5 552 974
2020	6 074 487
2021	6 074 487
2022	6 074 487
2023	6 074 487
2024	6 074 487
2025	6 074487
2026	6 074 487
2027	6 074 487
2028	6 074 487
2029	6 074 487
Total 2013 - 2029	97 355 839

E.4. Estimated baseline emissions:

>>

*Table **E-3.** Estimated baseline emissions (see formula (5) Section D.1.1.4)*

Estimated baseline emissions [tonnes of CO2 equivalent], crediting period	
Year	Estimated baseline emission (tonnes of CO2 equivalent)
2010	4 545 033
2011	4 443 865
2012	4 114 533
Total 2010 – 2012	13 103 431

Estimated baseline emissions [tonnes of CO2 equivalent], post-Kyoto period	
Year	Estimated baseline emission (tonnes of CO2 equivalent)
2013	4 659 648
2014	4 599 352
2015	6 021 979

2016	5 727 331
2017	5 574 122
2018	5 953 305
2019	5 873 861
2020	6 440 341
2021	6 440 341
2022	6 440 341
2023	6 440 341
2024	6 440 341
2025	6 440 341
2026	6 440 341
2027	6 440 341
2028	6 440 341
2029	6 440 341
Total 2013 - 2029	102 813 008

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

>>

*Table **E-4.** Emission reductions of the project (formula (6) from Section D.1.4)*

Estimated emission reductions of the project [tonnes of CO2 equivalent], crediting period	
Year	Estimated emission reductions (tonnes of CO2 equivalent)
2010	30 611
2011	60 163
2012	77 426
Total 2010 – 2012	168 200

Estimated emission reductions of the project [tonnes of CO2 equivalent], post-Kyoto period	
Year	Estimated emission reductions (tonnes of CO2 equivalent)
2013	142 969
2014	214 964
2015	279 816
2016	261 449
2017	271 141
2018	307 406
2019	320 886
2020	365 854
2021	365 854
2022	365 854
2023	365 854
2024	365 854
2025	365 854
2026	365 854
2027	365 854
2028	365 854
2029	365 854
Total 2013 - 2029	5 457 169

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

>>

*Table **E-5.** 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)
2010	4 514 422	0	4 545 033	30 611
2011	4 383 702	0	4 443 865	60 163
2012	4 037 107	0	4 114 533	77 426
Total (tonnes of CO2 equivalent)	12 935 231	0	13 103 431	168 200
Annual average value of the CO2 emission reductions (tonnes of CO2 equivalent)	4 311 744	0	4 367 810	56 067

*Table **E-6.** 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	4 516 679	0	4 659 648	142 969
2014	4 384 388	0	4 599 352	214 964
2015	5 742 163	0	6 021 979	279 816
2016	5 465 882	0	5 727 331	261 449
2017	5 302 982	0	5 574 122	271 141
2018	5 645 900	0	5 953 305	307 406
2019	5 552 974	0	5 873 861	320 886
2020	6 074 487	0	6 440 341	365 854
2021	6 074 487	0	6 440 341	365 854
2022	6 074 487	0	6 440 341	365 854
2023	6 074 487	0	6 440 341	365 854
2024	6 074 487	0	6 440 341	365 854
2025	6 074 487	0	6 440 341	365 854
2026	6 074 487	0	6 440 341	365 854
2027	6 074 487	0	6 440 341	365 854
2028	6 074 487	0	6 440 341	365 854
2029	6 074 487	0	6 440 341	365 854
Total (tonnes of CO2 equivalent)	97 355 839	0	102 813 008	5 457 169

Annual average value of the CO2 emission reductions (tonnes of CO2 equivalent)	5 726 814	0	6 047 824	321 010

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 №1 has been developed. All the others will also have the description of the Environmental Impact, which is usually the part of the Technical and Economical Assessment of the Project.

The environmental impacts of the Project are described in the Explanatory Note "Environmental impact assessment of the Zaporizka TPP Unit №1 Rehabilitation Project" prepared by the SRI "Teploenergoproekt" of the "Donbassenergo" JSC in 2007.

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:

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

SECTION G. Stakeholders' comments

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

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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 has approved the Project. The Letter of Endorsement has been received from the National Environmental Investments Agency of Ukraine.

The information concerning the Project was published in the local Energodar town newspaper "Zdes Zhivyom" №22 dated 14.06.07.

All the comments received were positive.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

PROJECT OWNER

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Salutation:	Mister
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PROJECT DEVELOPER

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THE POTENTIAL BUYER OF THE EMISSION REDUCTION UNITS

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E-mail:	-
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Represented by:	Peter van Eijndhoven
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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 0,984 tonnes of CO2/MWh to 0,9538 tonnes of CO2/MWh.

The values of the emission factor (*EFiy*) and the oxidation coefficient (*OXIDiy*) defined in the IPCC 1996 Guidelines for National Greenhouse Gas Inventories[42] and the "National GHG Inventory Report" (Inventory) of Ukraine for 1990 - 2009[43] were used for the calculations:
The CO2 emission factor (*EFiy*):

***EFiy* for the coal – 0,09167** tonnes of CO2 per GJ (according to the Inventory, the carbon emission factor of the coal, used at the Zaporizka TPP in 2009 (the latest reported year) was **25,0** tonnes of C / TJ[44]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **91,67** tonnes of CO2/TJ, or **0,09167** tonnes of CO2/GJ was used for the coal);
Acoording to the Inventory, the emission factor of the coal cobusted at the Zaporizka TPP in the previous years was:
2006 – 0,09167 tonnes of CO2/GJ;
2007 – 0,09167 tonnes of CO2/GJ;
2008 – 0,09167 tonnes of CO2/GJ [45].
***EFiy* for the heavy fuel oil – 0,0774** tonnes of CO2 per GJ (according to the IPCC 1996 Workbook, the carbon emission factor of heavy fuel oil is **21,1** tonnes of C / TJ. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **77,366** tonnes of CO2/TJ, or **0,0774** tonnes of CO2/GJ was used for the heavy fuel oil);
***EFiy* for the natural gas – 0,0554** tonnes of CO2 per GJ (according to the Inventory, the carbon emission factor of natural gas used in Ukraine in 2009 (the latest reported year) was **15,11** tonnes of C / TJ[46]. To calculate the carbon dioxide (CO2) emission factor we use the transformation coefficient CO2/C = **44 / 12**. Thus, for the Project and Baseline emission and the Emission reductions calculation for the Project the CO2 emission factor **55,4** tonnes of CO2/TJ, or **0,0554** tonnes of CO2/GJ was used for the natural gas).
Acoording to the Inventory, the emission factor of the natural gas cobusted at the Zaporizka TPP in the previous years was:

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42 http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

43 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

44 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 379, table. P2 10

45 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 379, table. P2 10

46 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 376, table. P2 6

2006 – 0,05566 tonnes of CO2/GJ;
2007 – 0,0554 tonnes of CO2/GJ;
2008 – 0,05544 tonnes of CO2/GJ[47].

The oxidation factor (*OXIDiy*) of the fuel used:
According to the Inventory ***OXIDiy*** for the coal used at the Zaporizka TPP in 2009 (the latest reported year) was **0,996**[48];
According to the Inventory The ***OXIDiy*** coefficient for the coal for the previous years was:
2006 – 0,994;
2007 – 0,997;
2008 – 0,996[49].
OXIDiy for the heavy fuel oil is **0,99** (IPCC data);
OXIDiy for the natural gas is **0,995** (IPCC data).

For calculations of the baseline emissions the historical data of the years 2006, 2007, 2008 and 2009 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:

AELS2006 = 4 209 123 MWh;

AELS2007 = 4 155 459 MWh;

AELS2008 = 4 922 574 MWh;

AELS2007 = 3 967 237 MWh;

AELSb = (4 209 123 + 4 155 459 + 4 922 574 + 3 967 237) / 4 = **4 313 598 MWh.**

The electricity generation by the TPP will substitute the less carbon effective, which would have occur in the Baseline Scenario. 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.

47 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 376, table. P2 6

48 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

49 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php, p. 381, table. P2 13

$$SFRy = \frac{\sum (Fiy * NCViy)}{7} / AELSy \qquad \textbf{(7)}$$

Where

SFRy – specific fuel rate of the power plant in year *y*, t.e.f./MWh. (GJ/MWh);

Fiy – the amount of the fuel *i* consumed by the power plant for the electricity production in year *y*, tonnes (th.m3);

NCViy – net caloric value of the fuel *i* in year *y*, Gcal/tonne (th.m3);

7 - the net caloric value of one ton of the equivalent fuel, Gcal;

AELSy - annual energy supply of the power plant in year *y*, MWh.

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 and the GKD 34.08.108-98, approved by the Ministry of the Fuel and Energy of Ukraine in 1998).

The fixed value of the *SFR* parameter in the Baseline scenario allows taking into account the effect of the planned repairs at the TPP (in accordance with the 34.08.108-98, approved by the Ministry of the Fuel and Energy of Ukraine in 1998). In the other case, the parameter would have been lowering every year.

It is usually measured in the grams of the equivalent fuel per kWh (tonnes per MWh) of the energy supplied to the grid. One ton of the equivalent fuel (tef) is 29.3076 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 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.

The energy efficiency of the power plant has to be determined prior to the implementation of the project activity. For this purpose, the value of the *SFR* parameter in the baseline scenario should be calculated taking into account the value of the parameter in at least 3 (three) years prior to the project implementation (for this Project – 4 years period was taken):

$$SFRb = \frac{\sum_{i=1}^{n} SFRyi}{n} \qquad \textbf{(8),}$$

Where:

SFRb – a specific fuel rate of the power plant in the baseline scenario, GJ/MWh;

SFRyi – a specific fuel rate of the power plant in years, prior to the Project Implementation, GJ/MWh;

n - number of years ($n \geq 3$).

For the Baseline Emission calculation the historical data for 4 years was used:

SFR2006 = 0,367 tef/Mwh (10,7641 GJ/MWh)

SFR2007 = 0,3667 tef/Mwh (10,7443 GJ/MWh)

SFR2008 = 0,3684 tef/Mwh (10,7941 GJ/MWh)

SFR2009 = 0,3678 tef/Mwh (10,7765 GJ/MWh)

SFRb = (*SFR2006* + *SFR2007* + *SFR2008* + *SFR2009*) / 4 = **0,3675 tef/MWh (10,767 GJ/MWh)**

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.

Two belt-conveyer weighers with the accuracy class provide coal supply metering 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 35 electricity meters SL761B071-type (accuracy class – 0,5).

The heavy fuel oil consumption is being calculated using the calibration line at the heavy fuel oil tanks. The calculations are made daily.

The heat supply to the 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.

If the monitoring data is unavailable the calculation of the emission reduction interrupts and the all-necessary documents will be presented to the AIE, SEIA and JISC.

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