Державне підприємство
Національна енергетична компанія
УКРЕНЕРГО

# 750 KV ZAPORIZKA – KAKHOVSKA TRANSMISSION LINE AND 330 KV TL DIVERSIONS PROJECT

# (ZAPORIZHZHA OBLAST, KHERSON OBLAST)

# DRAFT FINAL ESIA REPORT

## NON-TECHNICAL SUMMARY


Prepared by:

**MERCADOS – ENERGY MARKETS INTERNATIONAL**

Together with:

**RED ELECTRICA DE ESPAÑA**

**ERM IBERIA**

**ENERGY CONSULTING GROUP**



July 2009

Project ID: MI 1083

# 750 KV ZAPORIZKA – KAKHOVSKA TRANSMISSION LINE AND 330 KV TL DIVERSIONS PROJECT

# (ZAPORIZHZHA OBLAST, KHERSON OBLAST)

# DRAFT FINAL ESIA REPORT

# NON TECHNICAL SUMMARY

## TABLE OF CONTENTS

# FOREWORD

Note: The technical description of the Project in this Draft ESIA Report is based on the current design stage, which is not yet finalised. Therefore, minor changes to the technical details as included in this Report may occur in the future. Any substantial changes will be reflected in the final version of this Report.

This document provides a Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) Report of the new Transmission Line (TL) Project from Zaporiska Nuclear Power Plant (ZNPP) to Novokakhovska in the southern part of Ukraine. The document describes the proposed project and presents major findings of the ESIA. This includes a summary of environmental and socioeconomic conditions, a description of how the project could affect the environment and people and how these effects can be avoided or at least reduced.

This NTS is part of the larger package of documents, including the Draft Final ESIA Report and Stakeholder Engagement Plan (SEP). The ESIA, SEP and NTS will be publicly available in English and Ukrainian after July 29th, 2009 for a 120-day public consultations period as follows (refer also to the SEP):

**The electronic copy at the following websites:**

- Ukrenergo web site: http://www.ukrenergo.energy.gov.ua
- EBRD website: http://www.ebrd.com (NTS and SEP only)

**A full copy of the ESIA Report at the following locations:**

Ukrenergo offices in:

- Kyiv, 25, Kominternu Str., Tel. +380 44 238-32-64, 287-71-60, 238-35-82
- Nova Kakhovka, 2 Electromashinostroitelei Str, Tel. +380 5549 4 45 55)
- Zaporizhzha, 2 Grebelna Str, Tel. +380 61 239 39 51

Other locations:

Offices of Oblast State Administrations of Zaporizhzha and Kherson, and at the District State Administrations of the District or Municipal Councils of the seven Rayons through which the TL passes (smaller locations NTS and SEP only).

Comments on the project and the draft ESIA can be made in writing directly to Ukrenergo (see contact details below) from disclosure date until the end of October 2009 and at Public Hearings currently being scheduled for September 2009.

Ukrenergo contact: Mr. A.M. Shvedkyi, First Deputy Director Southern Electric Power System, NPC Ukrenergo office,

11 Koblivska Str., 65029, Odessa, Tel.: 8(048) 730 18 50, Fax: 8(048) 730 18 60,

E-mail: kanc@rdc2.south.energy.gov.ua.

The public and the stakeholders will be informed at least 3 weeks in advance of the Public Hearings (dates and locations will be identified and disclosed). After the Hearings, the comments from the public will be addressed and the final ESIA will be issued.

# 1. INTRODUCTION AND BACKGROUND

Ukrenergo, the operator of the long distance electricity grid in the Ukraine, intends to construct a transmission line and other facilities in southern Ukraine within the Oblasts of Zaporizhzha and Kherson. The Project involves the following components:

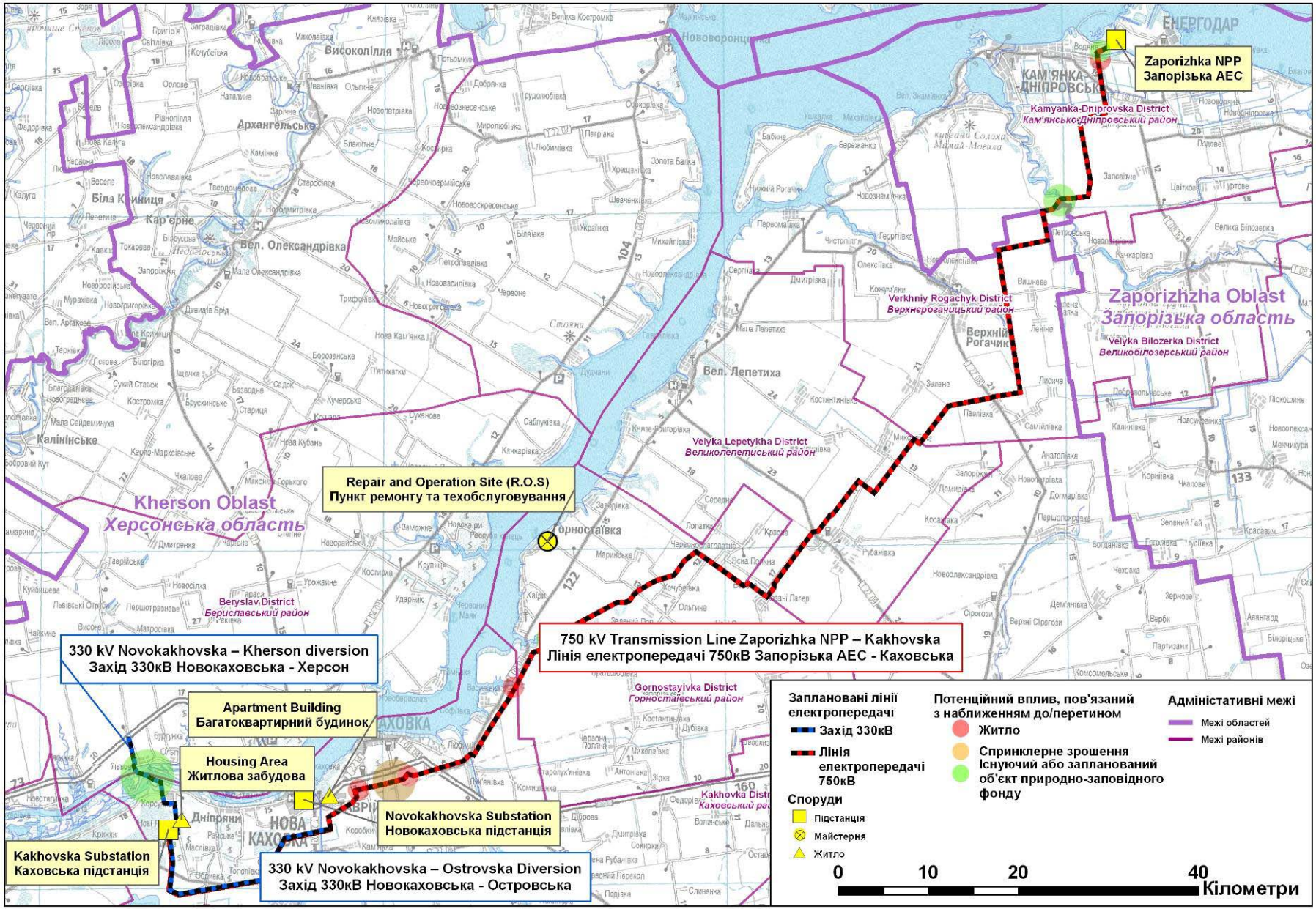
- **750kV Transmission Line** of 190km length connecting the Zaporiska Nuclear Power Plant (NPP) with the new Kakhovska substation (Zaporiszka NPP - Kakhovska TL)
- **750/330 kV Kakhovska substation** will be newly built, west of Nova Kakhovska (Kakhovska substation);
- **Existing 330/220 kV Novokakhovska substation** which will be rehabilitated (330 kV Novokakhovska SS);
- **Two 330kV diversion lines,** a 28 km diversion connecting Kakhovska Substation with the electrical grid running south-eastwards (Novokakhovska – Ostrovska) and a 17 km diversion connecting Kakhovska Substation with the electrical grid running northwards (Novokakhovska – Khersonska);
- **other sites** including a housing area with 15 houses for employees near Novi Lageri, a 7-floor apartment building near Tavriysk town and a repair and operations site (ROS) at Gornostayivka.

An overview of the Project area and its components is shown in Figure 1.

Ukrenergo is considering obtaining financing for the Project from international financial institutions (IFIs), such as the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB). This ESIA was undertaken to ensure compliance with local requirements and international best practice standards and EBRD policies.

# 2. WHY IS THE PROJECT NEEDED?

The Ukrainian electricity transmission network is in need of substantial rehabilitation and upgrading due to increase in demand patterns coupled with extended periods of insufficient investment into the network structure over the last years. As now configured, the network exhibits high technical losses and poor quality of power supply. This is costly, inconvenient and potentially dangerous to customers.


Zaporizhka NPP
Запорізька АЕС
Kamyanka-Dniprovska District
Кам'янсько-Дніпровський район
Verkhniy Rogachyk District
Верхнєрогачицький район
Velyka Bilozerka District
Великобілозерський район
Zaporizhzha Oblast
Запорізька область
Velyka Lepetykha District
Великолепетиський район
Repair and Operation Site (R.O.S)
Пункт ремонту та техобслуговування
Kherson Oblast
Херсонська область
Beryslav District
Бериславський район
330 kV Novokakhovska – Kherson diversion
Захід 330кВ Новокаховська - Херсон
750 kV Transmission Line Zaporizhka NPP – Kakhovska
Лінія електропередачі 750кВ Запорізька АЕС - Каховська
Gornostayivka District
Горностаївський район
Apartment Building
Багатоквартирний будинок
Housing Area
Житлова забудова
Novokakhovska Substation
Новокаховська підстанція
Kakhovska Substation
Каховська підстанція
330 kV Novokakhovska – Ostrovska Diversion
Захід 330кВ Новокаховська - Островська
Заплановані лінії електропередачі
Захід 330кВ
Лінія електропередачі 750кВ
Споруди
Підстанція
Майстерня
Житло
Потенційний вплив, пов'язаний з наближенням до/перетином
Житло
Спринклерне зрошення
Існуючий або запланований об'єкт природно-заповідного фонду
Адміністративні межі
Межі областей
Межі районів
0
10
20
40
Кілометри

The objective of this Project is to increase the efficiency of the national power sector by allowing the Zaporizhzha Nuclear Power Plant (ZNPP) to operate at full power (6000 MW) following a better connection to the power network with an ultimate benefit also to regional power supply reliability and quality.

The ZNPP was constructed starting in the 1980s using third generation Soviet VVR technology and comprising six reactors (each reactor with capacity of 1000 MW) with the last reactor brought online in 1995. The ZNPP design included four 750 kV transmission lines (TLs) for power distribution to supply central and southern parts of Ukraine. Three of the four planned TLs were built and are currently in operation while the fourth 750 kV TL to the Khakhovska Substation was planned and construction started at the end of the 1980s, but not finished. About 40% of the towers were built along the originally planned routing and the foundations were laid for the Kakhovska Substation, until all work stopped in the early 1990's as a result of the political and economic changes and uncertainties at that time.

Due to the non-completion of the fourth line as originally planned, the maximum output of the ZNPP is currently restricted to 5300 MW (compared to maximum output of 6,000 MW). The proposed Project therefore is the continuation of the original plan to further stabilise the existing network and help to deliver an additional 700 MW from existing capacity at the ZNPP to other regions, as per the original design.

Overall, the Project is thus anticipated to yield a number of tangible benefits to the electricity system and its users that include:

- Improved stability and reliability of the system - because additional redundancy will be built into the network that will reduce the need for power cuts in the event of the equipment breakdowns.

- Optimised supply of power to the southern region – from being able to exploit all the potential generating capacity (including both conventional and renewable sources feeding the grid).

- Increased energy efficiency - through increased efficiency of operation of existing ZNPP, as well as higher levels of energy efficiency in the transmission system.

- Compatibility with European networks - the design of the grid will be compatible with European systems that will allow greater flexibility in optimizing regional electricity supply and demand.

- Transfer and dispersion of skills - implementing projects of this nature provides for skills transfer and associated income for local workers.

# 3. PROJECT STATUS

The Project can be seen as have two parallel aspects related to environmental assessment: (i) the national Ukrainian permitting process, and (ii) the international ESIA process.

(i) The following environmental-related activities are currently being undertaken as part of the national Ukrainian permitting process:

- An Environmental Impact Assessment - EIA (abbreviated OVNS in Ukraine) is currently being prepared by a contracted company as required by Ukrainian regulations. It is planned for completion by September 2009 and will be submitted thereafter to the authorities together with the Detailed Design Document ("Proyekt") to obtain approval and the construction permit;

- A detailed field survey of tower locations of the 330 KV diversions and the 750 kV TL (additional locations) is being undertaken by a contracted company, including assignment of cadastral numbers to land plots, entry into the state land cadastre database, entry of records into the land register, and registration of the State Acts for land ownership. This is part of the detailed design process and completion is planned for July 2009.

(ii) The preparation of this ESIA, being done in parallel to the above OVNS, surveys and detailed design work, reflects the international assessment procedures and best practices as per the policies of the EBRD and other IFIs.

**The procurement tender** will be prepared by Ukrenergo after obtaining the Construction Permit (based on submittal of the above-referenced local permits and the ESIA), to contract a construction contractor that will implement the further project activities. The selected contractor will be responsible for working documentation for the construction stage, the Land Acquisition Plan (LAP), valuations of relevant costs and compensation. During Project implementation, Ukrenergo (and the Contractors) will be obliged to adhere to the requirements laid out in both the local permits and the ESIA Report.

Tendering for the construction contract is anticipated to occur in the first half of 2010; the overall future construction period of the Project is planned to last about 30 months.

# 4. PURPOSE AND SCOPE OF THIS ESIA

Overall, the purpose of this ESIA is to ensure that future activities related to this Project (e.g. design and construction of towers and new substation, repair and maintenance during operation) will be performed in a socially and environmentally acceptable manner, in compliance with local legislation as well as EBRD Performance Requirements and best international practice. Key elements of the scope of this ESIA[1] therefore were to:

[1] The information for this ESIA was mainly derived from publicly available sources, meetings and discussions with Ukrenergo and their design contractors, and the ERM field tour of the Project Area

- Initiate a consultation process with potentially affected people and relevant stakeholders to inform them about the Project and identify their concerns;
- Identify key environmental and socio-economic issues;
- Describe environmental and socioeconomic baseline conditions;
- Evaluate potential impacts (positive and negative) of the Project;
- Develop design and operating practices that will avoid, reduce, or compensate for significant environmental and social impacts;
- Develop monitoring programs to verify the Project is constructed and operated as intended, and to identify changes in environmental controls that may be needed.

# 5. DESCRIPTION OF THE PROJECT

*Characteristics of the Route*

The current design and planning is mainly based on the original routing from the 1980s and the already existing tower locations (40% of the 750 kV line). The exact routing of the current design and planning stage will be established after completion of field work by the surveyors. The approximate alignment showing the regions and districts crossed is shown in Figure 1.

A considerable portion of the transmission line routing, about 50% of the 750 kV line and 100% of the southern 330 kV Novokakhovska – Ostrovska diversion, is "bundled"; this means that as far as feasible, the designers tried to align the transmission line route alongside other linear features, such as roads, field borders, or other existing transmission lines. The practice of bundling is intended to minimize the net effects on land use and disturbance to local populations, and is consistent with the provisions of the Land Code of Ukraine and reflects common practice in Western Europe as well.

*Transmission Line*

The transmission line consists of a large number of towers at regular intervals along the selected route, the attachment of insulators to the towers and the connection of the conductors (see also Figure 2):

- The two types of towers are angle-tension and regular, self-supporting suspension towers. For the 750 kV line, the tower height to the cross arm is about 35 m, which can be increased by using higher base units. The distance from the cables to the ground varies between about 24.5 m at the towers, 12.5 m to 16 m at the middle of the span and 15 m on crossing points with motorways and railways.
- Towers are steel constructions erected by bolting together prefabricated steel sections. The foundations are typically piled using concrete and steel, with the depth depending on local geology and the type of towers. Assembly time is five (5) days per tower.
- Towers are typically spaced at 400 or 500 m intervals for 750 kV TL and 300-350 m for 330 kV, depending on the landscape characteristics.

- Conductors are connected to the towers by the attachment of insulators (suspension-type insulators). Each tower will have 3 circuits (of 5 conductors each) plus two earthing wires.

It is planned to establish additional temporary construction facility sites and storages for material and equipment in the vicinity of villages along the line route. Preliminary studies suggest that it will not be necessary to provide new access roads and that the right of way will be used to move equipment from one tower base to the next. The construction work will be carried out in daytime. All existing structures (at 40% of the 750 kV line) including foundation will first be demolished and waste recycled (all steel parts, e.g.) or disposed as legally required per consent of the local authorities. All these measures will be detailed in the Construction Plan by the Construction Contractor.

*Substations*

The construction of the 750 kV substation at Kakhovska involves the installation of two 1,000 MVA autotransformers and related equipment at the same site that was already partly built in the early 1990's. The existing 330 kV Novokakhovska substation will be reconstructed, including the replacement of the 220/150/35 kV autotransformer with a 330/220/35 kV autotransformer. The new transformers will be oil-cooled (free of toxic PCB additives). The substation works at both sites will be carried out within the existing perimeters and no extra land is needed.

*Public Health Aspects: Zoning due to electromagnetic radiation (EMR)*

Electro-magnetic radiation (EMR) is emitted by the conductors during the operation of such transmission lines. The potential health effects on humans from EMR are being extensively researched. While it is clear that very high doses of EMR from certain electrical equipment can cause direct injury to humans (such as burns from a micro-wave oven), there is no conclusive evidence on the effects from lower-level emissions such as from transmission lines. Some studies suggest that there may be an enhanced risk for certain diseases such as childhood leukemia, clinical depression or other illnesses, but the causal links are not strong[2].

In the absence of certainty, international organisations such as the World Health Organisation (WHO) and many national governments are pursuing a precautionary approach in which certain minimum distances are recommended between the lines and housing areas (EMR strength decreases with distance). In this respect, the norms of Ukraine (and other former Soviet Republics) are generally more stringent than those of Western European countries. The Ukrainian norms require that a formal Sanitary Protection Zone (SPZ) be established to protect the population from the possible impacts of EMR (i.e. where electric field strength exceeds 1 kV/m)[3]. In addition, safety zones are established to protect the power grid elements. For the 750 kV TL, the minimum distance to houses of residential settlements is 250 m.

The width of zones and corridors is shown in Figures 2 and 3.

[2] Numerous publications available, e.g. WHO Fact Sheet No. 322, June 2007

[3] In comparison, the EU suggests a maximum public exposure of 5 kV/m

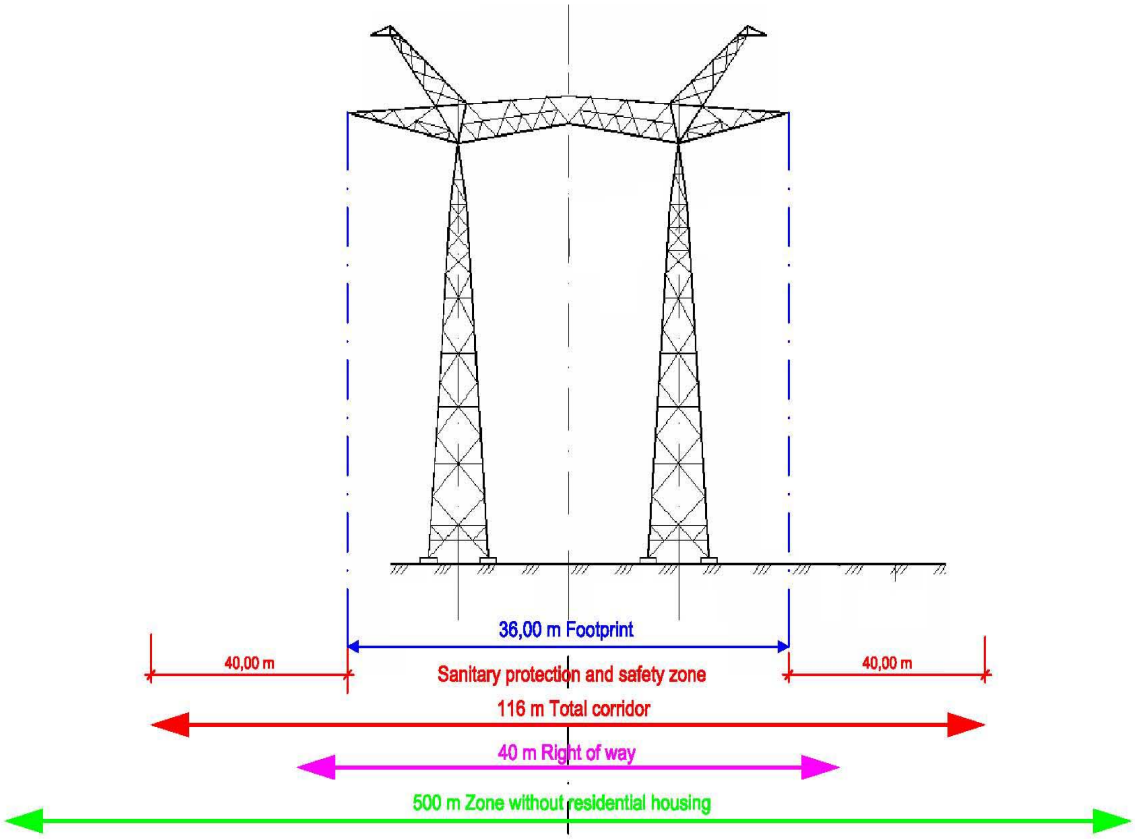



*Figure 2: Different Zones and minimum distances of 750 kV transmission line/intermediate support tower (SPZ, safety zone, 40 m minimum distance to housing)*

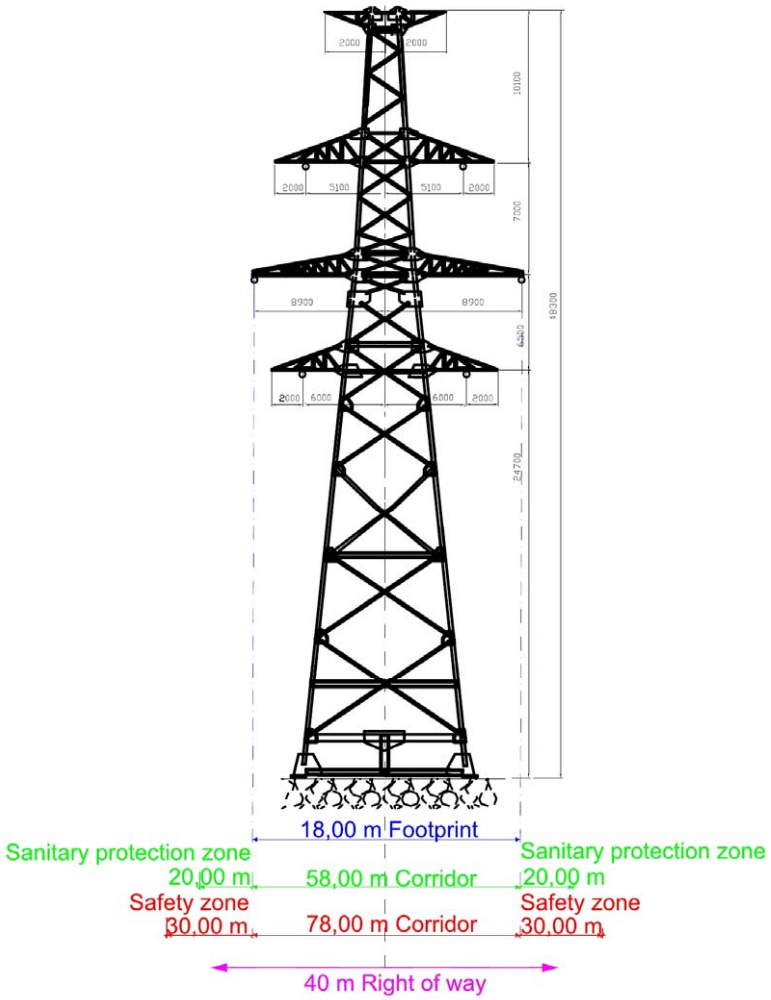



*Figure 3: Different Zones of 330 kV line/intermediate support tower (SPZ, safety zone and ROW)*

The land plots within the SPZ can be used for agricultural or other purposes, whereby there are some restrictions e.g. limited working hours by farmers, in accordance with the applicable regulations to protect workers from EMR. The land outside this area can be used for any activities without restrictions, whereby for the 750 kV line there is also a buffer zone of 250 m from each side of the line in which houses of settlements are prohibited.

# 6. ARE THERE ANY ALTERNATIVES TO THIS PROJECT?

Three alternatives were assessed for this Project as described below.

*No Action ("Zero-Option")*

If the Project were to not be implemented (i.e. everything stays as before), there would be no direct negative impacts on the environment, as the existing, unfinished components of the line do not pose any significant risks. From a socio-economic perspective, the non-implementation of the Project would have both positive and negative impacts. Positive impacts include the fact that there would be no temporary disruption and nuisance to villagers during construction of the line

and subsequent maintenance activities, nor the visual-aesthetic impacts of the new towers and conductors (in other words, the negative impacts of project implementation would be avoided). On the other hand, the Zero-Option would prevent the realization of positive impacts such as overall stabilization of the ZNPP operations and the better integration of regional, national, and European-wide grid systems (and other reasons given above on question of why the Project is needed).

Experience in Europe has also shown that a robust and flexible grid system is a prerequisite for the long-term expansion of renewable energy technologies such as wind and solar systems.

*Other route corridors between ZNPP and Kakhovka*

According to Ukrenergo engineers, during the original planning stages in the 1980's there were initial considerations of other route corridors, e.g. along the northern side of the Dnieper River. Some out-dated planning maps still exist showing various corridors. But these alternatives were quickly considered by Ukrenergo planners as being infeasible for various reasons, including the fact that they would have required multiple river crossings and/or have been of much greater length. In general, from environmental and social viewpoints, it is preferable to minimise the number of river crossings and to follow the shortest route that still avoids any sensitive land uses and populated areas.

*Optimisation of the proposed routes*

**Main 750 kV TL:** The existing route was selected during the 1980's planning because it is essentially the shortest connection between ZNPP and Kakhovka, taking into account the avoidance of villages. Also the comments and recommendation of the various administration authorities were considered in the line route decision, and the current route alignment was confirmed and approved.

So far during the ESIA preparation, no hindrances have been identified which would induce a significant variation of the planned route. For example, the route circumvents the main populated areas of the towns and villages. Nevertheless, as part of the field reviews and baseline evaluation of the ESIA, several sensitive areas were identified along the route which requires further detailed study and may warrant local deviations ("micro-detours") to the existing plans:

- Line crossing of the landscape reserves "*Kairska Balka*" (area of local importance) and "*Urochyshche Bilozirske*" (area of national importance); and

- the proximity to some buildings (unclear if used for housing) at several villages/isolated farms (i.e. within the 250 m buffer zone for residential dwellings for the 750 kV line).

**330 kV Diversions:** One main aspect identified at the 330 kV Novokakhovska – Kherson line diversion that requires further detailed study relates to the Dnieper River crossing by the 330 kV diversion. The location of the intended crossing is within the Dnieper River area that is planned for formal designation as a National Nature Park within the next year or two (2010/2011). (At the time of the original planning of this Diversion Line, there were not yet any intentions regarding the designation of this Park). Ukrenergo will need to further review the planning for the river crossing with the relevant authorities regarding the park planning and, if needed, undertake measures to minimise impacts of the line.

# 7. ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

Chapter 5 of the ESIA Report describes the key Baseline Conditions of the Project area with respect to the following topics:

Environmental topics

- Geographic units and Geomorphology
- Geology and Seismic
- Soil and Subsurface
- Groundwater
- Surface Water
- Climate Conditions
- Flora, Fauna & Habitats (protected areas)

Social/Socio-economic topics

- Socio-economic conditions & land use
- Visual Amenity & Scenery
- Public & Worker Health & Safety
- Cultural Heritage & Archaeological Sites and Recreation

The main baseline information is summarised below.

**Geomorphology & Soil:** The landscape of the project area is generally a flatland with depressions at river valleys and side arms of the nearby Kakhovske water reservoir. Downstream of the Kakhovske Water Reservoir the Dnieper River has largely natural condition, with many small sand islands and associated wetlands. The Project area has a varied soil cover, including fertile Southern Black Soils (Chernozems), chestnut soils, Solonetzs and Solonchaks (lower fertility with high sodium content and saline soils) and sand dunes. Soil degradation due to water and wind erosion is common given the agricultural land use and climatic conditions.

**Groundwater & Surface Water:** The main aquifer commonly found in the Project area is water-bearing layers of deeper limestone formations. Groundwater from these aquifers is the main source of drinking water across the Kherson Oblast. The feature of water-logging, i.e. accumulation of excess water in the shallow soil layers (about 2 m below surface level), is common due to intensive and long-term irrigation operations. Important surface waters crossed by the transmission lines are the Dniepr River and some estuaries, Velyka Bilozerka River, Rogachyk River, Kakhovsky trunk irrigation canal and North-Crimean irrigation canal.

**Flore/Fauna/Habitat:** The Dniepr River, as the dominant natural component of the region, forms one of the key ecological corridors in Ukraine. At the same time, the Project area has largely been affected by extensive agricultural use, facilitated by irrigation from the Kakhovka Water Reservoir. Altogether there are 13 protected areas of local or national significance in the Project area, many of which were established in the last 10 to 15 years and have different types of protection purposes (e.g. typical steppe landscape, typical plants (flora) and animal (fauna) species, protection of single trees or educational purposes). Some of the species of flora and fauna present in these areas are also formally listed as threatened or endangered species in the Ukrainian Red Book, and thus require special consideration. The transmission line appears to cross three of the protected areas and pass closely to a fourth one. In addition, there are two areas designated to become a national park in the future.

On international level, there are four Important Bird Areas (IBA) located along the Dniepr River within 10 km distance from the transmission line. In addition, the

Dniepr Delta (about 50 km from Project area at the Black Sea) is an IBA and also a designated wetlands protected area under the international Ramsar Convention[4], and thus an important ecological habitat. No Ramsar site is located within the Project area.

**Socio-economic conditions and land use:** The transmission line routing is primarily through rural areas characterized by farm fields and villages. The populations within the districts/Rayons range from 14,300 to 72,300. The main source of income in the Project area is from agriculture. Grains, sunflower, vegetables and fruits are the main crops. In addition, vineyards are found in the area south and south-west of Novokakhovka. Due to low precipitation levels, large areas are irrigated by an extensive irrigation channel system or "fregate" type moving watering systems.

**Cultural heritage, archaeological Sites and recreation:** Kherson and Zaporizhzha Oblasts both have rich and diverse cultural heritage and archaeological sites. Based on available literature, five archaeological sites were identified in the vicinity of the transmission line, whereby only the L'vove village site (early iron age) was found to be situated less than 1 km from the transmission line routing. The routing is approved by the responsible authority (Kherson Oblast Inspection for Protection of Cultural Heritage Objects) and no objection was raised to acquisition of land plots for tower construction by Ukrenergo in the proposed area.

The most popular recreational sites in the Project area are the banks of Dnieper River, the shores of Kakhovske Water Reservoir and related side arms (e.g. Kairska Balka), and in the forests (e.g. Korsunskiy forest, the mixed broadleaf forest near Kamenka). Popular recreational activities in the Project area include fishing, hunting and hiking.

# 8. IMPACTS AND MITIGATION MEASURES

This chapter describes the potential impacts to the key baseline topics and some key measures to avoid or mitigate/minimise any impacts. A more comprehensive elaboration of all mitigation measures is contained in the separate Environmental and Social Mitigation and Management Plan (ESMMP) described in Chapter 10 of this NTS.

[4] Ukraine signed the Ramsar Convention in 1991, and there are currently 22 such protected Ramsar sites in Ukraine; more information is available at: www.ramsar.org

**Impacts on Soils, Groundwater and Surface waters:**

The majority of the line route is presently under agricultural use with heavy machinery, and therefore the risk of additional significant soil compaction from construction works is considered negligible because the machinery used for construction will have a similar impact as the farm machinery. Erosion prevention measures should be taken; e.g. topsoil should be stored separately and re-used. For the 750 kV line, the existing foundations (along 40% of the route) are going to be replaced as part of this Project, which reduces the amount of net arable land loss. No additional land is needed for the substations.

The physical structures of the Project will not have a direct impact on the quality or usage of groundwater or surface waters. The construction works do not involve large amounts of chemicals or other dangerous substances, except for normal fuels and oils needed to operated the machinery. The contamination of near-surface aquifers or surface water due to spills or leaks of fuel and oils will be avoided through the application of best practice and safety measures such as use of proper containers and sealed filling areas; training will be provided for the contractors and construction areas will be routinely inspected. The minimum height of the lines at the Dnieper Crossing must be confirmed later in the design stage to meet the requirements of the shipping authorities.

*Mitigation: Good construction and best management practices will be adopted to avoid spills and leakages during construction.*

**Impacts on Air and Climate:**

During construction, short term and localised air impact might occur from dust from the working areas and engine emissions from the construction and transport vehicles. During operation of a transmission line, there are no significant emissions to air (such as gases, aerosols). The so-called "corona effect" at the conductors might lead to insignificant production of Ozone ($O_{3)}$ in the direct proximity of the conductors. There are no significant operating emissions from the substation facilities. The new equipment for the substations includes the installation of hermetically sealed gas-filled (sulphur hexafluoride - SF6) equipment such as switches and transformers. SF6 is an inert and non-toxic gas, but if released has a very high global warming potential, and thus it is important to prevent any leaks from the equipment.

*Mitigation: Good construction and best management practices need to be adopted to avoid the described potential emissions.*

**Impacts on Flora, Fauna and Habitats:** The planned 330 kV Kherson diversion would cross the Dnieper River at an ecological sensitive area (Important Bird Area – IBA, planned national park). Consequently there is potential for significant impacts, especially on birds (e.g. collision of birds with the conductors).

*Mitigation: Further evaluation of the impacts on birds based on additional information and potential mitigation measures. Optimise design of crossing if needed as based on the results of the additional studies. Obtain final agreement with the competent authorities.*

The planned 750kV alignment appears to cross the following three areas of local/national significance:

- Vodyanski Sands: protected pine forest and sands near the ZNPP; current routing is in bundling with two existing 750 kV lines;

- Urochysche Bilozirske: protection area for plants and insects;

- Kairska Balka: protected sidearm of the Kakhovske Reservoir and a classified Important Bird Area (IBA-UA129).

Many different types of bird species are expected to be present in the Project area around the year (breeding, migrating, resting, wintering) of which many are likely to be disturbed by construction activities. Apart from the Dnieper area, bird species sensitive to construction disturbance during breeding times are expected at the northern part of the route (first 5 – 10 km near ZNPP) and at side arms of the Kakhovske reservoir (close to Kajiry village).

*Mitigation: Confirm with the authorities the boundaries of the protected areas. Undertake further bird studies at Kairska Balka. Where lines cross protected areas, consider design of mitigation measures that will ensure compliance with National laws and limit environmental impacts. The determination of construction periods in these areas should be carried out in cooperation with local bird experts to avoid breeding periods, and to minimise overall impacts on birds and wildlife in the forests and in open areas (e.g. relevant for geese, bustards)*

**Impacts on Land use**

**For temporary use,** an area of 2,200 m² to 6,500 m² (depending on tower type) will be needed for construction and assembly of towers of the 750 kV line, and a temporary area of 250 m² to 550 m² for the 330 kV line towers. In addition, a narrow strip of land (about 21m wide) will be needed between the towers for unfolding the wires and wire ropes on the ground prior to stringing the wires sequentially to each tower. The land areas for temporary use will be provided to Ukrenergo under a short-term lease contract with the landowners (only for the construction time). Damage caused by construction activities, such as loss of crops, will be compensated.

**For permanent use**, an area of 174 m² to 360 m² (depending on tower type) will be needed for 750 kV tower locations, an area of 81 m² for 330 kV tower locations. These areas will be permanently lost for agricultural or other use. Taking into consideration that about 40% of towers of the 750 kV line have already been constructed and therefore are not being used agriculturally at this moment, the net additional area that will be lost for agricultural use will be about 8 ha in the entire Project area.

Land between the towers can continued to be used e.g. for agricultural purposes during operation of the transmission line, whereby there are certain restrictions within the corridors of the safety and sanitary protection zones (see Figure 2 and 3) limiting number of working hours under the wires and limiting options for irrigation (see below under Public and Occupational Health). As part of evaluation of the satellite photographs, land which appears to be sprinkler-irrigated with a circular pattern was identified at and near the 750 kV transmission line within the 300 m buffer area between Zavetnoe and Tavriysk of Kakhovka District.

No impact on land use was identified with respect to the construction of the Kakhovska substation and housing areas, and the rehabilitation of the Novokakhovska substation the repair and operation site (ROS) since all construction activities at these sites will be performed within the fenced premises.

*Mitigation: Compensation for permanent withdrawal of land from agricultural use as well as damage during construction or maintenance will be paid (see below).*

**Impacts on Income, Property Issues:**

**Temporary economic impacts** are expected to include damage or loss of crops and possibly some damage to agricultural infrastructure (such as fences) or loss of access to used areas. Compensation to landowners for the temporary withdrawal of their land for the construction period will be determined in the Land Acquisition Plan (LAP). Compensation of damages to the crops during line repair works will be calculated on a case-by-case basis, and protocols shall be prepared in each case. If land owners (land users) are not satisfied, the dispute shall be decided by a court.

At present there are no known occupied dwellings within the buffer areas of the planned transmission lines in which such housing is prohibited (250 m from the 750 kV line and 30 m from the 330 kV diversions). Consequently, there are no resettlement measures involving physical displacement as per the current planning stage. During the further field surveys for the detailed planning stage, and pending potential local re-routing, it may be discovered that a small number of dwellings exist within the routing corridor and potentially some of these may involve a resettlement on a case-by-case basis. For the purpose of the ESIA, the presence of housing along the routing within at least 250 m distance to the power line was evaluated using satellite photographs and topographic maps. As a result, 16 objects or object clusters were identified to be within 250 m of the 750 kV transmission line. All objects appear to be used for temporary purpose or as warehouse, but not for permanent residential use.

The need for **additional land acquisition** for this Project is limited because Ukrenergo already holds the formal State Acts for Permanent Use of Land Plots (State Acts) for towers locations along the 750 kV route and for the locations of the Kakhovska substation and housing areas at Novi Lageri and Kakhovka town. The routing for the two 330 kV diversions, however, is currently being finalized and Ukrenergo is in the process of acquiring the State Acts for these towers locations together with the premise of the planned repair and operation station (ROS) near Gornostayivka village.

A land acquisition plan (LAP) will be prepared by Ukrenergo which contains the *Register of Land Acquisition for Installation of Towers*. Compensation to land owners will be made in accordance with the applicable Ukrainian legislation. In order to determine the scope of the losses and the full compensation, a commission will be created that will prepare necessary protocols. Such commissions are created in compliance with the legislation to ensure the loss compensation process is carried out in a transparent way. Compensation to land owners is based on the fair market price of the land plot at the moment of withdrawal.

No major **forest areas** will be crossed by the line routing, but a number of affected trees (e.g. vegetation types along field borders) may be of high ecological value. The number of trees and bushes to be cut to construct the line will be identified. Compensation for any trees cut will be paid by Ukrenergo to the owner of the trees via a standard procedure.

*Mitigation: As part of the further detailed planning and design, the positions and use of the identified buildings near the 750 kV line will be confirmed. Should any of these objects be located within the 250 m zone of 750 kV line, verify that the buildings are not used for residential purpose. Should that be the case, identify*

*further options to comply with the requirements for restriction of housing in this zone.*

**Impacts on Visual Amenity and Scenery:**

The development of the new transmission line will cause visual change of the existing landscape and scenery to a limited extent. The visual impacts are moderated due to the relatively slim design of the intermediate suspension towers (about 85% of all towers), the general large scale of the landscape, the routing principle of parallel alignment/bundling with existing structures, and the mostly large distance to major settlements. The line does not pass through or near historic, architectural and garden monuments which might be impacted in their visual appearance.

*Mitigation: The visual landscape characteristics will be partly preserved via limiting as far as possible the cutting of trees, bushes and other important landscape elements. Re-cultivation of disturbed areas during tower construction will be enhanced via prompt re-contouring of the soil and re-vegetations, plus e.g. sowing perennial herbs under towers.*

Despite Mitigation measures, **notable visual change** will occur where the line is crossing several topographic structures such as the river valley Urochysche Bilozirske, Kairska Balka gully (side arm of the Dnieper River), river arm near Vasylevka crossed in bundling with existing TL and Dnieper River near Lvovo. In these areas the line will cross the line of sight in the valley, estuaries and gullies.

**Impacts on Public and Occupational Health and Safety:**

The main public health and safety hazards *during construction* are related to increased road traffic and risk of accidents. Occupational health and safety hazards during construction mainly include live power lines, working at heights, exposure to electric and magnetic fields.

During operations, the public is protected from the potential effects of EMR via the SPZ as previously described in "Description of the Project ". Maximum working hours are restricted depending on the height of hanging lines, but will not affect arable land used mechanically (i.e. not by hand or with animal traction). The lowest cable height between towers at hand-worked fields can be raised to 16 m, which would allow workers to be under the power lines for up to 8 hours .

The TL is designed to meet the norms and rules which ensure safe operation, including explosion and fire safety rules. In particular, the towers will be equipped with warning shields "Warning high voltage". The TL will be protected from direct lightning hits by connection of the grounding wire to an isolator.

*Mitigation: Public and occupational H&S risks during construction will be reduced by the implementation of a Construction H&S Plan, including a road traffic management plan, which will be part of the contract with the construction company. An SPZ will be established to protect people working under the power line.*

**Impacts through Noise:**

**Construction-typical noise effects** will be inevitable. However, the construction activities for building the towers will be neither extremely noise intensive nor of long duration at any one site.

**Audible noise** will be generated during the operation of the lines by the so-called "corona effect" that occurs around any energised conductors. The noise intensity depends on the technical characteristics of the lines, the local topography and especially on weather conditions, with dampness and humidity usually exacerbating the effect. The corona noise may be perceived by residents as a nuisance if the line is very close to houses. For this Project, the corona noise effects are likely to be of minimal nuisance, as there are no known houses directly close to the lines (due to the buffer zone to protect against EMR)and noise levels decrease with increasing distance to the lines. Ukrenergo will in any case design and implement the Project in a manner that conforms with the applicable limit values for the protection of sensitive receivers such as residential houses and other noise sensitive facilities.

Residents living along the route and near the other Project facilities (substations, housing areas, maintenance facility)will have the opportunity to issue any complaints about elevated noise levels or any other reasons as per the formal Grievance Procedure and as set out in the *Public Communication Program*.

*Mitigation: Appropriate scheduling of working hours will be applied to minimise disturbance when the construction is in the vicinity of settlements near the TL (such as Tawryisk, Zawetnoje, Weseloje, Mitshurina) or at the Novokakhovka substation, ROS, and the housing areas.*

**Impacts on Cultural Heritage:**

No important cultural structures are known to date in the immediate proximity of the planned route. The nearest known archaeological site is located about 1 km away from the planned 330 kV diversion Novokakhovska-Kherson line in village Lvovo. The Kherson Oblast Inspection for Protection of Cultural Heritage Objects has approved the diversion route.

*Mitigation: In case archaeological finds are identified during tower foundation works, the construction process will be stopped and representatives of the competent authority will be contacted.. The scope of monument protection measures will then be determined by the authority.*

**Cumulative Impacts:**

Transmission lines do not generate direct emissions of pollutants to air, water or land during their operations, and thus there are no relevant cumulative effects in this respect with any other pollutant emitters in the region.

Cumulative impacts may occur due to the visual characteristics of the transmission line structures and the interaction with other transmission lines, roads, and other linear structures. Where possible, the routes of the Project TL and diversion lines have been planned to be bundled with other existing structures, i.e. to run in parallel and as close as reasonable. Another potential negative cumulative impact is the creation of "islands", in which a relatively small land area is surrounded by various transmission lines or roads visible in most/all directions.

Based on the current stage of planning, there appears to be only one case of creation of "islands", in which a relatively small land area is surrounded by various transmission lines or roads, involving two adjacent farms south of Kakhovka.

*Mitigation: Where an" island effect" is identified, evaluate if a local detour is economically, environmentally and socially feasible. .*

# 9. NATURAL RISKS AND NON-REGULAR OPERATIONS

**Natural Hazards:**

The transmission line installations will be designed to withstand natural hazards and disaster impacts according to the applicable design standards and criteria.

The Project is not located in an active seismic region. In the event of a severe earthquake resulting in the toppling of towers and collapse of the power lines, it is unlikely occupied dwellings would be directly struck by the towers because the buffer-zone to houses is 250 m from the towers, and the typical tower height is approximately 35 m.

Flooding of the substation sites did not take place during the last years and is considered unlikely to occur in the future.

**Accidents/Emergencies:**

No other industry is known in the surrounding of the substation which might interfere with their activities. The SPZ at both sides of the TL and corresponding use restrictions ensures that no interference with other activities or uses might happen.

The types of major disasters or emergencies that may occur at transmission lines or in substations are fire, explosion, electrocutions or spillages (oil, acid, chemicals). All applicable standards will be implemented, such as installation of an adequate electrical safety system, fire protection and extinguishing equipment. Given these measures incorporated into the design of the line and the substations, major disasters are considered as unlikely and the facilities are not anticipated to pose a potential risk of significance to third parties.

Emergency response plans will be established for construction and operation of facilities.

# 10. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

An Environmental and Social Management and Monitoring Plan (ESMMP) was developed as part of this ESIA. It summarises the organizational requirements, actions and monitoring plans to ensure that the necessary measures are taken by Ukrenergo to avoid potentially adverse effects - and maximise potential benefits - of the Project, and to operate in conformance with applicable laws and regulations, as well as the policies of international lenders[5] . The overall responsibility for the ESMMP lies with Ukrenergo, whereby a number of the specific actions will be carried out by the third-party Contractors in the different stages under supervision of Ukrenergo.

Ukrenergo will provide for the following measures throughout the Project

[5] Of particular relevance is the EBRD Environmental and Social 2008 Policy - Performance Requirement (PR) #1 regarding ESAPs (ESMMPs)

- **Provide Organisational Capacity:** Ukrenergo must establish and maintain an organisational structure that defines roles, responsibilities, and authority to implement the ESMMP, including aspects such as the designation of a Senior Manager with overall responsibility for specific areas or stages of the ESMMP or a Statement of commitment by Senior Management to devote the necessary human and financial resources to achieve conformance with the ESMMP

- **Contractor Management Plan**: Much of the Project work will be done by various contractors engaged by Ukrenergo such as design firms, surveyors, and especially the main Construction Contractor. Thus it is important for Ukrenergo to implement procedures in a Contractor Management Plan to ensure that the Contractors are fully aware of the relevant ESMMP issues and similarly committed as is Ukrenergo to the successful implementation of the ESMMP. As main components the Contractor Management Plan includes training and awareness sessions, inclusion of specific relevant ESMMP provisions into tender documents or ensuring the bidding contractors' capacity to meet the ESMMP requirements

- **Annual ESMMP Performance Monitoring and Reporting:** As the Ukrenergo will be obliged to retain qualified specialists to undertake periodic monitoring/audits throughout the period of EBRD involvement with the Project. An initial ESMMP Audit will take place within six months of the start of each new Project Stage, and subsequent audits at least annually. The ESMMP Audit results must be documented and reviewed by senior Ukrenergo persons and the EBRD; also, the results must be disclosed to the relevant parties/stakeholders affected by the ESMMP. Depending on the findings, it may be necessary to revise the original ESMMP to better reflect the changing situation with the Project implementation, and/or the social, environmental or regulatory framework conditions.

- **Specific Mitigation Items:** The more specific action-mitigation items related to the various environmental and social topics are described in the chapters above and in more detail in Table 8-1 of the ESIA.