JOINT IMPLEMENTATION PROJECT

«Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine»

Position of the head of the organization, institution, body, which prepared the document

Director of CEP Carbon Emissions Partners S.A.		Knodel Fabian
(position)	(signature) P.S.	(name and patronymic, last name)

Position of the economic entity - owner of the source, where the Joint Implementation Project is planned to be carried out

Director of PE «FOSA»		S.A. Novak
(position)	(signature) P.S.	(name and patronymic, last name)

Kyiv - 2012

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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

"Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine"

Sectoral scope: 3 (Energy demand)

Version: 02

Date: 28/09/2012

A.2. Description of the project:

Aims of project activities.

The main objective of the Joint Implementation project (hereafter: JIP) "Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine" is improvement of energy-saving characteristics of Ukraine's lighting systems as well as improvement of the environmental situation in the country by distributing energy-efficient lighting equipment, namely compact fluorescent and LED lamps, to replace incandescent lamps.

Description of conditions under which the project is to be implemented:

PE "FOSA" was founded in 2006. Prior to the start of the project activity, PE "FOSA" was involved into the same type of activity as after the beginning of the project, i.e. distribution/sale of energy-saving lighting equipment. Distribution rates did not show major growth (for causes see PDD Section B.2), and the project levels of reduction in electricity consumption was unachievable. Thus, the reduction of GHG emissions from electricity consumption by private and commercial sectors was unremarkable. Although compact fluorescent lights (CFL) were introduced to the Ukrainian market as early as in 2004, they have failed to replace incandescent lamps as the largest component (around 80%) of the Ukrainian lighting stock. Incandescent light bulbs are extremely inefficient, as approximately 98% of energy consumed is emitted as heat. The operational life of incandescent lights is about 1000 hours, but they have a tendency towards early failure due to certain design features (namely the glowing filament). Among the alternatives to incandescent lights there are light-emitting diode (LED) lights and CFLs, which have much higher efficiency and operational life; moreover, their ligting mode is more comfortable for a human eye. Yet, rather high prices of these alternative light sources against those of incandescent lights, combined with low income level of an average citizen of Ukraine (in 2010, the average consolidated financial wealth per adult Ukrainian was USD 947[1]) prevented these technologies from wide distribution in the country.

Baseline scenario.

The scenario provides for further use of ILs as the main lighting source. Utilisation of a low-efficient light source, like incandescent lamps, will entail high energy consumption (5 to 7 times higher than that of the project scenario) and overloading of energy infrastructure of Ukraine, which in turn will lead to great amounts of GHG emissions into the atmosphere.

The baseline scenario justification is presented in Section B.

[1] Global Wealth Report, Credit Suisse Research Institute, 2010, p. 72.

Project scenario.

In the framework of the project activities, between 2008 and 2022, PE "FOSA" will distribute within the geographic borders of Ukraine 40 000 000 CFLs and 7 000 000 LEDLs, which will substitute incandescent lamps. The installation of high-efficient light sources, like CFLs and LEDLs, will lead to lowering energy consumption, which in turn will entail lowering the amount of fossil fuel combusted at a conventional power plant, which in turn will lead to the reduction of GHG emissions into the atmosphere. The positive effect, secondary to main project aims, will be consumers' financial savings on energy costs.

The project provides for the distribution of LEDLs and CFLs both among private persons (households) and legal entities (industrial, commercial, organisational and governmental bodies). The distribution of the project equipment (LEDLs and CFLs) will be carried out through electric energy consumers of the 2nd category.

The proposed JI project will utilise one of two types of incentives or their combination for LEDL and CFL distribution:

1) Discount;

The customers receive CFLs free of charge or at a heavily discounted price.

2) Rebate;

The customers pay full price of CFLs upfront and then are reimbursed gradually after certain time periods in several instalments.

The incentives can vary for different types of consumers according to the marketing policies of the project, and can be up to 50% or free of charge. In any case, the average (of all CFLs and LED lamps distributed within the project for any given year) incentive will be no less than 50% of the average market price of a CFL and LED lams for that particular year.

To bridge the cost differential between the market price of the CFLs and the price at which they are distributed to the consumers, the JI mechanisms of Kyoto Protocol are harnessed. The project owner would cover the project cost through sale of GHG emission reductions.

Activities implemented within the project framework (see Section A.4.2. below) as well as constant monitoring will reduce electricity and, as a result, fossil fuel consumption at a conventional power plant, which altogether will ensure a reduction of GHG emissions into the atmosphere.

PE "FOSA" has all licenses and permits to implement the project.

Necessary equipment for the project is planned to be purchased from leading Ukrainian and European manufacturers on a tender basis.

Historical details of the JI project "Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine"

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11/02/2008 – the starting date of the project, when PE "FOSA" started to implement activities within the framework of the Joint Implementation Project.

15/08/2012 – preparation and submission of the project idea note to support anthropogenic GHG emission reductions, to the State Environmental Investment Agency of Ukraine.

20/09/2012 – obtaining of a Letter of Endorsement No.2675/23/7 from the State Environmental Investment Agency of Ukraine.

A.3. Project participants:

Party involved *	Legal entity project participant	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host)	• PE "FOSA"	No
Switzerland	• CEP Carbon Emissions Partners S.A.	No
*Please indicate if the Party involved is a host Party.		

PE "FOSA" is an organization that implements the project (Applicant, Supplier). Its code in the Unified State Register of Enterprises and Organizations of Ukraine is 34485388. Type of activity: 46.47 Wholesale of furniture, carpets and lighting equipment; 46.90 Non-specialised wholesale trade; 70.22 Market research and public opinion polling companies; 46.19 Agents involved in the sale of a variety of goods. PE "FOSA" is responsible for project works performed by its own staff or through contractors. The enterprise finances the project and does not receive profit.

CEP Carbon Emissions Partners S.A. is research and engineering organization. It is responsible for the development of project design documents for the joint implementation project. Besides, it will participate in determination, monitoring and verification of the project.

A.4. Technical description of the project:

A.4.1. Location of the project:

Project activities cover all the territory of Ukraine (which is mapped in Figure 1).

Figure 1. Location of the project and owner of the project in the map of Ukraine

A.4.1.1. Host Party(ies):

The project is located in the territory of Ukraine.
Ukraine is an Eastern European country that ratified the Kyoto Protocol to the UN Framework Convention on Climate Change on February 4, 2004. It is listed in Annex 1 and meets the requirements of participation in Joint Implementation projects[2].

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

All regions/provinces of Ukraine.

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

Project activities in all the territory of Ukraine are envisaged.

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

The project location is in Ukraine.
PE "FOSA" is located at the following address:

[2] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?page=1&nreg=995_801

3/7 Pidhirna/Tatarska St., 04107 Kyiv, Ukraine

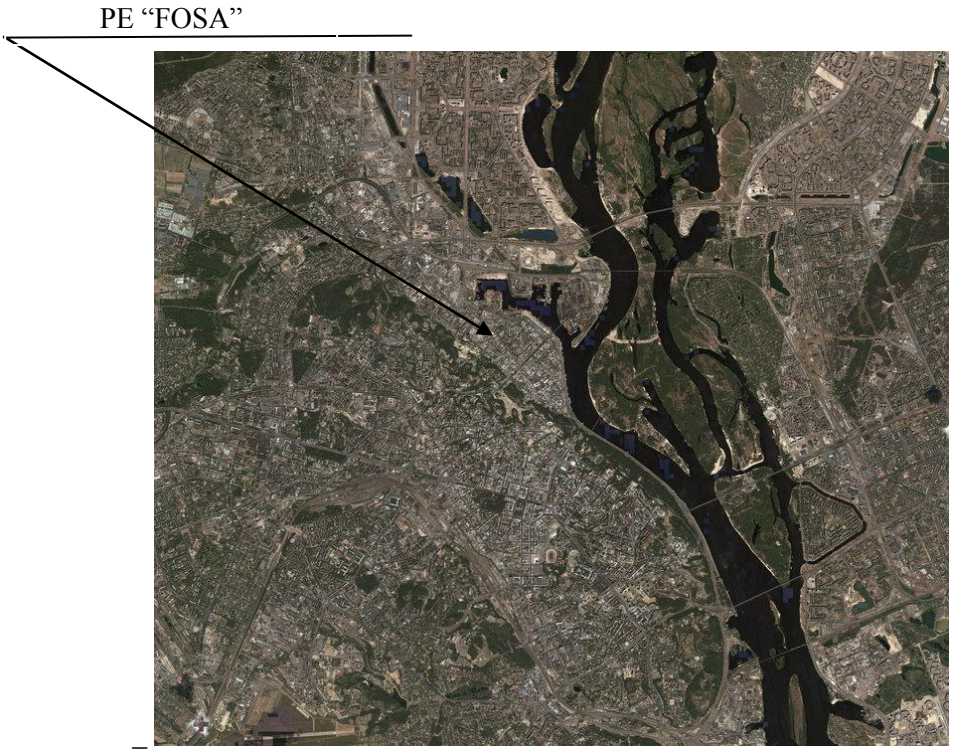

Figure 2. Location of the project owner in the map of Kyiv

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

Distribution of CFLs and LEDLs in the course of the project activities will be carried out among:

1. Private persons (households).

Among households, it is planned to distribute CFLs by way of direct installation in every household, or distribution through specialised outlets located in retail shops, through housing and community amenities servicing points etc. Maximum quantity of lamps for one household is determined according to the project’s marketing strategy. This limitation should help prevent the breach of the project’s rules and the repeated sale of CFLs belonging to the project. Maximum power of CFLs designated for households is limited to 23 W (equivalent to 100 W), similar to consolidated methodology AM0046, version 2.0.

2. Legal entities (industrial, commercial, organisational and governmental bodies).

Among legal entities, replacement of incandescent lamps with CFLs and LEDLs will be carried out through contracts for CFL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Depending on their lighting needs, legal entities will grouped by category, whereupon for every category an average value of lighting set performance per day/year will be calculated.

The description of key technologies, envisaged by the project, is presented below; more information on all implemented measures for energy saving enhancement by way of energy saving light bulbs instalment will be presented at the monitoring stage of the JIP “Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine”:

1. Installation of compact fluorescent lamps[3] instead of incandescent lamps;

[3] http://www.masterlamp.ru/

CFL is a compact gas-discharge light source, in which visible light is emitted by the agency of luminophore. CFL runs by streaming electricity through mercury vapour, which in turn emits ultraviolet light. The ultraviolet light is absorbed by phosphorus coating inside the lamp, making it glow. CFL has E27 and E14 screws, similar to those of incandescent lamps, which simplifies their replacement and reduces time spending for socket replacement. CFLs shown at Figure 4 are more effective than IL and have a much longer life span. Basic technical specifications of CFLs to be installed in the course of the project are presented in Table 1.

Table 1. Technical specifications of compact fluorescent lamps

Parameter	Measuring units	Value
Nominal voltage	Volt	220
Nominal frequency	Hertz	50
Operating voltage range	Volt	198-242
Operating temperature range	^{O} Celsius	-60
Colour temperature	^{O} Kelvin	2700 (Warm White) 4000 (Cool White) 6400 (Daylight)
Luminous efficacy	Lumens per Watt	>45

Figure 3 Compact fluorescent lamps

The main advantages of CFLs over ILs are:

- a much longer life span (CFL: up to 15 000 hours; IL: 1000 hours);
- low power consumption (the difference between CFL and IL powers with equivalent light flux is presented in Table 2);
- relative persistence to changes of voltage (therefore there is no need for additional ballasting resistors).

Table 2. Difference between IL and CFL powers with equivalent light fluxes

Incandescent lamps	CFL	Power difference
500	105	395
300	68	232
200	55	145
150	40	110
120	30	90
	32	88
100	20	80

	23	77
75	16	59
	18	57
60	13	47
	15	45
40	9	31
	11	29
25	5	20
	7	18

Whereas incandescent lamps generate light by streaming electric current through resistive threads, thus heating the threads to a very high temperature, so that they emit visible light (which simultaneously leads to the increased risk of the lamp prematurely going out of order). The light of incandescent lamps is extremely inefficient, because nearly 98% of energy output is emitted in the form of heat. Replacement of ILs with LEDLs, foremost, and CFLs will allow energy savings without loss of the lighting of premises, which will lower fossil fuel consumption at a conventional power plant, which in turn will cause reductions of GHG emissions into the atmosphere.

2. Installation of light emitting diode lamps[4] instead of incandescent lamps;

Figure. 4 Light emitting diode lamp, equivalent to an IL with a power of 100 Watt

As against incandescent lamps whose main operating component is resistive filament, through which electric current passes, light emitting diode lamps emit light by means of streaming electric current through light emitting diodes embedded into the lamp. Light emitting diode is a semiconductor device emitting light when exposed to electric current passing through it (an effect known as electroluminescence). Light emitted by traditional light emitting diodes belong to a narrow spectral region, its colour depending upon the chemical composition of the semiconductor utilised. Key technical specifications of LEDL to be implemented in the course of the project are presented in Table 3.

Table 1 Key technical specifications of light emitting diode lamps

Parameter	Measuring units	Value
Nominal voltage	Volt	220
Nominal frequency	Hertz	50
Operating voltage range	Volt	80-239

[4] http://www.optogan.ru/

Operating temperature range	^{O} Celsius	from -60 to + 60
Colour temperature	^{O} Kelvin	2700 (Warm White) 4000 (Cool White) 6400 (Daylight)
Luminous efficacy	Lumens per Watt	>69

The main advantages of LEDLs over ILs are:

- a much longer life span (LEDL: up to 100 000 hours; IL: 1000 hours);
- low power consumption (comparative characteristics of CFL and IL are presented in Table 4);
- vibration and mechanical shock resistance;
- fail-safe performance in different climate conditions at temperatures from -60 to +60 °C;
- persistence to changes of voltage (therefore there is no need for additional ballasting resistors).
- emission of a narrow spectral region, so called 'pure colour';
- no ultraviolet emission which is harmful to human health;
- no need for unconventional disposal;
- soundless operation.

Table 4. Comparative characteristics of incandescent lamps and light emitting diode lamps

Incandescent lamps		Light emitting diode lamps	
Nominal power, W	Light flux, lm	Nominal power, W	Light flux, lm
25	200	5	250
40	430	6.5	420
60	730	10	760
75	960	12	850
100	1380	21	1500
150	2180	26	2500
200	2950	36	3300
300	4800	53	5000
500	8400	129	11400

The project schedule

The beginning of the investment phase of the project is the start date of distribution of LEDLs and CFLs in the course of the project. Distribution of energy saving lamps will last until 2020. Within the framework of the project activities, disposal of CFLs will take place, which have exceeded their service life, or prematurely gone out of order. Thus, after the last year of distribution of energy-saving lamps, the next 3 years the monitoring of their performance and their disposal will be carried out. LEDLs implemented in the course of the project activities will operate further on after the ending of the project lifetime and reduce GHG emissions into the atmosphere, but, as they don't cause any environmental impacts and don't need any special disposal measures, the monitoring of their work is unnecessary. If the monitoring shows that CFLs installed in the course of the project still operate at the end of 2022, the monitoring will be carried out further on, until the last CFL goes out of order.

The expected schedule of CFL and LEDL implementation in the course of the project activities is presented in Table 5 and, schematically, in Figure 5.

Table 2. Project implementation schedule

Investment phase (distribution of LEDL and CFL) beginning date	11.02.2008
Investment phase (distribution of LEDL and CFL) ending date	31.12.2020
Operational phase (monitoring) beginning date	11.02.2008
Operational phase (monitoring) ending date	31.12.2022

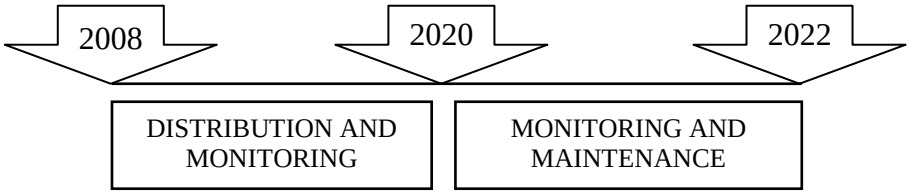

Figure 5. Expected project implementation schedule

Energy-efficient lighting technology is the most advanced element in the overall process of minimizing energy consumption worldwide. The implemented equipment, namely CFL and LEDL, fully meets all the requirements of modern international practice. Replacing, and installing new, CFLs and LEDLs for the project period is planned, according to established time standards, after 15,000 hours (CFL) and after 100 000 hours (LEDL). Implementation of the project requires no special knowledge of workers and specialists of PE "FOSA", and their work in the course of the project activity will not differ from their normal work, so there is no need for additional training for the personnel of PE "FOSA". If necessary, specifically in case of the lack of training for work with equipment that is being implemented within the project activity, PE "FOSA" will organise additional training or refresher courses in institutions accredited by the state standard for the relevant activity.

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:

At the time of the beginning of the project, it was a common practice to install low-efficient incandescent bulbs as the main light source; statistics show that ILs contribute to about 80% of lighting capacities[5]. Despite the fact that CFLs and LEDLs are much more efficient, which could have interested an average consumer in terms of savings on electricity bills, they are not widely in demand in Ukraine primarily due their high price compared to ILs (average price for a CFL at the start of the project was about 5 USD, and LEDL about 18 USD). Given the dynamics of the market in recent years[6] and taking into account the fact that Ukraine has not developed effective mechanisms to encourage consumers in the private and commercial sectors to switch to energy saving technologies, we can conclude that in the near future in the absence of the JI project "Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine" ILs will remain the main source, that will result in pre-project-level GHG emissions.
The installation of high-efficient light sources, like CFLs and LEDLs, will lead to lowering energy consumption, which in turn will entail lowering the amount of fossil fuel combusted at a conventional power plant and lowering loading of Ukrainian energy system, which in turn will lead to the reduction of GHG emissions into the atmosphere.

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

[5] http://pau.com.ua/news/4/13734/

[6] http://pau.com.ua/news/4/13734/

Table 3. Estimated emission reductions for the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Years	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	463 725
2009	1 219 236
2010	1 562 140
2011	1 274 281
2012	1 274 281
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	5 793 664
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1178372

Table 4. Estimated emission reductions for the period following the first commitment period (2013-2022)

	Years
Length after the crediting period	10
Years	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	2 319 836
2014	3 813 026
2015	3 937 731
2016	4 127 602
2017	4 447 805
2018	4 768 008
2019	5 088 211
2020	5 408 414
2021	4 235 426
2022	3 062 439
Total estimated emission reductions after the crediting period (tonnes of CO_2 equivalent)	41 208 498
Annual average of estimated emission reductions after the crediting period (tonnes of CO_2 equivalent)	4 120 850

For more details refer to Supporting Document 1.

For the description of the formulae used for calculation of emission reductions see Section D.1.1.2., D.1.1.4. and D.1.4.

A.5. Project approval by the Parties involved:

Letter of Endorsement No. 2675/23/7 dated 20/09/2012 for the JI project "Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine" was issued by the State Environmental Investment Agency of Ukraine.
Upon concluding the project analysis, the project design document (PDD) and the Determination Report will be submitted to the State Environmental Investment Agency of Ukraine to obtain the Letter of Approval.

SECTION B. Baseline scenario

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

Baseline is a scenario which judiciously presents antropogenic emissions by greenhouse gas sources which could have occurred but for the project implementation, which was chosen according to the Guidance on criteria for baseline setting and monitoring, Version 03[7]. According to the Guidelines for users of the joint implementation project design document form, Version 04[8], for the description and justification of the baseline chosen, a step-by-step approach is used:

Step 1. Identification and description of the approach chosen to establish the baseline.

For the proposed project, which is aimed at enhancing the energy efficiency of Ukrainian lighting capacities by way of distributing energy-efficient lighting equipment, specifically compact fluorescent and light emitting diode lamps in substitution for incandescent lamps in the private and commercial sectors, and, as a result, at reducing GHG emissions into the atmosphere, none of the existing methodologies can be applied. The project participant has chosen a JI-specific approach based on the JI projects requirements according to paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring, Version 03 and consolidated methodology AM0046 "Distribution of efficient light bulbs to households", version 02[9].

The baseline is established by selecting the most plausible scenario from the list and description of plausible future scenarios based on conservative assumptions.
The following steps were made to determine the most plausible baseline scenario:
1. Identification of plausible alternatives that could be the baseline scenario;
2. Justification of exclusion from consideration of alternatives, which are unlikely to take place from a technical and / or economic point of view.

To set the baseline scenario and further development of additionality justification in Section B.2. the following was taken into account:

- State policy and applicable law in the mining sector;
- Economic situation in the energy sector of Ukraine and demand forecast for its products;
- Technical aspects of the enterprise's equipment managing and operation;
- Availability of capital (including investment barriers);
- Local availability of technology / equipment.

In addition, uncertaintly of ERU generation possibility due to lower activity beyond the project boundary or due to force-majeure circumstances is also taken into account, using conservative assumptions.

Step 2. Application of the approach chosen

The choice of the plausible baseline scenario is based on assessment of energy-saving lighting equipment distribution alternatives, which potentially could occur.
These alternatives are the following:

[7] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[8] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

[9] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

Alternative 1.1: Continuation of the current situation, without the JI project implementation.
Alternative 1.2: Proposed project activity without the use of the JI mechanism.
Alternative 1.3: Partial project activities (some of the project activities are implemented) without the use of the Joint Implementation Mechanism.
The detailed analysis of each alternative follows.

Alternative 1.1
The continuation of the current practice of distributing CFLs and LEDLs at their market price, against the financial limitations of Ukrainian consumers.
Condition of Ukrainian energy industry and lighting equipment market.
State and trends in the market of lighting equipment in Ukraine are not very optimistic for the CFL and LEDL. Ukrainian lighting market is not isolated from the overall economic situation in Ukraine, as the economic situation in the country primarily affects the ability of consumers of commercial and especially the private sectors to purchase a particular product category. According to the general situation of the economy low but stable growth of sale volumes of lighting equipment in general and the CFL and LEDL in particular was seen in the lighting sector of Ukraine in 2007 and early 2008. But in late 2008 a sharp decline (two-threefold) occurred, which was due, primarily, to crisis in the banking and construction sectors of the market. Many companies that worked on the borrowed capital were forced to return their loans that greatly affected their financial performance, and some of the companies went bankrupt. Metallurgy and mining industry, as the largest consumer of industrial lighting made a big contribution to reduction of lighting market during the crisis. Although in late 2009 slow growth in the market started again, the crisis has not gone unnoticed. So far the pre-crisis rates of the market have not been achieved yet and a number of operators decreased almost twice. The price of electricity increased significantly; this raised the question of energy saving to all industries. For this purpose, the Cabinet of Ministers of Ukraine issued a Decree "On measures to reduce electricity consumption by budget institutions"[10] dated 16/10/08 No. 1337-r, which provides for a gradual replacement of conventional incandescent bulbs with modern energy efficient light sources. This order didn't contain any information relating to mechanisms for the encouragement and control of the prescribed guidelines and was not backed up with adequate funds. Because of acute shortage of funds, it could not be enforced and in practice it is not enforced. Currently, there aren't any binding regulations on the use of energy efficient light sources for the private sector. Limited financial capacity of Ukrainian consumers is an obstacle to the wide use of CFLs in the sector. According to data on national income, buying 5 CFLs (for 5 USD apiece) will be about 35% of weekly earnings[11], which is often a heavy burden on the family budget. On the other hand, the budgets of government and commercial organizations reduced because of the crisis, do not allow investment in energy efficiency. Ukraine lacks its own CFL- and LEDL-making capacities; that is why the bulk of innovative lighting equipment, which CFLs and LEDLs belong to, is imported at relatively high prices for Ukraine. We may conclude that in the absence of JI project, a situation will take place, under which the main lighting source will be ILs due to its low price, in comparison to CFLs and LEDLs.
In any situation of reduced activity outside the project boundary or due to force majeure, the need for lighting in the private, commercial and public sectors will remain, and its main source will be power tools that use electricity, which makes the risk of reducing the number of ERUs through the above causes minimal.
This Alternative is the most plausible baseline scenario, as:

- It allows satisfying the necessary need for lighting at minimal costs to consumers.

[10] http://zakon2.rada.gov.ua/laws/show/1337-2008-p

[11] http://www.obzorzarplat.com.ua/average-wage-ukraine-2011/

Consequently, *Alternative 1.1* can be considered the most plausible baseline.

Alternative 1.2

Even if prices for CFLs and LEDLs are very close to their production cost, Ukrainian consumers buy them quite slowly, showing the market dynamics of lighting equipment in Ukraine. Ukraine lacks its own CFL- and LEDL-making capacities to meet even the low level of demand, which is at the moment; that is why the bulk of innovative lighting equipment is imported from abroad, which increases their prices, which in turn reduces the demand for this type of products. Manufacturers and distributors of CFLs and LEDLs are not interested in reducing prices for CFLs and LEDLs, as well as other energy-efficient lighting equipment, to bring them below their production cost, since it would lead to losses of producers; this investment barrier is shown in detail in section B2. From the viewpoint of potential investors, projects involving investment in building capacity in Ukraine are risky because of little demand for their products. So in the absence of JI mechanism, manufacturers and distributors of CFLs and LEDLs will have no incentive to distribute energy-saving equipment in quantities sufficient for tangible savings.

This Alternative is the least plausible baseline scenario, as it makes manufacturers and distributors operate at a loss, so Alternative 1.2 cannot be seen as a plausible baseline.

Alternative 1.3

In case of partial project activity, i. e. distribution of a small number of CFLs with a discount which is proportionate to the discount that will be applied in the course of the project activity by producers and distributors, GHG emission reductions in the amount, which is achieved with the use of the Kyoto mechanisms, will not be achieved. In addition, manufacturers and distributors are not interested in creating a discount for buyers because it will cause them to work without profit, or to becoming loss-making businesses. If manufacturers distribute the same amount of CFLs, as intended by this project, the discount will be insignificant, that will not encourage consumers to purchase CFLs instead of ILs, which will be much cheaper. The above *Alternative 1.3* is the least plausible baseline scenario, as it makes producers and distributors work to a loss, and it doesn't provide significant reductions of GHG emissions into the atmosphere; that is why *Alternative 1.3* cannot be viewed as a plausible baseline.

The analysis of the above alternatives shows that Alternative 1.1 is the most plausible one, and Alternative 1.2 the least plausible one.

The results of the additionality analysis in Section B.2. show that *Alternative 1.2* and *Alternative 1.3* cannot be seen as the most attractive one as regards financing. These assumptions are confirmed in Section B.2. The analysis carried out in accordance with the "Tool for the demonstration and assessment of additionality" (Version 06.0.0) in Section B.2. shows that the project is additional.

Baseline scenario description

The baseline scenario provides for the continuation of current practice that involves the purchase and use of incandescent lamps in large scale, as well as related GHG emissions that would occur in the absence of the project and replacement of general-purpose lamps by CFLs and LEDLs. Thus, the baseline scenario provides for the predominant use of standard incandescent lamps with power from 25 to 500 W. Wattage distribution breakdown (for Ukraine) is presented in Table 8.

Table 5. IL wattage breakdown in Ukraine

Power (W)	Breakdown

500	<1%
300	1%
200	1%
150	2%
100	39%
75	31%
60	19%
40	6%
25	1%
Weighted average value = 88.4 kW	

To generate the baseline which is the absence of the JI project and the continuation of the current practice, data on the number of CFLs and LEDLs, power of ILs, which were replaced in the course of the project activity by energy-saving lamps with equivalent light flux and lower power consumption, as well as operationg hours per year, were used. For more information on the parameters that were used to calculate baseline and project emissions refer to Section D of this PDD.

Description of formulae for calculating GHG emissions in the baseline scenario is presented below:

$$BE^{y} = BEC_{b}^{y} * EF_{b,CO_2,ELEC}^{y}; \quad \text{(B1)}$$

Where:

BE^{y} - total GHG emissions in monitoring period *y* of the baseline scenario, t $CO2_{eq;}$

BEC_{b}^{y} - total electricity consumption in monitoring period *y* of the baseline scenario, MWh;

$EF_{b,CO_2,ELEC}^{y}$ - indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the baseline scenario, t CO_2/MWh;

y - monitoring period;

b - baseline scenario;

CO_2 - carbon dioxide, or CO_2;

$ELEC$ - electric energy.

$$BEC_{b}^{y} = \sum_{n=1}^{10} \sum_{j=1}^{m} \frac{R_{p,k,n,j}^{y} \bullet P_{b,k,n,j}^{y} \bullet t_{on,b,n}^{y} + R_{p,l,n,j}^{y} \bullet P_{b,l,n,j}^{y} \bullet t_{on,b,n}^{y}}{1000000}; \quad \text{(B2)}$$

Where:

$R_{p,k,n,j}^{y}$ - total amount of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$R_{p,l,n,j}^{y}$ - total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$P_{b,k,n,j}^{y}$ - power of IL replaced by type *j* CFL in customer group *n* in monitoring period *y* of the baseline scenario (W);

$P_{b,l,n,j}^{y}$ - power of IL replaced by type *j* LEDL in customer group *n* in monitoring period *y* of the baseline scenario (W);

$t_{on,b,n}^{y}$ - average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the baseline scenario (hrs);

1000000 – Watt to MW conversion factor;

y - monitoring period;

b - baseline scenario;

j - type of replaced IL;

k - CFL;

l - LEDL;

n - customer group where CFL or LEDL were installed;

on - operating period of lighting equipment.

Environmentally, this scenario is less favorable for the near future (including the first commitment period, 2008-2012), as greenhouse gas emissions will be higher than in the project scenario. Therefore, this practice is not able to provide a reduction in greenhouse gas emissions. Continued use of ILs will lead to increased costs of fossil fuel used at a conventional power plant to generate electricity. Therefore, under the baseline scenario, harmful effects on the atmosphere through its pollution by GHG, continue.

Details of the calculation of the baseline algorithm are presented in Section D.1.

To establish the baseline, the following parameters are used:
Baseline emissions are covered in more detail in Sections D, E and Annex 2.

Data / Parameter	$EF^{y}_{b,CO2,ELEC}$
Data unit	tCO2/MWh
Description	Indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Specific indirect carbon dioxide emissions for electricity consumption in 2008 are taken from the Decree No.62 of the National Environmental Investment Agency of Ukraine (NEIAU) dated 15.04.2011 "On approval of carbon dioxide emission factor in 2008";[12] Specific indirect carbon dioxide emissions for electricity consumption in 2009 are taken from the Decree No.63 of NEIAU dated 15.04.2011 "On approval of carbon dioxide emission factor in 2009";[13] Specific indirect carbon dioxide emissions for electricity consumption in 2010 are taken from the Decree No.43 of NEIAU dated 28.03.2011 "On approval of carbon dioxide emission factor in 2010";[14] Specific indirect carbon dioxide emissions for electricity consumption in 2011 are taken from the Decree No.75 of NEIAU

[12] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[13] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[14] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

	dated 12.05.2011 "On approval of carbon dioxide emission factor in 2011". [15] If other specific carbon dioxide emissions associated with electricity consumption are approved for Ukrainian grids, the baseline will be recalculated for any reporting year according to the Monitoring Plan.
Value of data applied (for ex ante calculations/determinations)	**2008** 1.219 **2009** 1.237 **2010** 1.225 **2011** 1.227
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the course of a JI project development, common nationally approved carbon dioxide emission factors are applied.
Comments	Data allowing to calculate greenhouse gas emissions, the information will be archived in electronic form

Data / Parameter	$R^{y}_{p,k,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j CFL which replaced IL in customer group n in monitoring period y of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of CFL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When CFLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of CFL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every CFL is installed, the project owner conducts instruction on CFL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed CFLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

[15] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Data / Parameter	$R^{y}_{p,l,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j LEDL which replaced IL in customer group n in monitoring period y of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of LEDL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When LED lamps are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of LEDL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every LEDL is installed, the project owner conducts instruction on LEDL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed LEDLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$P^{y}_{b,k,n,j}$
Data unit	W
Description	Power of IL replaced by type j CFL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type *j* CFL. Powers of CFL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the process of CFL distribution in the private sector, based on the consolidated methodology AM0046, version 2.0[16], maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL

[16] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

	designated for them is limited to 23 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for CFL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by CFLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group n.

Data / Parameter	$P^{y}_{b,l,n,j}$
Data unit	W
Description	Power of IL replaced by type j LEDL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type *j* LEDL. Powers of LEDL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the process of LEDL distribution in the private sector, based on the consolidated methodology AM0046[17], version 2.0, maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 21 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for LEDL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by LEDLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data on power of the ILs which were replaced by LEDLs form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$t^{y}_{on,b,n}$
Data unit	hrs
Description	Average operating period of lighting equipment (lamps of every

[17] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

<table>
<tr><td></td><td>type and power) in customer group n in monitoring period y of the baseline scenario</td></tr>
<tr><td>Time of determination/monitoring</td><td>Daily</td></tr>
<tr><td>Source of data (to be) used</td><td>Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group n.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th>No. of customer category</th><th>Operating hours per day</th><th>Average operating hours per annum</th></tr>
<tr><td>A</td><td>3.80</td><td>1 387</td></tr>
<tr><td>B</td><td>5.25</td><td>1 916</td></tr>
<tr><td>C</td><td>6.56</td><td>2 394</td></tr>
<tr><td>D</td><td>7.85</td><td>2 865</td></tr>
<tr><td>E</td><td>12.20</td><td>4 453</td></tr>
<tr><td>F</td><td>16.27</td><td>5 939</td></tr>
<tr><td>G</td><td>1.80</td><td>657</td></tr>
<tr><td>H</td><td>2.35</td><td>857</td></tr>
<tr><td>I</td><td>2.14</td><td>781</td></tr>
<tr><td>K</td><td>15.95</td><td>5 822</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>All the project participants were divided into ten groups (customer groups, as mentioned elsewhere in the text). For every group, a certain number of customers were allotted, which had loggers installed at their lighting equipment; this customer group is called the project representative group (PRG). Data on lighting equipment operating hours for PRG will be used to extrapolate those of all customers of the relevant group.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>PRG was created based on the consolidated methodology AM0046[18], version 2.0. An electronic database will be created, wherein all the project data will be stored, including information on operating hours of lighting equipment, specifically that which is installed in customer group n. This information will be stored for not less than two years following the transfer of the last emission reduction units.</td></tr>
<tr><td>Comments</td><td>Data on lighting equipment average operating hours in customer group n form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.</td></tr>
</table>

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

Anthropogenic greenhouse gas (GHG) emissions in the project scenario will decrease due to the implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine.

Implementation of these activities will considerably reduce fuel and energy resources consumption during production, entailing a reduction of greenhouse gas emissions into the atmosphere.

[18] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

Additionality of the project

Additionality of the project activity is demonstrated and assessed below using the "Tools for the demonstration and assessment of additionality"[19] (Version 06.0.0). This tool was originally developed for CDM projects but it is also applicable to JI projects.

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

Sub-Step 1a. Definition of alternatives to the project activity

There are three alternatives to this project (which have already been discussed in Section B.1 above):

Alternative 1. Continuation of the current situation, without the JI project implementation.

Alternative 2. Proposed project activity without the use of the JI mechanism.

Alternative 3. Partial project activities (some of the project activities are implemented) without the use of the Joint Implementation Mechanism.

Sub-Step 1b. Consistency of the alternatives with mandatory laws and regulations

Alternative 1. Continuation of the current situation, without the JI project implementation.
The Law of Ukraine "On Energy Saving"[20] provides for voluntary use of energy-saving technologies. Using conventional incandescent lamps doesn't contradict the Ukrainian legislation, and the continued use of outdated technologies is a common practice for the population of Ukraine. State and trends in the market of lighting equipment in Ukraine are not very optimistic for the CFL and LEDL.

Alternative 2. Proposed project activity without the use of the JI mechanism.
The Law of Ukraine "On Energy Saving" proclaims the basic principles of energy policy, including a combination of economic incentives and financial responsibility for the rational use and saving of energy resources. Use of energy-efficient technologies (in our case, CFL and LED lighting equipment) has some advantages in the form of state aid. That is, this alternative does not contradict existing legislation.

Alternative 3. Partial project activities (some of the project activities are implemented) without the use of the Joint Implementation Mechanism.
This alternative, by its nature, meets all principled provisions (in terms of compliance with legislation) of Alternative 1.2, and, therefore, is fully consistent with applicable standards of Ukrainian legislation.

Outcome of Sub-Step 1b. Under such circumstances, it is believed that all the scenarios are consistent with current laws and regulatory acts.

Therefore, Step 1 is satisfied.
According to the "Tool for the demonstration and assessment of additionality"[21] (Version 06.0.0), further justification of additionality shall be performed by means of barrier analysis.

Step 2: Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. The following sub-steps are applied.

[19] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0pdf

[20] http://document.ua/pro-energozberezhennja-nor9455.html

[21] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0pdf

Sub-step 2a: Identification of barriers that would prevent the implementation of alternative scenarios
Barriers to the uptake of energy efficient products, including CFL and LEDL, are well known and documented. Such barriers include inadequate access to capital, isolation from price signals, information asymmetry and split-incentives[22,23]. That such barriers exist is clear given that CFLs only account for 6% of the global lighting market despite their obvious financial benefits and having been available for several decades[24]. The list of barriers that in our view may prevent alternative scenarios to occur is given below.

Financial barrier
Particularly relevant for low-income consumers is the fact that CFL and LEDL may be up to ten times more expensive than incandescent light bulbs. In the process of prioritising household expenditure towards basic requirements such as food, healthcare and education, there may be very little opportunity for spare capital to be targeted towards investments in energy efficiency. Despite the financial savings delivered by energy efficiency improvements, the upfront capital requirement acts as a significant barrier to the uptake of CFL and LEDL by consumers. To address this barrier, the project activity involves the sale of CFL and LEDL at prices substantially lower than the costs i.e. generates net loss without ERU sales. For the project owner, the implementation of the project activities without JI mechanisms is low-effective as regards revenue making. The substantial discount of up to 50% significantly lowers the revenue of PE "FOSA".

Information barrier
The information barrier is primarily connected to informing society. In Ukraine, understanding of the benefits of energy efficiency remains rudimentary. Barriers to obtaining and applying information relating to energy efficiency are significant, including:

- Time lag between energy consumption and payment of energy bills. Energy price information is divorced from the time at which it is consumed. This time lag can impact the efficacy of price information in influencing consumer awareness and behaviour with regard to energy use.
- Aggregated energy prices may limit consumers' understanding of the individual appliance use and its impact on energy bills. Consumers are not aware of which particular appliance or equipment is contributing to the total price they ultimately pay for electricity for a given period, militating against behaviour change, demand response and investment in energy efficient technologies.
- Significant parts of the Ukrainian CFL and LEDL markets belong to low cost and also low quality lamps leading to large scale failure rates. The poor performance of CFL and LEDL, especially of early generation CFL, created certain consumer distrust in the energy-saving lighting technology.

Organisational barrier
There is no experience in managing the implementation of JI projects, including: international negotiations, validation, verification, registration, monitoring etc.

Sub-step 2b: Elimination alternative scenarios which are prevented by the identified barriers
The only plausible scenario that is not prevented by any of the above listed barriers is continuation of the current situation (*status quo*) and according to the "Tool for the demonstration and assessment of additionality" [25] (Version 06.0.0) is identified as the baseline scenario.

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[22] Mind the Gap: Quantifying Principle-Agent Problems in Energy Efficiency, International Energy Agency, 2007, Paris, France.

[23] KfW-Survey of the barriers and the profits of energy efficiency measures, KfW Bankengruppe, 2005.

[24] Barriers to Technology Diffusion: The Case of Compact Fluorescent Lamps, Information paper for the Annex 1, Expert Group on the UNFCCC, OECD/IEA, 2006, Paris, France.

[25] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0pdf

Conclusion 1: The baseline scenario for the Joint Implementation project "Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine" is continuation of the current practice.

Each of the barriers discussed above can be overcome by registering the proposed project as a JIP. Financial barriers such as access to capital and discount rates are overcome due to the fact that the carbon finance delivered by the project enables compact fluorescent lamps to be provided with strong financial incentives i.e. discounts and compensations. Similarly, information barriers and high transaction costs will be ameliorated through the media and promotional activities which will direct consumers to distribution centres with clear instructions and information regarding CFL benefits.

Step 3: Investment analysis
According to the "Tool for the demonstration and assessment of additionality" [26] (Version 06.0.0) the Investment analysis was not conducted.

Step 4: Common practice analysis

Currently activities similar to the proposed project are not observed in Ukraine, therefore, according to the methodology, the proposed Joint Implementation project is additional.

Conclusion 2: The JI Project "**Implementation of energy-saving light sources in the public, corporate and private sectors of Ukraine"** provides a reduction in emissions that is additional to any that would otherwise occur.

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

The project boundary encompasses all light bulbs distributed by PE "FOSA" under the terms of this project (a discount of up to 100%), to replace incandescent light bulbs. PE "FOSA" expects to install 40 000 000 CFLs and 7 000 000 LED light bulbs under the project till 2022 in the geographical territory of Ukraine. 5 700 000 CFLs are planned for installation during the first crediting period. At the moment of PDD elaboration the number of light bulbs distributed is 5 681 129.
Details on numbers of distributed energy-saving lamps in the course of the project will be stored in an electronic database created for the monitoring of work of already distributed lamps and calculation of reductions of GHG emissions into the atmosphere. The data will be stored for not less than two years following the transfer of the last emission reduction units.

Table 9 demonstrates a summary of GHG emission sources in the boundary of the baseline scenario of the JIP.

Table 6. Summary of emission sources in the baseline scenario

Source	Gas	Included / excluded	Justification / Explanation
Baseline emissions			
GHG emissions from electricity consumption by incandescent light bulbs for lighting needs satisfaction	CO_2	Included	While emitting visible light, IL consume electricity generated through fossil fuel combustion at a conventional power plant, which causes GHG emissions into the atmosphere.

Project boundary for the baseline scenario is represented in a black rectangle in Figure 6.

[26] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0pdf

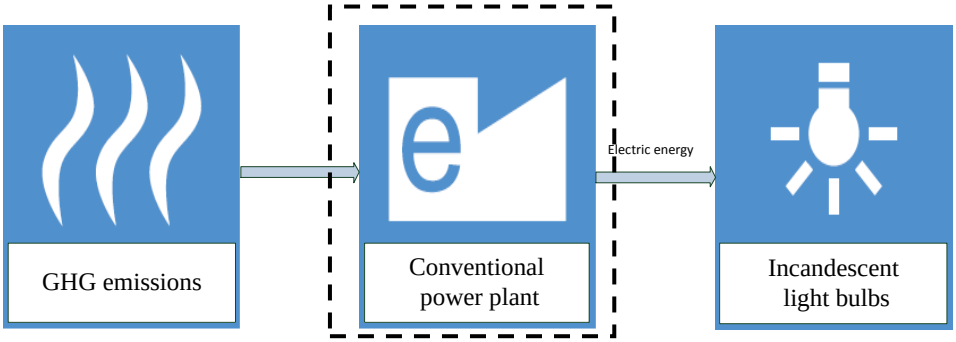

Figure 6. Project boundary for the baseline scenario

Table 10 demonstrates a summary of GHG emission sources in the boundary of the project scenario.

Table 7. Summary of emission sources in the project scenario

Source	Gas	Included / excluded	Justification / Explanation
Project emissions			
GHG emissions from electricity consumption by energy-saving lamps (CFL and LEDL) for lighting needs satisfaction	CO_2	Included	While emitting visible light, CFL and LEDL consume electricity generated through fossil fuel combustion at a conventional power plant, which causes GHG emissions into the atmosphere.

Project boundary for the project scenario is represented in a black rectangle in Figure 7.

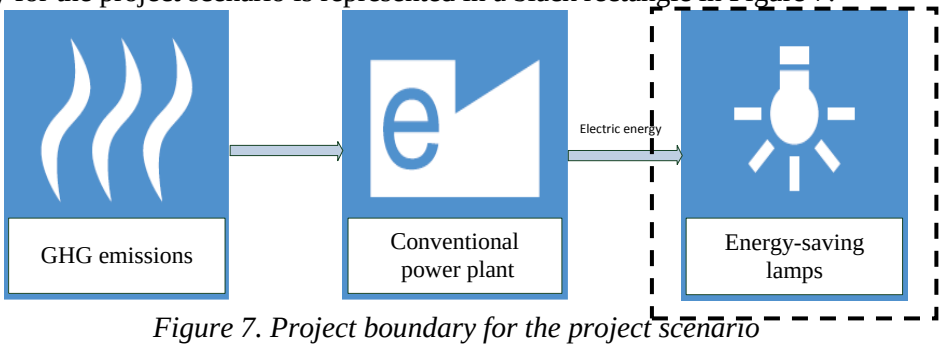

Figure 7. Project boundary for the project scenario

Indirect external emissions of CO_2, CH_4, N_2O from the combustion of fossil fuel at power plants are excluded.

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

Date of baseline setting: 14/06/2012.
The baseline was set by CEP Carbon Emissions Partners S.A., the project developer, and PE "FOSA".

Private Enterprise "FOSA"
Papian Pavlo Borysovich
Deputy Director General
Phone: +38 0973700005
E-mail: fosa_info@ukr.net
PE "FOSA" is a project participant (stated in Annex 1).

Route de Thonon, 52, Geneva, Switzerland,
Fabian Knodel
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Phone: +41 763461157
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e-mail: 0709bp@gmail.com
CEP Carbon Emissions Partners S.A. is a project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The starting date of the project is 11/02/2008, when PE "FOSA" began the distribution of CFLs and LEDLs in the course of the project implementation.

C.2. Expected operational lifetime of the project:

A project participant will conduct the monitoring of CFLs and LEDLs that were installed in the course of the project activities; whereas the last CFL and LEDL distribution is planned for 2020, the last year in 4500-hour regime (average weighted operating hours used in calculations) will be 2022. Despite of this, lamps operating less intensively and enduring longer will be monitored and disposed after going through their operating term. The lifetime of the project is from 11/02/2008 to 31/12/2022 (14 years and 11 months, or 179 months).

C.3. Length of the crediting period:

Duration of the crediting period in years and months is 14 years and 11 months, or 179 months. The beginning date of the crediting period is taken to be the date when the first emission reduction units' generation is expected, namely February 11, 2008. Producing ERUs falls into the first commitment period lasting for 4 years and eleven months (February 11, 2008, - December 31, 2012). Prolongation of the crediting period after 2012 is subject to approval by the Host party; calculations of emission reductions are presented separately for the period before 2012 and the period after 2012.

If after the first commitment period under Kyoto Protocol its effect is extended, the project crediting period will be prolongated for 10 years/120 months, till December 31, 2022.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The proposed project applies a JI-specific approach based on the JI projects requirements according to paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring, Version 03[27] and consolidated methodology AM0046, version 2.0[28].

The monitoring plan is set up for the sake of accurate and intelligent calculation of GHG emission volume and preparing reports on GHG emission reduction, on the ground of baseline and project activities. The monitoring plan provides for the collection of information on numbers of LEDLs and CFLs with relevant power, and their installation location according to the customer category. Customers were grouped by categories according to artificial lighting operating hours. Details on types of constructions and facilities and their belonging to a relevant consumer category are presented in Table 11 of the PDD. Lamp operating hours for each consumer category is to be determined through the installation of lamp operation measuring equipment among consumers within the project representative group (PRG). For each customer category, a separate PRG will be created; and after measuring their lighting equipment operating hours, the received data will be corrected according to statistical data to confidence interval (similar to the consolidated methodology AM0046 version 2) and used to extrapolate those of all CFLs and LEDLs working during the given monitoring period in the relevant consumer group.

Table 8. Customer categories of the JI project

No. of customer category	Type of institution, facility	Lighting equipment operating hours per day
A	Private households, specifically residential quarters, apartments and houses, hotels and halls of residence etc.	3.80
B	Administrative buildings, specifically governmental institutions, banks, post offices etc.	5.25
C	Industrial enterprises	6.56
D	Secondary and higher education establishments	7.85
E	Out-patient hospitals	12.20
F	Medical institutions working 24 hours a day, specifically hospitals, maternity homes etc.	16.27
G	Schools 1st shift	1.80
H	Schools 2nd shift	2.35
I	Child care	2.14
K	Misc. (metro, military bases, supermarkets, prisons, commercial farms, poultry farms etc.)	15.95

[27] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[28] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

The monitoring plan includes a complex of measures (metering, technical maintenance, calibration), which are to be carried out in order to satisfy the requirements of the chosen monitoring methodology and ensure the possibility to verify the GHG emission reduction calculations.

Data and parameters that are not monitored throughout the crediting period, but are determined only once and that are available already at the stage of PDD development: absent.

Data and parameters that are not monitored throughout the crediting period, but are determined only once and that are unavailable at the stage of PDD development: absent.

Data and parameters monitored throughout the crediting period:

$R^{y}_{p,k,n,j}$	total amount of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);
$R^{y}_{p,l,n,j}$	total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);
$P^{y}_{b,k,n,j}$	power of IL replaced by type *j* CFL in customer group *n* in monitoring period *y* of the baseline scenario (W);
$P^{y}_{b,l,n,j}$	power of IL replaced by type *j* LEDL in customer group *n* in monitoring period *y* of the baseline scenario (W);
$t^{y}_{on,b,n}$	average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the baseline scenario (hrs);
$P^{y}_{p,k,n,j}$	power of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);
$P^{y}_{p,l,n,j}$	power of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);
$t^{y}_{on,p,n}$	average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the project scenario (hrs);

y - monitoring period;

b - baseline scenario;

p - baseline scenario;

j - type of replaced IL;

k - CFL;

l - LEDL;

n - customer group where CFL or LEDL were installed;

on - operating period of lighting equipment.

Tables of parameters to be included in the process of monitoring and verification for the calculation of ERUs are presented in Sections **D.1.1.1** and **D.1.1.3.**

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

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

Data / Parameter	$EF^{y}_{p,CO2,ELEC}$
Data unit	t CO_2e/MWh
Description	Indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Specific indirect carbon dioxide emissions for electricity consumption in 2008 are taken from the Decree No.62 of the National Environmental Investment Agency of Ukraine (NEIAU) dated 15.04.2011 "On approval of carbon dioxide emission factor in 2008";[29] Specific indirect carbon dioxide emissions for electricity consumption in 2009 are taken from the Decree No.63 of NEIAU dated 15.04.2011 "On approval of carbon dioxide emission factor in 2009";[30] Specific indirect carbon dioxide emissions for electricity consumption in 2010 are taken from the Decree No.43 of NEIAU

[29] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[30] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

	dated 28.03.2011 "On approval of carbon dioxide emission factor in 2010";[31] Specific indirect carbon dioxide emissions for electricity consumption in 2011 are taken from the Decree No.75 of NEIAU dated 12.05.2011 "On approval of carbon dioxide emission factor in 2011".[32] If other specific carbon dioxide emissions associated with electricity consumption are approved for Ukrainian grids, the baseline will be recalculated for any reporting year according to the Monitoring Plan.			
Value of data applied (for ex ante calculations/determinations)		**2008**	1.219	
		2009	1.237	
		2010	1.225	
		2011	1.227	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	In the course of a JI project development, common nationally approved carbon dioxide emission factors are applied.			
Comments	Data allowing to calculate greenhouse gas emissions, the information will be archived in electronic form			

Data / Parameter	$R^{y}_{p,k,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j CFL which replaced IL in customer group n in monitoring period y of the project scenario
Time of determination/monitoring	Monthly

[31] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[32] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Source of data (to be) used	Number of CFL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When CFLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of CFL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every CFL is installed, the project owner conducts instruction on CFL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed CFLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$R^{y}_{p,l,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of LEDL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of	When LEDLs are delivered to their installation location, according

data or description of measurement methods and procedures (to be) applied	to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of LEDL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every LEDL is installed, the project owner conducts instruction on LEDL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed LEDLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$P^{y}_{p,k,n,j}$
Data unit	W
Description	Power of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Information on power of CFLs installed in the course of the project activities, similarly to their condition annual monitoring data, is recorded in an electronic database.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Power of every CFL installed in the course of the project, similarly to the number of lamps installed at every single customer's household, is recorded in installation supporting documents (delivery and acceptance acts), whereupon each month this information is added to an electronic database.

QA/QC procedures (to be) applied	In the process of CFL distribution in the private sector, based on the consolidated methodology AM0046, version 2.0[33], maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 23 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for CFL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by CFLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data on power of the CFLs which were installed in the course of the project activities form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$P^{y}_{p,l,n,j}$
Data unit	W
Description	Power of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Information on power of LEDLs installed in the course of the project activities, similarly to their condition annual monitoring data, is recorded in an electronic database.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and	Power of every LEDL installed in the course of the project, similarly to the number of lamps installed at every single customer's household, is recorded in installation supporting documents

[33] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

procedures (to be) applied	(delivery and acceptance acts), whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the process of LEDL distribution in the private sector, based on the consolidated methodology AM0046[34], version 2.0, maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 21 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for LEDL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by LEDLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data on power of the ILs which were replaced by LEDLs form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$t^{y}_{on,p,n}$
Data unit	hrs
Description	Average operating period of lighting equipment (lamps of every type and power) in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group *n*.

[34] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

<table>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><th>No. of customer category</th><th>Operating hours per day</th><th>Average operating hours per annum</th></tr>
<tr><td>A</td><td>3.80</td><td>1 387</td></tr>
<tr><td>B</td><td>5.25</td><td>1 916</td></tr>
<tr><td>C</td><td>6.56</td><td>2 394</td></tr>
<tr><td>D</td><td>7.85</td><td>2 865</td></tr>
<tr><td>E</td><td>12.20</td><td>4 453</td></tr>
<tr><td>F</td><td>16.27</td><td>5 939</td></tr>
<tr><td>G</td><td>1.80</td><td>657</td></tr>
<tr><td>H</td><td>2.35</td><td>857</td></tr>
<tr><td>I</td><td>2.14</td><td>781</td></tr>
<tr><td>K</td><td>15.95</td><td>5 822</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>All the project participants were divided into ten groups (customer groups, as mentioned elsewhere in the text). For every group, a certain number of customers were allotted, which had loggers installed at their lighting equipment; this customer group is called the project representative group (PRG). Data on lighting equipment operating hours for PRG will be used to extrapolate those of all customers of the relevant group.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>PRG was created based on the consolidated methodology AM0046[35], version 2.0. An electronic database will be created, wherein all the project data will be stored, including information on operating hours of lighting equipment, specifically that which is installed in customer group n. This information will be stored for not less than two years following the transfer of the last emission reduction units.</td></tr>
<tr><td>Comments</td><td>Data on lighting equipment average operating hours in customer group n form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.</td></tr>
</table>

[35] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

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

$$PE^{y} = PEC_{p}^{y} \bullet EF_{p,CO_2,ELEC}^{y};$$ (1)

Where:

PE^{y} - total GHG emissions in monitoring period *y* of the project scenario, t $CO2_{eq;}$

PEC_{p}^{y} - total electricity consumption in monitoring period *y* of the project scenario, MWh;

$EF_{p,CO_2,ELEC}^{y}$ - indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the project scenario, t CO_2/MWh;

y - monitoring period;

p - baseline scenario;

CO_2 - carbon dioxide, or CO_2;

$ELEC$ - electric energy.

$$PEC_{p}^{y} = \sum_{n=1}^{10} \sum_{j=1}^{m} \frac{R_{p,k,n,j}^{y} \bullet P_{p,k,n,j}^{y} \bullet t_{on,p,n}^{y} + R_{p,l,n,j}^{y} \bullet P_{p,l,n,j}^{y} \bullet t_{on,p,n}^{y}}{1000000};$$ (B2)

Where:

$R_{p,k,n,j}^{y}$ - total amount of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$R_{p,l,n,j}^{y}$ - total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$P_{p,k,n,j}^{y}$ - power of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);

$P_{p,l,n,j}^{y}$ - power of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);

$t_{on,p,n}^{y}$ - average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the baseline scenario (hrs);

1000000 – Watt to MW conversion factor;

y - monitoring period;

p - baseline scenario;

j - type of replaced IL;

k - CFL;

l - LEDL;

n - customer group where CFL or LEDL were installed;

on - operating period of lighting equipment.

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:

Data / Parameter	$EF^{y}_{b,CO2,ELEC}$
Data unit	tCO2/MWh
Description	Indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Specific indirect carbon dioxide emissions for electricity consumption in 2008 are taken from the Decree No.62 of the National Environmental Investment Agency of Ukraine (NEIAU) dated 15.04.2011 "On approval of carbon dioxide emission factor in 2008";[36] Specific indirect carbon dioxide emissions for electricity consumption in 2009 are taken from the Decree No.63 of NEIAU dated 15.04.2011 "On approval of carbon dioxide emission factor in 2009";[37] Specific indirect carbon dioxide emissions for electricity

[36] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[37] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

	consumption in 2010 are taken from the Decree No.43 of NEIAU dated 28.03.2011 "On approval of carbon dioxide emission factor in 2010";[38] Specific indirect carbon dioxide emissions for electricity consumption in 2011 are taken from the Decree No.75 of NEIAU dated 12.05.2011 "On approval of carbon dioxide emission factor in 2011".[39] If other specific carbon dioxide emissions associated with electricity consumption are approved for Ukrainian grids, the baseline will be recalculated for any reporting year according to the Monitoring Plan.
Value of data applied (for ex ante calculations/determinations)	**2008** 1.219 **2009** 1.237 **2010** 1.225 **2011** 1.227
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the course of a JI project development, common nationally approved carbon dioxide emission factors are applied.
Comments	Data allowing to calculate greenhouse gas emissions, the information will be archived in electronic form

Data / Parameter	$R^{y}_{p,k,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j CFL which replaced IL in customer group n in monitoring period y of the project scenario
Time of	Monthly

[38] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[39] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

determination/monitoring	
Source of data (to be) used	Number of CFL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When CFLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database..
QA/QC procedures (to be) applied	In the course of CFL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every CFL is installed, the project owner conducts instruction on CFL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed CFLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$R^{y}_{p,l,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j LEDL which replaced IL in customer group n in monitoring period y of the project scenario,
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of LEDL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period

Justification of the choice of data or description of measurement methods and procedures (to be) applied	When LEDLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of LEDL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every LEDL is installed, the project owner conducts instruction on LEDL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed LEDLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$P^{y}_{b,k,n,j}$
Data unit	W
Description	Power of IL replaced by type j CFL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type j CFL. Powers of CFL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A

QA/QC procedures (to be) applied	In the process of CFL distribution in the private sector, based on the consolidated methodology AM0046, version 2.0[40], maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 23 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for CFL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by CFLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group n.

Data / Parameter	$P^{y}_{b,l,n,j}$
Data unit	W
Description	Power of IL replaced by type j LEDL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type j LEDL. Powers of LEDL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and	N/A

[40] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

procedures (to be) applied	
QA/QC procedures (to be) applied	In the process of LEDL distribution in the private sector, based on the consolidated methodology AM0046[41], version 2.0, maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 21 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for LEDL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by LEDLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data on power of the ILs which were replaced by LEDLs form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$t^{y}_{on,b,n}$
Data unit	hrs
Description	Average operating period of lighting equipment (lamps of every type and power) in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group *n*.

[41] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

<table>
<tr><td>Value of data applied
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<tr><td>K</td><td>15.95</td><td>5 822</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>All the project participants were divided into ten groups (customer groups, as mentioned elsewhere in the text). For every group, a certain number of customers were allotted, which had loggers installed at their lighting equipment; this customer group is called the project representative group (PRG). Data on lighting equipment operating hours for PRG will be used to extrapolate those of all customers of the relevant group.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>PRG was created based on the consolidated methodology AM0046[42], version 2.0. An electronic database will be created, wherein all the project data will be stored, including information on operating hours of lighting equipment, specifically that which is installed in customer group n. This information will be stored for not less than two years following the transfer of the last emission reduction units.</td></tr>
<tr><td>Comments</td><td>Data on lighting equipment average operating hours in customer group n form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.</td></tr>
</table>

[42] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

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

$$BE^{y} = BEC_{b}^{y} \bullet EF_{b,CO_2,ELEC}^{y}; \quad (3)$$

Where:

BE^{y} - total GHG emissions in monitoring period *y* of the baseline scenario, t $CO2_{eq;}$

BEC_{b}^{y} - total electricity consumption in monitoring period *y* of the baseline scenario, MWh;

$EF_{b,CO_2,ELEC}^{y}$ - indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the baseline scenario, t CO_2/MWh;

y - monitoring period;

b - baseline scenario;

CO_2 - carbon dioxide, or CO_2;

$ELEC$ - electric energy.

$$BEC_{b}^{y} = \sum_{n=1}^{10} \sum_{j=1}^{m} \frac{R_{p,k,n,j}^{y} \bullet P_{b,k,n,j}^{y} \bullet t_{on,b,n}^{y} + R_{p,l,n,j}^{y} \bullet P_{b,l,n,j}^{y} \bullet t_{on,b,n}^{y}}{1000000}; \quad (4)$$

Where:

$R_{p,k,n,j}^{y}$ - total amount of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$R_{p,l,n,j}^{y}$ - total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);

$P_{b,k,n,j}^{y}$ - power of IL replaced by type *j* CFL in customer group *n* in monitoring period *y* of the baseline scenario (W);

$P_{b,l,n,j}^{y}$ - power of IL replaced by type *j* LEDL in customer group *n* in monitoring period *y* of the baseline scenario (W);

$t_{on,b,n}^{y}$ - average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the baseline scenario (hrs);

1000000 – Watt to MW conversion factor;

y - monitoring period;

b - baseline scenario;

j - type of replaced IL;

k - CFL;

l - LEDL;

n - customer group where CFL or LEDL were installed;

on - operating period of lighting equipment.

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

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

N/A

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):

N/A

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

No leakage connected to the project implementation is expected.

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

N/A

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

N/A

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):

Emission reductions resulting from project activities are calculated using a JI-specific approach:

$$ER^y = (BE^y - PE^y)$$

ER_y – emission reduction due to project activity in period y of the project scenario, t CO_2eq;
BE_y – total GHG emissions in period y of the baseline scenario, t CO_2eq;
PE_y – total GHG emissions in period y of the project scenario, t CO_2eq;

(5)

[y] - index for monitoring period

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

The enterprise systematically controls the emissions of pollutants into the environment in accordance with the laws of Ukraine:

- The Law of Ukraine No. 1264-XII "On environmental protection"[43] dated 25.06.1991;
- The Law of Ukraine No. 2707-XII "On air protection"[44] dated 16.10.1992.;
- Order of the Ministry of Environmental Protection of Ukraine: "On approval of permissible pollutant emissions from stationary sources"[45] – approved on 27.06.2006, No. 309 and registered with the Ministry of Justice of Ukraine on 01.09.2006, No 912/12786[46].

[43] http://zakon2.rada.gov.ua/laws/show/1264-12

[44] http://zakon1.rada.gov.ua/laws/show/2707-12

[45] http://zakon2.rada.gov.ua/laws/show/z0912-06

[46] http://search.ligazakon.ua/l_doc2.nsf/link1/RE12786.html

According to the above laws, the Environmental Impacts Assessment (EIA) at PE "FOSA" is not obligatory, as activity of the enterprise is recognised as such that doesn't entail significant environmental impacts.
In the course of the project activities, CFLs that has gone through their operating term or prematurely gone out of order are taken to special waste reception points, where they are diposed by a state-accredited organisation.

Information on environmental impacts of the project is collected in the course of the project activities of the enterprise and archived throughout the lifecycle of the JI project and for two years following the transfer of the last emission reduction units generated by the project.

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.
R^y	Low	In the course of lighting equipment distribution in the private and legal sectors, delivery and acceptance acts are drawn up, whereupon each month this information is added to an electronic database, which enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
P^y	Low	Power of every lamp installed in the course of the project is recorded in installation supporting documents (delivery and acceptance acts), whereupon each month this information is added to an electronic database. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
t_{on}^y	Low	Verification (calibration) of measuring and recording devices is conducted in accordance with manufacturer's instructions, measuring devices verification/calibration validated methodologies and state standards of Ukraine.

*For the identification of parameters, refer to Section D.1.

In compliance with the Law of Ukraine "On metrology and metrological activity"[47] measuring equipment utilised by PE "FOSA" is subject to periodic verification and calibration procedure. Periodicity of verification/calibration procedure is determined in accordance with manufacturer's instructions, measuring devices verification/calibration validated methodologies and state standards of Ukraine.

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

Collection of information necessary for calculating GHG emission reductions resulting from the JI project activities is conducted in accordance with the Guidance on criteria for baseline setting and monitoring, Version 03[48] and the consolidated methodology AM0046, version 2.0[49].

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

Operating structure of the enterprise allows for the collection of source data, consolidation and cross-examination, being part of the monitoring plan preparation, as shown in the figure below:

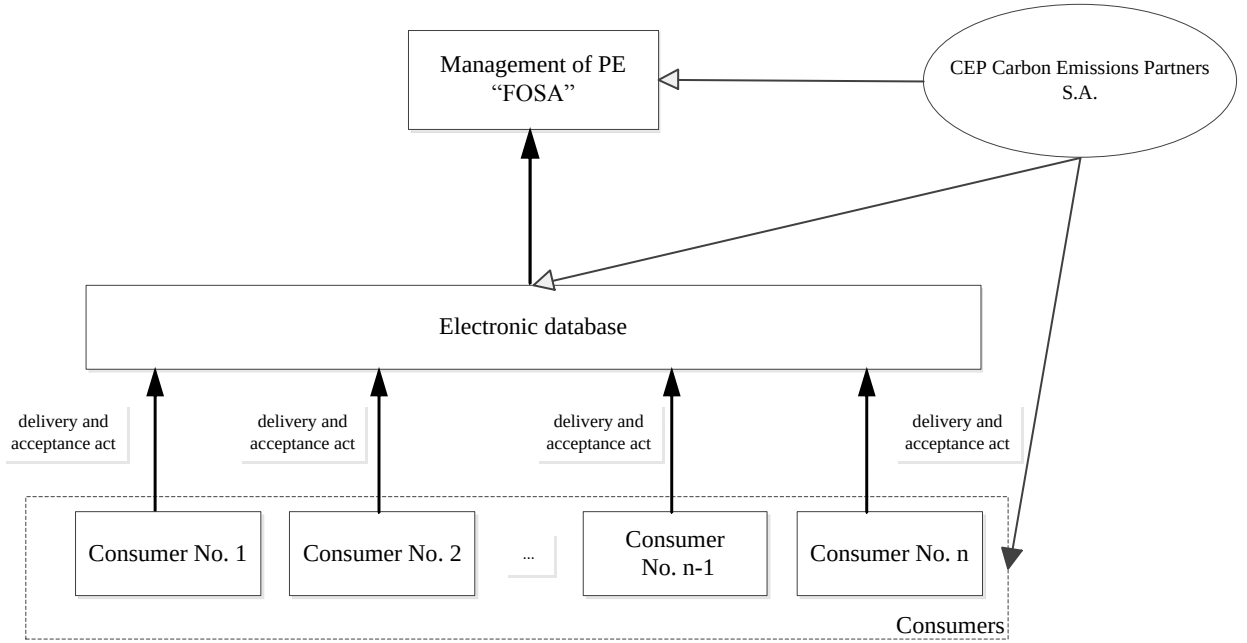

Figure 8. Structure of data collection and processing according to the monitoring plan

The system of monitoring is integrated into the current systems of control and reporting at the company. This provides reliable data related to project performance, which would ensure the quality and effectiveness of monitoring system.
Information from all sources on the parameters of effectiveness and calculations will be directed to the operator’s workplace.

Working parameters of the amount of installed CFLs and LEDLs of every type in all consumer groups, and those of their power and operating hours are subject to additional verification by CEP Carbon Emissions Partners S.A. consultants to ensure quality and reliability of monitoring data.

[48] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[49] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

The monitoring plan provides for the following measures:
1. List of PRG members, including information for the identification of consumers.
2. The following data related to energy-saving lamps and equipment monitoring:
   - identification number of every item;
   - type and quantity of lighting equipment (energy-saving lamps) for monitoring, and installation date;
   - at the time of every examination, acknowledgement of lamps subject to monitoring being in working order;
   - data on the utilisation of energy-saving lamps (operating hours, or energy consumption).
3. Collection of the information on measurement equipment, its calibration.
4. Collection and archiving information on the impact of project activities on the environment.
5. Data archiving.
6. Determination of the structure of responsibility for project monitoring.

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

The monitoring plan is established by CEP Carbon Emissions Partners S.A. , the project developer, and PE "FOSA", the project owner.

Private Enterprise "FOSA"
Papian Pavlo Borysovich
Deputy Director General
Phone: +38 0973700005
E-mail: fosa_info@ukr.net
PE "FOSA" is a project participant (stated in Annex 1).

CEP Carbon Emissions Partners S.A.
Route de Thonon, 52, Geneva, Switzerland,
Fabian Knodel
Director
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Fax: +41 763461157
e-mail: 0709bp@gmail.com
CEP Carbon Emissions Partners S.A. is a project participant (stated in Annex 1).

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project emissions were estimated based on the formulae presented in Section D.1.1.2.

The calculation results are provided in Tables below. The calculations are presented in Supporting Documents 1, 2 and 3, which are added to this PDD.

For the period between 2008 and 2011, estimated baseline GHG emissions are calculated based on actual data on the number and power of installed CFLs and LEDLs; and for the period between 2012 and 2022, forecasted according to the plan of CFL and LEDL distribution in the course of the project activities.

Table 9. Estimated project emissions between February 11, 2008, and December 31, 2012

Years	Project emissions (t CO_2eq)
2008	139 182
2009	354 844
2010	450 996
2011	367 938
2012	367 938
Total project emissions during 2008-2012 (tonnes of CO_2 equivalent)	1 680 898

Table 10. Estimated project emissions between January 1, 2013, and December 31, 2022

Years	Project emissions (t CO_2eq)
2013	1 166 549
2014	1 931 873
2015	1 890 948
2016	1 888 416
2017	1 962 669
2018	2 036 922
2019	2 111 175
2020	2 185 428
2021	1 494 357
2022	803 286
Total project emissions during the 2013-2022 crediting period (tonnes of CO_2 equivalent)	17 471 624

E.2. Estimated leakage:

Leakage is not expected for this project. The proposed project does not result in a leakage or the net change of anthropogenic emissions by sources and/or removals by sinks of GHGs which occurs outside the project boundary.

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

Since no leakage is expected, the sum of emissions from leakage and project activities equals those from project activities.

E.4. Estimated baseline emissions:

The baseline emissions were estimated using formulae in Section D.1.1.4.

The calculation results are provided in Tables below. The calculations are presented in Supporting Documents 1, 2 and 3, which are added to this PDD.

For the period between 2008 and 2011, estimated baseline GHG emissions are calculated based on actual data on the number and power of installed CFLs and LEDLs; and for the period between 2012 and 2022, forecasted according to the plan of CFL and LEDL distribution in the course of the project activities.

Table 11. Estimated baseline emissions between February 11, 2008, and December 31, 2012

Years	Estimated baseline emissions (t CO_2eq)
2008	602 907
2009	1 574 080
2010	2 013 135
2011	1 642 220
2012	1 642 220
Total baseline emissions during the 2008-2012 crediting period (tonnes of CO_2 equivalent)	7 474 562

Table 12. Estimated baseline emissions between January 1, 2013, and December 31, 2026

Years	Estimated baseline emissions (t CO_2eq)
2013	3 486 386
2014	5 744 900
2015	5 828 679
2016	6 016 018
2017	6 410 474
2018	6 804 930
2019	7 199 386
2020	7 593 842
2021	5 729 783
2022	3 865 725
Total baseline emissions during the 2013-2022 crediting period (tonnes of CO_2 equivalent)	58 680 122

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

The emission reductions were estimated using formula (5) in Section D.1.4. The calculation results are provided in Tables below. The calculations are presented in Supporting Documents 1, 2 and 3, which are added to this PDD.

Table 13. Estimated emission reductions between February 11, 2008, and December 31, 2012

Years	Estimated emission reduction (t CO_2eq)
2008	463 725
2009	1 219 236
2010	1 562 140
2011	1 274 281
2012	1 274 281
Total estimated emission reductions during the 2008-2012 crediting period (tonnes of CO_2 equivalent)	5 793 664

Table 14. Estimated emission reductions between January 1, 2013, and December 31, 2022

Years	Estimated emission reduction (t CO_2eq)
2013	2 319 836
2014	3 813 026
2015	3 937 731
2016	4 127 602
2017	4 447 805
2018	4 768 008
2019	5 088 211
2020	5 408 414
2021	4 235 426
2022	3 062 439
Total estimated emission reductions during the 2013-2022 crediting period (tonnes of CO_2 equivalent)	41 208 498

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

Table 15. Table containing emission reduction estimation results for the period between February 11, 2008, and December 31, 2012

Year	Estimated project emissions (t CO_2eq)	Estimated leakage (t CO_2eq)	Estimated baseline emissions (t CO_2eq)	Estimated emission reduction (t CO_2eq)
2008	139 182	0	602 907	463 725
2009	354 844	0	1 574 080	1 219 236
2010	450 996	0	2 013 135	1 562 140
2011	367 938	0	1 642 220	1 274 281
2012	367 938	0	1 642 220	1 274 281
Total estimated emission reduction (t CO_2eq)	1 680 898	0	7 474 562	5 793 664

Table 19. Table containing emission reduction estimation results for the period between January 1, 2013, and December 31, 2022

Year	Estimated project emissions (t CO_2eq)	Estimated leakage (t CO_2eq)	Estimated baseline emissions (t CO_2eq)	Estimated emission reduction (t CO_2eq)
2013	1 166 549	0	3 486 386	2 319 836
2014	1 931 873	0	5 744 900	3 813 026
2015	1 890 948	0	5 828 679	3 937 731
2016	1 888 416	0	6 016 018	4 127 602
2017	1 962 669	0	6 410 474	4 447 805
2018	2 036 922	0	6 804 930	4 768 008
2019	2 111 175	0	7 199 386	5 088 211
2020	2 185 428	0	7 593 842	5 408 414
2021	1 494 357	0	5 729 783	4 235 426
2022	803 286	0	3 865 725	3 062 439

Total estimated emission reduction (t CO_2eq)	17 471 624	0	58 680 122	41 208 498

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:

CFLs, as EIA has shown, have no negative impact on environment.

CFLs contain a very small amount of mercury sealed within the glass tubing – 5 milligrams on average (roughly equivalent to the tip of a ball-point pen). Mercury is an essential, irreplaceable element of CFLs as it allows the bulb to be an efficient light source. There is no current substitute for mercury in CFLs; however, manufacturers have taken significant steps to reduce mercury levels in fluorescent lighting products over the past decade, with some beginning research into the production of mercury-free CFLs.

Most mercury vapour inside fluorescent light bulbs becomes bound to the inside of the light bulb as it is used. It is estimated that the rest of the mercury within a CFL – about 14 per cent (0.7mg) – is released into air or water assuming the light bulb is broken.

Although CFLs contain mercury, paradoxically their use results in less mercury in the environment compared to traditional light bulbs. This is due to the fact that one tone of coal used in Ukraine contains on average 0.42 grams of mercury[50]. During coal burning process this mercury is entirely emitted as vapour. This is confirmed by experiments, as well as theoretical calculations[51,52]. As shown in the table below, a 13-watt, 10,000-rated-hour-life CFL (60-watt equivalent) will save 470 kWh over its lifetime, thus avoiding the emission of 78 mg of mercury if properly recycled. If the bulb goes to a landfill, overall mercury emission savings would drop a little, to 77.3 mg.

Table 2016. Mercury emissions from a 13 Watt CFL and corresponding incandescent lamp

Light bulb type	Watts	Hours of use	kWh use	Tons of coal*	Mercury from electricity** (mg)	Mercury from landfilling (mg)	Total mercury (mg)
CFL	13	10,000	130	0.065	22	0.7	22.7
IL	60	10,000	600	0.3	100	0	100

* Conservatively assuming that 1 ton of coal generating 2 MWatt-hour of electricity.
** For coal-fired power plants with 20% capture at filters.

The above table shows that despite the fact that CFLs contain small amount of mercury, it is way less than would be emitted by a coal-fired power plant to light incandescent bulbs for the same amount of time.

The end-of-life CFLs will be collected by the project owner, and then they will be disposed at appropriate landfills or via an appropriate recycling process in cooperation with a registered recycling company operating within applicable environmental norms and accredited according to state standards.

[50] B. S. Panov *et al*, Eco-technological problems of coal extraction, enrichment and utilization, Donetsk National Technical University, 2003.

[51] M. Ya. Shpirt, Migration of mercury and its compounds in coal processing. Solid Fuel Chemistry, 2002, #5, pp. 73-86.

[52] Sources of mercury emission in Russia, Review by Zero Mercury, 2010.

Transboundary impacts from the project activity, according to their definition in the text of "Convention on long-range transboundary pollution" ratified by Ukraine, will not take place[53].

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:

As stated above, the project will involve the distribution of energy efficient light bulbs already available to consumers (at market prices, but for the project implementation). These items have passed relevant quality standards and their use does not entail significant environmental impacts. The Ukrainian Government does not require that environmental impact assessments be undertaken for activities included in the project.

[53] http://search.ligazakon.ua/l_doc2.nsf/link1/MU79302.html

SECTION G. Stakeholders' comments

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

Since the project activities don't entail any negative environmental or social impacts, special public consultations were unnecessary. Consultations with Stakeholders took place at local administrations' sessions.

The programme of raising the efficiency of fuel and energy resources consumption by the company, by way of distribution of energy-saving lamps, is regularly covered in press.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Private enterprise “FOSA”, the owner of the project

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Fax:	-
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URL:	
Represented by:	--
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Salutation:	-
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Middle name:	Borysovich
First name:	Pavlo
Department:	-
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Project participant:

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URL:	-
Represented by:	-
Title:	Director
Salutation:	Mr.
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Fax (direct):	+41 (76) 3461157
Mobile:	-
Personal e-mail:	0709bp@gmail.com

Annex 2

BASELINE INFORMATION

Baseline is a scenario which judiciously presents antropogenic emissions by greenhouse gas sources which could have occurred but for the project implementation, which was chosen according to the Guidance on criteria for baseline setting and monitoring, Version 03[54]. According to the Guidelines for users of the joint implementation project design document form, Version 04[55], for the description and justification of the baseline chosen, a step-by-step approach is used:

For the proposed project, which is aimed at enhancing the energy efficiency of Ukrainian lighting capacities by way of distributing energy-efficient lighting equipment, specifically compact fluorescent and light emitting diode lamps in substitution for incandescent lamps in the private and commercial sectors, and, as a result, at reducing GHG emissions into the atmosphere, none of the existing methodologies can be applied. The project participant has chosen a JI-specific approach based on the JI projects requirements according to paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring, Version 03 and consolidated methodology AM0046 "Distribution of efficient light bulbs to households", version 02[56].

Data / Parameter	$EF^{y}_{b,CO2,ELEC}$
Data unit	tCO2/MWh
Description	Indirect carbon dioxide emission factor related to electricity consumption by electricity consumers in historical period *y* of the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Specific indirect carbon dioxide emissions for electricity consumption in 2008 are taken from the Decree No.62 of the National Environmental Investment Agency of Ukraine (NEIAU) dated 15.04.2011 "On approval of carbon dioxide emission factor in 2008";[57] Specific indirect carbon dioxide emissions for electricity consumption in 2009 are taken from the Decree No.63 of NEIAU dated 15.04.2011 "On approval of carbon dioxide emission factor in 2009";[58] Specific indirect carbon dioxide emissions for electricity consumption in 2010 are taken from the Decree No.43 of NEIAU dated 28.03.2011 "On approval of carbon dioxide emission factor in 2010";[59] Specific indirect carbon dioxide emissions for electricity consumption in 2011 are taken from the Decree No.75 of NEIAU

[54] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[55] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

[56] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

[57] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[58] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[59] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

	dated 12.05.2011 "On approval of carbon dioxide emission factor in 2011".[60] If other specific carbon dioxide emissions associated with electricity consumption are approved for Ukrainian grids, the baseline will be recalculated for any reporting year according to the Monitoring Plan.
Value of data applied (for ex ante calculations/determinations)	**2008** 1.219 **2009** 1.237 **2010** 1.225 **2011** 1.227
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the course of a JI project development, common nationally approved carbon dioxide emission factors are applied.
Comments	Data allowing to calculate greenhouse gas emissions, the information will be archived in electronic form

Data / Parameter	$R^{y}_{p,k,n,j}$
Data unit	Dimensionless unit
Description	Total amount of type j CFL which replaced IL in customer group n in monitoring period y of the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of CFL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When CFLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database..
QA/QC procedures (to be) applied	In the course of CFL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every CFL is installed, the project owner conducts instruction on CFL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed CFLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$R^{y}_{p,l,n,j}$

[60] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Data unit	Dimensionless unit
Description	Total amount of type j LEDL which replaced IL in customer group n in monitoring period y of the project scenario,
Time of determination/monitoring	Monthly
Source of data (to be) used	Number of LEDL distributed in the course of the project activities is recorded in the JI project electronic database once a month
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	When LEDLs are delivered to their installation location, according to the project, a delivery and acceptance act is drawn up, whereupon each month this information is added to an electronic database.
QA/QC procedures (to be) applied	In the course of LEDL distribution in the private and legal sectors, delivery and acceptance acts are drawn up, which, coupled with the electronic database, enables project data cross-checking. The project database will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	When every LEDL is installed, the project owner conducts instruction on LEDL operating rules and disposal norms, which is also carried out by efforts of the project owner. The information on the number of distributed LEDLs, which replaced ILs, forms the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$P^{y}_{b,k,n,j}$
Data unit	W
Description	Power of IL replaced by type j CFL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type j CFL. Powers of CFL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the process of CFL distribution in the private sector, based on the consolidated methodology AM0046, version 2.0[61], maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 23 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL

[61] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

	will be carried out through contracts for CFL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by CFLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group n.

Data / Parameter	$P^{y}_{b,l,n,j}$
Data unit	W
Description	Power of IL replaced by type j LEDL in customer group n in monitoring period y of the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	IL power equals such power that provides a light flux equivalent to that of type j LEDL. Powers of LEDL and IL at the same values of light flux are represented in Table 2 of the PDD.
Value of data applied (for ex ante calculations/determinations)	Value is set for every monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	In the process of LEDL distribution in the private sector, based on the consolidated methodology AM0046[62], version 2.0, maximum number of lamps per household is limited as consistent with the floor space of the household, and maximum power of CFL designated for them is limited to 21 W (equivalent to 100 W of IL). Among legal entities, replacement of incandescent lamps with CFL will be carried out through contracts for LEDL installation (in substitution of incandescent lamps) and disposal, after conducting lighting needs analysis for every particular organisation. Data on power of the ILs which were replaced by LEDLs in the course of the project will be stored for not less than two years following the transfer of the last emission reduction units.
Comments	Data on power of the ILs which were replaced by LEDLs form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.

Data / Parameter	$t^{y}_{on,b,n}$
Data unit	hrs
Description	Average operating period of lighting equipment (lamps of every type and power) in customer group n in monitoring period y of the baseline scenario

[62] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

<table>
<tr><td>Time of determination/monitoring</td><td>Daily</td></tr>
<tr><td>Source of data (to be) used</td><td>Data from loggers which, in continuous running mode, measure the daily operating hours of the lighting equipment installed in the customer group n.</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><th>No. of customer category</th><th>Operating hours per day</th><th>Average operating hours per annum</th></tr>
<tr><td>A</td><td>3.80</td><td>1 387</td></tr>
<tr><td>B</td><td>5.25</td><td>1 916</td></tr>
<tr><td>C</td><td>6.56</td><td>2 394</td></tr>
<tr><td>D</td><td>7.85</td><td>2 865</td></tr>
<tr><td>E</td><td>12.20</td><td>4 453</td></tr>
<tr><td>F</td><td>16.27</td><td>5 939</td></tr>
<tr><td>G</td><td>1.80</td><td>657</td></tr>
<tr><td>H</td><td>2.35</td><td>857</td></tr>
<tr><td>I</td><td>2.14</td><td>781</td></tr>
<tr><td>K</td><td>15.95</td><td>5 822</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>All the project participants were divided into eleven groups (customer groups, as mentioned elsewhere in the text). For every group, a certain number of customers were allotted, which had loggers installed at their lighting equipment; this customer group is called the project representative group (PRG). Data on lighting equipment operating hours for PRG will be used to extrapolate those of all customers of the relevant group.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>PRG was created based on the consolidated methodology AM0046[63], version 2.0. An electronic database will be created, wherein all the project data will be stored, including information on operating hours of lighting equipment, specifically that which is installed in customer group n. This information will be stored for not less than two years following the transfer of the last emission reduction units.</td></tr>
<tr><td>Comments</td><td>Data on lighting equipment average operating hours in customer group n form the basis for the greenhouse gas emission calculations, which will be archived and stored in electronic form.</td></tr>
</table>

[63] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

Annex 3

MONITORING PLAN

The proposed project applies a JI-specific approach based on the JI projects requirements according to paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring, Version 03[64] and consolidated methodology AM0046, version 2.0[65].

The monitoring plan is set up for the sake of accurate and intelligent calculation of GHG emission volume and preparing reports on GHG emission reduction, on the ground of baseline and project activities. The monitoring plan provides for the collection of information on numbers of LEDLs and CFLs with relevant power, and their installation location according to the customer category. Customers were grouped by categories according to artificial lighting operating hours. Details on types of constructions and facilities and their belonging to a relevant consumer category are presented in Table 11 of the PDD. Lamp operating hours for each consumer category is to be determined through the installation of lamp operation measuring equipment among consumers within the project representative group (PRG). For each customer category, a separate PRG will be created; and after measuring their lighting equipment operating hours, the received data will be corrected according to statistical data to confidence interval (similar to the consolidated methodology AM0046 version 2) and used to extrapolate those of all CFLs and LEDLs working during the given monitoring period in the relevant consumer group. To calculate GHG emissions in the baseline scenario, calculations of the reductions of GHG emissions into the atmosphere use average weighted value of incandescent lamps' power, according to their wattage breakdown in Ukraine (ref. to Table 8), which were replaced by CFLs in the course of the project activities; and the power of CFLs and LEDLs, to calculate GHG in the project scenario, is taken as such that provides a light flux equivalent to that of ILs. In monitoring reports, power of lamps will be recorded upon their installation, and their life span according to monitoring data on lamps installed in the course of the project activities.

The monitoring plan includes a complex of measures (metering, technical maintenance, calibration), which are to be carried out in order to satisfy the requirements of the chosen monitoring methodology and ensure the possibility to verify the GHG emission reduction calculations.

Data and parameters monitored throughout the crediting period:

$R^{y}_{p,k,n,j}$	total amount of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);
$R^{y}_{p,l,n,j}$	total amount of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (dimensionless);
$P^{y}_{b,k,n,j}$	power of IL replaced by type *j* CFL in customer group *n* in monitoring period *y* of the baseline scenario (W);
$P^{y}_{b,l,n,j}$	power of IL replaced by type *j* LEDL in customer group *n* in monitoring period *y* of the baseline scenario (W);
$t^{y}_{on,b,n}$	average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the baseline scenario (hrs);
$P^{y}_{p,k,n,j}$	power of type *j* CFL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);
$P^{y}_{p,l,n,j}$	power of type *j* LEDL which replaced IL in customer group *n* in monitoring period *y* of the project scenario (W);
$t^{y}_{on,p,n}$	average operating period of lighting equipment (lamps of every type and power) in customer group *n* in monitoring period *y* of the project scenario (hrs);

[64] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[65] http://cdm.unfccc.int/methodologies/DB/5SI1IXDIZBL6OAKIB3JFUFAQ86MBEE

Annex 4
Assumptions and parameters used for the estimation of emission reductions

For the calculations of GHG emission reductions in the PDD in 2013-2022, the following assumptions have been made:

- The average time of use of artificial lighting by consumers is equal to 4500 hours per year.

Upon determining the average weighted operating hours of artificial lighting at consumers' places, where approximately 6 000 000 CFLs were already installed, which equalled 12.97 hours per day, or 4732 hours per annum, and based on conservative principles, to avoid GHG emission reductions overstatement, the artificial lighting hours at consumers' places was taken as 4500 hours. Average weighted lighting equipment operating hours calculation is presented in Supporting Document 2.

- Power of an IL, used for GHG emission calculations in the baseline scenario, was taken as 88.4 W.

Power of an IL was estimated as average weighted IL power according to IL wattage breakdown in Ukraine, presented in Table 8. Average weighted IL power calculation is presented in Supporting Document 2.

- Power of a CFL, for GHG emission calculations in the project scenario, was taken as 31.29 W.

Power of a CFL was taken as such that provides a light flux equivalent to that of ILs which were replaced in the course of the project. Average weighted CFL power calculation is presented in Supporting Document 2.

- Power of a LEDL, for GHG emission calculations in the project scenario, was taken as 16.81 W.

Power of a LEDL was taken as such that provides a light flux equivalent to that of ILs which were replaced in the course of the project. Average weighted LEDL power calculation is presented in Supporting Document 2.

- The life span of a CFL is 10 000 hours.

This is the most frequent life span of CFLs and it is considered as standard by most manufacturers.

- The life span of a LEDL is 50 000 hours.

This is the most frequent life span of LEDLs and it is considered as standard by most manufacturers.

The schedule of CFL distribution in the course of the project is as follows:

5 780 906 CFL (total) from 11/02/2008 to 22/03/2012;
Distribution of CFL and LEDL after 22/03/2012 is planned to be carried out on 2011 level.
34 000 000 CFL for the period between 01/01/2012 and 31/12/2020;
7 000 000 LEDL for the period between 01/01/2012 and 31/12/2020;
0 CFL and LEDL from 01/01/2020 to 31/12/2022.
For details on the number of CFLs and LEDLs designated for distribution, refer to Supporting Document 2.