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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

"Power generation at HPPs of PJSC "Zakarpattyaoblenergo"

The sectoral scope: (1) Energy industries (renewable/non-renewable sources)

The version number of the document: 2.0

The date of the document: 13th of September 2012.

A.2. Description of the project:

The project is aimed at achieving reductions in greenhouse gas emissions by replacing carbon-containing electricity that comes from Ukrainian electricity grid with renewable energy, which is produced by reconstructed small-scale hydro power plants (HPPs) of the company PJSC "Zakarpattyaoblenergo". In the absence of the project, these HPP would be stopped because their technical condition would not allow their safe and reliable operation. Reconstruction of three HPP is expected – Tereblya-Ritska HPP (installed capacity is 27 MW), Onokivska HPP (installed capacity is 2.65 MW) and Uzhgorod HPP (installed capacity is 1.9 MW). This project is being realized in the Zakarpattya Region, Ukraine.

Situation existing prior to the starting date of the project

Technical condition of existing HPPs (which are involved in this project) is characterized by significant or complete obsolescence of fixed waterpower, hydro technical and electrical equipment, the presence of faults in the structures of waterfront that can cause to the accident, silting of water reservoirs, increasing of water intake for non-energy needs, abrasion mounts of spillway and coastal areas of lower tail, etc. All these factors are potentially dangerous and can cause accidents with unforeseen consequences.

Detailed description of the situation before the project is given in Annex 4.

Baseline scenario

The baseline scenario represents a situation in which the operation of hydro power plants, which PJSC "Zakarpattyaoblenergo" owns, will be suspended due to the emergency condition of equipment and hydrological structures. The corresponding amount of electricity will be supplied from the grid.

Project scenario

The project activity is aimed at technical and structural reconstruction of HPPS, which PJSC "Zakarpattyaoblenergo" owns, and their further operation with production of environmentally friendly electric power. The project includes a number of measures, which will allow continuing the operation of the HPPs within the project. Due to the using of hydraulic power to produce electricity and supply it to consumers, a certain amount of electricity will be replaced in the grid. During the construction of new HPPs, minor greenhouse gas emissions (GHG) to the atmosphere take place because of land flooding and the process of anaerobic degradation of plant residues. In this project, these emissions are absent, since all project HPPs were built in the middle of last century, and the project activity is being implemented without changing the territory of existing water reservoirs. Thus, reduction of GHG emissions will be achieved by replacing the equivalent amount of power from the grid.

Thus, in the **project scenario**, electricity, which will be produced at the indicated HPPs, will partially replace electricity that comes from Ukrainian electricity grid, and thereby will reduce carbon dioxide emissions, resulting from the combustion of fossil fuel at thermal power plants.

In general, the implementation of this project is environmentally and socially beneficial. Technological process is environmentally friendly and does not require the use of hazardous materials. Owing to this project activity, new workplaces will be created that will only contribute to economic development in the region.

Brief summary of the history of the project, including its JI components

Chronologically, the history of the project can be represented by the following dates:

17.03.2004 – Minutes of general meeting of shareholders of PJSC "Zakarpattyaoblenergo" on the development and realization of the Program of HPPs reconstruction (Minutes No. 4). This date is considered to be the start date of the JI project.

31.12.2004 – Ensuring implementation of priority measures that allowed safe operation of HPPs without deactivating. Fixing the first results on emission reductions according to the results of the performed measures and the by restoration of HPPs operation.

17.03.2004 – 31.12.2011 – gradual implementation of measures under the program, together with the preparation and study of the situation on the JI projects implementation in Ukraine (order of projects registration, studying precedents of JI projects implementation in Ukraine, tax laws, choice of the project developer, etc.).

13.06.2012 – Signing contract with Carbon Management Company GmbH for the development of PDD.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	PJSC "Zakarpattyaoblenergo"	No
Switzerland	Carbon Management Company GmbH	No

PJSC "Zakarpattyaoblenergo" (KVED Code 00131529**)** is an integral part of the unified energy system (UES) of Ukraine and provides generation and supply of electricity to consumers of Zakarpattya Region at regulated tariff.
Sectors according to the Classifier of Economic Operations (KVED):

- 40.11.0 Power production;
- 40.13.0 Power distribution and delivery;
- 40.30.0 Hot water and steam delivery.

Carbon Management Company GmbH was established in Switzerland to provide complete package of services related to JI mechanism starting from carbon audit of the possible project and finishing by provision of the brokerage services on emission reduction units. Carbon Management Company is a potential buyer of emissions reduction units generated under current project.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is being implemented at energy generating stations of PJSC "Zakarpattyaoblenergo" – Tereblya-Ritska HPP, Onokivska HPP and Uzhgorod HPP – situated in Zakarpattya Region, in the west of Ukraine. Area of the region is 12.777 million sq. km. Population – 1.244 million people (as of January 1, 2010).

A.4.1.1. Host Party(ies):

Ukraine

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

Zakarpattya Region

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

Zakarpattya Region

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

This project is being implemented within Zakarpattya Region of Ukraine:

Figure 1. Location of Zakarpattya Region on the map of Ukraine.

Production facilities of three project hydro power plants (HPPs) within the project are directly located as it is shown in Figure 2.

Figure 2. Location of hydro power plants within the project.

Geographic coordinates of the hydro power plants within the project:
Tereblya-Ritska HPP: 48°22′09″ N 23°38′09″ E.
Onokivska HPP: 48°39′76″ N 22°21′45″ E.
Uzhgorod HPP: 48°37′46″ N 22°19′08″ E.

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

At the end of 2004, the technical condition of HPPs buildings and equipment, which and became a part of the project, were in unsatisfied condition required significant financial resources for complex repair. However, further operation of HPPs posed a significant risk. To achieve this objective in 2004 the HPP reconstruction Program was initiated, which allowed avoiding of dangerous accidents and resuming the operation of HPPs. The project also includes replacement and reconstruction of basic HPPs power equipment to achieve a stable level of electricity generation. Thus, the whole project can be divided into two conditional components:

- priority measures that allow to avoid dangerous situations;
- measures that allow ensuring stable operation of power equipment.

The first category of measures is characterized primarily by large amount of funds necessary for their implementation, and, on the other hand, lack of financial "return" after implementation. In other words, it was necessary to attract significant funds, awaiting their return only after implementation of the second category of measures, which is also characterized by a significant level of financial burden.

Brief description of the project HPPs, as well as equipment and facilities used, is provided in the Tables 1-3 below.

Table 1 – Brief description of HPPs within the project

Name	Installed capacity, MW	Type	Comment
Tereblya-Ritska	27	Derivative	-
Onokivska	2.65	Derivative	Together they form a cascade from the same derivational channel Kamyanytsya-Uzhgorod.
Uzhgorod	1.9	Derivative	

Table 2 – Equipment and structures installed at Tereblya-Ritska HPP

Equipment	Q-ty	Notes	Year of manufacture
Vertical axis turbine of Frensis type manufactured by Tampela Company (Finland), 9 MW	3	As part of station hydroelectric units: N1 (GA-1), N2 (GA-2) and N3 (GA-3) – Inv. No. 10070, 10071 and 10072	1956
Electric generator of VGS type 260/99/10 manufactured at "Uralelektroaparat", 9 MW	3		1956
Rotational speed control by KMV company, of "KANOWA" series, of RC – 0.8 F-10 type	3		1956
Derivation tunnel with derivation channel (Inv. No. 00912)	1	Diameter 2.5 m; Length 3 653 m.	1956
Pressure metal piping (Inv. No. 01023)	1	Diameter 2.1-2.3 m; Length 445 m.	1956
Outlet channel (Inv. No. 15878)	1	Length 34.0 m; Width at bottom 16.0 m.	1956
Dam in Vilshany Village (Inv. No. 15872)	1	-	1956

Table 3 – Equipment and structures installed at the cascade of Onokivska and Uzhgorod HPPs

HPPs	Equipment	Q-ty	Technical specifications	Year of manufacture
Onokivska	Vertical swivel-blade turbine "ChKD-Kaplan" (Prague) (Vertical hydraulic turbine with power generator - Inv. No. 10485 and 10486)	2	Unit capacity GA-6: 1.85 MW; Unit capacity GA -7: 0.8 MW;	1941
	Synchronous generator (in units with turbines, please see above. Inventory numbers are the same)	2	Unit capacity NTG 350/30x28: 1.85 MW; Unit capacity NTG 229/27x16: 0.8 MW;	1941
	Floodgate and emergency spillway at Onokivska HPP (Inv. No. 15882)	1	Width 5 m.	1938
Uzhgorod	Vertical swivel-blade turbine "ChKD-Kaplan" (Prague) (Vertical hydraulic turbine with power generator - Inv. No.11190 and 10487)	2	Unit capacity GA-4: 1.3 MW; Unit capacity GA-4: 0.6 MW;	1941
	Synchronous generator (in units with turbines, please see above. Inventory numbers are the same)	2	Unit capacity NTG 350/30x28: 1.3 MW; Unit capacity NTG 229/22x20: 0.6 MW;	1941
	Floodgate and emergency spillway at Uzhgorod HPP (Inv. No. 00868)	1	Width 5 m.	1938

HPPs	Equipment	Q-ty	Technical specifications	Year of manufacture
-	Derivation tunnel of HPP water intake (Inv. No. 15880)	1	Diameter 12-14 m; Length 10.2 m; Design depth 2.4-4 m.	1941
-	Main node dam in Kamyanka Village (Inv. No. 15881)	1	-	1964

Reconstruction works started in 2004. During 2004-2007 the most of measures were taken (see Table 4), thus allowing safe operation of HPPs (prevention of accidents). However, some measures have not been implemented due to the lack of funds required for their realization. Thus, rotational speed control by KMV company, of "KANOWA" series, of type RC – 0.8 F-10 installed at Tereblya-Ritska HPP reached its operational lifetime and need to be replaced. Wear of bearing surfaces, backlash emergency (which is unacceptable), abrasion of brake away edges of control-valves leads to problems during start-up of hydroelectric units, especially in time of synchronization and frequent "thrusts" during the turbine frequency fluctuations in the system. This can lead to accidents with further disconnect of the units from the grid. Taking into account the specificity and complexity of this type of works and their high price, the project will be impossible to implement without funds from the sale of ERUs. Likewise, the existing system of generators excitation manufactured in 1956 has not been under any overhaul since being put into operation. Currently, it is physically and mentally worn out, and it does not ensure a stable operating mode of generators under power fluctuations, and when generator is being operated in synchronous compensator mode.

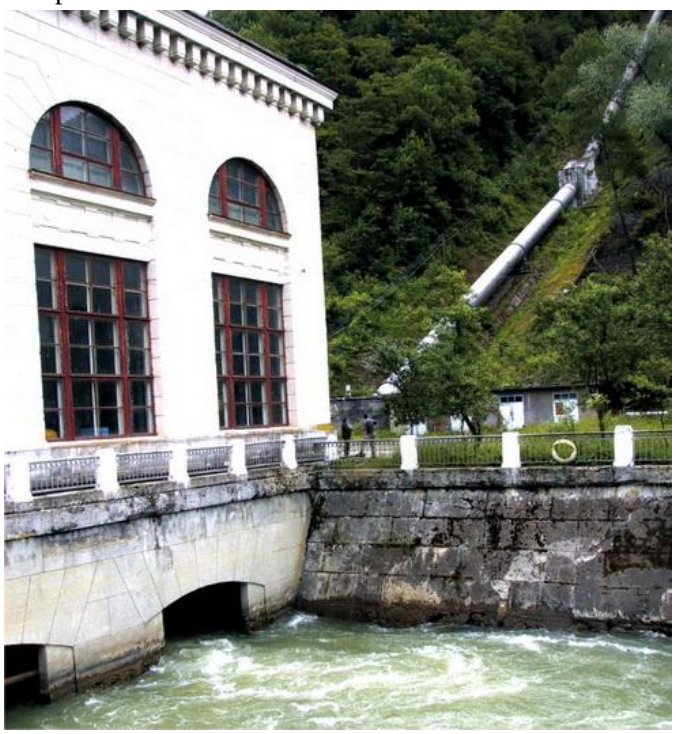

Figure 3 – Main building of Tereblya-Ritska HPP and pressure piping.

Main equipment installed at HPPs included into the project boundaries and its technical characteristics are described in Tables 2-3 above. The project foresees reconstruction or substitution of outdated equipment (please see Table 4 below), the way to keep installed capacity on the pre-project level. Therefore, main technical characteristic of equipment remains the same after project implementation.

It is assumed that by selling ERUs, the project will receive an additional component of return that was needed to start the reconstruction works and which will make the project profitable. It is also expected that due to these funds, the reconstruction will be fully completed, which will lead to improvements in the market of power production in the Zakarpattya Region and ensure safe and reliable operation of project HPPs.

Table 4 – Measures implemented under the project and those, which are planned to be realized (marked with "") in the future*

HPP	Activity	Outcome	Year
TRHPP	Cleaning the water reservoir of snags	Continuous water supply to hydroelectric units	2004
	Desilting of dammed zone of a water reservoir	Safe operation of dam outlet	2006
	Repair of reinforced concrete walls outside the main water inlet node of the dam.	Sage operation of main water inlet node. Excluding the possibility of accidents at dam	2007
	Elimination of corrosion occurred at equipment and at metal structures of water inlet mine		2007
	Construction of new bridge over the dam	Safe traffic and mitigation of hazardous load at the dam	2008
	Overhaul or replacement of hydro turbines speed regulators	Stable operation of power equipment	2012*
	Overhaul or replacement of generator excitation system	Stable operation of power equipment	2012*
HPP cascade (OnHPP and UzhHPP)	Replacement of roof covering of asbestos cement sheets, gutters and pipes	Filtration of water passing from the upper pool through the dam body (potentially dangerous situation)	2005
	Repair of rubble concrete base of dissipation basin and bank strengthening		2007
	Some areas of dam apron buckle restored		2007
	Incomplete disilting of derivation channel	The possibility of hydrological equipment operation	2004
	Complete desilting of derivation channel	Channel capacity restored at the project level	2011
	Overhaul or replacement of the main power equipment OnHPP and UzhHPP	Reliable and safe operation of HPPs	2012*

All the technologies and measures that will be implemented during the reconstruction of project HPPs are typical and are applied by other companies in Europe and worldwide, so no "weak points" are not expected. Also, used technologies and measures, which were implemented, meet the current practice in this area.

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:

Anthropogenic GHG emissions will be implemented under this project due to the fact that the amount of greenhouse gas emissions that would occur in the absence of the proposed project, i.e. in the baseline scenario, is bigger than that amount of greenhouse gas emissions, which will occur in the project scenario.

Baseline scenario of the project provides that electricity, which was transferred to the grid as a result of the project implementation, which would, otherwise, be produced by work of power plants, connected to the grid, and by adding new generating sources of energy production. All these power plants are outside the project boundaries, but as their emissions are the main and the only source of emission reductions under the project, these emissions are not attributed to leakage, but can be called *baseline indirect emissions* (hereinafter: *baseline emissions*) carbon dioxide. Due to water energy use for electricity production and its supply to consumers, certain amount of electricity in the grid will be replaced. During the construction of new HPPs, insignificant greenhouse gas emissions (GHG) into the atmosphere occur, as a result of flooding of the land and occurrence of the processes of anaerobic decomposition of plant residues. In this project, such emissions are considered absent; as all HPPs, which are under the project, were built in the middle of the last century and project activity is implemented without changing the area of the existing reservoirs.

Thus, baseline emissions include only CO_2 emissions from electricity production at power plants that run on fossil fuels, and the level of which was reduced within the project implementation. More detailed information concerning justification of the baseline scenario is given in section B of this PDD.

In the **project scenario,** electricity is produced by hydro power plants, connected to the grid, operation of which was restored. Electricity, produced by hydro power plants, is considered to be of that kind, which does not cause greenhouse gas emissions.

Thus, **emission reductions** generation under the project realization **occurs** by switching from electric power, which comes from the grid, related to CO_2 emissions, that are the result of power plants operation, running on fossil fuels, to green electricity generated by hydro power plants.

The project requires substantial funding and without additional revenue from ERUs sale is not financially attractive. In addition, project implementation is impeded by risks, related to the complex nature of reconstruction, specificity of measures and unfavourable investment climate in Ukraine. The situation is somewhat improved by availability of special "green tariff" in Ukraine, but the profits that the company receives as a result of HPPs operating and electricity generation is not sufficient for implementation of all measure under the project. In case of involving only its own funds, the implementation of the project scenario could occur over decades. Thus, taking into account emergency condition of power equipment and hydrological structures, it is most likely that operation of these HPPs would be stopped until the complete elimination of accidents possibility. This could complicate realization of the project even more, because during that period company would not receive any profit from the generation and sale of electricity to the grid.

Information on the total expected emission reductions under the project is given in Section A.4.3.1 below.

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

Emission reduction calculations are provided in the Excel file *20120521_ZOE_Hydro_calculations.xls*.

Table 5. Emission reductions within the crediting period before the first commitment period under the Kyoto Protocol (2005-2007)

	Years
Length of the crediting period	3
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2005	81 860
2006	105 004
2007	113 633
Total estimated emission reductions over the crediting period 2005-2007 (tonnes of CO_2 equivalent)	300 497
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	100 166

Table 6. Emission reductions within the first commitment period under the Kyoto Protocol (2008-2012)

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	160 546
2009	132 954
2010	160 793
2011	120 326
2012	140 028
Total estimated emission reductions over the crediting period 2008-2012 (tonnes of CO_2 equivalent)	714 647
Annual average of estimated emission reductions over the crediting period 2008-2012 (tonnes of CO_2 equivalent)	142 929

Table 7. Emission reductions within the crediting period after the first commitment period under the Kyoto Protocol (2013-2024)

	Years
Length of the crediting period	12
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	140 028
2014	140 028
2015	140 028
2016	140 028
2017	140 028
2018	140 028
2019	140 028
2020	140 028
2021	140 028
2022	140 028
2023	140 028
2024	140 028
Total estimated emission reductions over the crediting period 2013-2024 (tonnes of CO_2 equivalent)	1 680 336
Annual average of estimated emission reductions over the crediting period 2013-2024 (tonnes of CO_2 equivalent)	140 028

A.5. Project approval by the Parties involved:

Letter of Endorsement ref. 2550/23/7 from 12/09/2012 was achieved from the State Environmental Investment Agency of Ukraine. Approval by both Parties will be received after successful implementation of determination process, in accordance with the requirements and procedures of Parties involved.

SECTION B. Baseline

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

The baseline scenario of the JI project should be implemented according to the requirements of Appendix B to Decision 9/CMP.1 ("Criteria for Baseline Setting and Monitoring")[1], further meeting the requirements of the "Guidance on criteria for baseline setting and monitoring", developed by the Joint Implementation Supervisory Committee (JISC). According to the "Guidance on criteria for baseline setting and monitoring" (version 03)[2] (hereinafter referred to as JI Guidance), the baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions of greenhouse gases by sources or anthropogenic removals by sinks of GHGs that would **occur in the absence of the project absence**. According to Paragraph 9 of the Guidance the project participants may select either: an approach for baseline setting and monitoring developed in accordance with appendix B of the JI Guidance "Criteria for baseline setting and monitoring" (JI specific approach); or a methodology for baseline setting and monitoring approved by the Executive Board of the clean development mechanism (CDM), including methodologies for small-scale project activities, as appropriate, according to the paragraph 4(a) of Decision 10/CMP.1; as well as methodologies for afforestation/reforestation project activities. Paragraph 11 of the Guidance allows project participants that select the JI specific approach to use the selected elements or combinations of approved CDM baseline and monitoring methodologies; or, if necessary, approved CDM methodologies or methodological tools.

Description and justification of the baseline chosen are given below in accordance with "Guidance for Users of the Implementation Project Design Document Form" [3] version 04, using the following step-wise approach:

Stage1. Identification and description of the chosen theoretical approach for baseline scenario setting

The project participants selected the following approach for the baseline setting defined in Guidance (Paragraph 9a):

- An approach for baseline setting and monitoring developed in accordance with appendix B of JI Guidance (JI specific approach).

JI Guidance was applied to this project as well as the stated above approach, which was chosen in accordance with Paragraph 12 of JI Guidance. Project participants should provide a detailed theoretical baseline description performed in clear and transparent manner and baseline justification according to paragraphs 23-29 of the JI Guidance.

Project participants decided to use, as far as possible within the JI specific approach, the elements of the approved CDM methodology for baseline scenario and monitoring ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[4] – version 12.3.0 which was the newest one at the moment of the baseline justification for the given project. On purpose to determine the baseline scenario, demonstration of additionality and monitoring plan of this project, project participants used elements of the methodology dealing with emission reductions calculation under the project, as the given methodology cannot be used in general because of the nonfulfillment of some

[1] http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2 (latest access – 18.07.2012)
[2] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf (latest access – 18.07.2012)
[3] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf (latest access – 18.07.2012)
[4] http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L (latest access – 18.07.2012) Hereinafter - "ACM0002"

compulsory conditions of its application (see Table 8). Also the approved for the CDM mechanism "Tool to calculate the emission factor for an electricity system"[5] that should be used when applying the methodology ACM0002 was not used. Emission factor for Ukrainian electric grid was chosen on the basis of the analysis of the existing studies of carbon dioxide emission factors in Ukraine.

Table 8. Criteria for ACM0002 application

Criteria for ACM0002 application	***Application within the project***
This methodology is applied to the project activity on production of renewable energy connected to the grid, in particular: (a) building of new power plants at the site where there were no power plants operating on renewable energy before the project implementation start (new electric power plant); (b) attraction of additional capacities; (c) existing electric power plant(s) modernization; (d) substitution of the existing electric power plant(s).	The proposed project activity provides the existing hydro power stations reconstruction (modernization).
Project activity involves building, attraction of additional capacities, modernization or substitution of electric power plants/ electro installations of one of the following types: - hydro power plant/unit (with either fluvial reservoir or cumulative reservoir , - wind power plant/unit, - geothermal power plant/unit, - solar power plant/unit, - wave power plant/unit or tidal power plant/unit	Project activity provides hydro power plants reconstruction.
In case of attraction of additional capacities, modernization or substitution: the existing plant started its commercial activity before the minimal accounting historical period (5 years), which is used to calculate the baseline level of emissions and emissions under the baseline scenario, started. During the time from the start of the minimal accounting historical period till the project implementation no capacity expansion or equipment modernization was performed at the plant.	The project activity provides reconstruction of the existing hydro power stations, which started their commercial activity in mid XX century, i.e. before the minimal accounting historical period (5 years), which is used to calculate the baseline level of emissions and emissions under the baseline scenario, started. During the time from the start of the minimal accounting historical period till the project implementation no capacity expansion or equipment modernization was performed at the plant.
In case of hydro power stations one of the following conditions shall be used: - The project activity is implemented at the	The project activity is implemented at the existing reservoir without changing its volume.

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.1.0.pdf (latest access – 18.07.2012)

Criteria for ACM0002 application	*Application within the project*
existing reservoir without changing its volume; or - The project activity is implemented at the existing reservoir which volume is extended and the power density according to the definitions given in section "Emissions under the project" is more than 4W/m^2; or - New reservoir is the result of the project activity and the power density according to the definitions given in section "Emissions under the project" is more than 4W/m^2	
The methodology is not applied to the following: - The project activity provides switching from fossil fuel to renewable energy sources at the site of the project activity, as in this case under such baseline scenario using fossil fuel may be continued on site; - Electric power plants operating on biomass; - Hydro power plants activities of which resulted in new reservoirs or expansion of already existing ones but their power density remains less than 4W/m^2	None of the given conditions takes place in the project.
In case of modernization, substitution or attraction of additional capacities this methodology is applied only if the most plausible baseline scenario as a result of the baseline scenario determination is "continuation of the current situation that is the usage of the power producing equipment, used before the project activity implementation, and carrying out activity as usual service".	The project activity provides the reconstruction of hydro power plants which would be suspended in the absence of the project as it was impossible to provide safe conditions of their operation. Inconsistency of this condition is the reason of not applying this CDM methodology in full scope and only use of its elements on the calculation of emission reductions.

From the table given above it can be concluded that the given methodology cannot be used in full scope but some of the elements of ACM0002 methodology can be used to determine and describe the baseline scenario in the context of ERUs calculations.

The baseline scenario means a situation where operation of HPPs within the project will be stopped as a result of emergency state of equipment and hydrological units. However the relevant amount of the electric energy will be supplied from the grid. The project requires significant investments and is not financially attractive without additional revenue received from ERUs sale. Besides, the project implementation is prevented by risks connected with complex nature of reconstruction, specific character of measures and unfavourable investment climate in Ukraine. In case of attraction only owner's funds the project realization could last during several decades. Moreover, taking into account emergency state of the power plant equipment and hydrological units, it is the most probable that the mentioned HPPs would be stopped until complete removal of accident possibility. This would have complicated the process of

project realization even more, as at that time the company would not have receive any profit from electric power generation and its sale to the power grid.

Thus it is unlikely that the project scenario could have been realized without this JI project.

Justification of the chosen baseline level of emission according to the Guidance is given below:

1) The baseline scenario comprises the emissions of all **gases of the sectors of all the sources and categories** that are listed in Annex A of the Guidance, as well as anthropogenic emissions by the absorbents that occur within the project and are defined according to Appendix B of the JI Guidance. Information concerning coverage of emissions by the baseline scenario within the project is given in section B.3 of this PDD.
2) The baseline scenario is set with the usage of **emission factor which is applied to many projects**. Emission factor selected for the baseline description is based on the results of analysis of studying existing carbon dioxide emissions factor in the baseline scenario for Ukrainian electric power grid.
3) The baseline scenario **is set in a transparent manner as for the choice of approaches, assumptions, methodologies, parameters, data sources or key factor**s. To state a baseline emission level the project participants use the elements of the approved CDM methodology of the baseline scenario and ACM0002 monitoring methodologies. All the assumptions, parameters, data sources and key factors make reference to authorized resources.
4) The baseline scenario is set **taking into account relevant policies at governmental/sectoral level and circumstances, such as initiatives for sectoral reformation, fuel availability in the region, plans for energy sector expansion and economy state in the project sector.** The key factors were estimated and their impact is given below:
    a. *The sector reform policy and legislation.* On 25th of September 2008 Ukrainian Parliament adopted a number of laws[6] on "green tariff" introduction in Ukraine. "Green tariff" was defined as a special tariff under which the electric power produced by the alternative sources is subject to mandatory purchase. This tariff exceeded the purchasing price for electric power produced by traditional sources by several times. Nevertheless the adopted laws were undefined and they lacked practical mechanisms for realization. Moreover the proposed level of "green tariff" does not involve acceptable revenues from possible investments. Thus on April 1, 2009 amendments to the laws on "green tariff"[7] were adopted. These amendments provide guarantees for electric power plants which use "green tariff" till 2030, and obligatory entering of adjustments to "green tariff" as a result of Euro exchange rate violation. Besides it was prohibited to deny access to the transmission and distribution grid for "green energy producers". These amendments also fix the amount of minimal "green tariff" for the electric power produced by some particular types of alternative energy which varies depending on energy source, generating capacity of the equipment and other factors. Nonetheless, there is still lack for certain statutes regulating the following issues of "green tariff" project realization:
        i. procedure of providing electric power plants with access to the grid;
        ii. compensation of expenses dealing with grid building, reconstruction and modernization to get access to the electric power network;

[6]Law of Ukraine "On Amendment of Certain Legislative Acts of Ukraine Concerning the Establishment of "Green" Tariff" http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=601-17 (latest access – 18.07.2012)
[7]Law of Ukraine "On Amendments to the Law of Ukraine "On Electrical Power Industry" as to stimulation of alternative energy sources use" http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1220-17 (latest access – 18.07.2012)

iii. procedure of signing the contract with the relevant state company on electric power purchase, and other practical aspects of project implementation.

b. *Economic picture/economic growth and socio-demographic factors in certain sector of economy and demand conditioned by this according to "Energy strategy of Ukraine for the period till 2030"*[8]. Despite this, essential investments needed to meet this demand will be channelled to the modernization of transmission grids and restoration of thermal and nuclear power plants.

c. *Capital availability (including investment barriers).* Ukraine has always been considered to be country with high risk level for making investments and doing business. Key factors of doing business in Ukraine are demonstrated in the table below.

[8] "Energy strategy of Ukraine till 2030", Section 2.
http://mpe.kmu.gov.ua/fuel/control/uk/doccatalog/list?currDir=50505 (latest access – 18.07.2012)

Table 9. International ratings of Ukraine [9]

Indicators	2006	2007	2008	2009	Note
Corruption index of Transparency International	99 position from 163	118 position from 180	134 position from 180	-	Index of corruption
Rating of business practices of The World Bank (The Doing Business)	124 position from 155	118 position from 179	139 position from 178	145 position from 181	Rating of conduct of business (ease of company opening, licensing, staff employment, registration of ownership, receipt of credit, defence of interests of investors)
The IMD World Competitiveness Yearbook	46 position from 55	46 position from 55	54 position from 55	56 position from 57	Research of competitiveness (state of economy, efficiency of government, business efficiency and state of infrastructure)
Index of Economic Freedom of Heritage Foundation	99 position from 157	125 position from 161	133 position from 157	152 position from 179	Determination of degrees of freedom of economy (business, auction, financial, monetary, investment, financial, labour freedom, freedom from Government, from a corruption, protection of ownership rights)
Global Competitiveness Index of World Economic Forum	69 position from 125	73 position from 131	72 position from 134	-	Competitiveness (quality of institutes, infrastructure, macroeconomic stability, education, development of financial market, technological level, innovative potential)

Risks of doing business in Ukraine have great influence on capital endowment in the country. According to the official data of the National Bank of Ukraine[10] commercial interest rates in euro for the period more than 5 years in Ukraine violated between 8% and 10.4% in October 2010. Thus in contrast, according to the data of the European Central Bank[11] the same index for the same period violated from 2.3% to 3.6% in Germany. The cost of debt financing in Ukraine is at least two times higher than in Eurozone. The risks of investing into Ukraine are additionally confirmed by the country ratings provided by the "Moody's international rating" agency and the associated country risk premium. Payment risks (%) for Russia and Ukraine are compared in the table below[12]:

Table 10. Payment risks (%) for Russia and Ukraine

Total Risk Premium, %	2008	2009	2010
Russia	6.52	8	6.9
Ukraine	10.04	14.75	12.75

[9] Data from the State Agency of Ukraine for Investments and Innovations
[10] Statistical Release. Archive, Interest Rates, 2010. http://www.bank.gov.ua/doccatalog/document?id=66258 (latest access – 18.07.2012)
[11] Germany, Harmonised long-term interest rates for convergence assessment purposes http://sdw.ecb.europa.eu/browse.do?node=bbn642 (latest access – 18.07.2012)
[12] Data is provided by Aswath Damodaran, Ph.D., Stern School of Business NYU http://pages.stern.nyu.edu/~adamodar/ (latest access – 18.07.2012)

It can be seen from the table above that Russia which suggests worth complex of investment opportunities is a country with considerably smaller degree of risk if compared to Ukraine.

High interest rates and insufficient resources of financial institutions complicate big infrastructure projects financing. Such projects rely on direct investments or collaboration with private investors, international financial institutions and government. Large-scale infrastructure projects financed by private companies can be hardly found in Ukraine.

d. *Availability of skills, know-how in the area of technologies/techniques and availability of the best technologies/techniques in the future*. In 1950s alongside with creation of powerful nuclear and thermal power plants the small hydro energy suffered decline. The growth of centralized power supply, low fuel and electricity prices for authority bodies and enterprises having small HPPs on their balance sheet are the reasons why the plants had lost their expediency, had begun their conservation and spontaneous dismantling. In 2000s reconstruction activity was initiated at some HPPs, but these projects also needed additional funds gained from ERUs sale. Ukraine possesses huge industrial potential for production of traditional technologies for nuclear and thermal power plans. There are general electric power grids technologies, production of transformers and cables in Ukraine. However, the local market lacks for new technologies in the sector of hydro energy.

e. *Prices for fuel and its availability*. As for fuel, natural gas consumption prevails historically on the scheme of primary energy consumption in Ukraine – 41% (39% in 2005) for comparison an average share of natural gas consumption in total fuel consumption in other countries is 21%; an average share of petroleum consumption in Ukraine is 19%, of coal – 19%, of uranium – 17%, and share of hydro and other renewable sources of energy consumption is 4%. During the period from 2000 till 2005 Ukraine was 60.7% dependent on organic fuel import including traditional primary fuel in comparison with average European index[13] which is 51%. Ukraine is self-sufficient only with coal; all the other types of fuel are mainly imported. Prices for petroleum and for petroleum products in the international market and also prices for gas that is supplied to Ukraine from Russia increased to the European level. Prices for coal in Ukraine are low, but in most cases they do not refund production costs[14].

f. *National and/or local plans as for energy sector expansion as necessary*. Energy strategy of Ukraine till 2030[15] does not include expansion of alternative energy sources, especially their use as key area of growth and development. According to this document the growing demand for electric energy will be met by introduction of new capacities and improving of the existing nuclear and thermal power plants.

[13] Energy strategy of Ukraine till 2030. Section 1.4. http://mpe.kmu.gov.ua/fuel/control/uk/doccatalog/list?currDir=50505 (latest access – 18.07.2012)

[14] According to the Report of the Ministry of coal industry in Ukraine price for 1t of coal produced by state companies was UAH 442.3 in October 2009 while cost of its production was UAH 717.25.
http://www.nbuv.gov.ua/portal/soc_gum/pips/2011_1/tom1/019.pdf (latest access – 05.09.2012);
http://www.mvp.gov.ua (latest access – 05.09.2012)

[15] Energy strategy of Ukraine till 2030. Section 5.4. http://mpe.kmu.gov.ua/fuel/control/uk/doccatalog/list?currDir=50505 (latest access – 18.07.2012)

g. National or local forestry and agricultural policy as necessary. According to the Fifth National Communication on Climate Change[16], land parcelling according to the type of land-use in Ukraine is performed in the following way: agricultural land (71%), forests (17.5%), land for building construction (4.1%), land covered with water (4%), bogs (1.6%), others (1.8%). The principal regulatory documents in this sphere are Conception of development and reformation of the forestry, State programme "Forests of Ukraine"; Strategy of land-use and land parcelling is absent[17]. The project is realized on the existing HPPs sites which were approved by relevant government institutions.

5) The baseline scenario is set **in such a way that it is impossible to get ERUs at the cost of decrease of activity level out of the project activity boundaries or as a result of force majeure circumstances.** The project activity provides the acquisition of emission reductions only for the amount of the energy produced and supplied to the electric grid by the renewable sources such as water power.

6) The baseline scenario is set **taking into account ambiguity and using careful assumptions.** Stating the baseline emission level project participants were guided by some elements of baseline scenario, approved by the CDM, and ACM0002 monitoring methodology. All data necessary for baseline emission level setting were received from open and publicly available resources. Calculation of emission factor selected for the baseline scenario setting is based on careful assumptions:

- Calculation of emission factor from electric grid is based on the current data of thermal power plants activity, electric grid operator and companies supplying electric power;
- According to ACM0002 methane and nitric oxide emissions from the production of electricity by conventional power plants were not taken into account that is conservative;
- Greenhouse gas emissions caused by land flooding and processes of anaerobic decomposition of plant remains were not taken into account as all the HPPs which are included in the project were built in the mid last century, and the project activity is realized without changing the territory of existing reservoirs.

Carbon dioxide emission factor for Ukrainian grid

Researches on carbon dioxide emission factor in the baseline scenario for Ukrainian grid are given below:

1) Guidance for project design document of JI projects. Dutch Ministry of Economic Affairs, May 2004[18] (Baseline scenario of the Netherlands tender for ERUs purchase (ERUPT). The baseline ERUPT scenarios are based on the following key principles: mainly on indirect data sources on electric grids (MEA/OECP reports); taking into account expenses concerning JI projects reduction; assumption that all the power plants are operating with excess power, and that during the period from 2000 till 2030 all the thermal power plants will be gradually switched to operating on natural gas.

The weak point of such assumption is an ambiguity of data sources. For example, NCV (net calorific value) of coal was not defined at the unit level, but was taken from the default values given by Intergovernmental Panel on Climate Change (IPCC). Moreover MEA data concerning electric power are available only to 2002. The programme ERUPT implies that Ukraine should

[16] Fifth National Communication on Climate Change of Ukraine, Article 33 http://unfccc.int/resource/docs/natc/ukr_nc5rev.pdf (latest access – 18.07.2012)
[17] http://www.uceps.org/ukr/files/category_journal/NSD107_ukr_1.pdf (latest access – 18.07.2012)
[18] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/GuidVol1.doc (latest access – 18.07.2012)

have switched all the thermal power plants from coal use to natural gas use. This assumption is considered to be unrealistic in Ukraine as opposite tendency is being observed. This tendency is very conservative and obsolete as it was used only for early JI projects and, as a rule, was not used for emission reduction verification.

2) *Standardized emission factors for Ukrainian grid, Version 5, 2007 developed by the Global Carbon B.V. company (baseline scenario of Global Carbon).*
This research was designed with a specific goal to justify a baseline scenario within the JI project. It was grounded on some conservative assumptions such as emission factor fixation for electric grid when indeed its increase conditioned by tendency of switching from gas to coal was expected. TUV SUD company estimated the emissions described in this research and admitted it to be acceptable for carbon dioxide emission factor determination within JI projects. This emission factor was used in a number of JI projects approved by Ukraine and by those whose determination is considered to be final and adopted by the JISC: project #0104 "Improvement of the Energy efficiency at Energomashspetsstal (EMSS), Kramatorsk, Ukraine"[19], project #0035 "Utilization of Coal Mine Methane at the Coal Mine named after A.F. Zasyadko"[20];
3) *The research "Development of the electricity carbon* dioxide *emission factors for Ukraine"[21], 2010, designed by Lahmeyer International Company (baseline scenario of EBRD).*
The research on the dynamics of carbon dioxide emission factors development in the process of electric power production was completed in October 2010. The research results were based on the imitation model of energy system which was specially designed to consolidate the forecast annual changes of efficiency and carbon dioxide emissions for the period from 2009 till 2020. Independent entity TUV SUD, accredited Joint Implementation Supervisory Committee (JISC) tested studies and method; it was based on, and proved its correspondence to the relevant methodology of UNFCCC. This study was based on recently received data and counterbalance to conservatism and acceptability. It was not applied to JI projects which determination was adopted by JISC as a final one;
4) *Carbon dioxide emission factor in the process of electric power production, National Environmental Investment Agency (NEIA), 2011 (baseline scenario of DFP)*[22]. This methodology and, as a result of it, carbon dioxide emission factor were developed by the Designated Projects Coordinator in Ukraine for the purpose of their application to the JI projects. The estimation of carbon dioxide emission factors for 2008, 2009, 2010 and 2011 is available[23]. It was determined that actual carbon dioxide emission factors for the previous period would be calculated and released annually before March 1. This calculation is based on current data provided by the power plants. The results of this research are closely related to the results of calculation according to the baseline scenario of EBRD.

19 http://ji.unfccc.int/JI_Projects/DB/VY889VYDTR7YGFRYTY9TXLB4AWBLUR/Determination/Bureau%20Veritas%20Certification1246891334.73/viewDeterminationReport.html (latest access – 18.07.2012)
20 http://ji.unfccc.int/UserManagement/FileStorage/1E3ZT7ZUJQ04TYPH3SBEY8BTBDLF1L (latest access – 18.07.2012)
21 http://www.ebrd.com/downloads/sector/eecc/Ukraine_English.pdf (latest access– 18.07.2012)
22 http://www.neia.gov.ua/nature/doccatalog/document?id=125381 (latest access– 18.07.2012)
23 http://www.neia.gov.ua/nature/doccatalog/document?id=127171 (latest access– 18.07.2012);
http://www.neia.gov.ua/nature/doccatalog/document?id=127172 (latest access– 18.07.2012);
http://www.neia.gov.ua/nature/doccatalog/document?id=126006 (latest access– 18.07.2012);
http://www.neia.gov.ua/nature/doccatalog/document?id=127498 (latest access– 18.07.2012);

As the project is being realized during a considerable period of time, combination from the given factors was chosen, according to the principle of the highest reliability for a concrete period of time. Thus the figures for the period 2005-2024 are the following:

2005 – 0.740 tCO_2e/MWh ($kgCO_2e$/kWh)[24]

2006-2007 – 0.807 tCO_2e/MWh ($kgCO_2e$/kWh)[25]

2008 – 1.055 tCO_2e/MWh ($kgCO_2e$/kWh)[26]

2009 – 1.068 tCO_2e/MWh ($kgCO_2e$/kWh)[27]

2010 – 1.067 tCO_2e/MWh (kg CO_2e/kWh)[28]

2011-2024 – 1.063 tCO_2e/ MWh ($kgCO_2e$/kWh)[29]

For the forecast estimates in this PDD the last available carbon dioxide emission factor is used during the whole estimation period. The actual carbon dioxide emission factor, if occurs, will be used for emission reductions calculation. If such an emission factor is absent, the very last available factor will be used instead of it.

Step 2. Application of the approach chosen

The theoretical approach described above is applied to determine the baseline scenario. According to this project the baseline scenario for this project lies in the following:

The electric power that is supplied to the grid as a result of the project activity, in other case, could be produced as a result of the activity of a power plant connected to the grid or in a result of building of new sources of power production.

Baseline emissions include only CO_2 emission in the process of electric power production by thermal power plants substituted in a result of project activity. The methodology implies that the total electric power production that exceeds the baseline level under the project could be realized in the result of operation of the existing electric power plants connected to the grid and at the cost of building of new power plants. The baseline level is calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,produced,y}, \quad \text{(Formula 1)}$$

Where:

BE_y –	Baseline emissions in period *y* (tCO_2e);
$EG_{PJ,y}$ –	Amount of specific electricity production produced and supplied to the grid as a result of JI project implementation in period *y* (MWh);
$EF_{grid,produced,y}$ –	Specific CO_2 emission factor during electricity production at the power plants connected to the grids, tCO_2e/MWh.

[24] Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (Version 2.3), Table B1, page 42: http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html (latest access– 18.07.2012)
[25] Standardized emission factors for the Ukrainian electricity grid, Table 8, page 10: http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514 (latest access– 18.07.2012)
[26] http://www.neia.gov.ua/nature/doccatalog/document?id=127171 (latest access– 18.07.2012)
[27] http://www.neia.gov.ua/nature/doccatalog/document?id=127172 (latest access– 18.07.2012)
[28] http://www.neia.gov.ua/nature/doccatalog/document?id=126006 (latest access– 18.07.2012)
[29] http://www.neia.gov.ua/nature/doccatalog/document?id=127498 (latest access– 18.07.2012)

Key information and data used for the baseline scenario setting (variables, parameters, data sources, etc.) are given in the tables below.

Table 11. Key information and data used for the baseline scenario setting: Amount of specific *electricity production supplied by the project HPPs to the grid in period y*

Data/Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Amount of specific electricity production supplied by the project HPPs to the grid in period *y*.
Time of determination/ monitoring	Continuous measurements and making monthly notes.
Source of data (to be) used	Measurement complexes installed on HPPs
Value of data applied (for ex ante calculations/determinations)	As provided by estimation of electricity production
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements of electricity on site by meters on commercial purpose.
QA/QC procedures (to be) applied	Cross-check of the measurements results with accounting record keeping on the sold electricity
Any comment	No

Table 12. Key information and data used for the baseline scenario setting: Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine.

Data/Parameter	$EF_{grid,produced,y}$
Data unit	tCO_2e/MWh
Description	*Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine*
Time of determination/ monitoring	Actual, according to the annual records provided by NEIA.
Source of data (to be) used	Reference data. The source is given below separately for each factor used.
Value of data applied (for ex ante calculations/determinations)	For 2005 – 0.740 tCO_2e/MWh ($kgCO_2e/kWh$)[30] For 2006-2007 – 0.807 tCO_2e/MWh ($kgCO_2e/kWh$)[31] For 2008 – 1.055 tCO_2e/MWh ($kgCO_2e/kWh$)[32]

[30] Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (Version 2.3), Table B1, page 42: http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html (latest access – 18.07.2012)
[31] Standardized emission factors for the Ukrainian electricity grid, Table 8, page 10: http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514 (latest access – 18.07.2012)

	For 2009 – 1.068 tCO_2e/MWh ($kgCO_2e/kWh$)[33] For 2010 – 1.067 tCO_2e/MWh ($kg\ CO_2e/kWh$)[34] For 2011-2024 – 1.063 tCO_2e/MWh ($kgCO_2e/kWh$)[35]
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Using such factors is a common practice when estimating JI projects.
QA/QC procedures (to be) applied	Only officially accepted factors have been used for estimation.
Any comment	In NEIA Order indicator is given in the dimension $kgCO_2/kWh$ that equals to tCO_2/MWh. In case of absence of actual indicator value for the certain monitoring period, the latest available value is used for calculation.

[32] http://www.neia.gov.ua/nature/doccatalog/document?id=127171 (latest access – 18.07.2012)
[33] http://www.neia.gov.ua/nature/doccatalog/document?id=127172 (latest access – 18.07.2012)
[34] http://www.neia.gov.ua/nature/doccatalog/document?id=126006 (latest access – 18.07.2012)
[35] http://www.neia.gov.ua/nature/doccatalog/document?id=127498 (latest access – 18.07.2012)

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

The following step-wise approach demonstrates that this project provides a reduction of emissions from their sources that are additional to those emission reductions that would otherwise be created:

Step 1. Indication and description of the approach applied

As it is proposed in Paragraph 44 of the Annex 1 of Guidance and methodology ACM0002, version 12.3.0, latest version of "Tool for the demonstration and assessment of additionality", approved by CDM Executive Board, is used to demonstrate additionality. Assessing applicability of ACM0002 was performed in subsection B.1. of this PDD. At the moment of completing PDD, the latest version of "Tool for the demonstration and assessment of additionality" is version 05.2[36], which demonstrates additionality of this project activity.

Step 2. Application of the approach chosen

The following check stages are applied in compliance with "Tool for the demonstration and assessment of additionality", version 05.2.

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

Realistic and reliable alternatives to the project activity will be defined through the following sub-steps:

Sub-step 1a: Identification of alternatives to the project activity

Table 13. Alternatives to the project activity

Alternative 1	**Continuation of the current situation** In Ukraine, part of thermal power plants (which work on coal, oil, natural gas) in electricity generation is around 46% of the total volume of its production, other 48% are produced by nuclear power plants, and the remaining 6.0% are produced by other sources (mainly hydro power plants). Total installed generating capacity is 53.1 GW, which is more than enough to meet current demand for electricity, although thermal capacities are outdated (approximate period of operation, on average, is 40 years), they need to be replaced in the near future. However, as long as excessive capacity of thermal power plants is present in Ukraine, it will not get any significant changes regarding the installation of building new capacities. This alternative provides that electricity, production of which exceeds the baseline level of emissions under the project, would be generated by existing power plants, connected to the grid (including project hydro power plants), and by building new power plants connected to the grid.
Alternative 2	**Proposed project activity, which is implemented without being registered as activity under JI project** Ukraine has significant potential for wind power, which is currently little used. This alternative involves reconstruction of HPPs, included in the project without developing of JI project.

[36] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf (latest access – 18.07.2012)

Alternative 3	**Construction of new power plants, operating on coal** Considering the fact that Ukraine has significant deposits of coal, it becomes possible to replace existing thermal power plants with new ones. However, coal production in Ukraine requires large funds. In addition, means for its transportation and preparation are also needed. Moreover, environmental groups will press on the power station that runs on coal, because Ukraine already has excess capacity of such plants. This alternative involves the construction of new power plants that run on coal in order to produce electricity, generated within activity of the proposed project.
Alternative 4	**Continuation of the current situation with disconnecting project HPPs from the grid** This alternative is completely analogous to Alternative 1, but with the condition that, as a result of emergency condition of the project HPPs, their work will be stopped until complete elimination of the accidents possibility. As indicated above, total installed generating capacity is 53.1 GW, which is more than enough to meet current demand for electricity. Herewith, disconnecting project HPPs from the grid will have no significant impact on the overall level of production. This alternative provides that existing power plants, connected to the grid, will produce additional electricity to cover the volume, equivalent to the volume that was produced by the project HPPs prior to the project implementation.

Outcome of Step 1a: Realistic and reliable alternatives to the project activity were defined.

Sub-step 1b: Identification of consistency with mandatory applicable laws and regulations

All above mentioned alternatives are in compliance with current laws and regulations in Ukraine. Traditional power plants work under current legislation of Ukraine. According to Article 5 of the Law of Ukraine "On Electric Power Industry" No 575/97-VR[37], state policy in the field of hydro power is following: supporting the development of hydro-energetic industry as environmental and non-fuel energy sub-sector by purchasing all produced electricity by power plants with cash payments without debt settlement as payment for electricity. Additional information on tariff policy is presented in Section B.1. of PDD.

Outcome of Step 1b: Four realistic and reliable scenarios for the project activity were defined, which meet mandatory laws and regulations of Ukraine.

Step 2. Investment analysis

According to "Tool for the demonstration and assessment of additionality" (version 05.2) this stage is optional and can be skipped. Alternative option was chosen – barrier analysis (see below).

Outcome of Step 2: Not applicable.

[37] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=575%2F97-%E2%F0 (latest access – 18.07.2012)

Step 3: Barrier analysis

Sub-step 3a: Identification of barriers that would prevent the implementation of alternative scenarios.

Alternative 1: Continuation of the current situation.

Investment barriers: There are no investment barriers for this alternative.

Technological barriers: Technical condition of existing HPPs within the project is characterized by significant or complete obsolescence of fixed waterpower, hydro technical and electrical equipment, the presence of faults in the structures of waterfront that can cause to the accident, silting of water reservoirs, increasing of water intake for non-energy needs, abrasion mounts of spillway and coastal areas of lower tail, etc. Thus, the continuation of the current situation with the continuation of HPPs operation within the project is too risky and is not a plausible scenario.

Alternative 2: Proposed project activity, which is implemented without being registered as activity under JI project.

Investment barriers: Project activity within the proposed Project is a process that requires significant annual investments and attracting human resources.

It is associated with:

- complex nature of reconstruction;
- necessity of preliminary detailed study in order to identify weak points that need to be reconstructed, as well as development of project decisions that should be based on the principles of absolute reliability, taking into consideration the enormous risks in case of emergency;
- necessity of constant training of personnel to work with new equipment;
- necessity of implementation of preliminary works on reconstruction of hydrological equipment (buildings, dams, and etc..) that do not provide quick returning of investments.

Constant flow of funds in Ukraine is possible only with the financial attractiveness of the project. Existing system of tariffs formation for electric power transfers financial burden of electricity loss to the end consumers, and does not allow to profit from their reduction. Herewith, the tariff is strictly regulated.

Access to financial resources at the international level for the proposed project is extremely limited. Investment climate in Ukraine is rather poor, especially in comparison with neighbouring countries. Ukraine is also considered to be a high risk country for doing business and investing in. Almost no private capital is available from domestic or international capital markets for mid to long term investments, and any capital that is available has high cost. The table below represents risks of doing business in Ukraine according to various international indexes and studies.

Table 14. International ratings of Ukraine [38]

Indicators	2008	Note
Corruption index of Transparency International	134 position from 180	Index of corruption
Rating of business practices of The World Bank (The Doing Business)	139 position from 178	Rating of conduct of business (ease of company opening, licensing, staff employment, registration of ownership, receipt of credit, defence of interests of investors)
The IMD World Competitiveness Yearbook	54 position from 55	Research of competitiveness (state of economy, efficiency of government, business efficiency and state of infrastructure)
Index of Economic Freedom of Heritage Foundation	133 position from 157	Determination of degrees of freedom of economy (business, auction, financial, monetary, investment, financial, labour freedom, freedom from Government, from a corruption, protection of ownership rights)
Global Competitiveness Index of World Economic Forum	72 position from 134	Competitiveness (quality of institutes, infrastructure, macroeconomic stability, education, development of financial market, technological level, innovative potential)

The data above shows that both real and perceived risks of investing in Ukraine are in place and influence the availability of capital in Ukraine both in terms of size of the investments and in terms of capital costs. Comparison of commercial lending rates in Ukraine and in the euro zone for loans for 5 years in Euros is presented in the figure below:

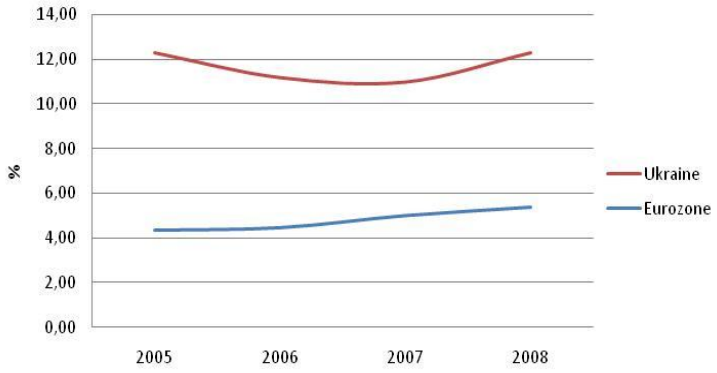

Figure 4. Commercial lending rates, Euros, for 5 years[39].

Cost of debt financing in Ukraine is at least twice as high than in the Eurozone. The risks of investing into Ukraine are additionally confirmed by the country ratings provided by the "Moody's international rating" agency and the associated country risk premium. The table below compares country risk premiums for Russia and Ukraine [40]:

[38] Data is provided by the State Agency for Investment and National Projects of Ukraine
[39] Data for Ukraine from National Bank of Ukraine http://www.bank.gov.ua/files/4-Financial_markets(4.1).xls (latest access – 18.07.2012)
[40] Data is provided by Aswath Damodaran, Ph.D., Stern School of Business NYU http://pages.stern.nyu.edu/~adamodar/ (latest access – 18.07.2012)

Table 15. Sovereign Awards for Russia and Ukraine

Total Risk Premium, %	2003	2004	2005	2006	2007	2008	2009	2010
Russia	7.0	7.02	6.6	6.64	6.52	8	6.9	7.25
Ukraine	11.57	11.59	10.8	10.16	10.04	14.75	12.75	12.5

As shown in this table, Russia offers a comparable set of investment opportunities and at the same time is much less risky country for investment than Ukraine.

As stated at the OECD (Organization for Economic Co-operation and Development) Roundtable on Enterprise Development and Investment Climate in Ukraine, the current legal basis is not only inadequate, but to a large extent it sabotages the development of market economy in Ukraine. Voices in the western press can basically be summarized as follows: The reforms in the tax and legal systems have improved considerably with the adoption of the Commercial Code, Civil Code and Customs Code on 1 January 2004 and new Tax Code on 1 January 2011 but still contain unsatisfactory elements and pose a risk for foreign investors[41]. Ukraine is considered to be heading in the right direction with significant reforms having been put into action but still has a long way to go to realize its full potential. Frequent and unpredictable changes in the legal system along with conflicting and inconsistent Civil and Commercial Codes do not allow for a transparent and stable enforced legal business environment. This is perceived as a great source of uncertainty by international companies, which make future predictions of business goals and strategy risky.

The conclusion from the abovementioned is as follows: the investment climate of Ukraine is risky and unwelcoming, private capital is not available from domestic or international sources or available at prohibitively high cost due to real and perceived risks of doing business in Ukraine as shown by various sources. Alternatives markets, such as Russia, offer similar profile of investment opportunities with lower risk and better business environment.

Subject to the above information, financing this Project is possible only if funds from the sale of emission reduction units of greenhouse gases are attracted.

Technological barriers: At the beginning of the Project organizational structure and infrastructure of the Company did not allow its implementation without substantial reorganization. Project implementation is related to significant risk of failure, as the exact effect from the implementation of certain measures cannot be calculated, and their effectiveness can be assessed only after a certain time after implementation. Taking into account the complex nature of reconstruction, and inaccessibility of investments (see above), the project realization could be performed during decades. Herewith, taking into account emergency state of power equipment and hydrological structures, it is most likely that the work of specified HPPs would be suspended until the complete elimination of the possibility of accidents. This would complicate project implementation even more, because at that time the company would not receive any profit from the generation and sale of electricity to the grid.

[41] Foreign Direct Investment in Ukraine – Donbas, Philip Burris, Problems of foreign economic relations development and attraction of foreign investments: regional aspect, ISSN 1991-3524, Donetsk, 2007. p. 507-510

Alternative 3: Construction of new power plants, operating on coal.

Investment barriers: For this alternative investment barriers are identical to those described in alternative 2.

Technological barriers: Technological barriers for this alternative are almost absent, because such activity is a common practice in Ukraine. All technologies that should be used in this case are well known and available in Ukraine.

Alternative 4: Continuation of the current situation with disconnecting project HPPs from the grid.

Investment barriers: There are no investment barriers for this alternative.

Technological barriers: There are no technological barriers for this alternative.

Outcome of Sub-step 3a: List of barriers is given above.

Sub-step 3b: Removal of alternative scenarios that exclude by identified barriers. Only Alternative 4 does not contradict any of the identified barriers.

Outcome of Sub-step 3b: Only Alternative 4 does not contradict any of the identified barriers.

Outcome of Step 3: Only Alternative 4 does not contradict any of the identified barriers and can be chosen as the baseline scenario.

Thus, the implementation of the project without registering it as JI project is improbable alternative, unlike Alternative 4, which is not prevented by any barriers. Instead, for the project scenario, JI component gives the following benefits:

- Possibility of obtaining additional revenue from the sale of ERUs is formed that will help to increase the profitability of the project and reduce the risk of investing that were involved;
- Climate component of the project is fully consistent with environmental goals and commitments, operating in the company at the global level. Thus, the implementation of JI project will allow improving the environmental performance of the company in general because the project does not include any negative impact on the environment, and moreover, its implementation leads to improvement of ecological situation in the region as a whole;
- Image benefits for the company operating on the international market.

Step 4: Common practice analysis

Sub-step 4a: To analyze other measures similar to the proposed activities under the project:

Proposed project activity is the first large-scale reconstruction of small HPPs, condition of which can be characterized by complete wear of equipment and hydrological structures that has already passed critical stages of recovery and transferred to the operating mode. Similar projects are also implemented at hydro power plants of companies Enerhia-1 and Hidroenerhoinvest. As the mentioned projects are also implemented under JI mechanism and according to "Tool for the demonstration and assessment of additionality" (Version 05.2), they cannot be considered to be a part of the common practice. PDD of the mentioned projects are currently under development.

Sub-step 4b: To discuss any similar occurring Variants:

Other, comparable to this project activity, projects are being developed in Ukraine as JI projects. Thus, the project is not a common practice.

Sub-steps 4a and 4b are satisfactory.

Therefore, in accordance with requirements of "Tool for the demonstration and assessment of additionality", version 05.2, the proposed project is additional.

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

Project boundaries for this very project are presented in figures 5 and 6

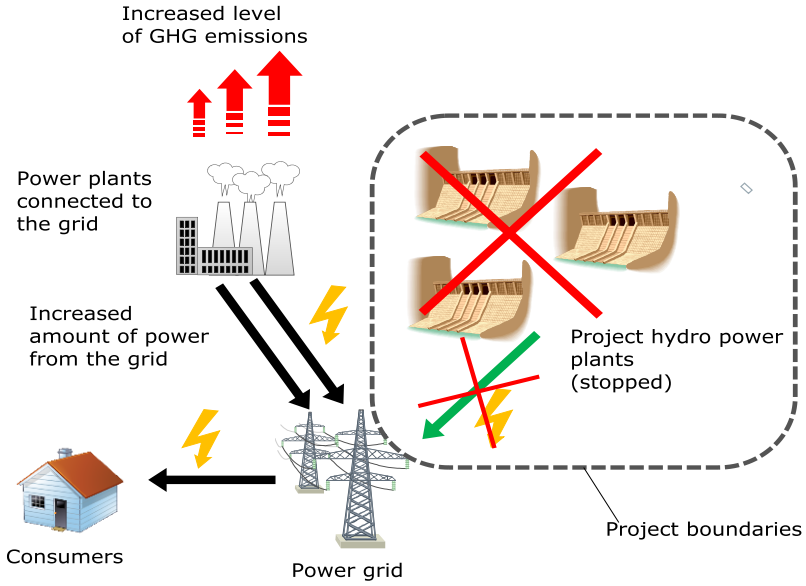

Figure 5. Project boundaries under baseline scenario.

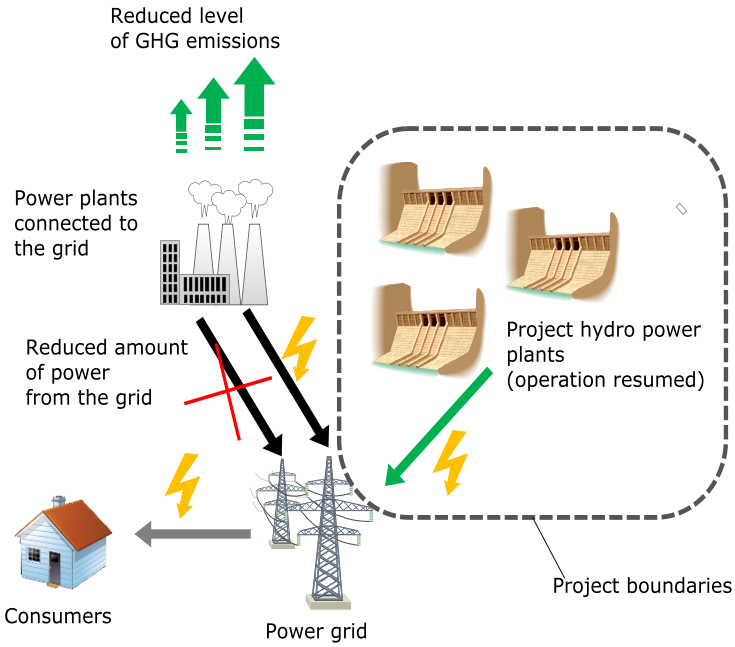

Figure 6. Project boundaries under the project scenario.

List of sources and greenhouse gases that were included in the project boundaries is presented in table 16

Table 16. Emission sources that were included ore excluded from the project boundary

Source		Gas	Included / Excluded	Justification /Explanation
Baseline scenario	CO_2 emission as a result of power production at the thermal power plants which were substituted as a result of project implementation.	**CO_2**	**Included**	**Main emission source**
		CH_4	Excluded	Not included as it is a secondary emission source according to ACM0002.
		N_2O	Excluded	Not included as it is a secondary emission source according to ACM0002.
Project scenario	CO_2 emission as a result of grid electricity consumption on site.	CO_2	Excluded	Electricity from the grid is not used in this project in substantial quantities. This fact is confirmed by the forms of statistical reporting 6-TP.
		CH_4	Excluded	
		N_2O	Excluded	
	CO_2 emission as a result of power production on HPPs.	CO_2	Excluded	According to the project scenario the electric power produced with the use of water power is climate friendly.
		CH_4	Excluded	According to the project scenario the electric power produced with the use of water power is climate friendly.
		N_2O	Excluded	According to the project scenario the electric power produced with the use of water power is climate friendly.
	CO_2 emission to the atmosphere conditioned by downstream effect and processes of anaerobic decomposition of plant remains.	CO_2	Excluded	Such emissions are considered to be absent within this project as all the HPPs included in the project were built in the mid last century and the project activity is realized without changing the territory of existing water reservoirs.
		CH_4	Excluded	Such emissions are considered to be absent within this project as all the HPPs included in the project were built in the mid last century and the project activity is realized without changing the territory of existing water reservoirs.
		N_2O	Excluded	Such emissions are considered to be absent within this project as all the HPPs included in the project were built in the mid last century and the project activity is realized without changing the territory of existing water reservoirs.

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

Date of completion of the baseline scenario: 17/07/2012

The baseline was developed by Carbon Management Company GmbH.

Developer's contact details:
Alain Girardet
Director of Carbon Management Company GmbH.
Tel: +41 79 691 33 13
Fax: +41 41 544 07 72
e-mail: Girardet@carbonmc.com

Detailed contact information is given in Annex 1.

Carbon Management Company GmbH is a project participant.

Alain Girardet is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

17.03.2004.

C.2. Expected operational lifetime of the project:

Operational lifetime of the project is 20 years or 240 months.

C.3. Length of the crediting period:

Start of the crediting period: 01.01.2005.

Length of the crediting period: 20 years or 240 months.

Length of the part of the crediting period (01.01.2005-31.12.2007) before the first commitment period under the Kyoto Protocol: 3 years or 36 months.

Length of the part of the crediting period (01.01.2008-31.12.2012) within the first commitment period under the Kyoto Protocol: 5 years or 60 months.

Length of the part of the crediting period (01.01.2013-31.12.2024) after the first commitment period under the Kyoto Protocol: 12 years or 144 months.

ERUs status or clean absorption increase developed by the JI projects after the first commitment period under the Kyoto Protocol may be defined by any relevant agreements within the UNFCCC and the host Party.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

This monitoring plan is defined in accordance with Annex B of the JI Guidelines and further guidelines on setting baseline scenario and monitoring developed by JISC. Description of the monitoring plan chosen is made with the use of the following step-wise approach:

Step 1. Indication and description of the approach chosen regarding monitoring

The Project participants decided to use under JI specific approach (Paragraph 9a of the JI Guidance) elements of the monitoring methodology which are available in ACM0002, version 12.3.0. The ACM0002 applicability to this project activity is discussed in the section B of this PDD. The monitoring plan will involve in particular:

- Collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions from GHG sources occurring within the project boundaries during the crediting period;
- Collection and archiving of all relevant data necessary for determining of the baseline level of anthropogenic emissions from GHG sources occurring within the project boundaries during the crediting period;
- Identification of all potential sources as well as collection and archiving of data on increased anthropogenic emissions from GHG sources outside the project boundaries that are significant and can be reasonably attributed to the project during the crediting period;
- Quality assurance and control procedures of the monitoring process;
- Procedures for the periodic calculation of the reductions of anthropogenic emissions by sources according to the proposed JI project and leakage effects if any.

Step 2. Application of the approach chosen

The monitoring methodology of ACM0002 requires that all data within the monitoring should be archived in electronic format and stored during at least 2 years after completion of the last crediting period and within 2 years after the last transfer of ERUs. 100% of data should be checked if other requirements are not stated in the sections below. All the measurements should be done with the use of calibrated monitoring equipment according to the relevant branch-wise standards.

All the large-scale producers of electricity in Ukraine are obliged to have Automated commercial electricity metering (ACEM). This system allows measuring the whole volume of the electric energy that is supplied to the electric grid and consumed from the electric network, which guarantees the transparency of the

calculation of the net electricity supplied to the electric grid. Detailed technical characteristics of this system are provided by the main Ukrainian wholesale electricity market operator – State enterprise "Enerhorynok" [42].

In the project activity process there will be used Option I – Emissions monitoring under the project baseline scenario. See subsections below to get additional information on the approach application.

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

This section is left blank on purpose.

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

This section is left blank on purpose.

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

According to the approach chosen for the project activity on electric energy production by means of water energy:

$$PE_y = 0, \quad \text{(Formula 2)}$$

Where:

PE_y – Project emissions in period y (tCO_2e).

[42] http://www.er.energy.gov.ua/doc.php?c=1228 (latest access – 18.07.2012)

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
1	$EG_{PJ,y}$ – Amount of electricity supplied to the grid as a result of JI project implementation in period *y*	Official reports	MWh	c	Constantly, making monthly notes	100%	Electronic and paper	This parameter is measured and used during usual commercial activity of an enterprise. Data are based on the forms of statistic accounting #6-TP
2	$EF_{grid,produced,y}$ – Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine	According to official data of the DFP of Ukraine or other relevant authorities	tCO_2/MWh	e	Actually, according to annual data of the DFP of Ukraine	100%	Electronic and paper	This emission factor is the last carbon dioxide emission factor for Ukrainian electric grids which is adopted by the DFP of Ukraine

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

According to ACM0002, for project activity on producing electric power out of water power, the baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,produced,y}, \quad \text{(Formula 3)}$$

Where:

BE_y - Baseline emissions in period *y* (tCO_2e);

$EG_{PJ,y}$ - Amount of electricity supplied to the grid as a result of JI project implementation in period *y* (MWh);

$EF_{grid,produced,y}$ - Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine (tCO_2/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 is left blank on purpose.

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

This section is left blank on purpose.

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):

This section is left blank on purpose.

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

According to ACM0002 none of the emissions leakages can be observed.

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

Not applicable.

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

Not applicable.

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

According to ACM0002 emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \, . \qquad \text{(Formula 4)}$$

Where:

ER_y – Emission reductions in period *y* (tCO_2e);

BE_y – Baseline emissions in period *y* (tCO_2e);

PE_y – Project emissions in period *y* ($t\ CO_2e$).

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

Any negative effect on the environment as a result of the project implementation is absent. Therefore, the Host Party's requirements are not applicable.

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.
№1, Table D.1.1.3.	Low	Exported electric power volume will be estimated accordingly to the data of the monitoring complexes that are installed at the stations. Electric meters that are included to the monitoring complexes are commercial record devices and are regularly tested according to the legislative requirements of the Law of Ukraine # 113/98-VR dated 10.06.2012 "On Metrology and Metrological activity" [43]. Transmission of the data on exported/imported volume of electric power is controlled on-line. Registration is made monthly by a responsible operator. Measurement data are used for commercial operations of the company that is why they are properly checked. Measurement data and notes on sold electric power cross check will be performed periodically. Data sources are forms of statistical reporting #6-TP.
№2, Table D.1.1.3.	Low	Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine are calculated by the DFP of Ukraine on the periodical basis. For Monitoring Reports the newest factors will be used.

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

The monitoring plan will be performed within the existing operational and management structure of the company. Controllable parameters and data provided by the automated commercial system of energy recording will be compared on site. Data of the supervisory monitoring and data collection system will be also used for results verification.

General operational and management structure of the company which will be used by project operator for the monitoring plan implementation is performed on the scheme below:

[43] http://zakon2.rada.gov.ua/laws/show/113/98-%D0%B2%D1%80

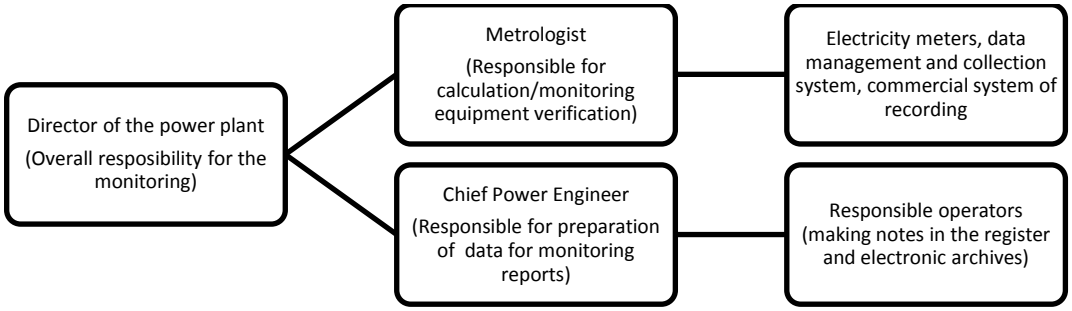

Figure 7. Operational and management structure.

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

Date of the completion of the monitoring plan implementation: 17/07/2012.

The monitoring plan was developed by Carbon Management Company GmbH.

Developer's contact details:
Alain Girardet
Director of Carbon Management Company GmbH.
Tel: +41 79 691 33 13
Fax: +41 41 544 07 72
e-mail: Girardet@carbonmc.com

Detailed contact information is given in Annex 1.

Carbon Management Company GmbH is a project participant.

Alain Girardet is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

According to ACM0002 for projects on hydro electric power production, emissions within the project are equal to zero.

E.2. Estimated leakage:

According to ACM0002 any leakage was not observed. To get more detailed information, please see Section D.1.3.

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

This sum is equal to zero.

E.4. Estimated baseline emissions:

Estimation of the baseline scenario emissions was done according to the formulae presented in section D.

The results of calculation are presented in the table below. The calculation itself is made in the file *20120521_ZOE_Hydro_calculations.xls*, attached to the PDD.

Table 17. Baseline scenario emissions over the period from 01.01.2005 to 31.12.2007

Year	GHG baseline emissions (tonnes of CO_2 equivalent)
2005	81 860
2006	105 004
2007	113 633
Total (tonnes of CO_2 equivalent)	300 497

Table 18. Baseline scenario emissions over the period from 01.01.2008 to 31.12.2012

Year	GHG baseline emissions (tonnes of CO_2 equivalent)
2008	160 546
2009	132 954
2010	160 793
2011	120 326
2012	140 028
Total (tonnes of CO_2 equivalent)	714 647

Table19. Baseline scenario emissions over the period from 01.01.2013 to 31.12.2024

Year	GHG baseline emissions (tonnes of CO_2 equivalent)
2013	140 028
2014	140 028
2015	140 028
2016	140 028
2017	140 028
2018	140 028
2019	140 028
2020	140 028
2021	140 028
2022	140 028
2023	140 028
2024	140 028
Total (tonnes of CO_2 equivalent)	1 680 336

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

Emission reductions are calculated according to the formula (4) hereinbefore. The results are presented in the tables 20, 21, 22 below.

Table20. Emission reductions over the period from 01.01.2005 to 31.12.2007

Year	Sum of the project emissions and leakage (tonnes of CO_2 equivalent)	GHG baseline emissions (tonnes of CO_2 equivalent)	Emission reductions (tonnes of CO_2 equivalent)
2005	0	81 860	81 860
2006	0	105 004	105 004
2007	0	113 633	113 633
Total (tonnes of CO_2 equivalent)	0	300 497	300 497

Table 21. Emission reductions over the period from 01.01.2008 to 31.12.2012

Year	Sum of the project emissions and leakage (tonnes of CO_2 equivalent)	GHG baseline emissions (tonnes of CO_2 equivalent)	Emission reductions (tonnes of CO_2 equivalent)
2008	0	160 546	160 546
2009	0	132 954	132 954
2010	0	160 793	160 793
2011	0	120 326	120 326
2012	0	140 028	140 028
Total (tonnes of CO_2 equivalent)	0	714 647	714 647

Table 22. Emission reductions over the period from 01.01.2013 to 31.12.2024

Year	Sum of project emissions and leakage (tonnes of CO_2 equivalent)	GHG baseline emissions (tonnes of CO_2 equivalent)	Emission reductions (tonnes of CO_2 equivalent)
2013	0	140 028	140 028
2014	0	140 028	140 028
2015	0	140 028	140 028
2016	0	140 028	140 028
2017	0	140 028	140 028
2018	0	140 028	140 028
2019	0	140 028	140 028
2020	0	140 028	140 028
2021	0	140 028	140 028
2022	0	140 028	140 028
2023	0	140 028	140 028
2024	0	140 028	140 028
Total (tonnes of CO_2 equivalent)	0	1 680 336	1 680 336

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

Table 23. Emission reductions over the period from 01.01.2005 to 31.12.2007

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2005	0	0	81 860	81 860
2006	0	0	105 004	105 004
2007	0	0	113 633	113 633
Total (tonnes of CO_2 equivalent)	0	0	300 497	300 497

Table 24. Emission reductions over the period from 01.01.2008 to 31.12.2012

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	0	0	160 546	160 546
2009	0	0	132 954	132 954
2010	0	0	160 793	160 793
2011	0	0	120 326	120 326
2012	0	0	140 028	140 028
Total (tonnes of CO_2 equivalent)	0	0	714 647	714 647

Table25. Emission reductions over the period from 01.01.2013 to 31.12.2024

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2013	0	0	140 028	140 028
2014	0	0	140 028	140 028
2015	0	0	140 028	140 028
2016	0	0	140 028	140 028
2017	0	0	140 028	140 028
2018	0	0	140 028	140 028
2019	0	0	140 028	140 028
2020	0	0	140 028	140 028
2021	0	0	140 028	140 028
2022	0	0	140 028	140 028
2023	0	0	140 028	140 028
2024	0	0	140 028	140 028
Total (tonnes of CO_2 equivalent)	0	0	1 680 336	1 680 336

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:

None of the project measures involves any negative impact to the environment that is why the EIA for this project was not designed intentionally.

The project does not have cross-border effects as it is implemented on the territory of Zakarpattya Region in Ukraine and does not involve any effects that can appear on the territory of any other country.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The given project in general will have positive effect on the environment if compared to the existing condition, as modernization will allow producing "clean" electric power from renewable sources. The project will also result in reductions of the emissions into the air and rivers made by traditional power plants. Thus, in general the reconstruction effect is not significant.

SECTION G. Stakeholders' comments

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

The project does not have cross-border effects.

The reconstruction programme was discussed at the sessions which were attended by the representatives of the Region Administration, the Ministry of Energy of Ukraine, NJSC Energy Company of Ukraine, State Supervision on Electricity and Heat Consumption. The programme key points were covered in the electronic mass-media and by the regional radio. No negative comments were received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Project owner:

Organisation:	"Zakarpattyaoblenergo", PJSC
Street/P.O.Box:	Golovna Str.
Building:	57
City:	Uzhorod District, Onokivtsi Village
State/Region:	Zakarpattya Region
Postal code:	89412
Country:	Ukraine
Phone:	+380312619859
Fax:	+380312619859
URL:	http://www.energo.uz.ua
Represented by:	
Title:	JI project representative
Salutation:	
Last name:	Lystrova
Middle name:	Yulia
First name:	Viktorivna
Department:	
Phone (direct):	+38 044 569-17-75
Fax (direct):	+38 044 569-17-70
Mobile:	
Personal e-mail:	lystrova@cei.com.ua

Project consultant:

Organisation:	Carbon Management Company GmbH
Street/P.O.Box:	Sonnenbergstrasse Str.
Building:	18
City:	Sarnen
State/Region:	Kanton Obwalden
Postal code:	6060
Country:	Switzerland
Phone:	+ 41 41 544 07 71
Fax:	+ 41 41 544 07 72
E-mail:	
URL:	http://www.carbonmc.com
Represented by:	
Title:	Director
Salutation:	
Last name:	Girardet
Middle name:	
First name:	Alain
Department:	
Phone (direct):	+41 79 691 33 13
Fax (direct):	+41 41 544 07 72
Mobile:	
Personal e-mail:	Girardet@carbonmc.com

Annex 2

BASELINE INFORMATION

Table containing the key elements of the baseline scenario

#	Parameter	Measurement unit	Data source
1	$EG_{PJ,y}$ _ Amount of electricity supplied to the grid as a result of JI project implementation in period y	MWh/year	Data of the project owner based on the measurements and official sources.
2	$EF_{grid,produced,y}$ – Specific CO_2 emission factor during electricity production at the power plants connected to the Unified Energy System of Ukraine	tCO_2/MWh	Reference data. The source is given in Section B.1, separately for every used factor for the period 2005 -2024.

Annex 3

MONITORING PLAN

See Section D of the PDD.

Annex 4

DESCRIPTION OF THE SITUATION AT THE BEGINNING OF THE PROJECT ACTIVITY

In Ukraine, part of thermal power plants (which work on coal, oil, natural gas) in electricity generation is around 46% of the total volume of its production, other 47% are produced[44] by nuclear power plants, and the remaining 7% are produced by other sources (mainly hydro power plants). Total installed generating capacity is 53.1 GW[45], which is more than enough to meet current demand for electricity; although thermal capacities are outdated (approximate period of operation, on average, is 40 years).

Today nuclear power plants provide Ukrainian electric power grid with the basic load. They produce the best part of the electric power – 48% of total electric power output that accounted 185 TW in 2008[46]. Now there exist some big companies producing electric power in Ukraine, namely:

- 5 thermal power generated companies – "Centrenerho", "Donbasenerho", "Dniproenerho", "Shidenerho", "Zahidenerho" that include 14 high-capacity thermal power plants with total installed capacity of 27.3 GW;
- 4 nuclear power plants with total installed capacity of 13.8 GW within the State Enterprise "Enerhoatom";
- 2 hydro power generating companies – "Ukrhydroenerho" and Dniester Hydroelectric Station that include series of Dnieper and Dniester hydro power plants with total installed capacity of 4.6 GW;

Besides, there are some other thermal power plants (HPPs). Some of them are operating under the direction of local energy distribution companies and other organizations, while other thermal power plants set up separate enterprises. Besides this, some small companies producing electric power are also operating in Ukraine (small hydro and wind power plants); however their part of the overall electric power production is insignificant.

PJSC "Zakarpattyaoblenergo" includes three electric power plants – Tereblya-Ritska HPP (hereinafter referred to as TRHPP), Onokivska HPP (hereinafter referred to as OnHPP) and Uzhgorod HPP (hereinafter referred to as UzhHPP) with total capacity of 31.55MW.

Ukrainian electric power system is characterized by great superpower mainly in the sphere of heat and power engineering. Plans for electric power production expansion in Ukraine are based on new nuclear power plants, which comprise a complex of low cost electric power plants with obligatory electric power production.

Rapid development of small hydro power in Ukraine started at the beginning of the XX century. In 1924 there operated 84 small HPP of total capacity 4000 kW, and in 1929 their amount increased to 150 (total capacity of 8400 kW).

In western regions of Ukraine on some rivers there were installed dozens of watermills equipped with small generators of 5-25 KW capacity. Those were the simplest micro-HPPs with V-belt, flat-belt and gear transmissions from hydraulic actuator to generator with the simplest regulation of speed and

[44] Values are calculated based on the data of the State Statistics Service of Ukraine on the production of basic industrial products in 2010.
[45] http://www.ukrenergo.energy.gov.ua/ukrenergo/control/uk/publish/article?art_id=87570&cat_id=35061 (latest access – 18.07.2012)
[46] www.ebrd.com/downloads/sector/eecc/Ukraine_English.pdf, Section 2.1, page 10 (latest access – 18.07.2012)

voltage. They provided mainly autonomous local loads. In 1950 in Ukraine 956 small HPPs were into operation.

New, more powerful plants were designed and constructed in the 50's. There were built about 30 small HPPs, in particular, Ust-Chornanska (400 kW), Uhlyanska (250 kW), Turyi-Remetska (360 kW), Dilovska, Keretskovska, Stavnyanska, etc. Based on the Korsun-Shevchenkivska (1650 kW), Steblivska (2800 kW) and Dybnenska HPPs (560 kW) the first in Ukraine local rural energy system was established and put into operation, which also included Yurkivska TPP (2000 kW).

But still, along with the creation of powerful atomic and thermal power plants, small hydropower suffered a decline. The growth of centralized power supply, low fuel and electricity prices for authority bodies and enterprises having small HPPs on their balance sheet are the reasons why the plants had lost their expediency, had begun their conservation and spontaneous dismantling.

Hundreds of small HPPs were abandoned, dams and buildings destroyed. Plant premises were used as warehouses or for other commercial purposes, lifting mechanisms fall into despair, diversion channels were overgrown with forest or were filled, water silted and dams were used only as bridges.

Along with this very strong irrigation systems were built without taking into account the possibility of construction of hydro power plants at them. During irrigation and drainage construction process in Ukraine, the construction of small HPPs at 100 water reservoirs was planned, but not one of them was build.

Today in Ukraine there are 150 small HPPs. 49 of them are being under operation, but their equipment needs to be renovated or completely replaced. Among them are Korsun-Shevchenkivska, Steblivska, Ladyzhynska and other plants considered in this project, namely – Tereblya-Ritska HPP, Onokivska HPP and Uzhgorod HPP.

Brief description of the project history including JI elements

Before the project was implemented the HPPs of PJSC "Zakarpattyaoblenergo" operated irregularly as a result of frequent accidents and disrepairs. Hydrologic facilities were used for purposes other than that intended. Thus dams were used as bridges, reservoir got considerably silted. To achieve the project aim the program of HPP reconstruction was initiated in 2004. This allowed avoiding dangerous breakdowns and resuming the HPP operation. During 2004-2007 a lot of measures were performed, however some measures had not been taken because of the lack of fund for realization. Along with reconstruction process PJSC "Zakarpattyaoblenergo" management investigated issues connected with JI projects implementation in Ukraine, as funds gained from ERUs sale were taken into account after making decision as for the project implementation. Beginning with 2006 the first legislative documents concerning meeting requirements under the Kyoto Protocol to the UN Framework Convention on Climate Change appeared in Ukraine. Thus the Decree #206 of the Cabinet of Ministers of Ukraine "On Approval of the Procedure of Drafting, Review, Approval and Implementation of Projects Aimed at Reduction of Anthropogenic Emissions of Greenhouse Gases"[47] dated 22.02.2006 is the principal legislative document regulating JI projects implementation activity in Ukraine. This Decree regulates general issues concerning JI projects implementation in Ukraine. The next important step was the creation of the State Environmental Investment Agency of Ukraine according to the Decree #612 of Cabinet of Ministers of Ukraine "On Creation of the National. Environmental Investment Agency of Ukraine" dated 04.04.2007[48]. Thereby by the start of the crediting period (2008) the basic legislation was developed and the State entity, regulating JI projects implementation activity was created in Ukraine.

[47] http://zakon2.rada.gov.ua/laws/show/206-2006-%D0%BF
[48] http://zakon2.rada.gov.ua/laws/show/612-2007-%D0%BF

Despite the presence of necessary conditions, there was no possibility to realize the JI project and get funds from ERUs sale at that moment. Thus the Ukrainian registry carbon units was created in April, 2008 and the first ERUs issuing was made in 2009. At that time the activity concerning JI projects in Ukraine was not transparent enough, no national procedure (International name – Track 1) of projects realization was designed. Shortly after the implementation of national procedure Ukraine was debarred from project realization under this procedure because of some defects in the National GHG Inventory. Ukraine was able to resume the ability to realize JI projects according to the national procedure just in March 2012[49].

It should be noted as well that the given JI project is not the only one that is being realized by the management of PJSC "Zakarpattyaoblenergo". In 2003 there was adopted a Programme aimed at reduction of technological electric power consumption in power grids as it is described in the PTD "Reduction of Process Losses in Power Lines Zakarpattyaoblenergo PJSC" [50]. At the moment the project is registered according to the national procedure. The JI project described above and the given project will not result into double consideration of the emission reductions as these two projects differ in boundaries.

[49] http://lb.ua/news/2012/03/10/140419_ukraina_snova_vklyuchena_kiotskiy.html
[50] http://ji.unfccc.int/JIITLProject/DB/AAXF1NI4CKHNPH7NDK01ROQ5DEXH14/details