Державне підприємство
Національна енергетична компанія
УКРЕНЕРГО

Project „Construction of the 750 kV Rivne NPP – Kyiv overhead transmission line with an extension of the 750 kV Kyiv substation and diversion of the 750 kV overhead transmission line from Khmelnitsk NPP”

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)[1]

May 2007

[1] The ESIA has been prepared for meeting environmental requirements of the European Bank for Reconstruction and Development (EBRD) and European Investment Bank (EIB) that are considering the opportunity to finance the Project.

The ESIA report is the main document with the help of which the EBRD and EIB will implement environmental assessment of the Project

Report prepared by

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Acronyms

EIB	European Investment Bank
EBRD	European Bank for Reconstruction and Development
EEC	European Economic Community (European Union)
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental & Social Managgement Plan
GDP	Gross Domestic Product
ITT	Invitation to tender
HSE MS	Health, Safety & Environment Management System
ESMP	Environmental & social management plan
OVNS	The EIA in Ukrainian
LAP	Land Acquisition Plan
RoW	Right of Way
NPP	Nuclear Power Plant
PCDP	Public Consultation and Disclosure Plan
SEE	State Environmental Expertise
TEO	The feasibility study in Ukrainian
TL	Transmission Line
TPP	Thermal Power Plant
SPZ	Sanitary Protection Zone
UAH	Ukrainian Hrivna
UEG	United Electricity Grid
UCTE	Union for the Co-ordination of Transmission of Electricity

1. Non-technical summary

1.1 Introduction

NPC Ukrenergo is a Ukrainian State owned enterprise that is responsible for constructing, operating and maintaining 220 – 750 kV electricity grid networks.

The Government of Ukraine has identified a number of high voltage electricity transmission projects which are urgent and strategically important for providing constant electricity supply to the Ukrainian consumers and reliable work of Ukrainian electricity grid as a whole. Firstly, the strategy of the electricity grid development is directed towards creation of standard conditions for utilization of the capacity from power supply units currently operating as well as from new power supply units comissioning of which is planned by the Government, optimization of the balance structure of the capacity, providing for frequency and voltage regulation.

Amongst these projects is the construction of the 750 kV overhead transmission line Rivne NPP – Kyiv with extension of the 750 kV Kyiv Substation and diversion of the 750 kV overhead transmission line Khmelnytsk NPP – Chernobyl NPP. To finance the project, NPC Ukrenergo is seeking loans from the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD).

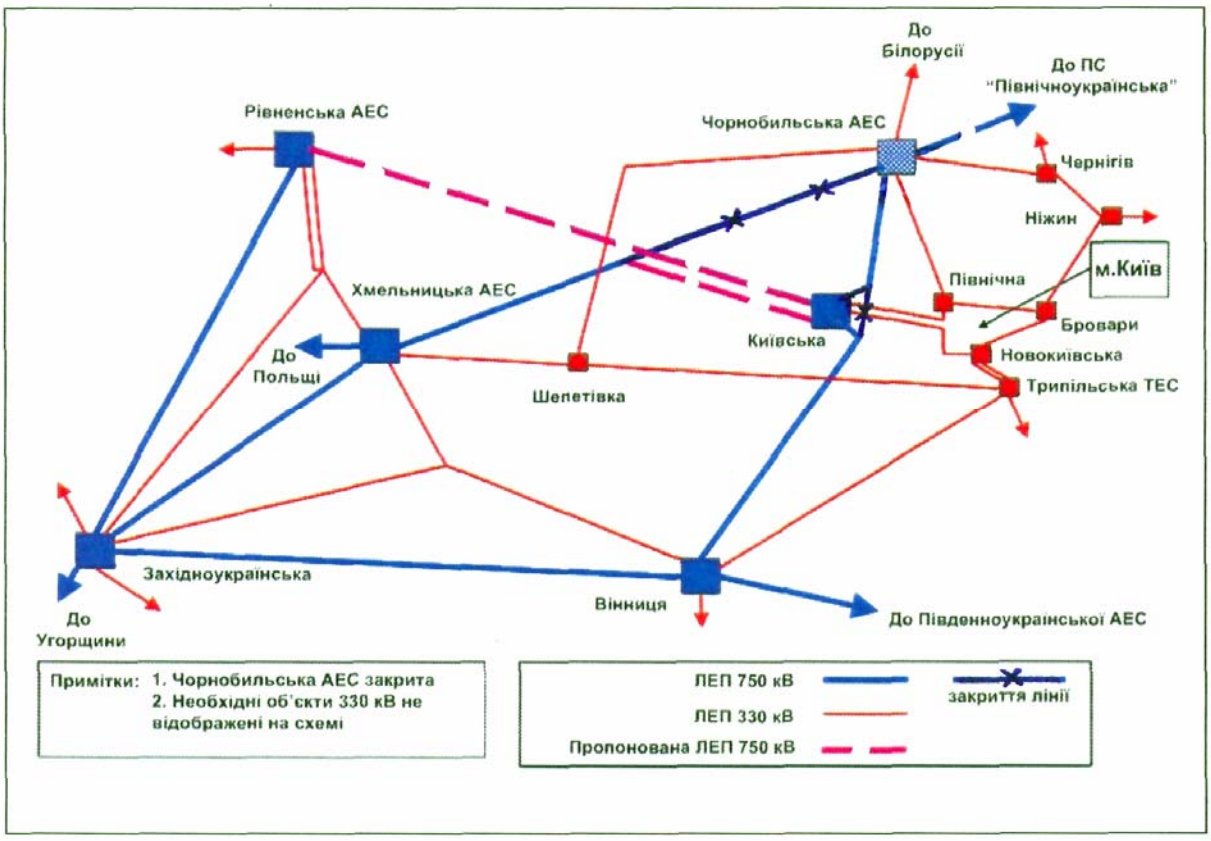

Figure 1.1 Electrical grid networks of the Western region of Ukrainian and proposed re-enforcement

Figure 1.1 above shows electricity transmission lines through which power generating capacity of nuclear power plants (NPPs) of integrated power system of western region of Ukraine is connected with central Ukraine through two major lines: a 750 kV transmission line from Khmelnytsk NPP to a 750/330 kV open distribution unit at Chernobyl NPP and another 330 kV line from Rivne and Khmelnytsk NPPs to Zhytomyr and Kyiv regions. The shown grid of the electric power supply system does not make it possible to generate the full capacity of the Nuclear Power Plants of the Western regions of Ukraine while the inadequacy of the electric power supply network of the Kyiv power system does not allow to meet the needs of the region for sustainable economic and industrial development and in separate cases may result in disconnecting a considerable number of consumers from electric power supply. Implementation of the project for construction of the transmission line Rivne NPP – Kyiv with 750 kV Kyiv substation will allow to increase reliability and quality of electric power supply to the consumers of the region and to transfer the surplus capacity of NPPs in the amount of 1000 MW to the Kyiv region which is short of electric power supply (the deficit in capacity accounts for 1300 MW and has a stable tendency of 4-5% increase annually). It should be noted specifically that the present project will create conditions for possible reduction of power facilities (substations and transmission lines) located in the contaminated Chernobyl zone.

1.1.1 Project definition

The scope of the project ESIA covers the construction and operation of two new transmission lines: the 750 kV Rivne NPP – Kyiv transmission line of total length of 353 km and the 265 km 750 kV Khmelnytsk NPP – Kiev transmission line, which is created by means of construction of the diversion of the 750 kV transmission line Khmelnytsk NPP – Chernobyl NPP of 135 km length to Kyiv substation.

This is shown in Figure 1.2.

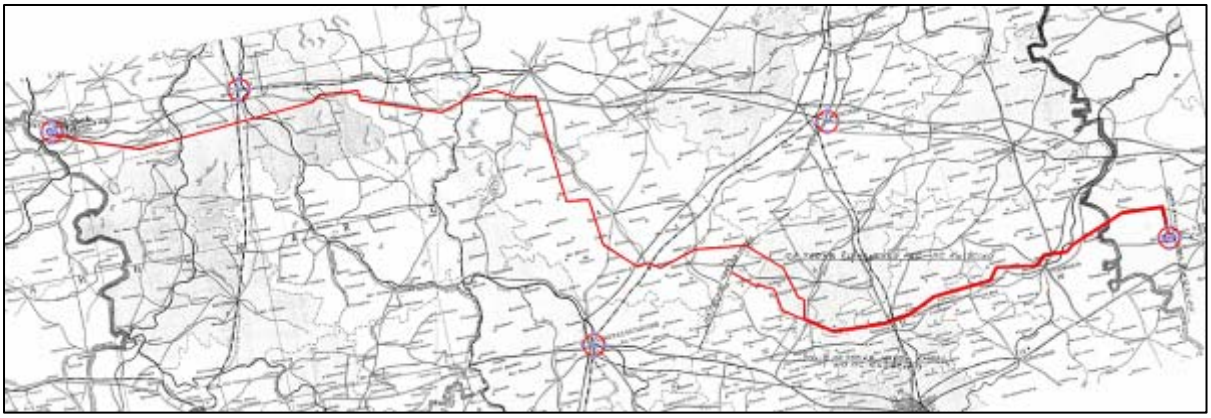

Figure 1.2 Location of proposed transmission lines

1.1.2 Project benefits

The construction of the proposed transmission line is anticipated to facilitate achieving the following:

- **Improved stability of the system:** The reliability of the gird will be significantly improved by means of introduction of additional electrical networks that will make

imposiible power cuts in the event of the unplanned breakdown of a major piece of equipment.

- **Optimised supply of power to Kyiv** - It will help to exploit all the potential of the energy from the power stations in Western Ukraine. Grid re-enforcement has the potential to deliver additionally more than 1,000 MW from these power stations to the central and eastern regions.

- **Increased energy efficiency -** through increased efficiency of operation of NPPs, as well as higher levels of electricity supply in the transmission system.

- **Compatibility with European networks** - the design of the transmission grid construction will allow making the maximum use of the geographical and geopolitical position of Ukraine to much closer international co-operation in energy sector.

- **Transfer and dispersion of skills -** to power generation complex of Ukraine from implementing projects of this nature and associated income for contractors and sub-contractors.

1.2 Legislation

1.2.1 Project permitting

The strategy to construct a 750 kV power transmission line from Rivne NPP to Kyiv was defined in the Presidential Decree (09.12.2005) as a part of the plan to improve power transportation capacity.

Following its mandate, NPC Ukrenergo then contracted through a tender procedure the State project design and research institution – Ukrenergomerezhproekt that produced the construction project documents and also covered general aspects of potential impacts of the power transmission line on human health, safety, environmental and social aspects. The evnvironmental impact assessment (OVNS) was included into the said documentation as a separate volume in accordance with requirements of the State Construction Normative DBN A.2.2-1-2003. Under the effective legislation for environmental impact assessment in Ukraine, the comprehensive EIA is not explicitly required for high voltage transmission lines and the comprehensive state environmental expertise is not required either.

The said construction project documents were examined by the state comprehensive investment expertise by the Central Service of the “Ukrinvestexpertise” under the Ministry for Construction, Architecture and Communal Services of Ukraine. It came to a positive conclusion that the overall technical construction documents met the national technical standards and effective legal requirements. This conclusion also was based on approvals of other competent state authorities concerning the project documentation, including the bodies of the Ministry for environmental protection of Ukraine.

Based on the positive conclusion of the state investment expertise, the Cabinet of Ministers of Ukraine approved the project for construction of the overhead high voltage transmission line by the Directive No.15-p on 22.01.2007.

The contracts for development of working documentation for the construction, commissioning and testing of the transmission line will be signed through a tender process and exact sites for tension towers will be established in the working documentation after these plots will be defined on the land surface. Currently some flexibility is envisaged in selection of the exact sites for the towers and for variations in the RoW to avoid ownership, environmental and socially sensitive problems.

The conclusions of the environmental impact assessment have been presented in the Statement on the Environmental Consequences of Project Activities that in fact becomes the NPC Ukrenergo's commitment, and it is binding for all its contractors during the whole period of project implementation, as far as the environmental issues are concerned.

1.2.2 Ukrainian Land Legislation

1.2.2.1 Land tenure

The legal framework for land tenure is currently being debated and some changes may take place in the near future. Currently there is a moratorium on the sale of agricultural land established in Ukraine until 2008.but this prohibition is not applicable as far as the withdrawal of lands for public needs is concerned. There are draft laws on easements (*servitut*) and on withdrawal (buyout) of land for public needs under consideration in the Parliament and some land issues relating to the project require more detailed regulation.

Each land plot is given for a specific purpose determined in accordance with the Land Code of Ukraine – for instance agricultural land can only be used for farming and cannot be freely converted by its owner to any other use without decision of the competent state authorities.

Some people have already received ownership acts and some had not even applied for these acts because it would have an adverse effect on their income or they found it more convenient to rent their land rights to third parties. The situation is moving in the direction of land reform, privatisation and land sales.

Apart from agriculatural lands other land purpose models include:

- **Reserve** (state) **lands** (*zemli zapasu*) – undistributed public lands held in trust by local councils and administrations. Ths includes areas of arable land, hay meadows and pasture as well as unproductive land (marshes etc).
- **Village** (communal) **land** is generally used by the community – i.e. no one has specific allocations or rights to pasture, although hay meadows are typically assigned to individuals.
- **Forest lands** (predominanatly state owned) - small areas of forest may belong to communities or even to private owners (up to 5 ha).
- **Houses and house lots** – are already in private ownership and can be freely bought and sold.

1.2.2.2 Land acquisition

NPC Ukrenergo will have to acquire the right of permanent use of land plots needed for the "footprints" of the towers. It is estimated that the line will need approximately 1312 land plots of 140-620 m^2, depending upon the type of tower. An easement or right of use (*servitut*) will also be required for the land crossed by the transmission lines in the right of way (RoW).

The land plots for towers will be assigned to NPC Ukrenergo by the state administrations or acquired for NPC Ukrenergo by the local councils. NPC Ukrenergo will be given State Certificates of Permanent Use for each plot of land.

The route of the transmission line has been chosen to avoid the built-up areas of villages and only one house owner will have to be resettled. To finalise the route the construction contractor will prepare a Land Acquisition Plan that will:

- Contain data on the ownership, designated use, rights of use, rights of way, archaeological data on the plots required for the tower bases, the RoW as well as access roads, stockpiles, construction areas etc.
- Inform the land owners and land users, obtain their consent and get the approval of competent local and state authorities with a review by the State Agency for Land Resources.
- Prepare the valuation reports and compensation schedules for each landowner and land user – this covers the value of the land (for landowners), improvements, crops, hay meadows and forests
- Prepare Permanent State Land Use Certificates in the name of NPC Ukrenergo. This will involve decisions to change targeted use of the land plots that will be acquired. This decision will be taken by the Cabinet of Ministers of Ukraine and will be based on the recommendations of the raion and oblast administrations and land resources authorities.

1.2.2.3 Land valuation and compensation

Land valuation is only required for the plot that will be assigned for NPC Ukrenergo for tower bases and will take place as a part of the Land Acquisition Plan. Ukrainian legislation requires that expert valuation is undertaken by licensed valuers. A market price of land should be established for any transaction for deeds between the public authorities and private entities. The method of expert evaluation is based on calculation of the three following factors:

- capitalization of the operational revenues of the land owner or rent payments;
- comparative prices for similar land parcels; and
- calculation of cost of all improvements to the land.

The amount of due compensation to landowners and users will be approved by decisions of special commissions set up by relevant local councils or state administrations

No compensation is paid for the visual impacts on the landscape or for potential or possible hazards associated with the electro-magnetic fields generated by the transmission line. This is the same as the current practice in other parts of the world including Western Europe.

Compensation will be paid to owners and users of the land for damage to crops and loss of potential earnings while assembling and erecting the towers, for access to the RoW of the transmission lines, as well as the land required for construction camps, stockpiles, parking and maintenance of vehicles and equipment and any other uses.

The Village, Rayon Councils will be compensated for any land taken within the village boundaries (communal lands) and the Regional and Rayon State Administrations will be compensated for land outside the boundaries of the villages (state owned lands).

Compensation for value of land will only be paid to the owners of the land acquired for the towers but not to the owners of the land within the RoW. The easement for the RoW or sanitary protection zone imposes three basic limitations, apart from prohibiting the construction of housing and other buildings:

- In areas where the cables are hanging at the standard 12.5m above the ground people can work up to 3 hours at a time under the transmission line – this is a limitation that would affect areas of arable land worked by hand or with animal traction, but NPC Ukrenergo has proposed that the cables will be raised to 16m in areas used for arable farming and in this case the length of time people can work under the power lines will be increased to up to 8 hours at a time;
- In forested areas trees would have to be cut on a regular basis to keep them to a pre-defined height.
- The owners and users of the land in the ROW are obliged to allow maintenance and repair crews to have access to the transmission line. Any damage caused by the maintenance should be compensated by NPC Ukrenergo in compliance with the law on a case-by-case basis.

It is envisaged that NPC Ukrenergo will have to sign contracts for the easement with the private landowners whose land is situated in the RoW and with the Village Councils (for land within village boundaries) and with the State Raion Administrations (for forests land outside village boundaries).

1.3 Current environment and socio-economic baseline

1.3.1 Natural environment

1.3.1.1 Geography and geomorphology

The transmission line routes are situated in the south- west of the East European Plain within the territory of mixed forests in the Polissya Province, and passes through the geographic regions of Volynian, Zhytomyr and Kyiv Polissya.

The route starts in the north-west of Ukraine, in Volynian Polissya. The area is a flat swamp plain with separate sand hills and ridges, considered as the most humid, forested

and swamped area in the Ukrainian Polissya. In Zhytomyr Polissya, the surface is much higher, drained and less boggy in comparison with the areas of Volynian and Kyiv Polissya, with elevation ranging between 184 – 245 m.

The routes end in the west of Kyiv region on the territory of Makariv district. The landscape here is slightly undulating, covered with forests and peat bogs at some places. It is dissected by ravines, gullies and the Teteriv River course and its tributaries, swamp ditches and grooves, with elevation of 150 - 250 m.

A summary of the land affected is shown in Table 1.1.

Indicators	**Rivne region Single line**	**Zhytomyr region Single line**	**Zhytomyr-Kyiv regions, section with parallel lines**
Route length, km	118	99	135
Bogginess, km	6	29	7
Forest, bushes, km	59	36	27-36

Table 1.1 Ground crossed by the transmission line routes

1.3.1.2 Geology

The transmission line route at Rivne region crosses areas that are part of the North-West edge of the Ukrainian crystalline craton. The geological composition here includes rocks of Lower Proterozoic, Upper Cretaceous Turin horizon and Quaternary eras. Zhytomyr region is a part of the Ukrainian crystalline craton while Kyiv region is located in the tectonic zone of transition from the Ukrainian crystalline craton in the west to the Dnieper-Donetsk basin in the east.

1.3.1.3 Climate

The area is part of the plain sub-region of the Atlantic continental region, with climatic conditions influenced by the humid air masses from the Atlantic Ocean and the Mediterranean Sea. Incoming Arctic air masses can cause abrupt temperature drops in winter to -35ºC, -40ºC, and drought phenomena in summer. In general, the area is characterized by a moderate continental climate with optimum humidification.

The average annual air temperature is about +7.0°C but temperatures up to 40°C and down to -37°C have been observed. The annual precipitation is around 600 mm and is more intense in July.

West winds prevail over the year, bringing precipitation and rise of temperature in winter and temperature drop in summer. On average, during the period of climatic load record once per 25 years the recorded wind speed was from 2-3 m/s to 26 m/s.

The area is covered by snow for 90-100 days per year during end of December and beginning of March. The height of the snow cover is 15-25 cm, but it can reach 45-50 cm.

Over recent decades, the period with snow cover as well as snow height has reduced. It may now happen that the whole winter passes without any permanent snow cover.

1.3.1.4 Hydrogeology and hydrology

The route of 750 kV Rivne NPP – Kyiv transmission line and 750 kV transmission line diversion crosses a number of different hydrogeological basins; the Volyn-Podillya artesian basin at Rivne region, the Dnieper-Donetsk artesian basin at Kyiv region and the Dnieper-Donetsk artesian basin or the Ukrainian craton in Zhytomyr region.

In hydrological terms, the route is a part of the Polissya hydrological area with rich water resources. Overall, two hydrological basins are distinguished, the river Prypyat basin and the river Dnieper basin. The river Prypyat basin is characterized by a multitude of rivers and tributaries, some of them canalized for soil reclamation. A specific feature of the landscape in Dnieper basin is marshes. Polissya marshes play an important role in hydrological regimes of rivers and temporary streams.

Under the influence of human economic activity in recent times, the hydrographic network of the territory has experienced significant changes related to the establishment of reservoirs and ponds, the construction of canals for soil drainage and the icing regime of rivers (due to changes in water temperatures by effluent discharges).

1.3.1.5 Seismology

Both transmission line routes are located within the same seismic area where the maximum earthquake intensity can has a magnitude of 5 – 6 on MSK-64 scale. In simple terms, the earthquake of the magnitude more than 5 can occure once in 500 years.

1.3.1.6 Flora / fauna

The transmission lines cross the territory of mixed forests in the Polissya - an entire ecological system which covers southern Belarus, northern Ukraine as well as adjacent areas in Poland and Russia - a vast, waterlogged region of Eastern Europe, actually the largest swamp of the European continent. In general more than one-third is arable land, nearly one-quarter is covered with mixed woodland, about 5 percent is peat bog, a substantial portion is marshland, and the river valleys are floodplains.

The majority of the affected forests are mixed areas of pines, oaks, and birch trees. Spruce trees and fir stands are also present as well as willow thickets. In the natural areas and in not intensively exploited parts of the forests as well as in natural reserves there are also hornbeams, alders and aspens. An indication of woodland habitats is show below.


Figure 1.3 Access roads in woodlands and forest with small river in Dibrova

Polissya flora is very rich and diverse. There are nearly 100 species of medicinal herbs, 90 species of vitamin plants that are used as colouring materials. The presence of significant number of bee plants has advantaged the development of beekeeping.

The area supports a number of bird species that are listed in the Red Data Book of Ukraine, such as Common Crane, Capercaillie, and the Black Grouse. It is also important for a number of raptors, including rare species such as Short-toed Eagle, Spotted Eagle etc.

Within the exploited forests, the mammalian fauna includes species that are relatively accustomed to human presence, such as wild boars, deer and roe-deer, hedgehogs, moles and shrews, badgers, musk beavers. Beavers are also common and at places make their presence clear through their small dams and burrows. The main freshwater fish found in the area include limnophilous species such like pike, chub, roach, bleak, crusian carp, loach, eelpout, and river perch. Entomofauna is represented by typical for Polissya species that can be distinguished in different communities of forest, meadow, aquatic and semi aquatic insects and xerophytic stations.

Little is known on the location and/or population status of the above species. Anecdotal evidence suggests that many of these species are already withdrawn to the most inaccessible parts of the wider area due to human presence and property development.

Protected areas and reserves

The transmission line does not cross any Natural Reserves, National Parks or any other protected area of national status and importance. However, there are a number of reserves protected at the regional or district level that have been identified following consultation with the Ministry of Environmental Protection – Dept of Reserve Management as being close or affected by the transmission line construction:

In Sarny District:	**In Olevsk District:**
• Kostantinovskiy (0.8 ha) • Beech forest (3.5 ha) • Vovcha gora • Pine forest plot (7.8 ha)	• Teresyny (2184 ha) • Teljachiiy mokh 1 & 2 (553 and 915 ha)
In Rokytne District	**In Yemylchynsk District:**

• Dibrova – pechka brod (16 ha) • Stvyga (3.1 ha) • Pechorky (7.2 ha)	• Juzykhovka (439 ha) • Tokov mokh (454 ha)

No Important Bird Areas (IBAs) will be impacted by the construction project. There are some IBAs located north of the proposed route, in Rivne and Zhytomyr administration regions, but these are too far to be affected by the transmission line or the works during its construction, although there is a possibility of interactions that may occur during migration.

1.3.2 Socio-economic issues

The transmission line crosses territories of 3 raions of Rivne oblast (Volodymyretsky, Rokytniansky, Sarnensky), 7 raions of Zhytomyr oblast (Olevsky, Emilchynsky, Volodar-Volynsky, Cherniakhivsky, Korostyshivsky, Radomyshlsky, Chervonoarmiyskiy) and one raion of Kyiv oblast (Makarivsky). All these raions lay mainly on agricultural and forest lands. Soil fertility in this area is usually much lower than in other regions of Ukraine.

1.3.2.1 Land use

The land use pattern in Ukraine has changed dramatically over the past 15 years and this process is ongoing. Categories of land are defined according to the type of use: agricultural lands, lands for housing, nature protection land, recreation land, and land used by industries, etc. At this stage there is no detailed information available on land ownership and land use in the RoW of the transmission line. Such information will be collected during preparation of the working design documents when the construction contract has been tendered.

1.3.2.2 Socio-Economic Situation in the Affected Districts

The population of the different raions in the transmission line route varies from 40,000 - 100,000 inhabitants. Urban population comprises from about 25% (Emilchynsky, Makarivsky raions) to 60% (Korostyshivsky raion).

The main economic activities are agriculture (crops and cattle), forestry, quarrying stone and mining (clay, titanium ore). Land ownership is a process in progress, as the assets of the collective or state farms (*kolhozy* and *sovkhozy*) of the Soviet era, are still not shared among workers and pensioners. The economic environment varies significantly in different raions depending on various factors such as the proximity to cities/industrial enterprises which can provide side earnings, the distance to major transport lines, the efficiency of new agribusinesses which rent land plots from individual land owners etc. This is increasingly apparent as we move closer to Kyiv, i.e. in Makariv raion and is reflected in the cost of housing.

1.3.3 Cultural environment

1.3.3.1 Archaeology / Cultural heritage

During the project technical design the transmission line route was submitted and approved by Regional Administrations (Inspections) of the cultural heritage protection.

The result of an approval was a modification of the proposed route as well as the compliance with specific terms regarding construction.

A modification of the route direction was made near Torchin village in Zhytomir region, where during the preliminary investigations archaeological artefacts were discovered. The findings date back to the period of the Bronze-early Iron Age as well as the XII – XIII century Kyiv Russ.

Additional archaeological surveys were also requested in Rivne, Zhytomyr and Kyiv regions. These surveys will be implemented by authorized organizations.

1.3.3.2 Aesthetics / visual impacts

The area crossed by the transmission line route is a relatively flat terrain partially covered by mixed forests. As such, there is little opportunity for using the natural landscape to limit the visibility of the tower structures.

1.4 Project description

This section provides a description of the proposed project activities over the lifecycle of the project: planning, construction, operation and decommissioning.

The detailed planning of construction phase will be carried out by the general construction contractor. An outline plan of the construction methods will be included in the tenders for the construction contract and form part of the tender evaluation, so NPC Ukrenergo will have some direct control over construction methods. The following description and the subsequent impact assessment in the next section, is based on the expected construction methods but may alter with the selection of the construction contractor. If significantly different approach is used, it will be subjected to a Change Control Process mediated by NPC Ukrenergo, in which the ESIA process will be applied to identify and assess any new environmental aspects and impacts. Appropriate mitigation measures will then be developed and incorporated into the Environmental & Social Management Plan (ESMP).

1.4.1 The transmission lines

The transmission line consists of self supporting towers which bear the wires that carry the electricity. The towers are typically spaced at 400 or 500 m intervals, depending on the landscape characteristics. Each tower supports 15 wires that carry the electricity in 3 phases, with 5 wires per phase. Insulators are used to isolate the towers from the live wires. They also carry 2 earthing wires that protect the line from lightening strike.

There are two types of towers (see Figure 1.4). Angle tension towers are used to tension the wires and accommodate changes in direction of the line, wiith support towers in the straight sections to keep the wires off the ground. The height of the wires at the towers is normally approximately 25m which drops to a minimum 12.5m at the centre of the span. The height at the centre of the span can be increased to 16m when crossing sensitive areas like roads, railways or agricultural land by adding additional sections to the base of the towers, or by reducing the distance between the towers.

Figure 1.4 Photographs of angle towers and a support tower

1.4.2 Construction

It is assumed that the construction materials will be stored at the construction contractor's premises or at NPC Ukrenergo's maintenance stations.

The construction is expected to take place by carrying the tower materials to each tower base by lorry and assembling the towers on site. Work is expected to take place at several construction locations at the same time. The construction teams at each location would consist of four or five crews of 5-10 people, working one after another, with each crew responsible for one of the following: preparing the RoW, laying the foundations for the towers, assembling the towers on the ground, erecting of the towers and installing the wires and testing and commissioning the line.

1.4.2.1 Preparing the RoW

Once the negotiations for land acquisition and easements are complete, the construction phase will define the right of way on the ground using marker posts in open country or by marking trees that need to be felled in woodlands. Protected area will generally be 120 m wide for the single transmission line and 195 m wide for the double line and RoW will constitute 22 m in the interval between towers. Additional space will also be made as necessary for the construction and erection of the towers. The preparation of the RoW in woodland areas will be managed in close co-operation with State Forestry. The timber will be prepared for sale and the revenue used to offset the costs of compensation for trees that were cut down.

The provision of access roads to the construction sites is a key feature of these preparatory works. The selection of the access routes will be discussed and agreed with Village Councils and Raion authorities. It is expected that the RoW, existing roads, tracks

or woodland fire breaks will be used wherever possible, upgraded as necessary and re-instated to their former condition at the end of the construction phase. Special provision may have to be made for constructing roads into wetland areas.

1.4.2.2 Construction of foundations

There shall be two basic types of reinforced concrete foundations used: pad and chimney & piles. The pad & chimney foundations are normally used in firm dry ground. In a typical installation, a hole from 2x2 m to 2.7 x 2.7 m is dug down to approximately 3 - 5m deep. The earth that is removed is carefully separated to preserve the topsoil and the foundation is strengthened with cross-bars. The subsoil is then backfilled into the hole and compressed to strengthen the foundation and the topsoil is laid on top and reseeded with appropriate vegetation.

Pile foundations are used on wetter ground and are expected be the more common type of foundation. Piles are driven into the ground with 2-4 piles at each corner and covered with a reinforced concrete beams. None of the foundation types results in a solid concrete platform on the surface, as the foundations are laid under each supporting point of the tower, so that only 20 cm of concrete foundation is above the ground level. Connections for raising and securing the towers are provided at each corner of foundation through bolted joints.

1.4.2.3 Assembly and raising of towers

The materials will be sent to each tower foundation from the storage depots using small 8-10 tonne trucks. The tower itself is then assembled from galvanized angle steel and sheet steel and bolted together (10 days for 1 tower). The bolts are welded up to the height of 10m to prevent theft (2 days for 1 tower).

The towers are raised using swivel bolts on the foundation and a falling jib as shown in Figure 1.5. The falling jib is first raised almost vertically by a crane. Then 2-4 tractors are used that pull on the wire. One tractor is used as a balance weight.

Figure 1.5 Raising a portal (towers are being raised the same way)

1.4.2.4 Wiring

Tension and suspension sets of insulators for wires and wire ropes are assembled on the ground for the whole anchor span, i.e. from one angle tower to the next. The wires and wire ropes are unfolded on the ground along the anchor span and then raised and strung sequentially on the towers and tensioned.

The line is then energized with a 330 kV protective voltage to prevent the theft of the wires and steel parts: These unfinished sectors have a special warning sign “Danger! High voltage!” The ground around the tower bases is re-cultivated and the construction site is

restored as far as possible to its original state. When the whole of the transmission line is completed, it is connected to the design voltage of 750 kV and is then operational.

1.4.3 Operations & maintenance

Once lines are constructed the main impacts that arise stem from their physical presence, the Electromagnetic Field (EMF) together with noise created by the Corona effect. Physical presence creates a visual impact and a threat to birds from collision with the wires.

1.4.3.1 Electromagnetic Fields (EMF)

The size of the RoW and sanitary protection zone is largely determined by EMF, where measurements have shown that the EMF of 750 kV lines at a distance of 40m from the footprint of the line is < 5 kV/m, which is the national standard for limitless exposure.

It is also noted that the “Sanitary Protection Zone” along the pipeline is 40m from both sides of the routing, with the closest house to the routing being some 250 m away. This is in contrast to Europe; in the United Kingdom for instance, 0.63% of homes (139,000 houses) in England & Wales are within 200m of 275-440 kV lines with 0.007% (1,700 houses) directly underneath the wires[2]. However, it must be made clear that this applies to 275-440kV transmission lines where the EMF fields are substantially less.

Figure 1.6 shows the distribution of the electrical field under wires of 750 kV TL with the minimum distance from the wire down to the ground being 12m; the dash line shows the border of the sanitary zone.

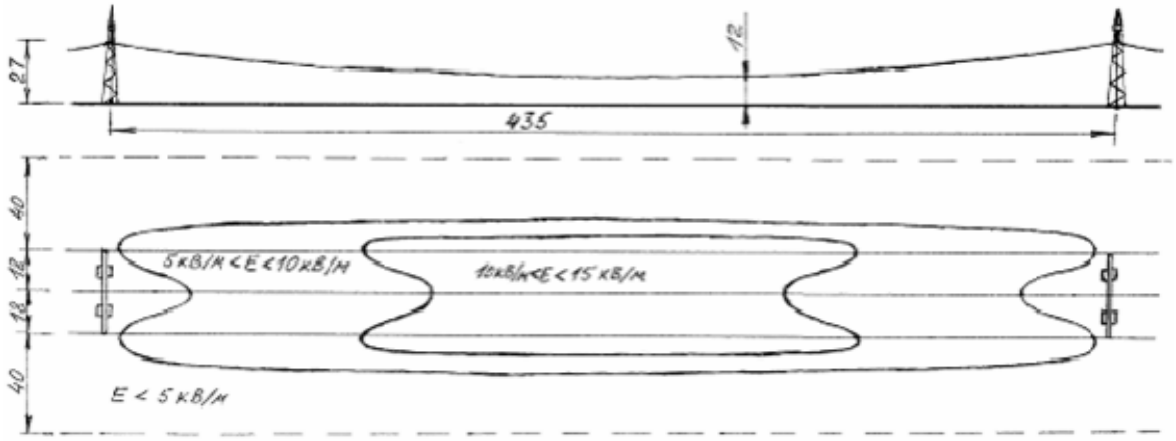

Figure 1.6 Sanitary protection zone

1.4.3.2 Noise

Transmission lines produce noise through the Corona effect and noise levels can be significant, especially in foggy, damp, or rainy weather conditions, when power lines can create a subtle crackling sound due to the small amount of the electric current ionizing the moist air near the wires.

[2] http://www.emfs.info/issue_home.asp

The Corona effect can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimetres immediately surrounding conductors. Ozone is a reactive form of oxygen and combines readily with other elements and compounds in the atmosphere.

Corona on transmission line conductors can cause interference with radio waves, primarily with AM radio stations and the video portion of TV signals, depending on the frequency and strength of the radio and television signal.

Interference with communications equipment is also caused by loose or damaged hardware on the transmission line itself and can be remedied by repairing equipment.

1.4.3.3 Accidental events

The most common types of accidental events with transmission lines are toppling of towers (frequency of the order of 1 event per year for older designs) and breakage of transmission wires (frequency >10 events/year). If a wire breaks normally it makes a short circuit and the power is disconnected. Tower toppling can occur in high winds or, more often, from the theft of nuts and bolts and consequential weakening of the structures.

Normally the main consequences of tower toppling, wire failure and fires are not significant. The size of the sanitary protection zone provides enough distance to ensure that people do not get harmed.

1.4.3.4 Maintenance

The main part of service is maintaining the protected area of the transmission line especially in woodlands, with the cutting trees, lopping branches and maintaining ground cover around the tower bases. The integrity of line is normally visually inspected once a year. If any problems are revealed, the line is disconnected and repaired at times when the electricity demand is low.

1.4.3.5 Decommissioning

The expected field life of a transmission lines is approximately 50 years. No decommissioning of 750kV lines has been carried out in Ukraine as yet, but it is expected that the decommissioning process will be essentially the reverse of the installation process, with opportunities for reducing the environmental impact and offsetting cost by re-using or recycling materials.

1.5 Identification and consideration of alternatives

1.5.1 No project option

It was made clear in the scoping consultation meetings that this ESIA will address the impacts associated with proposed transmission lines and will not cover the broader issues of Ukrainian Energy Policy. The simplest way to avoid providing infrastructure is to improve energy efficiency and so reduce electricity demand. However, energy efficiency improvements are addressed in the 2030 Energy Strategy and it is assumed that further substantial improvements in energy efficiency are not practicable. Any extensive increase in renewable electricity sources will almost certainly require gird re-enforcement. In this

context, lack of investment in the proposed project would have the following consequences:

- The underlying system instability problem caused by inadequate transmission capacity would compromise supply reliability in the Kyiv Region and across the whole country;
- Increasing energy demand will have to be met by grid re-enforcement in other parts of the network.

1.5.2 Alternative routes

Different options of re-enforcing the grid infrastructure in Western Ukraine were considered. Connecting to the existing 750kV substation at Vinnytsia, was more expensive and offered no advantages in improving the security of supply into the Kyiv region as there is no additional capacity actually feeding the Kyiv area.

A northern route was also considered with options to go through the contaminated land areas in the Chernobyl region or connecting to the 750 kV open distribution unit at Chernobyl NPP. An example is shown in Figure 1.7, in which the red and blue lines show the preferred route and the orange and green lines show the northern variant. The hatched pink area shows the radioactive contaminated areas around Chernobyl. The northern route was subsequently rejected because of the Chernobyl contamination. The route avoiding Chernobyl was too expensive, mostly due to the presence of extensive wetlands.

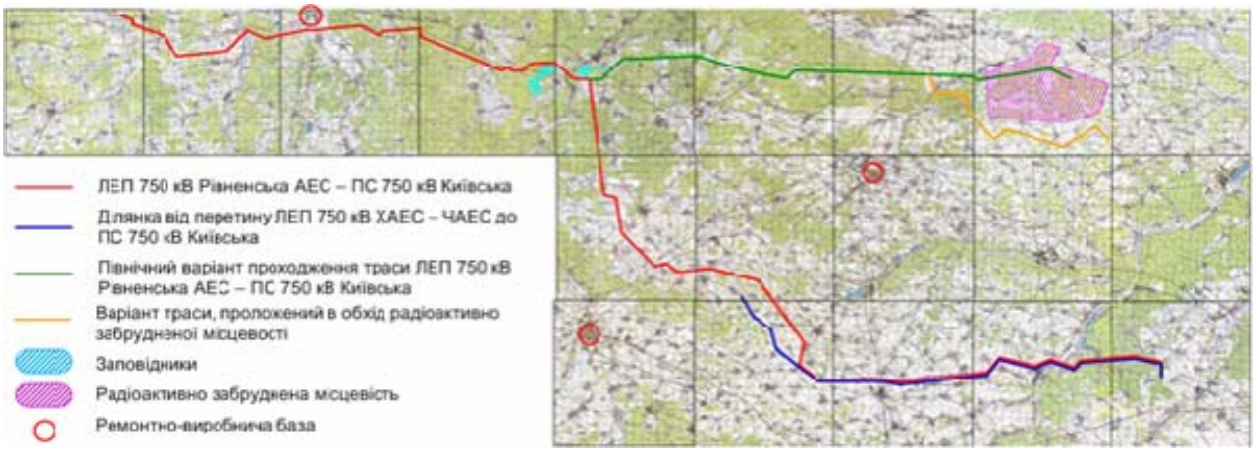

Figure 1.7 Alternative routes

1.6 Prediction and assessment of impacts and mitigation measures

The objective of the impact assessment is to identify and manage the risks to the environmental and society that are expected from the proposed activities. The process involves:

1. Identifying all the hazardous and beneficial activities
2. Assessing the level or risk arising in terms of frequency (how likely is it to happen?) and consequences (how good or bad is it?)

3. Assessing the acceptability of the risk.

4. Introducing mitigation measures to reduce those risks at acceptable level.

The hazardous and beneficial activities were identified using a Checklist based on EU Guidelines[3] to provide a systematic approach and help to make sure that nothing is missed. Given that the construction contractor has yet to be appointed, the construction methods described in the project description are used as the basis for the impact assessment, although some additional scenarios have been considered, such as the use of mobile construction camps.

The risk assessment has been based on the identification of environmental aspects and impacts so that it is consistent with the requirements of DSTU ISO 14001-97, the international standard for environmental management systems. This format makes it easy to use the impact assessment in the implementation of the contractor's environmental management system.

The environmental risk associated with the environmental impacts are then determined by estimating the likelihood of occurrence and the environmental consequences and assessed for significance as being High, Medium or Low. Mitigation measures are developed to reduce the risk and risks are then re-assessed. The following tables (see Table 1.2- Table 1.4) show the risk levels before and after the introduction of mitigation measures.

1.6.1 High risk impacts before mitigation

The highest risk of environmental damage comes from construction activities and the preparation of the RoW. Wetland areas are very sensitive to damaging vegetation and topsoil from vehicle movements disturbing the ground leaving ruts and changes in topography. Mitigation measures include planning for access when the ground is hard, whether from ice or dry weather and the provision of suitable ground protection, such as log roads and working areas.

While the route only passes through commercial woodlands and avoids ancient forests, large areas will be affected as 122km of the 353km route (35%) passes through woodland. The impact will be reduced where possible by using the space as a nursery for new trees. Where possible, the branches from felled trees will be finely chopped and used as mulch for the new plants. It is quite possible that there could be an overall increase in biodiversity from this type of management, as it will encourage the growth of small reptiles and mammals that are a good food source for birds of prey.

The main safety risk arises from construction traffic and the dangers to other road users, especially pedestrians. This will be managed by the implementation of a road traffic management with co-operation and agreement of all of the village councils and traffic police along the route, to select preferred routes and make provision for sensitive times like market days or school opening and closing.

[3] *Guidance on EIA: Scoping*, issued by the European Commission in June 2001

There is a risk to human health from electromagnetic fields (EMF), from the length of the line and number of people who could be potentially affected. There are mixed views within the scientific community on the health risks from EMF. Ukrainian norms take a precautionary approach to the size of the sanitary protection zones and, based on the current scientific understanding, the mitigated risk are assessed as low, provided exposure times beneath the wires are observed.

Transmission lines have a substantial physical presence and the visual impact can cause strong public reaction. The landscape over the route is very flat and there is little opportunity for reducing the visual impact from using the topography of the landscape, although the height of the trees in woodlands will help to reduce the visual impact.

1.6.2 Medium risk impacts before mitigation

Payment for land compensation and loss of earnings was a key area of concern during the scoping consultation meetings. NPC Ukrenergo will use the Ukrainian norms to guide the valuation and compensation of land required for the tower bases and compensate for damage or loss of earnings during construction. There are health and safety risks arising from electrocution and working at heights during operations that will be managed in line with NPC Ukrenergo's current safety management systems and emergency response plans. NPC Ukrenergo will also continue to communicate and talk to stakeholders about the progress of the project and respond to concerns.

Most of the remaining risks arise from the activities of the construction contractor, who will develop management plans to implement the required mitigation measures in the following areas in line with Ukrainian legislation:

- Environmental management: Reinstatement of access roads and construction sites. Avoiding the nesting sites of some particularly sensitive areas in the spring and early summer.
- Rules of conduct: This sets out the contractors expectations for the construction workforce to ensure good relations with people affected by the project and generate a positive attitude to safety and the environment. A rapid response plan will be developed to allow people to contact the contractor quickly if incidents arise that require immediate attention – like a broken fence.
- Waste management: Use of Licensed waste disposal contractors and use of best practice to prevent oil spills
- Safety management: Induction training for workers and visitors and the development of emergency response plans. Site security will be provided to prevent unauthorised access and theft of materials.
- Archaeological finds: Assessing the importance of new finds and contacting the appropriate authorities, together with suitable training for the workforce.

1.6.3 Opportunities for positive impacts after mitigation

While much of the construction work, like the erection of towers can only be carried out by specialists, there will be opportunities to boost the local economy by employing local

people in semi-skilled tasks (like driving and land clearing) and general labouring. Similarly, there are opportunities to contract out other goods and services like accommodation and catering. NPC Ukrenergo will favourably assess tenders that demonstrate a high content of local goods and services, with appropriate penalties for failing to deliver.

1.6.4 Cumulative impacts

Transmission lines generate very little pollution during operation and the main cumulative impacts arise from their physical presence. This is a linear project that covers 353 km and the main cumulative impacts arise from the interaction with other transmission lines and highways. A balance has been struck between following existing infrastructure corridors and avoiding environmentally sensitive areas and private land. There are no extensive areas of interactions with other transmission lines and the creation of a “wirescape” when different transmission systems converge.

No.	Aspect	Impact	Context	Risk	Mitigation measures	Risk
D, G, I, K	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Churning up topsoil, creation of ruts, changes in topography	H	Install when dry / iced, use temporary plank-road (logs, branches etc.)	M
D.04	Cutting down trees, land clearance	Destruction / degradation of habitats	No high value woodlands on the route, but areas affected are considerable - long term change in land use	H	Use cleared spaces for nursery areas	M
D.05	Cutting down trees, land clearance	Loss of income	No high value woodlands on the route.	H	Compensation. Encourage use of cleared spaces for nursery areas	M
A.02	Construction traffic	Safety / health impact for the neighbouring population	Risk of accidents from increased traffic	H	Traffic management schemes in place.	M
H.03	Creation of EMF	Safety / health impact for the neighbouring population	Prevent potential damage to health from restricting time from working under the wires	H	Provide guidance on exposure times - 4hr/day. Risk that advice may not be taken.	M
I.06	Creation of EMF	Safety / health impact for workers	Prevent potential damage to health from restricting time from working under the wires	H	Provide guidance on exposure times - 4hr/day. Risk that advice may not be taken.	M
H.14	Physical presence of towers and cables	Visual impact -> Reduction of amenity value	Visual impact is highly emotive and subjective	H	Careful routing, consultation	M

Table 1.2 High risk impacts before mitigation

No.	Aspect	Impact	Context	Risk	Mitigation measures	Risk
A.06	Solid waste generation and disposal	Contamination surface waters	Contamination from inappropriate waste disposal	M	Require contractor to use dispose of waste in designated facilities	L
E.04	Change of land use	Death or illness from infectious disease	Danger of sites disturbing sites used to bury animals that died from anthrax	M	Liaise with authorities and consultees	L
H.11	Fire	Destruction / degradation of habitats	Fire arising from third parties or construction workers	M	Effective emergency response measures	L
E.07	Solid waste generation and disposal	Impact to geomorphology (from soil and debris)	Careless disposal of soil from excavation of tower foundations	M	Ensure that there is an appropriate plan for disposal of soil	L
F.01	Influx of labour	Safety / health impact for the neighbouring population	Potential increase in sexually transmitted diseases from migrant workers	M	Require contractors to follow Rules of Conduct.	L
H.01	Accidents from electrocution	Safety / health impact for the neighbouring population	People have been electrocuted trying to steal the transmission wires for scrap value	M	Take measures to make it difficult for people to steal	L
H.10	Failure of wires	Safety / health impact for the neighbouring population	Risk from falling object, electrocution	M	Establish TL protected area, education, population imforming	L

No.	Aspect	Impact	Context	Risk	Mitigation measures	Risk
A.08	Accidents and injuries	Safety / health impact for workers	Accidents arising from alcohol abuse, dangerous driving, firearms etc	M	Require contractor to follow Rules of Conduct	L
G, I, K	Accidents from working at height	Safety / health impact for workers	High potential for serious/fatal accidents, relatively short exposure time	M	Training programmes, supervision	L
I.03	Accidents from electrocution	Safety / health impact for workers	Electrocution risk	M	Training programmes	M
K.06	Solid waste generation and disposal	Visual impact -> Reduction of amenity value	Disposal of towers, wire etc at end of life	M	Implement responsible decommissioning programme. Re-use or recycle material where possible	L
H.12	Physical presence of towers and cables	Visual impact -> Reduction of property value	Property cannot be owned outright under Ukrainian legislation but this is expected to change soon	M	Consultation and careful routing of line. Resolve compensation issues	M
C.08	Cutting down trees, land clearance	Changes in biodiversity	No high value woodlands on the route. Risk of habitat islandisation.	M	Handover to local authority or re-instate on completion	L
D.01	Solid waste generation and disposal	Climate change, acidification	Disposal of slashed vegetation, branches - burn or mulch?	L	Chop into small pieces & use as a mulch. Leave some small trees to rot	
E.05	Physical disturbance (noise, movement, dust)	Changes in biodiversity	No high value woodlands on the route, small footprint compared with RoW long term change in land use	M	Keep footprint to a minimum	M
F.03	Discharge of effluent / sewage	Contamination surface waters	From mobile construction camps, if used	M	Make provision for appropriate disposal	L
C.01	Cutting down trees, land clearance	Destruction / degradation of habitats	No high value woodlands on the route.	M	Handover to local authority or re-instate on completion	L
E.06	Change of land use	Destruction / degradation of habitats	Permanent loss of approx 20 hectares of land of different types	M	Keep footprint to a minimum	W
C, D,E, G,I,K	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	M	Avoid disturbing nesting areas during nesting season	L
D, E, G, I, K	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	M	Sensitive management by contractors, use of appropriate vehicles	L
C.03	Change of land use	Increased access & secondary impacts	Increased access routes may lead to new settlements, illegal logging, though forestry is well controlled	M	Handover to local authority or re-instate on completion	L
F, G, I, K	Change of land use	Loss of income	Temporary loss of land use	M	Make appropriate compensation	L

No.	Aspect	Impact	Context	Risk	Mitigation measures	Risk
I.07	Accidental damage to crops / land / property	Loss of income	Some damage may be unavoidable in order to effect emergency repairs	M	Make appropriate compensation	L
D.09	Land acquisition / use	Nuisance to neighbouring population, visitors	Only one household affected, but significant impact	M	Provide compensation	L
A.11	Accidents and injuries	Safety / health impact for the neighbouring population	Danger from children playing on construction sites	M	Hazardous areas should be protected / secured	L
H.09	Failure of towers / loss of structural integrity	Safety / health impact for the neighbouring population	Toppling of transmission towers from storms or theft of bolts	M	Good design. Welding bolts to prevent theft.	P
H.13	Above ground cultural heritage sites	Visual impact -> Reduction of amenity value	No impact expected on national monuments but possible concerns about sites of local interest	M	Consultation and careful routing of line	L

Table 1.3 Medium risk impacts before mitigation

No.	Aspect	Impact	Context	Risk	Mitigation measures	Risk
D.03	Cutting down trees, land clearance	Changes in biodiversity	No high value woodlands on the route, but areas affected are considerable - long term change in land use	M	Use cleared spaces for nursery areas, may improve conditions for certain species (reptiles, raptors)	L
H.04	Improved transmission efficiency	Climate change, acidification	Improved transmission efficiency and reduction of power losses	M	Positive impact wrt TTP emissions	M
A.07	Influx of labour	Increased income	Opportunity for increased goods and services. Potential resentment of lost opportunity	M	Require contractor to maximise local labour wherever possible	M
I.08	Cutting down trees, land clearance	Increased income	Additional work maintaining the RoW in forested areas	M	Chop into small pieces & use as a mulch. Leave some small trees to rot	M

Table 1.4 Positive environmental impacts after mitigation

1.7 Environmental & Social Management Plan (ESMP)

A summary of the mitigation measures and objectives that will be undertaken by NPC Ukrenergo and the construction contractor is shown in **Table 1.5** and **Table 1.6**.

Commitment	Performance Objectives
A copy of the Non-Technical summary is available for inspection by the public in the affected Village Councils and the ESIA in all raion and oblast administration offices	Documents distributed to all affected Village Councils, Raion and Oblast administrative offices
A complaints database is maintained and a consolidated summary is available for inspection by the public. Grievances are responded to within 30 days	Complaints and grievances are addressed adequately and in a timely manner
One article or advertisement placed in local radio, TV and newspapers each year providing information on health and safety risks	Raise and maintain awareness of public health issues related to the project
The environmental management of land in the right of way will be audited during construction and operation at least once a year	Maximise biodiversity in the forested areas that have been cleared for the right of way. Reduce damage to wetlands and sensitive areas
Meeting with ornithologists to assess the risk of bird mortality from collision with the transmission and earthing lines after one year of line operation	Assess risks and possible requirement for additional mitigation measures
Database of land owners / users affected by land acquisition	Ensure the land acquisition process is adequately documented

Table 1.5 NPC Ukrenergo mitigation measures and objectives

Commitment	Performance Objectives
Project schedules provided to village and raion councils	Timely distribution allows land users to plan agricultural activities in advance
Environmental restoration of construction sites and removal of waste	Document restoration of the sites used for construction
Compliance with national safety management, emergency response legislation and rules of conduct	Safe operation, avoid risks to workers and general public
Security at construction sites	Avoidance of risks to public, livestock and wildlife
Compliance with national legislation and norms in relation to archaeological and unexpected finds	Prevent damage to cultural heritage sites
Compliance with national legislation and norms for traffic management and noise levels.	Avoid accidents and nuisance to people at risk
Advertisement and use of job opportunities in local press	Maximise potential local employment opportunities from the project

Table 1.6 Construction contractor mitigation measures and objectives

1.8 Public Consultation

As part of the project feasibility studies, NPC Ukrenergo undertook preliminary discussions to determine the optimum route for the transmission line with a number of statutory consultees, including the State Regional and District Administrations, District Environmental Inspections, Regional and District Sanitary and Epidemiological Services, State Forestry Management Departments in each region, State Forestry in each district, State Regional and District Inspections on Protection of Cultural Heritage, State Regional and District Departments on Urban Development, Architecture and Infrastructure Development.

The framework for the consultation with the public was setup in the Public Consultation and Disclosure Plan (PCDP), which was initiated in December 2006 in compliance with EBRD requirements and Ukrainian legislation. The PCDP provides an analysis of the principal stakeholder groups, identifies channels of communication and describes the approach to public consultation and disclosure that will be used throughout the project.

In line with the provisions of the PCDP, a number of scoping meetings were held. The scoping meetings took place in the period 19 – 23 February 2007 in the regional and district centres of the territories affected by the project, i.e. Kuznetsovsk, Zhytomyr, Makariv and Kyiv.

The issues raised at the meetings can be broadly divided into four categories:

i) compensation issues;

ii) construction impacts;

iii) other potential risks, impacts and issues; and

iv) procedural issues

An additional meeting was held in Kyiv on April 3, to give the NGOs the opportunity to study the project documentation and come supplied with a deeper knowledge and a better informed position on the project. The draft ESIA captures the main issues raised during these meetings and provides a clear path how these issues were addressed.

2. Introduction

NPC Ukrenergo is a Ukrainian State owned enterprise that is responsible for constructing, operating and maintaining 220 – 750 kV electricity grid networks.

The Government of Ukraine has identified a number of high voltage electricity transmission projects which are urgent and strategically important for providing constant electricity supply to the Ukrainian consumers and reliable operation of the Ukrainian electricity grid as a whole. Firstly, the strategy of the electricity grid development is directed towards creation of standard conditions for utilization of the capacity from power supply units currently operating as well as from new power supply units, the comissioning of which is planned by the Government, optimization of the balance structure of the capacity, providing for frequency and voltage regulation.

Amongst these projects is the construction of the 750 kV overhead transmission line Rivne NPP – Kyiv with extension of the 750 kV Kyiv Substation and diversion of the 750 kV overhead transmission line Khmelnytsk NPP – Chernobyl NPP. To finance the project, NPC Ukrenergo is seeking loans from the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD).

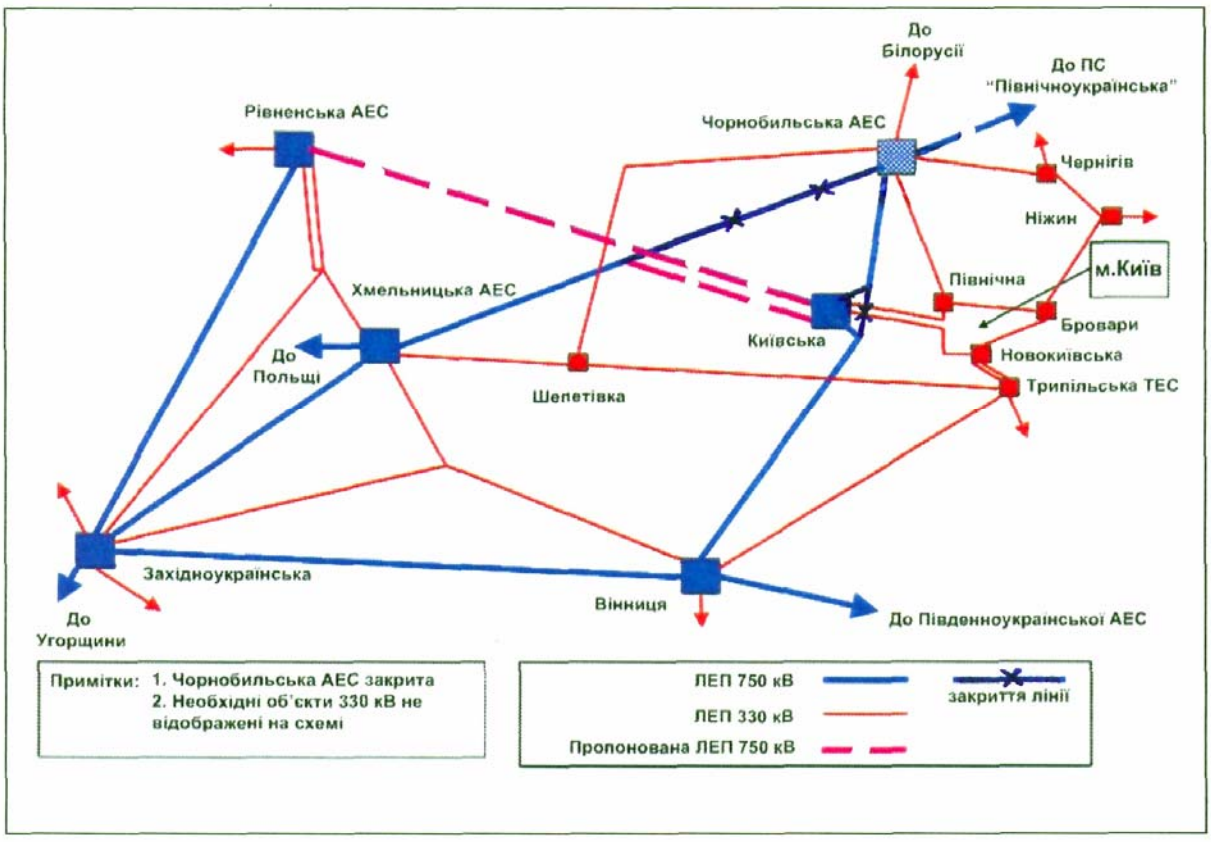

Figure 2.1 Electrical grid networks of the Western region of Ukrainian and proposed re-enforcement

The proposed transmission lines will re-enforce the existing network and allow the eventual decommissioning of the Chernobyl sub-station. It will also help address concerns about the security of electricity supply within the Kyiv region, where the demand was approaching 4,500 MW in 2006 and is rising. At the same time, the 2,880 MW generation capacity of Rivne Nuclear Power Plant (NPP) and Khmelnytsk NPP (2,000 MW) is currently limited by the throughput capacity of the transmission network. Grid re-inforcement has the potential to deliver an additional 1,000 MW from these power stations to the Kyiv region.

The construction of the proposed transmission line is anticipated to yield a number of tangible benefits to the electricity system and NPC Ukrenergo that include:

- **Improved stability of the system -** The reliability of the gird will be significantly improved as additional redundancy will be built into the network that will reduce the need for power cuts in the event of the unplanned breakdown of a major piece of equipment.
- **Optimised supply of power to Kyiv** – from being able to exploit all the potential generating capacity established in Western Ukraine.
- **Increased energy efficiency -** through increased efficiency of operation of NPPs, as well as higher levels of energy efficiency in the transmission system.
- **Compatability with European networks -** the design of the transmission grid will be compatible with European systems that will allow greater flexibility in optimising electricity supply and demand.
- **Transfer and dispersion of skills** - to power generation complex of Ukraine from implementing projects of this nature and associated income for contractors and sub-contractors.

2.1 The electricity grid and its function

The united electricity grid (UEG) of Ukraine is a complex technological system consisting of working in parallel energy systems joint by general operational regime and unique centralized system of operational dispatch management.

The main functions of operational dispatch management that are implemented by NPC Ukrenergo are the following:

- Providing for reliable parallel operation of power plants within the UEG of Ukraine;
- Providing for reliable parallel operation of the UEG of Ukraine along with the electricity grids of neighbouring countries;
- Providing for support of balanced regime between consumable and generating electric capacities within UEG of Ukraine;
- Providing for reliable and secure transmission of electricity through the main network of Ukrainian UEG to the electricity suppliers and consumers who are powered from the main network of UEG of Ukraine;

- Providing for meeting the requirements of security of energy supply in Ukraine.

In accordance with the requirement of the Article 15 of the Ukrainian Law “On electricity” there is a wholesale electricity market (WEM) established in Ukraine. The mechanism of its functioning is defined by the rules of the WEM. According to these rules NPC Ukrenergo is a Dispatch Centre responsible for coordinating actions of electricity producers, electricity suppliers and outer flow operators. In this connection the priorities are: providing for stability of parallel operation of power plants and separate electricity grids within UEG of Ukraine and arrangement of conditions for electricity suppliers to allow secure electricity supply to the consumers from the main network of UEG of Ukraine.

In addition, during UEG regime control in real time the dispatcher NPC Ukrenergo based on the regime that has been created make the correction of a daily power plants load curve, consumption, generation of electrical capacity and electricity flow through the controlled intersections of the transmission lines as well as interstate transmission lines. In cases of an emergency in order not to allow using of measures of forced limitation of consumers the dispatcher has a right to alter the magnitude of operational capacity of generating sources depending on their price characteristics. Dispatcher’s orders are mandatory for all the operational personnel of the economic entities – participants of the parallel operation.

The grid also needs to be able to cope with rapidly changing demands. **Figure 2.2** is a snapshot of energy demand in Megawatts and shows how demand varies widely between night and day as well as through the week.

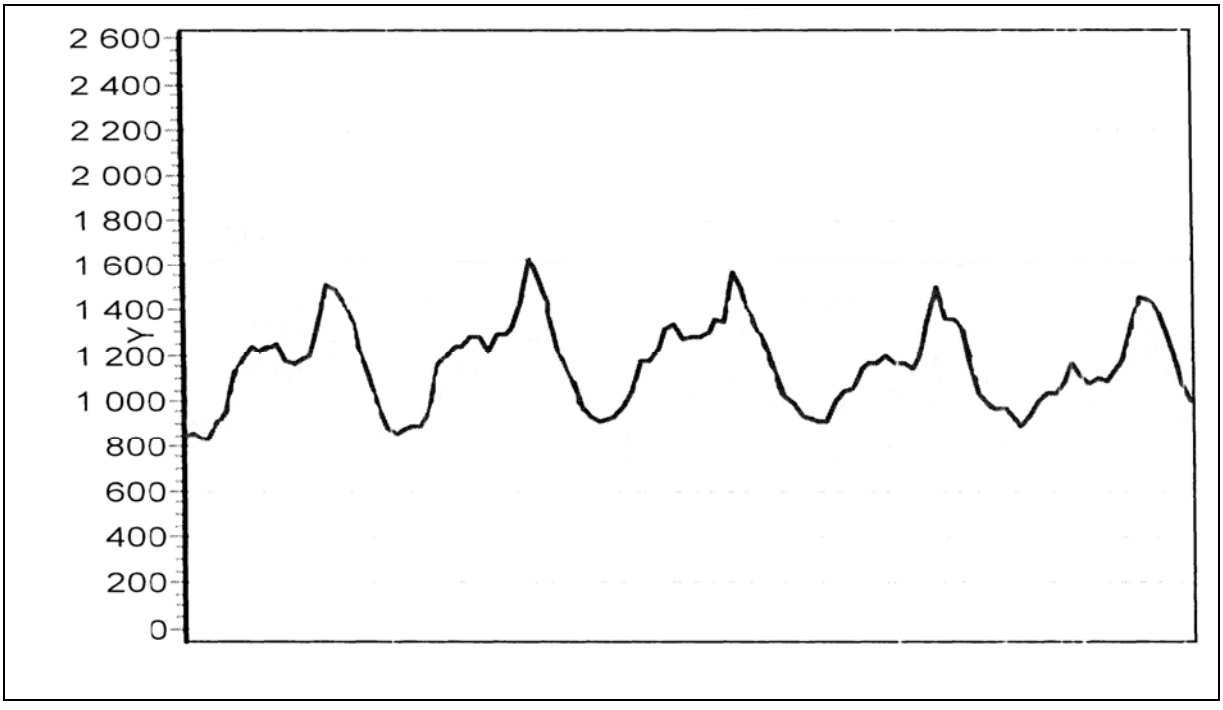

Figure 2.2 Daily curve of the Central Electric Power System working day from October 22-26th 2006

This is managed by having a balancing system that predicts electricity demand every 30 minutes and arranges appropriate supply. Electricity is drawn from a number of different

sources: nuclear sources are good at providing a steady base load, whilst thermal and hydro-electric power plants are good at responding to sudden demand.

If a transmission line is taken out of service in one part of the power grid, the power can usually be rerouted through other power lines to continue delivering power to customers.

This system helps achieve a high reliability for power delivery because any one power plant that shuts down will only constitute a fraction of the power being delivered by the grid.

2.2 Project definition

This section of the ESIA defines the scope of the loan application and study boundaries. The scope of the present ESIA comprises the following developments:

- The 750 kV Rivne NPP – Kyiv transmission line, of total length 353km.
- The 135km long diversion of 750 kV transmission line Khmelnytsk NPP – Chernobyl to Kyiv substation (total length of the 750 kV transmission line Khmelnytsk NPP – Kyiv is 265 km).

Additional projects will be undertaken to achieve the project objectives, but are outside the scope of this ESIA:

- The modernization of the 750 kV Kyiv substation, which requires upgrading works in order to be able to accommodate the new transmission line
- Three maintenance stations to be built along the proposed transmission line route

Figure 2.3 Sketch of the proposed transmission line within the transmission network

2.3 Boundaries

One of the deliverables of the scoping part of the ESIA process is to establish what needs to be addressed within the ESIA and the appropriate level of detail. The following areas were deemed to be outside the scope of the ESIA:

- Ukrainian energy strategy.
- The future role of nuclear power in electricity generation
- Existing problems with other networks.

2.4 Project location and characteristics

The 353km-long Rivne NPP – Kyiv high voltage transmission line goes through a number of districts in three different regions:

- in Rivne region: Volodymeretsk, Rokytyany, and Sarny;
- in Zhytomyr region: Olevsk, Yemylchansk, Volodar-Volynsk, Chernyakhiv, Korostyshev, and Radomyshl and Chervonoarmiysk;
- in Kyiv region: Makariv district.

The 135km-long Khmelnytsk NPP – Kyiv transmission line diversion goes through the territories of Yemylcansky, Volodar-Volynsky, Chernyakhivskiy, Korostyshevsky, Radomyshlsky and Chervonoarmiysk districts in Zhytomyr region and Makariv district in Kyiv region.

EBRD has classified the project as “A/0”, requiring an Environmental and Social Impact Assessment (“ESIA”) inclusive of public consultation.

This ESIA is informed by the Environmental Impact Assessment (also referred to as “OVNS”) carried out by the State design, survey and research Institute of energy systems and networks “Ukrmerezhproekt” in accordance with the Ukrainian legislation as part of project documentation. Based on this OVNS, a positive expert opinion was issued by the Ministry of Health Protection and State Supervisory Committee on Labour Protection on the project. The opinion of the Ministry of Environmental Protection with regard to the OVNS was not provided – but such opinion was not mandatory since, in accordance with Annex “E” to the Ukrainian Design Standards DBN A.2.2-1-2003, the construction and operation of electricity transmission lines is not classified as an activity or object of high environmental hazard. The present project was approved by the Resolution of the Cabinet of Ministers of Ukraine No.15-p of 22/01/2007.

2.5 Project owner

The proposed project is put forward by the State Enterprise National Power Company **Ukrenergo**, responsible for operational dispatch management of 220-750 kV transmission lines and balancing energy supply and demand.

Any communication regarding comments for the project or on the project, in written form, by phone or by e-mail, should be adressed to the following:

Organization	**NPC Ukrenergo**	**Western Electric Power system** **NPC Ukrenergo**	**Central Electric Power System** **NPC Ukrenergo**
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3. Strategic review of the project

3.1 Rationale for the Project

3.1.1 Overview of Ukrainian power System

The total installed power generating capacity of UEG of Ukraine at the end of 2005 was 52.0 GW comprising 14 coal, gas and mazout (heavy fuel oil) fired thermal plants with a capacity of 33.5 GW, 4 nuclear plants with a capacity of 13.8 GW and 7 hydro and 1 pumped storage station with a total capacity of 4.7 GW. The maximum demand in December 2005 was 28.7GW, indicating a surplus 80% in installed capacity compared to demand. As a result, 12.5 GW of thermal plant was on either on standby, out of regular service or mothballed.

Plant load factors for 2005, indicating the utilisation of each type of plant, are shown on **Figure 3.1** along with capacity and energy generation mixes. The nuclear units are operated in preference to thermal units with hydro operation primarily dictated by using available water in the most economic manner. This pattern is consistent with the aim of generating electricity at the lowest marginal cost subject to any transmission system constraints and reflects the lower marginal cost of energy of US cents 1.67/kWh from nuclear plants compared to US cents 4.07/kWh from thermal plants (2006 costs).

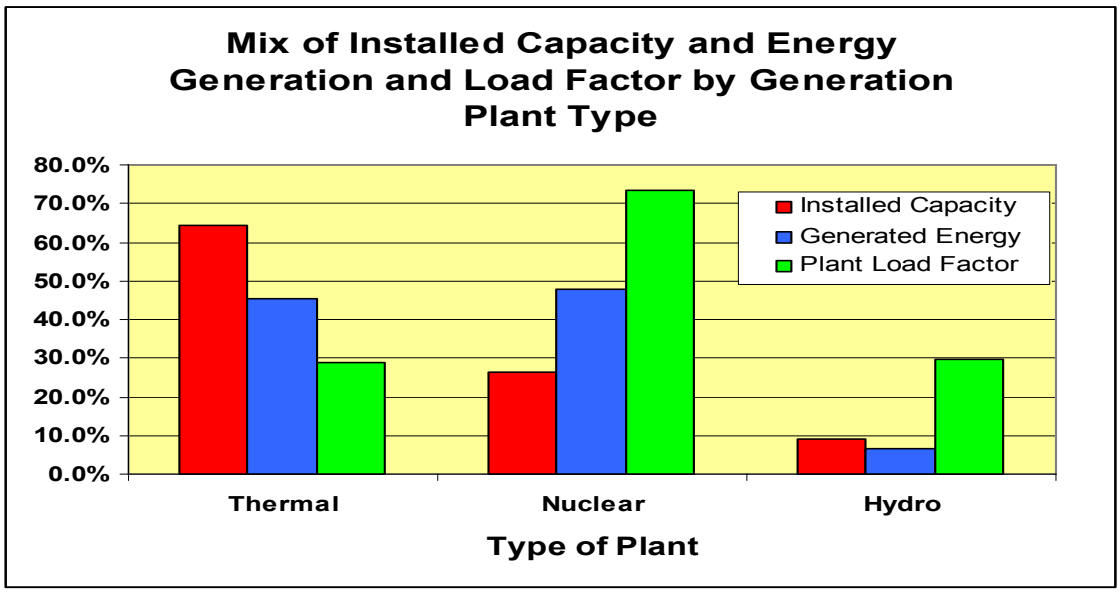


Figure 3.1 Plant load factors for 2005

The power plants have been sited around the country for technical and strategic reasons, and as shown on **Figure 3.2**, the network is presently based around a 750kV spine connection running the length of the country supplemented by an extensive network of 750 kV and 330 kV transmission lines to enable generated energy to be transmitted to the load centres.

The 750 kV network has a key role in getting the output from the large nuclear plants to the customers and the system is operated with the objective of minimising the risk of supply interruptions in the event of the failure of a major piece of equipment.

Figure 3.2 The electricity transmission and distribution network in Ukraine

3.1.2 Ukrainian Long Term Energy Strategy

Ukraine's long term energy strategy to 2030 was published in 2006. A key objective is to reduce the historically high level of Gross Domestic Product (GDP) Energy content by almost 50% from its present value of 0.89 kg of standard fuel per US$ GDP, or 2.6 times the world average. This is planned to be achieved through a comprehensive energy saving programme aimed at manufacturing industry, the domestic and commercial sectors as well as the energy industry itself. The policy also envisages a reduction dependence on gas in favour of coal, a continuing dependence on nuclear for around 50% of generated energy as well as increases in the use renewable energy resources, including hydro power, which under the Strategy would represent over 14% of total installed generating capacity, or 12.6 GW, by 2030.

Consequently, under the base case scenario, electricity demand is only forecast to increase by 123% to 395.1TWh in 2030 despite a threefold increase in GDP. Industry will remain the largest sector at 42.8% of demand whilst the power sector itself will benefit in a reduction in power transmission losses from 14.7% of power input to 8.2%, and

improvements in generation efficiency through the use of new conventional and renewable technologies. Specific measures which are envisaged to achieve the energy savings amongst the industrial and domestic consumers are:

1. Use of State-of-the-Art Energy Inputs Accounting and Control Equipment
2. Development and Introduction of Automated Power Management Systems
3. Use of Efficient Electric Lighting Systems and Equipment
4. Introduction of Power Electronics Equipment
5. Improvement of Electric Motor Pool Structure in Sectors
6. Application of State-of-the-Art Low-Rank Coal Combustion Processes
7. Heat Supply System Improvement
8. Enhancing Efficiency of Secondary Energy Inputs

Total installed generating capacity is forecast to reduce in the short term to 49.2 MW by 2010 and then to increase over the next 20 years to 58.1 MW by 2015, 70.6 MW by 2020 and 88.5 GW by 2020, an increase of 36.5 GW from 2005. The relatively low increase in installed generating capacity compared to growth in demand reflects the reduction in the present surplus generating capacity of over 80% of demand to a more prudent level of around 30% which is more typical for a generating system including hydro electric plant. The strategy presently envisages that this will be met by an increase in all forms of generation, including renewables and this increase in generation will need to be matched by an expansion in the high voltage transmission network. The following table summarises the planned development in generating capacity and production by plant type.

	Year				
	2005 (actual data)	**2010**	**2015**	**2020**	**2030**
Total installed capacity of power plants (GW)	**52.0**	**49.2**	**58.1**	**70.6**	**88.5**
Thermal	33.5	27.9	32.8	37.6	46.4
Nuclear	13.8	13.8	15.8	21.8	29.5
Hydro & Pumped Storage	4.7	7.4	8.7	9.6	10.5
Renewable energy resources	0.0*)	0.1	0.8	1.6	2.1
Total power generation (billion kWh)	**185.236**	**210.2**	**251.0**	**307.0**	**420.1**
Thermal	84.1	96.4	125.1	129.9	180.4
Nuclear	88.8	101.2	110.5	158.9	219.0
Hydro & Pumped Storage	12.3	12.5	14.6	16.6	18.6
Renewable energy resources	0.0	0.1	0.8	1.5	2.1

Table 3.1 Generating capacity per type of plant

As may be noted, the strategy envisages that energy from nuclear plants will remain a similar proportion of the total as at present.

A further component of the Strategy is to extract economic value from the surplus generation capacity within the country by increasing exports to neighbouring countries and to enable the Ukrainian network to be fully connected to the Western European Grid. However this interconnection and enhanced levels of exports cannot be made until known improvements have been made to the reliability and design of the Ukrainian electric power system.

3.1.3 Background to power generation in Western Ukraine

An ambitious nuclear power construction programme was put in pace in Ukraine in the 1970's. This started with the 4 RMBK units at Chernobyl NPP which were commissioned between 1970 and 1979 and was followed by 18 VVER type reactors at four other sites including Rivne NPP and Khmelnytsk NPP where construction was started on 4 units at each site. By the time of the Government moratorium on nuclear power plant construction, following the 1996 Chernobyl accident, 3 units at Khmelnitska and 1 unit at Rivne were incomplete and further work on these units was suspended.

Following the closure of the last unit at Chernobyl in December 2000, the Ukrainian Government took the decision to complete construction of two of the partially built units to compensate for the loss of the Chernobyl capacity, and these were one unit at Rivne NPP and one at Khmelnytsk NPP. These both entered commercial service in late 2004.

3.1.4 Present operational issues

The original plans for the development of the power system, including the integration of the fully developed Rivne NPP and Khmelnytsk NPP sites, envisaged that the high voltage transmission network would require reinforcement to handle the design capacities of these stations. Despite the expansion of these sites with the completion of two of the uncompleted units in 2004, budgetary constraints meant that no major transmission works could be funded as originally intended, and the two newly commissioned units could not operate to their full potential due to major technical constraints.

Two sets of problems have been identified. Firstly, in the event of certain unplanned disconnections due to equipment failures or other faults on the network (known also as outages), some of the operating transmission grid lines still in service would become overloaded and would need to be disconnected. This would lead to the disconnection of some of the generating units and resulting in loss of electricity supply to customers. Secondly, some unplanned outages could also result in what is termed "system instability" which could result in the collapse of all or part of the power network with widespread loss of electricity supply.

In the absence of any transmission investment, these problems are only being avoided by reducing the output of Rivne and Khmelnytsk NPPs by up to 1200 MW for about 180 days per year and running the more expensive thermal power plants instead to balance load

and generation. Thus in the present circumstances, the investment that has been made to complete the two units is not capable of being fully utilised.

3.1.5 Demand and Supply to the Kyiv Region

Chernobyl power plant had an important role in supplying power to the Kyiv region, and following its closure, an imbalance has been created between demand and generation within the region. This is currently being covered by importing power from adjacent regions, which is predominantly sourced from more expensive thermal power plants. In addition, demand in the Kyiv Region is growing at a higher rate than in the rest of the country, with demand approaching 4,500 MW in 2006 and rising. This is primarily due to the increasing importance of Kyiv as a commercial centre, which is experiencing a massive expansion in commercial property construction including offices, retail centres and housing. The network therefore needs reinforcing to avoid overloading the existing substations and transmission lines and compromising security of electricity supply for the Region.

NPC Ukrenergo has responded to this situation in part by starting construction of a new substation to the west of Kyiv which is being connected into the existing 750 kV network and has a potential supply capacity of between 1,500 and 2,000 MW. This strengthens the supply network in the Region but does not address the need to strengthen the connections to the existing generation plants outside the Region and studies indicate that the shortfall of generation within the Kyiv region is between 2,000 and 2,500 MW.

3.1.6 Closure of the open distribution unit at Chernobyl NPP

Although the generating units at Chernobyl NPP are no longer in operation, the associated 750/330 kV open distribution unit at Chernobyl NPP remains in service as a key link in the supply of power imported from other regions into the Kyiv region. Conventional equipment maintenance needs to be undertaken on a regular basis. It is currently under discussed the option of closing the 750 kV open distribution unit at Chernobyl NPP as soon as practical to remove the need for maintenance staff to work in the contaminated zone.

The 750-330 kV open distribution unit at Chernobyl NPP is effectively the main link of supplying power to the Kyiv region. To meet the long term objective of closing the open distribution unit at Chernobyl NPP, NPC Ukrenergo have developed the project of the new 750 kV Kyiv substation as a replacement supply point. Although the new substation is an important element in the Chernobyl closure plan, additional substation and transmission capacity must be constructed in the Kyiv region before the open distribution unit at Chernobyl NPP can finally be closed.

3.2 Project Benefits

3.2.1 Improvement in electricity supply reliability

The reliability of the grid operation will be significantly improved as additional redundancy will be built into the network to minimise the need to reduce system demand in the event of the unplanned breakdown of a major piece of equipment.

Similarly the strengthening of the transmission connection between Rivne NPP and the rest of the network will minimise the risk of system technical instability occurring after an unplanned fault in the Rivne/Khmelnytsk section of the network.

3.2.2 Improving security of supply

There are concerns about the security of electricity supply within the Kyiv region, where the demand was approaching 4,500 MW in 2006 and is rising. At the same time, the 2,880 MW generation capacity of Rivne Nuclear Power Plant (NPP) and Khmelnytsk NPP (2,000 MW) is currently limited by the throughput capacity of the transmission network. Grid re-inforcement has the potential to deliver an additional 1,000 MW from these power stations to the Kyiv region.

3.2.3 Enhanced prospects for economic development in the Kyiv region

Reliable energy supplies are a critical success factor in maintaining the continued economic development of Kyiv and Ukraine. Ukraine's GDP is projected to increase from €63 billion in 2005 to €80 billion in 2010. The Kyiv Region accounts for some 15% of the national requirement for power and any loss of confidence in the security of power could have a significant impact on investor confidence and economic growth.

3.2.4 Reductions in transmission line electrical losses

Technical studies undertaken by NPC Ukrenergo demonstrate that there is a modest reduction in electrical losses on the transmission system following completion of the project. For 2006, this is estimated at 2.35MW or enough power for approximately 12,000 homes.

3.2.5 Facilitate closure of open distribution unit at Chernobyl NPP

The construction of the proposed transmission lines will enable the amount of energy presently supplied to the Kyiv Region through the open distribution unit at Chernobyl NPP to be reduced, although the project alone will not allow the substation to be closed. This will require further construction of other parts of the northern trunk.

3.2.6 Enhanced prospects for transmission equipment manufacturers and employees

Ukraine has a traditional manufacturing base in the provision of both transformers and reactors for substations, tower steel and line conductors for overhead lines along with construction and commissioning skills. Although the project will be subject to international competitive tendering, it is probable that Ukraine's relatively low cost base and familiarity with local conditions should assist the domestic industry in winning a proportion of the estimated €250 to €300 million worth of project work with the associated direct and indirect economic benefits.

4. Regulatory framework

4.1 State of project permitting

The regulatory basis for the strategy to construct a 750 kV power transmission line from Rivne NPP to Kyiv can be found in the Presidential Decree 09.12.2005. NPC Ukrenergo according to its mandate, then contracted the State project development and research institution – Ukrenergomerezhproekt, that designed the project for construction of the transmission line and conducted the feasibility studies (*TEO*). At this stage of the project Ukrenergomerezhproekt covered all technical aspects of the design, alternatives for routes of the line, identified in general terms potential impacts of the transmission line on human health, safety, environmental, social aspects.

During the feasibility studies Ukrenergomerezhproekt, representing NPC Ukrenergo , notified all regional/local councils along the proposed route about project. Several initial discussions took place with the local and regional authorities, public organisations to identify the most feasible route for the power transmission line. The regional/local councils took into consideration opinions of the competent state departments (sanitary, land, environmental, archaeological, forestry) and issued their decisions on acceptability of construction of the high voltage power transmission line through their territories, which as the main element at this stage have identified the best route for the transmission line.

The alignment of the route for the power transmission line was established with respect to the following main principles:

a) to duly inform public about the land withdrawals and allocations, about the compensatory mechanisms established by the law;

b) to use only publicly owned lands as much as possible and minimize cases of withdrawal of lands from private or even communal property,

c) as much as possible to avoid inhabited areas and lands having any structures on them, and thus to minimize the impact on the individuals and households.

The technical, environmental, social and legal issues were taken into account in the feasibility studies and a preferred route was proposed, although this did not specify the exact number of the land plots to be acquired for towers or the scope of Right of Way to be secured within the proejct. All these details will be dealt with by a construction managing organisation selected through a tendering process. Currently some flexibility is envisaged in selection of the exact sites for the towers and for variations in the RoW to avoid ownership, environmental and socially sensitive problems.

As far as environmental aspects of the project is concerned, it should be noted that under the effective regulatory requirements for environmental impact assessment in Ukraine (OVNS – detailed by national standard DBN A.2.2-1-2003) the comprehensive, it is not explicitly foreseen that comprehensive investigations and detailed OVNS report should be prepared for construction of high voltage transmission lines. Such requirements exist only for the highly hazardous objects listed in the Decree of the Cabinet of Ministers' No.554 dated July 27, 1995. A similar approach is taken in the said national standard for OVNS

(in particular, a list of objects requiring comprehensive OVNS is established in Annex E thereof) and the compulsory state environmental expertise (SEE) is not required for these objects.

Therefore the OVNS submitted for the state authorities' approval at this stage was a short review of potential environmental impacts and mitigation that was presented as a chapter in the TEO documents submitted by Ukrenergomerezhproekt to the competent state authorities, within the procedure for obtaining permits for construction operations. The comprehensive state environmental expertise (SEE), as a separate project stage, was not carried out in this case.

The project's profile has a national dimension as it is implemented in several regions of Ukraine and partially financed through the state budget. Therefore the project documentation is subject to the State Comprehensive Investment Expertise (SIE) regulated by the Decree of the Cabinet of Ministers of Ukraine No484 adopted on 11.04.2002. The SIE was carried out at the stage of feasibility study by Central Service of "Ukrinvestexpertise" under the Ministry for Construction, Architecture and Communal service of Ukraine that has competence over the CIE for projects of the national scale. Based on submission of the project by the Ministry of Fuel and Energy, Ministry of Finance and the Ministry of Justice of Ukraine and with consideration to the positive conclusion of the state comprehensive investment expertise the Cabinet of Ministers of Ukraine approved the project for construction of 750kV power transmission line from Rivne NPP to Kyiv with an extension to Kyiv substation and additional measures as to transmission line from Khmelnytsk NPP to Chernobyl NPP by its Directive No.15-p on 22.01.2007.

Currently the project implementation is at the stage of preparing terms and conditions for procurement tender to contract a construction contractor or a consortium that will implement further project activities on "turn key" or fixed cost basis. The tendering conditions and procedures will be prepared by NPC Ukrenergo in cooperation with an international consultant and the selection of the contractor will be implemented in compliance with the national public procurement legislation and the EBRD procurement policies. The selected contractor will have, among many other obligations pertinent to the turn key construction contracts, to ensure development of all working documentation for the constriction stage of the project as designed and approved by the government at the pre-construction stage. The contractor will prepare the Land Acquisition Plan, valuations of relevant costs and compensation, receive all necessary conclusions of the state authorities and state expertise, and obtain all permits before actual start of construction works.

This type of project does require a full environmental and social impact assessment under European legislation and this ESIA is being prepared by a team of international and Ukrainian experts to meet European standards and the policy requirements of the EBRD and EIB. It will be also be used in the development of the detailed working documentation. NPC Ukrenergo has prepared the Statement on the Environmental Consequences of Project Activities according to the OVNS Standard DBN A.2.2-1-2003 and it will be the investor's commitment, binding for all its contractors, within the whole period of project

implementation. This document will be made public in accordance with Article 10 of the Law “On environmental expertise” and Section 1.8 of the DBN A.2.2-1-2003.

As far as public participation in the decision-making process is concerned, Ukraine is a signatory to the UNECE (Aarhus) Convention (approved by the Verhovna Rada of Ukraine by the law N 832-XIV від 06.07.1999) and its provisions should be governing public consultation and disclosure of information. High voltage transmission lines over 15 km of length are listed in Annex 1(17) of the Convention as objects that require compulsory public discussions of relevant environmental issues. At sector-specific regulations in Ukraine, such as the national OVNS standard, do not require such public participation in decision making with respect to power transmission lines. This fact represents a certain regulatory inconsistency between the national implementation conditions for the Aarhus Convention as a piece of framework legislation.

Nevertheless, the national environmental laws provide a firm legal ground for enforcement of the Convention principles in Ukraine. For instance, the Law “On environmental protection” ensures the right of public to discuss and put forward proposals in order to mitigate negative impact upon the environment, participate in public hearings and organize public environmental expertise, and if needed, turn to court for protection of their rights or for a failure of the state authorities and companies to act in compliance with the rules for environmental protection.

Following the Convention’s ideology the Ministry for Environmental Protection adopted Order No.168 dated 18.12.2003 “On Procedure for participation of public in decision making process in the sphere of environmental protection”. Therefore, the overall legal framework for public participation in decision-making process in environmental governance is fully enforceable in Ukraine. At the same time certain regulatory acts that refer to the lists of hazardous objects or establishing contents of construction project documentation need to be updated in order to ensure more efficient enforcement of Aarhus Convention in Ukraine.

Due to legal requirements and importance of the project for the electricity sector, NPC Ukrenergo and Ukremerezhproekt already at the stage of feasibility study have held extensive consultations with Oblast, Raion and Village Councils, Environmental, Land Resources, Sanitary, Architectural and the National Heritage State Departments and even with some individuals such as the landowners. The public authorities are aware of the project implementation and under the law they are required to duly inform population about the potential environmental impacts of the project and invite public to take part in the decision-making process. Furthermore, the recent scoping consultation and planned consultation on the ESIA is fully compliant with the requirements of the Aarhus Convention and have involved direct communication with the public.

4.2 EIA process in Ukraine

This section provides a little more detail on the Environmental Impact Assessment (OVNS) Process in Ukraine and within Europe. The Environmental Impact Assessment is a compulsory component of any investment project in Ukraine in the meaning of Article 51 of the Law of Ukraine “On Environmental Protection”.

The OVNS in Ukraine is regulated by at least 12 International Conventions and Agreements, 42 laws and numerous regulatory acts, methodological guidelines and national standards.

Any business undertaking planning a project that might have an impact on the environment should notify the territorial bodies of the Ministry for Environmental Protection. Project developing organizations are required to collect relevant environmental data and submit a package of EIA materials within a portfolio of the investment project documentation.

The mandatory comprehensive OVNS is foreseen only for objects referred to the category of highly hazardous objects (the law of Ukraine on “On highly hazardous objects” and the Decree of the Cabinet of Ministers’ No.554 dated July 27, 1995). Other investment projects can have only a limited EIA, in the scope sufficient for approval by the regional departments of the Ministry for Environmental Protection and by the Sanitary Epidemiologic Department under the Ministry of Health.

The OVNS contents, structure, procedures and quality of required information are established by *the State Construction Norm - DBN A.2.2-1-2003* adopted by Ministry of Construction and Architecture of Ukraine in Order No.214 dated 15.12.2003 annexed by a few standard formats for documents. For instance its Annex B provides a rather detailed guideline as to the structure of information, measures to be taken by the project developers at each stage of OVNS to ensure an adequate quality of analysis and control over environmental issues in investment projects. The liability for compliance with the state standards of environmental analysis and information is borne by the project developing institutions – there is an administrative and even a criminal liability for infringements of the rules for construction design and operations without due installment of the adequate engineering systems for environmental protection (example Article 253 of the Criminal Code of Ukraine).

Most OVNS activities are implemented at the very early stages of project development, during feasibility studies (Section 5.1 of DBN A.2.2-1-2003). The project developer should prepare an important document - *Statement of Intentions* (Annex G to DBN A.2.2-1-2003) in which all environmental issues should be addressed and potential environmental risks identified. The statement should also propose remedies for existing environmental concerns in the project.

The OVNS materials after approval of the Ministry for Environmental Protection, Sanitary and Epidemiologic Safety Department under the Ministry of Health, the State Agency for Land Resources, the State Water Management Committee and the State Committee for Forestry should be finalized in *the Statement on Environmental Consequences of the Industrial Operations (SEC).* The SEC in a concise form states the main conclusions of OVNS and important comments (Section 4.2 of DBN A.2.2-1-2003). SEC is published in the national and/or local press, placed on the Internet.

The state environmental expertise is established in Chapter IV of the law “On Environmental Protection” as an important instrument of the overall public management and control over environment. In detail the SEE is regulated by the law “On Environmental

Expertise". Basically the environmental expertise is targeted at the following tree main tasks:

i) to identify objects and operations that have or might have a negative impact on the environment in future;

ii) to assess adequacy of project decisions at the preliminary, intermediate and implementing stages of each project and to establish compliance of the project documents with the existing requirements and standards; and

iii) to evaluate adequacy and sufficiency of proposed measures for environmental protection and public safety (Article 28 of the Law "On Environmental Protection").

The findings and conclusions of the SEE are also disclosed to public (Article 11 of the Law "On Environmental Expertise"). The conclusions of the SEE approved by the regional state authorities become mandatory for project implementation (Article 12). No construction project can be implemented without a positive conclusion of the SEE (Article 29).

The comprehensive SEE is compulsory only for the projects with highly hazardous objects listed in the Cabinet of Ministers' Decree No.554, July 27, 1995. The high voltage power transmission lines are not included into this category.

4.3 Compliance with international standards

According to Section 21 of the EBRD Environmental Policy (2003) all projects financed through the bank funds should be structured so as to meet:

(i) applicable national environmental law; and

(ii) The EU environmental standards, insofar as these can be applied to a specific project. The basic principles and good international practice of environmental assessment identified therein is the EU Directives on environmental assessment and the World Bank Group guidelines.4 The EBRD will not finance projects that contravene the relevant country obligations under relevant international environmental treaties. The table in the Appendix 11.1 demonstrates major points for comparison between the Ukrainian legal regime and the good international practice standards accepted by the International Financial Institutions.

4.4 Land Acquisition Plan

In compliance with Article 151 of the Land Code of Ukraine and the Decree of the Cabinet of Ministers No.427 (2004) "On the procedure for selection of land parcels for deployment of objects", all affected land owners/users should be notified through regional authorities about possible encumbrances, withdrawals or buyouts of land plots. Some of the

[4] This approach could be found in Section 3.04 of the Loan Agreement between the NEC Ukrenergo and EBRD for construction of the high voltage electric power transmission line between Adjalik and Usatove in Odessa region dated December 16, 2005.

landowners and land users were already individually contacted by NPC Ukrenergo or by Ukrenergomerezhproekt assisted by the local authorities.

According to the requirements of Article 146 (2) of the Land Code of Ukraine and Article 350 (3) of the Civil Code of Ukraine the affected land owners must be informed at least one year prior to withdrawal (buyout) of their land due to public needs. Based on the comments received from interested stakeholders and individuals at the project feasibility stage, the regional/local authorities and state bodies provided preliminary consent for the route to deploy the transmission line.

According to the preliminary investigations and consultations at the stage of selecting the route for transmission line the overwhelming majority of the land parcels needed for towers is currently in the state ownership. The communal lands allocation of which for construction could be unavoidable will not be numerous - the communal lands are restricted to the village/town territories and the effective sanitary regulations for operations of high voltage power transmission lines require that they should be located at least 250 m away from the residential premises. Therefore, the transmission line practically will not cross the residential areas. In fact the land therefore will not require transferring from private into public ownership – the public ownership will be retained and easement for permanent or the long-term use by NPC Ukrenergo will be established. The assignment of lands for permanent use by NPC Ukrenergo will be done under decisions of the regional/rayon administrations in accordance to the Land Code of Ukraine (Art 149). The decision of the Cabinet of Ministers would be needed since its jurisdiction covers the change of the purpose of use of the lands (Article 20 of the Land Code) and also transfer of forests and the lands referred to precious soil resources.

Those lands that are in the communal property will be transferred to NPC Ukrenergo on terms of long-term lease. Some communal land will be also short-term leased to NPC Ukrenergo for the period of construction and for ensuring access to the construction sites, storage of materials etc. Short-term lease agreements will be signed by NPC Ukrenergo with those private owners, whose lands will be needed for the period construction works.

The Land Acquisition Plan (LAP) will be developed by a licensed expert organization (the Laws of Ukraine “On organization and management of lands in Ukraine”, “On Public Procurement” and Decree of the Cabinet of Ministers No.677, 2004). The contents, terms conditions, obligations of the parties involved in the development of LAP in a standardized agreement provided as Annex to said Decree of the Cabinet of Ministers.

The Land Acquisition Plan will contain:

- All relevant data on the ownership, designated use, the rights of use, rights of way, and archaeological data on the plots required for the tower bases, the RoW as access roads, stockpiles, construction areas etc.
- Documents confirming that the land owners/users have been duly informed and their consent has been obtained, approvals of local and state authorities have been also received.

- Valuation reports and compensation schedules for each landowner and land user – this covers the value of the land (for landowners), improvements, crops (permanent and standing crops), hay meadows and forests.

Basically the requirements for contents and procedure for approval of LAPs in Ukraine are regulated by the following legislative acts:

- Constitution of Ukraine (in particular Articles 13, 14, 41);
- Land Code of Ukraine (25.10. 2001 No.2768-II, in particular Articles 5, 92,141-149, 151)
- Civil Code of Ukraine (Article 350);
- Law of Ukraine "On Local Self-Governance in Ukraine" (21.05.1997 No.280/97-BP);
- Law of Ukraine "On Land Lease" (October 6,.1998 No.161-XIV)
- Law of Ukraine "On Valuation of Lands" (11.12.2003 No.1378-IV)
- Law of Ukraine "On organization and surveillance of lands" (22.05.2003 No. 858-IV, Articles 20, 38, 50,56);

There are also several regulatory acts and national standards to be applied:

- Decree of the President of Ukraine (14.08.2000 No. 970/2000) "On regulation of the State Committee for Land Resources of Ukraine" (and the Decree of the Cabinet of Ministers of Ukraine 31.01.2007 "On reorganization of the State Committee for Land Resources of Ukraine")
- Decree of the Cabinet of Ministers of Ukraine (17.11.1997 No. 1279) "On values and procedure for calculation of losses of agricultural and forestry losses subject to compensation".
- Decree of the Cabinet of Ministers of Ukraine (19.04.1993 No.284) "On procedure for calculation and compensation of losses to land owners and land users"
- Decree of the Cabinet of Ministers of Ukraine (26.05.2004 No 677) "On approval of the procedure for organization of lands during development of land allocation plans"
- The national construction standard DBN B.2.5-16-99 "On measurement of land parcels allocated for objects of power transmission networks"

The NPC Ukrenergo's contractor will prepare a complex document consisting of at least three volumes – one for each region of Ukraine where the land withdrawals (buyouts) and easement of rights will take place. The Land Acquisition Plan will contain a comprehensive list and detailed maps of all parcels that have to be acquired or temporarily leased and all the existing rights of way. It will also include a calculation of the

compensations and losses that will have to be paid, the names and titles of every landowner and land user and confirmations of their formal consent to the transfer of rights.

The LAP has to be reviewed and approved by the State Agency for Land Resources for a comprehensive state expertise. The LAP will be also reviewed by the land allocating commissions under the regional/local administrations. These bodies are set up to investigate land allocation issues and to act on behalf of local administrations/councils in assessment of the land allocation plans. The local administrations will pass their decision based on the conclusions of the commissions.

Once the owners and users have given their consent and the competent administrations/ local councils have passed their decision on allocation of the land parcels needed for the towers, the regional state administrations will approve the proposed acquisitions and submit their resolutions to the Cabinet of Ministers of Ukraine. The Cabinet of Ministers will also approve assignment of the particular land plots to NPC Ukrenergo and will wherever needed change the purpose of public agricultural lands (all such land plots will be listed in attachment to the governmental decision). The regional administrations will be thus empowered to issue state acts on NPC Ukrenergo's title to the listed land plots and they will implement procedure for withdrawal/ buyout and transfer of the public land plots to NPC Ukrenergo.

4.5 Land valuation

The valuation is a constituent part of LAP preparation. The contractor developing the LAP for NPC Ukrenergo project should employ professional licensed valuators. Activities of professional land valuators in Ukraine are regulated by the following legislative acts:

1. Law of Ukraine "On valuation of property, property rights and professional valuation activities in Ukraine" (2001) No.2658-III,

2. Law of Ukraine "On valuation of lands" (dated 11.12.2003, No1378-15).

   In particular this legislative act establishes the principles and types of land valuation in Ukraine depending on its purpose (*economic* and *monetary valuation)*.

   The monetary valuation can be carried out as

   a) a standardized procedure (based on established indexes) or

   b) an expert valuation.

   The standardized procedure is applied to calculate the value of land as a productive natural resource and amounts of land tax or rent payments by users of public lands, or to establish losses of agricultural producers caused by temporary encumbrances. Standardized valuation is done for all purposes other then commercial transactions with the land.

   The expert valuation is compulsory if a market price of land needs to be established for any commercial transaction. Particularly in cases when land deeds are concluded between public authorities and legal entities or individuals

(withdrawal, buyouts, transfer of ownership either under contracts or under court decisions).

The expert valuation is performed only by licensed valuators contracted by the relevant land owner/user or by other interested party. The method of expert evaluation is based on calculation of the three following factors:

a) capitalization of the operational revenues of the land owner or rent payments;

b) comparative prices for similar land parcels; and

c) the calculation of cost of all improvements to the land. The valuation reports are subject to the state expertise.

The valuation reports on private land buyouts due to public needs require obligatory professional review by authorized valuators having at least 2 years of experience or by the expert councils under professional associations of land valuators.

3. *Decree of the Cabinet of Ministers of Ukraine "On methodology for expert valuation of lands"* (No 1531 dated 11.10.2002)

   This regulation prescribes detailed *techniques* for calculation of capitalization of land owner/user's revenues, rent payments, adjustments to prices during comparison of land prices, discounts on value of land improvements etc. It also establishes procedures for calculation of incomes and cost of agricultural land production, the lands under water objects (ponds, lakes, canals), lands occupied by immovable property. There are procedures to calculate values of servitudes – basically the value of these rights is established as a difference in the market value of a land parcel before and after establishment of a particular encumbrance on the land.

   All valuation reports are subject to approval by the state authority for land resources of relevant jurisdiction.

4 Order of the State Committee on Land Resource "On approval of procedure for expert monetary valuation of the land parcels" (dated 09.01.2003 No.2).

This regulatory document is a step- by-step guidance for implementation of expert land valuation and for the form of expert land valuation reports. It establishes that any land evaluation report is valid during one year since its approval.

The procedure of expert land valuation includes the following steps:

- Investigating the land parcel "on site" (analysis of all available legal, technical and land cadastre documents)
- Analysing the relevant land market situation;
- Establishing cost factors to be considered;
- Defining a Scope of Work for the valuator and signing an agreement;

- Collecting and analysing relevant data ;
- Defining the most effective use of the land parcel;
- Selecting the most appropriate method for valuation;
- Calculating a value on the basis of the selected method;
- Drawing conclusions and producing a land valuation report.

4.6 Review of Ukrainian legislation on land tenure

The legal framework for land tenure is currently being debated and some changes may take place in the near future. Currently there is a moratorium on the sale of agricultural land established in Ukraine until 1st January 2008. A draft law on easements (*servitude*) and a draft law on organisation of withdrawal (buyout) of land for public needs are also under consideration in Parliament and until these are approved there are uncertainties relating to easements of the kind required by the project.

Since 1995 people that had worked on the collective and state farms were given shares in their farm lands and by 2005 most of those nominal landowners had received land ownership certificates (*acts*) that converted their shares into actual plots of land defined on the maps by the State Land Authority.

Due to the moratorium on the sale agricultural land plots can be inherited but cannot be sold or given as a present. There is a specific purpose determined for each land plot in accordance with the Land Code of Ukraine – for instance agricultural land can only be used for farming and cannot be freely converted by its owner to any other use without decision by a competent state authority.

Some people had not even applied for acts on ownership because it would have an adverse effect on their incomes or they found it more convenient to rent their land rights to third parties. In Makariv Raion of Kyiv Oblast the situation is moving strongly in the direction of land privatisation and sales. An initial assessment suggests that only about 5% along the route of the transmission line is in private ownership.

Other land ownership models include:

- **State reserve lands** (State owned). These state owned land plots are held in trust by the Village (District or Regional) Councils on behalf of the State within their particular competences.
- **Communal lands** (owned by Village, Town Communities) - these lands are used jointly by the communities
- **Forests and forest lands** - predominantly State-owned, some small areas of forest up to 5 ha. Could belong to communities and even to private individuals
- **House lots** – are in full private ownership and can be freely bought and sold.

4.7 Land acquisition and compensation process

4.7.1 Official registering of the right of use of land

NPC Ukrenergo will have to register the right of use of the land plots needed for the "footprints" of the towers. It is estimated that the line will need approximately 1312 towers with land areas of 140 m^2- 620 m^2, depending upon the type of tower. A right of use (*servitude*) will also be required for the land crossed by the transmission lines (RoW). The plots for the towers will be assigned to NPC Ukrenergo for permanent use by the State and NPC Ukrenergo will be given a state certificate *(derzhavni akty)* for each such plot of land. The village councils will be compensated for any communal land, i.e. within the village boundaries, and the State Regional Administrations will be compensated for lands outside the boundaries of the villages. The decision to issue the land use certificates will be taken by the Cabinet of Ministers and will be based on the conclusions of the Raion and oblast land use authorities

According to the preliminary investigations there is only one house owner that will have to be resettled.

The land that will be allocated for the towers comprises roughly an area of up to 620m² for each of the tension towers and 140m² for the suspension towers. The towers will be placed at intervals of 400m-500m depending on the characteristics of the landscape: this means that 700-875 towers will be needed for the Rivne NPP - Kyiv line and 270-338 for the Khmelnytsk NPP - Kyiv line. One estimate gives a total of 1312 towers: comprising 160 tension and angle-tension towers and 1152 intermediate support towers.

The protection zone of the transmission line – i.e. the land where the restrictions on use apply - varies from 22-40m from the outer electric cables. At the towers the ROW is defined as a distance of 40m from the extreme cables, giving a total width of 116m and between the towers where the cables are hanging the RoW is 22m on either side of the outer cable giving a total width of 80m. Where the two transmission lines run in parallel the distance between them will be at least 80m between the cables.

4.7.2 Land compensation

Compensation for withdrawal of land plots will only be paid to the owners of the land required for the towers but not to the owners of the land within the protection zone of the power line. Ukrainian Land Code determines land use and in principle, the restrictions on use should do little or nothing to change the status or potential value of the land. There are in the protection zone three basic limitations, apart from prohibiting the construction of housing and other buildings:

- In areas where the cables are hanging at the standard 12.5m above the ground people are not supposed to work for more than 1.5-3 hours at a time under the transmission line – this is a limitation that would affect areas of arable land worked by hand or with animal traction, but NPC Ukrenergo has proposed that the cables will be raised to 16m in areas worked by hand and in this case the allowed time would be 3-8 hours at a time

- In forested areas trees would have to be cut on a regular basis to keep them to a pre-defined height.
- The owners and users of the land in the RoW are obliged to allow maintenance and repair crews to have access to the transmission line. Any damage caused by NPC Ukrenergo maintenance should be compensated on a case-by-case basis.

This may be the reason that there is no provision for compensation for the easement that is required for the protection zone under Ukrainian legislation..NPC Ukrenergo will have to sign contracts for the easement with the private landowners whose land is situated in the protection zone of the power line and with the Village Councils (for land within village boundaries) and with the State Raion Administrations (for lands outside village boundaries).

No compensation is paid for the visual impacts on the landscape or for potential or possible hazards associated with the electro-magnetic fields (EMF) generated by the transmission line. This is the same as the current practice in other parts of the world including Western Europe.

Compensation will be paid for damage to crops and loss of potential earnings while assembling and erecting the towers, for access to the transmission lines, as well as the land required for construction camps, stockpiles, parking and maintenance of vehicles and equipment and any other uses.

4.8 Review of compensation for construction impacts

NPC Ukrenergo will compensate the landowners and land users whose lands are affected by temporary impacts during construction of the transmission lines. This will include compensation for damage to crops and other assets and for loss of potential earnings (*lucro cessans*) from the land that will be used for assembling and erecting the towers, for access to the RoW of the transmission lines as well as the land required for construction camps, stockpiles, parking and maintenance of vehicles and equipment and any other uses.

The levels of compensation will be determined by commissions created by the State Raion Administrations that will include representatives of the affected Village Councils, the State Land Use Authority, the Raion Architecture and Planning Authority, the Raion Department of Finance, NPC Ukrenergo and the affected landowners. The compensation for private landowners and land users will be assessed on the basis of Cabinet of Ministers Decree No 284 (1993), which provides for compensation for: i) the value of residential buildings, other premises and unfinished buildings, ii) fruit trees and other permanent crops, iii) forests and bushes, iv) sources of water and irrigation systems, and v) investments in agriculture including the loss of investments in crops (cost of ploughing, agrochemicals and so on).

The compensation for private owners will be paid by NPC Ukrenergo to the relevant local administration or local council within one month of the valuation being approved by the state administration and the local government executive body. The local administration will

then pay the affected landowner or land user. Payment must be made before the land can be taken for construction or other purposes.

4.9 Review of international standards for transmission lines

According to the information published by Eurelectric – the European Union of the Electricity Industry (www.eurelectric.org) – most countries in Western Europe including Austria, Finland, France, Germany, the Netherlands, Norway, Portugal, Spain, Switzerland and the UK pay compensation for the impacts of new transmission lines on land use, but not for the visual impacts or the possible impacts of EMF. In Denmark compensation is paid for buildings such as farmhouses that are situated at a distance of less than 35m from a new 132/150kV transmission line or less than 50m from a new 400kV transmission line. In Italy compensation is paid for "the disadvantages" to properties situated up to 50m from a 130/380kV transmission line.

In regard to the impacts on population, the good practices recommended by Eurelectric for new transmission lines state:

> "As far as possible the line corridor must be sited away from population centres, isolated dwellings and areas of potential urban, tourist or recreational development. If technically this cannot be avoided then technical design considerations and construction practices ought to be sought".

Finally, the conclusions of the practices of the member countries of Eurelectric include the following recommendations in regard to land acquisition and compensation:

> "Affected landowners must be respected and they should continue to own the affected land unless the required development hinders to a predetermined level the free use of the land. In such cases the acquisition of the land must be possible through national law in return for reasonable and objectively defined compensation. In all other cases, landowners must be satisfactorily compensated through regulated procedures for the limitations that are imposed the free usage of the land."

The standards of compensation for new transmission lines applied in Ukraine appear to be similar to those of most Western European countries. In fact, the standards in relation to EMF appear to be stricter, since they do not allow for any construction within 22-40m of the outer cables of the transmission line. However, unlike many Western European countries the Ukrainian standards do not envisage the payment of any compensation for the restrictions placed on the use of the areas under the cables (i.e. the land crossed by the transmission line). The information provided by Eurelectric suggests that in most Western European countries the electricity transmission companies pay small amounts of compensation to the landowners and/or land users for the restrictions imposed by free span transmission line crossings. The payments are usually small. In Austria, for example, a single payment of approximately US$ 0.45/m² is made to the landowner and does not take into account the use to which the land is put. In the UK some companies pay a fixed rate of compensation to the land owner for the impact of free span crossings while others pay a small monthly fee to the owners and users.

5. Description of the environment

This section discusses the current environmental baseline conditions and environmental sensitivities in the wider project area, in order to be able to assess the nature and significance of the environmental impacts arising from the proposed activities. The information presented in this section builds upon information gathered by the design team during the preparation of the OVNS as well as additional research and site visits aiming at filling any gaps in this information.

5.1 Project location

The proposed 750 kV Rivne NPP – Kyiv transmission line stretches between Rivne NPP and Kyiv substation, at a total length of about 353 km in northwest Ukraine. The Khmelnytsk NPP – Kiev transmission line stretches between Khmelnytsky NPP and Kyiv substation, at a total length of 265 km. The section of the line from Khmelnytsk NPP to the junction with the proposed Rivne NPP - Kyiv line (about 130 km) already exists. From the junction point to the Kyiv substation a new 135 km long line section will be constructed that will run alongside the Rivne NPP – Kyiv line.

A map of the wider project area (scale of 1:200,000) with the transmission line routes shown on it, is presented in Appendix 12.1. A satellite image of the route and the surrounding areas is provided in Appendix 12.5. Maps of greater detail (scale 1:100,000) showing parts of the proposed route are presented in Appendix 12.2.

The present study was also informed by detailed topographic maps (scale 1:10,000 or 1:25,000) which cannot be attached here for practical reasons.

5.2 Natural environment

5.2.1 Geography and geomorphology

In terms of physiographic zoning, both transmission line routes are situated in the south-west of the East European Plain, within the territory of mixed forests in the Polissya[5] Province. The 750 kV Rivne NPP – Kyiv transmission line route goes through the regions of Volynian, Zhytomyr and Kyiv Polissya, with the boundaries of the geographic areas practically matching the administrative boundaries of Rivne, Zhytomyr and Kyiv respectively.

The beginning of the route of the 750 kV Rivne NPP – Kyiv transmission line is located in the north-west of Ukraine in Volynian Polissya. The area is a swamp plain characterized by flat relief with separate sand hills and ridges. Elevation ranges from 150 to 202 m. The plain has a gradual inclination in the northern direction – towards the river Prypiat. The territory of the Volynian Polissya is the most humid, forested and swamped area among physiographic regions of the Ukrainian Polissya.

[5] Polissya represents an entire ecological system which covers all of the south of Belarus, northern Ukraine as well as adjacent areas in Poland and Russia

The major part of both transmission line routes is located in Zhytomyr region. The 750 kV Rivne NPP – Kyiv transmission line crosses the area from east to west, while the Khmelnytsky NPP – Kyiv line from south to north. In Zhytomyr Polissya, the surface is much higher, drained and less boggy in comparison with the areas of Volynian and Kyiv Polissya. The elevation ranges between 184 – 245 m.

Both transmission line routes end in the west of Kyiv region on the territory of Makariv district. The landscape here is slightly undulating, covered with forests and peat bogs in some places. It is dissected by ravines, gullies and the Teteriv River course and its tributaries, swamp ditches and grooves. The elevation is about 150 - 250 m.

The density of rural population along the entire route of the 750 kV Rivne NPP – Kyiv line is 20-30 persons per square km. It increases in some districts of Zhytomyr and Kyiv regions up to 30-40 persons per square km.

Summary indicators of the territories and objects crossed by the transmission line routes are presented in **Table 5.1**.

Indicators	**Number**			
	Rivne region	**Zhytomyr region, till the junction with the Khmelnytsky – Kyiv line**	**Region from the junction till Kyiv substation**	**Diversion of the Khmelnytsky – Kyiv line till Kyiv substation**
Route length, km	117,860	99,06	135,	134,9
Bogginess, km	6,76	29,98	7,405	7,460
Forest, bushes, km	59,383	36,57	27,124	35,6
Main cross sections, pcs.				
Highways	17	10	24	23
Rail”ways	6	1	4	4
0,4 - 10 kV transmission lines, lines and communication cables	44	14	33	34
35 kV transmission lines	5	6	5	5
110 kV transmission lines	3	2	3	3
330 kV transmission lines			1	1

Indicators	Number			
	Rivne region	Zhytomyr region, till the junction with the Khmelnytsky – Kyiv line	Region from the junction till Kyiv substation	Diversion of the Khmelnytsky – Kyiv line till Kyiv substation
Gas pipe-lines	7	4	7	7
Rivers and water barriers	9	10	16	16
Product pipeline «Druzhba»		1		

Table 5.1 Objects crossed by the transmission line routes

Figure 5.1 presents an extract of the map of important geomorphological as well as anthropogenic features likely to affect the proposed developments.

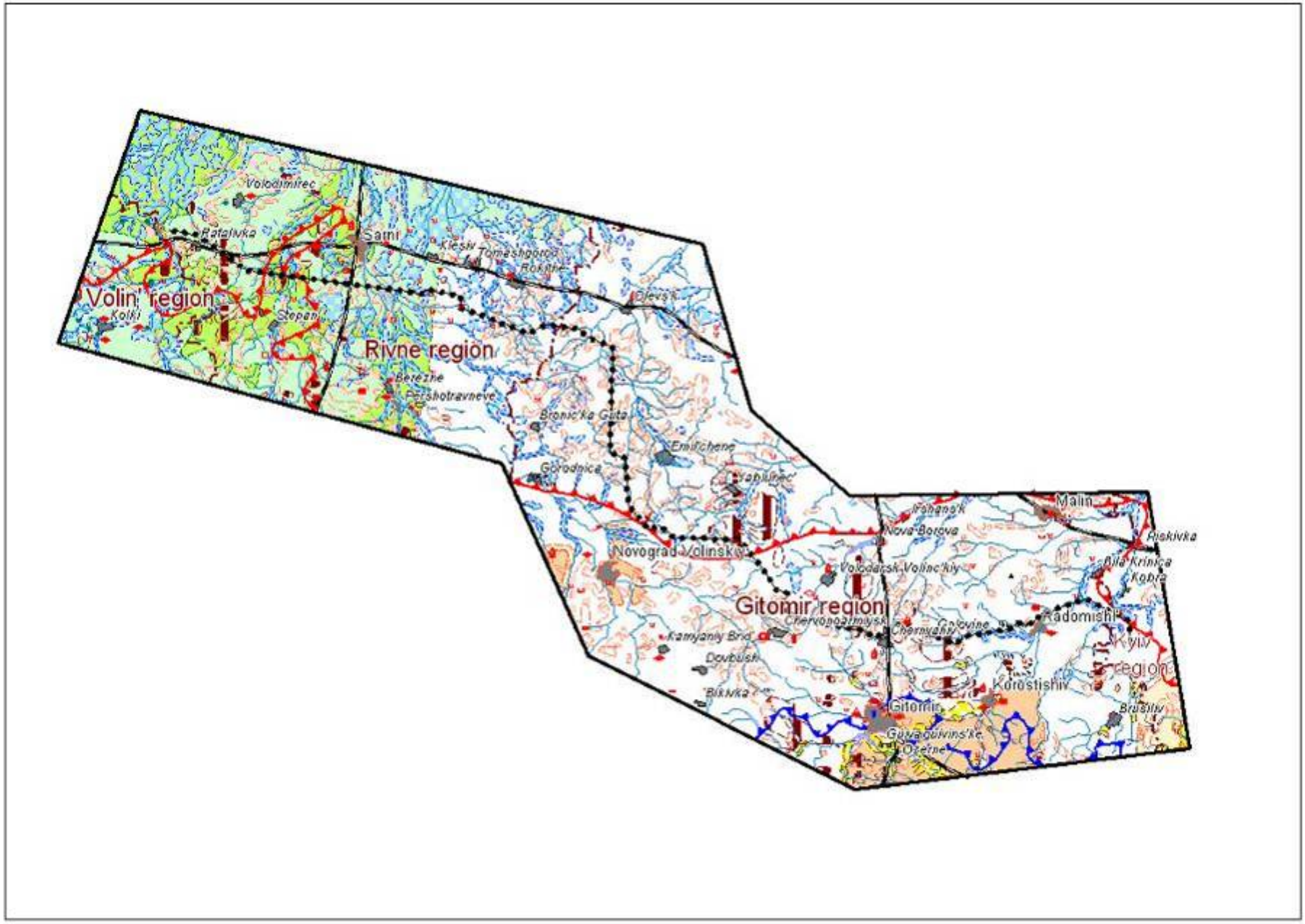

Volodymyrec
Ratalivka
Volin' region
Kolki
Stepan
Sarny
Klesiv
Tomashgorod
Rokitne
Dubrovytsya
Dubrovytsya
Rivne region
Berezhe
Pershotravneve
Bronic'ka Guta
Zdolbuniv
Gorodnica
Varash
Novograd-Volinskiy
Malin
Irshans'k
Nova Borova
Ruskivka
Nova Krinica
Kodra
Volodarsk-Volinc'kiy
Gitomir region
Radomishl'
Chervonoarmiysk
Chernyakhiv
Kamyanny Brid
Dovbush
Bikivka
Korostishiv
Brusilov
Gitomir
Ozerne

Figure 5.1 Main geomorphological and anthropogenic features along the proposed route (Source: Institute "Geoprognoz" (M.Kolot), 1998, with ammendments made by the Institute of Environmental Geochemestry (G.Maruchev), 2007

5.2.2 Geology

Rivne Region

In geological terms the area where the transmission line route crosses Rivne region is part of the North-West edge of the Ukrainian crystalline craton. The geological composition includes rocks of Lower Proterozoic (Pt_1), Upper Cretaceius Turin horizon (K_2t), and Quaternary eras.

Lower Proterozoic is represented by Osnitsk complex composed of Osnitsk granites, and Klesiv granites and diorites which can primarily be found near the urban settlements of Klesiv and Rokytne, the villages of Fedorivna, Vyry, Chabel, and Osnitsk. The thickness of Lower Proterozoic rock is over 1000 m. Upper Cretaceius rock is represented by Turin horizon chalk found mainly in the valley of the Goryn River. Turin strata occur transgressively on the eroded surface of Premesozoic rocks with cross and stratigraphic bedding. Thickness of chalk varies from 15 to 70 m. Quaternary rocks are represented by marsh (turf, peaty and silty loams), and alluvial and fluvioglacial sediments (sands of different granulometric composition, loamy sands, and clays). The thickness of Quaternary strata varies between 0.5 and 40 m.

Zhytomyr and Kyiv Regions

Zhytomyr region is a part of the Ukrainian crystalline craton. Kyiv region is located in the tectonic zone of transition from the Ukrainian crystalline craton in the west to the Dnieper-Donetsk basin in the east.

The geological composition involves two structural layers: lower Precambrian layer, consisting of crystal metamorphized rocks and upper Paleozoic-Cainozoic layer made of a complex of Paleozoic (Permian), Mesozoic (Triassic, Jurassic, and Cretaceous), and Cainozoic (Palaeogene, Neogene, and Anthropogene) sedimentary rocks. Paleozoic sediments are represented by Permian terrestrial sands of bright and light colours. The Mesozoic period of development is represented by Jurassic sandy sediments. Clays are also commonly found. Cretaceous sediments are represented by albian-cenoman argillo-arenaceous and marly chalk strata, with thickness varying from 8 to 10 m. Palaeogene sediments are represented by rocks of Kanev, Buchak, Kyiv and Kharkiv suites. One of the features of the sediment cover is monoclinical bedding of its layers and increase of their thickness towards northeast as they approach the Dnieper graben.

5.2.3 Climate conditions

The area is part of the plain sub-region of the Atlantic continental region. Climatic conditions are influenced by the humid air masses from the Atlantic Ocean and the Mediterranean Sea which travel in northwest, west, and southwest flows. Inbreaking of Arctic air masses can cause abrupt temperature drop in winter (sometimes down to -35ºC, -40ºC), and in summer intensifies drought phenomena and increase of air temperature, especially under the influence of Azores anticyclone. In spring, air masses from the Mediterranean enter the area boundaries from southeast and south. Depending on intensity and combination of these types of air masses, significant deviations may occur in humidification and heat regime which impact natural conditions of the region. In general, the area is characterized by rather comfort moderate continental climate with optimum humidification.

The average annual air temperature is about +7.0°C. Statistically, the coldest month of the year is January, and the warmest is July. Average air temperatures during 1961-1990 are shown in **Table 5.2**.

Weather station	Average air temperature, °C			Absolute maximum, °C	Absolute minimum, °C	Temperature of the coldest five-day period, °C
	Jan	Jul	Annual			
Sarny	-5.0	18.2	7.0	39	-37	-20
Olevsk	-5.2	18.5	7.2	38	-35	-20
Korosten	-5.6	17.8	6.7	39	-37	-21
Ovruch	-5.8	18.4	6.9	39	-34	-21
Poliske	-5.8	18.4	6.8	38	-34	-22
Teteriv	-5.9	18.8	7.0	39	-35	-22
Fastiv	-5.9	18.9	6.9	40	-37	-22

Table 5.2 Recorded air temperatures in the period 1961-1990

Winter is mild with overcast and frequent fogs. Weak frosts from -3°C to -5°C are often followed by thaw when the temperature rises above 0°C. The average duration of frost-free period is 187 days. The depth of seasonal ground frost penetration does not exceed 1.1 m. The first part of spring is chilly, and the second is warm with light frosts at night. Summer is warm, and its second part is hot. Days are partly cloudy with weak wind, and nights are clear, quiet, and chilly. Precipitation comes as short showers, often with thunderstorms and winds. Autumn is warm and dry, and its second part is chilly with overcast, incessant drizzling rains, and light night frosts.

On average, there are 163 days per year with precipitation. Most frequently precipitation occurs in winter and has the form of snow. Over the year, most precipitation occurs in July, least in February. The average monthly precipitation (mm), based on many years of observations of weather stations located along the route, is given in **Table 5.3**.

Weather station / month	Precipitation, mm												
	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Manevychy	39	35	31	39	56	77	79	64	56	44	49	45	614
Sarny	35	30	28	40	58	86	79	62	52	46	43	41	601
Olevsk	41	34	33	43	55	87	97	73	54	41	48	49	650
Korosten	32	27	30	39	51	82	91	80	47	37	43	37	596
Ovruch	35	30	30	38	52	79	89	75	48	39	48	40	603
Poliske	35	31	30	42	48	79	87	68	47	38	47	42	594
Teteriv	38	35	33	39	51	82	84	69	43	39	49	43	605

Fastiv	38	32	30	44	52	74	88	70	39	37	46	42	592

Table 5.3 Average monthly precipitation along the proposed route

West winds prevail over the year. Most frequently they occur in autumn. As a rule, west winds bring precipitation and rise of temperature in winter and temperature drop in summer. Recurrence of wind directions and average percentage of calms based on measurement data of weather stations located along the transmission line route are given in **Table 5.4**.

Weather station	N	NE	E	SE	S	SW	W	NW	Calm
Manevychy	9	7	11	16	10	13	20	14	9
Sarny	10	7	8	15	16	12	18	14	14
Olevsk	7	9	12	14	12	13	19	14	11
Korosten	10	9	9	13	14	11	20	14	7
Ovruch	10	10	10	11	11	14	15	19	8
Poliske	8	10	12	13	11	15	19	12	15
Teteriv	10	9	11	16	10	14	16	14	15
Fastiv	13	9	10	13	13	10	15	17	5

Table 5.4 Wind direction (percentages) along the proposed route

Wind speed is the highest in winter months, and the lowest in summer. On average, over the period 1961-1990, the recorded wind speed was 2.8 m/s in January and 2.1 m/s in July. However, wind speeds of over 10 m/s were observed in 78 days and over 15 m/s in 11 days. Maximum wind speeds registered by weather stations located along the transmission line route are given in **Table 5.5**.

Weather station	Max wind speed, m/s										
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Manevychy	14	16	13/28	17	15	13	9	9	13	9	9
Sarny	16	12	13	20	12	11	11/28	9	11	13	14
Olevsk	12	10	10	17/33	13	13	15	15/35	20/34	15	17
Korosten	19/30	22	16	24	16	15	17	17	20	17	17
Ovruch	18	20	15	20	15	15	17	15	17	17	17
Poliske	15	16	9	13	9	11	15	15	11/24	11	13
Teteriv	10	15	10	15	11	9	13	11	13/25	15	11

Fastiv	8/30	10	8	11/30	9	9	11	9	9	11	9

Table 5.5 Wind speed along the proposed route

The area is covered by snow for 90-100 days per year on average. Permanent snow cover forms at the end of December, and melts at the beginning of March. The highest snow cover can be registered in the second half of February. The height of the snow cover (average of maximum heights per ten-day intervals) is 15-25 cm, but it can reach 45-50 cm. Over recent decades, the duration of the period with snow cover, as well as its height has reduced. It may now happen that the whole winter passes without any permanent snow cover.

5.2.4 Hydrogeology

The proposed route of the Rivne NPP – Kyiv transmission line crosses a number of different hydrogeological basins; the Volyn-Podillya artesian basin at Rivne region, the Dnieper-Donetsk artesian basin at Kyiv region and the Dnieper-Donetsk artesian basin or the Ukrainian craton in Zhytomyr region.

These basins differ by the hydrogeological profile and general features of underground water formation which is caused by the nature of tectonic structures and the composition of sedimentary cover.

Volyn-Podillya Artesian Basin

The hydrogeological conditions of the Volyn-Podillya artesian basin are closely related with geological structure of the area where one can identify several water-bearing horizons, such as alluvial and fluvioglacial sediments, granites and migmatites. The thickness of the water-bearing horizon varies from 0.5 to 30 m with the depth of occurrence at 1-10 m.

Ukrainian Crystalline Craton

Underground waters within the Ukrainian crystalline craton belong to different stratigraphic horizons. These are waters in Anthropogenic sediments, Neogene sands and limestone, in Palaeogene sandy sediments, in the rocks of ancient residual soil of crystal rocks, and in the fractured zone of Precambrian rocks. The depth of underground water occurrence varies from several dozen centimeters to several meters. They are mainly recharged in the bead sides of the basin through overflow from other horizons and complexes, and precipitation.

Dnieper-Donetsk Artesian Basin

The area of the Dnieper basin belongs to stratigraphic horizons of Paleozoic, Mesozoic, and Cenozoic rocks. Water-bearing horizons grow thicker towards northeast and east in the direction of Precambrean crystal rocks supression. Deep running horizons are mainly recharged in the bead sides of the Dnieper basin partially through water overflow from upper and lower lying horizons. The source of supply for shallow horizons is the Polissya plain.

The water-bearing horizons are recharged through precipitation. The water-bearing horizons discharge in lowered parts of relief where swamp lands are located. Due to a moderate terrain slope and shallow valleys, the river network does not drain the watersheds, therefore a canal network was built here to drain the soil.

The underground waters in the section are represented by low-head water-bearing horizons tied to alluvial and fluvioglacial sands and loamy sands. The depth of ground water occurrence varies from 0.65 m to 6.0 m.

5.2.5 Hydrology

The area crossed by the proposed transmission line routes is a part of the Polissya hydrological area, an area characterized by rich water resources. Overall, two hydrological basins are distinguished, the river Prypyat basin and the river Dnieper basin. **Table 5.6** makes reference to a number of watercourses crossed by the proposed routes in the two river basins.

The river Prypyat bain is characterized by a multitude of rivers and tributaries, some of them canalized for soil reclamation. A specific feature of the landscape in Dnieper basin is marshes. One can clearly identify valley bogs, sometimes in former riverbeds, almost everywhere there are floodplain marshes. Polissya marshes play an important role in hydrological regimes of rivers and temporary streams.

The annual variation of water level in Polissya rivers is characterized by high spring flooding which can have several peaks (influenced by uneven snow melting or raining), and low river level in summer. The flood in small rivers usually starts in mid March or end of February, and ends at the end of April or beginning of May. During floods, the water levels rise from 20-40 cm to 1-2 m. During winter the rivers are covered by ice, which can reach thickness of 40-60 cm or 60 – 80 cm during severe winters. In these conditions it is not unusual for a river to remain frozen for 90-100 days.

Over the recent decades and especially recent years, under the influence of human economic activity, the hydrographic network of the territory has experienced significant changes related to the establishment of reservoirs and ponds, and the construction of canals for soil drainage. Human activities have also an effect on the icing regime of rivers, as they tend to change water temperatures by discharging into the rivers warm domestic and industrial waste-water.

Name	Basin	Width, m		Bank height, m	Transition section characteristics
		River-bed	Flood-plain		
Rivne region					
River Virka	River Prypyat	6.0	210	2.5-3.0	River is canalized, pasture
River Taraganka	Prypyat	9.0		1.5-1.8	Riverbed banks and floodplain boundaries are resistant to washout, pasture
River Yazvinka	Prypyat	12.0		1.8-2.1	Riverbed banks and floodplain boundaries are resistant to washout, pasture
River Goryn	Prypyat		3000	1.5-2.5	The valley is trapezium-shaped, the banks are steep and matted
River Sluch	Prypyat		3500	0.5-2.0	The plain is flat, in some places covered

Name	Basin	Width, m		Bank height, m	Transition section characteristics
		River-bed	Flood-plain		
					with forest and marshes, numerous former riverbeds
River Stal	Prypyat	2.0		1.2-11.3	Riverbed banks and floodplain boundaries are washed out, marsh
River Lyublinka	Prypyat	0.8		0.2-0.3	Riverbed banks and floodplain boundaries are washed out, marsh
reservoir on Lva River	Prypyat	245		0.6-2.8	Riverbed banks are resistant to washout, fish farming
River Grabivka	Prypyat	2.0	230	1.0-1.3	River is canalized, pasture
River Masevychi	Prypyat	8.0	150	0.8-1.2	River is canalized, pasture
Zhytomir region					
River Stvyga	Prypyat				Area is over-humid with soil-reclamation canal, mixed forest
River Lukovka	Prypyat	8.0			Area is open
River Mudrych	Prypyat				Area is open on the right-bank side
River Glumcha	Prypyat				
River Brovnyk	Prypyat	10.0			
River Zarovenka	Prypyat	5.0			Area is open
River Berestok	Prypyat	12.0			Area is open
River Uborot	Prypyat	10.0			Riverhead, area is open
River Bastova	Prypyat				Area is open
River Bastova and 2 small Rivers	Prypyat				1 km upstream confluence with river Uzh, area is open
River Khotoza (2 branches)	Prypyat	6.0			Transition areas are open
River Kunay	Prypyat				Area is covered with forest
River Uborot	Prypyat	28.0			Floodplain is open, valley slopes are covered with forest

Name	Basin	Width, m		Bank height, m	Transition section characteristics
		River-bed	Flood-plain		
River Uborot	Prypyat				Floodplain is open, forests approach the valley
River Uzh	Prypyat	10.0			Left bank is high and open, right bank is low, covered with forest and marshes
River Irshytsya	River Dnieper				
River Irsha	Dnieper				Waterlogged open woodland, drainage system
River Trostyanka	Dnieper				Waterlogged open woodland, drainage system
River Ocheretyanka	Dnieper				Waterlogged open woodland, drainage system
River Verkholuchchya	Dnieper				Waterlogged open woodland, drainage system, reservoir
River Korobochka	Dnieper				Waterlogged open woodland, drainage system
River Lutovochka	Dnieper				Waterlogged open woodland, drainage system
River Teterev	Dnieper	30.0	1000		Valley is waterlogged, covered with forest and shrubbery, numerous former riverbeds
reservoir on River Belka	Dnieper	400			Fish farming
Kyiv region					
River Kodra	Dnieper				Valley is waterlogged
River Trostyanka	Dnieper				Waterlogged open woodland, drainage system

Table 5.6 List of waterways crossed by the transmission line route

5.2.6 Seismology

In accordance with the State Standards (DBN V 1.1-12/206: Construction in seismic regions of Ukraine), seismic zoning in Ukraine is applied for three factors of earthquakes frequency: 500; 1000 and 5000-year earthquakes. The corresponding maps of seismic zoning are presented in **Figure 5.2** – **Figure 5.4**. The mapped seismic activity refers to sites represented by average soil according to seismic properties (category II, according to Table 5.7).

Both transmission line routes are located within the same seismic area of relatively low seismic risk, with predictions of an earthquake of intensity of >5 – 6 (fairly strong - strong) on the MSK-64 scale occurring once in 500 years. Earthquakes of these intensities are widely noticed but only casue minor structural damage.

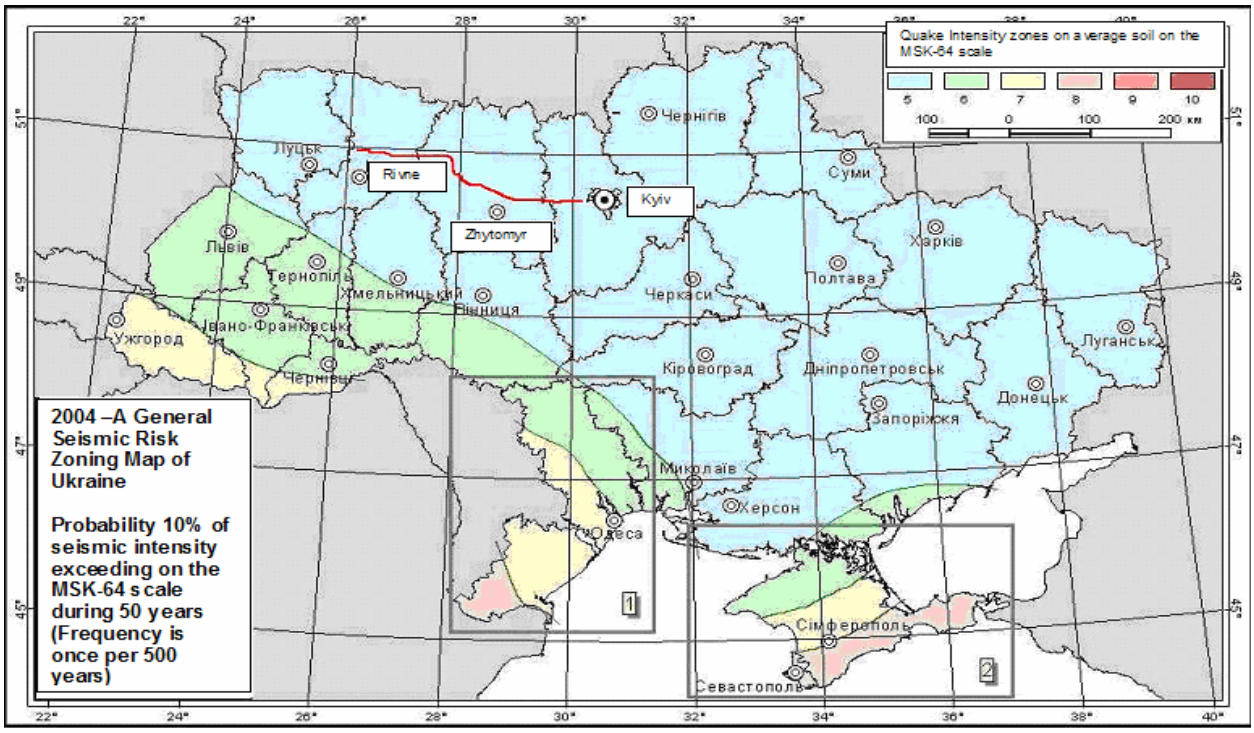


Figure 5.2 Seismic map of Ukraine for 500-year frequency (the transmission line is shown in red)

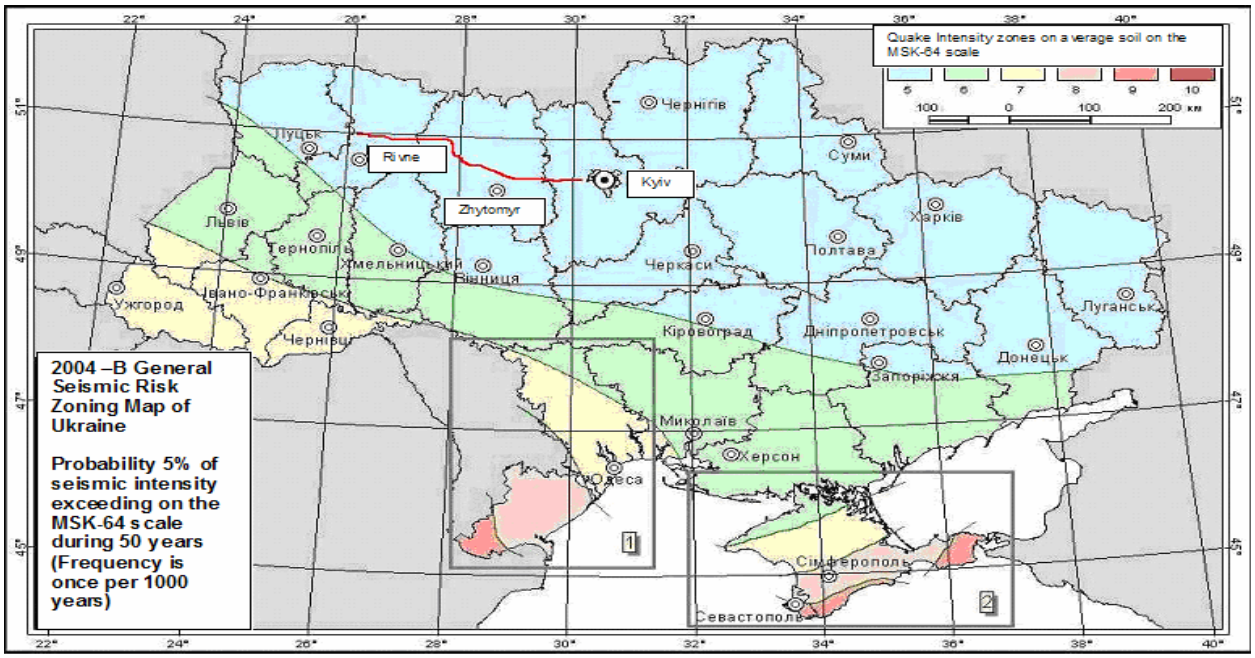


Figure 5.3 Seismic map of Ukraine for 1000-year frequency (the transmission line is shown in red)

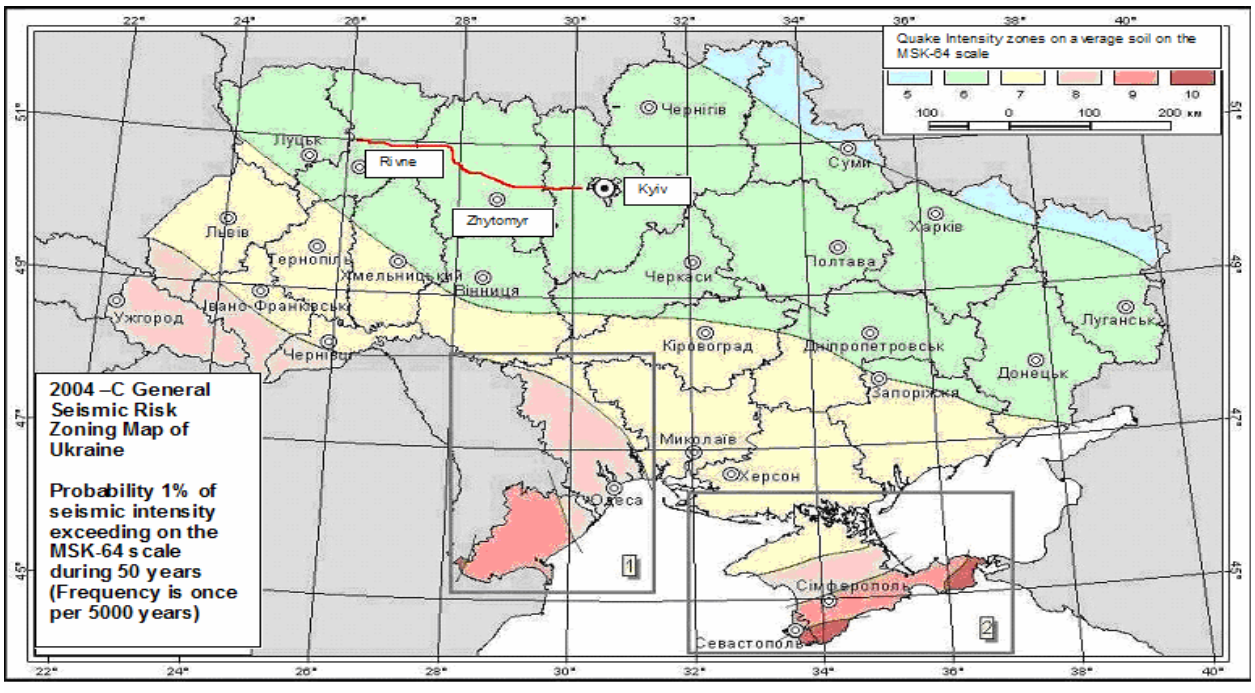


Figure 5.4 Seismic map of Ukraine for 5000-year frequency (the transmission line is shown in red)

Category of soil by seismic character	Soil	Standard seismic activity of a construction site at the seismic activity of the region, magnitude				Velocity of progress of seismic waves in soil, V_s, м/s
		6	7	8	9	
I	Rocky soils of all types, unweathered and lightly weathered; large fragment rocks, dense and low water-bearing of magmatic rocks containing up to 30% sand-clay filler.	5	6	7	8	V_s>800
II	Rocky soils of all types, weathered and highly weathered; large fragment rocks with the exception of those belonging to category I; gravel sands of large and medium-sized particles, dense and of medium density, water-bearing and low-water-bearing; sands, fine-grained and dust sands, dense and of medium density, water-bearing and low water-bearing; silt-loam soils with the flow rate $I_L \leq 0,5$ at the void volume $e < 0,9$ – for clay and loam and at the void volume $e < 0,7$ – for sand clay.	6	7	8	9	*500<V_s<800*
III	Loose sands regardless of water content and size of particles; gravel sands of large and medium-sized particles, dense and of medium density; water-bearing and low-water-bearing; sands, fine-grained and dust sands, water-bearing and water-saturated; ; silt-loam soils with the flow rate IL > 0,5; silt-loam soils with the flow rate IL ≤ 0,5 at the void volume e ≥ 0,9 for clay and loam and at the void volume e ≥ 0,7 for sand clay.	7	8	9	10	*200<Vs<500*
IV	Water-saturated sands liable to rarefying, fill-up ground and humus soils; flow earth, biogenic soils and silts.	According to the results of special researches.				V_s<200

Table 5.7 Predicted seismic activity of a construction site depending on the category of soils

5.2.7 Flora / fauna

The transmission line crosses the territory of mixed forests in the Polissya Province of Ukraine. Polissya represents an entire ecological system which covers southern Belarus, northern Ukraine as well as adjacent areas in Poland and Russia. As such the term describes a vast, waterlogged region of Eastern Europe, actually the largest swamp of the European continent. In general more than one-third is arable land, nearly one-quarter is covered with mixed woodland, about 5 percent is peat bog, a substantial portion is marshland, and the river valleys are floodplains.

The majority of the affected forests are mixed areas of pines (*Pinus silvestris*), oaks (*Quercus robur* and *Q. borealis*), and birch trees (*Betula pendula*). Spuce trees and fir stands (*Picea abies* and *Abies alba*) are also present as well as willow thickets (*Salix* sp). In the natural areas and in not intensively exploited parts of the forests as well as in natural reserves there are also hornbeams, alders (*Alnus glutinosa)* and aspens (*A. incana*). The exploited parts of these forests are quite dense but due to sanitation clearings and fellings there is almost no understorey. A significant percentage of these forests grow on hyperhumid and /or waterlogged conditions.

The forests across the transmission line are mainly managed, semi-natural or plantations for timber production. They are owned by the state and managed by the State Forestry Committee of Ukraine and local State Forest Enterprises. These State Forest Enterprises generate strategic 10 years plans and operational annual plans of forest management. Detailed maps of areas; tree species; category of forests and age classes, are kept at the head office and each forestry enterprise. Managed forests are harvested according to three basic types:

- Composed harvesting, applied mainly in beech stands. Two-three cuttings in repeats are carried out every 10 years; since beech trees are not very common in the study area this method is rather rare.
- Selecting harvesting. Cutting of particular trees in a stand for the creation of tree stands with trees of different age. This type secures permanent cover and is used in tree stands that also have different protective functions (e.g. water protection).
- General harvesting applied in exploited forest (mainly coniferous, but also oak and broadleaved without beech forest). This is also the more widespread harvest type in the forests crossed by the transmission line. The permitted area is 5 ha and in particular cases – up to 3 ha. The width of the clearing must not exceed 50m. The neighbour area can be harvested only after 3 years. The cutting age for different species is:
    - Pine, spruce, fir – 80 years,
    - Oak, beech – 120 years,
    - Hornbeam, birch – 60 years,

The created clearings are subsequently re-planted using young plants that are grown in local nurseries of the SFEs. Forest plantations are separated in quadrates that are separated by small clearings that also function as service roads.

Figure 5.5 Forest clearings – service roads

According to the geobotanic subdivision of Ukraine, the area crossed by the Rivne NPP – Kyiv transmission line route belongs to the European broad-leafed forest area of the Central Europe and specifically to the Polissya Sub-province.

According to the zoogeographic zoning the territory is situated within Polissya zoogeographic district. The fauna is dominated by different complexes including forest, wetland, field and meadow. There are more than 60 species of mammal (from 100 species encountered in Ukraine), 276 species of birds (from 350) and more that 30 fish species. Natural conditions and resources were of great historic importance for local population settlement and life activity.

Flora

Boreal, Nemoral and meadow-steppe species predominate in the area. Polissya flora is very rich and diverse. There are nearly 100 species of medicinal herbs, 90 species of vitamin plants that are used as colouring materials. The presence of significant number of bee plants has advantaged the development of beekeeping.

The territory of Polissya is characterized by considerable (30-60%) and spotted amount of forests, mainly Pine and Oak-Pine forests. There is often a bogged area in places of relief degradation. At some places one can find oak and hornbeam-oak forests. Uplands are occupied by pine forests. Among forest trees one can find birch *(Betula alba)*, aspen *(Populus tremula)*, alder *(Alnus)* and maple *(Acer)*. Also there are small forests, separate groves and oak-groves in open country as well as field-protective belts along the roads. The

alder foxes that cut pine forest areas dominate the floodplains of small rivers and bogged places. In the grass stand, the predominating species are bilberry accompanied by common boreal species – adder-spit, red bilberry *(Vaccinium vitis-idaea)*, starflower *(Trientalis europaea)*, bifoliate bead-ruby *(Majanthemum bifolium)*, prickly-toothed fern *(Dryopteris carthusiana).* Some rare species are also present such as shield fern *(Dryopteris austriaca)*, common club-moss *(Lycopodium clavatum),* peal-headed sedge *(Caaex pilulifera)* as well as stiff clublike *(Lycopodium annotinum)* included in the Red Book of Ukraine.

Among the forests, one can observe psammophytic meadows with low grass stand. *Apera* is mostly predominated there. Straw flower (*Helichrysum bracteatum*) which creates big bare areas takes considerable part in grass stand. Characteristic species to these meadows are also *Rumex sp.*, *Nardus sp.*, chimney sweep *(Plantago lanceolata)*, and veronica *(Veronica officinalis)*. There are areas of desert meadows with predomination of mat grass *(Nardus)* and heather *(Calluna)*. Among the typical for Polissia dry types of meadows there are some rare Central European species such as *Teesdalia nudicaulis*, *Figalo sp.*, *Apera sp.* and *Corynephorus canescens*.

In peaty meadows, turfted hair grass *(Deschampsia caespitosa)* predominates in projective cover up to 80-90%. Floristic composition is typical for peaty meadows.

The majority of the bogs are of eutrophic character (grass bogs and grass-hypnum bogs). Among the floral forms the predominating species are tufted loosestrife *(Naumburgia thyrsiflora)*, sage willow *(Lythrum salicaria)*, marsh cinquefoil *(Comarum palustre)*, water plantain *(Alisma plantago-aquatica)*, bog willow *(Salix acutifolia)*, etc. There are also rare species like the northern pondweed *(Potamogeton alpinus)* and the lesser badderwort *(Utricularia minor)*.

Aquatic vegetation has typical river features. Rare species can be observed along river channels where the gray willow *(Salix cinerea)* and the white willow *(Salix alba)* dominate. Among aquatic vegetation groups there are rare ones with predomination of blunt-leaved pondweed *(Potamogeton obtusifolius)* and floating moss *(Salvinia natans)* as well. Water chestnut can be rarely found.

Fauna

The area crossed by the transmission line supports a number of bird species that are listed in the Red Data Book of Ukraine, such as Common Crane (*Grus grus*), Capercaillie (*Tetrao urogallus)*, and the Black Grouse. It is also important for a number of raptors, including rare species such as Short-toed Eagle, Spotted Eagle etc.

Within these exploited forests the mammal fauna includes species that are relatively accustomed to human presence. These species include wild boars (*Sus scrofa*), deers and roe-deers *(Capreolus capreolus)*, hedgehogs (*Erinaceus albiventris*), moles (*Talpa* sp), and shrews (*Crocidura* sp., *Sorex* sp.), badgers (*Meles meles)*, musk beavers *(Ondatra zibethicus)*. Beavers are also common and at places make their presence clear through their small dams and burrows.

Figure 5.6 Evidence of beaver activity in Teresyny

Wild boars and roe-deers are raised in an establishment in Sarny district. Wild boars are then released in the forest while roe-deers are sold. As a result of property development some animals of the forest complex (bear *(Ursus arctos)*, lynx *(Lynx lynx)*, wolf *(Canis lupus)*, otter *(Lutra)*, hazel grouse *(Tetrao bonasia)*, and black stork *(Ciconia nigra)* became rare species.

The main freshwater fish found in the area include limnophilous species such like pike *(Esocidae)*, chub *(Leuciscus cephalus)*, roach *(Rutilus rutilus)*, bleak *(Alburnus alburnus)*, crusian carp *(Carassius carassius)*, loach *(Misgurnus)*, eelpout *(Lota lota)*, and river perch *(Perca)*.

Perhaps the most interesting fauna species, in terms of international status, are observed in the river floodplains. In general the predominant species in these habitats are Eurasian water shrew *(Neomys)*, bank vole *(Arvicola)*, root vole *(Microtus oeconomus)*, musk beaver *(Ondatra zibethicus)*, beaver, otter *(Lufra lutra)*, European mink *(Mustela lutreola)*, foumart *(Mustela putorius)*. Also the bird species: black-necked grebe *(Podiceps caspicus)*, black kite *(Milvus migrans)*, erne *(Haliaeetus albicilla)*, fish-hawk *(Pandion haliaetus)*, duck hawk *(Circus aeruginosus)*, Levant Sparrowhawk *(Accipiter brevipes),* purple heron *(Ardeapurpurea)* and white heron *(Egretta alba)*, black-crowned night heron *(Nycticorax nycticorax),* bittern *(Botaurus stellaris)*, little bittern *(Ixobrychus minutus)*, gray goose *(Anser anser)*, rust fliest *(Psilidae)*, waterhen, pheasant *(Phasianidae)*, oyster catcher *(Haematopus ostralegus)*, black-tailed godwit *(Limosa limosa)*, Black-headed Gull *(Larus ridibundus)*, spotbill duck *(Anas poecilorhyncha),* Lesser Spotted Woodpecker *(Dendrocopos minor)*, yellow wagtail *(Motacillaflava)* and white wagtail *(Motacilla alba),* bluethroat *(Luscinia*

svecica), Great Reed Warbler *(Acrocephalus arundinaceus)* and Sedge Warbler *(Acrocephalus schoenobaenus),* Penduline Tit *(Remiz pendulinus),* bearded tit *(Panurus biarmicus)*, oriole *(Oriolidae)*, Reed Bunting *(Emberiza schoeniclus)*. Espcially the birds of prey may also visit neighbour areas of forest or agriculture land in search of food. The same applies to other migratory species.

Entomofauna is represented by typical for Polissya species that can be distinguished in different communities of forest, meadow, aquatic and semi aquatic insects and xerophytic stations.

A collection of threatened and protected fauna species observed in the wider project area is presented in Table 5.8.

Species	**Common name**	**Red Data Book**	**Bern Convention * *Appendix II***
BIRDS			
Egretta alba	White heron		+
Ciconia ciconia	White stork		+
Ciconia nigra	Black stork		+
Aguila clanga	Spotted eagle	Vulnerable	+
Circaetus gallicus	Short-toed Eagle		+
Circus aeruginosus	Western marsh-harrier		+
Falco tinnunculus	Kestrel		+
Falco vespertinus	Red-footed falcon	Near threatened	+
Haliaeetus albicilla	White tailed eagle		+
Milvus migrans	Black kite		+
Pandion haliaetus	Osprey		+
Tetrao urogallus	Capercaillie	+ (Ukraine)	
Tetrao tetrix	Black grouse	+ (Ukraine)	
Grus grus	Common crane		+
Crex crex	Corncrake	Near Threatened	+
Otis tarda	Great bustard	Vulnerable	+
Numenius arquata	Eurasian curlew	+ (Ulraine)	
Strix nebulosa	Great gray owl		+
Alcedo atthis	Kingfisher		+
Dendrocopos syriacus	Syrian woodpecker		+
Motacilla alba	white wagtail		+

Species	Common name	Red Data Book	Bern Convention * *Appendix II*
Motacilla flava	yellow wagtail		+
Parus cristatus	Crested tit		+
Parus major	great tit		+
Parus melanolophus	black-rested tit		+
Luscinia luscinia	thrush nightingale		+
Emberiza citrinella	Yellow hummer		+
Hirundo rustica	European swallow		+
REPTILES			
Emys orbicularis	European pond turtle	LR/nt	+
Lacerta agilis	sand lizard		+
Lacerta viridis			+
Coronella	smooth snake		+
Vipera ursinii	Orsini's viper		+
Rana arvalis	moor frog		+
Hyla arborea	Common tree frog	Near threatened	+
Bufo calamita	Natterjack toad	+ (Ukraine)	
Bufo viridis	Green toad		+
Bombina bombina	Red-bellied toad		+
Pelobates fuscus	Common spadefoot		+
Triturus cristatus	Crested newt		+
MAMMALS			
Sciurus vulgaris	Red squirrel	Near threatened	
Martes martes	Common marten	LR/cd	
Lutra lutra	Common otter	Near threatened	+
Vespertilio murinus	Parti-coloured bat		+

Table 5.8 Threatened and protected species observed in the wider area of the transmission line, the pine and broad-leaved forests of Polissya, and the agricultural lands (Bern Convention, Appendix II, Strictly protected fauna species)

It should be noted however that there are no exact data on location and/or population status of the above species. Additionally as a result of human presence and property development

many of these species are already withdrawn to the most inaccessible parts of the wider area.

Protected areas and reserves

The transmission line does not cross any Natural Reserves, National Parks or any other protected area of national status and importance. There are however, some conflicts with a number of reserves protected at the regional or district level. It should be noted that these regional reserves have no specific administrative staff or structure but are overseen by the local forestry services. Additionally these sites are not properly monitored.

Maps of the environmentally sensitive areas of national and local importance in the wider project area are provided in the Appendix (12.3 and 12.4). A summary of the regulations in effect in the reserves of local importance is provided in Table 5.9.

There are no Important Bird Areas (IBAs) which will be impacted by the project. Some however are located north of the proposed route, in Rivne and Zhitomyr administration regions and too far to be affected by the transmission line or the works during its construction. A possible implication may occur during migration but impacts are impossible to estimate in the absence of an organised monitoring programme and relevant data on population numbers, exact routes and stop-over stations.

Description of regional natural reserves

Sarny district

A large part of the district is covered by Polissya (marsh areas), while there are also areas of open water. As a result, a number of waterfowl species can be observed in the region, not only during migration but also with nesting populations. Among them there are herons such as *Egretta alba* and *Ardea cinerea* but also Black storks and Cranes. Based on the data of the forestry enterprise and also the details of the Ukrainian IBAs the line at the region is not expected to have any negative impacts on nesting populations and habits. Nevertheless, and given the fact that especially storks are seen to prefer electricity poles as nesting sites, NPC Ukrenergo will undertake appropriate action to minimise risk of electrocution for birds that may nest on the pylons.

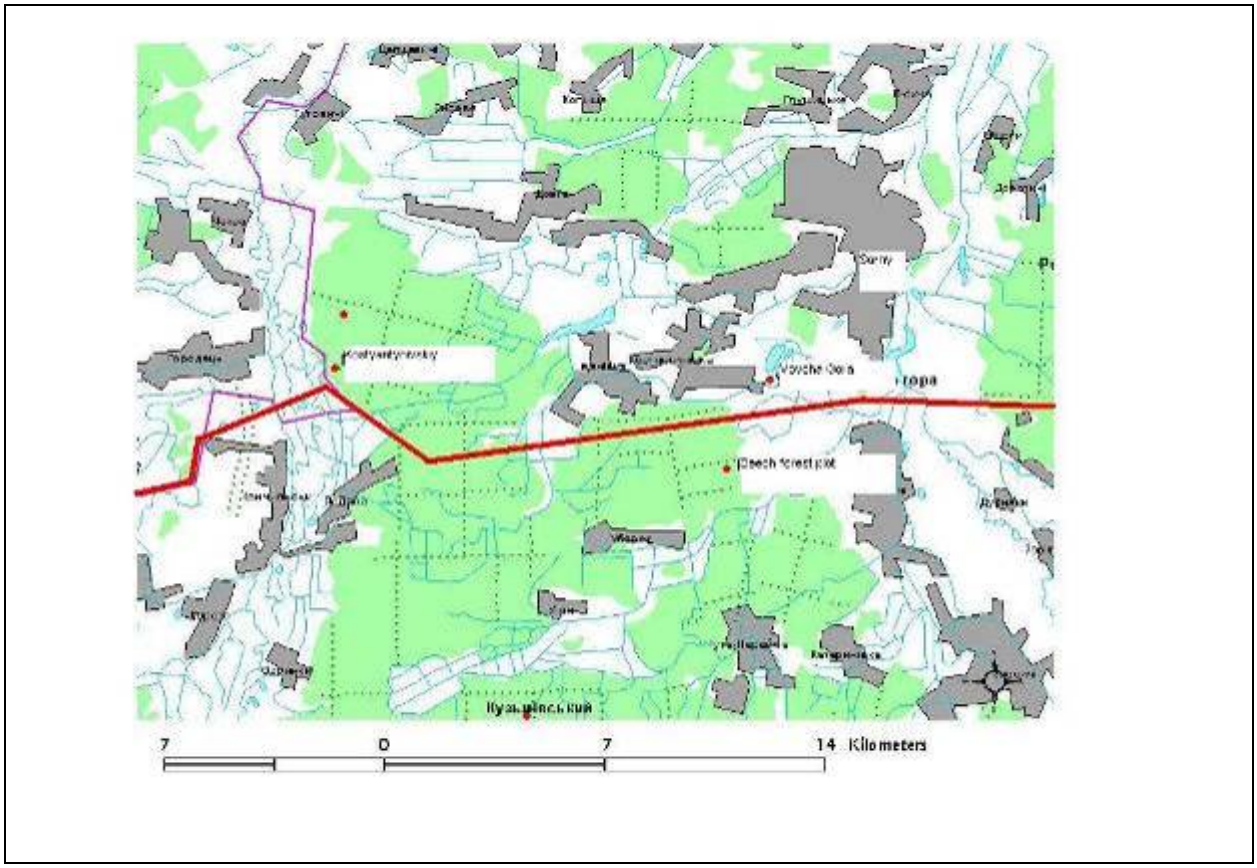


Figure 5.7 The transmission line section with adjacent natural reserves of local importance in Sarny district, Rivne region

1. Kostantinovskiy (Decision of regional executive committee No 343 of 22/11/1983) **-** Area: 0.8 ha.

It is an insular natural spruce (*Picea abies*) stand with trees that are more than 180 years old. The site also includes plants listed in the Red data Book of Ukraine (Club moss – *Lycopodium*). The protection status of the site is to conserve and allow for the reproduction of this high-yielding natural stand of spruce, extend the ecological knowledge and maintain the ecological balance in the region. Also to protect the natural territory, local flora and fauna.

The proposed route impacts the reserve, since the safety zone is adjacent to the reserve and actually 2-3 spruce trees may have to be cut.

The area surrounding the reserve and actually crossed by the transmission line, is a managed mixed forest with *Pinus silvestris*, *Betula pendula*, and *Alnus glutinosa*.

Figure 5.8 Spruce plot in Sarny district

2. Beech forest (Decision of regional executive committee No 98 of 18/6/1991) - Area: 3.5 ha. .

The site includes a stand of 12 beech trees that were planted around 70 years ago by a local Polish farm owner. It is situated 2 km from the way of the line and was not visited during the study as it was considered too remote to be affected by the project.

3. Vovcha gora (Decision of regional executive committee No343 of 22/11/1983) - Area: 64 ha,

The site is a lake that was created in the place of an old peat quarry site. There is no inflow of water and the lake was filled by the natural uprise of groundwater since the water table is very high. There are no seasonal changes in the size of the water-covered area. Covered by reeds and managed occasionally to maintain open water areas, it is a suitable habitat for wild waterfowl and also home to amphibians – the site is recorded as hosting the Red Data Book frog *Bufo calamita* and also *Hyla arborea*, included in the Bern Convention. During migration waterfowl are observed and occasionally counted but for no specific purpose. Observed species include herons, swans and also birds of prey. The reserve was established for the conservation of natural resources and the maintenance of the general ecological balance. The purpose of the natural boundary is also to preserve rare species of wild water fowl.

Near the lake, sand can be collected without any special permission up to 2m depth. Storage and use of toxic chemicals is forbidden in the area.

The proposed route is situated approximately 1km from the end of the water and in the edge of the open area that neighbours the lake. As such it is not expected to cause significant negative impacts to the site.

Figure 5.9 The lake in Vovcha gora

The site does not constitute a forest area and consequently it is not managed by the forest service. The KSGP 'Myr' that is mentioned as the authority responsible for the site's management has been inactive for almost 10 years and the land has been assigned to the local municipal council.

4. Pine forest plot - Area: 7.8 ha

It is a highly productive spermophytic stand of around 90 years old pine trees. The stand is used for the collection of pine seeds to serve as nursery for the forestry's nursery. According to the official description and decision, the aim of the reserve is the conservation of this pine forest plot in order to preserve the natural territory, flora and fauna; the organized observation of the natural and anthropogenic systems of the reserve by setting up stations for carrying out long-term geobotanical, hydrological, ground and other observations; the extension of ecological knowledge; and the maintenance of the general ecological balance in the region.

No construction, felling of trees or other intrusion is allowed (see Table 5.9). The reserve can be used, after permission of the State Department of Ecology and Natural Resources in the Rivne region, for scientific research, recreation and educational purposes and for scientific researches. Collection of berries and mushrooms and hunting may also be approved.

The proposed route of the transmission line is situated approximately 1km from this Pine Plot and as a result it is not expected to have any negative impact to the reserve. The forest surrounding the Pine Plot is mixed Pine forest managed for timber production. The clearing that will be created by the line and the safety zone will be similar to the ones created by the forestry activity.

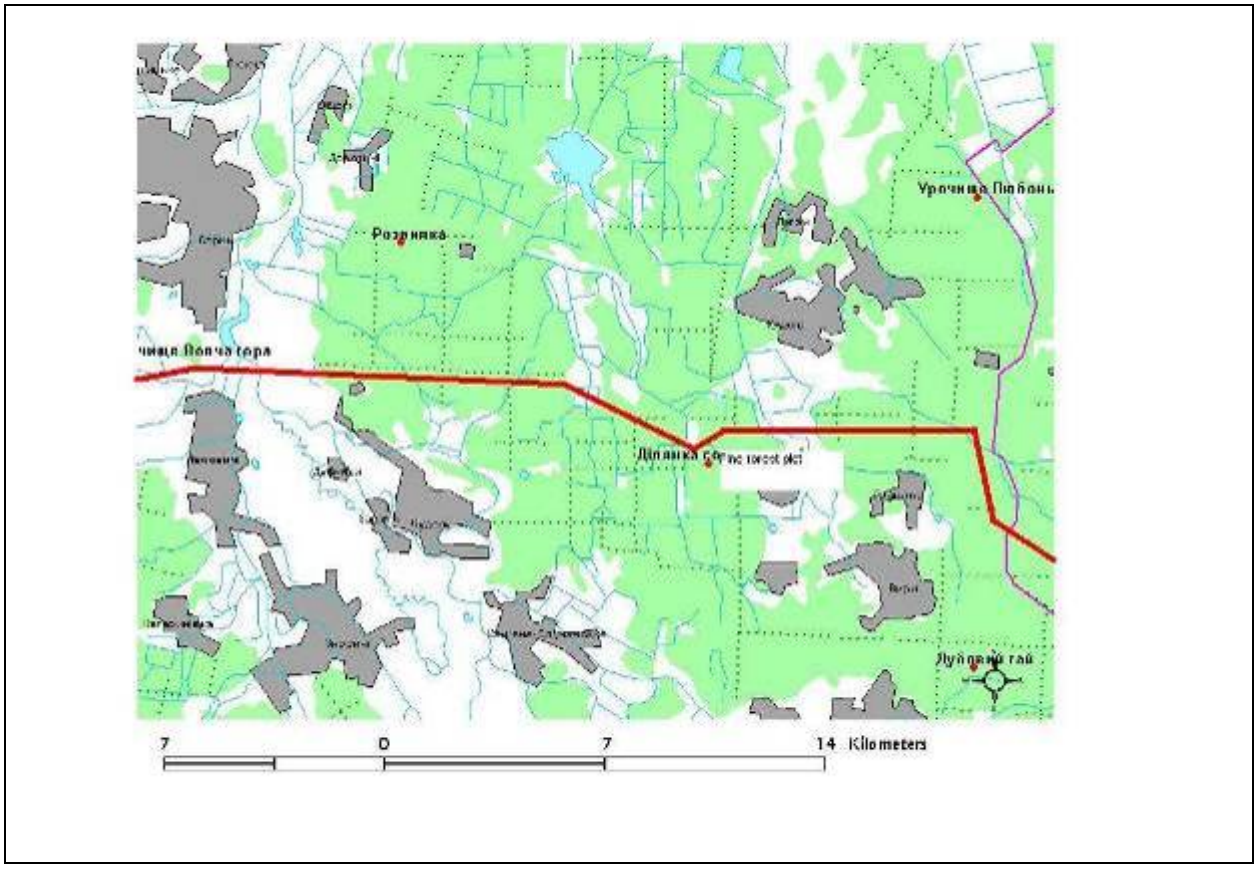


Figure 5.10 The transmission line section with adjacent natural reserves of local importance in Sarny district in Rivne region

Rokytnisk district

Fauna in the forest includes the Otter, *Capra* sp., *Sus scrofa* and deer. The area is also along the migration route of storks and grey geese towards Belarus. According to information provided by the Rokytnivskiy state forestry there are some nests of 2-3 families of Black Storks but these are not found anywhere near the line route.

5. Dibrova (Decision of regional executive committee no 343 22/11/1983) **-** Area: 16 ha.. Local name: **Pechka brod**

The reserve is a highly productive mixed forest of *Pinus silvestris*, *Quercus robur, Betula pendula*. In its largest percent is planted and not of seed origin. There are mature and old trees (120-years old oaks and approximately 80-year old pines) that are nevertheless generally harvested for timber production based on tree-age and species. Fallen trees and dead wood that could be used as possible refugees by small mammals or even invertebrates

are also removed. The reserve was declared as a suitable habitat of local importance for beavers based on the presence of a small river. Nevertheless the beaver population has significantly decreased during the last twenty years probably because of natural population movements. However there are no specific data on beaver population dynamics.

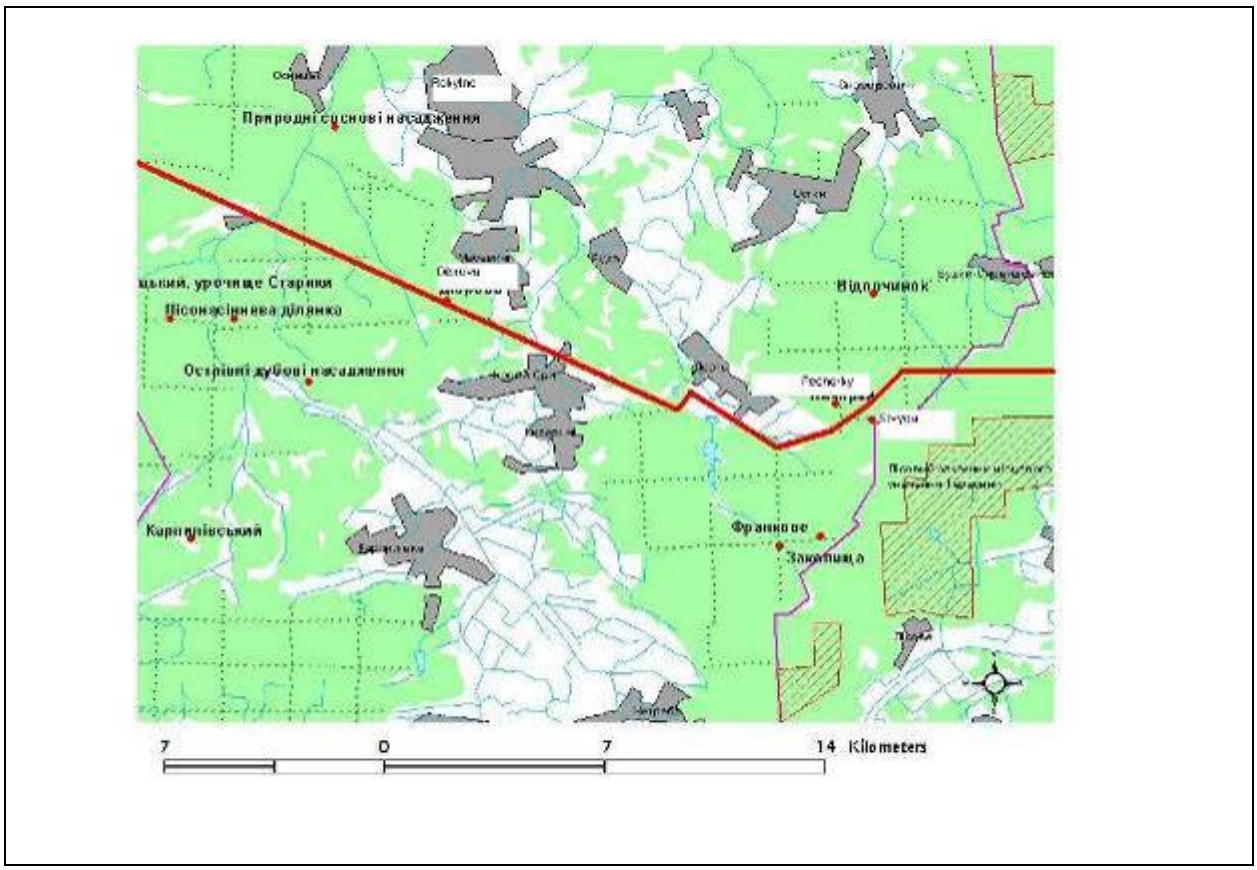


Figure 5.11 The transmission line section with adjacent nature reserves of local importance in Rokytne district, Rivne region

The proposed route cuts through the reserve. Based on the estimation of the local Forestry Enterprise, this is not considered a problem since the forest (even inside the reserve) is already exploited. Additionally since the project does not include any hydraulic works or works that may have any impact on water quality, it is not possible that will cause problems in any possible rehabilitation of the site by beavers. Other species such as *Lutra lutra* occasionally cross the area but they do so only occasionally and do not have established populations in the area.

Figure 5.12 View of the forest and small river in Dibrova

6. Stvyga (Decision of regional council no 33 of 28/02/1995) **-** Area: 3.1 ha.

The description in the decision for the protection of the site refers to an oak forest plot. However apparently this is no longer the case. The area now hosts a mixed forest with pine trees (*Pinus silvestris*), birch trees (*Betula pendula*), alders (*Alnus glutinosa*), hornbeams (*Caprinus betulus*), and oaks (*Quercus robur*). Some oak trees are still present but their stands are more and denser outside the reserve. Additionally the forest grows in a marsh that becomes virtually impenetrable without special vehicles. Finally there is also the safety zone of the natural gas pipeline. As a result of all of the above (protection status, marsh conditions, restrictions due to the gas pipeline) the area is not managed by the forestry service and presents a quite natural appearance with a dense understorey of hornbeam and aspens.

Near Stvyga the proposed route follows the path of an old and neglected road that is no longer discernible. It then goes more or less parallel to the highway, following the existing forest clearings that mark the forest quadrates. The route will not affect the Stvyga reserve but will cause the cutting down of oak trees that are nevertheless managed for timber production.

Near the highway there is a recreational area that will be encircled by the line. There will be probably an aesthetic impact from the part of the line that goes towards northeast. The other parts of the line will not be visible or affect the recreational area as there is a swamp area in between.

Figure 5.13 Recreation area in Stvyga

7. Pechorky (Decision of regional council no 33 of 28/02/1995) **-** Area: 7.2 ha.

According to the official description is a highly productive age-old oak stand in Polissya. The area was not visited as, according to the forest service guards, it is located far from the line and will not be affected.

Olevsk district

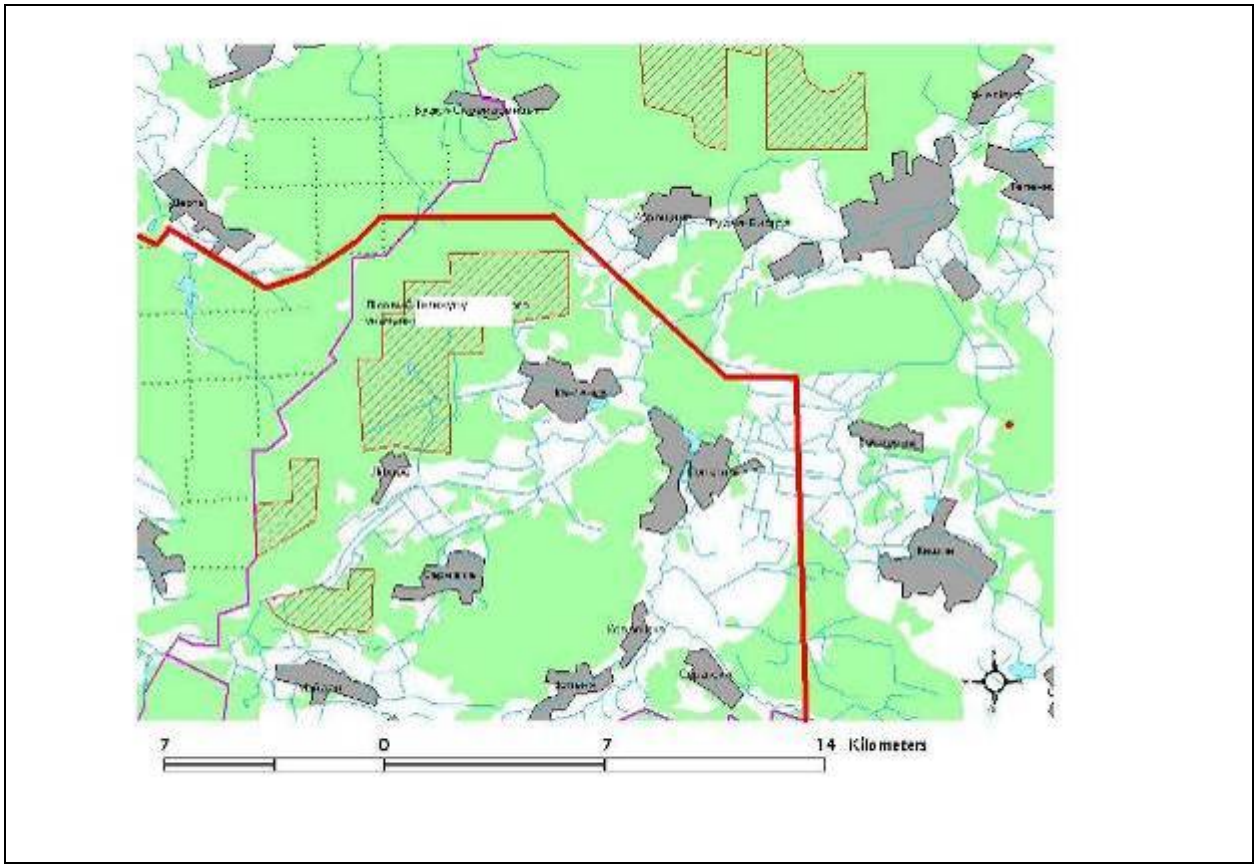


Figure 5.14 The transmission line section with adjacent nature reserves of local importance in Olevsk district, Zhytomyr region

8. Teresyny (Decision of the 14th session of 23 calling of the Regional Council of 4/7/2000) - Area: 2184 ha.

The site is a mosaic of dry forest complexes that alternate with considerable forest marsh areas. Tree species include *Pinus silvestris, Betula pendula, Quercus robur and Q. borealis, Salix alba, Caprinus betulus*. Additionally plants included in the Red Data Book of Ukraine such as *Lycopodiella inundata* (L.) Holub, *Juncus effusus*, *Oxycoccus microcarpus*, *Drosera intermedia* Hayne. Among the animals listed in the Red Book of Ukraine in the reserve have been observed the bird species *Grus grus (*grey crane), *Ciconia nigra* (Black Stork), *Tetrao urogallus* (Capecaile), *Numenius arquata* (Eurasian curlew). There is also a large population of *Tetrao tetrix* (black cock). Finally the site has a booming population of beavers. The purpose of the reserve is to protect and preserve the variety of upland forest complexes alternating with considerable swampy forest lands.

Entry of vehicles is prohibited with the exception of the vehicles of the Olevsk forestry, the State Environmental and Inspection Services, and fire trucks.

Figure 5.15 Forest marsh area in Teresyny

9 – 10. Teljachiiy mokh 1 & 2 – Area: 553 ha and 915 ha respectively

Teljachiiy mokh-1 is a site of hydrological importance, an upland marsh and the headstream of many small rivers and streams that feed into the Ubort river. There are heavy beds of willow, sedge and grass forbs, habitat of black cock and wood grouse. The purpose of Teljachiiy mokh-1 reserve is the conservation of this upland marsh as a regulator of the river Ubort, a growth area of *Rhododendron luteum* and *Azalea pontica* – remnant species of the tertiary period. The adjacent Teljachiiy mokh-2 is a lowland sphagnum moss marsh with willow and grass aggregations which also serves as a regulator of the water regime of small rivers within the basin of river Ubort. The site is a suitable waterfowl habitat, and a nesting site for the Black cock, a species listed in the Red Data Book of Ukraine. Additionally there are more than 10 species of fish, amphibians and reptiles. The reserve was established for the conservation and the protection of the lowland sphagnum moss marsh.

The Yemylchene forestry can utilise the land of the reserve. Research and practical training of students is also allowed provided that no damage will be caused to the complexes under protection, and only after approval of the Regional Inspection of Forest Management and Harvesting. The State Forestry bears responsibility for the proper maintenance and observance of the established regime in the Reserve.

Clear felling, selective sanitation cutting, cleaning cutting, forest litter removal, and collection of medicinal herbs and commercial raw materials are also allowed by special permission of the State Department of Ecology and Natural Resources in the Zhytomyr region.

The line is designed to pass more than 2km from the reserve and as a result it is not expected to have any direct impacts on the protected area.

Yemylchynsk district

The forests of the Yemylchene State Forestry are managed and harvested according to the standards of the Forest Stewardship Council (FCS).

11. Juzykhovka - Area: 439 ha.

The Juzykhovka reserve is a mixed forest of birch, pine and oak trees. The oaks (trees are 140-years old) are of special importance, forming stands of seed origin. The average height of the oak-trees in the stand is 28 m, and the average diameter 48 cm. The shrub layer consists of buckthorn, birch-trees, maples, hazels. Ground cover consists of thickets of May lilies *(Covallaria majalis)*, bilberries *(Vaccinium myrtillus)*, strawberries *(Fragaria vesca)*, fine medicinal plants, and forbs. The reserve is considered a standard stand of Pravoberezhne (Right Bank Dniper) Polissya. The reserve was established especially for the protection and conservation of these high-value oak stands.

The transmission line is designed to pass approximately 1km away from the reserve, and as such will not have any impact. The area affected by the transmission line consists of mixed forests that are managed for timber production. At the time of visit the Juzykhovka reserve was inaccessible.

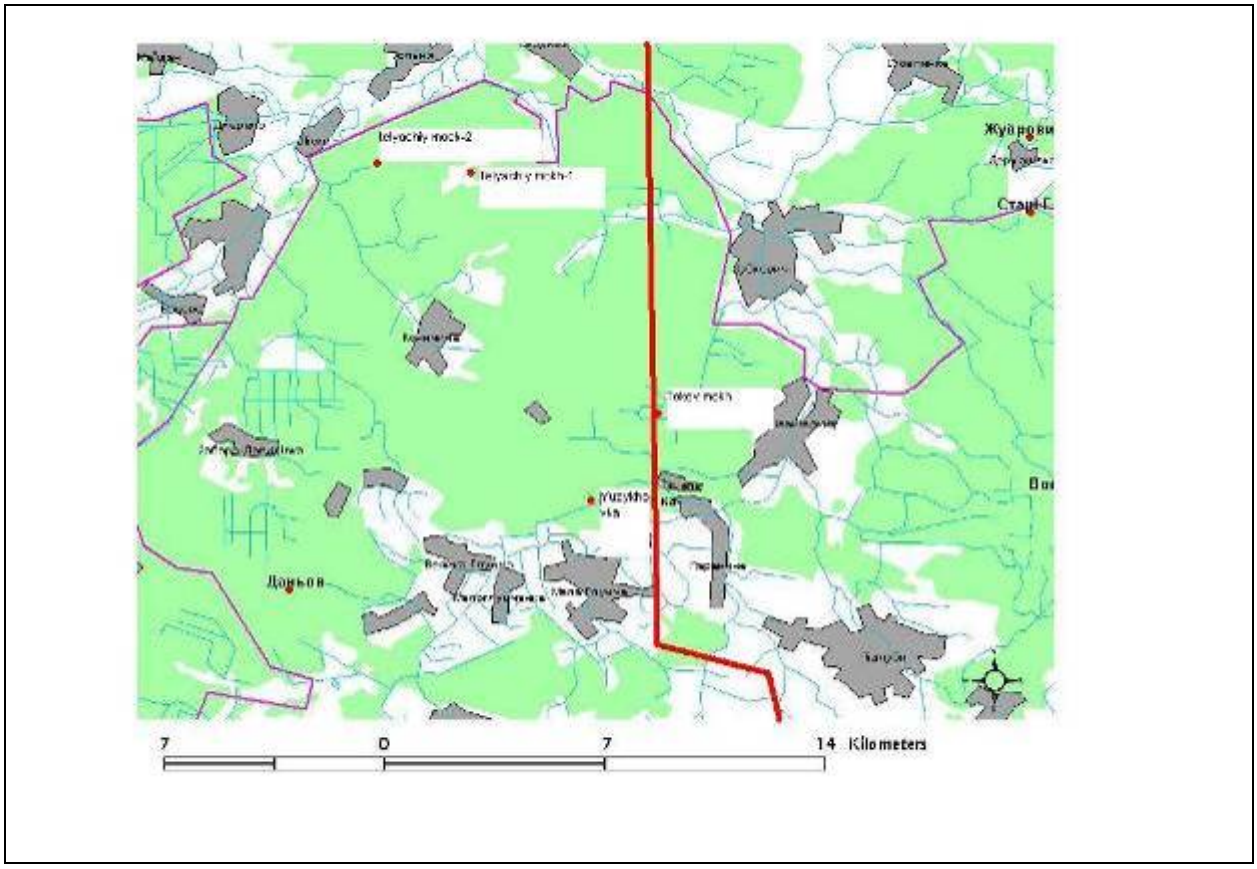


Figure 5.16 The transmission line section with adjacent nature reserves of local importance in Yemylchynsk district, Zhytomyr region

12. Tokov mokh - Area: 454 ha.

Tokov mokh is a lowland sphagnum marsh with willow and grass aggregations. The marsh is a suitable habitat of beavers and musk beavers *(Ondatra zibethicus).* It is also a lekking ground of the species *Tetrao tetrix* and *Tetrao urogallus*, both included in the Red Data Book of Ukraine. The site is also a waterfowl habitat. There are nearly 15 species of amphibians and reptiles. There is a bilberry, cranberry and fine medicinal plants thicket. The purpose of the reserve was the conservation and protection of this marsh site, its fauna and flora. Tokov mokh reserve is adjacent to Juzykhovka reserve.

The line will be approximately 1.75km away from the reserve and as such it is not considered that will have any impact on it. The proposed route crosses mixed coniferous forests, managed for timber production.

In Juzykhovka and Tokov mokh, clear felling, selective sanitation cutting, cleaning cutting, forest litter removal, and collection of medicinal herbs and commercial raw materials are permitted provided the former issuing of special permission of the State Department of Ecology and Natural Resources in the Zhytomyr region.

Entry of vehicles is prohibited with the exception of the vehicles of the Yemylchene forestry, the State Environmental and Inspection Services, and fire trucks. A summary of the restrictions on access and permitted activities within these reserves are summarised in Table 5.9.

Forbidden activites / Reserves	Teljachiiy mokh-1	Teljachiiy mokh-2	Juzykhovka	Teresyny	Tokov mokh	Vovcha gora	Konstantinovskiy	Pine forest plot
Construction of any structures, roads etc that can affect the character of the site and can damage natural objects.	+	+	+	+	+		+	+
Any other economic activities that may result in the disruption of natural associations and of natural processes, loss of scientific and aesthetical value of the natural complex under protection.		+	+	+	+			
Final felling and accretion cutting.	+	+	+	+	+		+	+
Use as pastures of livestock. The crossing of livestock through the reserve is also forbidden.	+	+	+	+	+		+	+
Use of chemical agents (e.g. pesticides, insecticides, mineral fertilisers).	+	+	+	+	+		+	+
Storage of all types of toxic chemicals		+	+	+	+		+	+
Use of toxic chemicals (Vovcha gora) and pollution of water (telijachiy mokh-1)	+					+		
Collecting of rare kinds of plants listed in the Red book of Ukraine, their flowers and seeds; medicinal plants; etc	+	+	+	+	+		+	+
Hay making					+		+	+
Economic activities that may result in the loss of scientific and environment-friendly value of the protection objective.	+							
Any disturbances of natural condition of reservoirs; straightening of the water course and deep dredging, excavation of soil, changing of the structure and configuration of the reservoir boundary line		+						
Melioration and any other works that can result in changing of the hydrological behavior of the reserve territory.	+	+	+	+	+	+	+	+

Forbidden activites / Reserves	Teljachiiy mokh-1	Teljachiiy mokh-2	Juzykhovka	Teresyny	Tokov mokh	Vovcha gora	Konstantinovskiy	Pine forest plot
Prospecting, explosive works, any mining or any disturbance of the top soil and hydrological regime.		+	+	+	+	+	+	+
Hunting	+				+	+		
Transfer of separate plots of a reserve for economic use.		+	+	+	+	+	+	+
Ploughing.		+	+	+	+		+	+
Any littering, contamination of the territory of the reserve and its water objects, upset of their hydrochemical condition.		+	+	+	+			
Sapping and tapping of trees and utilization of secondary wood-base material		+	+	+	+		+	+
Introduction of new species of plants and animals without due approvals and justification of scientific institutions.		+	+	+	+		+	+
Destruction of and damage to separate trees; bushes; aquatic and grassland vegetation		+	+	+	+		+	+
Destruction and substantial change in the species composition of the vegetation cover (underwood, undergrowth, foresting and transformation of forest plots into meadows).		+	+	+	+			+
Entry of any type of mechanically-driven transport.		+	+	+	+		+	+
Organization of camping-grounds, resting places (picnic areas), parking places, making any fires.	+	+	+	+	+	+	+	+
Disturbance, destruction and capture of any kind of animals living in the reserve, damage of nests, burrows, other coverts and places of habitation, collection of eggs, down..					+		+	+
Any activity that can lead to deterioration of the food potential for animals and their living environment..					+			

Table 5.9 Summary of regulations in the reserves of local importance

5.3 Socio-economic

The transmission line crosses territories of 3 raions of Rivne oblast (Volodymyretsky, Rokytniansky, Sarnensky), 7 raions of Zhytomyr oblast (Olevsky, Emilchynsky, Volodarsk-Volynsky, Cherniakhivsky, Korostyshivsky, Radomyshlsky, Chervonoarmiyskiy) and one raion of Kyiv oblast (Makarivsky). All these raions lay mainly on agricultural and forest lands. Soil fertility in this area is usually much lower than in other regions of Ukraine.

5.3.1 Land use

The land use pattern in Ukraine has changed dramatically over the past 15 years and this process is ongoing. Categories of land are defined according to the type of use: agricultural lands, lands for housing, nature protection land, recreation lands, land used by industry etc. Land plots of each category, which are not transferred to citizens or legal persons for ownership or use, could be held in state reserve (Land Code, art. 19). The rules of establishing and changing land use types are stipulated by the Cabinet of Ministers of Ukraine (Land Code, art.20).

There is no detailed information on land ownership and land use in the right of way (RoW) of the transmission line. Such information will be gathered during preparation of the working design documents when the construction contract has been tendered. The information will compare the land use in the areas crossed by the transmission line with the corresponding average figures at raion level, to demonstrate that the proportion of high value land is less in the RoW than in the raion as a whole.

5.3.2 Socio-Economic Situation in the Affected Districts

The population of the different raions crossed by the transmission line varies from 40,000 - 100,000. Urban population comprises from about 25% (Emilchynsky, Makarivsky raions) to 60% (Korostyshivsky raion). The proportion of pensioners is very high: e.g. 40% in Emilchynsky raion, 30% in Volodymyretsky raion.

Some of the territories crossed by the transmission line are located in the areas that are legally designated as "Territories that suffered as a result of the Chernobyl Catastrophe", and due to this some tax regulations (like land tax) and social support programs are different in different raions.

The main economic activities in the region of the transmission line are agriculture (crops and cattle), forestry, quarrying stone, mining (clay, titanium ore).

In Soviet era, the majority of people in rural areas worked in collective or state farms (*kolhozy* and *sovkhozy*). After the collapse of the Soviet system, most of these enterprises either collapsed or were privatised (sometimes by the management of *kolhozy* and *sovkhozy*). The land and other assets of these enterprises were shared among workers and pensioners. This process is not yet fully completed (see also section 4.7). Demarcation of land plots and delivery of land ownership certificates to owners was accelerated by the Law of Ukraine "On Rules of Demarcation of Land Plots" N 899-IV of 5 June 2003.

The situation in different villages can vary a lot depending on various factors: proximity to cities/industrial enterprises which can provide side earnings, distance to major transport lines, efficiency of new agribusinesses which rent land plots from individual land owners etc. In many cases people depend on their vegetable gardens, milk cows, pigs and poultry they produce for their own consumption.

There are significant differences between Rivne and Zhytomyr oblasts on the one hand and Makariv raion of Kyiv oblast, which is located close to Kyiv city (raion centre, Makariv is 58 km from Kyiv). Due to this, the value of land in Makariv raion is much higher than in Rivne or Zhytomyr oblast. Moreover, thousands of people from Chernobyl-affected raions of Kyiv oblast were resettled in Makariv raion during 1986 - 1995. Makariv raion was a testing ground for new land legislation and practices. Representatives of the Raion Administration and the Raion Land Use Authority insisted that all land plots in Makariv raion already have owners and some of them changed hands several times before the moratorium on trade in agricultural land and change of use of agricultural land was introduced in December 2006. It was also mentioned that some agricultural lands were converted into lands for housing, but it was not clear whether such changes were legitimate.

5.4 Cultural environment

5.4.1 Archaeology / Cultural heritage

During the preparation of the OVNS in the framework of the technical design, the proposed transmission line route was submitted and approved by Regional Administrations (Inspections) of the cultural heritage protection. These approvals were associated with the following conditions:

1. Changing the route – near Torchin village, Korostishivsky district, Zhytomir region in the course of the preliminary examination, archeological artifacts were discovered providing evidence for the occurrence of archeological objects.

   The objects were conventionally called Kamiany Brid – XXIV and Torchin – II. In order to protect them against annihilation or damage a temporary 50m protection zone was established around the objects[6].

   Kamiany Brid – XXIV (the smaller object). Located about 1,5 km to the north east of the eastern outskirts of Kamiany Brid village and 1 km to the southern slope of the village cemetery, which is in the south eastern part of Torchin village, Korostishivsky district.

   The archeological artifacts are collected on the surface in the form of fragments of wheel dishes of XII – XIII century Kyiv Russ, pieces of damask steel and slag. The total area of the archaeological site together with the protection zone is about 4 ha.

[6] No construction or earth works must be carried out within the limits of an archeological object and its protection zone without archeological supervision

Torchin — II (the larger object). Located in 750-800 m to the southeast of the village cemetery, which is in the south eastern part of Torchin village, Korostishivsky district.

The archeological artifacts are collected on the surface in the form of flint flake, pieces of thick-walled moulded dishes, which can be approximately dated back to the period of the Bronze-early Iron Age, as well as fragments of wheel dishes of XII – XIII century Kyiv Rus. The total area of the site together with the protection zone is about 8,3 ha).

The original ransmision line route was crossing the archaeological sites (dash line in). A deviation was designed to avoid the impact to the sites or their protection zoves.

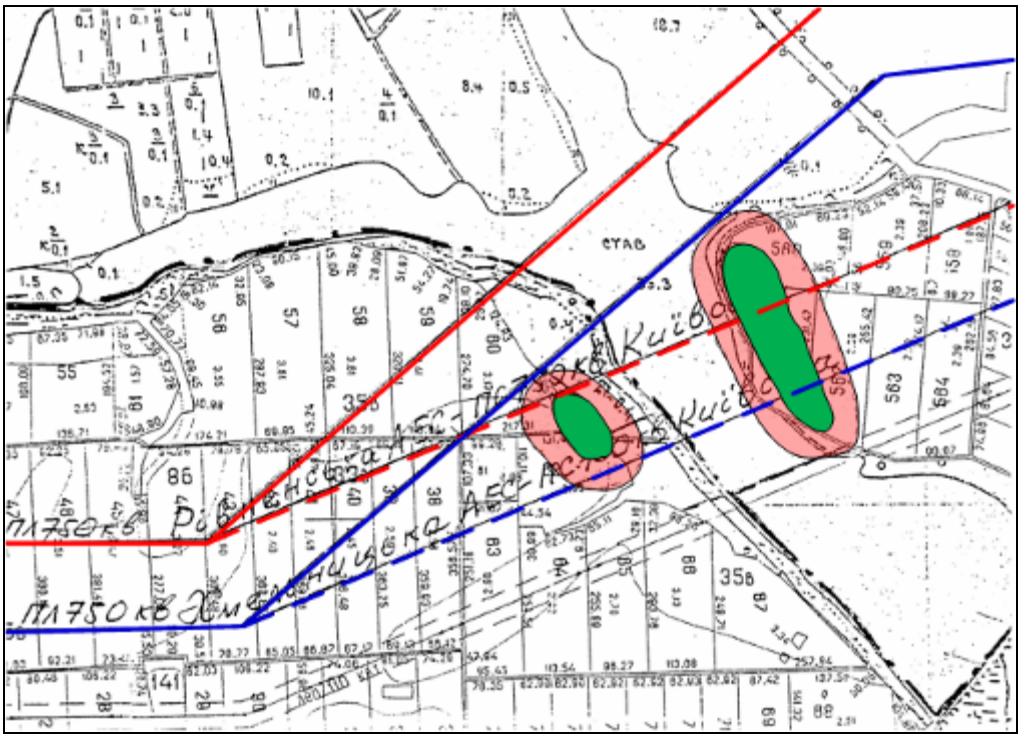


Figure 5.17 Route change due to archaeological findings

2. The necessity of additional archeological surveys in three districts of Zhytomir region

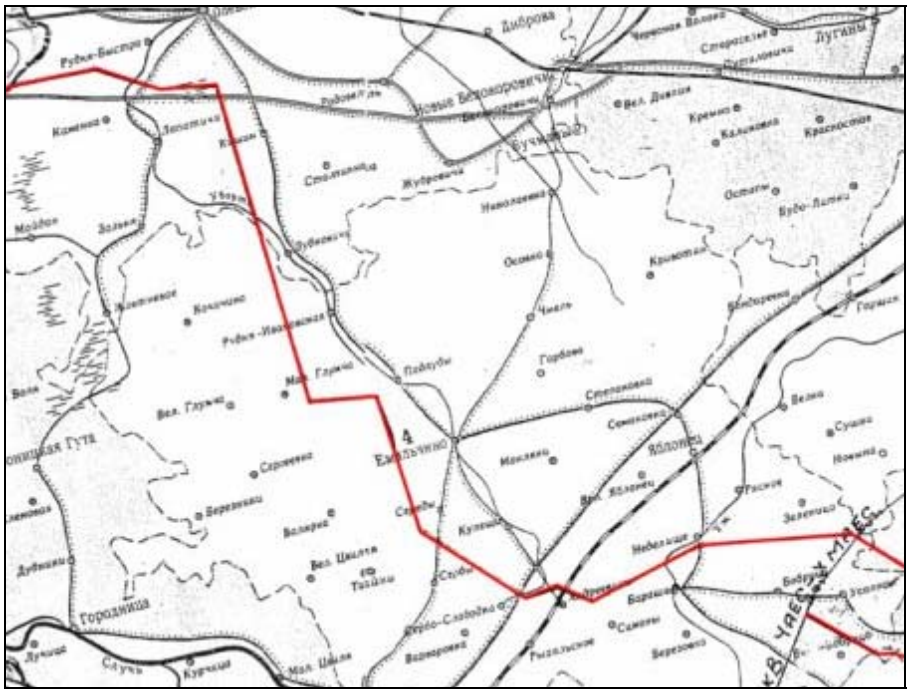


Figure 5.18 The route in Zhytomir region where additional archaeological surveys were necessary

According to these surveys the following limitations concerning designing activity shall be introduced (according to the Law of Ukraine ”On protection of cultural heritage”):

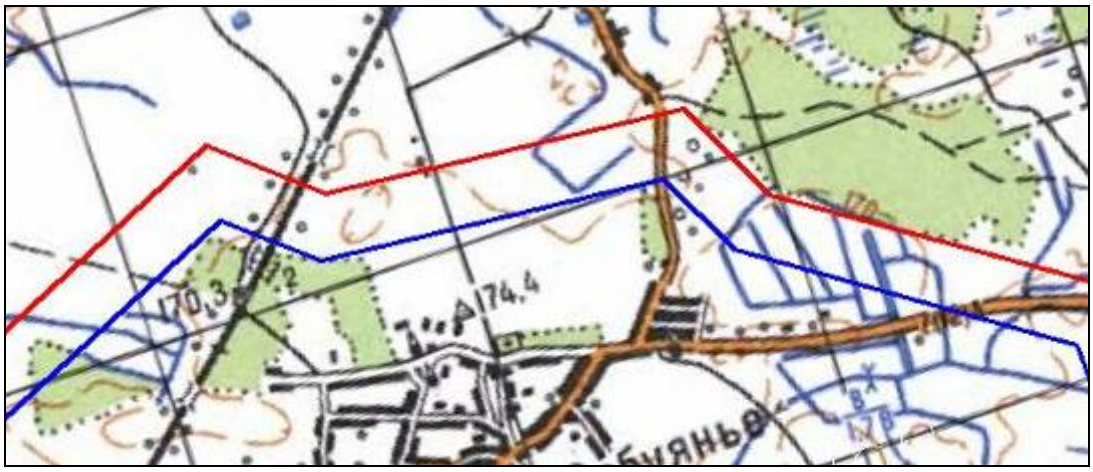
- Preservation of archeological objects of especial historical and cultural value (more than 2 m diameter tumuli, burial grounds, ancient settlements etc. are normally referred to them) is a potential necessity of inconsiderable change of the route as in the case described above.
- Avoidance, if possible, of the transmission line route passing though the objects of archeological value, if it is impossible to avoid that – complete archeological survey of the archeological object at the expense of the project owner.
- To conduct constant archaeological observation of the designing and construction activities, related communication and technological constructions.
- In period of construction, archaeological findings that are found to be in the place of construction must be archaeologically studied according to the Ukrainian legislation on Protection of Cultural Heritage. Defining the scope of such surveys should take place on the designing stage, and costs of the archeological studies must be put into the estimate cost of the works

5.4.2 Aesthetics / visual impacts

The area crossed by the transmission line route is a relatively flat terrain partially covered by mixed forests. Elevation ranges from 150 to 250 m. As such, it provides very little opportunity for using the natural landscape to limit the visibility of the tower structures. Nevertheless, the project design followed a number of principles with the aim to reduce visual impacts:

- The route was designed with the maximum approximation to a straight line, which considerably reduces the number of necessary angle-tension towers.
- According to the requirements of Sanitary Standards and Rules, the transmission line was designed to avoid approaching inhabited areas closer than 250m.
- The transmission line route runs in parallel to other energy or transport infrastructure, i.e. in those areas where the aesthetical value has already been reduced by the existing objects.

- In compliance with the Forestry Code of Ukraine the transmission line route was designed to avoid crossing forest lands where possible. In places where the line passes close to forest plots, the dark background will conceal the view of metal structures of the towers.



- Where the line route has to cross forest land (mostly through existing clearings), the visibility of the structures is greatly reduced.

It can be seen that the applied design principles comply to the extent possible with the **Holford rules**, which represent best practice in the design of transmission lines internationally:

1. Avoid altogether , if possible, the major areas of highest amenity value, by so planning the general route for the line in the first place, even if the total mileage is somewhat increased in consequence.

2. Avoid smaller areas of high amenity value of scientific interest, by deviation; provided that his can be done without using too many angle towers (i.e. the more massive structures which are used when lines change direction

3. Other things being equal, choose the most direct line, with no sharp changes of direction thus fewer angle towers.

4. Choose tree and hill backgrounds in preference to sky backgrounds wherever possible and when the line has to cross a ridge, secure this opaque background as long as possible and cross obliquely when a dip in the ridge provides an opportunity. Where it does not cross directly, preferably between belts of trees.

5. Prefer moderately open valleys with woods, where the apparent height of the towers will be reduced and views of the line will be broken by trees.

6. In country which is flat and sparsely planted, keep the higher voltage lines as far as possible independent of the smaller lines, converging routes, distribution lines and other masts, wires and cables so as to avoid a concatenation or “wirescape”.

7. Approach urban areas through industrial zones where they exist and where pleasant residential and recreational land intervenes between the approach line and substation, go carefully into the costs of under grounding, for lines other than those of the highest voltage.

5.4.3 Public amenity / Tourism

The area crossed by the transmission line route does not host any major tourism destination of national importance. Nevertheless, there are some areas close to the line route that are used by local people as recreation areas. These include:

- A picnic area and car stopover near Vovcha gora reserve, at the bank of the artificial lake (see 5.2.7). The line will cross at a distance of about 1 km to the north and will be visible from the picnic area

- A recreation area in Stvyga

Figure 5.19 Picnic area near Vovcha gora

Figure 5.20 Recreation area in Stvyga

6. Project description

This section of the ESIA describes the proposed activities throughout the lifecycle of the project.

6.1 Physical description

The transmission line consists of a large number of towers along the route that support the wires that carry the electricity. A high voltage wire diameter is used to maximise the carrying capacity. The towers are spaced at 400 or 500 metre intervals, depending on the landscape characteristics. Insulators are used to isolate the towers from the live wires that carry the electricity.

There are 5 wires is in each of three phase (ie there are three bunches of wires with five wires in each bunch). The storm-protecting (grounding) wire is connected to an isolator – so if there is a lightning strike, it will go through the closest isolator to the ground.

The specific details relevant to the materials selected and the design approach is the responsibility of the construction contractor, however a typical configuration would comprise the following:

There are two types of towers:

- Self-supporting towers ПС 750-3 are used as intermediate support towers. The tower height to the cross-arm is 35 m. To make the towers higher base units of two types (5 and 10m) are used.
- Angle-tension (anchor) towers of УС 750-1 type are the self-supporting tower-shaped rising mains. Angle-tension tower height to the cables is 20m, with the help of base units it can be increased up to 35 m.

Typical configurations for the above types of towers are presented in Figure 6.1 and Figure 6.2. Other technical characteristics comprise the following:

- The distance of the cables to the land ranges from 24,5 m (at the tower) to 12,5 m (midway between towers). At crossing points with motor and railways the distance is 16 m.
- The foundations of the towers are pilled. In high water beds on peaty sites piles with solid-cast reinforced concrete raft are installed.
- Graved bed is used in foundations in aqueous soils.
- Lightning protection of the project lines is made by means of two cables.
- Insulators are attached to the towers where the conductors will be connected. They are typically made of glass, ceramic or some form of composite materials.

- Line conductors are mounted to the towers. The conductors are made of aluminium core steel reinforced and they come in large drums. Each tower will have 3 circuits (of 5 conductors each) plus two earthling wires.

Construction details would include:

A. Conductors

Item	Units	Main Conductor	Earth Conductor
Conductor type		ACSR (AC400/51)	ACSR (AC70/72)
No. of conductors		5 per phase	2 per tower
Conductor diameter	mm	27.5	15.4
Cross sectional area	mm^2	445.1	140.6
Cross section of aluminium part	mm^2	394	68.4
Cross section of steel part	mm^2	51.1	72.2
Conductor weight	Kg	1490	755

B. Towers

Indices	Tower code		
	ПС750-3	**УС 750-1**	**УС750-1+5**
Design data on OL			
Icing degree of the region	III	III	III
Wire grade	5AC 400/51	5AC 400/51	5AC 400/51
Wind stress, N/m^2	55	55	55
Wire rope grade	2AC 70/72	2AC 70/72	2AC 70/72
Allowable stress in a wire, N/m^2	12.2	12.2	12.2
Maximum stress in a wire rope , N/m^2	27.2	27.2	27.2
Route turning angle, degrees	–	0-60	0-60
Material consumption for a tower, tn			
C245 grade steel	4.483	8.6	9.48
C345 grade steel	14.903	19.56	30.9
General metal products	1.08	1.58	2.03
Total	20.466	29.74	42.41

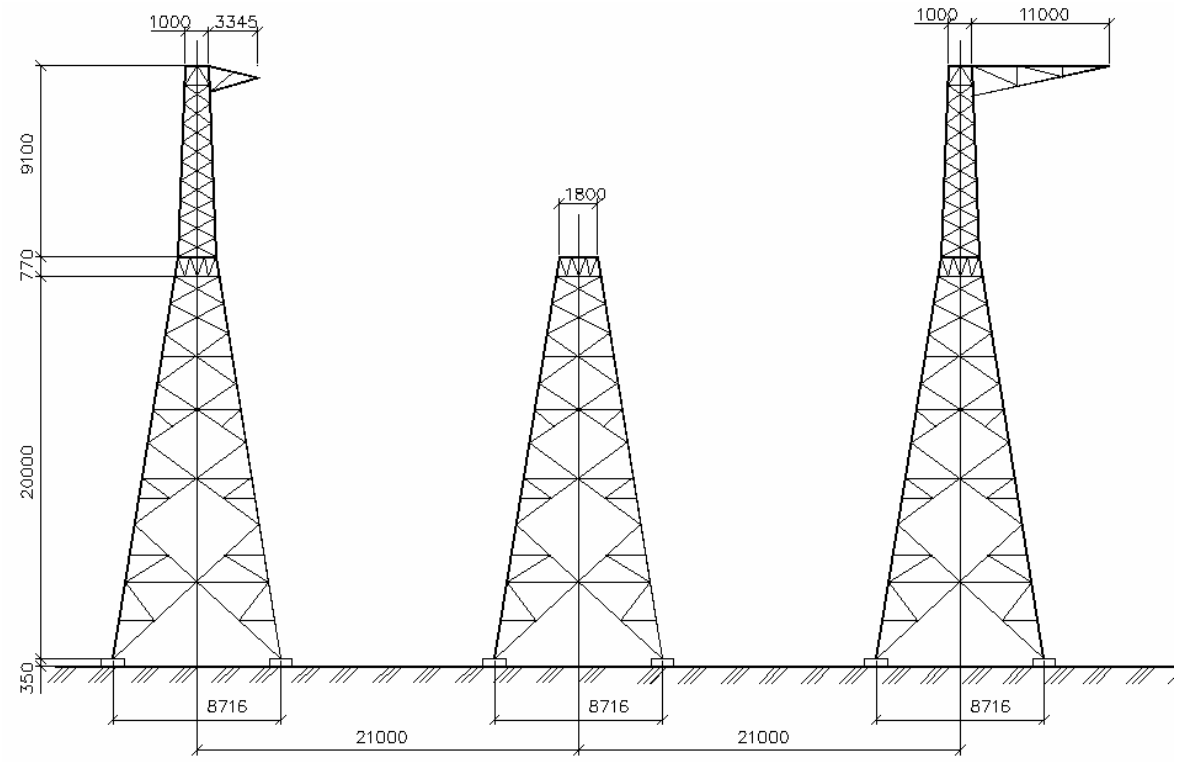


Figure 6.1 Typical 750 kV angle-tension tower УС750-1

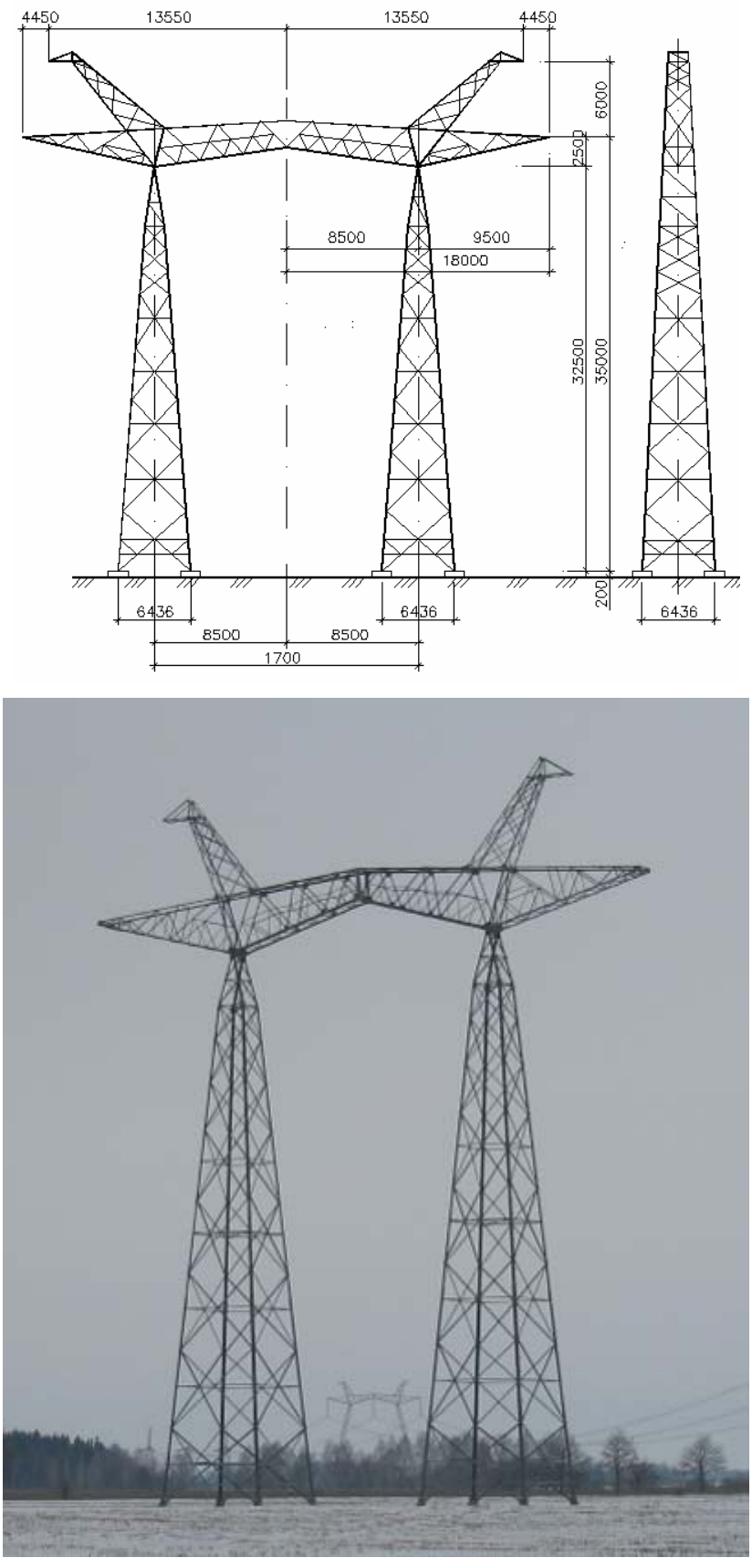


Figure 6.2 Typical 750 kV suspension tower ПС750-3

C. Foundations

There shall be two basic types of reinforced concrete foundations used:

1. Pad and chimney – the bearing capacity is up to 24 tons. They are typically used for installation on dry firm ground. The size (type) of the foundation is selected depending on geologic and geodetic conditions, in order to install a foundation of this sort a 2x2 m hole is dug down to approximately 5 m deep. Normally, earth that is removed is carefully separated so as to preserve the topsoil, and the foundation is strengthened with cross-bars. The subsoil is then backfilled into the hole and compressed to strengthen the foundation and the topsoil is laid on top and reseeded with appropriate vedgetation.

Figure 6.3 A pad and chimney foundation

Figure 6.4 Cross-bars for the pad and chimney foundation

2. Pile foundations – the bearing capacity of one pile is normally within 2 to 5 tons. Depending on tower loads and, respectively, foundation loads, one, two or four piles are being installed under each supporting point of tower. So pile foundation is able to withstand loads up to 80 tons.

   With installation of several piles under supporting point of tower, reinforced concrete or metal transition elements (grills) are being used. Pile foundations are used in construction on weak highly compressible water saturated grounds, as well as in case of transmission of large loads to the foundation bed. They allow the load from the building to be transmitted onto more solid grounds at greater depth. Piles can be made of reinforced concrete, steel or a combination of the above.

   It is anticipated that pile foundation will be prevailing in this project.

Figure 6.5 Concrete piles

Piles are either pre-cast and driven into the ground with a pile driver or they are cast-in-place (manufactured immediately in the ground, in the drilled-in channels). The soil is compressed by the pile driver or drilling machine without any soil disposal being necessary. The detailed design of the piled foundation (length, size & spacing) depends upon the local geology. There are two types of design.

- standing piles in solid ground, where the pressure is transmitted vertically from the foundation into the solid ground layer
- floating piles, where loading bearing uses friction forces on lateral surfaces as well as the vertical forces on the ground under the end of the pile

Both foundation types do not result in a solid concrete-made platform on the ground. Only 20 cm of concrete foundation is above the ground level. Connections are provided using a bolted joint.

6.2 Construction

The “Program of work” is a special document that describes the construction process in detail, the work schedule, the amount of man power and machinery used. It will be developed by the contractor selected following an Invitation to Tender (ITT). Nevertheless, the standard practice in constructing transmission lines is discussed in the following paragraphs.

The construction process is put into practice by groups of single purpose workers that execute their particular front of work. The construction teams at each location would consist of seven or eight crews of up to 10 people, working one after another, with each crew responsible for one of the construction assignment (preparing the RoW, laying the foundations for the towers, assembling the towers on the ground, erecting of the towers and installing the wires and testing and commissioning the line).

Workers involved in the construction works will dwell in the settlements neighboring the construction site (in dormitory accommodations, private houses etc.). There will be transport (bus) link arranged between the construction sites and the places of residence of the construction brigades.

In order to make the construction duration shorter (which will anticipate more workers but also the regular loading of the construction machinery) the line will be constructed in parallel on a number of sites.

The equipment, machinery and materials required for the construction works (including foundations and tower sections) will be supplied from the places of their storage along the route of the line as well as at Rivne and Kyiv substations (see Figure 6.6). Trucks of small tonnage (8-10 ton) will be used for supplying.

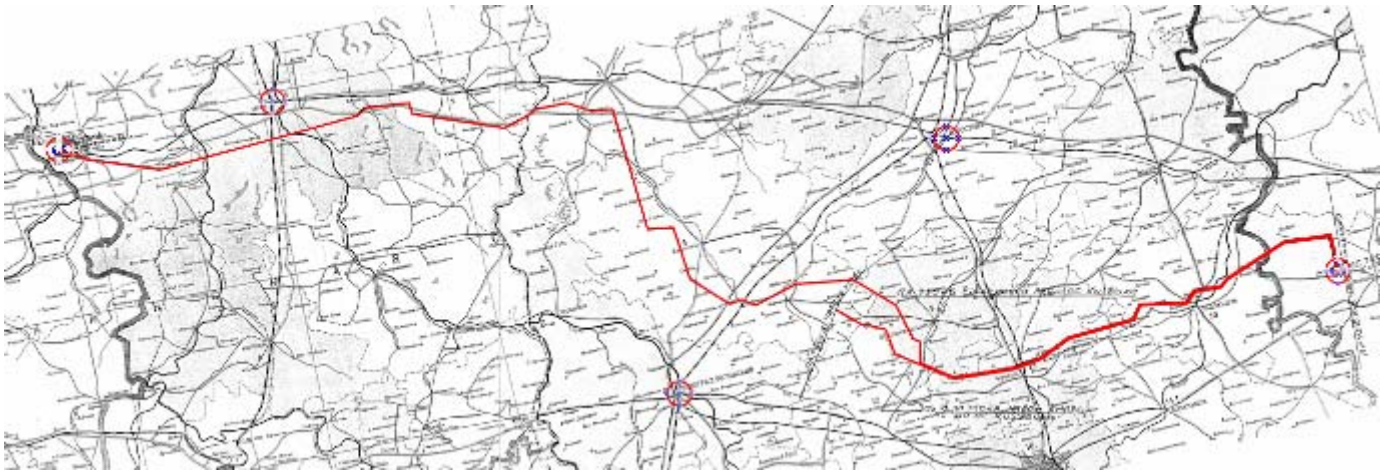


Figure 6.6 Location of the storage places

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, avoiding unsociable hours. Construction waste will be disposed of at waste disposal sites, following the consent of the local authorities managing these disposal sites.

The work sequence is expected to be the following:

1. Geodesists of a design organization make “sitting and layout” of the route on the base of working drawings (5 km a day).

2. Geodesists of a construction organization make a break-down of the ditch for the pad and chimney foundation or a layout for piles with defining the top of the foundations. The team comprises two-four people.

3. The route is to be cleared up (leveling of sites for foundations, cutting a glade) and temporary approach driveways to the towers are to be built – the time of execution depends on the conditions, in which the tower is installed. The ROW will generally be 120 m wide for the single transmission line and 195 m wide for the double line. There will be a special tender for this activity, the number of people will be decided based on deadline requirements.

4. The ditch is dug for the pad and chimney foundation bed (1 day for 1 ditch) or piles are driven in (1 day for 1 piling foundation). This job is usually carried out by one brigade of seven-eight people.

5. Pad and chimney foundations and cross bars with the ground back-filling (3 days for a foundation for a tower) or a metal grill on plies (1 day for installation of metal grills for a tower) are installed.

6. The tower is assembled from separate galvanized angles and sheet steel parts by means of bolt joint (10 days for 1 tower). These assignments are done by a team of ten individuals, but exact numbers depends on the technology.

7. Bolts are welded up to the height of 10 m (2 days for 1 tower, by a group of four).

8. The tower is raised by a swivel device attached to the foundation by means of the «falling jib» technique (2 days with preparation and regulation). It takes from six to nine people to raise a tower, but it also depends on technology

9. Tension and suspension sets of insulators for wires and wire ropes are assembled on the ground for the whole anchor span, i.e. from one angle tower to the next.

10. Wires and wire ropes are unfolded on the ground along the anchor span.

11. Wire ropes and wires are raised and stringed sequentially on the towers. The tasks 9, 10 and 11 are carried out by one brigade of up to 10 people.

12. Wires are connected together on the anchor (angle-tension) tower and wire stub (number of wires) is being connected to the previous anchor span (up to 4 people)

13. The ground around the tower bases is re-cultivated (up to 6 people for each tower area)

14. A protective voltage is supplied – this voltage is required to protect the unfinished line, for those sectors that are ready, to prevent stealing of the wires and steel parts: Towers will have a special warning sign “Danger! High voltage!” It is anticipated to supply the voltage of 330 kV from the transmission line of «Lesnaya-Chernobyl», Kiev substation and the substation of Rivne APP.

15. For 72 hours after the construction of the line is finished it works on the design voltage, and after that the line can be handed over to the Client.

Temporary allotment of land is described below in **Table 6.1** together with a diagram in Figure 6.7 showing how wires and towers are typically laid out on the ground.

# schemes	**Tower code**	**Size of the site for assembling towers**			**Additional areas for passage of machinery in case of raising the towers on tower angles, m^2**	**The total area of the temporary allotment exclusive of a 21 m strip, m^2**
		a, m	**b, m**	**S, m^2**		
1	ПС 750-3	36	59	2125	–	885
2	УС 750-1	71	54	3835	2000	4700
	УС 750-1+5	73	61	4455	2000	5172

Table 6.1 Temporary allotment of land

To unfold and mount the wires and wire ropes there are three strips provided along the line with the total width of 21 m.

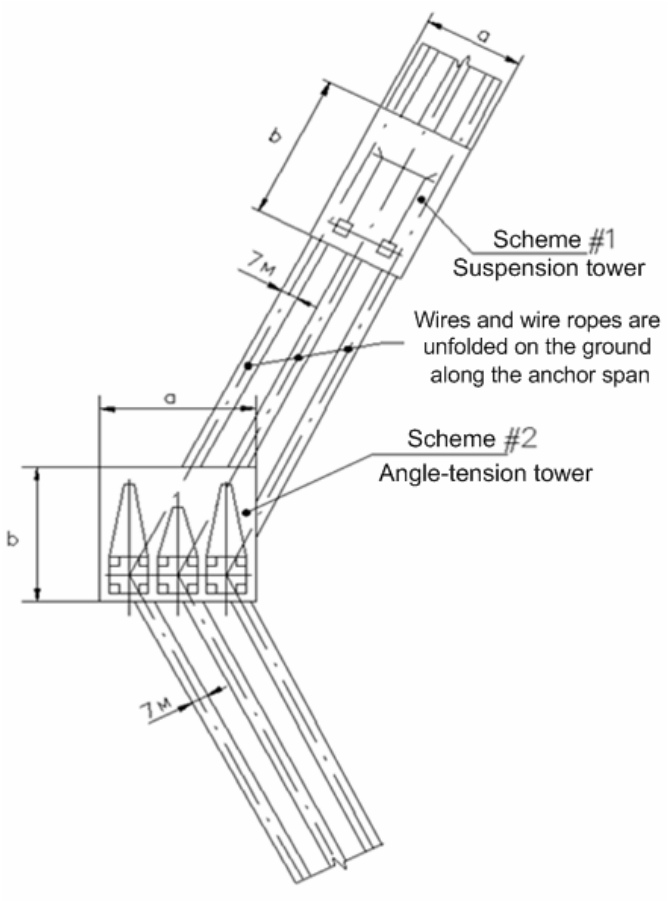


Figure 6.7 Temporary allotment of land for placing the towers and wires before lifting the towers and stringing the wires

6.3 Operation

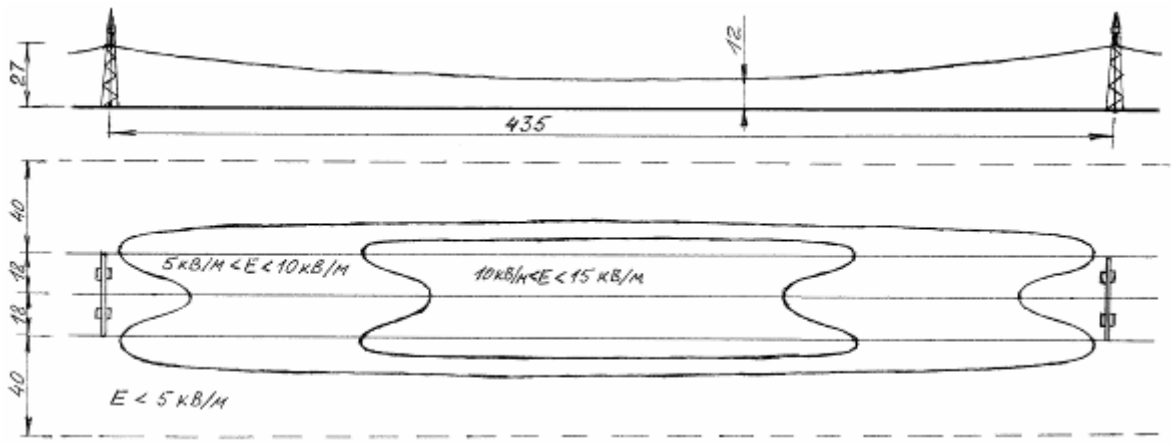
The main impacts associated with the operation of transmission lines are the creation of Electromagnetic Fields (EMF) and noise related to the Corona effect.

6.3.1 Electromagnetic Fields (EMF)

A detailed description of EMF and its effects is given in section 8.2.6. Measurements of EMF at existing 750 kV lines have shown that at a distance of 20 m from the footprint of the line the EMF is already below 5 kV/m, which is the national standard for limitless exposure.

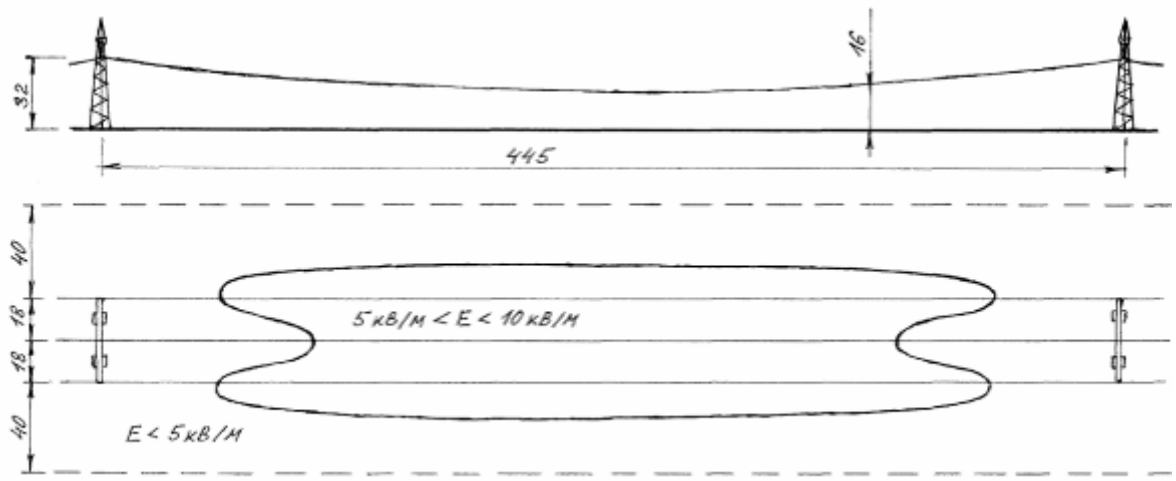
It should be noted that according to these standards, the allowable exposure time is 3-8 hr for 5 – 10 kV/m, 1.5-3 hr for 10 – 15 kV/m and less than 1.5 hr for EMF above 15 kV/m. It is also noted that the “sanitary” zone along the transmission line is 40 m from both sides of the routing.

The distribution of the electrical field under wires of a 750 kV transmission line, at a distance from the wire down to the ground at 12 and 16 meters is shown below (the dash line shows the border of the sanitary zone).



In those places where the TL passes through agricultural areas, mechanized work (tillage etc.) is not limited.

Manual labor (vegetable gardens, sites of summer cottages etc.) under the transmission line middle conductor is limited due to the electromagnetic field (see the picture above – with normal tower height the cables are hanging at the standard 12.5m above the ground so people are not supposed to work for more than 1,5-3 hours at a time under the transmission line) – this is a limitation that would affect areas of arable land worked by hand or with animal traction. NPC Ukrenergo has proposed that the cables will be raised to 16m (see picture below - to 5 m heightening of towers УС 750-1+5) in areas used for arable farming and in this case people will be allowed to work for about 3-8 hours under the power lines.



Calculated electromagnetic fields at the edge of the SPZ will be 1 kV/m which is a national standard for EMF at the settlement.

6.3.2 Noise

Transmission lines produce noise due to the Corona effect that can generate reasonable loud noise under certain meteorological and transmission system conditions. The level of noise or its loudness depends on voltage level and weather conditions. In foggy, damp, or rainy weather conditions, power lines can create a subtle crackling sound due to the small amount of the electricity ionizing the moist air near the wires. During heavy rain the general background noise level is usually greater than the noise from a transmission line. During light rain, dense fog, snow, and other times when there is moisture in the air, the proposed transmission lines may produce audible noise higher than rural background levels but similar to household background levels. During dry weather, audible noise from transmission lines is a nearly imperceptible, sporadic crackling sound.

Another source of noise associated with transmission lines is an electromagnetic generated noise termed Corona. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimeters immediately surrounding conductors. Because of its reactivity, ozone is relatively short-lived.

Corona-generated noise from transmission lines is generally characterized as a crackling, hissing noise.

Transmission-line audible noise is measured and predicted in decibels (A-weighted) or dBA. The average noise-level at 100 m for the proposed 750 kV line will be in the range between 70 dBA on wet weather and 35 dBA on dry weather. Some typical noise-levels are given for comparison:

- library, 40 dBA;
- light automobile traffic at 30m feet, 50 dBA;
- an operating air conditioning unit at 6m, 60 dBA;
- a freeway traffic or freight train at 15m feet, 70 dBA - the point at which a contribution to hearing impairment begins.

6.3.3 Radio interference

Corona on transmission line conductors can cause interference with radio waves, primarily with AM radio stations and the TV signals, depending on the frequency and strength of the radio and television signal.

Interference with communications equipment is also caused by loose or damaged hardware on the transmission line itself and can be remedied by repairing equipment.

6.3.4 Accidental events

Among the potential hazards of operation of the transmission line there are fires, wire break, grounding wire break, tower falling, with the electric shock.

A transmission line as well as any other metal structure cannot burn. But in case of fire under the transmission line (burning of agricultural waste, burning of dried grass, forest fire etc.), a short circuit arises, and the automatic protection stops line operation.

Cases of fire registered on 750 kV existing lines during last couple of years:

- 2003: two cases of rush burning; one case – forest fire;
- 2004: two cases of rush burning;
- 2005: one case of burning of dried grass, tall grass;
- 2006: one case of rush burning; two cases - burning of dried grass, tall grass;
- 2007: two cases of rush burning.

Damage – limitation of NPP capacity distribution; there was no damage caused to the transmission line.

If the grounding wire falls it makes a short circuit with high voltage wires and the line is disconnected. This occasion is unlikely, but in certain set of circumstances – the weather, third parties actions - it may happen.

The wire break can be caused by an attempt to steal the wire or due to unfavorable weather conditions. If the wire breaks it will create short circuit with ground surface.

According to official confirmation from NPC Ukrenergo there were no failures of 750 kV transmission line wires in recent 10 years.

Falling of towers is very unlikely if all the standards and rules of construction and operation are followed. In case of stealing of steel angles or weather disaster (storms etc.) the tower loses can fall. Falling of a tower is followed by a break of wires – see paragraph above (a short circuit – line disconnection).

Cases of 750kV lines towers toppling registered on existing lines during last couple of years (note: those towers were less stable due to older technical design):

- 1997: one case (1 tower) – stealing of metal angles by local population; one case (two towers) – natural disaster (strong wind);
- 1998: three cases (four towers) – stealing of metal angels by local population;
- 1999: two cases (two towers) – stealing of metal angels by local population;
- 2000: one case (1 tower) – stealing of metal angels by local population; two cases (24 towers) – natural disaster (strong wind); one case (36 towers) – natural disaster (ice coating);

- 2001: three cases (4 towers) – stealing of metal angels by local population; one case (two towers) – natural disaster (strong wind);
- 2002: three cases (four towers) – stealing of metal angels by local population; one case (two towers) – natural disaster (strong wind);
- 2005: one case (two towers) – stealing of metal angels by local population.

The consequences of tower toppling were limitations of NPP power distribution.

Any disconnection of the line becomes immediately known to the operating services. The type of damage can be assumed in advance judging from the type of the short circuit. A repairing brigade visits the site, depending on the degree of damage repairs take from several hours (spanning of wire ropes and wires) to several days (restoration of a tower). Within this time the voltage is transferred to other transmission lines, or distribution of the electric power by NPP blocks is compulsively limited.

In the course of land acquisition the easement contract is concluded with the owners of neighbouring lands (the contract of joint / neighbouring use of the land), with the annex to it being a set of accident prevention instructions.

6.4 Maintenance

The main part of service is maintaining the protective zone of the transmission line: cutting trees, lopping branches, refreshing earth fillings near the towers.

Scheduled patrolling (visitations) of the line is held once a year with a view to the visual revealing of cut-offs, breaks etc. If any problems are revealed that call for repairing with disconnection of the line, such disconnection is agreed with the regional electric networks and is made in the period of the least network loading.

All service and repair works are carried out with the safety regulations being observed concerning workers staying in the coverage of the electromagnetic radiation of the TL.

All service and repair work that anticipate disconnection of line (no difference if they are caused by routing maintenance reasons or by accident) are followed by change of electricity flow (other transmission lines), or limitation of power generation.

6.5 Decommissioning

The expected field life of a transmission system is approximately 50 years. The decommissioning process is essentially the reverse of the installation process.

As far as this is quit long life-time no 750 kV lines were decommissioned before. But based on common sense, the decommissioning process will anticipate the following:

1. If the line is still needed (except for the case if the decision to close NPP will be made during following 50 years or new technology to deliver capacity will be excepted) there is no need to decommission it.
2. Existing facilities (foundations, towers, wires etc.) should be checked for conformity to present standards of technical requirements.

3. In case of non-conformity they should be decommissioned (cut-off from electricity, to remove wires, to disconnect welded tower connections, to disassembly the towers, to dig up the foundations, re-cultivation)

7. Identification and consideration of alternatives

It was made clear in the scoping consultation meetings that this ESIA will not cover or comment upon Ukrainian Energy Policy. Readers interested in energy policy and alternative approaches are referred to the Ukrainian energy policy review by the International Energy Agency (2006)[7] and recent proposal from Ukrainian Environmental Non Governemental Organisations (2007)[8] on the internet.

This section presents the alternatives that have been considered at 4 levels, including:

- A No-project alternative;
- Alternatives within Western Ukraine to meet the strategic objectives of re-enforcement and maximing existing generating capacity;
- Alternatives within the Rivne NPP – Kyiv route;
- Optimisation of the proposed Rivne NPP – Kyiv route.

7.1 Background - Long term transmission strategy for Ukraine

NPC Ukrenergo, in common with other transmission companies, undertakes investment in its network to meet the requiements of a long term energy strategy. The most recent update is the "Energy Strategy of Ukraine for the Period until 2030" [9] or, from now on referred to as the 2030 Energy Strategy. This was approved by the Ukrainian Cabinet of Ministers in 2006. The plan for the transmission network is summarised in Figure 7.1 and prioritises:

- Reinforcing the existing 750kV network through the establishment of Northern and Southern trunk routes running in parallel with the present 750 kV central spine (These are predominantly longer term projects);
- Reinforcing connections to existing generating stations at Rivne, Khelminitska, Zaporizhia and Dniester (These are predominantly shorter term projects);
- Connecting consumers in the Odessa region to the main grid;
- Facilitating more exports to neighbouring countries in the South and West;
- Strengthening supplies in the Lugansk, Crimea, Kherson and Mykolaiv regions.

An underlying objective, particularly through construction of the southern and northern trunk routes, is to improve the security of the network to meet Western European

[7] International Energy Agency (2006) http://www.iea.org/w/bookshop/add.aspx?id=248

[8] The Concept of Non-nuclear Development of the Power Industry of Ukraine http://www.mama-86.org.ua/files/nnconcept_eng.pdf

[9] Ukraininan Government (2006) Energy Strategy of Ukraine for the Period until 2030 mpe.kmu.gov.ua/fuel/doccatalog/document?id=50523

standards set by the UCTE which co-ordinates the transmission system operation in Continental Europe. This would allow NPC Ukrenergo's network to be synchronised with the Western European network, thus facilitating exports and improving the reliability of the network in the country. The northern trunk is also an important part of the works required to enable the open distribution unit of Chernobyl substation to be closed.

Reinforcements to existing power plants are intended to reduce the risk of station disconnections as well as providing greater flexibility in the number of stations that are operated, to minimise generation costs.

The plan includes the construction of the new 750/330kV substation at Kyiv (project No.1 on Figure 7.1) which is now underway and due for completion by the end of 2007, and the existing 750kV line from Vinnytsia substation to Chernobyl NPP being linked into Kyiv substation. The proposed new 750 kV line from Rivne NPP to Kyiv substation is also shown and forms part of the northern trunk.

Figure 7.1 Long-term development plan of the Ukrainian transmission system

7.2 The "No Project" option

The simplest way to avoid providing additional infrastructure is to improve energy efficiency and so reduce electricity demand. However, energy efficiency improvements are addressed in the 2030 Energy Strategy, with projected savings of 318,360,000 tonnes of standard fuel by 2030, reducing the GDP energy content from 0.48 kg of standard fuel/UAH to 0.24 kg of standard fuel/UAH. In looking at the no project option, it is assumed that any substantial energy efficiency improvements are not practicable.

Lack of investment in the proposed project would therefore have the following consequences:

- The underlying system stability problem caused by inadequate transmission capacity between the western and central regions of the NPC Ukrenergo network would increase. This would compromise supply reliability not just in the Kyiv Region, but across the whole country;
- Increasing energy demand will have to be met by grid re-enforcement in other parts of the network.
- There would be no progress in closing the open distribution unit of Chernobyl substation. The maintenance staff would have to continue working in the contaminated zone.

7.3 Increase investment in renewable energy resources

The Project has two main objectives:

1. bring utilisation of the Khmelnytsk NPP and Rivne NPP to normative level
2. resolution of the transmission capacity and stability problems, particularly in the Kyiv region.

The development of distributive wind generation in the Kyiv region would not significantly contribute to resolving the underlying system stability issues which unavoidably require significant transmission interconnection reinforcement between Rivne and the rest of the network. Renewable energy will be able to contribute to the generation mix for the Kyiv region, but not as an economic or technical alternative to the Project.

As discussed in Section 4.1 under NPC Ukrenergo's base case planning scenario, no additional generating capacity is required until 2010 or later, when there is an opportunity to look at large scale development of wind power. According to data provided by Windenergo and by the Kyiv-based Renewable Energy Agency (NGO) in their 2003 presentation Vision 2050[10], Kyiv lies in an area of lower than average wind speeds and national interest suggests that priority should be given to developing resources in the southern and Black Sea areas where wind speeds are significantly higher. The development of wind resources in these areas may also require additional grid re-enforcement which can be carried out in line with the stragetic planning for the development of the grid. It is not thought that the development of the Rivne NPP – Kyiv transmission line will adversely affect the connectivity and development of wind resources.

7.4 Routing options in western Ukraine

Exististing connections to Riven NPP are limited to a single 750kV line running south west to the West Ukraine substation and 330kV lines to Khmelnitska and surrounding areas. There is insufficient capacity to enable the full output of 2880 MW from the Rivne NPP to

[10] Available at http://www.inforse.dk/europe/pdfs/VisionUKR_report.pdf

be transmitted in the event of the failure of the present single 750 KV line. Additional capacity needs to be constructed from Rivne to overcome this limitation. In addition, the stability problems which were discussed earlier can only be overcome by strengthening the electrical connections between Rivne NPPs and the rest of the network.

In the longer term, it is logical that additional transmission capacity should be connected to the Kyiv Region to mitigate the present restrictions on importing power into the area which is presently experiencing higher than average load growth. Given the amount of power to be transmitted, and given that there is no benefit in constructing a line at a different voltage to that already adopted in Ukraine, 750 kV which can handle in excess of 1000 MW is the appropriate choice for the transmission voltage. Considering the present network, the main options for a new line from Rivne are:

- Option 1 - Construct a 750 kV line to Khmelnytsk NPP and rely on the existing 750 kV connection to open distribution unit of Chernobyl NPP for bringing power into the Kyiv region;
- Option 2 - Construct a 750 kV line directly into the Kyiv region to either the open distribution unit of Chernobyl or Kyiv substations;
- Option 3 - Construct a 750 kV line to the existing 750kV substation at Vinnytsia.

Option 1 is the cheapest but does not address the need to reinforce the capacity into the Kyiv region as an unplanned outage of the Khmelnytsk NPP to Chernobyl NPP 750 kV transmission line would result in overloading of other parts of the network and the need for load disconnection.

Option 2 provides the next cheapest alternatives and either routing would address the capacity and stability concerns.

Option 3 is the most expensive and has no advantages as it does not improve the security of supply into the Kyiv region as there is no additional capacity actually feeding the Kyiv area.

7.5 Connection of new transmission lines from Rivne NPP to Chernobyl or Kyiv substations

NPC Ukrenergo’s planning at the start of the construction of Rivne NPP was to construct a 750 kV line directly to open distribution unit of Chernobyl NPP. With the closure of the power plant at Chernobyl and the subsequent decision to construct a new substation to the west of Kyiv, NPC Ukrenergo have rerouted the line to Kyiv. This has the advantage of connecting directly into new and less loaded substation capacity and meets the Government’s desire that the open distribution unit of Chernobyl substation should be closed as soon as possible.

Technical studies have confirmed that constructing this project overcomes the system capacity and security concerns as well as the technical stability concerns.

7.6 Diversion of Khmeltnytsk NPP to Chernobyl line

As part of the project concept, NPC Ukrenergo have included a second element, which is the diversion of the Khmelnitska to Chernobyl 750 kV line into the Kyiv substation and closure and dismantling of the section of the overhead line from the diversion point to the open distribution unit of Chernobyl NPP. The diversion, which for the most part would run in the same corridor as the overhead line from Rivne NPP, is consistent with the strategy of reducing dependence on the Chernobyl substation and enabling its closure.

This is not part of the solution to the security and stability problems which the overhead line from Rivne NPP resolves and technical studies have confirmed that the section of line to the open distribution unit of Chernobyl NPP should not be closed until additional reinforcements of the 330 kV network in the Kyiv region have been completed. This is due to the need to build additional transmission capacity to offset the reduction in power which could be supplied from the open distribution unit of Chernobyl NPP into the Kyiv region once that section of line is closed.

7.7 Routing options for the proposed project

Transmission line routes in the Ukraine are selected in conformity with “The Land Code of Ukraine” which requires that infrastructure developments, such as roads and power transmission lines, avoid using agricultural land. Power transmission and communications lines generally follow the routes of roads and highways and the routing of the 750 kV transmission line between Rivne NPP and the Kyiv substation was selected according to these principles.

The new Kyiv 750/330 kV substation was originally planned to be located in one of three alternative locations in the Ivankovskiy district of the Kyiv oblast, but this option was rejected by regional main architect and the regional land surveyor as the land at those sites is in use for agriculture. An alternative location was proposed on the reserve lands of Piskivs village council near village Karpylivka. However, studies on the routing of the transmission lines indicated that the lines would pass through an area of radioactive contamination and it would be unsafe to allow construction workers into that area. An additional drawback to that location was that the transmission lines would need to pass through a boggy area which would significantly increase construction costs.

An alternative and more southerly location for the Kyiv 750/330 kV substaion was then chosen in the area of Nalivajkovka village in the Makarovskiy district of the Kyiv oblast which is well away from the contaminated zone and to the west of Kyiv city. The site was chosen for a number of reasons including ease of constructing transmission lines into and out of the substation including into Kyiv city, proximity to roads enabling heavy loads to be readily transported to the site, proximity of a railway station, the presence nearby of residential developments from which construction and other staff could be drawn, the relatively poor value of the ground for agricultural use, the geological and hydrological characteristic of the site, and many other factors.

The selection of the Rivne NPP - Kyiv transmission line route has mirrored the change in location of the substation. From the Rivne NPP, the line route basically runs in parallel to and a short distance from the Kyiv - Kovel motorway. With the change in the location of

Kyiv substation, it has been necessary to turn the line south in the area of Zabareche village due to the presence of granite quarries which are presently in operation with extensive blasting using explosives. This area is characterized by extensive forests which are not readily bypassed, and the line route passes through the forest making use of existing clearings.

The proposed diversion of the 750 kV transmission line from Khmelnytsk NPP to Kyiv has been planned to run parallel to the Rivne NPP – Kyiv transmission line as much as practical to reduce future operational and maintenance expenses.

A map with the two routing alternatives in presented in **Figure 7.2**.

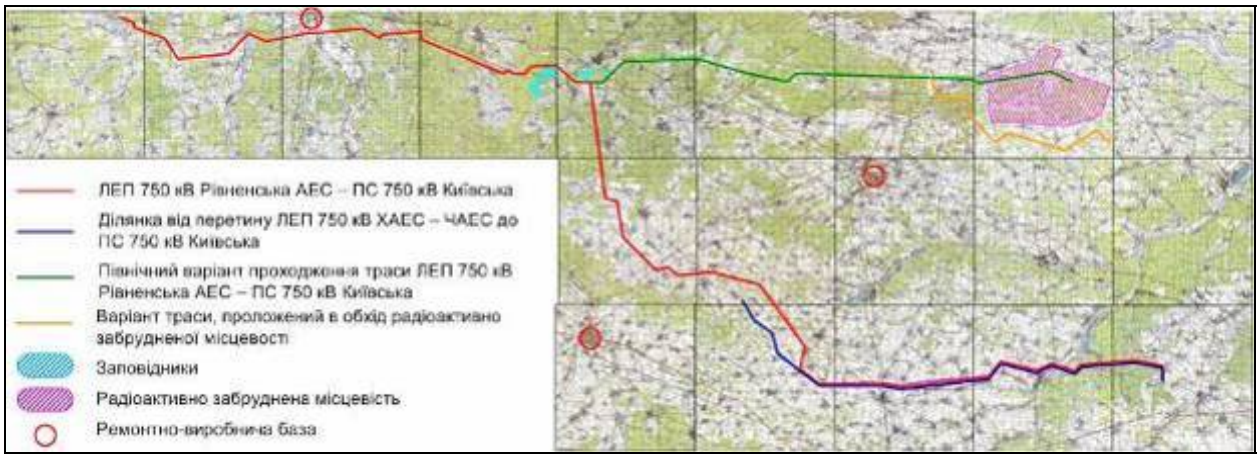


Figure 7.2 Map of the north-west Ukraine showing the northern and southern transmission line routes

Under the direction of NPC Ukrenergo and under the order of regional state administrations of the Rivne, Zhitomir and Kyiv oblasts, committees on the choice of transmission lines routes in all the administrative districts in which the line would run were created. These committees included representatives of local authorities, regional state inspections and supervising bodies, and also the interested organizations, including large land users. Members of these committees have specified and signed off the line route on scale 1:10000 maps.

The work of the committees has taken into account factors of concern to local authorities and interested organisations as well as the results of specialised inspections. These factors included the value of the agricultural lands, value of large forests, the infrastructure and economic development prospects of the districts including the sites of prospective minerals mining along the route, the presence of the recreational places used by inhabitants, the presence of local sights etc.

Simultaneously with work of the committees, surveys were undertaken on communications facilities which might be subject to interference from the transmission lines and designs were developed to mitigate potential problems. There has also been coordination with the regional level state supervising bodies which do not have representatives on the committees. In the light of their comments, minor alterations were made on the routing of the transmission lines. For example, in the area of Torchin village

in the Korostyshevskiy district of Zhitomir oblast, at the request of the Regional inspectorate on cultural heritage protection, a detour was agreed around the territories known as "Stone Ford - XXIV" and "Torchin - II" where archaeological remains have previously been found. Final amendments to the routings were then made taking into account technical requirements on crossing and integration with underground communications equipment.

In summary, the routing of the Rivne NPP - Kiev transmission line, and the diversion of the Khmelnytsk NPP - Kyiv transmission line have been selected to take into account the opinions and requirements of all participants of the committees. Whenever possible, all potentially interested parties which were identified during the period of coordination have been included in membership of the committees, although land users with small land plots did not participate in the committees. This was because at the stage of selecting the line route, precise details of the location of the line were not known and so it was not possible to identify the impacts that the planned construction would have on specific small land users. The Interests of these land users were represented by the local government institutions on the committees. The procedures for selecting the routes for the lines followed the requirements stipulated by Ukrainian law.

8. Prediction and assessment of impacts

8.1 Methodology

The objective of the impact assessment is to identify and manage the risks to the environmental and society that are expected to arise from the proposed activities. The process involves:

1. Identifying all the hazardous and beneficial activities
2. Assessing the level or risk arising in terms of frequency (how likely is it to happen) and consequences (how good or bad is it)
3. Assessing the acceptability of the risk.
4. Introducing mitigation measures to reduce those risks an acceptable level.

The hazardous and beneficial activities were identified using a Checklist based on EU Guidelines[11] to provide a systematic approach and help to make sure that nothing is missed. The construction contractor has yet to be appointed and the construction methods described in the project description are used as the basis for the impact assessment, although worst case scenarios have been considered such as the use of mobile construction camps. If there is any material change in these procedures once the contractor is selected, the contractor will be required to re-assess the social and environmental impacts under a change control process.

The project activities are summarised below:

- Carry out pre-installation investigations
- Construct access roads
- Prepare line corridor
- Prepare and construct tower foundations
- Mobilisation / Demobilisation of temporary construction sites
- Install towers and cables
- All construction activities
- Operate the line
- Maintain the line
- De-commission and reinstatement

Table 8.1 List of activities

The outcomes of the activities described were divided into environmental aspects and environmental impacts to make it easy use the impact assessment in the installation contractor's environmental management system.

[11] *Guidance on EIA: Scoping*, issued by the European Commission in June 2001

Environmental aspects have a special meaning within the ISO 14001 the international standard for Environmental Management Systems and are defined as any “element of an organisation’s activities, products or services that can interact with the environment”.

An environmental impact is defined within SSU (State Standart of Ukraine) ISO 14001-97 as “any change to the environment, whether adverse of beneficial, wholly or partially resulting from an organisation’s activities, products or services.”

Put more simply we start with an activity, like preparing the line corridor that leads to an environment aspect, like cutting down trees (usually physical effect), that in turn has a impact like the destruction or degradation of a habitat (biological effect). The environmental aspects and impacts that have been identified are listed below.

- Cutting down trees, land clearance
- Physical disturbance (noise, movement, dust)
- Compaction of soil
- Noise
- Solid waste generation and disposal
- Discharge of effluent / sewage
- Fuel or oil leaks
- Change of land use
- Creation of EMF
- Physical presence of towers and cables
- Failure of towers / loss of structural integrity
- Construction traffic
- Influx of labour
- Accidental damage to crops / land / property
- Land acquisition / use
- Failure of wires
- Accidents from electrocution
- Accidents from working at height
- Working in wetlands, soil disturbance
- Subterranean cultural heritage finds
- Above ground cultural heritage sites
- Air emissions
- Creation of ozone, NOx
- Accidents and injuries
- Improved transmission efficiency
- Light pollution
- Fire
- Theft

Table 8.2 List of aspects

From these aspects a number of impacts are generated. Clearly, each aspect may lead to more than one impact while many aspects may share the same impact. The list of impacts associated with the above aspects is the following:

- Contamination of soil
- Contamination surface waters
- Destruction / degradation of habitats
- Safety / health impact for the neighbouring population
- Safety / health impact for workers
- Impact on hydrological patterns
- Impact to geomorphology (from soil and debris)
- Changes in biodiversity
- Loss of income
- Increased income
- Disturbance of mammals / nesting birds
- Mortality of birds
- Nuisance to neighbouring population, visitors
- Reduction of property value
- Reduction of amenity value
- Reduction of soil productivity
- Resettlement of population
- Visual impact -> Reduction of property value
- Visual impact -> Reduction of amenity value
- Climate change, acidification
- Changes in soil dynamics and composition
- Changes in flora species (esp. in wetland areas)
- Increased access & secondary impacts
- Improve conditions for certain species (e.g. reptiles, raptors)
- Loss of cultural heritage
- Death or illness from infectious disease

Table 8.3 List of impacts

With the risk assessment, the frequency of likelihood is scored either qualitatively or semi-quantitatively in terms of the how often the incident will occur within the life of the project. For instance, assessing the score of a worker fatality from working at height, a qualitive judgement would say that this **M**ay occur or would **P**robably occur or is even **L**ikely to occur. To get a more accurate estimate, accident records were checked and showed that a fatality on this line would be expected within a 10 year period and is therefore scored as **P**robable.

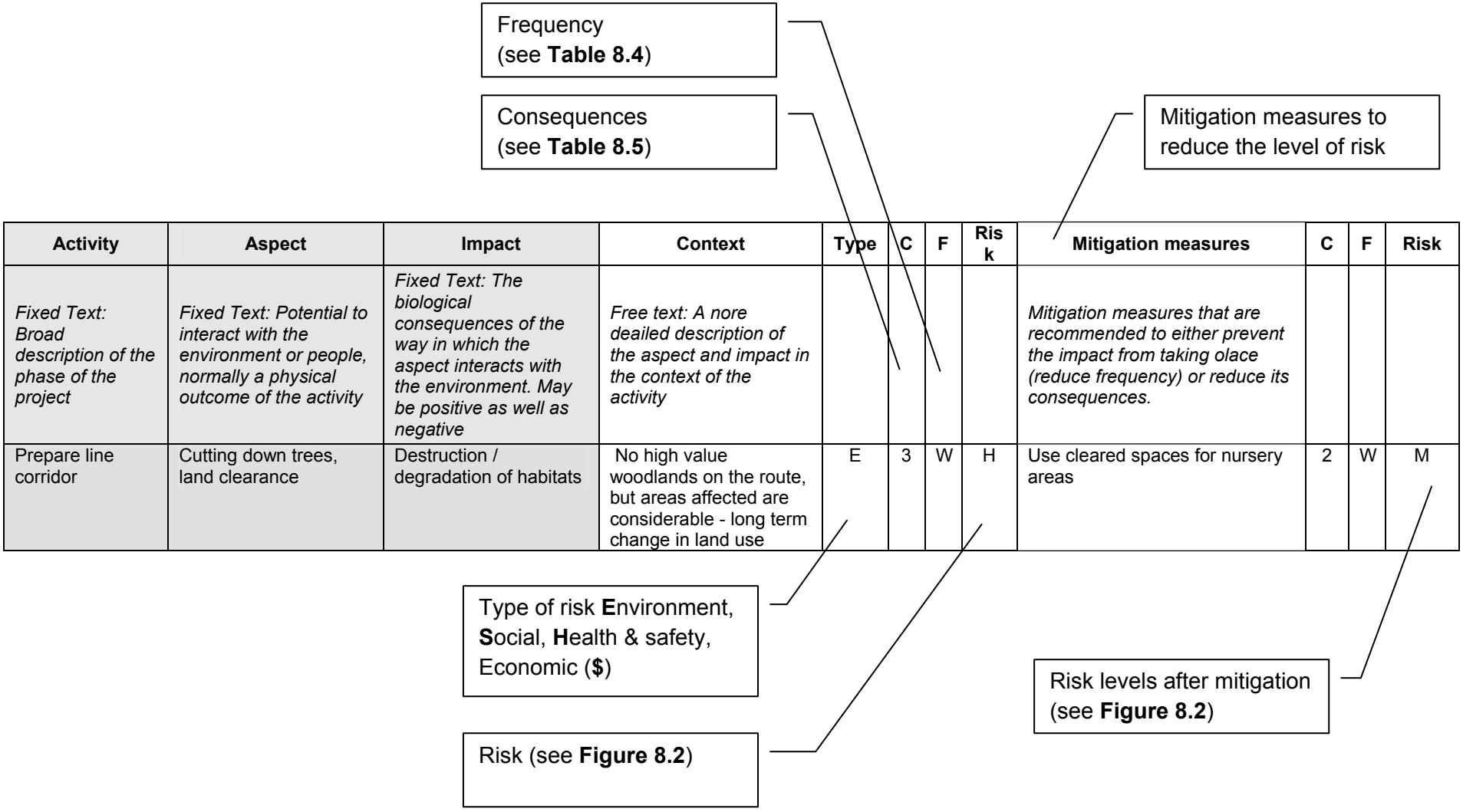
Very Unlikely	**U**nlikely	**M**ay Occur	**P**robable	**L**ikely	**W**ill (Planned)
<10,000	<1,000	<100	<10	>1	>10
Years per Event				Events per Year	

Table 8.4 Qualitative and quanitative scoring of frequnecy

The consequences are broadly organised in categories – ecological, economic, social and health & safety – and marked in terms of consequence in a scale of 1 to 5 as shown in **Table 8.5** overleaf. Notably, provision is made for positive as well as negative impacts.

Consequences	Ecological	Economic	Social	Health & Safety
Type / Score	*Effects on the biological and physical environment*	*Economic value to the local community or asset value*	*Social impacts including noise, traffic etc*	*Health & safety impacts including EMF etc*
-5 Extreme	Total change to ecosystem and no recovery. Permanent loss of several conservation areas, habitat or species of international importance	Loss of asset value or business > $10 million	Massive social changes, affecting majority of population negatively	Multiple (>10) fatalities in life of project. Extensive and severe chronic effects in local populations
-4 Major	Major impact. Permanent loss of a conservation area, habitat or species of International / national importance.	Loss of asset value or business <$10 million	Social changes or nuisance, affecting major part of population	Extensive chronic effects of moderate severity in local populations (>100) or localised severe chronic effects. 1-10 fatalities in life of project
-3 Moderate	Change beyond natural variability with poor recovery potential. Significant impact on conservation area or species of regional importance	Loss of asset value or business <$1 million	Social changes affecting a significant section of the community	1 fatality in life of the project, Localised moderate chronic effects I fatality in life of project
-2 Minor	Greater impact than natural variability but good recovery potential. Slight changes in habitats or species within conservation areas or large areas of high biodiversity.	Loss of asset value or business <$100,000	Changes to a small section of the community	Localised minor chronic effects, marked increase in lost time injuries.
-1 Negligible	Within scope of natural variability. Change in habitats or species within scope of existing variability and difficult to measure or observe	Loss of asset value or business <$10,000	Changes affecting a few individuals negatively	Poses additional hazard but low risk
0	Effects not detectable	None	Effects known but not detectable	Poses less hazard and less risk
+ 1 Negligible	Marginal improvements to local ecosystems	Generates business <$10,000	Positive changes affecting a few individuals	Positive changes affecting a few individuals
+2 Minor	Measurable improvements to local ecosystems	Generates business <$100,000	Positive benefits to a small section of the community	Localised slight improvements in health of local populations
+3 Moderate	Marked improvement to local ecosystems	Generates business <$1 million	Social changes affecting a significant section of the community	Localised moderate improvements in health of local populations
+4 Major	Permanent improvements to national ecosystems	Generates business <$10 million	Social changes, affecting major part of population	Extensive moderate improvements in health of local populations
+5 Extreme	Permanent improvements to several ecosystems of international importance	Generates business >$10 million	Massive social changes, positively affecting majority of population	Extensive and major improvements in health of national populations

Table 8.5 Marking of impacts



Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
Fixed Text: Broad description of the phase of the project	*Fixed Text: Potential to interact with the environment or people, normally a physical outcome of the activity*	*Fixed Text: The biological consequences of the way in which the aspect interacts with the environment. May be positive as well as negative*	*Free text: A nore deailed description of the aspect and impact in the context of the activity*					*Mitigation measures that are recommended to either prevent the impact from taking olace (reduce frequency) or reduce its consequences.*			
Prepare line corridor	Cutting down trees, land clearance	Destruction / degradation of habitats	No high value woodlands on the route, but areas affected are considerable - long term change in land use	E	3	W	H	Use cleared spaces for nursery areas	2	W	M

Figure 8.1 Illustration of impact assessment methodology

We now have to establish the significance of the risks that have been identified. This is derived plotting consequence against frequency of occurrence as a "significance" matrix below that provides guidance on the whether the level of risk is acceptable.

		Low		Frequency			*High*
		V	U	M	P	L	W
Consequence	5	M	M	H	H	H	H
	4	M	M	M	H	H	H
	3	L	L	M	M	M	H
	2	L	L	L	M	M	M
	1	L	L	L	L	L	L
	0	L	L	L	L	L	L

Figure 8.2 Significance of impacts

The green, yellow or red areas of the matrix represent low, medium or high risk levels respectively:

L: The risk level is generally acceptable as long as mitigation measures are in place and maintained

M: The risk level should be reduced to a level that is As Low As Resonably Possible (ALARP) with the introduction of mitigation measures that prevent the event from occurring (reduce the frequency or likelihood) or reduces the consequences (emergency response).

H: The risk level is unacceptable and must be reduced by the introduction of mitigation measures to reduce the risk to the ALARP level.

The whole process is summarised in **Figure 8.1** and the full risk assessment is provided in the Appendix 11.3.

8.2 Socio-economic impacts and mitigation measures

8.2.1 Involuntary resettlement

It appears that only one family will have to be moved because of the project. This is a family that lives in Yanivka (Ivanivkha) village, which belongs to Kostyatinovka Village Council in Rivne Region, whose house is situated at 80m from the transmission line. NPC Ukrenergo is in the process of acquiring a new house for the family, and they have given their consent to the proposal and the transaction will be completed as soon as NPC Ukrenergo makes the final decision to construct the line along this section of the proposed route.

8.2.2 Temporary Economic Impacts during Construction

Temporary economic impacts are expected to include damage or loss of crops and possibly some damage to agricultural infrastructure such as fences, bridges and drainage

ditches. The impacts may also include loss of access to hay meadows or areas used for grazing livestock and will definitely include the clearance of areas of forest. The impacts will occur at the sites used for assembling the towers and along the all access routes that will be used to reach the sites where the towers will be erected. It is expected that other sites will also be required for construction camps, for stockpiling materials and for parking and the maintenance of the vehicles and equipment (cranes, generators and so on) that will be used at the assembly and tower sites.

It is important to emphasise that the details of the construction programme – including the selection of the access roads to the ROW, the number of work fronts, the selection of the sites for the construction camps, stockpiles and vehicle maintenance sites will only be determined once the construction contract has been let. The amount of damage can be reduced through the careful selection of access roads, which will have to be carried out in close consultation with the local authorities, landowners and land users. The timing of the construction programme is another factor that will have to be taken into account: work carried out during the winter will have less economic impact if it is returned to the landowners and users by mid-March. There will be an opportunity to negotiate the specific conditions with land users before construction starts.

Past experience shows that compensation for temporary damage does not represent a significant problem. Compensation will be assessed in accordance with the Cabinet of Ministers Decree No. 284 (1993) and will be determined by commissions created by the State Raion Administrations that will include representatives of the affected Village Councils, the State Land Use Authority, the Raion Architecture and Planning Authority, the Raion Department of Finance, NPC Ukrenergo and the affected landowners (see 4.4).

8.2.3 Other Temporary Impacts during Construction

This may include positive and negative impacts. The possible positive impacts include the generation of some direct employment for people living in the project area, an increase in opportunities for indirect income generation and possibly the reconstruction of roads in the project area.

- **Direct employment.** This is important since there are high levels of under and unemployment in the villages situated along the route of the transmission line. The employment of local labour would help to maximise the potential benefits to people living in the nearby settlements. It is likely that the construction workers will be organised as four or five separate teams at each work front. The teams would be responsible for:

  1) Laying the foundations for the towers,

  2) Construction or assembly of the towers,

  3) Erection of the towers and installation of the electric cables.

  The first team as a rule will not require highly skilled labour and the work could potentially be carried out by local excavator and bulldozer drivers and builders under the supervision of qualified taskmaster. In fact, the main contractor may conceivably sub-contract these tasks to local companies. The other tasks,

particularly the erection of the towers and hanging the cables requires labour with specialist skills that will have to be drawn from all over Ukraine.

In addition to employment on the construction sites there may opportunities for direct employment – perhaps through local sub-contractors – in areas such as catering (at construction camps), transport (bringing workers and/or materials to the construction sites) and security. The potential benefits of the project can be maximised either by including a requirement in the tender documents for the contractor/s to hire a certain proportion of non-specialist workers from the districts or perhaps regions affected by the project and/or by requirements in the tender for the contractor/s to publicise job opportunities in the affected districts, using local media (radio and local newspapers) and by providing information to local authorities and village councils. Some additional jobs could be reserved for the local population, for instance, forest clearance along the RoW and access roads.

- **Opportunities for income generation.** As well as the sub-contracts noted above, the influx of construction workers and/or the increased disposable income available to the local workers employed on the project will have a minor multiplier effect on the economy of the towns and villages situated along the route of the transmission line. There may be an increased demand for rented accommodation, meals and so on. There may also be some opportunities for linkages, such as the provision of food to the caterers at the construction camps, sale of clothing for workers, maintenance of vehicles and so on.

- **Improvements to the road network.** In some cases there will be a need to improve or construct access roads leading to the RoW of the transmission line. These roads can be used by other traffic and will improve the transport network in the project area. However, negative secondary impacts may also arise from improved access, disturbance of birds at nesting times or illegal logging.

Other potential negative impacts during construction include an increase in road traffic and an increased risk of road accidents, noise, dust and perhaps traffic fumes, which could create conflict between local people and outside workers. Most of these impacts can be avoided or at least significantly mitigated if the consultation process is maintained and the concerns of local people are properly addressed during the detailed planning of the construction programme. These mitigation measures will be explicitly addressed in the tender documents, monitoring procedures and environmental management plan. The grievance procedures will also allow NPC Ukrenergo to identify any unforeseen problems as they arise.

- **Road traffic and risk of accidents.** The project will increase the movement of heavy traffic on roads near the route of the transmission lines. This will include movements of excavators and bulldozers, cranes and other lifting gear, trucks carrying building materials for the towers and the cables, and buses or minibuses carrying workers to and from the construction sites. The negative impacts of this traffic flow can be reduced by selecting specific access roads to the route of the transmission line and avoiding or by-passing the built-up areas of villages and towns and especially avoiding routes that pass in front of schools, old people's

homes or hospitals. The access routes – especially for oversized or hazardous loads – will be determined in coordination with the local authorities and will be binding on the contractor/s and sub-contractor/s. This can be enforced by putting up signs to show the selected route and/or the roads where access is prohibited. The impacts can also be reduced by restricting traffic to certain hours, for instance from 8.00am to 10.00pm and/or by prohibiting heavy traffic on minor roads outside daylight hours. The risk of road accidents can be reduced through strict enforcement of the health and safety policy (particularly in regard to vehicle maintenance), speed limits and the code of conduct, especially in regard to the consumption of alcohol or drugs (see below).

- **Noise, dust and traffic fumes.** The main problems during construction relate to the traffic movements and possibly pile driving in some areas for construction of the foundations of towers. As noted above, the worst impacts on the local population can be avoided by ensuring traffic is restricted to specific, clearly-defined access roads and by limiting traffic movements outside normal working hours. Dust may be a problem in some areas during the summer months, especially where heavy traffic is moving along dirt roads. It can be controlled by using water spraying from bowsers – although this may make the roads slippery and perhaps more dangerous for light vehicles. Controls on noise, dust and traffic fumes have to be addressed in the tender documents.

- **Presence of an outside workforce.** There is a potential for conflict if much of the workforce is brought from outside and is housed in a temporary construction camp or camps near the work sites. Typical problems include disputes with local people and possibly the presence of bars and prostitutes, leading to a risk of fights, accidents, increase in sexually transmitted diseases and so on

  The construction of the transmission line is not concentrated in a single place but is continually moving from one site to another. Since the work requires four or five separate teams on each front and a number of fronts may be working simultaneously, it is expected that the contractor/s will bring the workers to the construction sites on a daily basis, bussing them in from the nearest towns or villages. In this case the workforce is less likely to have a negative impact on villages along the route of the transmission line; indeed many of the less specialised workers could be hired locally and would live at home.

  It is essential that the presence of an outside workforce does not adversely affect local people and strict “code of conduct” will be applied that will cover public health and safety issues along with respect for the environment and respect for local people. An outline “code of conduct” is presented in 9.1.3. The application of a “code of conduct” will be contractually binding and will be described in the tender documents and included in the contract drawn up between NPC Ukrenergo and the main contractor.

8.2.4 Permanent Land Take and Restriction of Use

The areas of that land required for the transmission towers are relatively small: 620m² for the tension towers and 140m² for the suspension towers. The ratio of tension to

suspension towers is about 1:8. One estimate gives a total of 1312 towers: comprising 160 tension and angle-tension towers and 1152 intermediate support towers. This would give a total land take of just over 26 hectares for all the towers (10 hectares for the tension towers and 16.3 hectares for the suspension towers). As the areas required are relatively small and since the line will not pass through the built-up areas of any villages, the impact of the permanent land-take will be minor and is unlikely to have any significant effect on the productive capacity or earning potential of people living in the project area.

It is recommended that people do not work for more than 1.5-3 hours at a time under the cables – which normally would hang at a minimum of 12.5m above the ground. In fact, where the cables cross areas of arable land they will be raised to 16m. This would reduce the likelihood of any effects from EMF and would allow people to work under the cables for 3-8 hours at a time. The main concerns relating to the easement are:

- Much of the line crosses areas of forest. Most forest and forest land belongs to the State Forestry Department. The forest will have to be cut to the height determined in the maintenance regulations for power lines. In terms of the purely social impacts (i.e. as opposed to environmental or aesthetic impacts) this will not be very significant and in fact may generate some additional employment as the forest will have to be cut back on a regular basis.

- The main concerns in relation to land acquisition and the easements have been raised in Makariv District, where land is being developed and converted from agricultural to other uses. Apparently changes in land use can be authorised by the State Land Use Agency at the Raion level. Satellite towns are growing in the district and people from Kyiv have been buying land to build weekend cottages and in some cases for industrial development.

  Although at present the sale of land has been suspended as a result of the moratorium, it appears people are still acquiring and disposing of land under irregular arrangements in the expectation that the moratorium will be lifted by January 2008 or before. At the public hearings it was clear that there is an expectation that land values will rise and landowners are demanding compensation for the easements and the payment of “market value” for the land needed for the towers.

  It should be noted that since there is really no formal market for land it would be difficult to ascertain the “market value” of the land needed for the towers. Since the Constitution of Ukraine does not allow for the expropriation of land against an owner’s will, people in Makariv District have been arguing that NPC Ukrenergo must negotiate the acquisition of all plots on a willing buyer-willing seller basis. There is also an expectation that the “market value” should take into account the potential increase in the value of the land once the sale of land is legalised.

8.2.5 Public Safety

It is useful to distinguish public health and safety issues during construction from the long-term public health and safety issues related to the transmission line. The main issues

during construction relate to the potential for road accidents and security at the construction sites.

- The increased risk of road accidents due to an increase in heavy traffic is discussed above in section 8.2.3. It should be noted that normally there is very little traffic in rural villages in Rivne and Zhytomyr Oblasts. This accentuates the risk, firstly because children and others are not used to traffic and secondly because people in rural areas often use animal traction – especially horse-drawn carts. The contractor/s can reduce the risk of accidents first by instilling a health and safety focused working culture among all the drivers and other employees – i.e. they will be obliged to drive slowly in village areas, respect horse-drawn transport and not frighten the horses by using their horns or revving their engines to hurry them along. Second, there may be opportunities to organise road safety classes in local schools in order to instil greater awareness of the potential hazards of road traffic among pupils.

- The other issue that needs to be considered is security at the construction sites. The security requirements differ from most construction projects as the project involves about 1312 separate building sites that will be worked in four phases: viz. laying the foundations, assembling the tower, erecting the towers and hanging the cables. Adequate security will be provided during construction at all the sites: where appropriate temporary fencing will be provided to prevent livestock straying onto the sites and to prevent children playing there. During construction of the foundations and assembly of the towers it will probably be necessary to have a watchman at the site to prevent people and animals from entering the site and to discourage the pilfering of materials. The watchmen or security guards will have adequate training in dealing with the situations that are likely to arise. In particular they must be trained not to overreact to minor incidents.

The long-term issues include the risk of people trying to steal materials or climb the towers, the risk of the towers collapsing and possible impacts of the electrical and magnetic fields (EMF) on the health of people living near to the transmission lines.

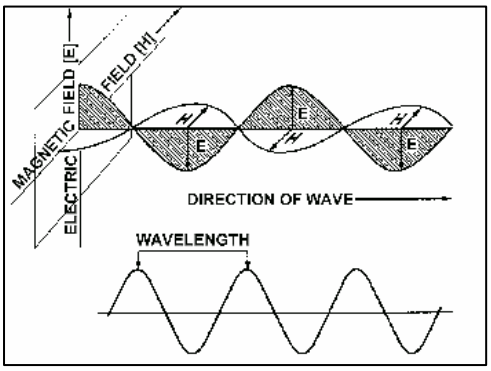
- Apparently in other parts of Ukraine there have been cases where people have been killed trying to steal cables from transmission lines to sell as scrap. This can be discouraged by presenting regular information programmes in the villages situated along the route of the transmission line. The information could be provided through posters and leaflets – distributed in schools and other public buildings – and could be backed up with short radio or TV “spots”.

- The nuts and bolts used in the construction of transmission towers are also prone to theft, and this can in turn lead to the toppling or collapse of the towers. To prevent this all the nuts are welded to the bolts in the towers.

The transmission companies have contingency plans to deal with the collapse of towers, for instance due to exceptionally high winds, icing and/or trees falling across the line as well as possible acts of vandalism.

8.2.6 Public health & Electromagnetic fields (EMF)

During the past 20 years the public has become increasingly concerned about potential adverse health effects of exposure to electric and magnetic fields. With transmission lines, these effecrs occur at extremely low frequencies.



Electromagnetic fields consist of electric (E) and magnetic (H) waves travelling together, as shown in the diagram[12]. They travel at the speed of light and are characterised by a frequency and a wavelength. The frequency is simply the number of oscillations in the wave per unit time, measured in units of Hertz or cycles per second. The wavelength is the distance travelled by the wave in one oscillation (or cycle).

With transmission lines, the wavelengths in air are very long (6000 km at 50 Hz) and, for practical purposes, the electric and magnetic fields act independently of one another and can be measured separately.

Electric fields effectively arise from voltage and are measured in kilovolt per metre (kV/m). Anything that is connected to an electrical outlet, even if the device is not switched on, will have an associated electric field that is proportional to the voltage of the source to which it is connected. Electric fields are strongest close to the device. The strength of the field diminishes with distance and is shielded by materials such as wood and metal. WHO report that the available evidence suggests that, the effects of exposures of up to 20 kV/m are generally few and innocuous. Low frequency electric fields have not been shown to have any effect on reproduction or development in animals at strengths over 100 kV/m.

Magnetic fields arise from current and their strength is usually expressed as corresponding magnetic induction in units of tesla, (T), millitesla (mT). There is little confirmed experimental evidence that low frequency EMF can affect human physiology and behaviour at field strengths found in the home or environment. WHO report that exposure of volunteers for several hours to low frequency EMF fields up to 5 mT had little effect on a number of clinical and physiological tests, including blood changes, ECG, heart rate, blood pressure, and body temperature.

Some epidemiological studies have determined a tentative link with a doubling of childhood leukaemia, a rare disease affecting 4 out of 100,000 children[13]. These studies are still ongoing. There is no evidence to link EMF with other cancers.

Ukrainian requirements in relation to EMF are generally stricter than those of Western European countries and impacts of EMF are regulated by the "State Sanitary Norms and

[12] Courtesy of World Health Organisation (1998) Factsheet 205
http://www.who.int/mediacentre/factsheets/fs205/en/

[13] WHO (2001) Factsheet 263 http://www.who.int/mediacentre/factsheets/fs263/en/

Rules for Protection of Population from Impacts of Electromagnetic Fields" approved by the Order of the Minister of Health N 239 of 01 August 1996.

Section 2 of these "Norms..." regulates impacts of electric field of industrial frequency. The "Norms..." should be used when transmission lines are designed and operated. They apply to people who work in the area near the transmission lines or other facilities, which create electric fields. Compliance monitoring is the responsibility of managers of organizations who organize such work and the State Sanitary-Epidemiological Service, which agrees design documents, sign operation permits and monitors operation of transmission lines and facilities.

The "Norms..." define maximum permissible levels of electric field (at the height 1.8 m) which vary depending on the type of area and are shown in

Area	Intensity, kV/m
In buildings	0.5
Territory of settlements	1
Vegetable gardens and orchards	5
Roads of categories 1-4	10
Territory accessible for people, agricultural land	15
Hard to access areas, inaccessible areas protected by fences	20

Table 8.6 Maximum permissible electric fields

Sanitary-protection zones (SPZ) are established to protect population from impacts of electric fields. For 750 kV transmission lines the width of SPZ is 40 m from the projection of outer cable on the ground. It is recommended that:

- Only crops that do not require manual labor are cultivated within the SPZ.
- Machinery on pneumatic tires should be grounded;
- If agricultural mechanisms do not have metal copes, they should be equipped with special protective screens;
- Young people under 18 should not work in the SPZ.
- Personnel employed for maintenance of power lines should raise awareness of population regarding safe behavior near power lines. If any works are planned in sanitary-protection zone or near power lines, personnel responsible for labor safety should provide necessary briefing for involved workers.

For new power lines which are designed or being constructed, the distance from the axis of 750 kV transmission line to the boundary of settlement should not be less than 250 m.

In some cases this distance could be reduced to the SPZ if additional measures are taken to reduce the intensity of electric field (pp. 2.5.3 - 2.5.4 of "Norms...").

For the sake of comparison, electric and magnetic fields underneath overhead transmission lines may be as high as 12 kV/m and 30 μT respectively. Within industry, workers around generating stations and substations, are subjected to electric fields up to 16 kV/m and magnetic fields up to 270 μT. Workers within generating stations and substations experience electric fields in excess of 25 kV/m and magnetic fields in excess of 2 mT. Welders can be subjected to magnetic field exposures as high as 130 mT, whilst magnetic fields near induction furnaces and industrial electrolytic cells can be as high as 50 mT.

8.3 Environmental impacts and mitigation

8.3.1 Impacts on natural reserves

Dibrova: The line will cross part of the site. According to the foresters from the responsible Forestry Enterprise this will not cause significant impacts as, apparently, the forest is already managed and harvested even inside the reserve. The forest service has already planned to use the clearings that will be created either as plantations of Christmas trees or else as a tree nursery. The reserve has been established as a possibly suitable habitat for beavers. Nevertheless the current design of the line is not anticipated to cause problems with the species since the beaver population has been greatly reduced during the last 20 years to a degree that is possible that has left the site. In any case the possibly more suitable places for the species' reproduction are not located near the line but in a different part of the reserve.

Kostantinovskiy - The outer border of the line's safety zone is adjacent to the stand and it is possible that 2-3 spruce trees will have to be cut down.

Vovcha gora - In general the transmission line is not expected to cause negative impacts on either the reserve or the wider area around it. However based on the fact that the lake is used as a migration stop-over for different waterfowl and in order to minimise any possible disturbance, it is proposed that construction is not carried out during migration and nesting season (approximately middle March – middle June). Additional to the avian-safe construction of the towers, the power lines in this part of the project are properly insulated. Alternatively, a monitoring programme will be implemented for two migration periods to verify possible problems.

Teresyny - In its current design the transmission line lies at exactly the outer border of the reserve. The line is designed to follow the existing clearing but taking into consideration the required clearing and the sanitation zone around the line, the current proposal will cause the cutting of trees. At this northern part of the reserve the forest consists mainly of oak trees. As a result it will have a negative impact on the protected area. At Teresyny the line will be shifted towards the north so as not to touch and impact the reserve and its buffer zone. The area northern of the reserve consists of forestry plantations and mixed forests managed for timber production. As such they are already subject to clearings that consequently can be used as plant nurseries to maintain the vegetation cover.

Area near Teljachiiy mokh 1 & 2 and Yemylchynsk district - This wider area is characterised by the presence of many small streams and marsh areas. The line is not expected to cause any direct negative impacts as it mainly crosses forest plantations and mixed forests managed and cut for timber production.

8.3.2 Impacts on biodiversity

While the route only passes through commercial woodlands and avoids natural forests, large areas will be affected as 122km of the 350km route (35%) passes through woodland. The impact will be reduced where possible by using the space as a nursery for new trees. Where possible, the branches from felled trees will be finely chopped and used as mulch for the new plants. It is quite possible that there could be an overall increase in biodiversity from this type of management, as it will encourage the growth of small reptiles and mammals that are a good food source for birds of prey. Similarly, some young trees that are too small to use for timber, will be left in place to rot naturally. This provides a good home for insects and helps to promote overall biodiversity.

8.3.3 Loss of habitats

Apart from the abovementioned cases of direct habitat loss in natural reserves, the transmission line will not cause significant habitat loss. As regards to habitat homogeneity and continuance, the clearings that will be created for the needs of the transmission line (including access roads) while wider and stretching to a long and continuous line, they will still be similar to the ones resulting from the current clear-felling forestry practises. As a result, and provided that the mentioned small alterations are made to the proposed route, the created clearances will not cause significant loss of habitats or significant additional disturbance to local fauna.

The improper disposal of excavation material is another factor that may have significant impact on habitat both in terms of area and ofquality. This is especially important in the case of Polissia, that is water-logged and very humid sites and parts of the forest. Improper practises and dumping alters the composition of the soils, their ability to withhold and drain water, and finally causes changes in vegetation cover and flora. As a result they are not expected to have any impact on species composition and population numbers. In general the measures proposed for the geological impacts are suitable to maintain habitat qualities as well.

8.3.4 Impacts from construction, clearance, disturbance

Works during the construction phase (use of access roads, excavations and improper deposition of excavation material, human presence) are expected to cause some increased annoyance and disturbance. This applies especially to construction carried out during the reproduction period of important bird species. Birds may abandon their nests if disturbed or disturbance may result in very low reproductive success.

Apart from birds, the majority of the other fauna species encountered in the area are relatively common and tolerant to human presence. Rare species have already been obliged to withdraw in more isolated and inaccessible sites and are not considered to be threatened by the project, especially if the activities are not carried out during spring (to also accommodate the needs of birds).

Once constructed, the transmission line is not expected to cause any impacts greater than the ones already caused by the current general harvesting and commercial deforestations, provided that some vegetation (including trees) will continue to exist in at least parts of the line route

8.3.5 Impacts from operation / birds

The transmission line will go close to Polissye northward W-E migration corridor. Thus, it might impact species on migration such as geese and Mallard. Additionally it is expected to affect the existing nesting populations of *Grus grus*, *Ciconia nigra*, *Tetrao urogallus*, *Lyrurus tetrix*, and birds of prey (in particular *Aquila clanga*, *Circaetus gallicus*, etc.).

Depending on the type of construction used transmission towers, power lines and power poles may cause fatal injuries to birds. This is particularly true for large birds such as the White Stork and Black Stork *(Ciconia ciconia, Ciconia nigra)* and raptors. In general though, high voltage power lines are considered relatively avian safe.

Electrocution can occur when a bird completes an electric circuit by simultaneously touching two energized parts or an energized part and a grounded part of the electrical equipment. Most electrocutions occur on medium-voltage distribution lines. Energized hardware, such as transformers, can be especially hazardous, even to small birds, as they contain numerous, closely-spaced energized parts. Avian death can occur either by short – circuit (a bird's wings bridge the gap between energized wires with different voltages and electricity flows through its body causing severe and often fatal burns and paralysis) or by ground-fault that occur bird's body itself or nesting material spans the gap between a wire and a grounded part. Because dry feathers act as insulation, contact must be made between fleshy parts, such as the wrists, feet, or other skin, for electrocution to occur. In spite of the best efforts to minimize avian electrocutions, some degree of mortality may always occur due to influences that cannot be controlled, e.g. weather.

Factors that influence collision risk can be divided into three categories: species specific, related to the environment, and related to the configuration and location of lines. Species-related factors include habitat use, body size, flight behaviour, age, sex, and flocking behaviour. Heavy-bodied, less agile birds or birds within large flocks may lack the ability to quickly negotiate obstacles, making them more likely to collide with overhead lines. Likewise, inexperienced birds as well as those distracted by territorial or courtship activities may collide with lines. Environmental factors influencing collision risk include the effects of weather and time of day on line visibility, surrounding land use practices that may attract birds, and human activities that may flush birds into lines. Line-related factors influencing collision risk include the configuration and location of the line with respect to other structures or topographic features. Collisions often occur with the overhead static wire, which may be less visible than the other wires due to its smaller diameter.

Some towers may be preferred by birds as they may provide considerable elevation above the surrounding terrain, thereby offering a wide field of view. Identification and modification of these "advantage" structures may greatly reduce or minimize the electrocution risk on an entire line. However, the route crosses a quite homogeneous terrain and in this case there is no apparent advantage of some towers over others.

8.3.6 Geomorphology, geological structures, soil

Significant changes in the relief during the transmission line construction are not expected. Some local changes may take place close to the sites of towers locations as a result of earth-moving works.

Landscape change will be most noticeable at places of forest devastation. According to the design calculations the cutting area during the transmission line construction totals 827 ha, from which:

- Rivne region – 525 ha:
- Zhytomyr region – 222 ha;
- Kyiv region – 80 ha;

Impacts to the upper geologic layers and soil will take place at the locations of transmission towers installation, as the structure of layers may be disturbed during the excavation for the foundations and the backfilling. In addition, the construction of temporary access roads to the places of towers installation and sites for their assembly and erection will require earth works that may also impact on geological structures.

During the construction process the contamination of ground surface is possible at places of construction and installation works, at construction bases (storage places for building materials, machinery, mechanisms and at places where building workers will temporary live), along the temporary roads. Soil contamination may take place during preparatory works and carrying out of geological survey, clearing of the route, etc.

In order to address these potential impacts, the top layer of fertile soil is to be removed during construction works and stored. Lands recultivation and restoration will be carried out after works implementation. In addition, after completion of construction all the temporary roads and embankments will be decommissioned, lands will be recultivated and the micro relief reproduced.

8.3.7 Impacts on groundwater / surface water

The major part of the transmission line route is characterized by rather high groundwater level. As a consequence, the construction of the transmission line at some places may have impact to the aquifer.

In specific, changes in infiltration of the ground layer may take place at the locations where the towers will be installed as a result of the earth works related to tower foundations. In addition, direct ingress of contaminants into the aquifer is possible during the construction process, during foundations assembly and piling in particular. The significance of such impacts is expected to be small, limited to the area adjacent to the line towers.

Temporary contamination of surface water with runoffs from construction sites may also take place during the construction of the transmission line. Contaminants may comprise:

- soil particles (turbidity);

- fuel leaks;
- paints and solvents;
- construction waste and domestic garbage.

Similar impacts but at a lower scale may also occur during transmission line inspection and maintenance.

The contamination of surface and groundwaters will be avoided through the application of best practice during construction and operation of the line, including the management of subcontractors.

8.3.8 Archaeological finds

Despite the fact that reasonable precaution measures have been taken during the transmission line route planning not to interfere with sites of archaeological or cultural importance, there is a chance that archaeological finds come up during construction activities.

The costruction contractor will be required to have management plans in place to ensure that such finds are approapriately handled. This will include appropriate training of the workforce, and suitable procedures to assess the importance of finds and notify the relevant authorities.

8.3.9 Aesthetics

The transmission line route crosses a rather flat terrain with an elevation between 150 and 250 m over the almost 350 km of total length. In those segments of the route where the line crosses forest areas the visibility of towers and cables is reduced and so is the visual impact to local inhabitants and visitors. This is not the case, however, in non-forest areas, where the line may be visible from long distances.

Effort has been put during the route design to mitigate visual impacts as far as possible, through:

- Routing the line away from inhabited areas (the closest settlement is over 250 m away)
- Avoiding angle towers that are far more noticeable
- Running alongside other infrastructure (i.e. highways, transmission lines)
- Routing the line close to the edge of forest plots in order to conceive the lines in the dark background

Consultation was also carried out with the the regional administrations (inspections) of the cultural heritage protection as well as the local councils in order to identify and avoid potential impacts to buildings, monuments or sites of local cultural significance.

8.3.10 Noise

The audible noise associated with overhead transmission lines is due to the corona effect. Corona is the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. In a small volume near the surface of the conductors, energy and heat are dissipated. Part of this energy is in the form of small local pressure changes that result in audible noise.

Corona generated audible noise can be characterized as a hissing, crackling sound that, under certain conditions, is accompanied by a 120-Hz hum. Corona-generated audible noise is of concern primarily for transmission lines operating at voltages of 345 kV and higher during bad weather.

The conductors of high-voltage transmission lines are designed to be corona-free under ideal conditions. However, protrusions on the conductor surface—particularly water droplets on or dripping off the conductors—cause electric fields near the conductor surface to exceed corona onset levels, and corona occurs. Therefore, audible noise from transmission lines is generally a bad-weather (wet-conductor) phenomenon. Wet conductors can occur during periods of rain, fog, snow, or icing.

During bad weather, noise levels as high as 70 dB(A) have been observed at distances as much as 100 m from the conductors. Sound levels associated with common noise sources are given below (adapted from USDOE, 1996).

Sound Level, dBA	Noise Source or Effect
128	Threshold of pain
108	Rock-and-roll band
80	Truck at 50 ft.
70	Gas lawnmower at 100 ft.
60	Normal conversation indoors
50	Moderate rainfall on foliage
49	Edge of proposed 500-kV right-of-way during rain (no parallel lines)
40	Refrigerator
25	Bedroom at night
0	Hearing threshold

Noise levels reduce rapidly with distance from the source. Noise emissions associated with the Corona effect, even in bad weather conditions, will comply with national standards (acceptable level of night time noise less than 45 dB(A), day time less than 55 db(A) at the closest house) with the closest house being at least 250 m away.

8.4 Cumulative impacts

Transmission lines generate very little pollution during operation and the main cumulative impacts arise from their physical presence. This is a linear project that covers 352 km and and the main cumulative impacts arise from the interaction with other transmission lines and highways

Such cumulative visual impacts may be generated through the provisions of The Land Code of Ukraine, which requires that infrastructure developments such as power transmission lines and communication lines should follow the routes of roads and highways, i. e. in those regions, where the aesthetical value has already been reduced by the existing objects. These provisions have to be balanced with the guidelines in Holford rules – the international best practice principles for managing the visual impact of the transmission lines – which warn against the creation of a “wirescape” when different transmission systems converge.

Thus a balance also has to be struck with running the transmission lines along other infrastructure corridors in compliance with the provisions of the Land Code of Ukraine and avoiding the creation of cumulative visual impacts. The route design has led to situations as the ones shown below, where the transmission line runs in parallel and at close distance to existing infrastructure:

- 80 km in parallel with highway A-255 “Kyiv – Kovel” at the distance less that 2 km
- 47 km in parallel with existing 110 kV TL at the distance less that 1 km

A further complication stems from the fact that the Rivne NPP – Kyiv and Khmelnytsk NPP – Kyiv transmission lines, after their junction in Zhytomyr region, run in parallel for over 100 km at a distance between 75 and 200 m. It happens that at crossings with other transmission lines, closeby settlements are almost enclosed between lines, as shown in **Figure 8.3** overleaf.

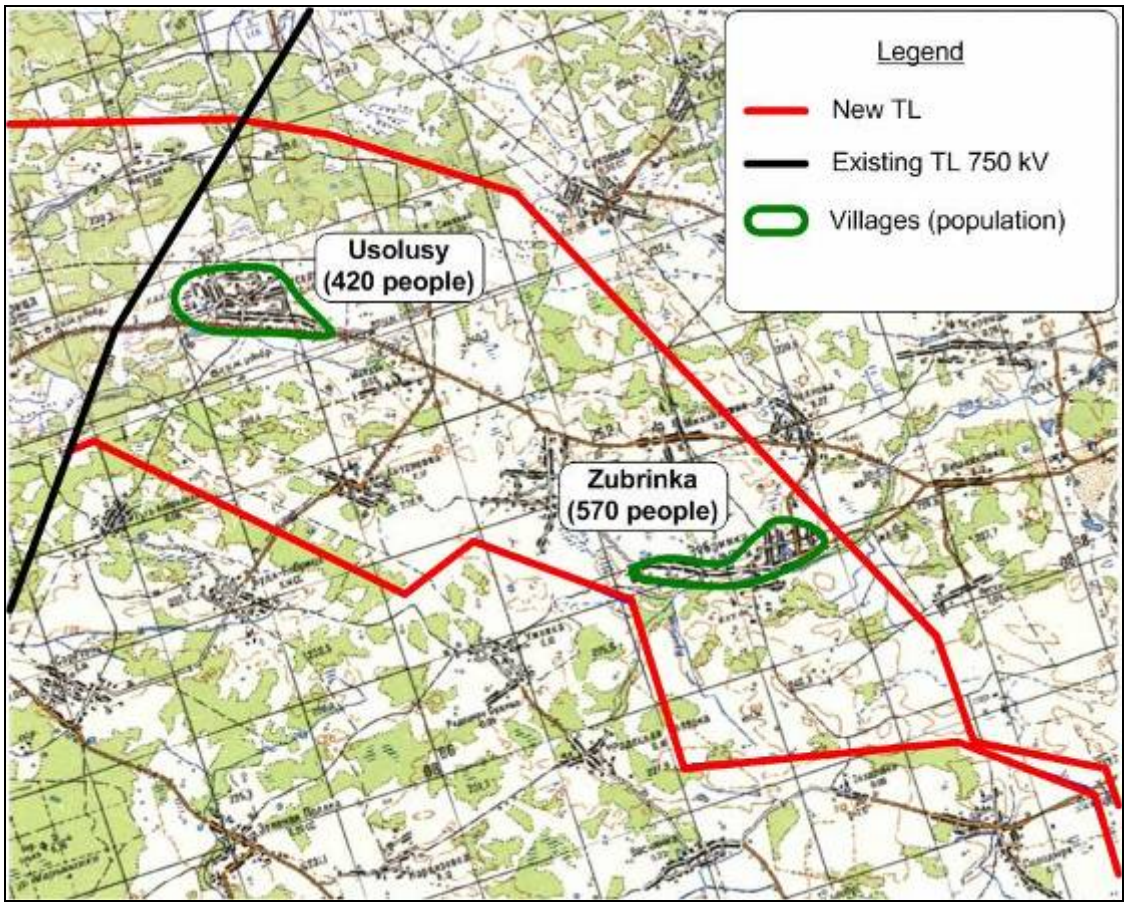


Figure 8.3 Wirescape surrounding two small villages

9. Environmental & social management and monitoring plan (ESMMP)

9.1 Introduction

The success of any environmental and social impact assessment (ESIA) depends upon the implementation of the recommended mitigation measures within a management plan. This chapter provides an overview of how the mitigation measures proposed during the impact assessment will be implemented and monitored to verify that they are in place and working efficiently.

The construction of the line will be carried out by a contractor, so the chapter is divided into two halves: NPC Ukrenergo's direct responsibilities and indirect management of the construction phase through the construction contractor.

NPC Ukrenergo will use elements of an environmental management system (EMS) to demonstrate that the environmental impacts of the project are being effectively managed and controlled through:

- Using a structured process to identify the significant environmental aspects;
- Using the impact assessment process to assess environmental impacts;
- Identifying mitigation measures to reduce the impacts to an acceptable level;
- Using appropriate Key Performance Indicators or audits to demonstrate that effective mitigation measures are in place.

The impact register, mitigation measures and detailed management plan are shown in the Appendix 11.3. These elements have been put together as a database and will be used to record the results of monitoring activities.

The impact assessment is based on the expected approach to construction, but this may be changed by the contractor. Any major changes to the expected approach will be subjected to a Change Control Process mediated by NPC Ukrenergo, in which the ESIA process will be applied to identify and assess any new environmental aspects and impacts. Appropriate mitigation measures will then be developed to reduce the risks to a level that is As Low As Reasonably Practicable. The impacts register and management plan will then be updated to reflect the new circumstances.

9.2 Direct responsibilities

9.2.1 Communication

The public consultation meetings during the ESIA process are the beginning of a dialogue with the public and stakeholders that will continue though the life of the project.

Good communication with affected communities is an essential part of efficiently implementing many mitigation measures that have been identified during the ESIA process. NPC Ukrenergo has good links within the affected areas and these will be used

to ensure that all relevant information, including an explanation of legal rights, is passed on to those who will be directly affected. The links established with affected communities will be carried forward into the construction phase when Contractor will inform the people about the timetable for starting construction works in particular districts and regions.

Monitoring: NPC Ukrenergo will make sure that a copy of the Non -Technical summary is available for inspection by the public at all the Village Councils that will be affected by the project and the full ESIA will be made available at all affected Raion and Oblast administrative offices.

9.2.2 Grievance Procedures

The NPC Ukrenergo grievance procedure is set out in the Public Consultation & Disclosure Plan (PCDP) and it is designed to allow people in the affected area to formally register any complaints about any part of the proposed project.

Another form called “Questionnaire for Receiving Comments Concerning Public Discussion of the Project Documentation” is also available in the PCDP to encourage more general feedback, expression of areas of concern and requests for information.

NPC Ukrenergo will respond to all complaints received within a period of 30 days. All the complaints will be logged on a database along with the results and outcome of the investigation. A summary of this log will be available to the Bank Lenders and will also be open to public inspection, with personal details removed to protect privacy. Provision will also be made with the construction contractor to provide a rapid response procedure to address issues that require immediate attention.

Monitoring: NPC Ukrenergo will conduct an internal monitoring programme to check that the 30 day response time to grievances is being met and that the complaints database is being maintained and is available for public inspection.

9.2.3 Environmental management

Whilst the RoW does not pass through any ancient or environmentally sensitive woodland, the amount of affected commercial woodland is extensive. There is an opportunity to provide additional biodiversity by making use of the cleared part of the RoW for as a tree nursery. This could be for commercial exploitation (Christmas trees), replacing trees that have been harvested in other parts of the woodland or as a conservation area with a view to using species that will not grow too large. In these cases, there are opportunities for increasing biodiversity by providing suitable habitats for reptile species and so increase food availability for birds of prey.

Where possible, NPC Ukrenergo will create further improvements in biodiversity by ensuring that all slashed material and unwanted branches from trees felled in the preparation of the RoW are mechanically chopped up into fine material and used as a mulch to improve the fertility of the nursery area. This also avoids additional pollution and transport disposal costs.

NPC Ukrenergo will discuss these opportunities with the State Forestry Committee of Ukraine and local State Forest Enterprises. Monitoring will take place at the same time as

routine monitoring for maintenance requirements during the construction and operations phases.

The management of the RoW will be audited at least once during construction, and after the commisioning of the line the RoW it will be audited in accordance with existing maintenance procedures.

Monitoring: A year after commissioning the project NPC Ukrenergo in partnership with local ornithological organisations will review the impact of the line on bird mortality due to collisions and will implement any mitigation measures that may required.

9.2.4 Health, Safety & Emergency Response

The health impacts of EMF are still very much a matter of research and the results of new research will be passed on to affected communities as it becomes available. The current practice of annualy sending a safety recommendation brochure to enterprises working the land in the RoW and informing people about health and safety risks through the local newspapers and radio will be continued. NPC Ukrenergo will look at opportunities to extend this education by offering briefing packages on EMF and safety issues to village councils. Key health issues are general information on EMF, the status of current research, safe exposure times for adults working beneath the lines and that children should be kept away from the sanitary protection zone altogether.

The safety information will highlight the risks from climbing the towers and in particular, the risk of electrocution from trying to steal the transmission wires. There are also risks of weakening the tower itself from stealing nuts and bolts. The design stipulates that all nuts and bolts below the 10m level will be welded.

Accidental events like breakage of wires and toppling of towers in extreme weather are rare, but do occur from time to time and people near the transmission lines will be advised of what to do in accordance with NPC Ukrenergo's emergency response procedures.

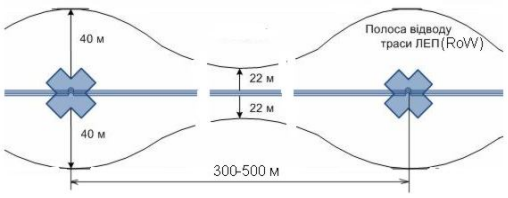
Monitoring: Every year, there will be at least one article or advertisement placed in local radio and newspapers providing information on health and safety risks.

9.2.5 Land Acquisition & Compensation

The criteria for compensation for land and crops affected by the transmission line are summarized in **Table 9.1** below.

People & Institutions Affected	Compensation		
	Land acquisition for the towers	**Restrictions of use of land in the RoW***	**Land used during construction**
1. Private owners working their own land	Cash compensation for withdrawal of land or the option of an alternative plot from the village or raion land reserve according to the decision of the local authorities	The easement contract will be signed between NPC Ukrenergo and the land owner. Subject to restrictions on use of land and must allow access to the power line. The only compensation is for actual damage & loss of earnings during repairs or maintenance	Compensation for damage to crops & infrastructure and/or loss of earnings
2. Private owners that are renting their land to others or who are not using the land	Cash compensation for the transfer of ownership or the option of an alternative plot	The easement contract will be signed between NPC Ukrenergo and the land owner. Subject to restrictions of use and must allow access to TL. Compensation for damages will be paid to the land user	Compensation for damages will be paid to the land user
3. Entrepreneurs working on village reserve lands	The Village Council or raion administration can provide alternative plots of equivalent size and quality from the village reserve	Subject to restrictions on use and entrepreneurs must allow access. Entrepreneurs will be compensated for any damages that occur during repairs and maintenance	Farmers will be compensated for damage to crops and other assets. With sufficient advance warning farmers can be offered alternative plots from the village reserve

* Picture of the RoW



People & Institutions Affected	Compensation		
	Land acquisition for the towers	**Restrictions of use of land in the RoW***	**Land used during construction**
4. Agribusiness and other entrepreneurs working on land belonging to other owners	Landowners will receive compensation	Subject to restrictions on use of land plots and the users must allow access to TL. The enterprises and entrepreneurs will be compensated for any damage to crops or loss of earnings	Compensation for damage to crops and other assets and for loss of earnings
5. Village councils which hold the land within and outside the village boundaries	Compensation will be paid to the budgets of Village Council, raion and oblast administration for the land transferred for use by NPC Ukrenergo	The Village/raion Council will sign the easement contract with NPC Ukrenergo and the users will be subject to restrictions on use and must allow access to TL. The land users will be compensated for damages	The land users will be compensated for damages
6. State forest land	Compensation will be paid in accordance with the legislation in force at the time the land is withdrawn	The State Raion Administration will sign the easement contract and users of land will be subject to restrictions on use of land plots. The State Forest authority will be compensated for initial and for further regular forest clearance in the protection zone of the TL.	Compensation for losses or other damages will be paid to the State Forest Authority

Table 9.1 Compensation for land and crops

A sanitary protection zone will be established and will extend 40 m from the projection of the outer cables. In the sanitary protection zone restrictions on the use of land will apply, but no compensation will be paid for the restriction on use.

NPC Ukrenergo will maintain a database of the affected landowners and land users with a description of the area/plot affected, size of the area affected, ownership, land use, the valuation of damages and amount due to be paid or paid. This will allow NPC Ukrenergo, the district authorities and the Village Councils to follow the progress of the compensation procedures on a day to day basis.

NPC Ukrenergo will confirm that the final route will not have any buildings within 250m of the axis of the new 750kV transmission line. Only one family has needed to be resettled and the details of the resettlement process will be recorded in the land acquisition database.

Monitoring: The maintenance of the database will be audited by NPC Ukrenergo staff at least once during the construction process and will be available for external audit if required, with appropriate controls in place to protect confidential details of individuals.

9.3 Supervision of the construction contractor

Carrying out an ESIA before the awarding the construction impacts provides an opportunity to include mitigation measures for the construction phase in the Invitation To Tender (ITT) for the construction contract. Companies wishing to tender will then make provision for implementing these mitigation measures in their proposals. The tenders will be required to demonstrate how these mitigation measures will be put into effect as part of their technical proposal. The contractor will also be required to provide the affected Village Councils with timely updates of the proposed schedule of work. The contractor will also develop a rapid response procedure at the Village Council offices that will allow people living in the affected to contact the contractor when any incidents occur or complaints arise that require the contractor's immediate attention.

The following is a list of management plans and indicative objectives that the contractor will be required to address in the tender. NPC Ukrenergo will then use Key Performance Indicators and an audit programme during the construction programme to demonstrate the management plans are working that these objectives are being met.

In their technical proposals in response to the invitation to tender the contractors will have to demonstrate their detailed knowledge of Ukrainian environmental, health, safety and labour legislation and will demonstrate how this will be implemented to ensure compliance with Ukrainian laws and standards.

A key element of implementing these requirements will be appropriate training of staff and ensuring that national requirements are well communicated among all staff and subcontractors. For instance as part of the induction courses the contractor will include, among others, the following information:

- Environmental regulations and standards
- Waste management
- Health and safety standards and requirements, including the requirements for personal health and safety equipment etc.
- Rules of conduct for all employees and sub-contractors
- Traffic management rules
- Procedures for dealing with archaeological finds
- Emergency response to any accident or incident

The induction courses will be supported with practical guidelines and visual aids at construction sites to address these issues. The contractor will inform NPC Ukrenergo of any non-compliance incidents relating to any of the above.

9.3.1 Environment

9.3.1.1 Management of wetlands

The RoW passes through a number of wetlands and there is a risk of vehicle activity causing a lot of damage very quickly by tearing up the wet ground. The risk of damage to wetland areas will be made clear to the construction contractors to minimise impact through:

- Only accessing these areas when the ground is firm – either in winter, using the ice or in summer when the ground has dried out;
- Using temporary plank-road (logs, branches etc.) wherever necessary.

9.3.1.2 Re-instatement and bio-restoration

All construction sites and new or improved access roads will be restored with the aim of recreating their original condition, unless there are good reasons for doing otherwise (e.g. Foresters want to keep a new access road. Typical requirements include:

- Minimising disturbance / footprints in the detailed design process;
- Soil management and erosion control, so that topsoil is segregated and preserved, the structure of excavated soil is preserved and there are no soil losses through erosion;
- Bio-restoration – native seeds of seedlings will be used where possible to recreate the original vegetation of the disturbed ground.

Monitoring: The contractor will gather and record photographic evidence for each tower foundation and major change to access roads before and after construction. This will be backed up with visual inspections of selected sites by NPC Ukrenergo.

9.3.1.3 Nesting seasons

To avoid disturbing full-grown birds and their offsprings during a nesting period some areas along the RoW will need protection. For example, Vovcha Gora is a migration stop-over for waterfawl. Protected areas (*zakaznyky)* Teresyn, Teliachiy Mokh-2 and Tokiv Mokh are known as sanctuaries for populations of rare and common bird species.

After the final approval of the route of the transmission line, the construction contractor will have to avoid construction activities in these areas during nesting season.

9.3.1.4 Waste management

The contractor will develop waste management measures in compliance with Ukrainian legislation that will include arrangements for the disposal of hazardous and non-hazardous waste through a licensed waste disposal contractor. This will also include:

- Avoid refuelling on site to prevent oil spills. If this is not possible procedures will be developed to avoid accidental spillage, like the provision of drip trays and bunding of fuel stores
- Responsible disposal of liquid effluents like sewage from temporary accommodation and lavatories

9.3.2 Safety & Emergency response

The contractor will develop and implement a safety and emergency response measures which comply with Ukrainian health and safety legislation and will ensure that qualified staff are available to implement and supervise the health and safety procedures. The contractor will keep records of all accidents and breaches of safety norms and procedures and will notify NPC Ukrenergo of all incidents. Any fatalities will be reported to NPC Ukrenergo within 24 hours.

Monitoring: Contractor will provide annual reports on accidents statistics and breaches of safety norms and procedures.

9.3.3 Security

Storage sites and temporary construction sites at the tower bases will be secured to prevent accidents to third parties or intrusion by livestock or wildlife. Details will be provided in the contractors' technical proposals on the security measures that will be implemented, including the training of watchmen.

9.3.4 Traffic management and operations

Construction activities will increase traffic in the area and this can be a serious safety risk (most construction related fatalities involve pedestrians), as well as potentially causing nuisance and disruption. Where required in accordance with Ukrainian legislation the contractor will consult and agree with the Village Councils and the traffic police at Raion level on measures to manage vehicle movements. This will address:

- Vehicle size and axle loads;
- Vehicle emissions;
- Training and qualifications of drivers;
- Induction training, including courtesy to other road users, especially pedestrians and horse drawn traffic;
- General speed limits.

Together with rayon authorities and village councils of villages, located along or near the route of the transmission line, if necessary, will be developed and approved local traffic management plans. In these plans, the following issues will be addressed:

- Development, future maintenance and reinstatement of areas used for any new access roads that may be needed to access the right of way or to move heavy loads;

- Maintenance and repairs, if required, to existing roads
- Selection of preferred routes to the construction sites. Identification of above ground buildings or monuments that may be at risk from the movement of heavy vehicles;
- Timing of traffic movements to avoid school opening / closing, markets etc;
- Control of noise, control of dust and other potential sources of nuisance.

9.3.5 Archaeological finds

All construction workers will be trained to comply with Ukrainian legislation and norms to deal with any archaeological or unexpected finds that are discovered during construction.

9.3.6 Management of construction workforce

The contractor will have to obey rules of conduct, based on national legislation and internationally accepted best practice to reduce the risk of accidents to workers and the public, to avoid impacts on the environment and to ensure good relations with people affected by the construction project.

The rules of conduct will be explained to all workers as part of their induction, along with the occupational health and safety procedures. The rules will be binding on all employees and sub-contractors, whatever their rank or occupation. Indicative issues include the following:

- A ban on consumption of alcohol anywhere on site.
- Respect wildlife and respect the country and forestry rules of conduct
- Do not light fires – other than as required for specific tasks – while working for the company (or similar measure to prevent forest fires).
- Do not leave litter anywhere on or off the worksite. Leave the worksite in as good or better condition than when you found it.

9.3.7 Measures to encourage local employment.

Much of the construction work, like the erection of towers and the stringing of transmission lines can only be carried out by specialists. However there will be opportunities for development of the local economy by employing local people in less skilled tasks and general labouring. Similarly, there will be opportunities to contract out other goods and services like accommodation and catering. The contractor will be required to advertise suitable job opportunities in the local press in the Raions affected by the project.

Monitoring: The contractor will keep a record of the number of people hired from the affected districts and upon completion of the construction works will submit to NPC Ukrenergo a report on the use of local resources and local workforce.

A summary of the mitigation measures and objectives that will be undertaken by NPC Ukrenergo and the construction contractor is shown below.

Commitment	Performance Objectives
A copy of the Non-Technical summary is available for inspection by the public in the affected Village Councils and the full ESIA in all affected raion and oblast administration offices	Documents distributed to all affected Village Councils, Raion and Oblast administrative offices
A complaints database is maintained and a consolidated summary is available for inspection by the public. Grievances are responded to within 30 days	Complaints and grievances are addressed adequately and in a timely manner
One article or advertisement placed in local radio, TV and newspapers each year providing information on health and safety risks	Raise and maintain awareness of public health issues related to the project
The environmental management of land in the right of way will be audited at least once during construction	Maximise biodiversity in the forested areas that have been cleared for the right of way. Reduce damage to wetlands and sensitive areas
Meeting with ornithologists to assess the risk of bird mortality from collision with the transmission and earthing lines after one year of commissioning the line	Assess risks and possible requirements for additional mitigation measures
Database of land owners / users affected by land acquisition	Ensure the land acquisition process is adequately documented

Table 9.2 NPC Ukrenergo mitigation measures and objectives

Commitment	Performance Objectives
Construction operations schedules provided to village and raion councils	Timely information allows land users to plan agricultural activities in advance
Environmental restoration of construction sites and removal of waste	Document restoration of the sites used for construction
Compliance with national safety management, emergency response legislation and rules of conduct	Safe operation, avoid risks to workers and general public
Security at construction sites	Avoidance of risks to public, livestock and wildlife
Compliance with national legislation and norms in relation to archaeological and unexpected finds	Prevent damage to cultural heritage sites
Compliance with national legislation and norms for traffic management and noise levels.	Avoid accidents and nuisance to people at risk
Advertisement of job opportunities in local press and recording numbers of jobs given to local people	Maximise potential local employment opportunities from the project

Table 9.3 Construction contractor mitigation measures and objectives

10. Public consultation

10.1 Route definition

As part of the preparation of OVNS, NPC Ukrenergo undertook preliminary discussions with local authorities and environmental and cultural institutes in each region and district along the proposed transmission line route. The aim of these discussions was to establish the environmental, socio-economic, cultural, landscape and tourism sensitivities and determine the optimum route for the transmission line. Among the consultees were the State Regional and District Administrations, District Environmental Inspections, Regional and District Sanitary and Epidemiological Services, State Forestry Management Departments in each region, State Forestry in each district, State Regional and District Inspections on Protection of Cultural Heritage, State Regional and District Departments on Urban Development, Architecture and Infrastructure Development.

A map with the provisional routing was delivered to local Committees of Nature Protection and to the organization "Heritage" for archaeological review to help with the optimisation of the route and avoid crossing or passing close by settlements, water, nature reserves & places of historical value.

This type of statutory consultation started in 2004 and it can be considered to be on-going. During this period the project was also advertised in local media.

10.2 Public Consultation and Disclosure Plan

The Public Consultation and Disclosure Plan (PCDP) was initiated in December 2006 and prepared in line with EBRD Consultation and Disclosure Requirements and the requirements of Ukrainian legislation. It provides an analysis of the principal stakeholder groups, identifies channels of communication and describes the approach to public consultation and disclosure that will be used throughout the project.

The PCDP was released on February 12, 2007, through the webpage of NPC Ukrenergo (http://www.ukrenergo.energy.gov.ua/ukrenergo/control/en/publish), in both English and Ukrainian languages. In the PCDP, the following stakeholder groups were identified as being relevant to the project:

- EBRD and EIB representatives;
- NPC Ukrenergo;
- State authorities and local government administrations in regions, districts and population centers the territories of which are crossed by the transmission line route;
- Territorial Administrations of the Ministry of Environmental Protection and the Ministry of Health Protection of Ukraine – Regional Environment and Natural Resources Administrations, district Environmental Inspections and Sanitary and Epidemiological Services;

- Land owners and land users on the area crossed by the transmission line route;
- Population of the villages adjacent to the route of the transmission line;
- Mass media;
- Non Governmental Organisations.

10.3 ESIA scoping

In the framework of ESIA scoping and in line with the provisions of the PCDP, a number of scoping meetings were held. The scoping meetings took place in the period 19 – 23 February 2007 in the regional and district centres of the territories affected by the project, i.e. Kuznetsovsk, Zhytomyr, Makariv and Kyiv.

Invitations to the meetings, accompanied by a package of documents including the project summary and the PCDP, were sent to the local authorities and regulatory control authorities, environmental NGOs, the press and a number of design institutes involved in the project in each region and district of the transmission line route. Details of the meetings, such as the venues and time, were published in local newspapers: Visti Rivnenschyny (on 16th February 2007), Zhytomyrschyna (on 15th February 2007) and Makarivski visti (on 17th February 2007).

The agenda of the scoping meetings comprised short presentations by NPC Ukrenergo and NPC Ukrenergo consultants, and ample time for the audience to take the floor and raise issues of concern or request clarifications on particular project aspects.

A significant number of people actually attended the meetings. Information relevant to the audience of the meetings is provided in the following table.

	Kuznetsovsk	**Zhytomyr**	**Makariv**	**Kyiv**
Total number of people	62	81	55	22
From which:				
State Authorities	29	48	24	
Organisations, Institutes	10	5	12	
Media	7	9		
NGOs	3	3		7
Public			3	

Table 10.1 Attendance to scoping meetings

The issues raised at the meetings can be broadly divided into four categories:

v) compensation issues;

vi) construction impacts;

vii) other potential risks, impacts and issues; and

viii) procedural issues

A Protocol of the scoping meetings was produced, which provided a comprehensive reference to the issues that were raised during the meetings and the responses given. The Protocol, still under review, is available through the web page of NPC Ukrenergo.

In general, the meetings have been successful in providing an opportunity to local people to obtain first-hand information about the project and raise any concerns or comments about issues that they felt should be addressed in the ESIA. However, at the Kyiv meeting (February 23, 2007) concern was expressed by NGOs that there had been insufficient time to make suitable preparation for the meetings and that some interested parties were unable to attend. It was agreed to have another meeting in Kyiv to give the NGOs adequate time to study the project documentation and come supplied with a deeper knowledge and a better informed position on the project.

The additional meeting took place on April 3, 2007, at EBRD offices in Kyiv. In total, invitations were sent to 29 NGOs from which 9 attended the meeting. Prior to the meeting, CDs with information related to the project, including the Project Summary, the PCDP, maps of the proposed route and environmental sensitivity maps were distributed to the NGOs. The same material was also placed at the NPC Ukrenergo website.

The issues raised during the scoping meetings and the way they were dealt with are presented in Appendix 11.4.

10.4 Disclosure of ESIA and public hearings

Upon its release, scheduled for end of May, the draft ESIA report will be published at NPC Ukrenergo and EBRD websites for a period of 120 days. At the same time, hard copies of the draft ESIA will be available for the public to review and comment at the Rivne and Zhytomyr regional state administrations, district state administrations along the transmission line route, at the city council of Kuznetsovsk.

Copies of the non-technical summary of the draft ESIA will be available at the village councils of the villages located close to the proposed route.

Public hearings are planned to be held in July 2007 for two weeks. During the hearings stakeholders including the public will be invited to comment on the draft ESIA or raise any other issues considered relevant. The invitations to take part to the public hearings will be published on NPC Ukrenergo web-site and distributed by July 2, together with the schedule of the meetings including venues, dates and time.

Indicative locations for the public hearings are the following:

- Rivne region – Sarny, Rafalivka, and Rokytne;
- Zhytomyr region – Olevsk, Yemilchyne, Volodar-Volynsk, Chernyakhiv, and Radomyshl;
- Kyiv region – Makariv.

The dates and time for holding the public hearings will be determined later. The notifications about the consultations will be made by publications in the local newspapers and by announcements over radio. Additional expenses for renting transportation means will be provided in order to give the opportunity from people in villages to attend the hearings.

Upon completion of the consultation period, NPC Ukrenergo will process and integrate the results of the consultation and the public hearings into the present document to produce the final ESIA.

11. Appendix I: Data and tables

11.1 Comparison of Ukrainian and international standards on ESIA

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
- General requirement for an ESIA in projects which are likely to have a significant effect on the environment. - Categorization of projects according to their negative impact on environment	EU Council Directive (85/337/EEC) Articles 1-2 EU Council Directive 97/11/EC Annex I, World Bank Group (IFC) OP/BP 4.01 -Environmental Assessment (Section, 1, 4-8) Sections 14 -16 of the EBRD Environmental Policy (2003) IFC Operational Policies – Environmental Assessment (Section 8) Section 2.3.1 of EBRD Environmental Procedures	Articles 26, 51 of the law "On environmental protection" Article 13 and 34 of the law "On environmental expertise" Decree of the Cabinet of Ministers No.554, July 27, 1995 DBN A.2.2-1-2003 (Section 1.7 and Annex E)	Environmental impact assessment is a compulsory component for any industrial project that potentially might have an environmental impact. Compulsory OVNS in Ukraine is foreseen only for the objects referred to the category of highly hazardous objects. High voltage power transmission lines are not on the list of highly hazardous objects established by the CMU Decree No. 554.27.07, 1995. The EU Council Directive (97/11/EC, Article 4 (1) Annex 1 (20) high voltage overhead electrical power transmission lines to the objects that require ESIA. Section 21 of Annex 1 of the EBRD Environmental policy also refers these projects to Category A, which require comprehensive ESIA.
- Environmental issues should be at the very early stages of project development (due to precautionary nature of environmental policies).	EU Council Directive (85/337/EEC) Articles 2, 8 Section 4 of the EBRD Environmental Policy (2003)	Law "On environmental protection" Article 26. The law " On Environmental Expertise", Article 39 Law "On environmental	No investment/construction project in Ukraine can be implemented without positive conclusion of the state environmental expertise that is based on the materials prepared within OVNS. OVNS is one of the earliest documents to be prepared and reviewed within any investment

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
- ESIA should be built into the procedure for obtaining consent of governments or IFIs financing. - Possibility to reject a project on environmental grounds		protection", Article 51	project documentation in Ukraine.
- Information disclosure and public consultations - Environmental issues to be identified and addressed at each stage of the ESIA	UNECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention)-1998. Sections 11, 26 and Annex 2 of the EBRD Environmental Policy Article 6 of the EU Council Directive (85/337/EEC)	Constitution of Ukraine (Article 50) The law of Ukraine No. 832-XIV dated July 6, 1999 on ratification of the UNECE Convention on Access to Information (Aarhus). The laws of Ukraine " On information" (02.10.1992,.№ 2657), "On Environmental Protection", "On State Environmental Expertise" (Article 10), "On associations of citizens"(16.06.1992, № 2460-12) "On local self-governance"	The public access to the environmental information (including materials of OVNS and SEE) is guaranteed by many legislative acts, supported by data filing systems and registers of the central and local authorities. Article 6 of the law "On environmental protection" Sections 1.6 -1.10 of the DBN A.2.2-1-2003 envisage participation of public in the decision-making process for deployment of industrial objects that might have an impact on the environment.

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
		(21.05.1997 № 280/97), "On requests of citizens" (02.10.1996, № 393/96) "On planning and construction in territories" Regulation on participation of public in decision-making process for environmental protection (by Order No 168 of the Ministry for Environmental Protection	
- ESIA conclusions are legally binding for project implementation	Section 25 of the EBRD Environmental Policy (2003)	The law " On Environmental Expertise", Article 39 DBN A.2.2-1-2003	The legally binding document for the Ukrainian projects is he Statement on Environmental Consequences of the Industrial Operations approved by comprehensive state environmental expertise. The Ukrainian legislation provides for two documents 1) the Statement of Intentions (as a conceptual document) and 2) the Statement on Ecologic Consequences of the Industrial Operations (a legally binding document) it is subject to approval by the state and monitoring during the project cycle.
Structure of ESIA			
Standardized approach to ESIA,	World Bank OP/BP 4.01-	Chapter 7 of the law "On	The environmental assessment in Ukraine is regulated specifically by the national standard DBN

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
its contents and procedures	Environmental Assessment. IFC Operational Policies – Environmental Assessment EBRD Environmental Policy	environmental protection” DBN A.2.2-1-2003 DSTU (State Standard) ISO-14001-97	A.2.2-1-2003. This act also specifically refers To particular legislative acts, regulations, industrial standards for architecture, materials, fire safety, health, soil, flora and fauna protection, and for operation of power transmission lines and equipment. Ukraine is a member of ISO International Organization since 2004 and standards of environmental project management are also effective in Ukraine.
ESIA Contents	Article 3 of the EU Council Directive (85/337/EEC) Sections 2-3 of the World Bank OP/BP 4.01 Annex B IFC Operational Policies (Environmental Assessment)	DBN A.2.2-1-2003 (Sections 2-3)	The Ukrainian OVNS standards require assessment of all those issues that are addressed under the international standards. The comprehensive OVNS is compulsory only in projects for construction of highly hazardous objects but the Ukrainian legal regime does not preclude project developers from doing it in projects that are to be financed through IFIs. The OVNS materials according to DBN A.2.2-1-2003 should include details concerning the following aspects: - Motivation and legal requirements for OVNS in the particular project; - Physical and geographic characteristics of the landscape along the route of the power transmission

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
			line; - Description of the objects under construction and general description of the project; - assessment of project's impact on the climate, air, geography, water soils, flora and fauna etc. - assessment of social impacts produced by the project; - assessment of project's impact on technological and industrial environment; - comprehensive plan for ensuring all safety aspects and viability of the natural resources in accordance with the requirements of the legislation; - assessment of temporary impacts during the construction period.
Institutional framework in ESIA			
- Capacity to implement ESIA and prepare reports, monitor implementation of ESIA conclusions; - Availability of guidance methodology for ESIA	EBRD Environmental Policy (Section IV)	The law " On Environmental Expertise", Article 9, DBN A.2.2-1-2003 (section 1.5)	The Ukrainian legal regime provides for a comprehensive system of environmental management and control on all levels of state power. The review of environmental information and monitoring exist within industrial sectors, corporations according to the regulatory requirements. The legislation also provides for existence and right of public organizations, NGOs.

General Principles	International good practice standards and EU rules	Ukrainian legislation	Comments
			Qualifications of the ESIA experts are confirmed by state certificates. There exist consultative bodies made up of the environmental experts, representatives of NGOs and public institutions, under the governmental and local administrations. The Ministry for Environmental Protection of Ukraine has multiple functions as the principal managing authority in the sphere of environmental protection, it coordinates activities of state authorities involved in the assessment of environmental impacts, its provides normative and methodological recommendations and facilitates environmental awareness and training programmes, interacts with NGOs and associations of citizens.

11.2 Scoping Checklist

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, etc)?				
1.1	Permanent or temporary change in land use, landcover or topography including increases in intensity of land use?	Yes	Construction and maintenance. Establishment of sanitary protection zone to protect from EM fields.	Yes. Large areas permanently affected. Forestry, management of agricultural land.
1.2	Clearance of existing land, vegetation and buildings?	Yes	Cutting down trees along a "sanitary" zone of TL. Access during construction and maintenance.	Yes – anticipate felling of trees in forest areas
1.3	Creation of new land uses?	Yes	Access roads, restrictions of use under Transmission lines, tower bases	Yes – potential 2y impacts from increased access such as illegal logging
1.4	Pre-construction investigations eg boreholes, soil testing?	Yes	Drilling waste from geotechnical evaluation of tower foundations	No – insignificant amounts of material generated
1.5	Construction works?	Yes	Temporary land use	No – small footprint low likelihood of permanent damage
1.6	Demolition works?	No	None anticipated	
1.7	Temporary sites used for construction works or housing of construction workers?	Yes	Temporary land use	Yes – mitigation required to ensure appropriate waste disposal and refurbishment of sites
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations?	Yes	Transmission Line towers	Yes – extensive visual impact, construction impacts
1.9	Underground works including mining or tunnelling?	No	None anticipated	
1.10	Reclamation works?	No	None anticipated	
1.11	Dredging?	No	None anticipated	
1.12	Coastal structures *eg* seawalls, piers?	No	None anticipated	
1.13	Offshore structures?	No	None anticipated	
1.14	Production and manufacturing processes?	No	None anticipated	
1.15	Facilities for storage of goods or materials?	Yes	Short term storage of construction materials	Yes- creation of temporary laydown areas
1.16	Facilities for treatment or disposal of solid wastes or liquid effluents?			
1.17	Facilities for long term housing of operational workers?	No	None anticipated	
1.18	New road, rail or sea traffic during construction or operation?	Yes	Access roads	Yes – land take, 2y impacts from access
1.19	New road, rail, air, waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?		No planned permanent creation of access roads	Yes – land take, 2y impacts from access

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1.20	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	None anticipated	
1.21	New or diverted transmission lines or pipelines?	Yes	Construct two 750 kV TL with total length of 488 km, among them 108 km of parallel routing	Yes – permanent changes to land use
1.22	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	No	None anticipated	
1.23	Stream crossings?	TBA	Access roads?	
1.24	Abstraction or transfers of water from ground or surface waters?	No	None anticipated	
1.25	Changes in waterbodies or the land surface affecting drainage or run-off?	No	None anticipated	
1.26	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Construction traffic	Yes – damage to roads, buidlings, safety risk, air emissions
1.27	Long term dismantling or decommissioning or restoration works?	No	None anticipated	
1.28	Ongoing activity during decommissioning which could have an impact on the environment?	Yes	Decommissioning at the end of design life	Yes – access, decommissioning activities, waste disposal
1.29	Influx of people to an area in either temporarily or permanently?	Yes	Workers during construction	Yes – potential social impacts both -ve (Sexually Transmitted Diseases) and +ve, generate short term business
1.30	Introduction of alien species?	No	None anticipated	
1.31	Loss of native species or genetic diversity?	No	National and internationally areas of environmental sensitivity are avoided	
1.32	Any other actions?	No	None anticipated	
2. Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply?				
2.1	Land especially undeveloped or agricultural land?	Yes	Change of land use, establishment of SPZ	Yes, large area with permanent changes
2.2	Water?	No	None anticipated	
2.3	Minerals?	Yes	Tower and wire construction	No – relatively insignificant consumption
2.4	Aggregates?	Yes	Tower foundations, road construction	No – relatively insignificant consumption
2.5	Forests and timber?	Yes	Tree felling to make RoW and SPZ	Yes – large areas potentially affected
2.6	Energy including electricity and fuels?	Yes	Electricity and fuel for construction activity. +ve benefits from improved use of resources	Yes – +ve impacts from energy savings, reduced overall carbon footprint from utilisation of NPP

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
2.7	Any other resources?	Yes	Cooing oil in transformers	Yes – accidental spills avoid use of PCBs, impact and health risks of PCB replcements
3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?				
3.1	Will the project involve use of substances or materials which are hazardous or toxic to human health or the environment (flora, fauna, water supplies)?	Yes	Cooing oil in transformers. Management of paint and	Yes – accidental spills avoid use of PCBs, impact and health risks of PCB replcements
		Yes	Managament of paint, solvents etc during construction and maintenance	Yes - requires appropriate handling and disposal
3.2	Will the project result in changes in occurrence of disease or affect disease vectors (eg insect or water borne diseases)?	Yes	Danger of sites disturbing sites that have been used to bury animals that have died from anthrax	Yes - issue raised in consultation and needs to be addressed as a potential risk
3.3	Will the project affect the welfare of people eg by changing living conditions?	Yes	Visual impact, restrictions on land use	Yes - high visual impact and potential loss of amenity value,
3.4	Are there especially vulnerable groups of people who could be affected by the project eg hospital patients, the elderly?	No	None anticipated	
3.5	Any other causes?	No	None anticipated	
4. Will the Project produce solid wastes during construction or operation or decommissioning?				
4.1	Spoil, overburden or mine wastes?	Yes	Material from foundations	Significant amounts [HOLD] How much?
4.2	Municipal waste (household and or commercial wastes)?	Yes	Waste generated from construction sites, maintenance including hazardous waste (painters, thinners etc)	Significant amounts
4.3	Hazardous or toxic wastes (including radioactive wastes)?	Yes	Disposal of used transformer cooling oils and maintenance products	Yes – disposal of significant amounts of toxic materials, paints
4.4	Other industrial process wastes?	No	None anticipated	
4.5	Surplus product?	No	None anticipated	
4.6	Sewage sludge or other sludges from effluent treatment?	Yes	Temporary construction camps	Yes - significant amounts
4.7	Construction or demolition wastes?	Yes	Tower construction, packaging	[HOLD]
4.8	Redundant machinery or equipment?	Yes	Towers, wires, insulators etc	Large amounts
4.9	Contaminated soils or other material?	No	None anticipated	
4.10	Agricultural wastes?	No	None anticipated	
4.11	Any other solid wastes?	No	None anticipated	
5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?				
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources?	Yes	Helicopter / road transport emissions during construction	Yes – quantities judged to be significant

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
5.2	Emissions from production processes?	Yes	Ozone, NOx generated from corona effect	Potentially signifiacant at high voltages
5.3	Emissions from materials handling including storage or transport?	Yes	Helicopter / road transport emissions during construction	Yes – quantities judged to be significant
5.4	Emissions from construction activities including plant and equipment?	Yes	Helicopter / road transport emissions during construction	Yes – quantities judged to be significant
5.5	Dust or odours from handling of materials including construction materials, sewage and waste?	Yes	Construction traffic	Dust, air emissions
5.6	Emissions from incineration of waste?	No	None anticipated	
5.7	Emissions from burning of waste in open air (*eg* slash material, construction debris)?	Yes		
5.8	Emissions from any other sources?			
6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?				
6.1	From operation of equipment eg engines, ventilation plant, crushers?	Yes	Certain weather conditions can cause small flashes on TL	No – judged to be insignificant
		Yes	Transmission lines produce noise under certain meteorological and transmission system conditions caused by “corona” effect.	Yes – though outside of the “sanitary” zone this noise won’t be noticeable, within the “sanitary” zone its influence will be temporary due to restriction on duration of stay in this zone
6.2	From industrial or similar processes?	No	None anticipated	
6.3	From construction or demolition?	Yes	Construction traffic	Yes – could be a local nuisance
6.4	From blasting or piling?	Yes	Piling operations	Significant noise
6.5	From construction or operational traffic?	Yes	Construction traffic	Noise
6.6	From lighting or cooling systems?	Yes	Heat generated from transformers, substations	No – judged to be insignificant – rapid dilution in ambient air
6.7	From sources of electromagnetic radiation (consider effects on nearby sensitive equipment as well as people)?	Yes	Electromagnetic radiation from TLs	Yes – requires establishment of SPZ
6.8	From any other sources?	No	None anticipated	
7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into sewers, surface waters, groundwater, coastal waters or the sea?				
7.1	From handling, storage, use or spillage of hazardous or toxic materials?	Yes	Waste generated from construction sites, spills from transformer oils	Yes – requires mitigation to prevent long term contamination
7.2	From discharge of sewage or other effluents (whether treated or untreated) to water or the land?	Yes	Subcontractors’ construction	Yes – requires mitigation to prevent contamination
7.3	By deposition of pollutants emitted to air, onto the land or into water?	No	None anticipated	

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
7.4	From any other sources?	No	None anticipated	
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	None anticipated	
8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?				
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous or toxic substances?	Yes	Overheating of transformers, electrical fires	Yes – large scale consequences from fire, land contamination
8.2	From events beyond the limits of normal environmental protection eg failure of pollution control systems?	No	None anticipated	
8.3	From any other causes?	Yes	Working at height, electrocution	Yes - accident statisitics
8.4	Could the project be affected by natural disasters causing environmental damage (*eg* floods, earthquakes, landslip, *etc*)?	Yes	Toppling of transmission towers	Yes – access for repairs, impacts from refurbishment
9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?				
9.1	Changes in population size, age, structure, social groups *etc*?	No	None anticipated	
9.2	By resettlement of people or demolition of homes or communities or community facilities eg schools, hospitals, social facilities?	Yes	One household requires resettlement. Land compensation	Yes – need to demonstrate best practice for fair compensation
9.3	Through in-migration of new residents or creation of new communities?	No	None anticipated	
9.4	By placing increased demands on local facilities or services eg housing, education, health?	No	None anticipated	
9.5	By creating jobs during construction or operation or causing the loss of jobs with effects on unemployment and the economy?	Yes	Potential +ve benefits to local economy	Yes – temporary increase in economy, construction jobs above baseline
9.6	Any other causes?	No	None anticipated	
Question - Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?				
9.1	Will the project lead to pressure for consequential development which could have significant impact on the environment eg more housing, new roads, new supporting industries or utilities, etc?	Yes	Improved energy supply to Kyiv allowing increased electricity consumption and industrial output	Yes – due to size of the project

No.	Questions to be considered in Scoping	Yes/No	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
9.2	Will the project lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment eg: · supporting infrastructure (roads, power supply, waste or waste water treatment, etc), housing, extracive industry, supply etc	Yes	Improved energy supply to Kyiv allowing increased electricity consumption and industrial output	Yes – due to size of the project
9.3	Will the project lead to after-use of the site which could have an impact on the environment?	No	None anticipated	
9.4	Will the project set a precedent for later developments?	No	None anticipated	
9.5	Will the project have cumulative effects due to proximity to other existing or planned projects with similar effects?	Yes	Cumulative – other transmission and distribution lines – visual effect doubles, so as limitations on agricultural land use	

11.3 Impact register

Note that impacts are all negative unless shown otherwise. Further information on what each column means is given in section 8.1.

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
A.01	All construction activities	Construction traffic	Reduction of property value	Potential damage to property	$	2	M	L	Traffic management. Use appropriate vehicles. Consultation	2	U	L
A.02	All construction activities	Construction traffic	Safety / health impact for the neighbouring population	Risk of accidents from increased traffic	S	4	P	H	Traffic management schemes in place.	3	M	M
A.03	All construction activities	Fuel or oil leaks	Contamination of soil / groundwater	Especially with the refuelling of construction machinery, generators etc	E	2	L	M	Temporary fuel stores should be lined and bunded. Use drip trays when refuelling.	2	M	L
A.04	All construction activities	Air emissions	Climate change, acidification	Air emissions from construction traffic, generators etc - little above baseline	E	2	M	L	Require contractor to use only equipment with compliant for air emissions	1	W	L
A.05	All construction activities	Solid waste generation and disposal	Contamination of soil / groundwater	Contamination from inappropriate waste disposal.	E	3	M	M	Require contractor to use dispose of waste in designated facilities	1	L	L
A.06	All construction activities	Solid waste generation and disposal	Contamination surface waters	Contamination from inappropriate waste disposal	E	3	M	M	Require contractor to use dispose of waste in designated facilities	1	L	L
A.07	All construction activities	Influx of labour	Increased income	Opportunity for increased goods and services. Potential resentment of lost opportunity	$	3	L	M	Require contractor to maximise local labour wherever possible	+2	W	M
A.08	All construction activities	Accidents and injuries	Safety / health impact for workers	Accidents arising from alcohol abuse, dangerous driving, firearms etc	H	3	M	M	Require contractor to follow Rules of Conduct	3	U	L
A.09	All construction activities	Theft	Loss of income	Theft of materials during construction	$	2	L	M	Provide security in vulnerable areas	2	M	L
A.10	All construction activities	Accidental damage to crops / land / property	Loss of income	Some damage may be unavoidable	$	2	L	M	Provide compensation	0	L	L
A.11	All construction activities	Accidents and injuries	Safety / health impact for the neighbouring population	Danger from children playing on construction sites	H	2	L	M	Hazardous areas should be protected / secured	2	M	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
A.12	All construction activities	Physical disturbance (noise, movement, dust)	Nuisance to neighbouring population, visitors	General activity associated with construction	S	2	W	M	Good communication with locals, implement Rules of Conduct	1	W	L
A.13	All construction activities	Noise	Nuisance to neighbouring population, visitors	General construction activities, piling, generators, welding, traffic, earthworks	S	1	W	L	Avoid unsociable hours	1	W	L
C.01	Create access roads	Cutting down trees, land clearance	Destruction / degradation of habitats	Unlikely to be required. No high value woodlands on the route.	E	2	P	M	Use existing cleared areas. Handover to local authority or re-instate on completion	1	W	L
C.02	Create access roads	Cutting down trees, land clearance	Loss of income	Unlikely to be required. No high value woodlands on the route.	$	2	P	M	Use existing cleared areas/roads. Handover to local authority or re-instate on completion	1	W	L
C.03	Create access roads	Change of land use	Increased access & secondary impacts	Unlikely to be required. Increased access routes may lead to new settlements, illegal logging, though forestry is well controlled	E	2	P	M	Handover to local authority or re-instate on completion	1	P	L
C.04	Create access roads	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Unlikely to be required. Churning up topsoil, creation of ruts, changes in topography	E	3	P	M	Install when dry / iced, use temporary plank-road (logs, branches etc.)	2	W	M
C.05	Create access roads	Solid waste generation and disposal	Climate change, acidification	Unlikely to be required. Disposal of slashed vegetation, branches - burn or mulch?	E	2	P	M	Chop into small pieces & use as a mulch. Leave some small trees to rot	+1	W	L
C.06	Create access roads	Above ground cultural heritage sites	Loss or damage to cultural heritage	Unlikely to be required. Vibration damage to cultural heritage sites or dwellings from oversized vehicles	$	3	P	M	Avoid using vehicles that will create more vibration that baseline conditions. If unavoidable, carry out baseline surveys on potential sites and risk assessment on all potential routes	2	M	L
C.07	Create access roads	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Unlikely to be required. Temporary disturbance - could adversely affect nesting birds.	E	2	P	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training	1	W	L
C.08	Create access roads	Cutting down trees, land clearance	Changes in biodiversity	Unlikely to be required. No high value woodlands on the route. Risk of habitat islandisation.	E	2	P	M	Handover to local authority or re-instate on completion	1	W	L
D.01	Prepare line corridor	Solid waste generation and disposal	Climate change, acidification	Disposal of slashed vegetation, branches - burn or mulch?	E	1	W	L	Chop into small pieces & use as a mulch. Leave some small trees to rot	+1	W	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
D.02	Prepare line corridor	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Churning up topsoil, creation of ruts, changes in topography	E	3	W	H	Install when dry / iced, use temporary plank-road (logs, branches etc.)	2	W	M
D.03	Prepare line corridor	Cutting down trees, land clearance	Changes in biodiversity	No high value woodlands on the route, but areas affected are considerable - long term change in land use	E	2	W	M	Use cleared spaces for nursery areas, may improve conditions for certain species (reptiles, raptors)	+1	P	L
D.04	Prepare line corridor	Cutting down trees, land clearance	Destruction / degradation of habitats	No high value woodlands on the route, but areas affected are considerable - long term change in land use	E	3	W	H	Use cleared spaces for nursery areas	2	W	M
D.05	Prepare line corridor	Cutting down trees, land clearance	Loss of income	No high value woodlands on the route.	$	3	W	H	Compensation. Encourage use of cleared spaces for nursery areas	2	W	M
D.06	Prepare line corridor	Compaction of soil	Reduction of soil productivity	Impact of heavy machinery leading to long term damage	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
D.07	Prepare line corridor	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
D.08	Prepare line corridor	Cutting down trees, land clearance	Reduction of amenity value	Loss of woodlands, access to public often restricted	S	2	L	M	Reduce visual impact, use cleared spaces for nursery areas	1	W	L
D.09	Prepare line corridor	Land acquisition / use	Resettlement of population	Only one household affected, but significant impact	S	2	W	M	Provide compensation	0	W	L
D.10	Prepare line corridor	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	E	2	L	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training in highly sensitive sites. Environmental awareness training	1	L	L
E.01	Prepare and construct tower foundations	Discharge of effluent / sewage	Impact on hydrological patterns	Pumping operations in wetlands	E	1	W	L	Use best practice to avoid impact	1	W	L
E.02	Prepare and construct tower foundations	Compaction of soil	Reduction of soil productivity	Impact of heavy machinery leading to long term damage	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
E.03	Prepare and construct tower foundations	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
E.04	Prepare and construct tower foundations	Change of land use	Death or illness from infectious disease	Danger of sites disturbing sites used to bury animals that died from anthrax	H	3	M	M	Liaise with authorities and consultees	3	U	L
E.05	Prepare and construct tower foundations	Physical disturbance (noise, movement, dust)	Changes in biodiversity	No high value woodlands on the route, small footprint compared with RoW long term change in land use	E	2	W	M	Keep footprint to a minimum	2	W	M
E.06	Prepare and construct tower foundations	Change of land use	Destruction / degradation of habitats	Permanent loss of approx 20 hectares of land of different types	E	2	W	M	Keep footprint to a minimum	E	2	W
E.07	Prepare and construct tower foundations	Solid waste generation and disposal	Impact to geomorphology (from soil and debris)	Careless disposal of soil from excavation of tower foundations	E	3	L	M	Ensure that there is an appropriate plan for disposal of soil	1	W	L
E.08	Prepare and construct tower foundations	Noise	Nuisance to neighbouring population, visitors	Piling operations for preparing foundations	S	2	W	M	Avoid unsociable hours	1	W	L
E.09	Prepare and construct tower foundations	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	E	2	L	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training in highly sensitive sites. Environmental awareness training	1	L	L
E.10	Prepare and construct tower foundations	Subterranean cultural heritage finds	Loss or damage to cultural heritage	Route avoids known sites, but excavations may reveal new finds	$	2	L	M	Archaeological finds procedure	1	L	L
F.01	Mobilisation / Demobilisation of temporary construction sites	Influx of labour	Safety / health impact for the neighbouring population	Potential increase in sexually transmitted diseases from migrant workers	H	3	M	M	Require contractors to follow Rules of Conduct. Education programs.	3	U	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
F.02	Mobilisation / Demobilisation of temporary construction sites	Influx of labour	Nuisance to neighbouring population, visitors	Short term social disruption from workers camps. See also construction activities	S	1	W	L	Require contractors to follow Rules of Conduct	1	W	L
F.03	Mobilisation / Demobilisation of temporary construction sites	Discharge of effluent / sewage	Contamination surface waters	From mobile construction camps, if used	E	2	W	M	Make provision for appropriate disposal	1	W	L
F.04	Mobilisation / Demobilisation of temporary construction sites	Change of land use	Loss of income	Temporary loss of land use	$	2	W	M	Make appropriate compensation	0	W	L
G.01	Install towers and cables	Accidents from working at height	Safety / health impact for workers	High potential for serious/fatal accidents, relatively short exposure time	S	3	M	M	Training programmes, supervision	3	U	L
G.02	Install towers and cables	Compaction of soil	Reduction of soil productivity	Impact of heavy machinery leading to long term damage	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
G.03	Install towers and cables	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
G.04	Install towers and cables	Change of land use	Loss of income	Temporary loss of land use	$	2	W	M	Make appropriate compensation	0	W	L
G.05	Install towers and cables	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Churning up topsoil, creation of ruts, changes in topography	E	3	W	H	Install when dry / iced, use temporary plank-road (logs, branches etc.)	2	W	M
G.06	Install towers and cables	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	E	2	L	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training	1	L	L
H.01	Operate the line	Accidents from electrocution	Safety / health impact for the neighbouring population	People have been electrocuted trying to steal the transmission wires for scrap value	H	3	P	M	Use barbed wire etc to make it difficult for people to climb towers	3	U	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
H.02	Operate the line	Change of land use	Loss of income	Loss of land use from restrictions from working under the wires	$	2	W	M	Raise heights of towers in valuable agricultural areas to lengthen working times	1	W	L
H.03	Operate the line	Creation of EMF	Safety / health impact for the neighbouring population	Prevent potential damage to health from restricting time from working under the wires	H	3	W	H	Provide guidance on exposure times - 4hr/day. Risk that advice may not be taken.	3	M	M
H.04	Operate the line	Improved transmission efficiency	Climate change, acidification	Improved transmission efficiency and reduction of power losses	E	2	W	M	Positive impact wrt Transmission power line emissions	+2	W	M
H.05	Operate the line	Physical presence of towers and cables	Mortality of birds	Collision risk & mortalities especially with endangered species	E	3	L	M	Monitor bird morality and install visual signs if required	3	U	L
H.06	Operate the line	Noise	Nuisance to neighbouring population, visitors	Corona effect	S	1	W	L	Mitigated by the design	1	W	L
H.07	Operate the line	Light pollution	Nuisance to neighbouring population, visitors	Corona effect producing flashes and sparks in certain conditions	S	2	W	M	Mitigated by the design	2	W	M
H.08	Operate the line	Creation of ozone, NOx	Safety / health impact for the neighbouring population	Corona effect can lead to the production of small amounts of ozone and NOx	H	1	W	L	Mitigated by the design	1	W	L
H.09	Operate the line	Failure of towers / loss of structural integrity	Safety / health impact for the neighbouring population	Toppling of transmission towers from storms or theft of bolts	H	2	L	M	Good design. Welding bolts to prevent theft.	2	M	P
H.10	Operate the line	Failure of wires	Safety / health impact for the neighbouring population	Risk from falling object, electrocution	H	3	P	M	Establish SPZ, education	3	U	L
H.11	Operate the line	Fire	Destruction / degradation of habitats	Fire arising from short circuits, bird nesting, wire failure etc	E	3	P	M	Effective emergency response procedures	1	M	L
H.12	Operate the line	Physical presence of towers and cables	Visual impact -> Reduction of property value	Property cannot be owned outright under Ukrainian legislation but this is expected to change soon	$	3	P	M	Consultation and careful routing of line. Resolve compensation issues	3	M	M
H.13	Operate the line	Above ground cultural heritage sites	Visual impact -> Reduction of amenity value	No impact expected on national monuments but possible concerns about sites of local interest	S	2	L	M	Consultation and careful routing of line	2	M	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
H.14	Operate the line	Physical presence of towers and cables	Visual impact -> Reduction of amenity value	Visual impact is highly emotive and subjective	S	3	W	H	Careful routing, consultation	2	W	M
H.15	Operate the line	Accidents from electrocution	Mortality of birds	Electrocution risk, nesting	E	2	L	M	Build nesting platforms as required	1	L	L
I.01	Maintain the line	Accidents from working at height	Safety / health impact for workers	High potential for serious/fatal accidents	S	3	P	M	Training programmes, supervision	3	P	M
I.02	Maintain the line	Solid waste generation and disposal	Contamination of soil / groundwater	Paints, packaging etc from maintenance activities	E	2	P	M	Training programmes, appropriate waste disposal	2	M	L
I.03	Maintain the line	Accidents from electrocution	Safety / health impact for workers	Electrocution risk	H	3	L	M	Training programmes	3	P	M
I.04	Maintain the line	Compaction of soil	Reduction of soil productivity	Impact of heavy machinery leading to long term damage	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
I.05	Maintain the line	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
I.06	Maintain the line	Creation of EMF	Safety / health impact for workers	Prevent potential damage to health from restricting time from working under the wires	H	3	W	H	Provide guidance on exposure times - 4hr/day. Risk that advice may not be taken.	3	M	M
I.07	Maintain the line	Accidental damage to crops / land / property	Loss of income	Some damage may be unavoidable in order to effect emergency repairs	$	2	L	M	Provide compensation	2	U	L
I.08	Maintain the line	Cutting down trees, land clearance	Increased income	Additional work maintaining the RoW in forested areas	$	2	W	M	Positive impact	+2	W	M
I.09	Maintain the line	Change of land use	Loss of income	Temporary loss of land use	$	2	W	M	Make appropriate compensation	0	W	L
I.10	Maintain the line	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Churning up topsoil, creation of ruts, changes in topography	E	3	W	H	Install when dry / iced, use temporary plank-road (logs, branches etc.)	2	W	M
I.11	Maintain the line	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	E	2	L	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training	1	L	L
I.12	Maintain the line	Solid waste generation and disposal	Climate change, acidification	Disposal of slashed vegetation, branches - burn or mulch?	E	1	W	L	Chop into small pieces & use as a mulch. Leave some small trees to rot	+1	W	L

No.	Activity	Aspect	Impact	Context	Type	C	F	Risk	Mitigation measures	C	F	Risk
K.01	De-commission and reinstatement	Accidents from working at height	Safety / health impact for workers	High potential for serious/fatal accidents, relatively short exposure time	S	3	M	M	Training programmes, supervision	3	U	L
K.02	De-commission and reinstatement	Compaction of soil	Reduction of soil productivity	Impact of heavy machinery leading to long term damage	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
K.03	De-commission and reinstatement	Compaction of soil	Impact on hydrological patterns	Impact of heavy machinery leading to long term damage, especially wetlands	E	2	P	M	Sensitive management by contractors, use of appropriate vehicles with low axle loads	1	P	L
K.04	De-commission and reinstatement	Change of land use	Loss of income	Temporary loss of land use	$	2	W	M	Make appropriate compensation	0	W	L
K.05	De-commission and reinstatement	Working in wetlands, soil disturbance	Changes in flora species (esp. in wetland areas)	Churning up topsoil, creation of ruts, changes in topography	E	3	W	H	Install when dry / iced, use temporary plank-road (logs, branches etc.)	2	W	M
K.06	De-commission and reinstatement	Solid waste generation and disposal	Visual impact -> Reduction of amenity value	Disposal of towers, wire etc at end of life	S	3	M	M	Implement responsible decommissioning programme. Re-use or recycle material where possible	0	W	L
K.07	De-commission and reinstatement	Physical disturbance (noise, movement, dust)	Disturbance of mammals / nesting birds	Temporary disturbance - could adversely affect nesting birds.	E	2	L	M	Avoid disturbing nesting areas late March to late June in highly sensitive sites. Environmental awareness training	1	L	L
K.08	Mobilisation / Demobilisation of temporary construction sites	Light pollution	Nuisance to neighbouring population, visitors	Light from temporary workers camps & construction sites	S	1	W	L	Consultation, sympathetic management	1	W	L

11.4 Consultation matrix

Issue	Meeting location	ESIA section	Comments
Crossing forest areas by the transmission line, cutting of trees	Kuznetsovsk, Kyiv	5.2.7, 7.7, 8.2.7	Forest areas are avoided to the extent possible, especially when they are designated as reserves of local importance. Forests crossed are managed forests and in such cases existing clearings are used to minimize tree cutting
Investigation of nature protected areas	Kyiv	5.2.7, 8.2.7	Reserves of national or local importance were investigated, in consultation with the Ministry of Environmental Protection – Dept of Reserve Management
Compensation for loss of land	Kuznetsovsk, Kyiv	4.7, 4.8	According to the Ukrainian Land Code, compensation will be paid for the land where the towers will be installed but not for the RoW.
Involving of local workforce to the construction process	Kuznetsovsk, Zhytomyr	8.2.3	There will be preference to using local workforce depending on the availability of skills required
Funds for development of infrastructure	Kuznetsovsk, Zhytomyr	8.2.3	Access roads may have to be constructed or improved to allow access to the RoW. Such infrastructure will be handed over to the local community for use
Resettlement	Kuznetsovsk	8.2.1	Only one family has to be resettled, in Rivne region, due to its proximity to the line route. There is ana agreement with NPC Ukrenergo to buy them a new house
Request to disclose all project material and involve NGOs to the ESIA process	Kuznetsovsk, Makariv, Kyiv	10.2, 10.4	Project information is disclosed according to the PCDP (available through NPC Ukrenergo website). The full ESIA will be posted on NPC Ukrenergo and EBRD websites for public consultation upon its release. NGOs are involved through dedicated NGO meetings and regular contacts by the ESIA team
Restrictions on land use	Kuznetsovsk	8.2.4, 8.2.6	According to Ukrainian standards, restrictions are imposed on the use of land within the Sanitary Protection Zone (40 m on each side of the line) due to electromagnetic fields.

Issue	Meeting location	ESIA section	Comments
Request as for providing legislative base	Kuznetsovsk	4	The current ESIA complies with Ukrainian DBN standards on environmental impact assessments, the environmental policy and procedures of EBRD and EIB, as well as the provisions of Aarhus Convention on the provision of environmental information to the public.
Impact on agricultural land, flora and fauna, aesthetic impact Mitigation measures	Kuznetsovsk, Kyiv	5.2.7 (description), 8.2.7 5.4.2, 8.2.9	The route was designed to avoid high-quality agricultural land. Impacts on flora and fauna have been an issue of specific focus within the ESIA, and where significant ones have been identified appropriate mitigation is proposed. Visual impacts were dealt with at design stage on the basis of international best practice
Towers protection – procedure, limitations	Kuznetsovsk	6.4.4, 9.3.3, 9.3.4	A safety management plan will be developed that will demonstrate how the contractor will manage the prevention of accidents and the recovery from accidents during construction. Security provisions will be also made to prevent accidents to third parties or intrusion by livestock or wildlife.
Compensation during maintenance	Kuznetsovsk	9.2.5	Compensation will be paid for actual damage or loss of earnings during maintenance and repair
Protection of communication lines	Zhytomyr	6.2, 7.7	The issue was considered during design - parallel running alongside communication cables was avoided except for small distances in order to avoid electrical interference.
Route options (direction and approvals)	Zhytomyr, Kyiv	4.1, 7.7	Project documentation at design stage was approved by the Cabinet of Ministers of Ukraine (Directive No.15-p on 22.01.2007). It included basically two routing alternatives.
Epidemiological burials	Zhytomyr	5.4.4	Contact was made with the Head of Veterinary Medicine Administration in Zhytomyr region, who pointed out areas where epidemiological burials were made.
Land acquisition process	Makariv	4.7.1	Only the land plots needed for the “footprint” of the towers

Issue	Meeting location	ESIA section	Comments
			will be acquired by NPC Ukrenergo
Special status of Kyiv oblast	Makariv	5.3.2	Due to its proximity to Kyiv, the value of land in Makariv raion is much higher than in Rivne or Zhytomyr oblast. In addition, Makariv raion was a testing ground for new land legislation and practices; reportedly, all land plots in Makariv raion already have owners and some of them changed hands several times before the moratorium on trade and change of use of agricultural land
Informing of local population about activities in the RoW, possible impacts	Kyiv	9.2.1, 9.2.2, 9.2.4	NPC Ukrenergo will use its established links with the local population of the affected areas to pass information, through the ESIA but also during construction (regular updates of plans and progress). Information will be also provided on a request basis through the grievance procedure.
Announcements in mass media	Kyiv	10.4, PCDP	The public hearings related to commenting on the ESIA will be announced through printed media and local radio. Details on communication can also be found in the PCDP (NPC Ukrenergo website: http://www.ukrenergo.energy.gov.ua/ukrenergo/control/en/publish).
Project alternatives	Kyiv	7	The project scope has been strictly defined as the transmission line connecting Rivne NPP with Kyiv substation. The relation of the project with potential changes in electricity generation or with the energy policy of Ukraine was considered outside the scope
Possibility that the project is not finally implemented	Kyiv		Has to do with NPC Ukrenergo defaulting on the loan which will have to be subsequently paid by the State - Outside the scope of the ESIA
Project financing, economic background	Kyiv		Outside the scope of the ESIA – Info provided by EBRD: limited non-commercial information on economics is

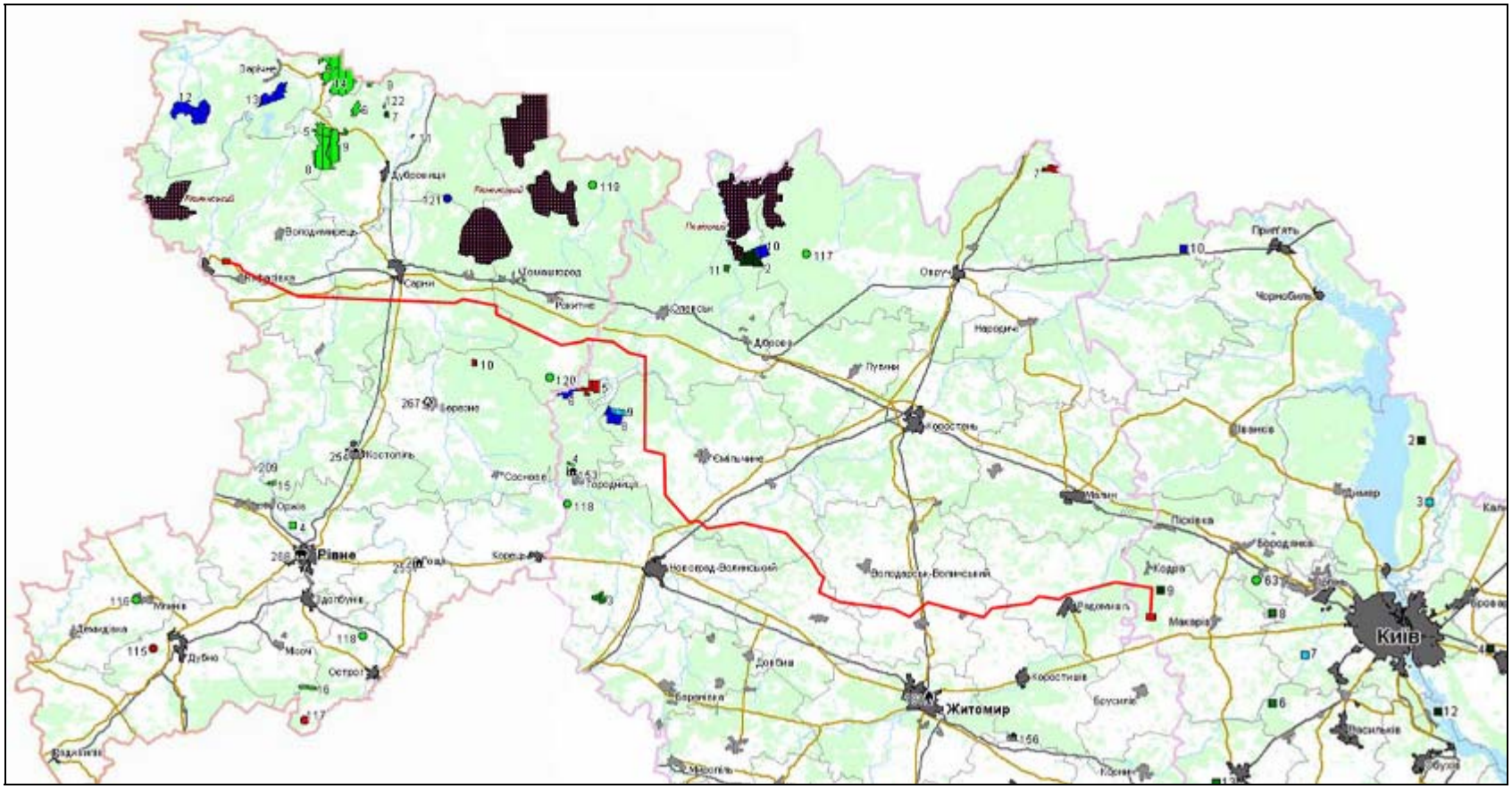
Issue	Meeting location	ESIA section	Comments
			available on request once the loan has been approved by the EBRD Board. A brief summary, including economic data, will also be produced before the Board meeting (currently due early September but this date may be changed)
Impacts on birds	Kyiv	5.2.7, 8.2.7	Potential impacts on birds, related with nesting and migration, have been taken into consideration in the ESIA and appropriate mitigation proposed. Communication channel established with NGOs to incorporate additional concerns, if any.
Consideration of dangerous sites/objects (landslide zones, waste dumps, cattle burials, etc.)	Kyiv		Such issues were addressed at the design stage in order to arrive at the proposed route. Additional research will be carried out at the detailed project design by the contractor.
Impacts to freshwater resources due to increased cooling needs of Rivne NPP	Kyiv		The issue has been notified to EBRD which are investigating in the framework of their standard project monitoring procedures

12. Appendix II: Maps

12.1 Map of the wider area (scale 1:200,000)

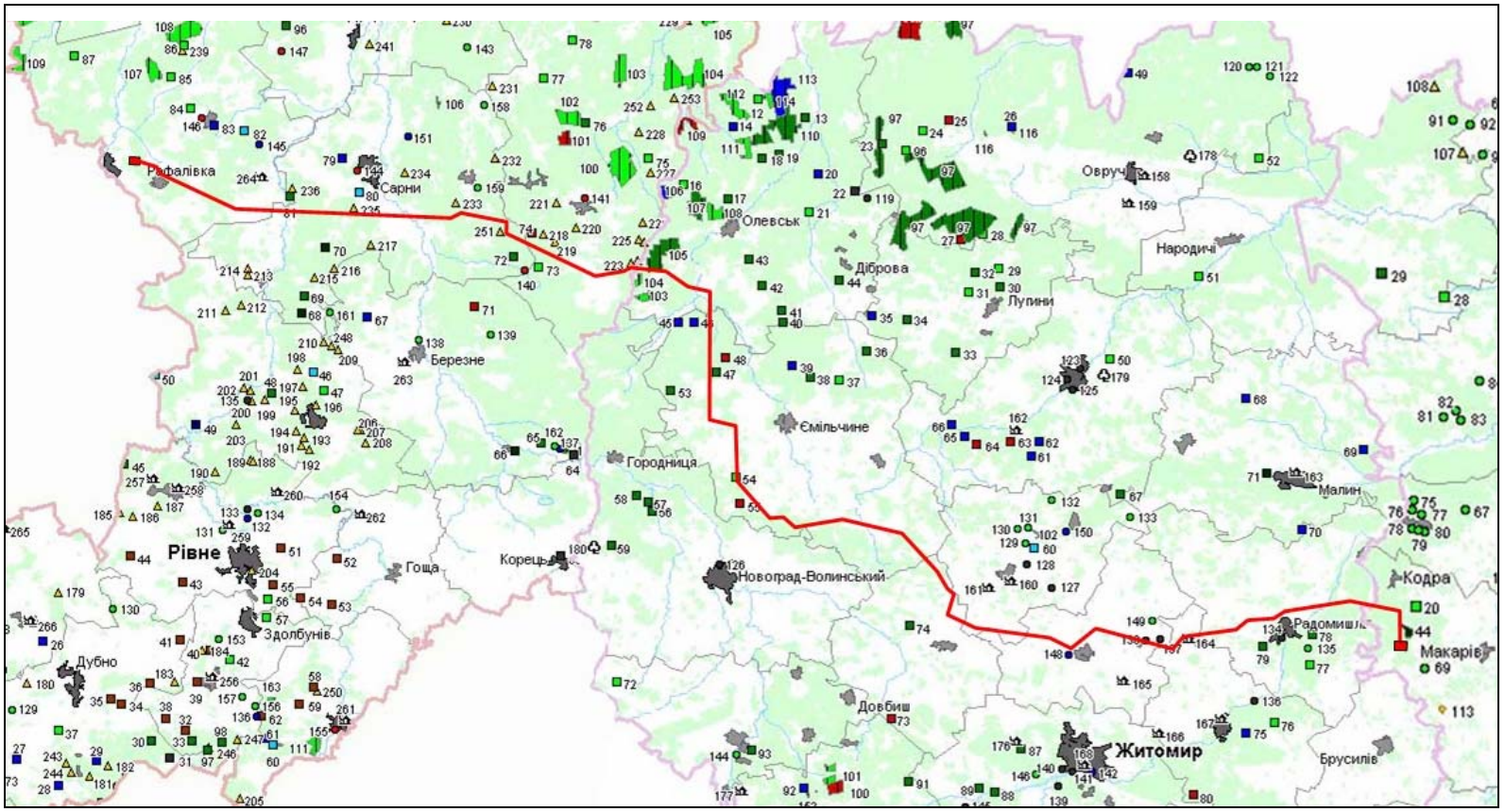
12.2 Maps of the transmission line route (scale 1:100,000)

12.3 Map of environmental sensitive areas of national importance



Flora	Habitat	Fauna	Birds	Hydrology

12.4 Map of environmental sensitive areas of local importance



12.5 Satellite image