JI MONITORING REPORT
(for reporting period 01.01.2008 – 31.12.2011)

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MONITORING REPORT OF JI PROJECT

Monitoring period:
01/01/2008 – 31/12/2011

Version 02
16/11/2012

Modernization and technical reequipment of PJSC "Centrenergo" TPP

CONTENTS

SECTION A. General project activity and monitoring information

A.1. Name of the project:

Modernization and technical reequipment of PJSC "Centrenergo" TPP
Sectoral scope 2 – Energy industry (renewable / nonrenewable energy resources).

A.2. Information about registration and approval of the project:

The project obtained written approval from Ukraine (the Host country) on 13/11/2012 (Letter of Approval № 3408/23/7, issued by the State Environmental Investment Agency). The project was also approved by Switzerland, the country – buyer of GHG emission reductions (Letter of Approval № J294-0485, issued by the Federal Office for the Environment (FOEN) dated 24/10/2012).

A.3. Brief description of the project:

The project provides for the modernization of technological equipment based on the use of more efficient production technologies and equipment. As a result the project implementation will increase fuel consumption efficiency and will reduce greenhouse gas emissions compared to baseline scenario.

The project design document of the project "Modernization and technical reequipment of PJSC "Centrenergo" TPP" is developed by CEP Carbon Emissions Partners S.A. according to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03) based on:

- Data presented by PJSC "Centrenergo";
- Data of the UN Framework Convention on Climate Change;
- Data of the National Bank of Ukraine;
- Data of "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"

A.4. Monitoring period:

- Date of commencement of the monitoring period: 01/01/2008.
- Date of termination of the monitoring period: 31/12/2011.

A.5. Methodology applied to the project:

A.5.1. Baseline methodology:

Among the approved CDM methodologies similar to the proposed project are the following methodologies:

- the consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[1].
- the consolidated baseline and monitoring methodology ACM 0011 "Consolidated baseline methodology for fuel switching from coal and/or petroleum fuels to natural gas in existing power plants for electricity generation"[2].

[1] http://cdm.unfccc.int/UserManagement/FileStorage/DYPFI935XBG274NWH6O8CM1KEZR0VU
[2] http://cdm.unfccc.int/UserManagement/FileStorage/1WS8W1641K25AZ8E9L80V1RS3TAVWK

- the baseline and monitoring methodology ACM 0061 "Methodology for rehabilitation and/or energy efficiency improvement in existing power plants"[3]

However these methodologies are directed at the use of renewable energy sources (ACM0002) and at switch from the more carbon intensive fuel to the less carbon intensive fuel (ACM0011), that does not correspond to the project activity. The closest methodology to the proposed project is baseline and monitoring methodology ACM 0061"Methodology for rehabilitation and/or energy efficiency improvement in existing power plants".

This methodology is applicable to project activities that implement rehabilitation and/or energy efficiency improvement measures for electricity generation. Investments in joint implementation project in the context of this methodology include energy efficiency measures of working TPP and / or rehabilitation to improve power units without adding new generating capacity.

However, this methodology also does not completely respond to the conditions of the project activity:

- In accordance with methodology ACM 0061 emission reductions within the frames of project activity take place on condition that emission factor of the power grid is higher, than emission factor of the power plant. Otherwise, the additional to the average history level production of electric power does not lead to emission reductions.
- The methodology ACM 0061 does not deal with GHG emission reduction in conditions of increase of fuel carbon intensity.

Thus, among the approved baseline and monitoring methodologies there is no suitable for the proposed project.

The proposed project uses the specific approach to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03[4]).

The specific approach chosen for proposed project is based on:

- Historical data for the period since 1993 to 1999 using the least squares method.
- Data "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[5]. At present 80% of the units of thermal power generation in Ukraine worked out (200 thousand hours). Half of the Ukrainian power is far beyond the permissible limits (block № 1 Zmyivska TPP at 1 January 2009 has worked 297 thousand hours), even young power in Ukraine Zuevskaya TPP (28) has workeded about 150 thousand hours.
- Data of the Ministry of Energy and Coal Industry of Ukraine[6]. Specific fuel for electricity generation at TPP (in Ukraine as a whole) compared with 1991 increased by approximately 17%.

According to the data above the linear increase in specific fuel consumption, which was based on historical data using the method of least squares on the methodology of PDD developer, will stop to grow, based on the principle of conservatism, the worst performance in achieving specific fuel consumption in the industry, as it values most clearly meets the baseline without introducing measures to improve maintenance of generating equipment.

A.5.2. Monitoring methodology:

The proposed project uses the specific approach to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03).

[3] http://cdm.unfccc.int/UserManagement/FileStorage/9K6GRQITX27OVG3CAS2MVDN1IWXJX1
[4] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf
[5] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[6] http://mpe.kmu.gov.ua/fuel/control/uk/publish/article;jsessionid=866C6FFC7148AF417483DD005778768C?art_id=93895&cat_id=35082

All relevant data related to the calculation of GHG emission reductions are stored in an electronic database. Each monitoring report will include all necessary information from this database.
The primary monitoring data necessary for calculating GHG emission reductions will be stored in separate sections of the company during the crediting period and at least two years since the last transfer of ERUs in the project.

A.6. Status of implementation including project milestones:

13/03/2000 – date when PJSC "Centrenergo" started implementation of project measures in introducing of modernization of technological equipment and improvement of its efficiency, reliability and safety rates.
03/04/2000 – Project design document development for the project activities.
01/10/2012 – The State Environmental Investment Agency of Ukraine issued a Letter of Endorsement № 2812/23/7.
13/11/2012 – The State Environmental Investment Agency of Ukraine issued a Letter of Approval № 3408/23/7.

Implementation of project measures is carried out according to the project plan that is included in the determined PDD version 02.
Detailed information on the status of realization and the main stages of implementation of project activities ic presented in the Excel file Annex 2.

A.7. Deviations from or change of registered PDD:

There aren't any deviations from or changes in the registered PDD.

A.8. Deviations from or change of the registered monitoring plan:

There aren't any deviations from or change of the registered monitoring plan.

A.9. Persons responsible for preparation and submitting of the monitoring report:

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PJSC "Centrenergo" is the project participant.

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CEP Carbon Emissions Partners S.A. is the project participant.

SECTION B. Key monitoring activities

The proposed project uses the specific approach to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03).

Monitoring plan provides for the following measures:
1. Collection of information on GHG emissions reduction within the project during the crediting period.
2. Assessment of the project implementation schedule.
3. Collection of the information on measurement equipment, its calibration.
4. Collection and archiving information on the impact of project activities on the environment.
5. Archiving of the primary monitoring data necessary for calculating of GHG emission reductions
6. Determination of the structure of responsibility for project monitoring.
7. Analysis of organization of personnel training.

B.1. Information about types of metering equipment:

List of measuring equipment is presented in Excel file Annex 3.

B.2. Data collection (consolidated data for the whole monitoring period):

Data and parameters not monitored throughout the whole crediting period, but determined only once, which are available at the stage of PDD development:

Data/Parameter	Description	Source of data	Unit of measurement	Value of data applied
$NCV^{y}_{p,tpp,i,rf}$	Net caloric value of reference fuel in monitoring period «y» project scenario, is 29,3 GJ/trf	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[7]	GJ/trf	29,3
$FC^{j}_{b,tpp,i,rf}$	Total amount of reference fuel combustion in historical period «j» baseline scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	trf (tones of reference fuel)	Refer to Excel file Annex 1
$EG^{j}_{b,tpp,i,rf}$	Total amount of supplied electricity in historical period «j», baseline scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	ths kW*h	Refer to Excel file Annex 1

7 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

Data and parameters that are monitored during the whole crediting period:

Data/Parameter	Description	Source of data	Unit of measurement	Value of data applied
$EF^{y}_{p,tpp,i,c}$	Coefficient of carbon content in fuel "i" in monitoring period «y» project scenario	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[8]	t C/TJ	Refer to Excel file Annex 1
$OXID^{y}_{p,tpp,i}$	Carbon oxidation factor in the course of fuel "i" combustion in monitoring period «y» project scenario	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[9]	Relative units	Refer to Excel file Annex 1
$NCV^{y}_{p,tpp,i}$	Net calorific value of fuel "i" in monitoring period «y» project scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	GJ/(ths m^3 or t)	Refer to Excel file Annex 1
$W^{y}_{p,tpp,i}$	Percentage of fuel "i" from consumption of reference fuel in monitoring period «y» project scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	%	Refer to Excel file Annex 1
$EG^{y}_{p,tpp,i,rf}$	Total amount of supplied electricity in monitoring period «y» project scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	ths kW*h	Refer to Excel file Annex 1
$FC^{y}_{p,tpp,i,rf}$	Total amount of reference fuel combustion in historical period «j» project scenario	Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"	trf (tones of reference fuel)	Refer to Excel file Annex 1

[8] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

[9] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

B.2.1. Data related to leakage:

Indirect irrelevand leaks of CO_2, CH_4, N_2O were excluded. The leaks are not under the control of the project developer (it is impossible to estimate the volume of leaks), that is why they were excluded, according to the monitoring methodology presented in PDD version 02.

B.2.2. Data relating to ecological and social impact:

Transboundary impacts of project activities according to their definitions in the text ratified by Ukraine "Convention on transboundary pollution at a great distance" will not take place. Project implementation does not bring any harmful effects on the environment.

Impact on water

Impact on water resources will be the same as in the baseline scenario.

Thermal power plants PJSC "Centrenergo" like other objects of thermal power belong to the enterprise, technological specifics of which involves the use of water resources and and outlet of waste water into the natural water cycle links, and fulfill the responsibilities regarding the use and protection of water resources in accordance with applicable laws and regulations, in particular in accordance with the requirements of:

- the Water Code of Ukraine;
- Resolutions of the Cabinet Ministers of Ukraine:
    - «Approval of protection of surface waters from pollution by inverse waters» # 465 dated 25/03/1999;
    - від 11.09.1996 №1100 «About the Order of the development and approval of standards for maximum acceptable discharge of pollutants and the list of normalized discharge of pollutants» #1100 dated 11/09/1996;
    - «On Approval of Procedure of consent and issuance of permits for special water use and making changes to the Resolution ofCabinet of Ministers of Ukraine #459 dated 10/08/1992» #321 dated 13/03/2002;
- The order of the Ministry of Environment Ukraine «On approval of Instruction on the procedure the development and approval of maximum permissible discharge of substances into the water with return water» #116 dated 15/12/1994;
- Sectoral regulatory document 34.02.403-2004 «Norms and standards for water and wastewater treatment at thermal power plants»;
- Sectoral regulatory document 34.21.321-2004 «Water withdrawals of thermal power plants. Method of determination»;
- Sectoral regulatory document 34.21.523-2004 «Cooling ponds of thermal power plants. Operating Instructions»;
- Building Standards and Rules 4630-88 «Protection of surface waters from pollution» etc..

Effects on ambient air

The project implementation will have positive effect on ambient air:

1) Reduction of GHG emissions through the implementation of measures to improve the production equipment for the production of electricity;
2) Reduction of fuel consumption for electricity production and power generation for own needs of power unit will lead to the air pollutants emissions reduction.

Effects on land use

There is no negative impact of the project on soil and land resources.

The main normative and legal acts regulating land relations in Ukraine and guiding enterprises of power systems in its activities are:

- The Land Code of Ukraine

- Laws of Ukraine:

«On state control over the use and protection of land» dated 19/06/2003.

«On protection of lands» від 19/06/2003.

- State Standard 17.4.1.02.-83 " Protection of nature, soils. Classification of chemicals for pollution control " ;

- SOU-N EE 27.508:2007 «Ash dumps of thermal power plants.Typical operating instructions» etc.

B.3. Emergency situations and procedures for detection and liquidation of malfunctions:

Operation of thermal power plants PJSC "Centrenergo" is carried out according to organizational and technical requirements established by regulatory document "Technical operation of power plants and networks. Rules ", which is regularly reviewed and approved by the Ministry of Energy and Coal Industry of Ukraine.
In accordance with these Rules energy companies must ensure generation of electric and thermal energy regulatory quality according to the schedules of operating, the effective work of power plants, reliable, safe and trouble-free operation of the equipment.
The order of maintenance and repair of power generation equipment, planning and financing repairs, preparation for repair, implementation of maintenance works, receiving the repair, assessment of repaired equipment, buildings and repair work performed are carried out according to rules set by Industry guidance document-34.20.661 2003 "Rules of technical service and repair of equipment, buildings and power networks" that are mandatory for enterprises engaged in these activities.
To avoid emergency situations system of maintenance and repair of process equipment power involves performing complex operations, which are conducted with regular intervals and consistency to ensure the serviceable condition of the equipment, its reliable and economic operation.
System of maintenance and repair of power equipment consists of:

- Technical and normative documents that defines a set of repair actions for each type of equipment, the frequency of such actions and processes of technical service and repair;
- The means of control of technical condition and testing of each type of equipment;
- Maintenance and repair services companies that provide maintenance and repair of equipment in use.

Technical maintenance of existing power generation equipment involves performing of complex operations review, control, lubrication and adjustment that does not require removing it in repair.
Repair of power generation equipment can be planned (based on analysis of learned resource of parts and components) and unplanned (due to sudden equipment failure and its transition into serious problems).
Routine repairs are divided into major, intermediate and current. Planning repair equipment based on the study and analysis of the resource parts and components with established technically and economically reasonable rules and regulations and provides for the development of:

- Advanced schedules repair and modernization (reconstruction) of the basic equipment (5 years);

- Annual schedules repair of basic equipment;

- Annual and monthly schedules repair of secondary, general station equipment.

General management of maintenance and coordination of all repair companies and organizations that are involved in the repair, by the Deputy Chief of Power Plant Engineer of repair or entity that is specifically assigned by plant.

Acceptance of installations with repairs performed by specially appointed committees approved by a special program. Admissions should assess the quality of the repair, which includes:

- quality assessment of repaired equipment;
- quality assessment of the repair works.

Acceptance testing of installations and individual systems must be performed after repairs according to the program to check operational parameters to match the requirements.

Controlled operation of repaired equipment begins after acceptance testing, the results of which are filled in information data, technical parameters of the equipment.

According to the results given by installation, testing, verification and analysis of submitted documentation selection committee gives permission to start. Start of the installation is operational personnel ordered by the chief engineer of the power plant.

SECTION C. Quality assurance and quality control measures

Data	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
$FC^{j}_{b,tpp,i,rf}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[10]
$EG^{j}_{b,tpp,i,rf}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[11]
$EF^{y}_{p,tpp,i,c}$	Low	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine" [12] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{y}_{p,tpp,i}$	Low	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine" [13] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$NCV^{y}_{p,tpp,i}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[14]
$W^{y}_{p,tpp,i}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[15] Measuring equipment is used to define the quantity of fossil fuel combusted than transfer it in reference fuel and determine the percentage of fuel «i» from consumed fuel

[10] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[11] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[12] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[13] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[14] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[15] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

$EG^{y}_{p,tpp,i,rf}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[16]
$FC^{y}_{p,tpp,i,rf}$	Low	Data of measuring equipment is used for compilation of Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment". Measuring equipment is regularly calibrated in accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity."[17] Measuring equipment is used to define the quantity of fossil fuel combusted than transfer it in reference fuel

C.2. Trainings:

PJSC "Centrenergo" provides for:

- Annual industrial trainings (labor protection, technical operation);
- Annual industrial trainings on fire- technical minimum;
- Special training (training works of high danger);
- Case studies (introduction of new equipment, process, software or regulation on labor protection);
- Individual trainings;
- Qualification (level, category);
- seminars;
- Trainings in special educational institutions.

The above types of training are implemented as being discontinued and without discontinuing work.
When new equipment not operated before is implemented at the enterprise trainings in accordance with the current legislation of Ukraine should be introduced in the following areas: targeted training and education on safety, including special training.
The enterprise is able to implement these types of trainings on their own, all the organizational conditions for this are available.

C.3. Involvement of third parties:

List of companies for calibration of measuring equipment involved by PJSC "Centrenergo" is presented below:

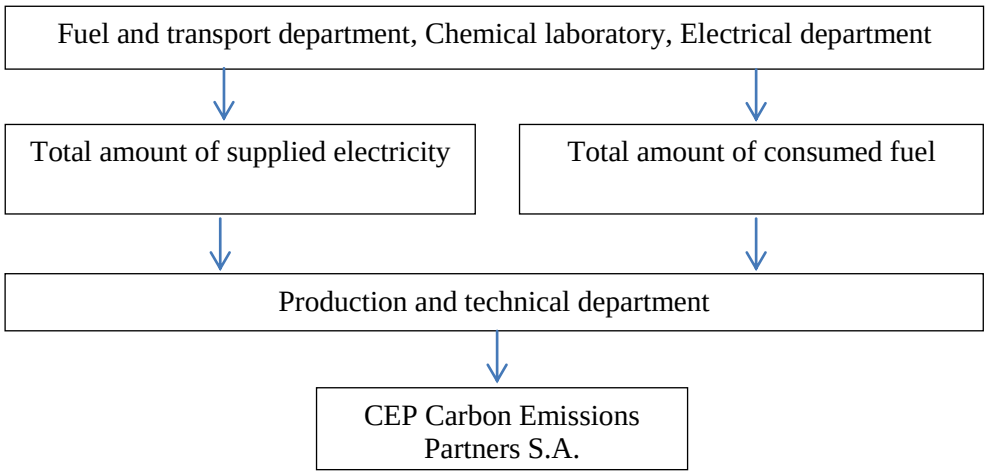
- - SE "Kyyivoblstandartmetrolohiya";
- - SE "Ukrmetrteststandard";
- - SE "Donetskstandartmetrologiya".

C.4. Internal audits and control methods:

The operational and management structure that is used in implementation of the project is shown below.

Subdivisions of enterprise: Trypilska TPP, Vuglegirska TPP, Zmyivska TPP.

[16] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[17] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/



The main source of data necessary for the operator to monitor and calculation GHG emission reductions to the project activity is a form Form №3-tech-TPP. The Ministry of Fuel and Energy of Ukraine "Technical and economic work indicators of equipment"

Therefore operational and management structure, which is used to implement the project will be integrated into the data collection according to the practice, established at the enterprise that allows to gather source data consolidate and cross-check, without involving any additional measures and changes in practice, established at the enterprise.

SECTION D. Calculation of GHG emission reductions

This section contains formulae used for calculation of project emissions, baseline emissions and GHG emission reductions.

D.1. Formulae for calculation of project emissions

$$PE_p^y = \sum_{n=1}^{3} PE_{p,tpp}^y \quad (1)$$

PE_p^y - total estimated GHG emission reduction in monitoring period *«y»* project scenario, t CO_2eq;

$PE_{p,tpp}^y$ - total estimated TPP GHG emission reduction in monitoring period *«y»* project scenario, t CO_2eq;

$$PE_{p,tpp}^y = \sum_{n=1}^{3} PE_{p,tpp,i}^y \quad (2)$$

$PE_{p,tpp,i}^y$ - total estimated TPP GHG emission reduction from fuel "i" in monitoring period *«y»* project scenario, t CO_2eq;

$$PE_{p,tpp,i}^y = FC_{p,tpp,i}^y \cdot EF_{p,tpp,i}^y \quad (3)$$

$FC_{p,tpp,i}^y$ - total amount of fuel "i" combustion in monitoring period *«y»* project scenario, ths m^3 or t;

$EF_{p,tpp,i}^y$ - default CO_2 emission factor for stationary combustion of fuel "i" in monitoring period *y*, in the project scenario, t CO_2/TJ;

$$EF_{p,tpp,i}^y = EF_{p,tpp,i,c}^y \cdot OXID_{p,tpp,i}^y \cdot NCV_{p,tpp,i}^y \cdot \frac{44}{12} \cdot 10^{-3} \quad (4)$$

$EF_{p,tpp,i,c}^y$ - coefficient of the carbon content in fuel "i" in monitoring period *«y»* project scenario, t C/TJ;

$OXID_{p,tpp,i}^y$ - carbon oxidation factor in the course of fuel "i" combustion in monitoring period *«y»* project scenario, relative units;

$NCV_{p,tpp,i}^y$ - net calorific value of fuel "i" in monitoring period *«y»* project scenario, GJ/(ths m^3 or t);

$\frac{44}{12}$ - stoichiometric ratio of CO_2 and C molecular masses, (t CO_2 /t C);

10^{-3} - transfer coefficient from GJ to TJ;

$$FC^{y}_{p,tpp,i} = \frac{FC^{y}_{p,tpp,i,rf} \cdot W^{y}_{p,tpp,i} \cdot NCV^{y}_{p,tpp,i,rf}}{NCV^{y}_{p,tpp,i}} \quad (5)$$

$FC^{y}_{p,tpp,i,rf}$ - total amount of reference fuel in monitoring period *«y»* project scenario, trf;

$W^{y}_{p,tpp,i}$ - percentage of fuel "i" from consumption of reference fuel in monitoring period *«y»* project scenario, %;

$NCV^{y}_{p,tpp,i,rf}$ - net caloric value of reference fuel in monitoring period *«y»* project scenario, is 29,3 GJ/trf;

$NCV^{y}_{p,tpp,i}$ - net calorific value of fuel "i" in monitoring period *«y»* project scenario, GJ/(ths m^3 or t);

[p] - index corresponding to project scenario;

[y] - index corresponding to monitoring period;

[tpp] - index related to TPP;

[i] - index corresponding to fuel combustion;

[rf] – index related to reference fuel.

D.2. Formulae used for calculation of emissions in the baseline scenario:

$$BE^{y}_{b} = \sum_{n=1}^{3} BE^{y}_{b,tpp} \quad (6)$$

BE^{y}_{b} - total estimated GHG emission reduction in monitoring period *«y»* baseline scenario, t CO_2eq;

$BE^{y}_{b,tpp}$ - total estimated TPP GHG emission reduction in monitoring period *«y»* baseline scenario, t CO_2eq;

$$BE^{y}_{b,tpp} = \sum_{n=1}^{3} BE^{y}_{b,tpp,i} \quad (7)$$

$BE^{y}_{b,tpp,i}$ - total estimated TPP GHG emission reduction from fuel "i" in monitoring period *«y»* baseline scenario, t CO_2eq;

$$BE^{y}_{b,tpp,i} = FC^{y}_{b,tpp,i} \cdot EF^{y}_{p,tpp,i} \quad (8)$$

$FC^{y}_{b,tpp,i}$ - total amount of fuel "i" combustion in monitoring period *«y»* baseline scenario, ths m^3 or t;

$EF^{y}_{p,tpp,i}$ - default CO_2 emission factor for stationary combustion of fuel "i" in monitoring period *y*, in the project scenario, t CO_2/TJ;

$$EF^{y}_{p,tpp,i} = EF^{y}_{p,tpp,i,c} \cdot OXID^{y}_{p,tpp,i} \cdot NCV^{y}_{p,tpp,i} \cdot \frac{44}{12} \cdot 10^{-3} \quad (9)$$

$EF^{y}_{p,tpp,i,c}$ - coefficient of the carbon content in fuel "i" in monitoring period *«y»* baseline scenario, t C/TJ;

$OXID^{y}_{p,tpp,i}$ - carbon oxidation factor in the course of fuel "i" combustion in monitoring period *«y»* project scenario, relative units;

$NCV^{y}_{p,tpp,i}$ - net calorific value of fuel "i" in monitoring period *«y»* project scenario, GJ/(ths m^3 or t);

$\frac{44}{12}$ - stoichiometric ratio of CO_2 and C molecular masses, (t CO_2 /t C);

10^{-3} - transfer coefficient from GJ to TJ;

$$FC^{y}_{b,tpp,i} = \frac{FC^{y}_{b,tpp,i,rf} \cdot W^{y}_{p,tpp,i} \cdot NCV^{y}_{p,tpp,i,rf}}{NCV^{y}_{p,tpp,i}} \quad (10)$$

$FC^{y}_{b,tpp,i,rf}$ - total amount of reference fuel in monitoring period *«y»* baseline scenario, trf;

$W^{y}_{p,tpp,i}$ - percentage of fuel "i" from consumption of reference fuel in monitoring period *«y»* project scenario, %;

$NCV^{y}_{p,tpp,i,rf}$ - net caloric value of reference fuel in monitoring period *«y»* project scenario, is 29,3 GJ/trf;

$NCV^{y}_{p,tpp,i}$ - net calorific value of fuel "i" in monitoring period *«y»* project scenario, GJ/(ths m^3 or t);

$$FC^{y}_{b,tpp,i,rf} = BPER^{y}_{b,tpp,i,rf} \cdot EG^{y}_{p,tpp,i,rf} \quad (11)$$

$BPER^{y}_{b,tpp,i,rf}$ - specific reference fuel consumption in monitoring period *«y»* baseline scenario, trf/ ths.kW*h;

$EG^{y}_{p,tpp,i,rf}$ - total amount of supplied electricity in monitoring period *«y»* project scenario, ths.kW*h;

Calculation of specific reference fuel consumption in monitoring period *«y»* baseline scenario is based on the assumption of its linear growth with time. This linear dependence is based on historical data (historical period) from 1993 to 1999 using the method of least squares.

$$BPER^{y}_{b,tpp,i,rf} = a \cdot y - b \quad (12)$$

$$a = \frac{j\sum_{j} BPER^{j}_{b,tpp,i,rf} - \sum_{j} BPER^{j}_{b,tpp,i,rf} \cdot \sum_{j} j}{j\sum_{j} j^{2} - (\sum_{j} j)^{2}} \quad (13)$$

$$b = \frac{\sum_{j} BPER^{j}_{b,tpp,i,rf} - a \cdot \sum_{j} j}{j} \quad (14)$$

$$BPER^{j}_{b,tpp,i,rf} = \frac{FC^{j}_{b,tpp,i,rf}}{EG^{j}_{b,tpp,i,rf}} \quad (15)$$

$FC^{j}_{b,tpp,i,rf}$ - total amount of reference fuel combustion in historical period *«j»* baseline scenario, trf;

$EG^{j}_{b,tpp,i,rf}$ - total amount of supplied electricity in historical period *«j»*, baseline scenario, ths.kW*h;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

[b] - index corresponding to baseline scenario;

[p] - index corresponding to project scenario;

[y] - index corresponding to monitoring period;

[j] - index corresponding to historical period;

[tpp] - index related to TPP;

[i] - index corresponding to fuel combustion;

[rf] - index related to reference fuel.

D.3. Formula for calculation of GHG emission reductions:

$$ER^y = BE_b^y - PE_p^y \quad (16)$$

ER^y - emission reductions achieved as a result of the project activity, in period «*y*», (t CO_2e);
PE_p^y - total estimated GHG emissions, in monitoring period «*y*», project scenario (t CO_2e);
BE_b^y - total estimated GHG emissions, in monitoring period «*y*», baseline scenario (t CO_2e);
$[y]$ - index corresponding to monitoring period;
$[b]$ - index corresponding to baseline scenario;
$[p]$ - index corresponding to project scenario.

Annex 1 (Excel file) contains the calculation of baseline and project emissions as well as emission reductions of the project during the monitoring period.

SECTION E. Results of the GHG emission reductions monitoring

E.1. GHG emissions in the project scenario

Results of calculation are provided in the tables below. The calculations are stated in Excel file Annex 1

Table 1. Estimated project emissions for the period January 1, 2008 – December 31, 2011

Year	Estimated project emissions (tons of CO_2 equivalent)
2008	15 105 641
2009	13 484 982
2010	14 438 583
2011	14 733 878
Total estimated project emissions over the period from 2008 to 2011 (tons of CO_2 equivalent)	**57 763 084**

E.2. Leakages

According to the Methodology provided in the determined PDD, version 02, there are no leakages related to this project.

E.3. GHG emissions in the baseline scenario

Results are provided in the tables below. Calculations are provided in the Excel file Annex 1

Table 2. Estimated baseline emissions for the period January 1, 2008 – December 31, 2011

Year	Estimated baseline emissions (tons of CO_2 equivalent)
2008	16 527 321
2009	15 074 356
2010	16 284 347
2011	16 859 830
Total estimated baseline emissions over the period from 2008 to 2011 (tons of CO_2 equivalent)	**64 745 854**

E.4. Emissions reduction due to the project implementation in the monitoring period:

Results are provided in the tables below. Calculations are provided in the Excel file Annex 1

Table 3. Estimated emission reduction for the period from January 1, 2008 – December 31, 2011

Year	Estimated emission reduction (tones of CO_2 equivalent)
2008	1 421 680
2009	1 589 374
2010	1 845 764
2011	2 125 952
Total estimated emission reduction over the period from 2008 to 2011 (tons of CO_2 equivalent)	**6 982 770**