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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Khmelnytskoblenergo PJSC power distribution system modernization

Sectoral Scope: (2) Energy Distribution

Version of the document 2.0

Date of the document: 29/08/2011

A.2. Description of the project:

The objective of the JI project «Khmelnytskoblenergo PJSC power distribution system modernization» is the realization of the programme of technical reconstruction of electrical network and equipment, introduction of the progressive technologies, organization structure improvement, transition to the higher organizational level of electricity grid transmission and distribution.

Taking measures foreseen by the project will let to increase the reliability and effectiveness of the distribution network of electric power in Khmelnytsk and Khmelnytsk Region, and enhance the quality of consumers service. It will also help to reduce the amount of electric power, that is lost in the distributive and transport electrical networks of Khmelnytskoblenergo PJSC , and that, in its turn, will help to reduce the amount of the generated electric energy and as the result pollutant emissions in the atmosphere.

Situation at the beginning of the activity of the Project.

Public Joint Stock Company Khmelnytskoblenergo (H) is an integral part of the unified energy system (UES) of Ukraine and provide the consumers of Khmelnytsk region with the electric energy regularly and reliably under the uniform tariff.

At the beginning of the project (2002) "Khmelnytskoblenergo" PJSC was realizing only such measures that were directed to the maintaining of electrical networks in good working order. These measures mainly included repairing work to eliminate errors, that arise during the operation of power networks. That resulted in the technological consumption, in 2002, in networks of OJSC «Khmelnytskoblenergo» which reached 28,952% from the electric energy amount, that was coming into the company's network.

Most of the equipment that was being used at that moment in the networks of Khmelnytskoblenergo PJSC was already physically and morally outdated, but because of the insufficient financing and operational reserves of this equipment, it remained still in use. Besides, it was possible to change this situation not only in the case of technical provision of the network modification, but also in the case of company's organizational structure improvement, which also required financing and manpower.

The possibility to sell greenhouse gas emission reduction units, became one of the factors for the start of the introduction program, the goal of which is the reduction of technological power consumption in the Khmelnytskoblenergo PJSC electric network.

Project Scenario

Joint implementation project is based on the implementation of complex of measures on elimination of power losses, which is introduced and financed since 2003.

The measures are taken within the framework of this program (see Section A.4.2), for the implementation and constant monitoring of potential sources of the technological losses and prevention of their appearing

enabled Khmelnytskoblenergo PJSC to reduce technological consumption to 16,38% of the amount of electric power delivered to the network.

Baseline Scenario

Baseline scenario foresees further usage of equipment while performing of planned repairing work without substantial investments. More information about baseline scenario is provided in section B.

History of the project

03/07/2002 - Decisions of Board of Khmelnytskoblenergo PJSC on the development and implementation of programs to reduce TPC (TVE)» (Protocol 10). This date is the date the acceptance of this project as a JI project.

Conducted on Khmelnytskoblenergo PJSC all - industry conference, "Reducing power technological consumption in the networks of its transport. Measures to improve work with consumers of electricity" - July 2002.

January, 2003 – start of the works on the program of TPC (TVE) reduction in the electrical network of Khmelnytskoblenergo PJSC

15/09/2010 – signing of a contract with ImexEnergo. Preparation of PDD.

Advantages of the project

Apart from emissions reduction the implementation of project «Khmelnytskoblenergo PJSC power distribution system modernization» has the following advantages:

- Creation of additional jobs, connected with the introducing of new equipment, construction and reconstruction of enterprise facilities;
- Pollutant emissions reduction by the cut down of the electric energy generation as a result of shortening of losses in the networks;
- Cutting production costs.

The realization of joint implementation project will reduct pollutant emissions by the shortage of electric energy generation, which is delivered to the network of Khmelnytskoblenergo PJSC . Thus, the realization of the project will reduce the greenhouses gasses emissions and will prevent from their further accumulation in the atmosphere, which in its turn, will loosen the climate changes.

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)	Khmelnytskoblenergo PJSC	No
Poland	«IMEX ENERGO», sp. z o. o.	No

Publik joint stock company, "Khmelnytskoblenergo" (Khmelnytskoblenergo PJSC) EDRPOU code 22767506 is an integral part of the unified energy system (UES) of Ukraine and provides the consumers of Khmelnytsk region with regular and reliable power supply under the uniform tariff.

Braches of CEA

- Power production and distribution
- Power distribution and supply
- Activities in the sphere of engineering

JSC "Khmelnytskoblenergo" was created as an public joint stock company according to the decree of the President of Ukraine of 04.04.95 "On the restructuring in the electric power engineering complex of Ukraine" in the process of corporatization and by order of the Ministry of energetics and electrification of Ukraine of 17.08.95. № 157 by transformation of the State power supply company "Khmelnytskoblenergo" into the State joint-stock energy-supplying company "Khmelnytskoblenergo" (SJSC "Khmelnytskoblenergo") and its further renaming into public joint stock company, energy supplying company "Khmelnytskoblenergo" (OJSC EC "Khmelnytskoblenergo") with legal succession of all rights and duties of a legal entity – subject fo the entrepreneurship and refers to the strategically important.

According to Shareholders general meetings decision Khmelnytskoblenergo PJSC (Protocol №20 of 11.11.2010) Public Joint-Stock Company "Khmelnytskoblenergo" was renamed into Public Joint-Stock Company "Khmelnytskoblenergo".

«IMEX ENERGO», sp. z o. o., NIP 7952307407, (EDRPOU code) REGON 651542435 was created on December 9th 2003 in Przemysl. The main Company's activity is exportation, importation, and supply of specialized electric devices for the energy sector, as well as natural gas, petroleum, liquefied petroleum gas, petrol, and electric energy supply.

The company also realizes some innovative-investment and ecological projects in Poland and Ukraine. In 2010 the legal address of the Company was changed, and now it is – Zheshuv, Przemysłowa, 14. Thereafter, the main Company's activity is:

- Development problem - stripped gas provision from Ukraine to Poland (Podkarpackie region)
- Chervonograd cogeneration systems 24 MW technical documentation elaboration (PJSC Energoinwest)
- Project on power generation investments, from the use of stripped gas in Boryslav, Ukraine (CHP 12 MW) – the project received the letter of approval № 2 from the Ukrainian Ministry of ecology in 2006.
- great quantity of CHP and equipment, boilers, etc., import to the Ukraine
- project starting with the help of wind power ("Kryla vitru" project in the Truskavec power station 40 MW)
- biomass organization and obtaining, assembly equipment briquetting, as well as supplies form Ukraine to Poland.
- Collaboration with the local thermal and electric stations in the sphere of investments to the operational network of heat distribution, from cogeneration with the use of biomass as the fuel.
- Preparation together with the Ukrainian companies: ecological systems and EUEU.

A.4. Technical description of the project:

A.4.1. Location of the project:

The Project is implemented on the establishments of Khmelnytskoblenergo PJSC , located in Khmelnytskyi and Khmelnytskyi Region in Western Ukraine. The area of the region is 20,600 km² (3, 4 % of the total area of Ukraine). The current estimated population is around 1 401,140 (as of 2004).

A.4.1.1. Host Party(ies):

Ukraine

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

Khmelnytskyi and Khmelnytskyi Region

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

Khmelnytskyi

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

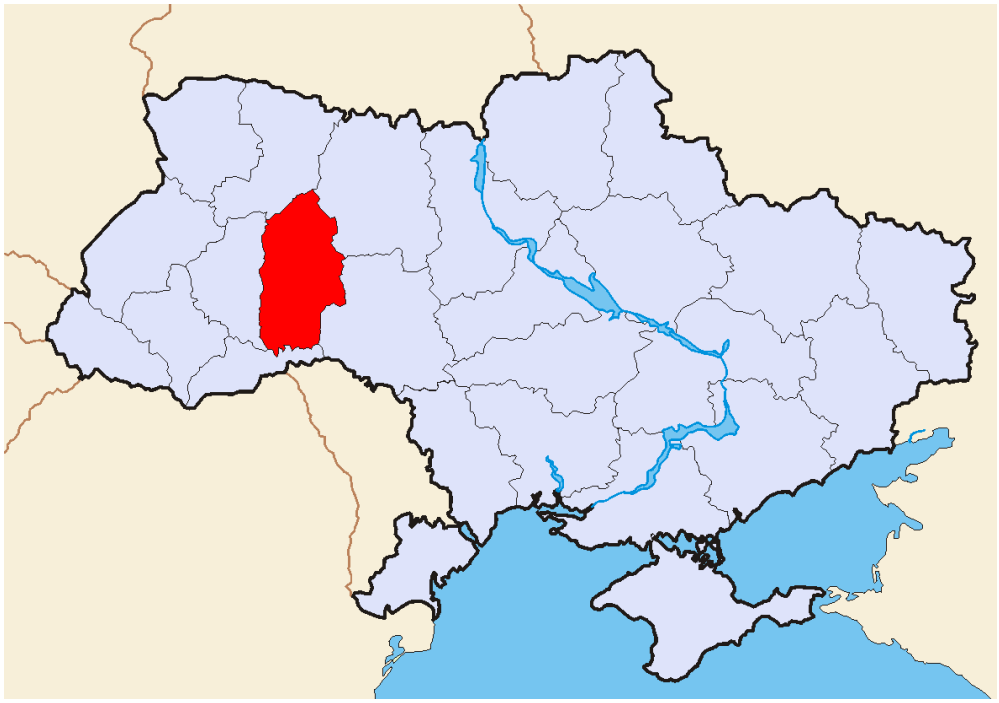

Figure 1. Location of the Khmelnytskyi Region on the map of Ukraine

Figure 2. The city of Khmelnytskyi (•) on the map of Ukraine

The project is to be implemented at the facilities of Khmelnytskoblenergo PJSC located in the city and region of Khmelnytskyi in the west of Ukraine (coordinates of main office: 26°57′21.9″ eastern longitude 49°24′1.35″ northern latitude). The region's total area is 20,600 sq. km (3.4% of Ukraine's total area) and the population is 1,401,140 people (by Jan. 1, 2004)

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

Public joint stock company "Khmelnytskoblenergo" (Khmelnytskoblenergo PJSC) is an integral part of the unified energy system (UES) of Ukraine and provides the consumers of Khmelnytsk region with the electric energy regularly and reliably under the uniform tariff.

At the beginning of the project (at the end of 2002) Khmelnytskoblenergo PJSC was realizing only such measures that were directed on the maintaining of electrical networks in good working order. These measures mainly included repairing work on eliminations of errors, that arise during the operation of electric networks. That resulted in the technological power consumption, in 2001, in networks of Khmelnytskoblenergo PJSC which reached 28.952% from the electric energy amount, that was coming into the company's network.

The objective of the project is the realization of technical reconstruction of electrical network and equipment programme, introduction of the progressive technologies, organization structure improvement, transition to the higher organizational level of electricity grid transmission and distribution by attracting investments.

The Joint implementation project is based on the implementation complex of organizational and technical measures on electricity losses reduction, which includes:

- realization of scientific and technical support, extension of the exploitation term of the functioning equipment, realization of the equipment diagnostics system and prognostication of its residual operating time;
- introduction of organizational and technical measures for technological power consumption reduction;
- reconstructions and renovations of the electric networks, and substitution of outdated equipment;
- attraction of investments for the development and achievement of high technical and economical level of the Company;
- increase of power supply reliability level for the region consumers;
- implementation of the Automatized system of commercial accounting of power consumption of the energy-supplying company perimeter, ASCAPC of consumers and substations;
- introduction of complex technical power consumption reduction Program;
- modernization of the equipment in the framework of the electric power development investment programs.

Implementation of the program is continuous process that wills conduct over the operational period of the project.

The Project implementation provided the following measures:

1. For processes of power transmission:

1.1. Organizational measures of methodological ensuring.

1.1.1. External audit and organization of constant internal audit of power transportation (power grid system, power accounting and power streams and balances detection and control)

1.1.2. Formation of a technical database (a list and specifications of all components and charts of normal operation modes) of the Company's power grid conforming to annual and monthly operation reports.

1.1.3. Implementation of a programmed system of calculation and analysis by feeder to locate intolerable power losses in 110-35 and 10-6-0.38 kV power network.

1.1.4. Development of a planning, organization and monitoring system of measures aimed at elimination of power losses.

1.1.5. Modernization of programs and technical means.

1.1.6. Creation of separate subdivisions within the Company dealing with the task of reducing power losses (power audit and accounting department, measuring laboratory, etc.)

1.1.7. Other improvement measures

1.1.8. Other actions aimed at reduction of power losses.

1.2. Organizational and technical measures:

1.2.1. Shutdown of transformers in small load mode for PS-110/35/10 kV and TP/RP-10/6.038 kV

1.2.2. Shutdown of transformers at PS-110/35/10 kV and TP/RP-10/6.038 kV substations with seasonally changing load:

1.2.3. Regular monitoring and phasing load leveling in power grids 0.38 kV

1.2.4. Modernization of technical means of control automation – telemeasurement system, alarm system in 110-35 and 10-6-0,38 kV power grids
1.2.5. Normal operation mode optimization.
1.2.6. Reduction of inefficient distribution and supply system operation time by reducing the maintenance time.
1.2.7. Implementation of measures aimed at reducing the power consumtion by the company's subdivisions.
1.2.8. Reduction of own power consumption by PS-110/35 kV and TP/RP-10/6.038 kV
1.2.9. Other actions aimed at reduction of power losses.

1.3. Technical measures:
1.3.1. Wire replacement on overloaded power lines PL-6-10 kV and PL-0.4 kV
1.3.2. Replacement of overloaded 10/0.4 kV transformers
1.3.3. Replacement of underloaded 35-110 kV and 10/0.4 kV transformers
1.3.4. Installation of new transformers at the existing transformer and distribution stations.
1.3.5. Replacement of high loss transformers older than 25 years.
1.3.6. Optimization of power grid loading by reconstruction
1.3.7. Reconstruction of PL-110/35 kV and PL 10-0.4 kV
1.3.8. Cleaning of PL-110/35 kV and PL 10-0.4 kV routes.
1.3.9. Replacement of wiring at PL-110/35 kV and PL 10-0.4 kV
1.3.10. Reinforcement of insulators, replacement of bindings on PL-110/35 kV and PL 10-0.4 kV
1.3.11. Replacement of twisting by clipping on PL 10-0.4 kV
1.3.12. Installation of KTP lead caps
1.3.13. Instollation of RLND apparatus clips
1.3.14. Insulation cleaning on PL-110/35 kV and PL 10-0.4 kV
1.3.15. Checking and improvement of grounding on PL-110/35 kV and PL 10-0.4 kV
1.3.16. Checking and improvement of grounding at PS 110/35 kV and TP/RP-10/6.038 kV
1.3.17. Fastening the contacts at TP/RP-10/6.038 kV
1.3.18. Reduction of PL-110/35 kV and PL 10-0.4 kV length.
1.3.19. Replacement of branching from PL-0.38 kV to bbuildings.
1.3.20. Current measurement and replacement of commutators and fuses.
1.3.21. Downsizing of PL-110/35 kV and PL 10-0.4 kV

2. For power supply

2.1. Organizational measures
2.1.1. External audit and organization of constant internal audit of power supply (power grid system, power accounting and power streams and balances detection and control)
2.1.2. Development of a planning, organization and monitoring system of measures aimed at elimination of power losses.
2.2. Organizational and technical measures:
2.2.1. Checking, improvement and accounting of power accounting facilities and power overflows with ORE participants.
2.2.2. Stimulating the transfer of the company consumers on tariff basis differentiated by time zones, in order to level the power consumption schedules during peak loads.

2.3. Technical measures:
2.3.1. Installation of insulated lead-ins in dwelling houses.
2.3.2. Improvement of inner networks in blocks of flats (fastening the contacts, earthing, replacement of wire with wrong cross-section).
2.3.3.. Introduction of ARSKOE for legal entities.
2.3.4. Implementation of SMART system of power supply accounting to individuals.

2.3.5. Introduction of ARSKOE on the battery limits.

All these measures, implementation and continuous monitoring of possible sources of energy losses and prevent possible occurrence of "Khmelnitskoblenergo" PJSC reduce technical electricity losses in their electrical systems.

Reduction of technological power consumption in the Company networks allowed reducing CO2 emissions, caused by generation of electricity that was lost.

Duration of the project is unlimited, since the measures taken to detect and remove TPC (TVE) in separate power network units and feeders, power network areas, as well as to reduce general technological power consumption in the Khmelnytskoblenergo PJSC , are a constant and continual process. CO2 eq emissions reduction are affirmed on one crediting period (22years) according to the modality and JI Mechanism procedures(3).

General characteristics of new equipment (transformers, substations and distributive stations, appliances and power account systems , electricity transmission lines, automatic equipment, etc), installed in the networks 110-35-10-6-0,38kV of Khmelnytskoblenergo PJSC from 2002 till 2010 as well as the equipment which is to be installed till 2025 are shown in the Annex 4, including the characteristics of equipment which was bought for improvement of networks exploitation and power supply processes (thermal imagers, measuring equipment, vehicles, etc).

Purchase of equipment and supplies as well as carrying out of project assembly and commissioning operations are accomplished by contract organizations by tender in the order, established in Ukraine. Besides the equipment and work cost, the main criteria of equipment selection is its quality and reliability, as well as professionatism and responsiveness to ISO–9000 of executors. The equipment suppliers are national and foreign producers which have proved themselves in the power.

During the period of the TPC (TVE) reduction program in the networks of Khmelnytskoblenergo PJSC implementation, according to the power audit resolutions recommendations such institutions as Department of energy audit and registration, High-voltage networks department, Distributive netwoks department, Information technologies and development of management system board, Quality management department were created, the post of power sales technical security associate director was introduced, the stuff was trained, the power accounting automatization subunits were fomed. Monthly technical and selling subunits power audit was implemented. The stuff of Power audit and accounting department carries out power specialty training and obligatory advanced training according to the program ”Power audit ” on the basis of NTU of Ukraine ”KPI”. Leading specialists of the Company have an opportunity to raise their educational level and to obtain second higher education in the higher education institutions of Ukraine.

Works on technological power losses reduction are held in the framework of investment Programs of the Company, Plans of current and capital repairs, Plans of power networks maintenance that are annually approved by “Minpalyvenergo”of Ukraine and NPRC of Ukraine.

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:

Introduction of the project will secure the reduction of greenhouse gasses emissions, due to the power production cut down in the national power network.

The list of measures aimed at reducing electricity losses in networks of Khmelnytskoblenergo PJSC given in Section A.4.2 above.

At the start of the Project (2002) there existed a number of normative acts (Power conservation Act), the aim of which was to stimulate manufacturers and suppliers to the power conservation activity. Yet, these acts had formal character, and were ineffective.

Realization of suggested reconstruction project demand considerable funding. At present, project funding on the foreign market is available for short period of time (up to three years), and interest rate is high. Obtaining of project funding on the foreign loan market for Ukrainian companies is complicated by low international ratings of Ukraine and, accordingly, high risks of investments. Additional income from the JIE sale was one of the leading criterias for the enterprise owners in the decision to make investments into the suggested project. The possibility to get the JIE, before the decision about the investment had been taken, was considered to be on the master-plan preparing stage.

Additional income from the JI mechanism usage will influence positively the economical indices of the project. JI project realization will raise inner profitability rate and reduce project payback period.

Most of the equipment, used at that moment, in the networks of Khmelnytskoblenergo PJSC was already physically and morally outdated, but because of the insufficient financing and operational reserves of this equipment, it remained still in use. Besides, changing of this situation was possible not only in the case of modification of technical provision of the network, but also in the case of company's organizational structure improvement, which also required financing and manpower.

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

Emission reduction calculations provided in the Excel file «ХМ-1БТВЕ-2002-2010-18-09-2011-Km-ok-КП.xls».

Table 1. Emission reductions for the period 2004-2007.

Length of the crediting period	**Years** **4**
Year	**Estimate of annual emission reductions in tonnes of CO2 equivalent**
2004	68429
2005	177229
2006	202596
2007	206635
Total estimated emission reductions over the crediting period 2004-2007 (tones of CO_2 equivalent)	**654889**
Annual average of estimated emission reductions over the crediting period 2004-2007 (tones of CO_2 equivalent)	**163722**

Table 2. Emission reductions for the crediting period 2008-2012.

Length of the crediting period	**Years** **5**
Year	**Estimate of annual emission reductions in tonnes of CO2 equivalent**
2008	256864
2009	250141
2010	240446
2011	249107
2012	249107
Total estimated emission reductions over the crediting period 2008-2012 (tones of CO_2 equivalent)	**1245665**
Annual average of estimated emission reductions over the crediting period 2008-2012 (tones of CO_2 equivalent)	**249133**

Table 3. Reduction of post-Kyoto period 2013-2025.

Length of the crediting period	**Years** **13**
Year	**Estimate of annual emission reductions in tonnes of CO2 equivalent**
2013	249107
2014	249107
2015	249107
2016	249107
2017	249107
2018	249107
2019	249107
2020	249107
2021	249107
2022	249107
2023	249107
2024	249107
2025	249107
Total estimated emission reductions over the crediting period 2013-2025 (tones of CO_2 equivalent)	**3238391**
Annual average of estimated emission reductions over the crediting period 2013-2025 (tones of CO_2 equivalent)	**249107**

A.5. Project approval by the Parties involved:

Approval by the investor country (Ministry of the Environment of Poland) and approval by the Ukrainian authorities (State Environmental Investment Agency of Ukraine) will be received after the successful passage of determination.

SECTION B. Baseline

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

For determination baseline scenario and demonstration additionality was used JI specific approach based on Methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 03.0.0). Using this tool is a common practice in determining the baseline and demonstrateion additionality.

Baseline scenario is determined according to the following four Steps:
STEP 1. Identification of alternative scenarios;
STEP 2. Barrier analysis;
STEP 3. Investment analysis (if applicable);
STEP 4. Common practice analysis.

Step 1: Identification of alternative scenarios
Step 1a: Define alternative scenarios to the proposed JI project activity

Only two alternatives are the most veritable for the suggested project activity.
Alternative A: Continuation of the current situation.
Alternative B: Implementation of proposed project activity without JI registration.

Partial implementation of the TPC (TVE) reduction program in the Khmelnytskoblenergo PJSC electric power networks will reduce the effect of its implementation. That's why this scenario is not considered as an alternative to the proposed project activity.

Outcome of Step 1a: Two most plausible alternatives were identified. List of identified alternatives is presented above.

Sub-step 1b: Consistency with mandatory applicable laws and regulations
At the start of the project (2002) there existed a number of regulation acts (Law on energy saving) aiming at directing the producers and supplyers to the sphere of energy saving. However, these acts mostly had formal character and were ineffective. It is confirmed by the permenant increase of TPC (TVE) in the electrical network of Khmelnytskoblenergo PJSC before the start of the project.

Outcome of Step 1b: Alternative A, Alternative B, is in compliance with applicable laws and regulations.

Step 2: Barrier analysis
Sub-step 2a: Identify barriers that would prevent the implementation of alternative scenarios
Alternative A: Continuation of the current situation.
There are no barriers for this Alternative.

Alternative B: Implementation of proposed project activity without JI registration

Investment barriers: The project activity within the framework of the suggested project is a perpetual process which requires considerable annual investments and manpower attraction.

- This is connected with:

- Annual electrotechnical equipment renewal, which is represented in the Ukrainian market;
- Necessity of the perpetual monitoring of places where the electricity is lost, their removal and prevention of their appearing;
- Necessity of the perpetual stuff training to work with he new equipment.

Constant funding in Ukraine is possible only in case of financial attraction of the project. The current system of electric power tariff formation shifts the financial burden of technological power consumption on the final consumers and does not allow to receive the income from their reduction.

The access to the financial resources on the international level is highly limited for the suggested project. The investment environment in Ukraine is rather poor in comparison with the neighbor countries. The confirmation of this is the sovereign rating of Ukraine according to the Fitch records in comparison with some neighbor countries of the Eastern Europe.
Ukraine B-
Poland A-
Hungary BBB
Slovakia A+

Due to the considerable volume of capital investments, needed for the accomplishment of the project, the funding obtaining from the international institutions may be rather difficult. Funding chances on the national level are also restricted. Nowadays commercial banks of Ukraine grant project financing at about 30% annually in the national currency on a three-year term. Examples of the largest bank institutions of Ukraine are: Raiffaizen Bank Aval (www.aval.ua), Pryvatbank (www.privatbank.com.ua), Pravex Bank (www.pravex.com.ua).

Taking into consideration all the hereinbefore mentioned, the funding of the project is possible only under the condition of funds attraction from the selling of greenhouse gases emission reduction units.

Outcome of Step 2a: List of barriers is provided above.

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers
Only *Alternative A* is not prevented by the identified barriers..
Outcome of Step 2b: Only *Alternative A* is not prevented by the identified barriers.

Step 3: Investment analysis
For the justification of the baseline scenario and additionality demonstration barrier analyse was used.

Outcome of Step 3: N/A
Step 4: Common practice analysis
Most similar projects (like utilization of coal mine methane) were implemented with grants or other non-commercial finance terms (for example JI investment). The common practice for Ukraine at the beginning of the project introduction was the operation work implementation in the volume necessary to keep the network in a good working order and the technological power consumption reduction activity.
Outcome: In consideration of mentioned above Alternative A is most plausible baseline scenario that is not prevented by any barriers and is in line with host Party common practice.

Key information and data used for baseline setting are provided below in tabular form:

Data/Parameter:	V_y
Data unit	MWh
Description	Total reduction of technical power losses in the power grid during the period y of the project scenario compared with the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Estimated by EES Ltd based on the statistical data of Kmelnytskoblenergo PJSC using the approved methodology as in Appendix 1 to PDD. Estimates under the methodology are shown as an Excel file «ХМ-1БТВЕ-2002-2010-18-09-2011-Km-ok-КП.xls».
Value of data applied (for ex ante calculations/determinations)	228539 MWh (for emission reduction estimation after 2010 the average value for 2008-2010 has been taken. See Excel file «ХМ-1БТВЕ-2002-2010-18-09-2011-Km-ok-КП.xls»)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is an objective quantitative representation of the project implementation results.
QA/QC procedures (to be) applied	This parameter is defined according to the valid norms, rules and approved methodology based on the company's statistical data.
Any comment	

Data/Parameter:	CEF_y
Data unit	t CO_2e/MWh (kg CO_2e/kWh)
Description	Carbon dioxide emission factor for projects of power loss reduction in power transport networks of Ukraine
Time of determination/monitoring	Annually
Source of data (to be) used	Reference data (approved calculations and Orders of the National Agency for Environmental Investments as indicated below)
Value of data applied (for ex ante calculations/determinations)	For 2003 – 0.936[1] t CO_2e/MWh (kg CO_2e/kWh) For 2004 – 0.916[2] t CO_2e/MWh (kg CO_2e/kWh) For 2005 – 0.896[3] t CO_2e/MWh (kg CO_2e/kWh) For 2006-2007 p– 0.896[4] t CO_2e/MWh (kg CO_2e/kWh) For 2008 - 1.082[5] t CO_2e/MWh (kg CO_2e/kWh) For 2009 - 1.0966 t CO_2e/MWh (kg CO_2e/kWh) For 2010 - 1.0937 t CO_2e/MWh (kg CO_2e/kWh) (See Appendix 2) For 2011-2025 - 1.0908 t CO_2e/MWh (kg CO_2e/kWh)

1 ERUPT 4, Senter, Нідерланди

2 ERUPT 4, Senter, Нідерланди

3 ERUPT 4, Senter, Нідерланди

4 Carbon dioxide emission quotien (for power consumption according to the methodology "Ukraine - Assessment of new calculation ofCEF", затвердженої TUV SUD 17.08.2007 p.)

5 Order of the National Agency for Environmental Investments No. 62 dd. 15.04.2011.

6 Order of the National Agency for Environmental Investments No. 63 dd. 15.04.2011.

7 http://www.neia.gov.ua/nature/doccatalog/document?id=126006

8 http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Using such factors is a common practice when estimating IJ projects.
QA/QC procedures (to be) applied	Only officially approved factors have been used for estimation.
Any comment	

Parameters, subjected to the monitoring are given in the tables D.1.1.1. and D.1.1.3 Section D

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:

For baseline setting, demonstration of additionality and feasibility of the JI project implementation the 'Combined tool to identify the baseline scenario and demonstrate additionality' (Version 03.0.0) has been used. Usage of the tool is a common practice when developing JI Projects.

According to this tool the barrier analysis and the common practice analysis have been used to demonstrate the additionality oif the project. The analyses show that the most probable baseline scenario is the continuation of the resent situation at the moment of the project commencement (2002). Therefore, the suggested project is not a baseline scenario and corresponds to the additionality principles.

A more detailed description of the implementation of the 'Combined tool to identify the baseline scenario and demonstrate additionality' (Version 03.0.0) is provided in B.1 above.

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

Project boundaries

The approach to the emission calculation takes into consideration the CO2 emission only, which is formed as a result of the electric power production, necessary for the compensation of the technological consumption in the network and in the distributing transformer stations, and in the substations of Khmelnytskoblenergo PJSC . The limits of the project scenario are shown on the Figures 3a and 3b (they are encircled with an dotted line).

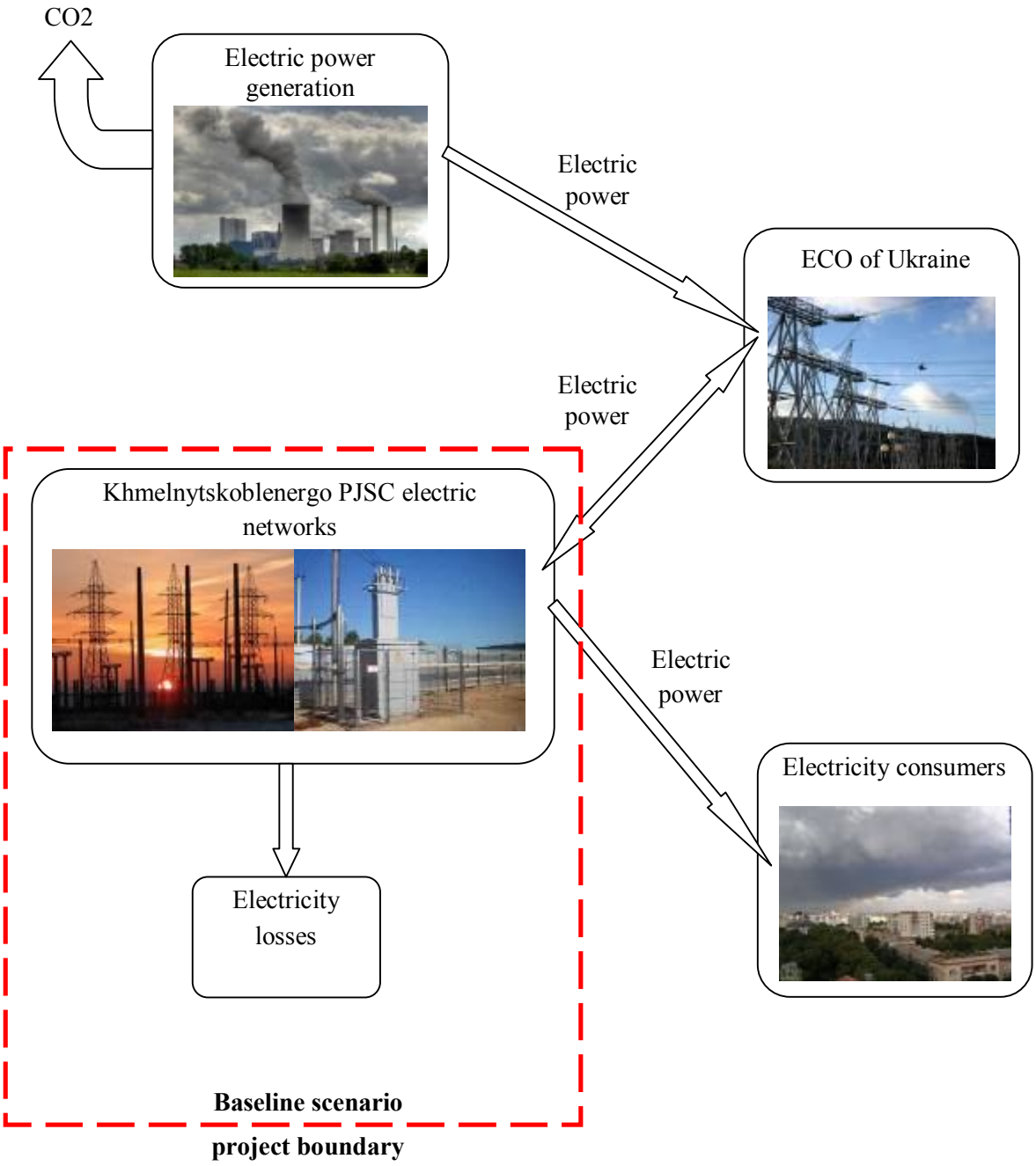

Figure 3a Project boundary of baseline scenario

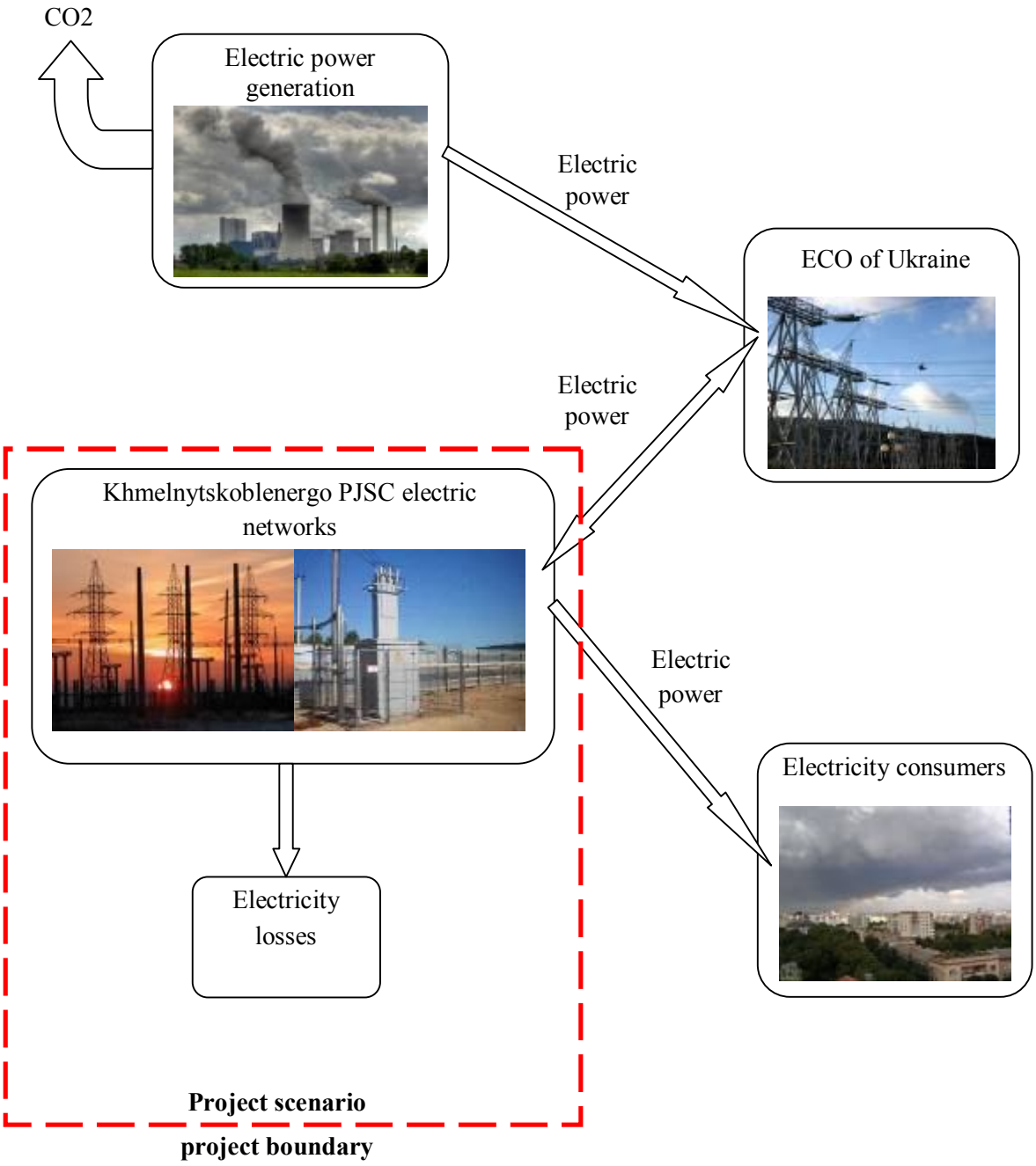

Figure 3b Project boundary of project scenario

Equipment within the project boundaries is given in the table:

Designation	Unit	Quantity	Capacity MVA
Power grid total length, incl.:			
air:	**km**	**37 905,284**	
110 kV	km	1 544,77	---
35 kV	km	1 771,05	---
10 kV	km	13 291,090	---
6 kV	km	0,740	---
0.38 kV	km	21 297,634	---
cable:	**km**	**1 609,00**	
10 kV	km	1 076,20	---
0.38 kV	km	532,8	---
Substation total number:			
110/35 kV	**pcs**	**174**	**1 765,100**
110 kV	pcs	70	1 349,900
35 kV	pcs	104	415,200
Transformer total number:			
110/35 kV	**pcs**	**252**	**1 765,100**
110 kV	pcs	107	1 349,900
35 kV	pcs	145	415,200
Substation total number:			
SCTP,KTP,ZTP 6-10/0.38 kV	**pcs**	**7 102**	**1 453,433**
Single-transformer SCTP	pcs	12	1,151
KTP	pcs		
No transformers	*pcs*	*10*	*-----*
One transformer	*pcs*	*5 846*	*799,645*
Two transformers	*pcs*	*20*	*14,618*
ZTP	pcs		
No transformers	*pcs*	*9*	*------*
One transformer	*pcs*	*626*	*178,094*
Two transformers	*pcs*	*579*	*459,925*
Transformer total number:			
10 kV	**pcs**	**7 751**	**1 485,299**
Distribution plant total number 10kV:	**pcs**	**61**	**31,8666**
No transformers	*pcs*	*15*	*-------*
One transformer	*pcs*	*23*	*8,626*
Two transformers	*pcs*	*23*	*23,240*

The list of the sources and the greenhouse gases that were included into the boundaries of the project is given in the table 4.

Table 4: Sources of emissions and greenhouse gases included or excluded from the project boundary

	Source	Gas	Included / Excluded	Justification / Explanation
Baseline emissions	Ukrainian ECO electric power stations that consume fossil fuel.	CO_2	Included	Emission is caused by burning of the fossil fuel by the Ukrainian ECO electric power stations to generate electricity which is necessary to make amends for consumption in the electrical network of Khmelnytskoblenergo PJSC in the baseline.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
Project emissions	Emissions related to the equipment installed in the project	SF_6	Excluded	Insulating gas (SF6), used in circuit breakers and other equipment Khmelnitskoblenergo PJSC is toxic and is listed as gas circulation and utilization of which is under the control of state environment organizations. Equipment containing Insulating gas is hermetically sealed and prevents leakage of gas into the atmosphere. In the case of it failure or decommissioning SF6 will be collected and reused by filling in new similar equipment. In connection with all the above SF6 emissions were excluded from the calculations.
	Ukrainian ECO electric power stations that consume fossil fuel	CO_2	Included	Emission is caused by burning of the fossil fuel by the Ukrainian ECO electric power stations to generate electricity which is necessary to make amends for technological power consumption in the electrical network of Khmelnytskoblenergo PJSC after the reduction of the technological power consumption volume as a result of the project activity.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification

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

Finalization date of the baseline developing – 29/08/2011**.**

Baseline was set by Ltd «EES»

Table 5. Project developer - personal information

Organisation:	Ltd " Ekologichni Energetychni Systemy "
Street/P.O.Box:	Mitskevycha
Building:	8
City:	Lviv
State/Region:	Lviv region
Postal code:	79000
Country:	Ukraine
Phone:	0324 451601, 0322 427545
Fax:	0324 451601, 0322 444462
E-mail:	ecoees@mail.ru, peklviv@meta.ua
Title:	Director
Last Name:	Shpak
First Name:	Yaroslav
Middle Name:	Fedorovych
Phone (direct):	0324 451601, 0322 427545
Fax (direct):	0324 451601, 0322 444462
Mobile:	0504315929

Ltd «EES» is not Project Participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

03/07/2002 - Decision of Board of Khmelnitskoblenergo PJSC on the development and implementation of programs to reduce TPC (TVE) (Minutes № 10).

C.2. Expected operational lifetime of the project:

25 years (300 months) or more – the program provides perpetual realization of the measures towards the reduction of technological power consumption in the electrical network of Khmelnytskoblenergo PJSC

C.3. Length of the crediting period:

Duration period is 22 years (264 months):

2004-2007 – Early crediting period (the project will qualify for an early test of quotas in accordance with Article 17 of the Kyoto Protocol);

2008-2012 – crediting period (the period of commitment);

2013-2025 – post-commitment period (period of credit extension beyond 2012 requires approval by the project Host country).

Period ERU generation will begin only on 01.01.2008 and will not exceed the lifetime of the project.

Date of the crediting period January 1, 2004 End Date December 31, 2025

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Data collected for monitoring will be stored electronically and/or paper form. All measurements carried used calibrated measuring equipment according to relevant industry standards.

The main parameter that objectively reflects CO2 emission reductions is reducing technological power consumption in electricity networks of the Khmelnitskoblenergo PJSC. The rate of technological power consumption reflects electricity that being spent in total electricity received by the network.

The main parameters that are monitored during the crediting period and parameters to be determined once for the entire crediting period and not subject to monitoring are presented below. Other parameters not included in the monitoring are derived and should be calculated using the initial parameters.

The monitoring project emission includes such parameters:
Not applicable

Parameters for the project emission that are calculated only once for the whole financing period:

Not applicable

Parameters for the project emission that are calculated only once for the whole financing period:
Not applicable

Parameters for the baseline emission monitoring:
V_y = Total reduction of technical power losses in the power grid during the period y of the project scenario compared with the baseline scenario

This parameter is defined according to the valid norms, rules and approved methodology based on the company's statistical data. This parameter is an objective quantitative representation of the project implementation results.

CEF_y = Carbon dioxide emission factor for projects of power loss reduction in power transport networks of Ukraine. This value objectively reflects specific carbon dioxide emissions due to power losses during transportation. Using such factors is a common practice when estimating JI projects. Only officially approved factors have been used for estimation.

Scheme of data collection and data management is provided in Section D.3.

Emission reduction units verification will be based on annual data. Responsible for documentation and submission to Accredited Independent Entities (AIEs) is Ltd "EES".

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proamount of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. PE_y	Greenhouse gasses project emission	Greenhouse gases emission monitoring	tCO2e	c	yearly	100 %	Electronic and paper	

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

The mission reduction will be achieved by reducing power losses in the company's power grids which in its turn will be achieved as a result of the project implementation.

Since the baseline emissions are calculated based on difference between of power loss before and after the project implementation, consequently the project emission will equal zero.

$$PE_y = 0$$

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	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proamount of data to be monitored	How will the data be archived? (electronic/ hard copy)	Comment
5. BE_y	Baseline emissions	Greenhouse gases emission monitoring	tCO2e	c	annually	100 %	Electronic and paper	
3. V_y	Power loss reduction in power distribution system during period *y*	Greenhouse gas emission monitoring	MWh	c	annually	100 %	Electronic and paper	Calculated in line with approved methodology ($V_y = \Delta A^{emissions}_{ALamount}$, see Annex 3)
4. CEF_y	t CO_2 e emission factor in UES of Ukraine for the the power replacement projects in the year y	Default value	t CO_2e/MWh	e	annually	100%	Electronic and paper	

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

Therefore, the baseline emissions are:

$$BE_y = V_y \cdot CEF_y, \quad (1)$$

where

BE_y = baseline emissions (tCO2e);

V_y = total technical loss reduction in the power distribution system during the period *y* of the project scenario compared with the baseline, MWh;

CEF_y = CO_2 emission factor in UPS of Ukraine for the the power replacement projects in the year y, tCO_2e/MWh;

y = the year for which estimates are made.

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

Not applicable

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	Proamount of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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):

Not applicable

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

Increase of the greenhouse gas emission outside the project, which may be caused by the project activity is not anticipated.

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	Proamount of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

Not applicable

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

Emissions reductions are defined by the following equation:

$$ER_y = BE_y - (PE_y + LE_y), \quad (2)$$

Where:
ER_y = emission reduction during the year y, t CO2e;
BE_y = baseline emission of the greenhouse gases in the year y, t CO2e;
PE_y = greenhouse gases emission caused by the project activity in the year y, t CO2e;
LE_y = escape emission in the year y , t CO2e.

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

The project implementation does not require gathering of information on the influence on the environment in excess of information collected at the company prior to the project inception.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.1.1.3.4	low	Defined according to the approved methodology as in Appendix 3 based on the company's statistical data
Table D.1.1.3.5	low	Only officially approved factors have been used for estimation

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

The monitoring plan does not anticipate any additional measures neither of any measuring equipment installation nor of any additional parameters collection, except those that are being taken in the company. Data collection scheme according to the monitoring plan is shown on the Figure 4.

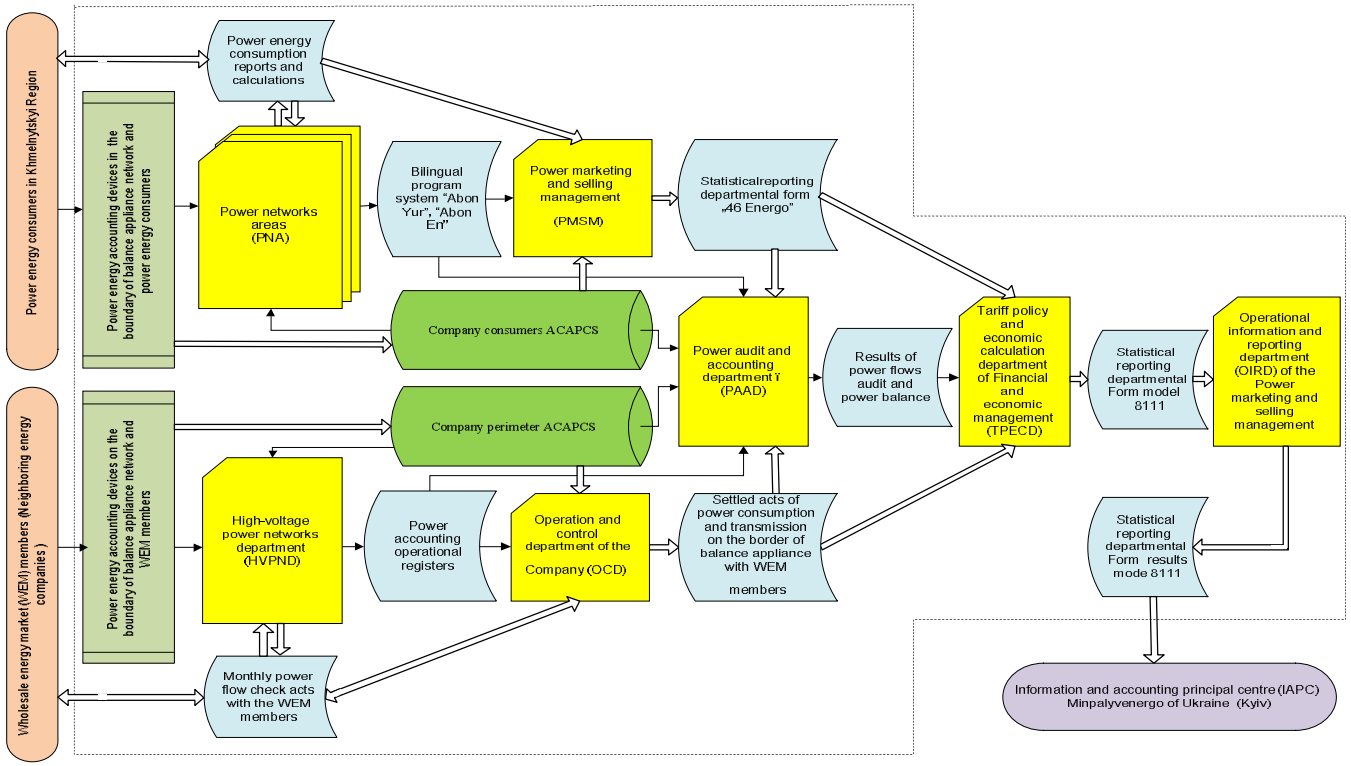

Figure 4 Scheme of data collection for the monitoring of the project parameters

Actuality of factor of specific indirect carbon dioxide emissions associated with the consumption of electricity during its transmission by power grids of Ukraine will be reviewed annually representatives Technical Consultant Ltd “EES”. If necessary, the coefficient will update.

All the necessary calculations for greenhouse gas emissions data collected by PJSC "Khmelnitskoblenergo" transferred to the technical consultant of the project. Technical adviser in turn, is responsible for payment reduction and processing periodic monitoring reports.

All the key data to be monitored and are necessary for the project determination are duplicated in different forms and reporting and will be kept for two years after the last transfer of ERUs the project. The Company PJSC "Khmelnitskoblenergo" embedded system archiving documents in specially equipped premises and archiving electronic data by duplicating the relevant servers.

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

Khmelnytskoblenergo PJSC (Project Paticipant)

Ltd “Ekologichni Energetychni Systemy” (not Project Participant)

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

According to D.1.1.2

$PE_y = 0$

E.2. Estimated leakage:

Leakage is not expected.

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

Since the leakage LEy = 0, and the project emissions $PE_y = 0$ the sum of the leakage and project emissions $PE_y + LE_y = 0$.

E.4. Estimated baseline emissions:

Estimate of the baseline emissions was done according to the formulae shown in D.1.1.4.

Results of the calculation are shown in the table below. The calculations are in the «ХМ-1БТВЕ-2002-2010-18-09-2011-Km-ok-КП.xls» file, attached hereto.

In Table 6 estimated baseline emissions are shown.

Table 6. Baseline emissions

Year	*BEy* Greenhouse gases baseline emission (tonnes of CO2 equivalent)
2004	68429
2005	177229
2006	202596
2007	206635
Total for 2004-2007:	**654889**
Average amount of emissions in 2004-2007:	**163722**
2008	256864
2009	250141
2010	240446
2011	249107
2012	249107
Total for 2008-2012:	**1245665**
Average amount of emissions in 2008-2012:	**249133**
2013	249107
2014	249107
2015	249107
2016	249107
2017	249107
2018	249107
2019	249107
2020	249107
2021	249107
2022	249107

2023	249107
2024	249107
2025	249107
Total for 2013-2025:	**3238391**
Average amount of emissions in 2013-2025:	**249107**
Total for 2004-2025:	**5138944**
Average amount of emissions in 2004-2025:	**233588**

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

Emission reductions are calculated according to the formula (3) above. The results are shown in the table 7 below.

Table 7. Emission reductions

Year	*PEy+ LEy*	*BEy*	*ERy*
	Sum of the project leakage and emissions	**Estimated baseline emissions**	**Estimated emission redactions**
	tCO2e	**tCO2e**	**tCO2e**
2004	0	68429	68429
2005	0	177229	177229
2006	0	202596	202596
2007	0	206635	206635
Total for 2004-2007:	**0**	**654889**	**654889**
Average emissions amounts 2004-2007:	**0**	**163722**	**163722**
2008	0	256864	256864
2009	0	250141	250141
2010	0	240446	240446
2011	0	249107	249107
2012	0	249107	249107
Total for 2008-2012:	**0**	**1245665**	**1245665**
Average emissions amounts 2008-2012:	**0**	**249133**	**249133**
2013	0	249107	249107
2014	0	249107	249107
2015	0	249107	249107
2016	0	249107	249107
2017	0	249107	249107
2018	0	249107	249107
2019	0	249107	249107
2020	0	249107	249107
2021	0	249107	249107
2022	0	249107	249107
2023	0	249107	249107
2024	0	249107	249107

2025	0	249107	249107
Total for 2013-2025:	**0**	**3238391**	**3238391**
Average emissions amounts 2013-2025:	**0**	**249107**	**249107**
Total for 2004-2025:	**0**	**5138944**	**5138944**
Average emissions amounts 2004-2025:	**0**	**233588**	**233588**

E.6. Table of values obtained from the aforementioned formula:

Year	*PEy* tCO2e	*LEy* tCO2e	*BEy* tCO2e	*ERy* tCO2e
2004	0	0	68429	68429
2005	0	0	177229	177229
2006	0	0	202596	202596
2007	0	0	206635	206635
Total for 2004-2007:	**0**	**0**	**654889**	**654889**
Average reductions 2004-2007:	**0**	**0**	**163722**	**163722**
2008	0	0	256864	256864
2009	0	0	250141	250141
2010	0	0	240446	240446
2011	0	0	249107	249107
2012	0	0	249107	249107
Total for 2008-2012:	**0**	**0**	**1245665**	**1245665**
Average reductions 2008-2012:	**0**	**0**	**249133**	**249133**
2013	0	0	249107	249107
2014	0	0	249107	249107
2015	0	0	249107	249107
2016	0	0	249107	249107
2017	0	0	249107	249107
2018	0	0	249107	249107
2019	0	0	249107	249107
2020	0	0	249107	249107
2021	0	0	249107	249107
2022	0	0	249107	249107
2023	0	0	249107	249107
2024	0	0	249107	249107
2025	0	0	249107	249107
Total for 2013-2025:	**0**	**0**	**3238391**	**3238391**
Average reductions in 2013-2025:	**0**	**0**	**249107**	**249107**
Total for 2004-2025:	**0**	**0**	**5138944**	**5138944**
Average reductions in 2004-2025:	**0**	**0**	**233588**	**233588**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The analysis of the environmental impacts of the project is done by the specialized companies. They also issued documents in which there is the estimation of emissions into the atmosphere by permanent sources - industrial areas (mechanical, welding, woodworking enterprises etc). According to the expert's report this enterprise belongs to the 3rd group, as its emissions do not exceed emissions limit. Due to the low level of emissions, the enterprise meets the pollution standard and its risk level is considered as harmless to the environment.

Aiming at increasing efficiency of the operating plans of harmful environmental impacts restriction, every year all the energy objects of the enterprise are subjected to complex verification, held by the State Ecological Inspection in Khmelnytskyi Region, as to check whether they abide the environmental legislation, to estimate the technical condition of the power plants and the general condition of the environmental protection, to check whether they take appropriate measures to minimize emissions, water discharge and wastes

Ecological audit of the enterprise is submitted to: The State Department of water economy in Khmelnytskyi Region – quarterly and yearly report on water usage; The State Statistics Department - the report on the environmental protection expenses and the ecological payments for the year (№1-Ecological expenses), report on wastes management for the year (№1-Wastes).

In accordance with the laws of Ukraine "On fire safety" and "On environmental protection", aiming at organization and control of meeting the requirements of the regulatory documents on fire and ecological security, taking organizational and other kinds of measures for preventing fires, reduction of the harmful impact of the production factor on the environment, life and health of the workers; coordination and improvement of the work, connected with fire and ecological safeguarding in the company units ,- in 2006 *Environmental protection and fire safety service* was created, which consists of: a service chief, an engineer and a technician. The main tasks and functions of the *Service* are:
- to conduct the internal fire and ecological safety audit in the administration of the Company and in the military and industrial complex to check their conformity with the regulatory acts;
- coordination of the fire-preventive work, organization of the complex measures elaboration to improve fire and ecological security, control of their performance;
- methodological management and control in the sphere of fire and ecological;
- registration of fires and accidents having impact on ecology, analysis of causes and their prevention;
- elaboration of the effective system of the environmental protection management;
- introduction of the achievements in science and technics, progressive and environmentally sound technologies into the manufacture;
- to hold meetings, seminars, conferences on ecological security;
- organization of briefings on fire and ecological security for the employees who are accepted on a permanent or temporary job;
- providing with the national, sectoral and intersectoral regulatory acts on fire and ecological security;
- organization of the complex measures elaboration to improve fire and ecological security, control of their performance;
- to prepare the project orders, decrees, information materials on fire and ecological security and to bring the to the knowledge of the subunits;
- propagation of fire and ecological security;
- control the abidance by the legislative and other kinds of regulatory acts on fire and ecological security, fulfilment of orders, directions and the requirements of the instructions and ordinances of the State and internal monitoring;

- organization of the official investigation of fires and accidents;
- make reportings according to the set forms;
- ensuring the appropriate issuance and keeping of documentation according to the standard practice;
- consideration of the letters, applications, complaints from the employees and other organizations as to the keeping the laws on environmental protection and fire security.

The project will not result in significant environmental impacts in addition to reducing greenhouse gas emissions.

The project activities will not have transboundary environmental impacts.

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:

According to the standard mass threshold for identification of hazardous substances of high-risk determined by the Resolution of CMU №956 of 11th of July, 2002, the specialized organization has defined the categories of equipment having characteristics that refer them to the hazardous substances (Form SHR-1). These are toxic substances of the 3rd group (harmful for people and the environment), namely: nickel compounds (fine-dispersed powder), quicksilver and its compounds, lead and its compounds, sulfuric acid, which can be found in fluorescent lamps and storage batteries; and of the 1st group (explosive substances), namely: combustible gasses and highly inflammable substances, that can be found in machinery and pipilenes of the 2 warehousesof fuels and lubricants and gas boiler houses.

Within the project activities there were installed electrical equipment containing in its composition insulating gas (SF6) which is a toxic gas. In the operation insulating gas dose not loose its properties, so after the life of the equipment or in case of its decommission for other reasons, insulating gas is disposed by pumping-out and then re-used in new equipment. To prevent unauthorized leaks of insulating gas at all the sites where relevant equipment is present the sensors of insulating gas leaks are installed.

There are specially equipped places on the enterprise for storage of such equipment, which are inspected and adjusted by the appropriate resolutions of the sanitary-and-epidemiological control and environmental protection bodies. Resolution of the State sanitary-and-epidemiological examination - №187 of 29th of June, 2010.

Measures preventing harmful environmental impact of carbon oxide and nitric oxide escaping from boiler houses:

- exploitation of boilers according to the regime map;
- prohibition to regulate units and blocks of the equipment on one's own;
- timely carrying out of the technical inspection according to the recommendations of the equipment manufacturer;
- periodical quality control of the combustion materials to detect the exceeding limits of emissions;
- control and registration of gross emissions.

Measures preventing harmful environmental impact of fumes of highly inflammable substances from fuels and lubricants namely :

- timely carrying out of the technical inspection according to the recommendations of the equipment manufacturer;
- intensification of the control over the technological regime of the equipment, evolving emissions;
- reducing the burden of the equipment.

According to the registration card№ 391 of 07.04.2010 the enterprise is one of the waste generation objects (WGO) and according to the permission it temporarily holds the wastes within the set limits (before their

utilization or removal) by the specialized enterprizes. The enterprise does not utilize any wastes apart from processed engine oils, which are used in tractors hydraulic systems and hoisting apparatus.

The main part of scrap metal is formed by exploitation of transformer substation, a part of which after refitment and regeneration of transformer oil is put into operation again and other part which is beyond repair and its regenerated oil is unfit, is discharged and submitted for utilization to the specialized enterprises according to concluded agreements.

During 7 years starting from 2004 out of 2805 transformer substations (TS) submitted to refitment: 1501 TS are repaired and put into operation again; 1301 TS (638190 kg) are discharged and submitted for utilization; 4200 kg of unfit oil is discharged and submitted for utilization.

SECTION G. Stakeholders' comments

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

The stakeholders in the realization of the project are the inhabitants of Khmelnytsk Region who were informed about the project through the mass-media, and also "Academy energetics of Ukraine", Ukrainian public organization.

Reduction program of TPL in the networks of the Company is permanently shown in the regional press and on television.

The tasks of TPC (TVE) reduction in Khmelnytskoblenergo PJSC have found its reflection in the Complex energy saving program of Khmelnytskyi Region till 2010.

Thus the TPC (TVE) reduction work of the Company is regularly dwelled into in the television programme "Energotyzhden" and also during the live television and radio broadcasts, where people have an opportunity to talk with the administration of JSC EC "Khmelnytskoblenergo". The achievements and the experience of the Company in TPC (TVE) reduction are enlightened in the regional newspaper "Podilski Visti" as well as in the short-run newspaper of Khmelnytskoblenergo PJSC "Energia".

The workers of the Company also published their articles in the specialized national journals, namely: "Elektrychni merezhi ta system", "Novyny energetyky", as well as in a quarterly science and technical journal "Energozberezhennya podillia".

On the basis of Khmelnytskoblenergo PJSC special seminars and conferences were held under the aegis of the Ministry of Fuel and Energy of Ukraine, NERC of Ukraine, which were directly connected with the technological power consumption and with the introduction of automatized systems of electric power commercial accounting.

The information about the TPC (TVE) reduction work is shown in the official site of Khmelnytskoblenergo PJSC www.hoe.com.ua.

The research work on the TPC (TVE) reduction in the electric networks of the power supply companies of Ukraine is the main point in the activity of Khmelnytskyi regional department of Ukrainian Academy of energetics (UAE). The TPC (TVE) reduction work of Khmelnytskyi regional department of Ukrainian Academy of energetics (UAE) on the basis of Khmelnytskoblenergo PJSC was considered and approved by the UAE presidium and has received recommendation for the spread of experience in other regions of Ukraine.

No negative stakeholders' comments were received on company adress.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

See Section B

1. Key information and data used for baseline setting

ID number	Description	Data variable
Table D.1.1.3.3.	Total reduction of technical power losses in the power grid during the period y of the project scenario compared with the baseline scenario	V_y
Table D.1.1.3.4.	Carbon dioxide emission factor for projects of power loss reduction in power transport networks of Ukraine	CEF_y

2. Emission factor in the Ukrainian ECO (tonnes of CO2 equivalent)

NATIONAL ENVIRONMENTAL
INVESTMENT AGENCY OF UKRAINE

ORDER

Kyiv

28.03.2010 № 43

About indices confirmation,

of carbon dioxide specific emissions in 2010

In order to execute clause 2.1 of the decree dated 21.03.2011 № 39 " About the carbon dioxide specific emissions, during power production on power plants and its consumption , calculation methodology confirmation" and to normalize the calculation of carbon dioxide specific emissions, during power production on power plants and its consumption,

Hereby I decree:

1) To establish the following indices of carbon dioxide specific emissions in 2010:
   - carbon dioxide specific emissions, during power production on the thermal electric power station, that are linked with the Unified Energy System of Ukraine - 1,067 kg CC>2/kW*h;
   - indirect carbon dioxide specific emissions during power consumption by users that refer to the 1class according the Users class determination arrangement, approved by the NERC of Ukraine decree of 13.08.1998 № 1052 - 1,093 kg C02/kW*h;
   - indirect carbon dioxide specific emissions during power consumption by users that refer to the 2class according to the Users class determination arrangement, approved by the NERC of Ukraine decree of 13.08.1998
   - № 1052 - 1,225 kg C02/kW*h;

- indirect carbon dioxide specific emissions, connected with the power losses during its transmission by the local networks - 1,093 kg C02/kW*h.

2) Carbon dioxide specific emissions indices in 2010, that were indicated in the clause № 1 of the given decree, are recommended to be used during the preparation of:
   - project proposal concerning anthropological GHG emissions reduction, project technical documentation, emissions reduction scopes annual reports, that are worked out according to "Projects, directed on the anthropological GHG emissions reduction preparation, examination, approval and realization order", sanctioned by the Ukraine Cabinet of Ministers decree of 22.02.2006 № 206 ;
   - GHG planned emissions reduction calculations, that are worked out according to the Order of projects examination, approval and realization, directed on the ecological investments, and proposals concerning suchlike projects, and obligations discharge by the parties of Kyoto protocol to the UN Framework Convention on Climate Change, sanctioned by the Ukraine Cabinet of Ministers decree of 22.02.2008 № 221, and actual GHG emissions, as the result of suchlike projects realization, reduction calculation.

3) Kyoto protocol flexible mechanisms administration (Shevchenko O.V) and Ecological investments and market development scheme administration (Yermakov V.M.) are to be directed by this decree during the JI and ecological investments projects documents verification.
4) GHG national accounting system administration (Khabatu'k O.P.) is to be directed by this decree during the JI projects, that are verified according the Instruction about the procedures concerning JI documents examination and arrangement, sanctioned by the Nacecoinvestagenstvo decree of 08.12.2010 № 184.
5) Public relations and mass media department (Zaets' I.V.) is to ensure this decree placement on the Nacecoinvestagenstvo web site.

Reorganization commission chairman  I.Varga

Annex 3

MONITORING PLAN

Detailed description of the monitoring plan presented in Section D of this PDD. The Methodology of technical power losses amount determination, in 0.38-150 kV power grids power supply company for the indirect carbon dioxide emission estimation that has been used to monitoring plan develop presented below.

Ltd " EKOLOGICHNI ENERGETYCHNI SYSTEMY "

THE METHODOLOGY

OF TECHNICAL POWER LOSSES AMOUNT DETERMINATION, IN 0.38-150 kV POWER GRIDS POWER SUPPLY COMPANY FOR THE INDIRECT CARBON DIOXIDE EMISSION ESTIMATION

Lviv
2011

PREFACE

1	ORDERED	Ltd " Ekologichni Energetychni Systemy "
2	DEVELOPED	OJSC " LvivORGRES"
3	EXECUTOR	Y.Koval
4	COORDINATED	Energy conservation and management institution
		National technical university of Ukraine "KPI", A.Prakhovnyk

Chief executive officer

OJSC "LvivORGRES" I.Kavych

Chief operative officer

OJSC " LvivORGRES " V.Kondratenko

Quality manager

OJSC " LvivORGRES " V.Kaminskyi

Electrical department manager

OJSC " LvivORGRES " I.Lutsyk

Electrical department sector supervisor

OJSC " LvivORGRES ",

Responsible executor Y.Koval

APPROVED

Ltd " Ekologichni Energetychni Systemy " director

_____ Y.Schpak

"_____"_____2011

APPROVED

Energy conservation and management institution
National technical university of Ukraine "KPI"

_____ A.Prakhovnyk

"_____"_____2011

CONTENTS

THE METHODOLOGY

OF TECHNICAL POWER LOSSES AMOUNT DETERMINATION, IN 0.38-150 kV POWER GRIDS POWER SUPPLY COMPANY FOR THE INDIRECT CARBON DIOXIDE EMISSIONS ESTIMATION

1 APPLICATION

The methodology of technical power losses amount determination, in 0.38-150 kV power grids power supply company for the indirect carbon dioxide emissions estimation (hereafter – Methodology) is used for the determination of technical power losses amount in 150-0.38 kV power grids power supply company for the indirect carbon dioxide emissions estimation during the transportation and supply of power.

2 NORMATIVE REFERENCES

Law of Ukraine «On electric power engineering» as of October, 16 1997, № 575/97-VR with subsequent amendments.

NST 6570-96 Electric counters of active and reactive power, motor meter. General technical conditions.

ISO 14064-1:2006 Greenhouse gases - Part 1: Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals.

Electrical equipment arrangement regulations. Chapter 1.5 Electric power calculation.

Regulations of electric power usage, are sanctioned by Electric power engineering regulation national committee decree as of 31.07.96 №28 (with supplements and changes as of 17.10.2005 № 910)

The methodology of carbon dioxide specific emissions, during power production and its consumption, estimation is sanctioned by the National agency of ecological investments decree of

March, 21 2011 № 39

GND 34.09.104-2003 Power balance structure in the 0,38-150 kV power grids, arrangement methodology, balance components analyses and technological power losses normalization.

Alteration № 1 to GND 34.09.104-2003 Power balance structure in the 0,38-150 kW power grids, arrangement methodology, balance components analyses and technological power losses normalization.

GND 34.09.203-2004 Power losses for 35-750 kW substations personal needs normalization and 6-10 kW distributive points.

Instructions to the power accounting procedure (Appendix 10 to the Contract between Wholesale Power Market members) approved by the Annual assembly on 21.02.2003 and by NCER Decree dated 30.05.2003 with subsequent amendments.

Instruction on compilation, reporting, and analyses of departmental 1B-TVE reporting form data "Power balance structure and technological power losses for the transition on power grids ", sanctioned by the Ministry of electrification and power engineering of Ukraine, on September, 09 1997.

Form № 67 – "Report on consumers electric power accounting system organization as of 01.01.20__ and about establishment in the consumers power grids and power transition organizations of automated power accounting systems and local data collecting and processing equipment (LDCPE)", sanctioned by the Ministry of fuels and energy of Ukraine decree of July, 01 2008 № 352 in the concordance with Ukrainian State Committee on Statistics.

3 TERMS AND NOTIONS

The following are terms used in this method and definition of concepts designated by them:

3.1 power return

The electric energy amount, that is returned by the licensee transferor and consumer and also lost for the economic needs

3.2 power issue (consolidated income) into the grid

The electric energy amount, which consists of the values sum of power for consumers return, for economic needs and reporting value of technical power losses, according to GND 34.09.104-2003

3.3 power losses for economic needs of local grids

Power consumption under the average purchase price for the ensuring of licensed activity on the transmitting and supply of power (power supply under the regulated tariff according agreement, concluded between the supplier and consumer (legal entity) respectively with the requirements of "Rules of power usage ", is not realized) , according to the GND 34.09.104-2003

3.4 power transmitting organization (licensee-transferor)

Economic entity, that received the NERC license for the right to go into business of power transmitting by the transnational power grids or by local grids, as well as power suppliers under the regulated tariff, that carry out their activity on the settled territory, according to GND 34.09.104-2003

3.5 **power characteristics**

The aggregate data reflecting the power balance structure of a power supply company in the reported year.

3.6 **power supply company**

A power transporting company transporting power by local power grids and supplying it at regulated tariff in a fixed area.

3.7 reported relative technological power losses in power grids

Quotient determined in the percent from the division of reporting value of technological power consumption and issue value of power into the grid, according to GND 34.09.104-2003

3.8 reported value of technological power losses in power grids

Power amount, that is determined by the difference between the sum of income value and sum of power return value, that are determined under the indices of calculated power account means, according to GND 34.09.104-2003

3.9 reported value of technological power consumption for substation and distributive points own needs

Constituent part of reporting value of technological power consumption that is equal to the power amount, lost for the substation and distributive points personal needs, that is determined under the indices of calculated power account means, according to GND 34.09.104-2003

3.10 Value of nontechnical power losses in the power grids

Constituent part of reporting value of technological power consumption (for the – conditionally reporting value of technological power consumption), that is equal to the difference between reporting value of technological power consumption and normative value of technological power consumption according GND 34.09.104-2003

3.11 reduction factor (scaling)

The quotient of the division of a power sale total for the reported year by that of the previous or following year.

3.12 conservative approach

The approach when selecting the TVE component calculation option used for CO2 emission reduction estimation only those options are taken into account aimed at reducing the resulting amounts of TVE components.

3.13 main power grid

Power grid, used for power transmitting from the producer to the linking points of local grids, according to the Law of Ukraine «On electric power engineering»

3.14 power grid

Collection of electrical equipment for power transference and distribution, according the Law of Ukraine «On electric power engineering»

3.15 metrological power losses

Constituent of the nontechnical power losses, stipulated by the power income and return measuring errors, according GND 34.09.104-2003

3.16 local power grid

Joined power grid, aimed at power transfer from the transnational power grid to the

consumer, according the Law of Ukraine «About electric power engineering»

3.17 power receipt

Power amount, received by the licensee-transmitter under the balance belonging from the neighboring licensee-transmitters, generating sources and power consumers substations, according to GND 34.09.104-2003

3.18 GHG indirect emissions (energetic mediated GHG emissions)

GHG emissions during power production, that is used by the economic entity or physical entity from the power grid, according to ISO 14064-1:2006

3.19 Non-technical power losses in the power grids

Part of the reporting technological power consumption, that arises during the power supply and is stipulated by the errors of income and power return measurement by the accounting devices, as well as power return understatement for the consumers at the actual payment with the use of retail prices for the electricity, errors during the determination of power consumption amount for the calculated month at the weighted values of power consumption by the consumers without power accounting devices indices taking down, in this calculated period, nonsimultaneous power accounting devices taking down, seasonal component presence and accounting devices with the estimation errors work, that excel their standard values, according to GND 34.09.104-2003

3.20 normative value of technological power consumption in the power grids

Reporting value of technological power consumption constituent, that is equal to the sum of technical calculated values in the power grids elements and normative power losses for the substations and distributive points personal needs, according to GND 34.09.104-2003

3.21 relative normative technological power consumption in the power grids

Quotient determined in the percent from the division of normative value of technological power consumption and issue value of power into the grid, according to GND 34.09.104-2003;

3.22 power transfer

Power transmitting with the help of grids under the agreement, according the Law of Ukraine «About electric power engineering»;

3.23 power supply

Consumer providing with the power with the help of technical means of power transportation and distribution under the agreement, according the Law of Ukraine «About electric power engineering»;

3.24 reference year

The year for which the components of the reported power balance structure are defined in accordance with the norms and used to reduce the power balance structure of the previous or following years to the same power characteristics

3.24 calculated period

Calendar section of time (month, quarter, year), predictable or reporting, for which the calculations of normative technological power consumption values, are carried out, according to GND 34.09.104-2003;

3.25 power accounting devices

Power accounting means, that are used for commercial calculations, according the Regulations of power usage;

3.26 power consumer

Economic entities and legal entities, that use power for their personal needs, under the agreement on its sell and purchase, according the Law of Ukraine «About electric power engineering»;

3.28 power balance structure

Licensee-transmitter indices system for the calculate period, that is composed on the ground of accounting devices indexes, and characterizes total power income, return, and transformation values with the spaces on every level and reporting value of technological power consumption structure, according to GND 34.09.104-2003;

3.29 neighboring power transmitting organization (neighboring licensee-transmitter)

Power transmitting company, that is the subject number two, on the balance belonging scale, between power transmitting organizations, according to GND 34.09.104-2003;

3.30 technical calculated power losses in the elements of power grids

Power amount, that is lost for the physical processes of grids elements current supply parts heating, during current running through them, magnetic wires heating and electric equipment elements constructions separate parts, and electricity line crown discharge, that is determined by calculation, taking into account definite conditions and assumptions, that are established by this normative document, according to GND 34.09.104-2003;

3.31 technological power consumption in the power grids

Power amount, that is equal to the sum of power losses in the power grids elements, that arise in them while power transfer, power losses for the substations and distributive points personal needs, and power losses for the glazed frost melting, accordint to GND 34.09.104-2003;

3.32 power transformation

Power amount that is transferred through the transformers from one level to the other in the scale of licensee-transferor grids, according to GND 34.09.104-2003.

4 ABBREVIATIONS

The following abbreviations were used in this methodology:

RVTVE – reporting value of technological power consumption in the power grids;

NPL – nontechnical power losses value in the power grids;

EM – electricity meter

LEP – transmission line;

NVTVE – normative value of technological power consumption in the power grids;

NERC	–	National Electricity Regulation Commission of Ukraine;;
NCTVE	–	normative characteristic of technological power consumption in the power grids;
PUE	–	Rules for electrical installation
TVE	–	technological power consumption in the power grids;
CT	–	current transformer;
VT	–	voltage transformer;

5 MAIN PRINCIPLES

5.1 Methodology of the specific emissions of carbon dioxide in the process of the power production by the thermal electric power stations and its consumption (hereinafter – DAEI methodology) determines the procedure and is used for carbon dioxide in the process of the power production by the thermal electric power station and its consumption by the final consumer specific emissions estimation, is lost while transmitting and supplying during GHG emission reduction estimation in the course of JI projects realization according the article 6 of the Kyoto protocol to UN framework convention on climate changes and other projects, directed on the GHG emissions reduction.

DAEI methodology contains directions as to the indicated indices values calculation arrangement and output data sources that are used in these calculations. Calculation of the indicated indices is carried out according thermal power stations activity actual results, transnational power grids operator, and power supply companies. Carbon dioxide emissions in the process of power consumption calculation or while its transfer and supply is based on the data concerning technological power consumption in the power grids.

According to DAEI methodology the data concerning technological power consumption in the power grids are accepted on the bases of annual report according the form 1B- TVE "Power balance structure and technological power consumption for the power transfer through the grids " (1B-TVE form).

Specific indirect carbon dioxide emissions for the electric power unit calculation that is used by the consumer and is lost for its transfer and supply should be carried out separately.

Specific indirect carbon dioxide for the electric power unit, that are lost for the its transfer and supply by the power supply company, are determined according the formula (6) of DAEI Methodology, in which the data as to the TVE in the 800-220 kV transnational grids are used, in the percent to the issue (consolidated income) of power into the network and data concerning TVE in the 150-0.38 kV power grids of power supply companies in the percent to the issue (consolidated income) of power into the grid according the form data 1-B TVE form for the respective year. So the use of the data of line 19 is expected “RVTVE percent from the power issue into the grid” form 1-B TVE.

5.2 GHG emission reduction estimation in the course of JI projects realization for the current calculated period (year) according to DAEI methodology is made through the means of difference

calculation between the basic emissions (for the basic year) and project emissions (for the current calculated year).

The peculiarity of the process of transmission and distribution is that the balance of power structure indicators (income and output power (total value and significance of voltage levels), transformation of energy between degrees of , RVTVE (total value and significance of voltage levels), NVTVE (total value and significance levels of voltage), calculated on the bypass power LEP and transformers for voltage levels and releasing (saldovane revenues) in the electricity network in different accounting periods (baseline and current) differ significantly among themselves, because changing the supply of electricity to consumers and the mutual flow of electricity between neighboring distribution companies. During the insignificant changes of technical characteristics of grids in the calculated periods, the scopes of transfer and power supply structure can change essentially, that is energetic characteristics of the object, concerning which the estimation of GHG emissions reduction in the course of JI projects realization should be made. Such estimation may be done correctly only under condition of object energetic characteristics providing, for the calculated periods to equal conditions. Object energetic characteristic, that is to be provided is the power balance structure according the form 1-B TVE "Power balance structure and TVE for the power transfer through the grids" for the respective year.

That important to note that chapter 8 data "Technical calculated power losses", chapter 9 "Normative power losses for substations personal needs", and chapter 10 "Normative TVE value" of forms 1-B TVE in different calculating periods were figured out according to requirements, that were in effect on that time, normative documents and should be adjusted to the normative base that is on effect nowadays.

Chapter 8 data "Technical calculated power losses" to March, 31 2004 were calculated according the requirements GKD 34.09.104-96 "TVE normalization for transference through 154-0.38 kV power grids. Methodical directions". In the period since April, 1 2004 till March, 31 2009 – according the requirements GND 34.09.104-2003, since April, 1 2009 and till present day - according the requirements GND 34.09.104-2003 with the consideration Change № 1 to GND 34.09.104-2003.

Chapter 9 data "Normative power losses for substations personal needs" to March, 31 2004, calculated according the requirements RD 34.09.208-81 «Instruction on the power consumption for 35-500 kV substations personal needs normalization», since April, 1 2004 and till present day - according the requirements GND 34.09.203-2004.

So, power balance structure on the form 1-B TVE for the respective years should be made according the data of form 1-B TVE 2010.

Power balance structure bringing to equal conditions on the form 1-B TVE should be made with the use of scoping coefficient, that is equal to 1 for the year 2010, being the reference year.

5.3 Applying the conservative approach, while it is evident, that grids technical characteristics in 2010, from the TVE point of view are more perfect, than in any previous calculated year, and to proceed from the fact that to calculate indices of chapters 8 and 9 of 1-B TVE forms for the previous calculated years with the use of data provided in chapters 1,2 and 3 and provided normative TVE (NCTVE) characteristics that is practically impossible because of necessity to

develop for each previous year NCTVE according to normative bases that is in effect at present day, data providing in chapters 8 and 9 should be made in the following way:

5.3.1. Variable technical calculated power losses in LEP (line 8.1) are equal to the value for 2010 on the respective power level multiplied by the calculated overplus transfused square through LEP for the respective previous year on the respective voltage level and divided by the square of calculated overplus transfused through LEP for 2010 on the respective voltage level;

5.3.2. Variable technical calculated power losses in transformers (line 8.3.1) are equal to the value for 2010 on the respective voltage level multiplied on the calculated overplus transfused square on transformers for the respective previous year on the respective level and divided on the square of calculated overplus transfused on transformers for 2010 on the respective voltage levels;

5.3.3. Conditionally-stable technical calculated power losses in transformers (line 8.3.2) for the respective previous year is considered equal to the value of 2010 on the respective voltage level; (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

5.3.4. Other conditionally-stable technical calculated power losses in other elements (line 8.4.3) for the respective previous year is considered equal to the value of 2010 on the respective voltage level; (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

5.3.5. Normative power losses for substations personal needs (chapter 9) for the respective previous year is considered equal to the value of 2010 on the respective voltage level (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

5.4. Reduction to equal conditions of the data in chapters 1, 2, 3 of the balance structure shall be made by using the reduction factor equal to 1 for 2010 and for other years the quotient from the division of the power sale in 2010 by the sale in the respective year. Such reduction, made by dividing the values in Chapters 1, 2, 3 for each year by the reduction factor, will be correct only if the following two conditions are simultaneously satisfied:

- relative values of power sale structure on voltage levels, calculated by Chapter 3 data as percentage of the power sale in 2010 and each other year are similar and do not have significant differences;
- reduction factor trend in 2010 and the previous years is stable, without sharp fluctuations and tends to decrease starting with 2010;

The decision to reduce the data in Chapters 1, 2, 3 of power balance structure to equal conditions is taken when the above conditions are satisfied. If not, only the data in Chapters 8 and 9 of 1-B TVE shall be reduced.

If the decision is made to reduce the data in Chapters 1, 2, 3 of the power structure balance to equal conditions the data are divided by the reduction factor. All other data of 1-B TVE form, besides those of Chapters 8 and 9 are calculated by the formulae given in the Instructions to reporting and analysis of the 1-B TVE form data.

The criteria of the 1-B TVE form data providing correction verification are as follows:

- equality of power sale into the grid values (chapter 18) for 2010 and respective previous

years;

- equality of reporting TVE percentage from the power issue into the grid (line 19) in forms 1-B TVE for the respective year before and after 1-B TVE form data providing.

5.5. In case of a change the territory of the energy supply company licensed to supply electricity at regulated tariffs, which took place as a result of its division and the formation of her new utility company in accordance with NERC's decisions and changes as a result, the structure of the balance of power in form 1B-TVE for the year in which was a division, and subsequent years after separation, may be required during the calculation of indirect carbon dioxide emissions, accounting reporting forms 1B-TVE utility company for part of the settlement period (the year in which the division took place, and prior to the year in which the division occurred).

5.6. For the years after 2010 the reduction of the data in Chapters 1,2,3 of 1-B TVE form to equal conditions is made using the reduction factor if such reduction was made for the years prior to 2010.

If the data in Chapters 1,2,3 of 1-B TVE form are reduced to equal conditions after 2010. the data in Chapters 8 and 9 are reduced as follows:

5.6.1. Variable technical calculated power losses in LEP (line 8.1) are equal to the value for the subsequent period on the respective power level multiplied by the calculated overplus transfused square through LEP for the respective previous year on the respective voltage level and divided by the square of calculated overplus transfused through LEP for the subsequent period on the respective voltage level;

5.6.2. Variable technical calculated power losses in transformers (line 8.3.1) are equal to the value for the subsequent period on the respective voltage level multiplied on the calculated overplus transfused square on transformers for the respective previous year on the respective level and divided on the square of calculated overplus transfused on transformers for the subsequent period on the respective voltage levels;

5.6.3. Conditionally-stable technical calculated power losses in transformers (line 8.3.2). other conditionally-stable power losses in other elements (line 8.4.3) and normative losses for substation own usage (Chapter 9) are taken as equal to reported values.

5.7. If the data in Chapters 1, 2, 3 of 1-B TVE form for the years after 2010 are equal to reported values than the data in Chapters 8 and 9 are also equal to reported values.

5.8 Total value in section 8, "Technical estimated energy losses" for all billing periods should be multiplied by coefficient of deterioration in electrical indexes over time, the value of which according to statements presented in [1], and Recommendations Appendix A [1] is taken no more than 1,15.

5.9. Structure of RVTVE in the main power grids 800-220 kV, relative value of which is used in the interest of power transmission to the grid (consolidated income) according to the formula (6) “Methodology of the specific emissions of carbon dioxide in the process of the power production by the thermal electric power stations and its consumption” to calculate specific indirect emissions

of carbon dioxide for the power unit, contains the technical calculated power losses in the grids, power consumption by the substations as well as the untechnical losses. Untechnical power losses in the main grids are conditioned by the metrological losses, which under the quantitative estimation of the structure of the untechnical losses are to be calculated on the basis of the actual metrological characteristics of the accounting devices. Thus RVTVE in the main power grids are such that are calculated by the power registration system with the actual metrological error and are considered as the indirect emissions of carbon dioxide.

The structure of the RVTVE in the local power grid 150-0.38 kV of the power supply company contains the technical calculation power losses in the grids, power consumption by the substations as well as the untechnical losses. Nontechnical losses in the local power grid of the power supply company are conditioned by the metrological losses as well as by others factors conditioned by the understatement (overstatement) of the power transmission to the consumers.

Metrological power losses in the process of the quantitative estimation of the structure of the untechnical losses are to be calculated on the basis of the actual metrological characteristics of the accounting devices. Peculiar feature of the system of power registration in the local grid 150-0.38 kV of the power supply company is the existence of hundreds of thousands of the accounting devices, actual metrological characteristics of which are unknown. That is why in the process of the quantitative estimation of the metrological losses only fixed metrological characteristics of the accounting devices must be used. The calculated metrological losses should be corrected taking into consideration actual metrological characteristics of the accounting devices of the same type, which are defined with the certain assumptions. As the result we obtain the component of the fixed metrological power losses.

The components of the untechnical losses, conditioned by the understatement (overstatement) of the power transmission to the consumers, arise:

- due to the power theft and to the errors in the process of calculation of the amount of the supplied power and compiling pay-lists;

- due to the technological reasons, connected with the procedure of the estimation of the amount of power supplied to the consumers, i.e. due to the calculation of the amount of power supplied to the consumers at the actual payment using the power retail prices without the pay-lists; usage of the average amounts while compiling the pay-lists; unsumuultaneous taking of indexes from the accounting devices as well as the existence of the seasonal component;

- due to the technical reasons, i.e: due to the errors of the accounting devices, which exceed their fixed indexes.

The first two components of the non-technical losses are conditioned by the power theft and by the drawbacks in the organization of the control over the power consumption and the payment. These losses form the part of RVTVE, conditioned by the faults of power supply organization. They are very difficult to formalize as this component of the nontechnical power losses is

predetermined by the social and organizational factors.

The component of the nontechnical power losses, conditioned by the faults of power supply organization cannot be considered as the indirect carbon dioxide emissions, because it is of untechnical nature.

The third component of the nontechnical power losses, connected with the work of the accounting devices with the measuring errors that exceed their fixed indexes, are to be estimated separately, according to the actual metrological characteristics of the accounting devices of the same type, which are defined with the certain assumptions.

Thus, RVTVE in the local power grid of the power supply company (data of the line 19 "The percentage of reporting TVE (RVTVE) from the power supply to the grid" form 1-B TVE) in the process of calculation should be transferred to the indirect carbon dioxide emissions taking into consideration the fixed metrological power losses and the component of the nontechnical power losses, conditioned by the faults of power supply organization.

5.10 According to the above mentioned the scheme of the putting of the power balance structure of the form 1B-TVE for the accounting periods to the equal condition and the scheme of RVTVE correction in the local power grid 150-0.38 kV of the power supply company to ensure the possibility of usage of the provided corrected RVTVE for the transmission of them to the indirect losses of carbon dioxide are to be worked out.

5.11 In the process of the development of the RVTVE correcting scheme the fact that NPL cannot be measured should be taken into consideration. They may be only calculated but with some error. The error depends not only of the power supply and transmission measurement errors in the process of RVTVE calculation, of the component of the nontechnical power losses, conditioned by the faults of power supply organization, etc, but also of the NVTVE calculation errors, and of the technical calculation power losses in the grids. The technical calculation power losses in the grids as well as the losses, conditioned by the measurement errors are the components of the power balance, and in the process of their analysis the interval estimations, which are based on the precision grade of registration devices are used. The literature review affirms that the defining of the errors of this or that measuring device of power losses accounting is usually used for the qualitative estimation of its acceptability. In the practical calculations, including the process of the NVTVE structure calculation, the results are provided as the determined indexes.

6 REDUCTION OF POWER BALANCE STRUCTURE DURING THE ESTIMATED PERIODS TO EQUAL CONDITIONS, AND RVTVE ADJUSTMENT IN THE 0.38-150 kV POWER GRID OF POWER SUPPLY COMPANY

6.1 Structure and principal power balance equations

6.1.1 According to the principles of GND 34.09.104-2003 the power balance structure is the system of the indexes of the power transmission organization (licensed-transmitter) within the calendar (computation) period, compiled according to the indexes of the accounting devices and characterizes the amounts of delivery, transmission and transformation of power and RVTVE structure.

6.1.2 RVTVE ΔA_{AL} is equal to the difference between the sum of the power delivery and the sum of power transmission to the licensed-transmitters (neighboring structural units), consumers as well as to the power for the proper needs, measured by the power accounting devices:

$$\Delta A_{AL} = A_D - A_T^{Neig} - A_T^C, \quad (1)$$

where ΔA_D - Amount of power delivered to the grid;

A_T^{Neig} - Amount of power transmitted to the neighboring licensed-transmitters;

A_T^C - Amount of power transmitted to the consumers and power used for the proper needs.

6.1.3 Delivery (consolidated delivery) of power to the grid A_{DG} is the amount of power transmitted to the consumers, used for the proper needs and for RVTVE

$$A_{DG} = A_T^C + \Delta A_{AL} \quad (2)$$

6.1.4 Reported relative technological power losses in the grids ΔA_{AL}^* are calculated in the interest as the quotient from the division of RVTVE and the amount of power delivery to the network:

$$\Delta A_{AL}^* = (\Delta A_{AL} | A_{DG}) \times 100\% \quad (3)$$

6.1.5 Untechnical power losses ΔA_{UT} is equal to the difference between RVTVE and NVTVE:

$$\Delta A_{UT} = \Delta A_{AL} - \Delta A_{NATPL} = \Delta A_M + \Delta A_K, \quad (4)$$

and consists of:

- amount of metrological power losses ΔA_M , calculated by the formula

$$\Delta A_M = \pm UB_D \cdot A_{DG}, \quad (5)$$

where UB_D - assumptive power unbalance in the grid;

- amount of the nontechnical power losses ΔA_K , produced in the process of power transmission and is equal to the difference between the amount of nontechnical power losses and the amount of metrological power losses:

$$\Delta A_K = \Delta A_{UT} - \Delta A_M . \quad (6)$$

6.2 **Power supply company official statistical reporting list containing input data for the RVTVE correction**

6.2.1 According to the principles of DAEI Methodology the calculation of indexes is carried according to the actual results of activity of the thermal electric power stations, of the main power grids operator as well as of the power supply companies. That is why in the process of calculation of RVTVE amount in the power grids of the company, that are transferred to the indirect carbon dioxide emissions only the data of the official statistical report should be used.

6.2.2 Reduction to equal conditions of the power structure balance is carried out using the data of the official statistical report of the power supply company according to:

- report form 1-B TVE "Structure of the power balance and the technological power losses in the process of its transmission in the power grids " within the year, which is compiled according to the Regulations of compiling and provision of reports and analysis of the data of the report form 1B-TVE;

- form No 67 – energo “Report of the organization of the active power registration system of the consumers as of 01.01.20__ and of the installation of the systems of the automatized power registration and the local devices of the data collection and processing in the consumers’ power grids and in the power transmission companies” within the year.

6.2.3 In case of absence of the data of the official statistical report of the year the usage of the estimated amounts, calculated by the substantiated assumptions is admissible.

6.2.4 Annual report data from the power supply company of the quantity of domestic power consumers.

6.3 Input data for the RVTVE correction

6.3.1 From the report form 1-B TVE "Structure of the power balance and the technological power losses in the process of its transmission in the power grids" data is used according to:

- power delivery to the grid, MW·h;

- power transmission to the consumers, MW·h;

- power transmission to the neighboring licenced-transmitters, MW·h;

- amount of RVTVE in the grid, MW·h;

- amount of NVTVE in the grid, MW·h;

- amount of NPL in the grid, MW·h;

- delivery (consolidated delivery) of power to the grid, MW·h;

- relative amount of RVTVE in the grid before delivery (consolidated delivery) of power to the grid, %.

6.3.2 From the form No 67 – energo "Report of the organization of the active power registration system of the consumers as of 01.01.20__ and of the installation of the systems of the automatized power registration and the local devices of the data collection and processing in the consumers' power grids and in the power transmission companies" the data of the amount of meters installed for the domestic users is used:

- single-phase induction meters of the appropriate accuracy class;

- three-phase induction meters of the appropriate accuracy class;

- single-phase electronic meters of the appropriate accuracy class;

- three-phase electronic meters of the appropriate accuracy class.

- data of the total amount of all the types of meters with the overdue term of the state control.

6.4 Reduction to equal conditions of power balance structure during the estimated periods in 1B-TVE form, for the periods prior to 2010

6.4.1 The reduction factor is calculated which is equal to one in 2010, for others previous computation years it is equal to the quotient of the division of the delivery (consolidated delivery) of power to the grid in 2010 (chapter 18 total) and the delivery (consolidated delivery) of power to the grid for the previous computation year (chapter 18 total).

6.4.2. The relative values of the power sale structure on voltage levels, calculated by Chapter 3 data as percentage of power sale of the respective year, are calculated for 2010 and each computation period.

6.4.3. Based on the analysis of the data calculated under 6.4.1 and 6.4.2 if the conditions of 5.4 are satisfied, the decision is taken on the reduction to equal conditions of the data from Chapters 1,2,3 of the power structure balance.

6.4.4. If the reduction to equal conditions of data in Chapters 1,2,3 and chapters 8 and 9 is to be made, then:

6.4.4.1 Amount of power delivery to the grid for the previous computation year in the chapter 1 (lines 1.1 – 1.12 in columns 10-15) is divided by the reduction factor.

6.4.4.2 Amount of the power transformation for the corresponding previous computation year in chapter 2 (lines 2.7 – 2.12 in columns 10-14) is divided by the reduction factor.

6.4.4.3 Amount of the effective power transmission for the corresponding previous computation year in chapter 3 (lines 3.1.1 – 3.1.10 and 3.2.1 – 3.1.11 in columns 10-16) is divided by the reduction factor.

6.4.4.4 Variable technical power computation losses in LEP (line 8.1 in columns 10-15) for the corresponding previous computation year are equal to the amount in 2010 (line 8.1 in columns 10-15) with the corresponding voltage degree multiplied by the square of the computation transference in LEP for the corresponding previous year (chapter 12 in columns 10-15) with the corresponding voltage degree divided by the square of the computation transference in LEP in 2010 with the corresponding voltage degree (chapter 12 in columns 10-15);

6.4.4.5 Variable technical power computation losses in the transformers (line 8.3.1 in columns 10-14) for the corresponding previous computation year are equal to the amount in 2010 (chapter 8.3.1 in columns 10-14) with the corresponding voltage degree multiplied by the square of the computation transference in the transformers for the corresponding previous year (chapter 13 in columns 10-14) with the corresponding voltage degree divided by the square of the computation transference in the transformers in 2010 with the corresponding voltage degree (chapter 13 in columns 10-14);

6.4.4.6 Conditionally-constant technical computation power losses in the transformers (line 8.3.2 in columns 10-14) for the corresponding previous computation year with the corresponding voltage degree are equal to the amount in 2010 (line 8.3.2 in columns 10-14) with the corresponding voltage degree; (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

6.4.4.7 Other conditionally-constant power losses in others units (line 8.4.3 in columns 10-15) for the corresponding previous computation year with the corresponding voltage degree are equal to the amount in 2010 (line 8.4.3 in columns 10-15) with the corresponding voltage degree; (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

6.4.4.8 Normative power losses for the proper needs of the substations (chapter 9 in columns 10-14) for the corresponding previous computation year with the corresponding voltage degree are equal to the amount in 2010 (chapter 9 in columns 10-14) with the corresponding voltage degree (for a leap year the Conditionally-stable technical calculated power losses in transformers shall be multiplied by 8784 hours and divided by 8760 hours).

6.4.4.9 The amount of power delivery (consolidated delivery) to the grid is verified (chapter 18) for the corresponding previous computation year, which should be equal to the amount of power delivery (consolidated delivery) to the grid (chapter 18) in 2010. If this condition is not fulfilled the error should be found.

6.4.4.10 The equality of the report TVE percentage of the power delivery to the grid is verified (line 19) in the forms 1-B TVE for the corresponding previous year before the reduction and after the reduction.

6.4.5. If only the data of Chapters 8 and 9 are to be reduced to equal conditions the calculation is done according to 6.4.4.4-6.4.4.8/

6.4.6 Technical calculated energy losses (line 8 in column total) is multiplied by a coefficient of deterioration in electrical indexes over time.

6.4.7 Data of the implemented forms 1-B TVE for the prior to 2010 calculation periods is used for the calculations in 6.6.

6.5. Reduction to equal conditions of power balance structure during the estimated periods in 1B-TVE form, for the periods following 2010

6.5.1. If the reduction to equal conditions is performed for the data from Chapters 1,2,3 of 1-B TVE form of the previous to 2010 periods, so for the subsequent periods the reduction factor is calculated equal to the quotient of the power sale in 2010 (Chapter 18 total) divided by power sale (Chapter 18 total) in the subsequent period.

6.5.2. The data in Chapters 1.2.3 and Chapters 8 and 9 are reduced to equal conditions as follows:

6.5.2.1. Amount of power delivery to the grid for the subsequent computation year in the chapter 1 (lines 1.1 – 1.12 in columns 10-15) is divided by the reduction factor.

6.5.2.2. Amount of the power transformation for the corresponding subsequent computation year in chapter 2 (lines 2.7 – 2.12 in columns 10-14) is divided by the reduction factor.

6.5.2.3. Amount of the effective power transmission for the corresponding previous computation year in chapter 3 (lines 3.1.1 – 3.1.10 and 3.2.1 – 3.1.11 in columns 10-16) is divided by the reduction factor.

6.5.2.4. Variable technical power computation losses in LEP (line 8.1 in columns 10-15) for the corresponding subsequent computation year are equal to the amount in 2010 (line 8.1 in columns 10-15) with the corresponding voltage degree multiplied by the square of the computation transference in LEP for the corresponding previous year (chapter 12 in columns 10-15) with the corresponding voltage degree divided by the square of the computation transference in LEP in 2010 with the corresponding voltage degree (chapter 12 in columns 10-15);

6.5.2.5. Variable technical power computation losses in the transformers (line 8.3.1 in columns 10-14) for the corresponding subsequent computation year are equal to the amount in 2010 (chapter 8.3.1 in columns 10-14) with the corresponding voltage degree multiplied by the square of the computation transference in the transformers for the corresponding previous year (chapter 13 in columns 10-14) with the corresponding voltage degree divided by the square of the computation transference in the transformers in 2010 with the corresponding voltage degree (chapter 13 in columns 10-14);

6.5.2.6. Conditionally-constant technical computation power losses in the transformers (line 8.3.2 in columns 10-14), other conditionally-constant power losses in others units (line 8.4.3 in columns 10-15) and normative power losses for the proper needs of the substations (chapter 9 in columns 10-14) are taken as equal to the reported values.

6.5.2.7. The amount of power delivery (consolidated delivery) to the grid is verified (chapter 18 total) for the corresponding subsequent computation year, which should be equal to the amount of power delivery (consolidated delivery) to the grid (chapter 18 total) in 2010. If this condition is not fulfilled the error should be found in the reduction of receipts, transformation and effective power transmission in 6.5.2.1-6.5.2.3.

6.5.2.8. The equality of the report TVE percentage of the power delivery to the grid is verified (line 19) in the forms 1-B TVE for the corresponding subsequent year before the reduction and after the reduction.

6.5.3. If the data in Chapters 1, 2, 3 of 1-B TVE form for the years after 2010 are equal to reported values. i.e. reduction using the reduction factor is not applied than the data in Chapters 8 and 9 are also equal to reported values.

6.4.6 Technical calculated energy losses (line 8 in column total) is multiplied by a coefficient of deterioration in electrical indexes over time.

6.5.5. The reduced data in 1-B TVE form for the subsequent to 2010 periods are used for calculation according to 6.6.

6.6 RVTVE correction procedure

6.6.1 Calculation of the admissible normative unbalance of power in the grid

6.6.1.1 The amount of the admissible non-balance of power in the grid UB_D is calculated according to the annex E GND 34.09.104-2003 using the formula:

$$UB_D = \pm\sqrt{\sum_{i=1}^{N_н} \delta_{нi}^2 d_{нi}^2 + \sum_{j=1}^{N_в} \delta_{вi}^2 d_{вi}^2}\ , \qquad (7)$$

where $\delta_{нi}^2\ (\delta_{вi}^2)$ - Correspondingly total relative error of the first (j) measuring complex which consists of the measuring current and transformers and a meter, which measures power delivery (transmission);

$d_{нi}^2\ (d_{вi}^2)$ - Amount of power, delivered (transmitted) through the first (j) measuring complex;

$N_{нi}$ - Amount of measuring complexes, used to measure the amount of power delivered;

$N_{вi}$ - Amount of measuring complexes, used to measure the amount of power transmitted.

While calculating the amount of power unbalance the calculation scheme provided in "Directions of the commercial power registration scheme" should be used.

6.6.1.2 The total relative error of the first (j) measuring complex is calculated using the formula:

$$\delta_i = \sqrt{\delta_{CTi}^2 + \delta_{TTi}^2 + \delta_{met}^2}\ , \qquad (8)$$

where δ_{CTi} - Relative error for the measuring current transformers of the first (j) measuring complex, which corresponds to the appropriate precision class, %;

δ_{TTi} - Relative error for the measuring current transformers of the first (j) measuring complex, which corresponds to the appropriate precision class, %;

δ_{met} - Relative error for the meter of the first (j) measuring complex, which corresponds to the appropriate precision class, %;

6.6.1.3 Portion of power delivered (transmitted) through the first (j) measuring complex on every current degree is calculated according to the data of the report form 1-B TVE of the power delivery and transmission to the neighboring licensed-transmitters and to the consumers with the with the corresponding degree.

6.6.1.4 Normative precision classes of the measuring complexes which are used for the registration of the power delivery and transmission to the neighboring licensed-transmitters and consumers while calculating the amount of the admissible normative unbalance are used according to the requirements of " Directions of the commercial power registration scheme" and chapter 1.5 PUE and are provided in the table 1.

Table1 - Set precision classes of the measuring complexes

ID number	Index	Name of equipment	Precision class, %
1	Set precision classes of the measuring complexes, used to register power delivery (all the degrees)	CT	0,5
		TT	0,5
		Meter	0,5
2	Set precision classes of the measuring complexes, used to register power transmission to the neighboring licensed-transmitters (all the degrees)	CT	0,5
		TT	0,5
		Meter	0,5
3	Set precision classes of the measuring complexes, used to register power transmission to the consumers with the degree 110 (150) kV	CT	0,5
		TT	0,5
		Meter	0,5

4	Set precision classes of the measuring complexes used to register power transmission to the consumers with the degree 35 kV	CT	0,5
		TT	0,5
		Meter	1,0
5	Set precision classes of the measuring complexes, used to register power transmission to the consumers with the degree 10(6) kV	CT	0,5
		TT	0,5
		Meter	2,0
6	Set precision class of the meters, used to register power transmission to the consumers with the degree 0,38 kV	Meter	2,0

6.6.1.5 The amount of the admissible normative power unbalance in the grid UB_{Dnorm} is calculated using the formula (7) under the condition that the metrological characteristics of the measuring complexes correspond to those provided in the table 1.

6.6.2 Calculation of the power non-technical losses component, conditioned by the existence of groups of the accounting devices of the same type, actual metrological characteristics of which differ from the normative ones

6.6.2.1 According to the data, provided in [2,3], the verification of the induction meters has shown that they have a low metrological reliability and exceed the bounds of the precision classes even during the interverification period.

Interverification period for the single-phase induction meters is 8 years, for the three-phase meters - 4 years.

6.6.2.2 Presuming that the average term of meters after the last repair is about 4 and 2 years, the average systematized error trend according to chapter [2,3] is about 0,2 relative units per year for both types of meters. Thus, the systematized error Δ_{met} for the induction meters of the corresponding type and precision class is calculated by the formula:

$$\Delta_{met} = -0,2 T_{ver} K_{met}, \text{ where} \quad (9)$$

T_{ver} - Meter service term after the last verification, years;

K_{met} - Meter precision class.

6.6.2.3 Systematized error for the electronic (statistic) meters $\Delta_{met} = 0$.

6.6.2.4 Using the conservative approach, the misregistration of power transmission is calculated only for the domestic consumers. Misregistration of power transmission for legal entities (industrial and non-industrial consumers) is equal to zero.

6.6.2.5 Misregistration of power transmission to the domestic consumers on one induction meter of the corresponding precision class, $A_i^{misregistr\ ation}$ per year is equal:

$$A_i^{misregistr\ ation} = (\Delta_{met} / 100) A_{aver}, \text{ where} \quad (10)$$

A_{aver} - Average annual power transmission to one domestic consumer.

6.6.2.6 Misregistration of power transmission to the domestic consumers, conditioned by the existence of accounting devices of the same type, the actual metrological characteristics of which differ from the fixed is equal to:

$$A_{misregistr\ ation} = \sum_{i=1}^{N_H} A_i^{misregistr\ ation} N_i, \text{ where} \quad (11)$$

N_i - Amount of induction meters of the corresponding type and precision class.

6.6.3 Calculation of the power non-technical losses component, conditioned by the existence of the sensitivity threshold in the inductive meters

6.6.3.1 Using the conservative approach, power misregistration is conditioned by the existence of the sensitivity threshold in the inductive meters, it is calculated only for the domestic consumers, where the most widespread meters of the precision class 2,5 are installed. According to the expert appraisal, it is presumed that the nominal current for 90% of the total number of such meters is 5A, and for the rest 10% - 10A. Misregistration of power transmission for the domestic consumers, equipped by the induction meters of precision 2,0 and 1,0, as well as for the legal entities (industrial and non-industrial consumers) is equal to zero.

6.6.3.2 Misregistration of power is conditioned by the existence of the sensitivity threshold in the inductive meters that is the minimal amount of current when the meter disc turns round constantly. Sensitivity threshold at State standard 6570 for the most widespread single-phase inductive meters of the precision class 2,5 is 0,85%. Total capacity of the devices of the domestic consumer (radiotelephones, radio and television equipment, etc, which are in the waiting mode) do not surpass the sensitivity threshold. The time, during which only the equipment which consume less than the sensitivity threshold is connected to the grid is more than 12 hours per day (night hours and the period when people are not at home during the working day). It is 4380 hours per year.

According to such assumptions, the misregistration of power for one single-phase meter of precision class 2,5 per year will be[3]:

$\Delta A_{misregistr\ ation\ 2.5} = -(U_{nom} I_{nom} T_t (0{,}85 / 100)$, where (12)

U_{nom} - Nominal current of the meter, 220 W;

I_{nom} - Nominal current of the meter, A;

T_t - Time, during which only the equipment which consume less than the sensitivity threshold is connected to the grid.

6.6.3.3 Misregistration of power transmission to the domestic consumers, equipped by the induction meters of the corresponding type , $A_{misregistr\ ation\ 2.5 sum}$ per year will be:

$\Delta A_{misregistr\ ation\ 2.5 sum} = \Delta A_{misregistr\ ation\ 2.5} N_{met\ 2.5}$, where (13)

$N_{met\,2.5}$ - Amount of single-phase inductive meters of precision class 2,5, for which the assumptions provided in chapter 6.4.3.1.are used.

If the data on 2.5 accuracy induction meters with nominal current 5A and 10A are missing, it shall be assumed that the amount of 5A meters is 90% while 10A meters are 10%.

6.6.4 Calculation of RVTVE amounts and untechnical losses

6.6.4.1 RVTVE amount $\Delta A_{ALamount}$, is calculated having reduced it by the absolute amounts of the misregistrations of power transmission to the consumers, conditioned by the existence of accounting devices of the same type, the actual metrological characteristics of which differ from the fixed and by the existence of the sensitivity threshold in the inductive meters:

$$\Delta A_{ALamount} = \Delta A_{AL} - \Delta A_{misregistr\ ation} - \Delta A_{misregistr\ ation\ 2.5}. \quad (14)$$

6.6.4.2 The amount of the relative RVTVE $\Delta A^*_{ALamount}$ is calculated using formula:

$$\Delta A^*_{ALamount} = (\Delta A_{ALamount} / A_{DG}) \cdot 100\%. \quad (15)$$

6.6.4.3 The amount of the relative NPL, is equal to the difference between the **relative** amounts of RVTVE and NVTVE:

$$\Delta A^*_{UTamount} = \Delta A^*_{ALamount} - \Delta A^*_{NATPL} \quad (16)$$

6.6.5 Calculation of the power untechnical losses component, conditioned by the faults in the power transmission organization

6.6.5.1 The relative amount of power untechnical losses component $\Delta A^*_{AUPLorg}$, conditioned by the faults in the power transmission organization, is calculated as the difference between the amount of the report relative TPL and the top bound of the admissible unbalance:

$$\Delta A^*_{AUPLorg} = \Delta A^*_{UTamount} - UB_{Dnorm}. \quad (17)$$

6.6.5.2 If the relative amount of the power untechnical losses component, conditioned by the faults in the power transmission organization $\Delta A^*_{AUPLorg}$, is more than zero, the amount of the of the power untechnical losses component, conditioned by the faults in the power transmission organization, MW·h. Is equal:

$$\Delta A_{AUPLorg} = A_{DG}(\Delta A^*_{AUPLorg} / 100) \quad (18)$$

6.6.5.3 If the relative amount of the power untechnical losses component, conditioned by the faults in the power transmission organization $\Delta A^*_{AUPLorg}$, is less or equals to zero, the amount of the of the power untechnical losses component, conditioned by the faults in the power transmission organization, MW·h. Should be equal to zero:

$$\Delta A_{AUOPLorg} = 0 \quad (19)$$

***6.6.6 Calculation of RVTVE* <u>for its transition to the indirect carbon dioxide emissions</u>**

RVTVE for its transition to the indirect carbon dioxide emissions, which is corrected according to the amount of the nontechnical power losses, conditioned by the faults in the power transmission organization; is equal to the difference between the amounts of RVTVE, calculated by the formula (14) and the amount of the nontechnical power losses component, conditioned by the faults in the power transmission organization, calculate using the formula (18) or (19):

$$\Delta A_{ALamount}^{emissions} = \Delta A_{ALamount} - \Delta A_{AUPLorg} \quad (20)$$

7. MONITORING OF TVE AMOUNT CALCULATION RESULTS IN 0.38-150 KV POWER GRID IN ORDER TO ESTIMATE INDIRECT CO2 EMISSIONS

The monitoring of TVE amount in 0.38-150 kV power grids of a power supply company used for estimation of indirect CO2 emissions for respective periods is performed by checking:

- compliance of the official statistic reports of the power supply company in 1-B TVE form, form No. 67 as well as annual report of the company for the respective year with the data used for calculation;

- compliance of the TVE amount calculation procedure to that of the given methodology.

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Annex 4

GENERAL CHARACTERISTICS OF ELECTRICAL NETWORK MODERNIZATION.

A. During the period of 2001 - 2010 in Khmelnytskoblenergo PJSC following works on modernization of power transmission and supply systems, connected with the reduction of technological power consumption (TPC (TVE)) were held:

1. In the distributive networks with voltage degree 0,4-10kV:

- **New transformer substations and electricity transmission lines were built:**
  Transformer substations TS-10/0,4kV - 113, with general power of 15570 kVA;
  Air ETL PL-10kV – total length 118,2 km;
  Cable ETL KL-10kV - total length 18,4 km;
  Air ETL PL -0,4kV - total length 102,6 km;
  Cable ETL KL -0,4kV - total length 9,15 km.
- **Operating transformer substations and electricity transmission lines were reconstructed and modernized:**
  Transformer substations TS-10/0,4kV – 229, general power - 39785 kVA;
  Air ETL PL-10kV – total length 179,8 km;
  Cable ETL KL-10kV - total length 39,6 km;
  Air ETL PL -0,4kV - total length 168,2 km;
  Cable ETL KL -0,4kV - total length 17,95 km;
  Unloading TS-10/0,4kV – 129, with general power of 16680 kVA;
- **Cable inlets for individual buildings were totally modernized (with substitution for isolated ones and with installation of power meters on the front of the building):**
  Single-phase inlets – 206 694;
  Three-phase inlets – 33 074.

- **Pilot projects of electricity networks 0,4-10kV modernization were realized:**

Modernization of the electricity networks in Netishyn , Letychiv and Stara Ushytsya promote TPC (TVE) reduction in case of increase of power consumption for electrical heating. Power accounting is held by multizone meters which enable the consumers to use power for electricity heating on reduced tariff at night and to reduce power network loading in rush hours.

Equipment suppliers and construction managers are – CJSC “Elektro”, MK “Mehkomplekt”, PJSC “Ukrelektroaparat” LLC “Ukrelektrokomplekt”, PJSC “Tavriya-elektro”.

- **Seasonal KTP 10/0.4 kV of passing type**
- **PL 10 kV and 0,4 kV of joint drop with outer light wire.**

Seasonal KTP 10/0.4 kV of passing type. Netishyn.

- **Inlet with isolated wire in the dwelling house with the inslallation of electricity meter in a separate box on the front of the building.**

Inlet with isolated wire in the dwelling house. Netishyn, Lisova street.

- **Air line bearing with the combined drop 10 kV and 0,4 kV.**

Powerline pole. Netishyn

Electrical networks are made of isolated wires;

- **Wire cut in the main areas should be 50 mm 2;**
- **Air lines longitude PL-0,4 kV should not exceed 400 - 450 m;**
- **In the construction of air lines 10 kV and 0,4kV, combined drop should be used;**
- **For the equipment which feeds the electrical heating systems seasonal operating regime is provided.**

Electrical networks reconstruction for electrical heating. Netishyn.

- **Sectional switch 0.4 kV for shifting in summer.**
- **The reconstructed electrical network 10kV has basic (permanently working) and seasonal (operating only in cold season) KTP 10/0.4kV. In summer power supply for consumers is carried out from the basic KTP by PLI 0.4kV by switching the sectional switches 0.4kV.**

Sectional switch 0.4 kV, Netishyn.

- **Reconstructed PL 10kV with the combined drop PL 0.4kV.**

PL-10kV in Netishyn, Lisova street

- **Double-transformer substation 10/0,4kV with double-sided feeding, cable inlets and 10kV and 0,4kV sectionizing**
- **In summer one transformer is switched off.**

Double-transformer substation 10/0,4kV Stara Ushytsya.

- **A section of the block of flats was put on electrical heating.**
- **Electronic electricity meters were installed outside the flats, in the well.**

Electronic power meters in Letychiv.

- **Electrical heating of the hospital and the sanatorium with the heat accumulation at night and its usage during the day.**

Electrical heating of the hospital and the sanatorium with the heat accumulation at night and its usage during the day. Stara Ushytsya.

2. In the high voltage networks 35-110kV of Khmelnytskoblenergo PJSC such equipment was commissioned (constructed, reconstructed, modernized):

2.1. High voltage substations with voltage transfotmation level 110/35/10kV;110/10kV.

- **Transformer substantions 35-110kV that were built and reconstructed:**

SS-110/10kV «Krystal» - with general power of 6300 kVA;
SS-110/35/10kV «Pivdenna», SS-110/10kV «Tsentralna», SS-110/35/10kV «Netishyn» – with general power of 91000 kVA;

- **The transformer equipment 35-110kV was mounted and replaced:**

Complete distributive equipment CDE-10kV (KM-1VM, KU-10) – 46;
Vacuum switches 10kV (VS/TEL-10, VR-1, VR-2) – 23;
Oily switches 110kV replaced for the gas-insulated (Siemens production) 110kV – 9;
Voltage suppressors (ABB production) 10kV – 66, 110kV – 12;
Disconnectors 10kV – 26, 35kV – 6, 110kV – 16;

Voltage transormers VT-10kV – 18;
Current transformers CT-10kV – 30; CT-110kV – 33; CT-35kV – 27;
Internal transformers– 22, with general power of 1156 kVA;
Power transformers– 8 with general power of 120200 kVA;
Oily switches 10kV replaced for the vacuum switches 10kV – 43;
Oily switches 35kV replaced for the vacuum switches 35kV – 9;
Valve dischargers 35kV, replaced for voltage suppressors 35kV, (ABB production)– 40;
Valve dischargers 110kV replaced for voltage suppressors 110kV (ABB production) – 36.

- **Transformer substations were modernized (technically refitted):**

SS-110/10kV «Mashzavod», SS-110/10kV «Ozerna» – with general power of 38600 kVA;

The modernization of the SS «Ozerna» foresaw the installment of the power transformer with general power of 6300 kVA, installment of the gas-insulated switch 110kV (Simens production) – 1, installment of the current transformer 110kV, discharger 110kV installment, installment of cells CDE-10kV 3-4 line sections.

- **Transformer substations equipment 35-110kV was technically refitted:**

Operation current cells (OCC-01) – 8;
Vacuum switches 10kV – 7;
Complete distributive equipment CDE-10kV (KM-1VM, KU-10) – 2;
Gase-insulated switches 110kV – 2;
Valve dischargers 10kV replaced for voltage suppressors VSP 10kV (ABB production) – 6;
Oily switches 10kV replaced for the vacuum switches 10kV – 289;
Oily switches 110kV (SS-110/35/10kV «Nova Ushytsya», SS-110/10kV «Stankozavod» SS-110/35/10kV «Gorodok»– 3;
Valve dischargers 110kV replaced for voltage suppressors 110kv – 18;

Building and reconstruction of the high-voltage substations 35-110 kV

SS-110/10 «Tsentralna». Access PL-110 kV to SS «Tsentralna».

SS-110/10 kV «Krystal». Gantry and line discharger after the installation.

SS-110/10 kV «Krystal». Power transformer 6,3 MVA after installation.

SS-110/10 kV «Tsentralna». VRU-110 kV . Replacement of the oily switch VMT-110 B for the gase-insulated switch 110 kV (Siemens production).

SS-110/10 «Tsentralna». VRU-110 kV. Installation of a gase-insulated switch (Siemens production).

SS-110/10 kV «Krystal». VRU-110 kV after the construction.

SS-110/10 kV «Tsentralna». VRU-110 kV after the reconstruction.

SS-110/10 kV «Tsentralna». Gase-insulated switch 110 kV(Siemens production)

SS-35/10 kV «Elevator». VRU-35 kV after the termination of construction.

SS-35/10 kV «Elevator». Power transformer (2,5 MVA) after the mending.

SS 110/35/10kV «Yarmoentsi». VRU-110

SS 110/35/10kV «Yarmolentsi». Gantry ETL-110.

SS 110/10kV «Dubovo». Cell 10kV after the reconstruction

SS 110/10kV «Dubovo». Cell 10kV after the vacuum switch installation

2.2. High-voltage electricity transmission lines, with the voltage degree 35 and 110kV:

- **New air electricity transmission lines (ETL) were constructed:**

PL-110kV – 2, total length 8,27 km. (PL-110kV Kam.Podilska-330-Boryshkivtsi is carried out with the wire AS-185, PL-110kV inlet and outlet to the SS «Krystal» is made with the wire AS-150);

PL-35kV – 2, total length 16,13 km. (PL-35 kV Antonitu – Chernelivka is made with the wire AS-95, PL-35kV inlet and outlet to the SS «Elevator» is made with the wire AS-95).

- **The wires of the air electricity transmission lines (ETL) were substituted:**

PL-35kV – 8, total length 29,504 km, from AS-50 for AS-95.

- **The pilot project on the ETL lightning protector was realized.**

In order to develop and improve the operating system of Khmelnytskoblenergo PJSC and to provide the electricity consumers with the regular power supply, the defective lightning protecting wire S-50 was substituted for the lightning protecting wire OKGT with the built-in fibre optic wire (NSW production, Germany) which functions as a lightening protector PL-110kV for Khmelnytskyi-Yarmolyntsi-Dunaivtsi-Kamyanets-Podilskyi with the total length of 122,65 km and ensures regular telecommunications between the regional centre (Khmelnytskyi) and the principal district centres of the southern part of Khmelnytsk region.

- **The capital refit of the electricity transmission lines was carried out:**

PL-110kV – 95, with total length of 1243 km was repaired;

PL-35kV - 147, with total length of 1651 km was repaired;

The isolation was substituted for PL-35 and 110kV - 26385 isolators;

The line PL-35 and 110kV was cleared on the area of 541,69 hectares with the total length of 283,35 km.

2.3. Equipment for high-voltage ETL and substations diagnostics according to the voltage degrees 35 – 110kV:

To improve the exploitation in the SDEO DVEM such equipment was purchased:

- infrared thermal imaging system for the equipment remote control;
- automatic device ADTR-2K for measuring the parameters of the fluid electrical-insulating materials;
- measuring complex KDZ-1 U to control the state of grounding devices;
- gase chromatograph “Kupol-55” for the chromatographical analysis of gasses, dissolved in the transformer oil;
- high-voltage, automatic axle of the alternating current CA7100-3 to measure the angle tangent of the dielectric losses, volume, voltage, frequency and current resistance;
- pyrometer FLUKE 572 for the remote control of the contacts;
- R-400 – device for partial discharge in insulation control;
- MIC-5000 – device for the electric insulation resistance, wetting and ageing measurement;
- MMR-600 – device for the small resistance values measurement;
- MRU-101 – device for the grounding appliances parameters measurement.

Equipment for high-voltage PL and substations diagnostics according to the voltage degrees 35 – 110kV.

Infrared thermal imaging system FLIR SYSTEM ThermaCam P-25

FLIR SYSTEM Sweden

Automatic device ADTR-2K for measuring the parameters of the fluid electrical-insulating materials

JV “Mikro-Kod” LTD, Lviv

Measuring complex KDZ-1 U to control the state of grounding devices

NDPKI “Molniya” (SPD FO Popovych V.L.)

Gase chromatograph “Kupol-55” for the chromatographical analysis of gasses, dissolved in the transformer oil

Izhevsk electromechanical works "Kupol", Russia

High-voltage, automatic axle of the alternating current CA7100-3 to measure the angle tangent of the

Pyrometer FLUKE 572 for the remote control of

dielectric losses, volume, voltage, frequency and current resistance

LTD "OLTEST", Russia

the contacts

LLC «Etalon-Prylad»

R-400 - device for partial discharge in insulation control

PVF «Vibri-Tsentr», Russia

MIC-5000 device for the electric insulation resistance, wetting and ageing measurement

«SONEL - Ukraine»

MMR-600 device for the small resistance values measurement

«SONEL- Ukraine»

MRU-101 device for the grounding appliances parameters measurement

«SONEL- Ukraine»

2.4. Metrological equipment for power and current transformers 0,4-10-35-110kV control.

The research laboratory of Khmelnytskoblenergo PJSC has produced the equipment meant for control over the power and current transformers of KVP SRZA DVEM group; usage of this equipment enables to reduce power losses by the detection and further substitution of defective power and current transformers.

In 2005 the stuff of Khmelnytskoblenergo PJSC have established the stationary control laboratory SCL-10 for the metrological control ever the power and current transformers 0,4-10kV.

In 2006 the transportable control laboratory was made TCL-110 for the metrological control ever the power and current transformers 0,4-10kV according to the place of their operation, the comparator SA-507 - for the metrological control ever the power and current transformers 0,4-10kV with TCL-110kV, the voltage transformer exemplary VT-6/10 - for the metrological control ever the voltage transformers 6-10kV, the current transformer exemplary CT-05 - for the metrological control ever the current transformers 0,4-110kV 15-600A, the current transformer exemplary CT -06 - for the metrological control ever the current

transformers 0,4-110kV 15-3000A.

In 2007 the voltage transformer exemplary was made VT-110 for the metrological control ever the voltage transformers 35-110kV.

During 2006-2008 electricity meters 0,4kV STEA-05, STEA-09 were installed, aiming at power registration for internal needs SS 110/35/10kV, this enabled to take control over the power losses of DVEM internal needs, as well as to reduce losses by reducing the power disuse –spending of power for economical purposes.

The equipment suppliers and construction managers on the construction and modernization of the high-voltage power networks 35-110kV are: PJSC «Ukrelektroaparat», Siemens, ABB, PJSC «ZTZ-Servis», CJSC «Lvivmontazhbudzvyazok», «SONEL - Ukraine», FLIR SYSTEM Sweden, JV "Mikro-Kod" LTD, Lviv, NDPKI "Molniya" (SPD FO Popovych V.L.), Izhevsk electromechanical works "Kupol", Russia, LLC "OLTEST", Russia, LLC «Etalon-Prylad», PVF «Vybro-Tsentr», Russia.

Relay protection service.
Stationary control laboratory SCL-10 for the current and voltage transformers control.
Post.

Relay protection service.
Stationary control laboratory SCL-10 for the current and voltage transformers control.
Voltage transformers control 10kV.

Stationary current transforers control device.

Stationary current transforers control device.

**SS 110/35/10kV «Yarmolentsi».
Transportable control laboratory TCL-110.
Current transformers control 110kV
without their dismantling.**

**SS 110/35/10kV «Yarmolentsi».
Transportable control laboratory TCL-110.
Current transformers control 110kV
without their dismantling.**

**SS 110/10kV «Krystal».
Transportable control laboratory TCL-110.
Current transformers control 10kV
without their dismantling.
Post.**

**SS 110/10kV «Krystal».
Transportable control laboratory TCL-110.
Current transformers control 10kV
without their dismantling.
Prepaation of the measurement scheme.**

**SS 110/10kV «Tsentralna».
Transportable control laboratory TCL-110.
Current transformers control 110kV
without their dismantling.**

**Transportable control laboratory
Khmelnytskoblenergo on the basis of the Reno
vehicle.**

Transportable control laboratory Khmelnytskoblenergo on the basis of the Reno vehicle.

Transportable control laboratory Khmelnytskoblenergo on the basis of the Reno vehicle.

3. In the system of the effective power supply registration with the voltage degrees 0,4-6-10-35-110kV:

3.1 Effective power supply registration measures were put into operation with the voltage degree 0,4kV:

- Current transformers 0,4kV - 7871;
- Single-phase electronic power meters - 133870;
- Three-phase electronic power meters - 5176;
- Systems of the automatized power registration SMART IMS, which include 32 routers, 7189 single-phase and 54 three-phase power meters;
- Systems of the automatized power registration Modul- PLC, which include 1 router, 99 single-phase power meters, 104 PLC-modems and 5 three-phase power meters.
- Single phase power meters of made-in item “Modul-1” -4711;
- Single phase power meters of made-in item “CO-EA05P” - 7500;
- Single phase power meters of made-in item LOE-5010” - 36267;
- Power meters control devices - 3.

The equipment suppliers and construction managers are: – PJSC «Umanskyi zavod «Mehommeter»», PJSC «Zolochivskyi radiozavod », LTD «Dnista», JSC «TD «Rostok», CJSC «Energomera»,DNVP « Objednannya Komunar», LTD «NIK», LTD «Energoterm», SOE «Novator», PJSC «K-PEMZ», LTD «Postachannya enerhokompaniy», Korolyov PJSC «Merydian», LTD «Promsnabinvest», LTD «Torgovyi dim «Ukrainska promyslova kompaniya », LTD «Modul-Telekom», LTD «Albat», LTD «Energolyuks-79», LTD «ADD-Energiya», LTD «Telekomunikatsijni tehnolohiyi» NPP «Delta –VH».

3.2. Power supply registration measures were put into operation with the voltage degree 10-35-110kV of the effective supply, distribution and on the border of the networks balance appliance between the WPM participants and consumers:

- Power meters**:**

Name	Precission grade	Manufacturer	Country	Unit	Amount
NIK 2301.AT1	1.0	LTD «NIK»	Ukraine	pieces	125
EPQS	0.5	CJSC "ELGAMA-ELEKTRONIKA"	Lithuania	pieces	56
EMT-112.02.6	1.0	CJSC "EMH-ELGAMA"	Lithuania	pieces	142
TSE6803V	2.0	PJSC concern "Energomera"	Russia	pieces	648

TSE6811	2.0	PJSC concern "Energomera"	Russia	pieces	60
SL7000	0.5	Siemens Metering Ltd	Switzerland	pieces	10
AT2A5E7ULRT	0.5	CJSC «Elvin»	Ukraine	pieces	318
Evro Alfa AIR-40L-C4-T	0.5	ABB VEI «Metronika»	Russia	pieces	10

- Automatized systems of the power commercial registration (ASPCR) on the border of the networks balance appliance with the WPM participants:

The power supply into the networks of Khmelnytskoblenergo PJSC registration is carried out by the automatized systems of the power commercial registration (ASPCR) on the border of the networks balance appliance with the participants of the wholesale power market (WPM), which was put into industrial operation 30.12.2010 and is registered in SOE «Enerhotynok» (Sertificate №33 of 03.03.2011). ASPCR Khmelnytskoblenergo PJSC on the border with the WPM participants comprises 488 commercial registration points, 196 of which are located on the power registration objects of Khmelnytskoblenergo PJSC , and the rest 292 are located on the power registration objects of the neighboring WPM objects. Data of ASPCR Khmelnytskoblenergo PJSC are applied to carry out daily calculations in the WPM starting from 17.03.2011.

- Automatized systems of the power commercial registration (ASPCR) on the border of the networks balance appliance with the consumers:

According to the standard of NERC of Ukraine (Resolution № 910 of 17.10.2005 with amendments and supplements) Khmelnytskoblenergo PJSC implements LUZOD and ASPCR (requirements 3.35 PRU) for the Company consumers – legal entities with the established voltage of 150kVA and average power consumption more than 50,000 kV*h in a month. By 01.01.2011 LUZOD and ASPCR was implemented for 81 consumers, including 125 registration areas and 320 points of power commercial registration (including HGS, CHP, coherent equipment).

The equipment suppliers and construction managers are : LTD «NIK» Ukraine, CJSC "ELGAMA-ELEKTRONIKA" Lithuania, CJSC "EMH-ELGAMA" Lithuania, PJSC concern "Energomera" Russia, PJSC concern "Energomera" Russia, Siemens Metering Ltd Switzerland, CJSC «Elvin» Ukraine, ABB VEI «Metronika» Russia.

Accomplishment of the work of the ASPCR building on the border of the networks balance appliance with the WPM participants is carried out by the Scientific park NTUU (Kyiv).

4. **In the system of automation of the main production operations of the power transmission and supply:**

- **The corporative connection network was constructed between the Company units and the power network objects 0,4-10-35-110kV:**

The electricity transmission lines to 22 power network areas and to the 2 power selling districts were put into operation;

The fibre optic electricity transmission lines were put into operation in the southern direction of power supply in Khmelnytsk region with the total length of 105 km with the connection to the 5 power network areas and to 4 principal district substations 110kV;

Between 4 territorial remote units of the Company in Khmelnysk the fibre optic electricity transmission lines were put into operation.

- **The corporative area network of the power supplying Company was built:**

The local area networks were put into operation in 22 districts of Khmelnytsk region of FastEthernet/GigabitEthernet technologies;

728 operating stations, 35 specialized servers and 22 routers of the local network of the substations 110/35/10kv were installed and connected with the local and corporative area network;

Local area networks of the Company units and the substations are united in the single corporative area network;

The effective outer communication of the corporative area network users through the general Internet access network and the departmental network TKM "Enerhiya" was provided.

- **Program and technical complexes of power supply management and control were implemented:**

The billing program system was elaborated and put into operation to carry out the calculations of consumed power in 22 power network areas for the legal entities and the population;

Operation-informative complex (OIC) was elaborated on the basis of SCADA-system TRACE-Mode and put into operation to control the power flow in the networks 35-110kV and the power supply on the territory of Khmelnytsk region with the integration of the data in the teleinformation and telesignalization substations 35-110kV;

The program complex of the feeder analysis and power technological spending optimization (FATSO) was put into operation for the networks 0,4-10kV and 35-110kV in 22 power network areas and the Company units.

- **Improvement of the management systems by the main and the accessory technological precesses of the power transmission and supply:**

The system of the quality management was introduced on the basis of the international standard ISO-9001-2008;

The process approach and measures of the project management aiming at TPC (TVE) reduction in the network of the Company were elaborated and put into operation.

Б. In 2011 - 2025 in Khmelnytskoblenergo PJSC such works on modernization of the power transmission and supply systems, connected with the technological power losses (TPC (TVE)) reduction are to be carried out:

1. **In the distributive networks with the voltage degrees 0,4-10kV:**

Transformer substations TS-10/0,4kV - 503 - general power - 78,026 kVA;
Air ETL PL-10kV – total length - 616,435 km;
Cable ETL KL-10kV - total length - 109,745 km;
Air ETL PL -0,4kV - total length - 485,35 km;
Cable ETL KL -0,4kV - total length - 34,68 км.

- **The operating transformer substations and the electricity transmission lines are to be reconstructed and modernized:**

Transformer substations TS-10/0,4kV – 1544 - general power - 182,906kVA;
Air ETL PL-10kV – total length - 1736,77 km;
Cable ETL KL-10kV - total length - 190,47 km;
Air ETL PL -0,4kV - total length - 2511,28 km;
Cable ETL KL -0,4kV - total length - 90,30 km.
Unloading TS-10/0,4kV – 909, general power - 109,305 kVA;

- **Cable inlets for individual buildings are to be totally modernized (with substitution for isolated ones and with installation of power meters on the front of the building):**

Single-phase inlets –84 271.
Three-phase inlets – 18 600.

2.1. In the high-voltage networks 35-110kV

2.2. High-voltage substations with the voltage transformation degree 110/35/10kV, 110/10kV, 35/10kV.

- ***Construction of 7 substations with the general power - 112 300kVA:***

SS-35/10kV «Loyevtsi», SS-110/10kV «Zahidna», SS-110/10kV «Ozerna-2», SS-110/35/10kV «Sataniv-110», SS-110/10kV «Kalyusyk», SS-110/10kV «Prybuzka», SS-110/10kV «Leznyevo».

- ***Total reconstruction of 29 substations with the general power 545 100kVA:***

SS-35/10kV «ATP», SS-35/10kV «Bohdanivni», SS-35/10kV «Zeleni Kyrylivtsi», SS-35/10kV «Ivanivna», SS-35/10kV «Holovli», SS-35/10kV «Kremenchuky», SS-35/10kV «Kuzmyn», SS-35/10kV

«Kupino», SS-110/10kV «Dubovo», SS-110/10kV «HZTP», SS-110/35/10kV «Letychiv», SS-110/35/10kV "Stara Synyava", SS-110/35/10kV "Zakupne", SS-110/35/10kV "Netishyn", SS-110/35/10kV "Bilohirja", SS-110/35/10kV "Pluzhne", SS-110/35/10kV "Chornyi Ostriv", SS-110/35/10kV "Lisovi Hrynivtsi", SS-110/10kV "Zapadyntzi", SS110/10kV "Molomolyntsi", SS-110/10kV "Medvedyvka", SS-110/35/10kV "Horodska", SS-35/10kV "KDZ", SS-35/10kV "Zhylyntsi", SS-110/35/10kV "Dunaivtsi", SS-110/35/10kV "Shidna", SS-110/10kV "Krasyliv", SS-110/10кВ "TPA".

- ***Modernization (replacement of oily switches 110kV for gase-insulated switches 110kV of Siemens production) of 32 SS 110kV:***

SS-110/35/10kV "Volochysk", SS-110/35/10kV "Pivnichna", SS-110/10kV "Horodok", SS-110/10kV "Lisovody", SS-110/35/10kV "Derazhnya", SS-110/10kV "Vovkovyntsi", SS-110/35/10kV "Heletyntsi", SS-110/10kV "Solodovyi".

- ***Modernization (replacement of oily switches 35kV for the vacuum switches 35kV of Siemens production) of 28 SS 35kV:***

SS-35/10kV "Sah.Zavod", SS-35/10kV "Derazhnya", SS-110/35/10kV "Dunaivtsi", SS-110/35/10kV "Volochysk", SS-110/35/10kV "Horodok", SS-110/35/10kV "Heletyntsi".

- ***Modernization (replacement of oily switches 10kV for the vacuum switches 10kV of «Tavryda Elektryk», «Rivnenskyi zavod vysokovoltnyh aparativ» production) of 158 SS 35-110kV:***

SS-110/35/10kV "Yarmolentsi", SS-110/35/10kV "Solobkivtsi", SS-110/35/10kV "Vostochnaya", SS-110/10kV "Tsentralna", SS-110/10kV "Ozerna".

- ***Modernization (replacement of dischargers 10 kV for the OPN 10kV of Siemens, ABB production) of 90 SS 35-110kV:***

SS-110/35/10kV "Volochysk", SS-110/35/1kV "Pivnichna", SS-110/35/10kV "Horodok", SS-110/10kV "Solodovyi", SS-110/10kV "Lisovody", SS-110/35/10kV "Derazhnya", SS-35/10kV "Sah. Zavod", SS-110/35/10kV "Yarmolyntsi", SS-110/35/10kV "Solobkivtsi", SS-110/35/10kV "Heletyntsi".

- ***Modernization (replacement of dischargers 35kV for the OPN 10kV of Siemens, ABB production) of 69 SS 35-110kV:***

SS-110/35/10kV "Volochysk", SS-110/35/10kV "Pivnichna", SS-110/35/10kV "Horodok", SS-110/10kV "Lisovody", SS-110/35/10kV "Derazhnya", SS-35/10kV "Sah. Zavod", SS-110/35/10kV "Yarmolyntsi", SS-110/35/10kV "Solobkivtsi", SS-110/35/10kV "Heletyntsi".

- ***Modernization (replacement of dischargers 110kV for the OPN 10kV of Siemens, ABB production) of 57 SS 110kV 57 um:***

SS-110/35/10kV "Volochysk", SS-110/35/10 kV "Pivnichna", SS-110/35/10 kV "Horodok", SS-110/10 kV "Solodovyi", SS-110/10кВ "Lisovody", SS-110/35/10kV "Derazhnya", SS-110/35/10kV "Yarmolyntsi", SS-110/35/10kV "Solobkivtsi", SS-110/35/10kV "Heletyntsi".

- ***Modernization (replacement of storage batteries for the economic storage batteries ШОТ-01 of Enerhomashvin production) of 4 SS 35-110kV:***

SS-110/35/10kV "Volochysk", SS-110/35/10kV "Derazhnya", SS-110/35/10kV "Ivaskivtsi", SS-110/10kV "IPP".

- ***Modernization (replacement of the power transformers inlets 110kV for the hard isolation inlets of ABB production) of 16 SS 110kV:***

SS-110/35/10kV "Heletyntsi", SS-110/35/10kV "Zakupne", SS-110/35/10kV "Ostropil", SS-110/10kV "Polyan'", SS-110/10kV "Mashzavod".

2.3. High-voltage electricity transmission lines with the voltage degree 35kV and 110kV:

- ***Construction of the high-voltage electricity transmission lines 35-110kV:***

Air ETL PL-10kV – 20, total length - 208,7 km;
Air ETL PL 35кВ – 8, total length - 99,3 km;

- ***Reconstruction of the electricity transmission lines 35-110kV:***

Air ETL PL 110kV – 33, total length - 322,521 km;
Air ETL PL 35kV – 13, total length - 148,729 km.

- **Capital refit of the electricity transmission lines 35-110kV**

PL-110kV - 95, total length - 1243 km;

PL-35kV - 147, total length - 1651 km;
Isolation replacement in PL-35-110kV - 26385 isolators;
PL-35-110kV line clearing on the surface of 541,69 hectares, total length - 283,35 km.

2.4. Diagnostics equipment of the high-voltage ETL and the substations with the voltage degree 35 and 110kV:

- UIM-90 equipment for the power stability of the transformer oil measurement.
- RETOM-2500 equipment for the control of the power stability of the isolation with the enhanced voltage of the industrial frequency up to 2,5 kV.
- MRP-200 measurer of the contact voltage and the parameters of the protective disconnection devices.
- MIC-5000 measurer of the resistance, moistening and the stage of the power isolation ageing.
- MRU-100 measurer of the grounding devices resistance, lightning conduction, conductors of the earth connection and the capacity leveling. .
- CoroCAM 504 ultraviolet camera for the search of the crown discharges in a day-time.
- «STEKS ETL-35 K» complex transportable electro technical laboratory.
- «STEKS AB 50/70» small-scale trial equipment.

3. In the registration system of the power effective distribution delivery with the power degrees 0,4-6-10-35-110kV:

3.1 Putting into operation of the registration measures of the power effective distribution delivery to the population with the voltage degree 0.4kV:

- Current transformers 0,4kV - 0.
- Single-phase electronic power meters– 326 589;

Among them:
- Single phase power meters of made-in item "Modul-1" – 93 267;
- Single phase power meters of made-in item "CO-EA05P" - 22 323;
- Single phase power meters of the producer factories – 211 000.

- Three-phase electronic power meters –19 200;
- Equipment for power meters control.
- Systems of the automatic power registration for the consumers, including:

200 routers;
61 593 single-phase power meters;
3 200 three-phase power meters.

- PLC-modems for the made-in meters stuffing

"Modul-1" – 6 945.

- Routers for the construction of the distant access systems – 19.

3.2 Putting into operation of the power registration measures with the voltage degrees 10-35-110kV on the limit of the networks with the WEM participants and the consumers:

- **Power meters:**

The total replacement of 514 induction power meters of the precision class – 2.0, which were installed on the feeders 10kV of the substations 110/35/10kV, which are owned by the Company, for the electronic intellectual power meters of the precision class - 0,5 and with the interface CL/RS485 for the connection with the ASPCR of the substations.

The total replacement of the induction power meters of the precision class - 2,0, which were installed on the inlets of the internal needs transformers in 173 substations for the electronic intellectual power meters.

Replacement of 1170power meters of the precision class - 1,0, which were installed on the feeders 10kV For the electronic multifunctional power meters of the precision class - 0,5.

- **Automated systems of the power commercial registration (ASPCR) on the limit of the networks with the participants of WPM and the consumers:**

Putting into operation of the ASPCR second set on the border of the networks balance appliance with the participants of WPM with the growth of the power registration points up till 1000 due to the control and calculation registration points on the border of the networks balance appliance and the participants of the WPM.

Implementation of ASPCR for 174 substations of Khmelnytskoblenergo PJSC , with the introduction of all the registration points (2100 units) into ASPCR on the inlets and feeders of the substations with the voltage degrees 10-35-110kV.

Putting into operation of LUZOD and ASPCR for 150 consumers-entities.

Elaboration of the project and the implementation consumers-entities ASPCR with raising of the calculation registration points number up to 1500 units.

4. In the automation system of the main production processes of the power transmission and supply:

- **Development of the corporative connection network aiming at providing with the telecommunications between the Company subunits and the objects of power networks 0,4-10-35-110kV:**

Construction of the connection channels with 174 substations 110/35kV to fulfill the needs of ASPCR, telemechanics, remote control, video control;

Construction of the fibre-optic electricity transmission lines to provide with the effective communications with 17 power network areas and the main substations 110kV.

- **Development of the computer systems of the Company:**

Implementation of the system of the servers virtualization aiming at calculation resources effectiveness increase and the power consumption;

Introduction of the usage of "thin clients" aiming at power consumption reduction, effectiveness increase of the working and storage of the information, improvement of the information security.

- **Development of the program and technical complexes of management and control of the power supply:**

Development of the operation and technical complex (OIC) on the basis of SCADA-system TRACE-Mode for the control over the power flows in the power networks 35-110kV and the power supply management on the territory of Khmenlytsk region with the integration of the data of the teleinformation and the telesignalization systems of 174 substations 35-110kV;

Implementation of the management automatization program system (basic and accessory production processes) on the basis of ERP mySAP 6.0.

- **Improvement of the systems of basic and accessory technological processes of the power transmission and supply**

Implementation of the ecological management system on the basis of the international standard ISO-14001-2004;

Implementation of the automatized management system of the project aiming at improvement of the organizational and technical measures of TPC (TVE) reduction in the networks of the Company.

B. Basic structural changes in the organization system of Khmelnytskoblenergo PJSC , connected with the TPC (TVE) reduction in the power networks of the Company.

1. **Technical management:**

The post of the new technique chief engineer assistant**;** the post of the high-voltage power networks (HVPN) as well as 2 posts of the HVPN manager assistant**.**

1.0. The perspective development and technical measures service was created - **5 persons.**

1.1. Security service was created - **2 persons.**

1.2. The power audit and power registration department was formed - **14 persons.**

2. **Marketing and power sale management:**

2.0. The post of the technical supply and power selling manager assistant as well as the post of power selling development manager assistant were introduced.

2.1. The department of balances distribution and the power market cooperation was created– **7 persons.**

2.2. The technical power selling security service was created - **5 persons.**

3. **Management of the administration and information technologies development:**

The post of the managing director assistant - administration and information technologies development manager; the post of the administration development manager assistant; information technologies manager assistant; corporate networks and technical securing manager assistant were introduced

3.1. The quality control department was created - **6 persons.**

3.2. The projects management department was created - **3 persons.**

3.3. Information technologies department was created - **14 осіб.**

3.4. Створено відділ інформаційно-комунікаційних систем - **27 persons.**

4. The labor and environment protection management:

4.1. The environmental protection and fire safety service - **3 persons.**