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

**CONTENTS**

## SECTION A. General description of the project

### A.1. Title of the project:

**Greenhouse gases emission reduction due to replacement of power, generated by the traditional fuel fired power plants, as a result of rehabilitation and construction of the small hydropower plants, operated by EEA "Novosvit" and "Energoinvest", Ltd.**

PDD Version: 07, dated November 23, 2010

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

### A.2. Description of the project:

The project's main goal is the reduction of the greenhouse gases emissions from the thermal power plants which consume traditional fossil fuel by means of replacement of electric power generated by them to the state grid with the electric power generated by the small hydro power plants as a renewables, due to rehabilitation, renewing and retrofit of existing obsolete small HPPs and building of the new ones**.** Increasing of the capacities and share of the hydro power generating in total power scope will result in greenhouse gases emissions reduction from the generating enterprises of Ukraine relative to the current practice.

In Ukraine the small hydro power plants were used for production of both mechanical and electric energy since fifties of the 20-th century. However, the advantages of the centralized production of electric power and high-voltage transmission in the recent half-century have led to that a lot of small hydro-electric power plants became neglected and fall into decay.

At the beginning of the 21-th century the growing significance of ecological problems, promoted interest to the renewing energy sources as well as the necessity of improving the reliability of power supply to rural area caused the interest to renewing of the small HPPs.

Renovation of the small HPPs will favour to solve the ecology problems, to improve infrastructure of rural regions, to create the systems of reliable local power supply, to improve water supply, to advance the fish industry, etc.

The project foresees the increase of power generation by means of capacity increasing, rehabilitation of existing and construction of the new hydroelectric generators at the existing and new small hydro power plants, operated by EEA "Novosvit" and "Energoinvest", Ltd., on the rivers of Pivdennyj Buh, Zbruch, Ushytsya, Ros, Hirskyj Tykych, Hnylyj Tykych, Sluch, Koropets, Bily Cheremosh, Perclub, Sarata, Yalovechora, Murafa, Prut, Stryj and Zolota Lypa. This will result in the reduction of greenhouse gases, mainly $CO_2$, emissions due to decreasing of the power production by the power generating capacities of the state grid of Ukraine.

The Supplyer for this project is the External Economic Association "Novosvit", which at present operates 15 small hydropower plants with the installed capacity of 10 280 kW. The first three of them (Sandratska HPP, Gordashivska HPP and Bodnarivska HPP) were renovated in 1999-2000 by the Ukrainian Energy Consortium, the founder of the EEA "Novosvit", and were then rented by EEA "Novosvit", these small HPP are not included in the project. After getting experience on their renovation and operation, the EEA "Novosvit" made the decision to rent and renovate step-by-step several small HPP. The other 12 already rehabilitated/constructed are included in the project, as well as 9 HPPs that are planned for rehabilitation/ construction, in total 21 small HPPs with total scheduled installed capacity of 13.360 MW.

Also, the EEA "Novosvit" is empowered to represent in this project the interests of company "Energoinvest», Ltd., which at present operates 11 already rehabilitated/constructed small hydropower plants with total installed capacity of 13.038 MW. 10 of these small HPPs are included in the project, as well as 2 HPP which are planed to retrofit, in total 12 small HPPs with total scheduled installed capacity of 12.488 MW.

Thus, in frames of this project, the total installed capacity of the 22 small hydropower plants that are already rehabilitated/renovated up to the end of 2009, is 20.528 MW, and the total installed capacity of all 33 small hydropower plants included in the project at the present stage is planned to be 25.848 MW.

## A.3. Project participants:

| Party involved | Legal entity project participant (as applicable) | Please indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Ukraine (host party) | • EEA "Novosvit" | No |
| The Netherlands | • E-Energy B.V. | No |

The project is initiated by the partners that distribute their functions in the project as follows:

- ***External Economic Association "NOVOSVIT":*** is a project implementation agency which operates small hydropower plants (**Supplier**). This enterprise operates the equipment for power generation, has all licenses and permissions, required under Ukrainian legislation, to perform the design and rehabilitation of the equipment. It is responsible for designing, construction, engineering and installation works' execution by its own staff or with help of subcontractors. It finances this project and receives profits.

Historical details:

**External Economic Association "Novosvit"** was founded in 1999. The main activity of the association is electric power supply (by the unregulated tariff) generated at the own and rented small hydropower plants and purchased at the Wholesale Power Market of Ukraine, as well as construction, renovation and rehabilitation of small hydropower plants. The area of activity of EEA "Novosvit" is Vinnytsya, Khmelnytsky, Ternopil, Chernivtsi and Cherkasy regions.

EEA "Novosvit" is the member of the Wholesale power market of Ukraine and the member of the Association of companies generating power at small hydropower plants.

Having a good staff of experienced specialists on renovation, rehabilitation and operation of small hydropower plants, EEA "Novosvit" till present time has already constructed one, reconstructed six and renovated the operation of eight small hydropower plants in Ukraine. The total installed generating capacity of 15 small hydropower plants operated by the Association in 2009 is 10.280 MW.

Up to 9 more small hydropower plants are planned to be renovated by the Association till 2012.

**"Energoinvest», Ltd** implements the project at small hydropower plants which it operates. "Energoinvest», Ltd operates the equipment for power generation, has all licenses and permissions, required under Ukrainian legislation to perform the design and rehabilitation of the equipment. It is responsible for designing, engineering and installation works execution at small hydropower plants which it operates by its own staff or with the help of subcontractors.

The main types of «Energoinvest», Ltd. activities are power generation and supply at the Retail Power Market of Ukraine as well as renovation and modernization of small hydropower plants. The company was founded in 1997 as joint Ukrainian-English enterprise "Energoinvest" which at first carried out the power supply to the consumers by the unregulated tariff. For the period since 1997 nearly 120 consumers in Vinnytsya, Ternopil and Zakarpattya regions have been supplied by the enterprise.

In May 2002 the enterprise was re-registered into «Energoinvest», Ltd., and rented 7 hydropower plants with the purpose of their rehabilitation and renovation. The new kind of activity such as power generation appeared. In time, besides rented plants, the company has reconstructed three own plants, and renovation and modernization of small hydropower plants have become one of the main kinds of its activity. "Energoinvest», Ltd has reconstructed seven and renovated four small hydropower plants allocated in Vinnytsya, Ivano-Frankivsk and Lviv regions. Total installed generating capacity of 11 small hydropower plants operated by the company in 2008 is 13.038 MW.

Up to 2 more small hydropower plants are planned to be renovated by the "Energoinvest», Ltd. till 2012.

"Energoinvest", Ltd. has authorized the EEA "Novosvit" (the Letter of Attorney #491 dated 25 December, 2007 and Agreement # 7-51/09 dated 22 December, 2009) to represent its interests on the issues associated with preparation, development, implementation, financing, benefit acquisition and other activities of this JI project.

- ***E-Energy B.V.:*** is the purchaser of emission reduction units generated from this project. It is a company registered in the Netherlands, and is one of subsidiaries belonging to the E energija group.

**Historical details:**

Having started its activity in 1994, E energija group has expanded from its first established company Energijos taupymo centras (Energy saving center).

The rising work range and economical-social conditions caused the creation of vertically integrated company's structure, with the separation of group's operation fields. For this purpose, the company E energija UAB, which now is the management company of the whole E energija group, was established.

E energija, UAB is an energy planning and management company, which implements turnkey projects from conceptual development and owns companies generating and supplying energy for industries and residents of the cities.

One of key aims of E energija specialists is to prepare energy plans to meet energy needs for subsistence and development of alternate energy sources and for the increase of energy efficiency at the least cost to the economy and environment.

Since 2005 E energija group, one of the first companies in the Baltic countries, has been involved in the project development under Kyoto Protocol flexible mechanisms, and started trading activities with EU allowances as specified by EU Emission Trading Scheme.

E-Energy B.V. is a company responsible for E energija group carbon credit procurement for its own purposes and all business related with carbon credit trade. E-Energy B.V. is active investor in the market of Eastern European countries in a number of JI projects.

## A.4. Technical description of the project:

### A.4.1. Location of the project:

The Project is located in Vinnytsya, Khmelnytsky, Ternopil, Chernivtsi, Cherkasy, Ivano-Frankivsk and Lviv regions in the western and central parts of Ukraine (**Figures 1, 2**).


*Fig. 1. The map of Ukraine with regions and neighboring countries*

### A.4.1.1. Host Party(ies):

Ukraine

Ukraine is an Eastern European country that ratified the Kyoto Protocol to UN FCCC on February 4, 2004, and is eligible for the Joint Implementation projects.


*Fig. 2. The map of Ukraine with main cities and rivers*

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

Project is located in Vinnytsya, Khmelnytsky, Ternopil, Chernivtsi, Cherkasy, Ivano-Frankivsk and Lviv regions (see **Figs. 1, 2**).

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

The small hydropower plants operated and planned to be operated by EEA "Novosvit" and "Energoinvest", Ltd., are placed at the rivers of Pivdennyj Buh, Zbruch, Ushytsya, Ros, Hirskyj Tykych, Hnylyj Tykych, Sluch, Koropets, Bily Cheremosh, Perclub, Sarata, Yalovechora, Murafa, Prut, Stryj and Zolota Lypa (**Figures 3, 4**).

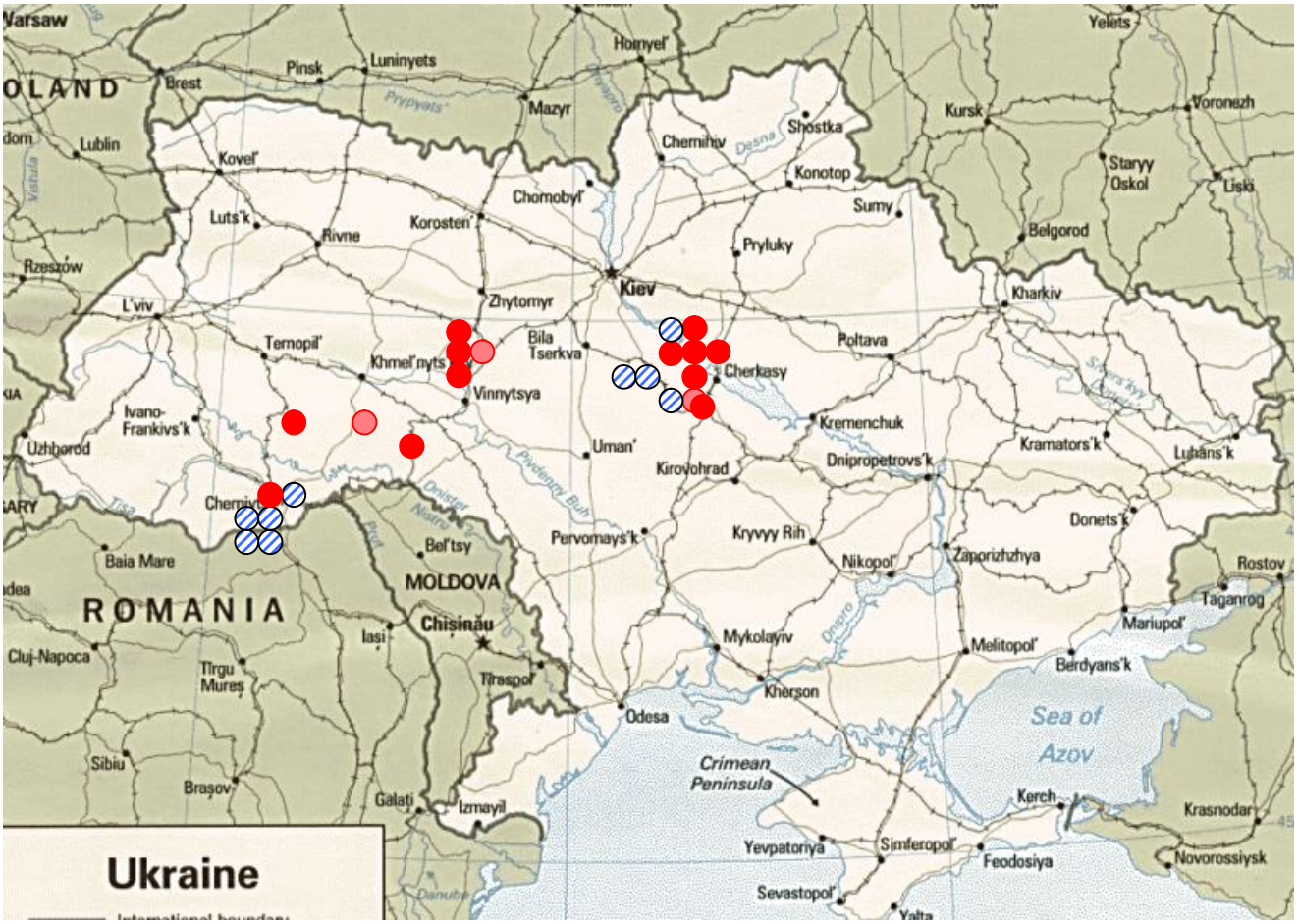


*Fig. 3. Location of small HPPs operated by EEA "Novosvit":*

- *already rehabilitated, included into the project;*
- *already rehabilitated, not included into the project;*
- *under rehabilitation or planned to be rehabilitated*


*Fig. 4. Location of small HPPs operated by "Energoinvest", Ltd:.*

- *already rehabilitated, included into the project;*
- *already rehabilitated, not included into the project;*
- *under rehabilitation or planned to be rehabilitated*

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

The small hydropower plants which are or will be operated by EEA "Novosvit" and are included in the project, are located in or near the towns/villages on the following rivers: Pivdennyj Buh, Zbruch, Ushytsya, Ros, Hirskyj Tykych, Hnylyj Tykych, Sluch, Koropets, Bily Cheremosh, Perclub, Sarata, Yalovechora, Murafa, Prut, Stryj and Zolota Lypa.
More detailed information is provided in the **Appendix 6.**

As an example, the physical location of Korsun-Shevchenkivska mini HPP is described below in detailes.

The ground area 0.0158 ha is situated in the central part of the town at Ros river bank, 30 m to the north-west of Korsun-Shevchenkivs'ka dam. The ground area borders: to the North – with Ros water area, to the West – with Ros offshore-shelter strip, to the East – with regional transmission company territory, where HPP dam is situated, to the south – with local council area – Ros terraced steep bank with trees and bushes.
The ground area for a transformer substation has a significant relief drop to Chapaeva street roadway. Mini-turbines are installed on the dam pier bays #17 and #18.
The ground area is situated in the preserved landpark landscape in water-preserved Ros area.
There are no engineering structures located at the ground area. Vegetable cover is absent, soil is sandy clay based on natural stone, fixed by 6 fundamental blocks.

The similar description of the physical location of other small HPP may be available.

The typical general view of small HPP (Steblivska HPP after renovation) is represented at Fig. 5.

*Fig. 5. Steblivska small HPP after renovation*

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

From the beginning of 1920-th the small hydropower plants in Ukraine were built on many small rivers, and at the beginning of 1950-th the number of the small hydropower plants in Ukraine was 956 with total

installed capacity of about 30 000 kW[1]. But then due to development of the centralized power supply and the tendency to concentration of electric power production at powerful thermal and hydro-electric power plants, building of small HPPs was stopped. The existing small HPPs were mainly preserved and dismaunted, hundreds of them were destroyed.

At present only less than 70 small HPPs with the total capacity of about 108 MW are in operation in Ukraine, which generate from 278 to 395 mln kWh of power per year depending on meteorological conditions[2]. At the same time the total hydro power potential of the small rivers in Ukraine is 12.5 billion kWh, and economically feasible potential comes to nearly 3.7 billion kWh[1], i.e. less than 10 % of the potential has been used.

Since the majority of the small HPPs have been put in operation more than 50 years ago, the technical state of the main hydropower, hydrotechnical and electric power equipment is characterized by significant of full deterioration, and thus some hydrounits operate at lowered loads and some have been out of operation for decades. The specific capital investments for rehabilitation of a small HPP in average are US $ 500-800 per 1 kW of installed capacity, for rehabilitation of a decomissioned hydropower plant – US $ 800-1200 per 1 kW[3].

EEA “Novosvit” and “Energoinvest”, Ltd schedule to fulfil the maintenance works up to the extensive repairs of the HPPs they operate every approximately twenty (up to thirty) years. This termin is determined on the base of existing experience, both already own and available from statistics and history of small HPPs in previous Soviet Union, including Ukraine. Without such renovation the small hydro power plants gradually approach and reach the end of their service life and become obsolete. Such capital maintenances should enable the effective long-term operation of these power plants. Project design engineering reflects current good practices in the country. The project uses state of the art technology.

EEA “Novosvit” and “Energoinvest”, Ltd have all licenses and permissions necessary for the project implementation.
The project requires extensive initial training and maintenance efforts in order to work as presumed during the project period, since for the majority of technical personnel this will be the new type of activity. Training of the technical personnel is provided at the beginning of employment and periodically according to enterprise’s schedule.

General information on small HPPs rehabilitated / constructed by EEA“Novosvit” in 2002-2009

| ## | Small HPP name | Number of power generating units | Installed capacity, kW | Year of construction | Start of rehabilitation | End of rehabilitation |
|---|---|---|---|---|---|---|
| N1 | Korsun-Shevchenkivska | 2 | 1600 | 1934 | 2000 | 05.2001 (fin – 2007) |
| N2 | Steblivska | 2 | 2800 | 1951 | 2000 | 03.2001 (fin – 2005) |
| N3 | Novokostyantynivska | 3 | 525 | 1953 | 2000 | 11.2001 |
| N4 | Shchedrivska | 1 | 640 | 1958 | 2001 | 04.2002 |
| N5 | Koropetska | 2 | 250 | 1952 | 2001 | 02.2002 |
| N6 | Lysyanska | 2 | 200 | 1953 | 2003 | 03.2004 |
| N7 | Korzhivska | 2 | 320 | 1953 | 2002 | 10.2004 |
| N8 | Zvenigorodska | 2 | 396 | 1955 | 2004 | 12.2006 |

[1] http://www.kem.com.ua/index.php?module=ContentExpress&func=display&ceid=31
[2] http://zhzh.info/publ/9-1-0-125

[3] http://www.zn.ua/2000/2229/50908/

| | | | | | | |
|---|---|---|---|---|---|---|
| N9 | Velykokuzhelevetska | 2 | 270 | 1953 | 2005 | 03.2007 |
| N10 | Korsun-Shevchenkivska mini-HPP | 2 | 110 | 2006 | 2006 | 09.2007 |
| N11 | Lotashivska | 3 | 429 | 1952 | 2006 | 12.2008 |
| N12 | Yablunytska | | 1000 | 1961 | 2007 | 10.2009 |

*Table 1. General information on small HPPs rehabilitated / constructed by EEA"Novosvit" in 2002-2009*

Plan of rehabilitation / construction of small HPPs by EEA "Novosvit" up to 2012

| ## | Small HPP name | Number of power generating units | Scheduled installed capacity, kW | Year of construction | Start of rehabilitation/ construction | End of rehabilitation/ construction |
|---|---|---|---|---|---|---|
| N13 | Yurpilska | 2 | 500 | | 2009 | 2011 |
| N14 | Bukska | 2 | 600 | | 2011 | 2012 |
| N15 | Kryvokolinska | 2 | 320 | | 2010 | 2011 |
| N16 | Marijina Hat | 2 | 800 | | 2009 | 2012 |
| N17 | Kalynychi | 2 | 700 | | 2010 | 2012 |
| N18 | Sarata | 2 | 700 | | 2010 | 2012 |
| N19 | Yalovechora | 2 | 500 | | 2010 | 2012 |
| N20 | Klyausa | 2 | 600 | | 2010 | 2012 |
| N21 | Steblivska mini-HPP | 2 | 100 | 2010 | 2009 | 2010 |

*Table 2. Plan of rehabilitation / construction of small HPPs by EEA "Novosvit" up to 2012*

General information on small HPPs rehabilitated / constructed by "Energoinvest", Ltd. in 2002-2009:

| ## | Name of small HPP | Number of power generating units | Installed capacity, kW | Year of construction | Start of rehabilitation | End of rehabilitation |
|---|---|---|---|---|---|---|
| E1 | Sutyska | 2 | 1400 | 1957 | ГА 1 – 2002<br>ГА 2 - 2007 | ГА 1 – 2002<br>ГА 2 - 2008 |
| E2 | Bratslavska | 4 | 400 | 1951 | 2002 | 07.2002 |
| E3 | Skalopilska | 3 | 456 | 1958 | 2002 | 07.2002 |
| E4 | Glybochanska | 3 | 6130 | 1960 | ГА 1 – 2003<br>ГА 2 – 2007<br>ГА 3 - 2007 | ГА 1 – 2004<br>ГА 2 – 2008<br>ГА 3 - 2008 |
| E5 | Chernyatska | 2 | 1400 | 1954 | 2003 | 02.2004 |
| E6 | Dmytrenkivska | 3 | 510 | 1953 | 2002 | 12.2003 |
| E7 | Snyatynska | 2 | 800 | 1959 | 2003 | ГА 1 – 05.2004<br>ГА 2 – 12.2005 |
| E8 | Halzhbiyivska | 2 | 250 | 1958 | 2003 | 02.2004 |
| E9 | Petrashivska | 2 | 192 | 1958 | 2003 | 05.2005 |
| E10 | Yavirska | 1 | 450 | 1956 | 2006 | 04.2008 |

*Table 3. General information on small HPPs rehabilitated/constructed by "Energoinvest", Ltd. in 2002-2009*

Plan of rehabilitation of small HPPs by "Energoinvest", Ltd. up to 2012

| ## | HPP name | Number of power generating units | Scheduled installed capacity, kW | Year of construction | Start of rehabilitation | End of rehabilitation |
|---|---|---|---|---|---|---|
| E11 | Sloboda-Bushanska | 2 | 200 | | 2010 | 2012 |
| E12 | Zolota Lypa | 2 | 300 | | 2010 | 2011 |

*Table 4. Plan of rehabilitation of small HPPs by "Energoinvest", Ltd. up to 2012*

## Plants operated by EEA "Novosvit":

**N1. Korsun-Shevchenkivska HPP**
**Installed equipment:**
**- 2 turbines F-130-VG-185, manufactured in 1945**
**- 2 generators 800 kW capacity each, manufactured in 1945**

| Category | Data unit | № of unit | 1996 - 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 |
| | | №2 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 |
| Operating capacity of hydro power unit | MW | №1 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 |
| | | №2 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 | 0,8 |
| Average load | MW | total | | 0,544 | 0,968 | 0,857 | 0,998 | 1.084 | 1.173 | 0,611 | 0,657 |
| Period of operation | ths hours | total | | 2.977 | 5.302 | 4.694 | 5.463 | 5.934 | 6.421 | 3.345 | 3.598 |

**N2. Steblivska HPP**
**Installed equipment:**
**- 2 turbines F-123-VG-160, manufactured in 1950**
**- 2 generators 1400 kW capacity each, manufactured in 1949, 1950**

| Category | Data unit | № of unit | 1996 - 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 |
| | | №2 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 |
| Operating capacity of hydro power unit | MW | №1 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 |
| | | №2 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 | 1,4 |
| Average load | MW | total | | 1,560 | 1,660 | 1,33 | 1,627 | 1,780 | 1,812 | 1,073 | 1,048 |
| Period of operation | ths hours | total | | 4,882 | 5,195 | 4,171 | 5,089 | 5,570 | 5,668 | 3,360 | 3,281 |

**N3. Novokostyantynivska HPP**
**Installed equipment:**
**- 3 turbines "Foit", manufactured in 1949**
**- 3 generators 175 kW capacity each, manufactured in 1949**

| Category | Data unit | № of unit | 1996 - 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| | | №2 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| | | №3 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| Operating capacity of hydro power unit | MW | №1 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| | | №2 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| | | №3 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 | 0,175 |
| Average load | MW | total | | 0.047 | 0.247 | 0,209 | 0,169 | 0,295 | 0,361 | 0,29 | 0,258 |
| Period of operation | ths hours | total | | 0.777 | 4.117 | 3.488 | 3,52 | 6,152 | 7,532 | 4,517 | 4,302 |

**N4. Shchedrivska HPP**
**Installed equipment:**
**- 1 turbine "Foit" "Kaplan", manufactured in 1954**
**- 1 generator 640 kW capacity, manufactured in 1954**

| Category | Data unit | № of unit | 1997 - 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | total | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 |
| Operating capacity of hydro power unit | MW | total | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 |
| Average load | MW | total | | 0,184 | 0,202 | 0,147 | 0,293 | 0,235 | 0,251 | 0,362 |
| Period of operation | ths hours | total | | 2,515 | 2,762 | 2,063 | 4,067 | 3,262 | 3,574 | 4.952 |

**N5. Koropetska HPP**
**Installed equipment:**
**- 2 turbines SG-220-500, manufactured in 1951**
**- 2 generators 125 kW capacity each, manufactured in 1949, 1953**

| Category | Data unit | № of unit | 1997 - 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 |
| | | №2 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 |
| | | №2 | - | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 | 0,125 |
| Average load | MW | total | - | 0,12 | 0,11 | 0,12 | 0,15 | 0,157 | 0,14 | 0,189 |
| Period of operation | ths hours | total | - | 4.221 | 3.840 | 4.242 | 5.265 | 5.506 | 4.736 | 6.627 |

**N6. Lysyanska HPP**
**Installed equipment:**
**- 2 turbines №1 – GF-59, №2 – GA-355-16, manufactured in 1952**
**- 2 generators 100 kW capacity each, manufactured in 2003**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | - | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | - | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| Average load | MW | total | - | 0,058 | 0,076 | 0,079 | 0,039 | 0,038 |
| Period of operation | ths hours | total | - | 2.540 | 3.349 | 3.466 | 1.697 | 1.661 |

**N7. Korzhivska HPP**
**Installed equipment:**
**- 2 turbines №1 - T-80, №2 - GA-400U-12, manufactured in 2004**
**- 2 generators GA-400U-12, 160 kW capacity each, manufactured in 2004**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,160 | 0,160 | 0,160 | 0,160 | 0,160 |
| | | №2 | - | 0,160 | 0,160 | 0,160 | 0,160 | 0,160 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,160 | 0,160 | 0,160 | 0,160 | 0,160 |
| | | №2 | - | 0,160 | 0,160 | 0,160 | 0,160 | 0,160 |
| Average load | MW | total | - | 0,93 | 0,177 | 0,236 | 0,183 | 0,238 |
| Period of operation | ths hours | total | - | 0,525 | 4,844 | 4,469 | 3,753 | 6.510 |

**N8. Zvenigorodska HPP**
**Installed equipment:**
**- 3 turbines F 300-GF-59, manufactured in 1957**
**- 3 generators 132 kW capacity each, manufactured in 1992, 1992, 1994**

| Category | Data unit | № of unit | 2001 - 2005 | 2006 | 2007) | 2008 |
|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,132 | 0,132 | 0,132 | 0,132 |
| | | №2 | 0,132 | 0,132 | 0,132 | 0,132 |
| | | №3 | 0,132 | 0,132 | 0,132 | 0,132 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,132 | 0,132 | 0,132 |
| | | №2 | - | 0,132 | 0,132 | 0,132 |
| | | №3 | - | 0,132 | 0,132 | 0,132 |
| Average load | MW | total | - | 0,01 | 0,058 | 0,057 |
| Period of operation | ths hours | total | - | 0.744 | 1.283 | 1.270 |

**N9. Velykokuzhelevetska HPP**

**Installed equipment:**

**- 2 turbines №1 – T-50, №2 – T-80, manufactured in 2006**

**- 2 generators №1 – 110 kW, manufactured in 2003, №2 - 160 kW, manufactured in 2004**

| Category | Data unit | № of unit | 2002 - 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,110 | 0,110 |
| | | №2 | - | 0,160 | 0,160 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,110 | 0,110 |
| | | №2 | | 0,160 | 0,160 |
| Average load | MW | total | - | 0,08 | 0,183 |
| Period of operation | ths hours | total | - | 3.058 | 5.942 |

**N10. Korsun-Shevchenkivska mini-HPP**

**Installed equipment:**

**- 2 turbines GTS-50, manufactured in 2007**

**- 2 generators 55 kW capacity each, manufactured in 1999, 2006**

| Category | Data unit | № of unit | 2002 - 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,055 | 0,055 |
| | | №2 | - | 0,055 | 0,055 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,055 | 0,055 |
| | | №2 | - | 0,055 | 0,055 |
| Average load | MW | total | - | 0,021 | 0,037 |
| Period of operation | ths hours | total | - | 1,656 | 2,952 |

**N11. Lotashivska HPP**

**Installed equipment:**

**3 turbines, manufactured in 2008**

**3 generators: AOZ-355S7U2 – 2 units, AOZ-400MU2 – 1 unit, manufactured in 2004**

| Category | Data unit | № of unit | 2002-2007 | 2008 |
|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 132 |
| | | №2 | - | 132 |
| | | №3 | - | 165 |
| Operating capacity of hydro power unit | MW | №1 | - | 132 |
| | | №2 | - | 132 |
| | | №3 | - | 165 |
| Average load | MW | total | - | 0,097 |
| Period of operation | ths hours | total | - | 0,169 |

**N12.Yablunytska HPP**

**Installed equipment:**

**2 turbines T-90, manufactured in 2008**

**2 generators SGG-600, manufactured in 2008**

| Category | Data unit | № of unit | 2002 - 2008 | 2009 |
|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 500 |
| | | №2 | - | 500 |
| Operating capacity of hydro power unit | MW | №1 | - | 500 |
| | | №2 | - | 500 |
| Average load | MW | total | - | 0,25 |
| Period of operation | ths hours | total | - | 1,1 |

**Plants operated by "Energoinvest", Ltd.:**

**E1. Sutyska HPP**
**Installed equipment:**
**- 2 turbines "Foit", 950 hp capacity, manufactured in 1951**
**- 2 generators "Siemens Shukkert", 950 kW capacity, manufactured in 1951**

| Category | Data unit | № of unit | 1997 - 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| | | №2 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| Operating capacity of hydro power unit | MW | №1 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 |
| | | №2 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 |
| Average load | MW | №1 | | 0,493 | 0,492 | 0,498 | 0,492 | 0,490 | 0,494 | 0,495 |
| | | №2 | | 0,456 | 0,457 | 0,497 | 0,498 | 0,496 | 0,496 | 0,496 |
| Period of operation | ths hours | №1 | | 1,015 | 1,921 | 1,892 | 2,533 | 2,542 | 1,906 | 1,915 |
| | | №2 | | 1,846 | 1,724 | 1,892 | 2,533 | 2,542 | 1,906 | 1.915 |

**E2. Bratslavska HPP**
**Installed equipment:**
**- 4 turbines "Foit", 170 kW capacity, manufactured in 1949**
**- 4 generators "Siemens Shukkert", 125 kW capacity, manufactured in 1949**

| Category | Data unit | № of unit | 1997 - 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №3 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №4 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| Operating capacity of hydro power unit | MW | №1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №3 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №4 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 |
| Average load | MW | №1 | | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 |
| | | №2 | | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 |
| | | №3 | | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 |
| | | №4 | | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 | 0,096 |
| Period of operation | ths hours | №1 | | 1,453 | 1,325 | 1,246 | 1,425 | 1,460 | 1,400 | 1,256 |
| | | №2 | | 1,412 | 1,417 | 1,258 | 1,418 | 1,476 | 1,321 | 1,345 |
| | | №3 | | 1,217 | 1,016 | 1,275 | 1,430 | 1,480 | 1,420 | 1,513 |
| | | №4 | | 1,368 | 1,071 | 1,263 | 1,435 | 1,465 | 1,516 | 1,031 |

**E3. Skalopilska HPP**
**Installed equipment:**
**- 3 turbines F300-GF84, 170 kW capacity each, manufactured in 1954**
**- 3 generators SG-220-500, 220 kW capacity each, manufactured in 1954**

| Category | Data unit | № of unit | 1997 - 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| | | №2 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| | | №3 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| Operating capacity of hydro power unit | MW | №1 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| | | №2 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| | | №3 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 | 0,152 |
| Average load | MW | №1 | | 0,151 | 0,150 | 0,150 | 0,151 | 0,152 | 0,150 | 0,151 |
| | | №2 | | 0,140 | 0,140 | 0,141 | 0,140 | 0,141 | 0,142 | 0,140 |
| | | №3 | | 0,138 | 0,138 | 0,138 | 0,139 | 0,140 | 0,142 | 0,138 |
| Period of operation | ths hours | №1 | | 1.514 | 1.544 | 1.360 | 1.580 | 1.590 | 1.585 | 1.514 |
| | | №2 | | 1.620 | 1.625 | 1.366 | 1.586 | 1.610 | 1.690 | 1.620 |
| | | №3 | | 1.600 | 1.594 | 1.368 | 1.592 | 1.600 | 1.721 | 1.600 |

**E4. Glybochanska HPP**
**Installed equipment:**
**- 3 turbines PRK-245-VB-220, 1710 kW, 2210 kW and 2210 kW capacity, manufactured in 1957**
**- 3 generators VGS 325/49-32, 2500 kW capacity each, manufactured in 1957**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 1,71 | 1,71 | 1,71 | 1,71 | 1,71 | 1,71 |
| | | №2 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 |
| | | №3 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 |
| Operating capacity of hydro power unit | MW | №1 | 1,71 | 1,71 | 1,71 | 1,71 | 1,71 | 1,71 |
| | | №2 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 |
| | | №3 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 | 2,21 |
| Average load | MW | №1 | | 1.321 | 1.485 | 1.560 | 1.320 | 1.313 |
| | | №2 | | 1.901 | 2.050 | 2.011 | 2.056 | 1.901 |
| | | №3 | | 1.920 | 2.014 | 2.011 | 2.034 | 1.901 |
| Period of operation | ths hours | №1 | | 1.201 | 1.415 | 1.720 | 1.368 | 1.354 |
| | | №2 | | 1.235 | 1.356 | 2.150 | 1.328 | 1.254 |
| | | №3 | | 1.241 | 1.281 | 1.699 | 1.421 | 1.246 |

**E5. Chernyatska HPP**

**Installed equipment:**

**- 2 turbines "Foit", “Caplan” type, 950 hp capacity each, manufactured in 1951**

**- 2 generators “Siemens Shukkert”, 950 kW capacity each, manufactured in 1951**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| | | №2 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| Operating capacity of hydro power unit | MW | №1 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| | | №2 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 | 0,7 |
| Average load | MW | №1 | | 0,696 | 0,560 | 0,7 | 0,68 | 0,69 |
| | | №2 | | 0,697 | 0,564 | 0,7 | 0,68 | 0,69 |
| Period of operation | ths hours | №1 | | 1,502 | 2,801 | 3,407 | 2,804 | 3,500 |
| | | №2 | | 1,547 | 2,824 | 3,401 | 2,824 | 3,500 |

**E6. Dmytrenkivska HPP**

**Installed equipment:**

**- 3 turbines F300-GF84, 170 kW capacity each, manufactured in 1949**

**- 3 generators SG-500-300, 250 kW capacity each, manufactured in 1949**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №2 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №3 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| Operating capacity of hydro power unit | MW | №1 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №2 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №3 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| Average load | MW | №1 | | 0,169 | 0,167 | 0,170 | 0,168 | 0,169 |
| | | №2 | | 0,169 | 0,167 | 0,170 | 0,168 | 0,169 |
| | | №3 | | 0,169 | 0,167 | 0,170 | 0,168 | 0,169 |
| Period of operation | ths hours | №1 | | 1,895 | 1,933 | 1,843 | 1,835 | 1,407 |
| | | №2 | | 1,910 | 1,940 | 1,850 | 1,911 | 1,302 |
| | | №3 | | 1,898 | 1,935 | 1,845 | 1,846 | 1,302 |

**E7. Snyatynska HPP**

**Installed equipment:**

**- 2 turbines "Francis", 500 kW capacity each, manufactured in 1954**

**- 2 generators №1 – AVFL 406/18-6 BSK "Siemens Shukkert" 480 kW capacity, manufactured in 1954**

**№2 - VGS-2-450-40-0,4, 450 kW capacity, manufactured in 2005**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | - | 0,4 | 0,4 | 0,4 | 0,4 |
| | | №2 | - | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Operating capacity of hydro power unit | MW | №1 | - | - | 0,4 | 0,4 | 0,4 | 0,4 |
| | | №2 | - | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Average load | MW | №1 | - | - | 0,398 | 0,399 | 0,395 | 0,395 |
| | | №2 | - | 0,4 | 0,390 | 0,398 | 0,394 | 0,395 |
| Period of operation | ths hours | №1 | - | - | 1,020 | 2,270 | 1,870 | 1,865 |
| | | №2 | - | 3,385 | 1,201 | 2,000 | 1,510 | 1,621 |

**E8. Halzhbiyivska HPP**

**Installed equipment:**

**- 2 turbines "Francis", 170 kW capacity each, manufactured in 1950**

**- 2 generators №1 – "Siemens Shukkert", 250 kW capacity, manufactured in 1950**

**№2 - DGCI 17-100 vertical 112 kW capacity, manufactured in 1967**

| Category | Data unit | № of unit | 1999 - 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,09 | 0,09 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,170 | 0,170 | 0,170 | 0,170 | 0,170 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,09 | 0,09 |
| Average load | MW | №1 | - | 0,170 | 0,170 | 0,170 | 0,122 | 0,170 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,078 | 0,09 |
| Period of operation | ths hours | №1 | - | 2,238 | 3,888 | 3,739 | 2,804 | 3,250 |
| | | №2 | - | 1,200 | 1,943 | 2,173 | 1,630 | 1.840 |

**E9. Petrashivska HPP**

**Installed equipment:**

**- 2 turbines "Francis", 87.5 kW capacity each, manufactured in 1952**

**- 2 generators №1 –FL 326/14-6 "Siemens Shukkert", 125 kW capacity, manufactured in 1952**
**№2 - DGCI 17-100 vertical 112 kW capacity, manufactured in 1967**

| Category | Data unit | № of unit | 2000 - 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | №1 | - | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,09 |
| Operating capacity of hydro power unit | MW | №1 | - | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,09 |
| Average load | MW | №1 | - | 0,1 | 0,1 | 0,1 | 0,1 |
| | | №2 | - | 0,09 | 0,09 | 0,09 | 0,09 |
| Period of operation | ths hours | №1 | - | 0,098 | 1,92 | 1,102 | 1,390 |
| | | №2 | - | 0,11 | 2,10 | 1,35 | 1,400 |

**E10. Yarivska HPP**

**Installed equipment:**

**- 1 turbine K-70-VB-160, 500 kW capacity, manufactured in 1956**

**- 1 generator VGS 2-450-40-0.4, 450 kW capacity, manufactured in 2006**

| Category | Data unit | № of unit | 2003 - 2007 | 2008 |
|---|---|---|---|---|
| Installed capacity of hydro power unit | MW | total | - | 0,450 |
| Operating capacity of hydro power unit | MW | total | - | 0,280 |
| Average load | MW | total | - | 0,260 |
| Period of operation | ths hours | total | - | 4,125 |

**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:**

The project foresees increasing of the installed and actual capacity of small hydropower plants by means of rehabilitation of existing ones and construction of new hydroelectric units, which will allow increasing of power generation by small hydropower plants, as well as the renovation of hydropower plants in operation with the aim to prolong their service life.

The emission reduction will be achieved due to increasing of the installed and operational capacity of small hydropower plants by means of their rehabilitation and construction of the new hydroelectric units. Implementation of these measures will provide the consumers with the same amount of power without use of carbon-intensive fossil fuels.

In the absence of the proposed project, the power generation by the small hydropower plants included into the project wouldn't increase and even more would be reduced, and any emission reductions would not occur.

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

In course of project execution, the following emission reductions are and will be achieved, at the stages of project implementation:

Length of the crediting period: March 2001 – December 2032 (31 years 10 months (382 months), corresponding to the 20 years lifetime of the last renovated small HPP in 2012 according to the project schedule). In the Table below only the crediting period of 2001 – 2020 (approximately 20 years (238 months), corresponding to the 20 years lifetime of the first renovated small HPP in 2001) is taken into account.

| | **Years(Month)** |
|---|---|
| **Length of the crediting period** | Appr. 20 (238) |

Period before 1 January 2008:

| **Year** | **Estimate of annual emission reduction in tonnes of $CO_2$ equivalent** |
|---|---|
| 2001 | 9714 |
| 2002 | 13915 |
| 2003 | 11356 |
| 2004 | 17155 |
| 2005 | 29339 |
| 2006 | 38689 |
| 2007 | 17349 |
| **Subtotal 2001 – 2007** | **137517** |
| Annual average of estimated emission reduction over the pre-commitment period 2001 – 2007 (tonnes of $CO_2$ equivalent) | **19645** |

*Table 5. Estimated amount of $CO_2e$ Emission Reductions before the start of the commitment period.*

Kyoto Commitment period 2008 – 2012:

| Year | Estimate of annual emission reduction in tonnes of $CO_2$ equivalent |
|---|---|
| 2008 | 23699 |
| 2009 | 41235 |
| 2010 | 47461 |
| 2011 | 47986 |
| 2012 | 49882 |
| **Subtotal 2008 – 2012** | **210 263** |
| Annual average of estimated emission reduction over the commitment period 2008 – 2012 (tonnes of $CO_2$ equivalent) | 42053 |

*Table 6. Estimated amount of $CO_2e$ Emission Reductions during the commitment period.*

Post-commitment period 2013 – 2020:

| Year | Estimate of annual emission reduction in tonnes of $CO_2$ equivalent |
|---|---|
| 2013 | 50 931 |
| 2014 | 50 931 |
| 2015 | 50 931 |
| 2016 | 50 931 |
| 2017 | 50 931 |
| 2018 | 50 931 |
| 2019 | 50 931 |
| 2020 | 50 931 |
| **Subtotal 2013 - 2020** | **407 448** |
| Annual average of estimated emission reduction over the post-commitment period 2013 – 2020 (tonnes of $CO_2$ equivalent) | 50 931 |

*Table 7. Estimated amount of $CO_2e$ Emission Reductions during the post-commitment period.*

Total amount of $CO_2e$ Emission Reductions:

| | Estimate of annual emission reduction in tonnes of $CO_2$ equivalent |
|---|---|
| **Total estimated emission reduction over the crediting period 2001 – 2020 (tonness of $CO_2$ equivalent)** | **755 228** |
| Annual average of estimated emission reduction over the crediting period (tonnes of $CO_2$ equivalent) | **37 761** |

*Table 8. Estimated total amount of $CO_2e$ Emission Reductions*

Thus the estimated amount of emission reductions over the first commitment period (2008-2012) is about 210 ths tonnes of $CO_2e$, over the minimal 20-years crediting period (2001-2020) - is about 755 ths tonnes of $CO_2e$.

Description of formulae used to estimate emission reductions is represented in paragraph D.1.4.

The term of project activity in accordance with normative equipment operation period is not less than 20 years since the moment of putting into operation after renovation / construction of the each small HPP included into the project, i.e. since 2001 till at least 2032. Generation of GHG emissions reduction units will take place at the project level during the action of international agreements on GHG emission limitation over the whole period of project activity.

More detailed information is provided in the **Appendix 1**

## A.5. Project approval by the Parties involved:

**The history of the project**

The project was initiated in 1999.

December, 1999 – Letter from EEA "Novosvit" to RSCE "Vinnytsyateplocomunenergo" on inclusion of emission reduction volumes from renovation and construction of small HPPs into the project "District Heating System Rehabilitation in Vinnytsya". Consent of RSCE "Vinnytsyateplocomunenergo" in January, 2000. Agreement between the RSCE "Vinnytsyateplocomunenergo" and the Institute of Engineering Ecology on development of the Joint Implementation Project on Green House Gas Emissions Reduction through rehabilitation of the Vinnytsya district heating system was signed in October 1999. Starting of Project planning.

March 5, 2000 – Agreement was signed between the Ukrainian Energy Consortium and the EEA "Novosvit" on cooperation in activity on rent and subsequent rehabilitation and renovation of 4 small HHPs and electricity production, in favour of GHG emissions reduction. Starting of renovation of small HPPs.

[This data of March 05, 2000 may be defined as the starting date for project as a whole, but according to the JI definition of a project starting date in JI guidelines, the later data of 1.03.2001 is defined as the project starting date (see below)].

March 1, 2001 – the first renovated small HPP (Steblivska) was launched. [This data of 1.03.2001 is defined as the project starting date, according to the JI definition of a project starting date in JI guidelines].

January 23, 2002 – Agreement was signed between EEA "Novosvit" and "Energoinvest", Ltd." on joining the efforts to achieve the goals of the JI project "Greenhouse gases emission reduction due to replacement of power, generated by the traditional fuel fired power plants, as a result of rehabilitation and construction of the small hydropower plants, operated by EEA "Novosvit" and "Energoinvest", Ltd."

During 2002 – the "Energoinvest", Ltd. rented 6 hydropower plants included into the project with the purpose of their rehabilitation and renovation.

October 2005 – Letter from EEA "Novosvit" to RSCE "Vinnytsyateplocomunenergo" on exlusion of emission reduction volumes from renovation and construction of small HPPs from the project "District Heating System Rehabilitation in Vinnytsya" for the reason of temporary holding on of this project. Consent from RSCE "Vinnytsyateplocomunenergo" in November, 2005.

November 2007 – Agreement was signed between the Group of companies “E energija” (Lithuania), potential buyer of the emission reductions to be generated from this project, and the Institute of Engineering Ecology on the development of formal JI project “Greenhouse gase emission reduction due to replacement of power, generated by the traditional fuel fired power plants, as a result of rehabilitation and construction of the small hydropower plants, operated by EEA “Novosvit” and “Energoinvest”, Ltd.”

April, 2008 - Ministry for Environmental Protection of Ukraine has issued the Letter of Endorsement (№ 4907/11/10-08 dated 15.04.2008) for this JI project “Greenhouse gases emission reduction due to replacement of power, generated by the traditional fuel fired power plants, as a result of rehabilitation and construction of the small hydropower plants, operated by EEA “Novosvit” and “Energoinvest”, Ltd.”

**Approval process for land use project including building and/or renovation of small hydroelectric power plant**

1. Order for the organisation and manufacturing of the engineering specifications containing text and graphic materials according to the specifications and technical documentation on land management in Ukraine, for contracts of rent of land for needs of power production, which are under buildings and constructions of small hydroelectric power plants.

1.1. The petitions to corresponding rural and city councils (further - local council) about permission reception on engineering specifications on land management for allocation of the ground areas for needs of power production under objects and constructions of hydroelectric power plants. The following notarially certified copies are applied to the petition:
- statutory documents of the legal person;
- contracts of purchase and sale of buildings and hydroelectric power plant constructions;
- certificate of reception-delivery of property;
- characteristics sheet of buildings and hydroelectric power plant constructions.

1.2. In a current of month from the moment of petition reception, the executive committee of local council considers possibility of granting of the ground area in rent, defines the ground area for needs of HPP.

1.3. According to the decision of executive committee session of local council at which deputies issue the decision "On the permission to working out of the project of the ground area assignment".
If the HPP is placed outside of settlement, by the corresponding petition the reference to regional state administration for permission reception on engineering specifications manufacturing on land management is made.

1.4. After reception of decision (order), it is necessary to address to land management organisation for corresponding licences for performance of such kind of works, and to sign contract on performance of land management works.

1.5. Documents for registration of the project of the ground area assignment are the following:
- local government decision (the administration order) on the permission to working out of the project of assignment;
- statement for project working out;
- contract with the design organisation;
- task for the work issued and confirmed by regional department of land resources;
- copy-out from the general plan of development of a city (architecture department);
- statutory documents on object of the real estate;
- statutory documents of the legal person.
All documents should be notarially assured.

1.6. The assignment project consists of 3 stages:
1.6.1. Preparation works (carrying out of field measurements, graphic materials).
1.6.2. Project drawing up (text materials).
1.6.3. The project coordination in the corresponding organisations and reception of the conclusion from:
- Architecture and town-planning department;
- Sanitary and epidemiological station;
- Department of land resources;
- Department of protection of monuments of history and culture.

1.7. After conclusion reception, technical documentation is stitched in 3 copies and is delivered to state expert appraisal of land management documentation to regional central administrative board of land resources.

2. An order of the statement of engineering specifications of land management concerning ground area assignment:

2.1. After reception of the positive conclusion of state expert appraisal of land management documentation, the engineering specification is delivered to the statement to local council (administration). Deputies consider it throughout a month and at session they issue the decision on the statement and authorise the conclusion of the contract of rent with a designation of term of rent and percent of normative-value estimation of the ground area.

2.2. In case if the normative-value estimation of the land of administrative borders is not made, EEA "Novosvit" orders for own means in regional research and project institutes of land management the "Engineering specifications by definition of normative-value estimation of land" which also passes State land management examination and is affirmed by the decision (order) of local council (administration).

3. The signing of the contract of rent of the ground area:

3.1. Regional departments of land resources prepare projects of Contracts on land rent in 4 copies.

3.2. After signing of Contracts on land rent the contract with SE "The Center of the state ground cadastre of the State committee of Ukraine on ground resources" about granting of services in conducting the state register of land, namely:

3.2.1. Entering of the given ground area into the automated system of the State ground cadastre;

3.2.2. Check and processing of the information on the given ground area on magnetic carriers and assignment to the ground area of cadastral number;

3.2.3. Entering of records into the Land book;

3.2.4. The state registration of Contracts on rent of the ground area;

3.3. After the state registration, the Contract on land rent is transferred to the tenant, the lessor, regional department of land resources and regional department of the Centre of the State Ground Cadastre, in 1 copy per each.

The EEA “Novosvit” and “Energoinvest», Ltd. have the necessary licenses for supply of the electric power at the unregulated tariff, according to the Law of Ukraine “On the electrical power industry”.[4]

[4] N 575/97-VR, The last edition dated 25.04.2009.

**The project has been already approved by the local authorities.**

In particular, the appropriate local authorities approved the renovation and construction works at the objects included in project, and adopted the corresponding acts for executed activities, for example:

Act of state technical board on the launch of Lysyanska HPP, approved by the Lysyanka local state administration, Cherkasy region, 29 January 2004;

Act of state technical board on the launch of Korzhivska HPP, approved by the Starokostyantyniv local state administration, Khmelnytsk region, 28 October 2004;

Act of state technical board on the launch of Halzhbiyivska HPP, approved by the head of Yampil local state administration, Vinnytsya region, 24 March 2005;

Act of state technical board on the launch of Petrashivska HPP, approved by the head of Yampil local state administration, Vinnytsya region, 10 June 2005;

Act of state technical board on the launch of Zvenigorodska HPP, approved by the Zvenigorod local state administration, Cherkasy region, 07 January 2007;

Dunaevets local state administration, Khmelnytsk region, act #635/2007-r on 21 June 2007 “On the approval of state expert board act concerning the reconstructed Velykokuzhelevetska HPP launch, which is situated on Uzhytsa river”;

Act of state technical board on the launch of Korsun-Shevchenkivska HPP, approved by the Korsun-Shevchenkivsky local state administration, Cherkasy region, 06 September 2007.

## SECTION B. Baseline

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

According to the "*Guidelines for users of the JI PDD form" ver. 04* [5], baseline shall be established on a project-specific basis, or where applicable, project participants may opt to apply approved clean development mechanism (CDM) baseline and monitoring methodologies.

Thus, the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 09, valid from 13 February, 2009)[6] may be used for the baseline scenario construction, where the project foresees the emission reduction due to rehabilitation and construction of new hydro power plants and reduction of power production by fossil fuel power plants.

This methodology ACM0002 is applicable to grid-connected renewable power generation project activities that involve electricity capacity addition.

The proposed project deals with the grid-connected renewable power generation, and activities in frames of it involve electricity capacity addition through rehabilitation and renovation of existing small hydropower plants and construction of new mini hydropower plants; thus it meets the area of applicability of methodology ACM0002.

The methodology ACM0002 is applicable, in particular, under the following conditions:

- The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.
- In case of hydro power plants:
  - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir;
  - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$;
  - The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$.
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and
- 5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant.

In the proposed project:

- The project activity is the installation or modification/retrofit of hydro power plants with run-of-river reservoirs.

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

[6] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_71ZC14NVE4V5DHA3TUT3896PFLPVGG

- The project activity is implemented in existing reservoirs, with no change in the volume of a reservoir. Only one new mini-HPP is constructed and one is planned to be constructed, both at escapage of existing HPP without a new reservoir.
- The geographic and system boundaries for the relevant electricity grid are clearly identified since this is the joined state grid, and information on the characteristics of the grid is available; and
- 5 years of historical data are available for those project activities where modification/retrofit measures are implemented in an existing power plant. Moreover, prior to the project activity the most of the small HPP included in the project were out of operation for a long period of time (for decades).

Thus the proposed project complies with all criteria of the methodology ACM0002; also this methodology does not include any limits concerning the minimum of capacity which is installed/retrofitted in the project.

The small-scale methodology AMS-I.D is not applicable to the project, because the project was previously the part of the larger project "District Heating System Rehabilitation in Vinnytsya" (see section **A.5**, the History of the project), and the total scheduled power capacity of all included small HPP is over the eligibility limit of 15 MW for a small-scale project activity.

In course of development of this JI project, the baseline development, project additionality background and the assessment of green-house gases emissions reduction were hold by the project specific approach based mainly on the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 09)[7].

**Identification of the baseline scenario**

For the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected thermal power plants.

For modification/retrofit of an existing grid-connected renewable power plant/unit, the baseline scenario is the following:
In the absence of the JI project activity, the existing facility would continue to supply electricity to the grid at historical average levels, until the time at which the generation facility would likely be replaced or retrofitted. According to the previous practice in Ukraine, this time is over 30 years.

**Calculation of Baseline Carbon Emissions**

The only one type of greenhouse gases emissions is included into baseline scenario:
GHG emissions from power generation by the traditional thermal power generating units, which consume the fossil fuel, supplied to the grid in amount that will be replaced by power generation by small hydropower plants. Ukraine has united state power grid, therefore the averaged values for Carbon Emission factors (CEF) for electricity production should be used.

[7] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_71ZC14NVE4V5DHA3TUT3896PFLPVGG

For calculations in this PDD we used values of the carbon emission factors according to the adopted sourses as following (see details in Annex 2 "Baseline information"):

| Year | 2002 | 2003 | 2004 | 2005 | 2006-2012 | 2013-2020 |
|---|---|---|---|---|---|---|
| CEFgrid, t $CO_2$/MWh | 0,785 | 0,770 | 0,755 | 0,74 | 0,807 | 0,807 |

*Table 9. The baseline Carbon Emission factors (CEF) used for calculations in PDD*

The calculation of total annual baseline carbon emissions, which would have happened in case of absence of the corresponding power generation by small hydropower plants, is presented in **Appendix 1.** They consist of the amount of general CO2 emissions which would have happened due to generation of power by traditional power generating units which consume the fossil fuel to the grid in amount which would be replaced by the power generation by small hydropower plants, additionally to hystoric levels.

In course of development of the Monitoring reports for this project, if available, the valid at that time CEF values for corresponding period will be used.

For visualization, the baseline GHG emissions corresponding to the effective power output of the hydropower plants included into the project (actual in 2001 – 2008 and expected for 2009 – 2013) are represented at **Fig. 6**.

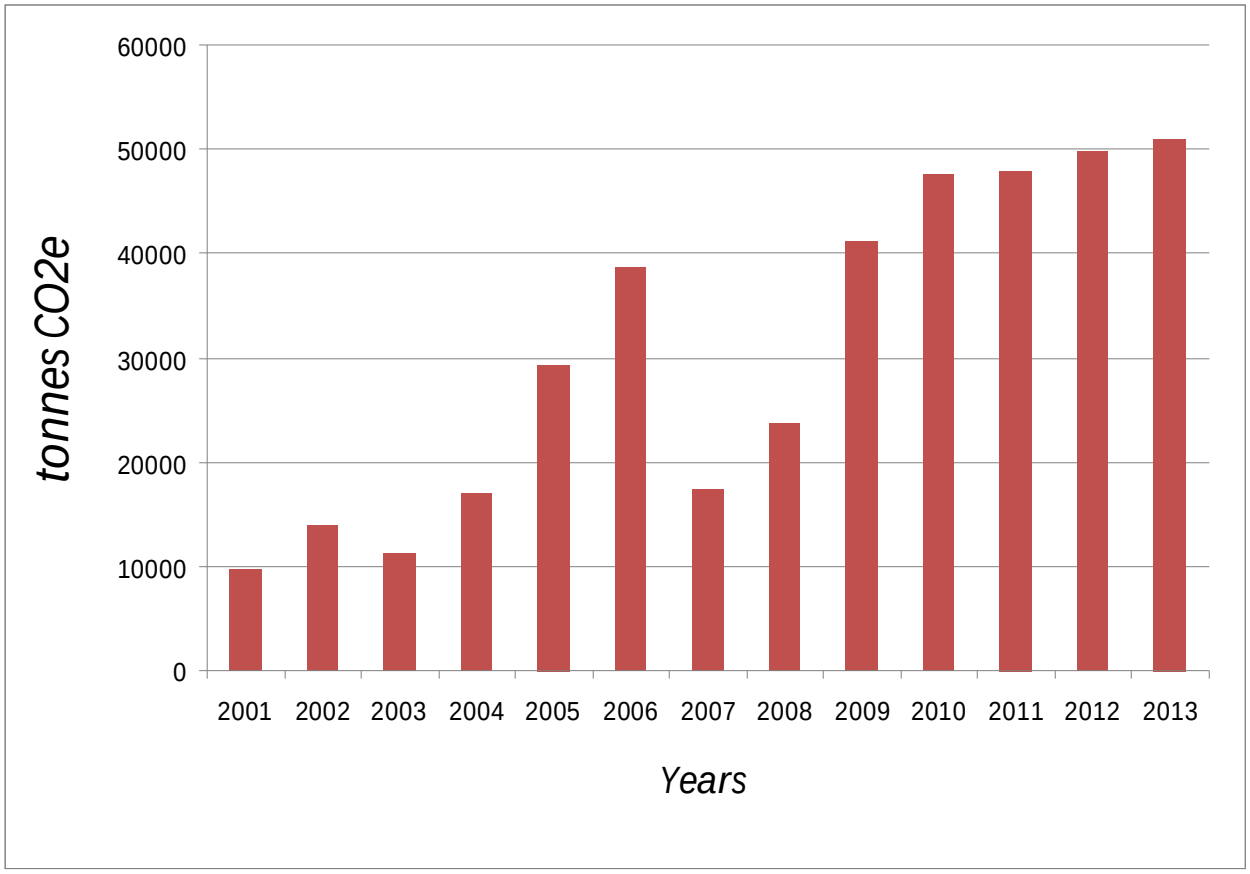


*Fig. 6. Baseline emissions of GHG*

The key information and data used to establish the baseline are provided in tabular form below:

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied by the project activity to the grid in year *y* |
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Electricity supplied by the project activity to the grid. Double check by receipt of sales |
| Any comment: | - |

| **Data / Parameter:** | $TEG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Total electricity produced by the project activity, including the electricity supplied |
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Measuring instruments (Electric power meters) must be calibrated according to national regulations |
| Any comment: | - |

| **Data / Parameter:** | $EG_{historical}$ |
|---|---|
| Data unit: | MWh |
| Description: | Average of historical electricity delivered by the existing facility to the grid |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Oblenergo, RES (region of power network), Hydropower plant |
| Value of data applied (for ex ante calculations/determinations) | See Appendix 1_1. |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calculated as the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available years to the time at which the facility was constructed, retrofit, or modified.A minimum of (excluding abnormal years) of historical generation data is required in the case of hydro facilities. Data for periods affected by unusual circumstances such as natural disasters, conflict constraints shall be excluded. |
| QA/QC procedures: | - |
| Any comment: | - |

| **Data / Parameter:** | $Cap_{BL}$ |
|---|---|
| Data unit: | MW |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity. |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Hydropower plant, unit specification |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Determine the installed capacity based on recognized standards. For new hydro power plants, this value is zero. |
| QA/QC procedures: | The data is obtained from technical documentation of the equipment of a small hydropower plant. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | $tCO_2$/MWh |

| | |
|---|---|
| Description: | Operating margin $CO_2$ emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Time of determination/ monitoring | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Source of data (to be) used : | Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Value of data applied (for ex ante calculations/determinations) | See Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| QA/QC procedures: | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Any comment: | - |

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

The anthropogenic emissions of GHGs will be reduced due to renovation and rehabilitation of existing old small hydropower plants, increasing of their installed and operating capacity by means of their rehabilitation and construction of the new hydro units and mini-HPPs, that will result in step-by-step increasing of the annual power generation by them up to 112 429 MWh (see Appendix 1.3), with corresponding replacement and decreasing of power generation at fossil fuel burning power plants.

Project implementation will provide obtaining of the same amount of power by the consumers but without using of carbon-intensive fossil fuel.

The baseline emissions, which are the function of the stage of project implementation and operating conditions, are represented at the **Figure 7** along with the project emissions assumed to be zero.

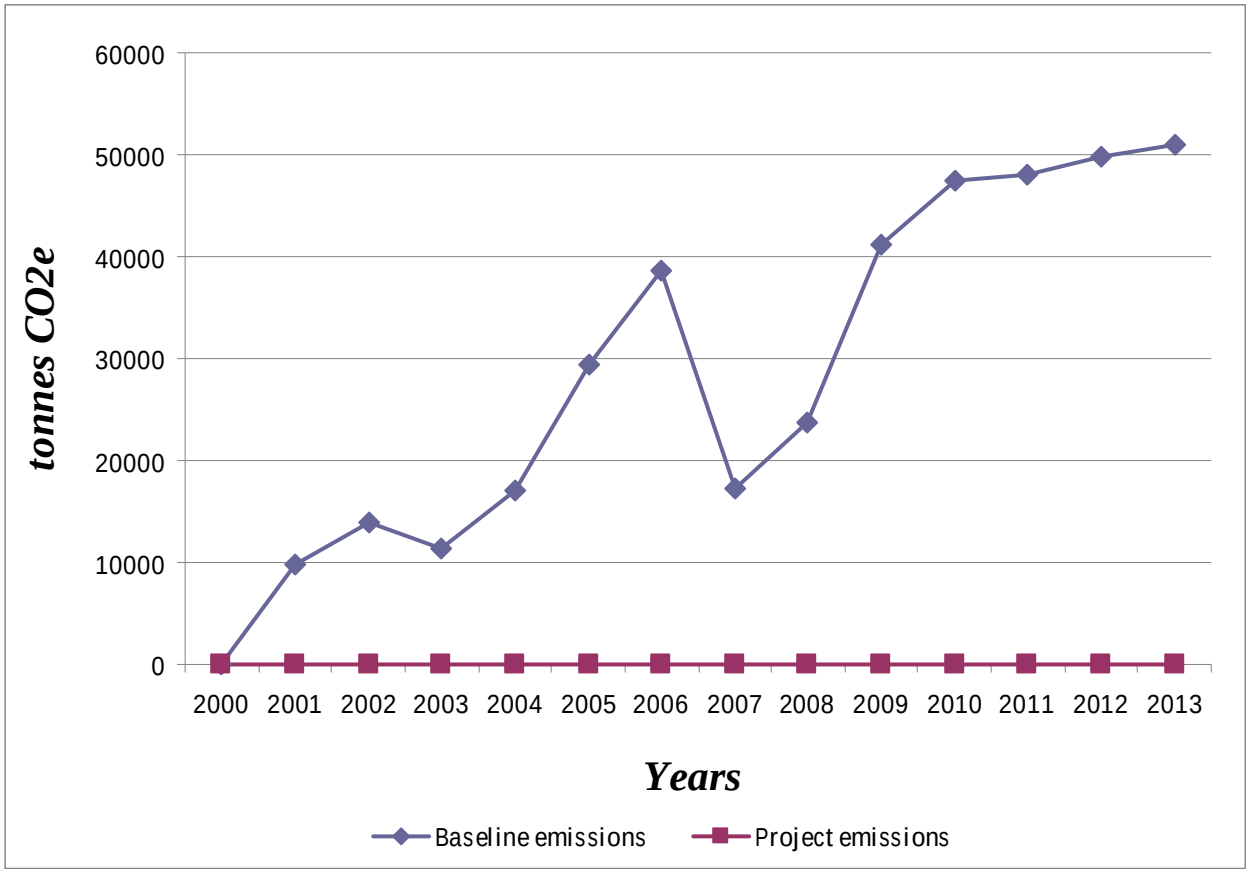


*Fig. 7. Baseline and project GHG emissions*

**Additionality of the project**

The additionality of the project activity is demonstrated and assessed below in accordance with the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 09), with using the "Tool for the demonstration and assessment of additionality" (version 05.2)[8] (see **Fig. 8**).

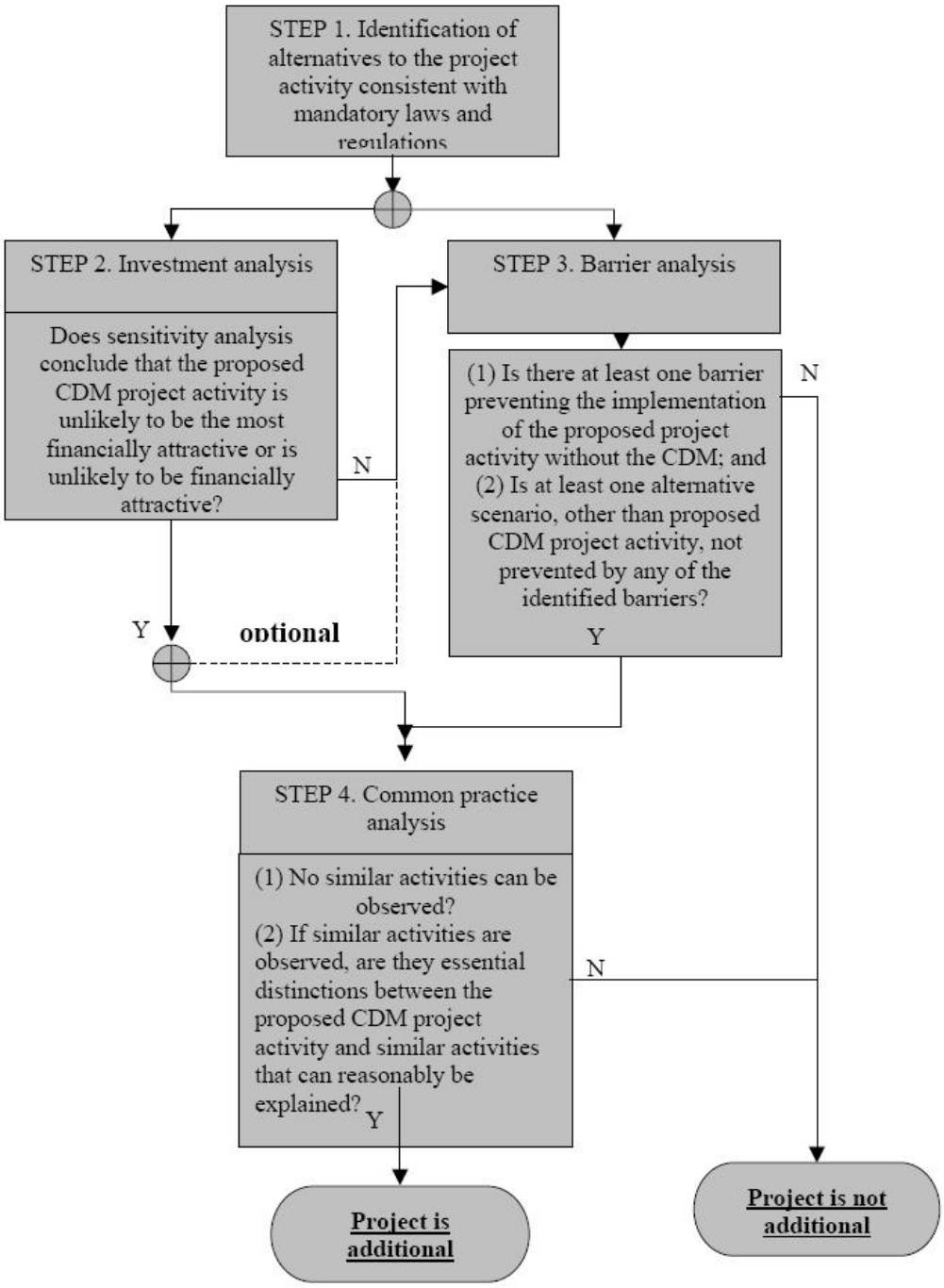


*Fig. 8. Steps for demonstration of additionality*

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

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

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

There are three realistic and credible options for baseline scenario for power generation – the proposed project activity with registration as a JI project activity, and two alternatives to this project.

Option 1: The proposed project activity, undertaken without being registered as a JI project activity;

Option 2: The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance, without rehabilitation of existing HPP or construction of new HPP;

In the absence of the project activity, the existing facilities would continue to supply electricity to the grid at historical levels.

The first alternative is to make reconstruction works (the proposed project activity) without JI mechanism.

This project activity requires substantial investments – about 16 million EUR. Without carbon credits sales the project is not economically favorable for a Supplier, which is financially unattractive due to the high capital costs comparably to the operational costs of the company and long pay back period for investments, and makes implementation of most activities impossible.

The second alternative is continuation of the current situation (no project activity or other alternatives undertaken), i.e. business-as-usual scenario without or with minimum maintenance works at operating small HPP and without any rehabilitation works at non-operating small HPP, in this case no replacement of power generated at the power plants in the power systems consuming the fossil fuel would take place.

This scenario is less environmentally favorable for the near future (including first commitment period 2008-2012), since GHGs emissions from power generation to grid will continue to be kept at the same level or even higher (due to degradation of the equipment), but economically such scenario is more attractive.

**Outcome of Step 1a:** Two realistic and credible alternative scenarios to the project activity are identified.

**Sub-step 1b. Consistency with mandatory laws and regulations:**

According to The Law of Ukraine "On Power Energy" № 575/97VR dated October 16, 1997 (in reduction from April 25, 2009)[9], execution of business activity in fields of electricity production, distribution and supply require a license that is to be issued by the National Power Energy Regulation Committee of Ukraine.

The EEA "Novosvit" and "Energoinvest», Ltd. have the necessary licenses for supply of the electric power by the unregulated tariff, according to the Law of Ukraine "On Power Energy", as well as other licenses and permissions necessary for the project implementation.

[9] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=575%2F97-%E2%F0&c=1

There are no legal or regulatory requirements in Ukraine which oblige to rehabilitate or renovate the obsolete small HPPs at small rivers in country regions; in any case the local administrations that usually are the owners of small HPPs have not enough funds for such activity.

**Outcome of Step 1b:** The alternatives, which are: to continue business-as-usual scenario and to make reconstruction works (the proposed project activity) with or without JI mechanism, are in compliance with the mandatory laws and regulations.

Hence, the Step 1 is satisfied.

According to the "Tool for the demonstration and assessment of additionality" (version 05.2), for further additionality analysis it is possible to follow the Step 2 or Step 3 (or to complete both of them).

**Step 2. Investments analysis**

**Sub-step 2a: Determine appropriate analysis method**

Since the JI project activity and the alternatives identified in Step 1 besides the JI related income generate also the economic benefits from electricity sale, the benchmark analysis (Option III) is used.

**Sub-step 2b: Option III. Apply benchmark analysis**

The discount rate of the National Bank of Ukraine as of November 2009[10] of 10.25 % was used for estimation, which is the conservative value comparing to the average in Ukrainian commercial banks for this period (15.5 % – 16.3 %)[11].

**Sub-step 2c: Calculation and comparison of financial indicators**

The financial indicators Net Present Value (NPV) and Internal Rate of Return (IRR) were calculated for two cases of project implementation – with and without the JI mechanism (see **Appendix 5**). The simple pay back period without JI mechanism is 25.7 years, with JI mechanism it is 18.1 years.

NPV and IRR of the project without using of JI mechanism will be:

NPV: – 2,0mln EUR,
IRR: 1,0 %

NPV and IRR of the project with using of JI mechanism will be:

NPV: – 0,4 mln EUR,
IRR: 9,1 %.

Using of JI mechanism enables to improve the attractiveness of the project activity for investments, but in both cases this activity is not attractive comparing to the discount rate even of the National Bank of Ukraine.
Thus, the project activity has a less favourable indicator (lower IRR) than the benchmark, then the project activity cannot be considered as financially attractive.

**Sub-step 2d: Sensitivity analysis**

The sensitivity analysis shows that the reasonable changes of input data for calculations (max +– 10 %), namely +10 % tariff and -10% investments, will not change the interrelationship between the calculated

[10] http://bank.gov.ua/Engl/Statist/Stat_data/discount_rate_e.htm

[11] http://bank.gov.ua/Fin_ryn/Pot_tend/2009.zip

IRR values (8.9% and 3.5%, respectively) and even the most conservative estimation of the discount rate (10.25 %), that is these calculated IRR values will be still below the discount rate.

**Outcome of Step 2:** It is concluded that the proposed project activity is unlikely to be financially/economically attractive.

**Step 3. Barriers analysis**

**Sub-step 3a: Identify barriers that would prevent the implementation of the proposed project activity:**

Actually the project should not be implemented without carbon credits because of some barriers such as:

***Investment barrier:***

The majority of small HPPs in Ukraine were built during the former Soviet Union times, and amounted almost thousand plants. During the transitional economy period the majority of small HPPs due to the lack of financing, default electric energy payment crisis, the low level of regulated electric energy tariffs and the general tendency to centralization were abandoned.

Now small HPPs as renewable energy sources are proclaimed to be developed and their operation is appreciated by the state. But the renovation process of small HPPs is still economically not favourable due to the low level of regulated electric energy tariffs and especially because of high investment barriers.

For the investor, the project of such kind is not enough attractive for making investments. The discount rate in Ukrainian banks is very high (typical is over 10,25 %), and placing money in bank is more attractive and less risky than investing into this project.

***Technological barrier:***

There are difficulties caused by the need of individual approach in designing, purchasing and installing of hydro power equipment for each power plant or unit.
Skilled and/or properly trained personnel necessary to operate and maintain the small HPP is practically not available in some villages neighbouring to the HPPs, which leads to an unacceptably high risk of equipment disrepair, malfunctioning or other underperformance;

***Organizational barrier****:*

The difficulties concerning the relations with electric energy pricing regulative body could occur.

***Barrier due to prevailing practice:***

The project activity on rehabilitation of the obsolete small HPPs by private company is the “first of its kind” in Ukraine.

**Outcome of Step 3a:** Identified barriers that may prevent one or more alternative scenarios to occur.

**Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):**

The identified barriers are absent and obviously would not prevent the implementation of at least one of the alternatives – continuation of the current situation, i.e. business-as-usual scenario.

Both Sub-steps 3a – 3b are satisfied.

**Outcome of Step 3:** The proposed project activity faces various serious barriers that prevent the implementation of the proposed project activity; and do not prevent at least one of the alternatives – continuation of the current situation, i.e. business-as-usual scenario.

***Step 4: Common practice analysis***

**Sub-step 4a: Analyze other activities similar to the proposed project activity:**

There are no observed similar activities on rehabilitation of the obsolete small HPPs by private company that have been implemented previously or are currently underway in Ukraine.

**Outcome of Step Similar activities cannot be observed, Sub-step 4a is satisfied; thus the proposed project activity is additional.**

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

The spatial extent of the project boundary includes the project hydro power plants and all thermal power plants connected physically to the state electricity grid.

The project boundaries for the project scenario are presented at the graph (**Figure 9**):

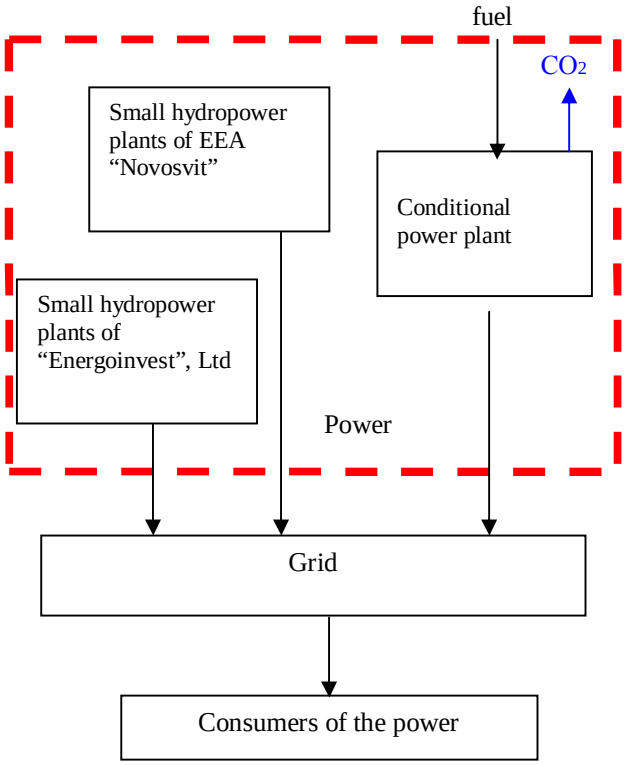


*Figure 9. Project boundaries*

The project boundaries are outlined by the red dashed line. The emission of conditional power unit X, which consumes the fossil fuel, by the project scenario is 0.
The balance of the generated power by the baseline scenario (BS) and the project scenario (PS) looks as follows:

BS (small hydropower plants) + x (power generating unit X) = PS (small hydropower plants)

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 10.

| | Source | Gas | Included | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| | Emissions of $CH_4$ from the reservoir | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| **Project activity** | Emissions of $CH_4$ from the reservoir | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |

*Table 10: Emissions sources included in or excluded from the project boundary*

Since the project activity is in frames of existing reservoirs and no new reservoirs or increase of existing reservoirs is planned, emissions of $CH_4$ from the reservoirs will be equal both in baseline and project scenarios, thus these emissions from the reservoirs should not be taken into account.

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

The baseline is determined by the Institute of Engineering Ecology, project developer and consultant, in collaboration with EEA "Novosvit" and "Energoinvest", Ltd., during 2007 – 2009, and finally set on April 10, 2009 (10/04/2009).
EEA "Novosvit" is also a project participant.

IEE:
Institute of Engineering Ecology
Kiev, Ukraine.
Dmitri Paderno,
Vice director, PhD.
Phone: +38 044 453 28 62
Fax: +38 044 456 92 62
e-mail: engeco@kw.ua

EEA "Novosvit"
Joined dispatcher center of EEA "Novosvit" and "Energoinvest", Ltd.
Vinnytsa, Ukraine
Konstantyn Mandybura
Phone: +38 0432 52 46 88
Fax: +38 0432 55 42 85
e-mail: nsvitbox@svitonline.com

The detailed information is given in **section D. 1.**

## SECTION C. Duration of the project / crediting period

### C.1. Starting date of the project:

March 01, 2001 – the first renovated small HPP (Steblivska) was launched by EEA "Novosvit".

### C.2. Expected operational lifetime of the project:

Expected operational lifetime of the project is at least 20 years (240 months) after renovation of the small HPPs included in the project (the nominal minimum lifetime of energy equipment).

### C.3. Length of the crediting period:

Earning of the ERUs corresponds to the first commitment period of 5 years (January, 1, 2008 – December, 31, 2012).

The starting date of the crediting period is set to the date where the first emission reduction units are expected to be generated from the project that is March, 2001. The end of the crediting period is the end of the lifetime of the main equipment installed during project implementation (from March, 2001 till December, 2012).

If the post first commitment period under the Kyoto Protocol will be applicable, the crediting period may be expanded up to the end of the expected operational lifetime of the project.

Thus the length of the crediting period is from March 2001 till December 2032 (31 years 10 months (or 382 months), corresponding to the 20 years lifetime of the last renovated small HPP in 2012 according to the project schedule). In this PDD only the crediting period of March, 2001 – February, 2021 (20 years (240 months), corresponding to the 20 years lifetime of the first renovated small HPP in 2001) is taken into account.

## SECTION D. Monitoring plan

### D.1. Description of monitoring plan chosen:

Monitoring plan is choosen according to the approved consolidated baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (version 09).

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

**Indicator of project performance**
The most objective and cumulative factor that will give a clear picture of whether emission reductions really took place – is the *increasing of effective output of power by a small HPP*. It can be identified as a difference between baseline effective output and effective output of power after project implementation.

**Verification of project performance indicators**
EEA “Novosvit” and “Energoinvest”, Ltd. collect and keep the data on generation of power in form of electronic files and acts and on effective output of power to the grid in form of acts, bills and reports.

**Verification of Emission Reduction Units and Baseline Scenario**

The table of parameters, which will be included into the monitoring process and control for the calculation of ERUs, is presented in the Section **D.1.1.1** and **D.1.1.3.**

| D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

Emissions reduction will be achieved due to creation and increasing of installed and operational capacity of small hydropower plants by means of their rehabilitation and construction of new hydropower units. Implementation of this activity will provide the substituting amount of power to the consumers without consumption of carbon-intensive fossil fuel.

Therefore, due to project implementation the fuel consumption at the conditional traditional power plant connected to the grid for generation of this substituting amount of power will be zero relatively to the baseline fuel consumption, and correspobding emissions will be zero.

In accordance with ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, the project emissions from water reservoirs of hydro power plants in year *y* ($PE_{HP,y}$) should be taken into account only if hydro power project activities result in new reservoirs or in the increase of existing reservoirs.

*PEy* = Project emissions in year *y* (tCO2e/yr);

In case of this project no new reservoirs are to be created and no increase of existing reservoirs is planned, thus Project emissions in year *y*

$PE_y = 0$.

Thereafter, the project emissions will be zero.

| **D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
| **1** | $TEG_y$, Total electricity produced by the project activity | Hydropower plant, power output meter | MWh | M | Hourly measurement and monthly recording | 100% | Data journal, (paper and electronic file) | |
| **2** | $EG_y$ , Electricity supplied by the project activity to the grid in year *y* | Hydropower plant, generated power meter | MWh | M,C | Continuous measurement and monthly recording | 100% | Data journal, (paper and electronic file) | |
| **3** | $EG_{historical}$ , Average of historical electricity delivered by the existing facility to the grid | Oblenergo, RES (region of power network), Hydropower plant | MWh | C | Once per a small HPP | 100% | Data journal, (paper and electronic file) | |
| **4** | $Cap_{BL}$, Installed capacity of the hydro power plant | Hydropower plant, unit specification | MW | E | Once per a small HPP | 100% | Technical documentation | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **5** | $EF_{grid,OM,y}$ Operating margin $CO_2$ emission factor for grid connected power generation in year *y* | Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 | $tCO_2/MWh$ | C | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 | 100% | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 | |

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

According to JI project specific approach which based on the CDM methodology ACM0002 (version 9)"Consolidated baseline methodology for grid-connected electricity generation from renewable sources", the baseline emissions, which include only the $CO_2$ emissions from electricity generation by the traditional fossil fuel power plants that are displaced due to the project activity, are calculated as follows:

$$BE_y=(EG_y-EG_{baseline})*EF_{grid,OM,y} \quad (1)$$

Where:
*BEy* = Baseline emissions in year *y* ($tCO_2/yr$)
*EGy* = Electricity supplied by the project activity to the grid (MWh)
*EGbaseline* = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero
*EFgrid,OM,y* = Operating margin $CO_2$ emission factor for grid connected power generation in year *y*

The methodology assumes that all project electricity generation above baseline levels (*EGbaseline*) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in *EFy*.

***Calculation of $EG_{baseline}$***

If the project activity is the installation of a new grid-connected renewable power plant/unit:

$$EGbaseline = 0 \quad (2)$$

If the project activity is the installation of additional power units at an existing grid-connected renewable power plant:

$$EG_{baseline} = \mathrm{MAX}(EG_{historical}, EG_{existing,y}), \text{ until } DATE_{BaselineRetrofit} \quad (3)$$

$$EG_{baseline} = EG_y, \text{ on/after } DATE_{BaselineRetrofit} \quad (4)$$

Where:

*EGbaseline* = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh)
*EGexisting,y* = The actual, measured electricity production of the existing units in year y (MWh)
*EGhistorical* = Average of historical electricity delivered by the existing facility to the grid (MWh)
*EGy* = Electricity supplied by the project activity to the grid (MWh).
*DATEBaselineRetrofit* = Point in time when the existing equipment would need to be replaced in the absence of the project activity (date)

***Calculation of $EG_{historical}$***

*EGhistorical* is the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available year (or month or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e., by 5% or more), expressed in MWh per year. A minimum of 5 years (120 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities. Data for periods affected by unusual circumstances such as natural disasters, conflicts, transmission constraints shall be excluded.
For calculation CO2 emmission reduction in the 1-st year of operation after reconstruction, when the HPP was launched after the reconstruction, is used coefficient n/12. These coefficients (n/12, n÷1-11) show a part of the year (rounded to months) when a HPP was in operation.

***Calculation of $DATE_{BaselineRetrofit}$***

In order to estimate the point in time when the existing equipment would need to be replaced in the absence of the project activity (*DATEBaselineRetrofit*), project participants may take the following approaches into account:

(a) The typical average technical lifetime of the type equipment may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.

(b) The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment.

In Ukraine previously all small HPPs were state owned. The advantages of the centralized production of electric power and high-voltage transmission in the recent half-century have led to that a lot of small hydro-electric power plants became neglected and fall into decay. No funds were provided for their maintenance. The common practices in Ukraine was operating of the small HPP's main equipment untill breakdown or till the regulatory decision to stop its operation, without any scheduled replacement of the equipment, so this country specific approach to this parameter should be used.
In case of this project all included small HPPs are very old (see Tables 1, 3) and the majority of them were out of operation for many years prior to the project activity. Thus, renovation of the last small HPPs may be treated from this point of view as having status of construction of the new ones, and for rehabilitation of the operating small HPPs this parameter should not be applicable.

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

The option 1 – Monitoring of the emissions in the project scenario and the baseline scenario is applicable for this project.

| **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 |
| | | | | | | | | |
| | | | | | | | | |

There are no data to be collected in order to monitor emission reductions from the project, because emission reductions will be calculate by means of formulae presented in paragraph **D.1.2.2.**

**D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of $CO_2$ equivalent):**

N/A.
The option 1 – Monitoring of the emissions in the project scenario and the baseline scenario is applicable for this project.

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

According to JI project specific approach which based on the CDM methodology ACM0002 (version 9) "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", the main emissions potentially giving rise to leakage in the context of hydroelectric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation. Project participants do not need to consider these emission sources as leakage in applying this methodology.

Thus, No leakage 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 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

No leakage is expected.

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

No leakage is expected.

**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):**

GHG emission reductions from the project are estimated by means of the following formulae:

$$ER_y = BE_y - PE_y - LE_y \quad (5)$$

Where:
$ER_y$ = emission reductions in year y (tCO2/yr)
$BE_y$ = baseline emissions in year y (tCO2/yr)
$PE_y$ = project emissions in year y (tCO2/yr)
$LE_y$ = leakage emissions in year y (tCO2/yr)

$LE_y = 0$;

Thus,

$$ER_y = BE_y - PE_y$$

For more detailed information see **Appendix 1.**

**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:**

Not applicable for this 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. |
| 1. $TEG_y$, Total electricity produced by the project activity | Low | Measuring instruments (Electric power meters) must be calibrated according to national regulations |
| 2. $EG_y$, Electricity supplied by the project activity to the grid in year *y* | Low | Measuring instruments (Electric power meters) must be calibrated according to national regulations |
| 3. $Cap_{PJ}$, Installed capacity of the hydro power plant after the implementation of the project activity | Low | The data is obtained from technical documentation of the equipment of a small hydropower plant |

| | | |
|---|---|---|
| 4. $EF_{grid,OM,y,}$<br>Operating margin $CO_2$ emission factor for grid connected power generation in year *y* | Low | for 2001-2005– according to the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands)<br>for 2006-2012 (and for the later period in the forecasting calculations in PDD as well) – according to the Table 8 "Emission Factors for the Ukrainian grid 2006-2012" of Annex 2 "Standardized Emission Factors for the Ukrainian Electricity Grid" to "Ukraine - Assessment of new calculation of CEF", verified by TUV SUD Industrie Service GmbH 17.08.2007 |

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

The operational structure will include operation departments of EEA "Novosvit" and "Energoinvest", Ltd., operation departments (repair-operation works and so on) and operational personnel of small hydropower plants.
The management structure (see *Fig.10)* will include management departments of Supplier and specialists of the project developer (Institute of Engineering Ecology).

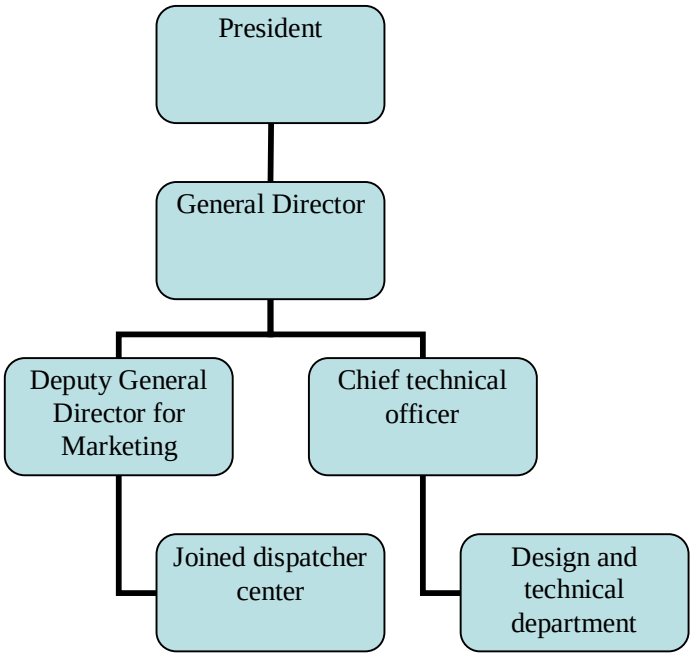


*Fig.10.* The simplified scheme of the management structure of EEA «Novosvit»

The overall responsibility for the project management and implementation is carried out by the president of EEA «Novosvit», Mr. Oleksandr Nikitorovych,

The project activity is managed by stuff of Design and technical department (PTD). Compliance of the project activity with the operational requirements is constantly controlled by responsible stuff of a HPP, and according to their reports – by PTD. Possible bottlenecks in project implementation should be identified and solved by responsible stuff of PTD.

The president of EEA "Novosvit", Mr. Oleksandr Nikitorovych, appointed a responsible person, Mr. Konstantyn Mandybura, deputy chief of the Joined dispatcher center of EEA «Novosvit» and «Energoinvest», Ltd., for the implementation and management of the monitoring process at the EEA «Novosvit» and «Energoinvest», Ltd. Mr. Konstantyn Mandybura is responsible for supervising data collection, measurements, calibration, data recording and storage.

Mr. Dmitri Paderno, vice director of the Institute of Engineering Ecology, is responsible for baseline and monitoring methodology development.
Ms. Marina Denisyuk, engineer of the Institute of Engineering Ecology, is responsible for baseline and monitoring methodology development and data processing.

All collected data will be transferred to Mr.Konstantyn Mandybura, who will be responsible for data storage and archiving, entry of the data into the monitoring spreadsheets. Ms. Marina Denisyuk will be responsible for the data processing according to methodology and for preparation of Monitoring Reports. Support in coordination of verification process will be undertaken by Dmitri Paderno.

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

The monitoring plan is determined by the Institute of Engineering Ecology, project developer, in collaboration with the joined dispatcher center of EEA "Novosvit" and "Energoinvest", Ltd.
EEA "Novosvit" is also a project participant.

IEE:
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## SECTION E. Estimation of greenhouse gas emission reductions

### E.1. Estimated project emissions:

Project Carbon Emission Factors are assumed equal to the Baseline Carbon Emission Factors.

**Calculation of Direct Project Emissions**

Project emissions – 0 t $CO_2$e.

### E.2. Estimated leakage:

We assume that possible leakage is absent. These indirect emissions are not under control of project developer so we do not include them in calculations**.**

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

Project Emissions + Leakages = 0 t $CO_2$e + 0 = 0 t $CO_2$e.

### E.4. Estimated baseline emissions:

**Estimation of baseline emissions**

Baseline emissions consist of one type of GHG emissions: $CO_2$e emissions from electricity generation to the grid by the traditional thermal power generating units which consume the fossil fuel, in amount that will be replaced after project implementation and increasing of power generation by the small hydropower plants.

| | Annual Baseline emissions, t $CO_2$e |
|---|---|
| $CO_2$ emissions from power generation to the grid by the traditional thermal power generating units, in amount which will be replaced after project implementation and increasing of power generation by the small hydropower plants | 50 931 |

*Table 11. Baseline emissions of $CO_2$e*

Annual Baseline emissions after project implementation are 50 931 t $CO_2$e

More detailed calculation of resulting annual Baseline Carbon Emissions, see in the **section B** and **Appendix 1.**

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

Annual Project Emission Reduction = Baseline emission – (Project emission +Estimated leakage) = **50 931 - 0 = 50 931 t $CO_2e$** .

In course of the project implementation, the different emission reduction will be achieved at the different stages of project implementation. The amounts of emission reductions are represented in the Tables 5 - 8 in the Subsection **A.4.3.1.**

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

See **Appendix 1.**

| Year | Estimated project emissions (tonnes of $CO_2$ equivalent) | Estimated leakage (tonnes of $CO_2$ equivalent) | Estimated baseline emissions (tonnes of $CO_2$ equivalent) | Estimated emission reduction (tonnes of $CO_2$ equivalent) |
|---|---|---|---|---|
| 2001 | 0 | 0 | 9714 | 9714 |
| 2002 | 0 | 0 | 13915 | 13915 |
| 2003 | 0 | 0 | 11356 | 11356 |
| 2004 | 0 | 0 | 17155 | 17155 |
| 2005 | 0 | 0 | 29339 | 29339 |
| 2006 | 0 | 0 | 38689 | 38689 |
| 2007 | 0 | 0 | 17349 | 17349 |
| **Subtotal** | **0** | **0** | **137517** | **137517** |
| 2008 | 0 | 0 | 23699 | 23699 |
| 2009 | 0 | 0 | 41235 | 41235 |
| 2010 | 0 | 0 | 47461 | 47461 |
| 2011 | 0 | 0 | 47986 | 47986 |
| 2012 | 0 | 0 | 49882 | 49882 |
| **Subtotal** | **0** | **0** | **210 263** | **210 263** |
| 2013 | 0 | 0 | 50 931 | 50 931 |
| 2014 | 0 | 0 | 50 931 | 50 931 |
| 2015 | 0 | 0 | 50 931 | 50 931 |
| 2016 | 0 | 0 | 50 931 | 50 931 |
| 2017 | 0 | 0 | 50 931 | 50 931 |
| 2018 | 0 | 0 | 50 931 | 50 931 |
| 2019 | 0 | 0 | 50 931 | 50 931 |
| 2020 | 0 | 0 | 50 931 | 50 931 |
| **Subtotal** | **0** | **0** | **407 448** | **407 448** |
| **Total (tonnes of $CO_2$ equivalent)** | **0** | **0** | 50 931 | 50 931 |

*Table 12. Table providing values obtained when applying formulae above*

## 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:**

According to the Ukrainian legislation (Laws of Ukraine "On the Environment Protection" (1991), "On the Ecological Expertise" (1995), "On Wastes" (1998), Water Code of Ukraine (1995), Soil Code of Ukraine (2001) etc. [www.rada.gov.ua]), the design documentation for the new building, reconstruction and technical re-equipment of industrial and civil objects must include the environmental impact assessment, the main requirements for which are listed in the State Building Norms of Ukraine A.2.2-1-2003 "Structure and content of documents on environmental impact assessment when designing and constructing of enterprises, buildings and structures"[12].

EEA „Novosvit" and "Enenrgoinvest", Ltd. have the necessary Environmental Impact Assessments for their activity according to Ukrainian legislation.

In general, the project will have positive effect on the environment. At the rehabilitation of the neglected small hydropower plants the renovation and purification of the specific conservation reservoirs and parts of the river from the silt and wastes is carried out. Fuel consumption reduction by the traditional power plant at the power generation plants using the fossil fuel will reduce emissions of $SO_x$, $NO_x$, CO and particulate matter.

The transboundary environmental impacts are not considered in the analysis.

**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:**

**Impact on the water medium**

Impact on the water medium is positive. At the rehabilitation of neglected small hydropower plants the renovation and purification of specific conservation reservoirs and parts of the river from the silt and wastes is carried out. Operation of small HPPs makes possible to regulate a daily water flow, floods and ice drifting, prevent underflooding of soil and buildings, to carry out bank stabilization, purification of rivers and derivation channels, to provide sanitary dumping of water from reservoirs.

Project implementation will provide improvement of the basic channel of the rivers, including the zones of recreation. by regular washing of a channel, improvement of a bottom condition, decrease of microbic pollution of water.

Installation of miniturbines does not lead to changes of an existing hydrological mode.

[12] http://proxima.com.ua/dbn/normdocs/a2/dbn-A.2.2-1-03.DOC

More over, water is enriched by oxygen. So, for example, at Korsun'-Shevchenkivsky water basin the water intake is carried out from depth of 0.83 m (a mark 98.98), that is 3.27 m above the previous mark. Besides, on tail-water reach it is established water-split well, at falling in which from height of 6.5 m water is additionally sated with oxygen, which is more, than at usual passage through overflow dam with difference of heights of 2.9 m.

**Effects on land use**

Green plantings and natural landscape are not subject to changes.
Water basin operation will be carried out according to Service regulations in which the safe mode of operation of a water basin is defined (dam and water outflow operation, level water basin mode, the minimum expenses of water for the normal sanitary-biological condition of the river, filling and draining of water basin).

Project implementation will provide improvement of the basic channel of the rivers, including the zones of recreation.

The project implementation will not entail any change of the area of water basin or the flooded land areas.

**Effects on biodiversity**

The project has obtained positive conclusions of the regional main administrations of fishing control subject to carrying out observations with the aim of determining the quantity and state of fishing resources after the siphon appliance with the aim of determining the need of fish-protective appliance installation. The fishery characteristics of the appropriate river area are analysed.
Hydrounits at work, owing to a turn of turbines, produce noise which extends in thickness of water that creates acoustic effect of fish protection.

For example, at Korsun'-Shevchenkivsky water reservoir the marginal throw velocity (0 m/sec) and free move velocity of young fish (0 m/sec) is reached with 0.21 m and 5.07 m distance from hydrounit correspondingly.

The distance of distribution of noise considerably exceeds the distance on which the speed of a water flow towards a water intake exceeds 0.15 m/sec.

Example for the Korsun '-Shevchenkivsky water basin is given below.

*Short Korsun '-Shevchenkivsky water basin fishery characteristic*

The river Ros is the inflow of the Kremenchug water basin and concerns to 2 order reservoirs.

Reservoir bottom is clay with sand impurity. A transparency of water is up to 2 m. In connection with building of a retaining dam in Korsun '-Shevchenkivsky town, a small river drain is regulated.

The shore along a reservoir in width of 2-5 m has grown with the higher water vegetation - a reed and reed mace, on separate sites the jug yellow grows.

The river site is used for amateur fishery; industrial fishery is not carried out. Within Korsun'-Shevchenkivsky water basin the fishery enterprises are absent.

The water basin is populated with such kinds of fishes: a crucian, a sazan, a redeye, a perch, a bream, a pike, a tench, a pike perch etc. Cancer-type - a river cancer. Molluscs - Radix peregra.

Vegetation: reed mace, reed, duckweed, jug yellow, sedge.

The industrial, protected and Red Book animals are not present.

Place of fishes is the whole water water area of the water basin. Obviously expressed winter stay holes are not observed. Structure of ichtiofauna according to control catchings in the autumn 2004: a redeye, a perch, small fry.

**Waste generation, treatment and disposal**

At the project implementation waste generation will occur after disassembling of physically and morally obsolete equipment at the rehabilitation of hydraulic units of hydropower plants.

The industrial and discharged waters are absent when operating the HPPs.

## SECTION G. Stakeholders' comments

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

As the activities by the project do not foresee the negative impact on the environment and negative social effect, the special public discussion was not necessary. Consults with Stakeholders have been hold at the seccions of local authorities, also through newspapers publications, scientific seminars and publications. Moreover, project implementation will provide improvement of sanitary conditions of the zones of recreation.

The local community was informed about the start of the project by declarations of intent, published in local newspapers. The local community, which is presented by local councils, has approved the project.

No comments from stakeholders were received.

Annex 1

## CONTACT INFORMATION ON PROJECT PARTICIPANTS

**Partner - Supplier:**

| | |
|---|---|
| Organisation: | EEA “Novosvit” |
| Street/P.O.Box: | Stanislavskogo str. |
| Building: | 16 |
| City: | Vinnytsa |
| State/Region: | Vinnytsa |
| Postal code: | 21022 |
| Country: | Ukraine |
| Phone: | (0432) 55-42-85 |
| Fax: | (0432) 55-42-85 |
| E-mail: | uekvin1@sovamua.com |
| URL: | |
| Represented by: | |
| Title: | President |
| Salutation: | Mr. |
| Last name: | Nikitorovych |
| Middle name: | Volodymyrovych |
| First name: | Oleksandr |
| Department: | |
| Phone (direct): | |
| Fax (direct): | |
| Mobile: | +38 050 313 80 96 |
| Personal e-mail: | |

**Partner - Purchaser:**

| | |
|---|---|
| Organisation: | E-Energy B.V. |
| Street/P.O.Box: | Strawinskylaan |
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| City: | Amsterdam |
| State/Region: | |
| Postal code: | 1077XX |
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| Phone: | (+370 5) 268 59 89 |
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| URL: | www.e-energy.eu |
| Represented by: | |
| Title: | Head of Climate Change department |
| Salutation: | Mr. |
| Last name: | Strolia |
| Middle name: | |
| First name: | Arturas |
| Department: | Climate Change department |
| Phone (direct): | |
| Fax (direct): | (+370 5) 268 59 88 |
| Mobile: | |
| Personal e-mail: | |

Annex 2

## BASELINE INFORMATION

The main Baseline information is listed in **Section B.** In this Annex 2 some detailed are represented.

Information on the power grid Baseline situation:

Ukraine has united state power grid, therefore the averaged values for Carbon Emission factors (CEF) for electricity production in Ukraine should be used for the project calculations.

For calculations we use values of the carbon emission factors at the combined approach base:

- for 2001-2005– according to the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 (ERUPT 4, Senter, the Netherlands):

| Year | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| $CEF_g$ $tCO_2e/MWh$ | 0.800 | 0.785 | 0.770 | 0.755 | 0.740 |

*Table A2-1. Carbon Emission factors (CEF) for electricity generation in Ukraine*

- for 2006-2012 (and for the later period in the forecasting calculations in PDD as well) – according to the Table 8 "Emission Factors for the Ukrainian grid 2006-2012" of Annex 2 "Standardized Emission Factors for the Ukrainian Electricity Grid" to "Ukraine - Assessment of new calculation of CEF", verified by TUV SUD Industrie Service GmbH 17.08.2007 [13]:

| Type of project | Parameter | EF (tCO2/MWh) |
|---|---|---|
| JI project producing electricity | EFgrid,produced,y | 0.807 |
| JI projects reducing electricity | EFgrid,reduced,y | 0.896 |

*Table A2-2. New Carbon Emission factors (CEF) for electricity generation and consumption in Ukraine*

It should be noted that according to "Ukraine - Assessment of new calculation of CEF"[13]:,"This baseline can be used as ex-ante (fixed for the period 2006 – 2012) or ex-post. In case an expost baseline is chosen the data of the Ukrainian grid have to be obtained of the year in which the emission reductions are being claimed. Monitoring will have to be done in accordance with the monitoring plan of ACM0002 with the following exceptions:
• the Monitoring Plan should also include monitoring of the grid losses in year y;
• power plants at which JI projects take place should be excluded. Such a JI project should have been approved by Ukraine and have been determined by an Accredited Independent Entity."

Thus. TUV SUD Industrie Service GmbH has validated the certain value of CEF for 2006 and possibly future up to 2012, as well as the methodology for calculations of this factor, and its "team recommends updating the calculation annually depending on point of time when national consolidated data are available", with taking into account the above monitoring conditions.

[13] "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007

EBRD in 2009 expressed that "these factors are in need for an update further to a request from the Ministry of Fuel and Power of Ukraine and the National Environmental Investment Agency of Ukraine."[14]

According to this, after obtaining the more recent input data for calculations according to the methodology developed by Global Carbon and validated by TÜV SÜD (or may be another one developed by EBRD, after its acceptance), the grid emission factor may and should be renewed annually, to be in line with actual situation.

Therefore, the following CEF values are used in calculations in PDD:

| Year | 2002 | 2003 | 2004 | 2005 | 2006-2012 | 2013-2020 |
|---|---|---|---|---|---|---|
| CEFgrid, t $CO_2$/MWh | 0,785 | 0,770 | 0,755 | 0,740 | 0,807 | 0,807 |

*Table A2-3. The baseline Carbon Emission factors (CEF) used for calculations in PDD*

In course of development of the Monitoring reports for this project, if available, the valid at that time CEF values for corresponding period will be used.

The key information and data used to establish the baseline are provided in tabular form below:

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied by the project activity to the grid in year *y* |
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Electricity supplied by the project activity to the grid. Double check by receipt of sales |
| Any comment: | - |

| **Data / Parameter:** | $TEG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* |

[14] TERMS OF REFERENCE. Development of the electricity carbon emission factors for Russia and Ukraine for the period 2009 – 2020. EBRD, 2009

| | |
|---|---|
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Measuring instruments (Electric power meters) must be calibrated according to national regulations |
| Any comment: | - |

| **Data / Parameter:** | $EG_{historical}$ |
|---|---|
| Data unit: | MWh |
| Description: | Average of historical electricity delivered by the existing facility to the grid |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Oblenergo, RES (region of power network), Hydropower plant |
| Value of data applied (for ex ante calculations/determinations) | See Appendix 1_1. |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calculated as the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available years to the time at which the facility was constructed, retrofit, or modified.A minimum of 5 years (120 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities. Data for periods affected by unusual circumstances such as natural disasters, conflicts, transmission constraints shall be excluded. |
| QA/QC procedures: | - |
| Any comment: | - |

| **Data / Parameter:** | $Cap_{BL}$ |
|---|---|
| Data unit: | MW |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity. |
| Time of determination/ monitoring | Once per a small HPP |

| | |
|---|---|
| Source of data (to be) used | Hydropower plant, unit specification |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Determine the installed capacity based on recognized standards.<br>For new hydro power plants, this value is zero. |
| QA/QC procedures: | The data is obtained from technical documentation of the equipment of a small hydropower plant. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Operating margin $CO_2$ emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the |
| Time of determination/ monitoring | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and<br>"Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Source of data (to be) used<br>: | Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and<br>"Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Value of data applied (for ex ante calculations/determinations) | See Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and<br>"Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and<br>"Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |

| | |
|---|---|
| QA/QC procedures: | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and<br>"Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Any comment: | - |

Annex 3

## MONITORING PLAN

The main Monitoring plan information is given in **Section D.**
In this Annex 3 some details are represented.

Monitoring data are registered with periodicity according to monitoring plan, and are stored in paper and electronic format for period not less than until the data of the Final verification report, and in any case not less than three years.

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

The measuring devices are subject to calibration according to valid regulatory in Ukraine, for majority of devices once per one to three years if otherwise is not stated by manufacturer or regulatory.

Relevant monitoring methodologies

In course of development of this project, the project specific approach based mainly on the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 09) was used.

**Data and parameters not monitored**

In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

| **Data / Parameter:** | $EG_{historical}$ |
|---|---|
| Data unit: | MWh |
| Description: | Average of historical electricity delivered by the existing facility to the grid |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Oblenergo, RES (region of power network), Hydropower plant |
| Value of data applied (for ex ante calculations/determinations) | See Appendix 1_1. |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calculated as the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available years to the time at which the facility was constructed, retrofit, or modified. A minimum of 5 years (60 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities.<br>Data for periods affected by unusual circumstances such as natural disasters, conflicts, transmission constraints shall be excluded. |

| | |
|---|---|
| QA/QC procedures: | - |
| Any comment: | - |

| **Data / Parameter:** | $Cap_{BL}$ |
|---|---|
| Data unit: | MW |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity. |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Hydropower plant, unit specification |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Determine the installed capacity based on recognized standards.<br>For new hydro power plants, this value is zero. |
| QA/QC procedures: | The data is obtained from technical documentation of the equipment of a small hydropower plant. |
| Any comment: | - |

**Data and parameters monitored**

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied by the project activity to the grid in year *y* |
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Electricity supplied by the project activity to the grid. Double check by receipt of sales |

| | |
|---|---|
| Any comment: | - |

| **Data / Parameter:** | $EG_{existing,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | The actual, measured electricity supplied to the grid by existing units in year *y* (MWh) |
| Time of determination/ monitoring | Hourly measurement and monthly recording |
| Source of data (to be) used | Project activity site |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | This parameter will be zero except in the case where one or more of the existing units is/are not modified as part of the project activity, continue to operate after the implementation of the project activity, and the configuration permits their generation to be measured separately |
| QA/QC procedures to be applied: | - |
| Any comment: | - |

| **Data / Parameter:** | $TEG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* |
| Time of determination/ monitoring | Continuous measurement and monthly recording |
| Source of data (to be) used | Hydropower plant, power output meter |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Calibrated power meter |
| QA/QC procedures: | Measuring instruments (electric power meters) must be calibrated according to national regulations |
| Any comment: | - |

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Operating margin $CO_2$ emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Time of determination/ monitoring | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Source of data (to be) used : | Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Value of data applied (for ex ante calculations/determinations) | See Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| QA/QC procedures: | As per the Table B1 "Baseline carbon emission factors for JI projects generating electricity" of operational Guidelines for PDD's of JI projects Volume 1: General guidelines Version 2.3 Ministry of Economic Affairs of the Netherlands May 2004 page 42 table B.1 (ERUPT 4, Senter, the Netherlands) and "Ukraine – Assessment of new calculation of CEF", from "Objective; Conclusion", assessed by TUEV SUED, 2007 |
| Any comment: | - |

| **Data / Parameter:** | $Cap_{PJ}$ |
|---|---|
| Data unit: | MW |
| Description: | Installed capacity of the hydro power plant after the implementation of the project activity. |
| Time of determination/ monitoring | Once per a small HPP |
| Source of data (to be) used | Hydropower plant, unit specification |
| Value of data applied (for ex ante calculations/determinations) | N/A |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | Determine the installed capacity based on recognized standards. |
| QA/QC procedures: | The data is obtained from technical documentation of the equipment of a small hydropower plant. |
| Any comment: | - |