Elementum Energy

Southern Wind Power Project, Ukraine

Non Technical Summary

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Contents

1 Introduction

The project involves the construction, operation and long-term maintenance of a small-scale wind farm consisting of three modern wind turbines, each with an installed capacity of up to 6.4 megawatts and a combined capacity of 19.2 megawatts. This development is one of three related projects that together will provide a total installed capacity of 57.6 megawatts. The wind farm will be located outside settlement boundaries. It is designed to generate electricity from wind in support of national priorities for energy independence, climate mitigation and sustainable development.

The turbines within each wind power plant will be connected by newly constructed access roads, alongside which underground cabling will be routed and linked to the local road network. All required land is currently used for agricultural purposes and has been secured for a period of forty-nine years through voluntary lease and easement agreements with private landowners. No physical displacement of residents is anticipated.

The project has been classified as one that may produce significant environmental effects and therefore requires an environmental impact assessment in accordance with Ukrainian legislation. The turbines will be sited on land previously used for agricultural production, which will transition to the placement and operation of energy-generating facilities. Land plots have been selected and allocated using cadastral information to ensure appropriate siting of foundations, cable routes and supporting infrastructure.

The project benefits from access to an established regional and European road network, with localised improvements required for the safe transport of turbine components. The combined footprint of the three projects covers 16.5 hectares across approximately 47 land plots. Additional land will be subject to easements for cabling, service routes and substations, though these areas do not require changes to land-use designation. The design aims to minimise the occupation of productive agricultural land and ensure that adjacent plots remain available for farming.

During operation, the facility will be monitored remotely without the need for permanent onsite staff. Maintenance and inspections will be performed periodically by specialised teams. The wind farm has an estimated operational life of twenty-five years, after which the operator may choose to modernise the site or decommission the facility and restore the land in accordance with established reclamation procedures.

1.1 Objectives

The primary objective of the project is to generate renewable, zero-emission electricity from wind, directly supporting Ukraine’s strategic goals for clean energy development and reduced dependence on imported fossil fuels. The initiative is consistent with national policy documents including the Energy Strategy of Ukraine to 2035 and the Low-Carbon Development Strategy to 2050, both of which emphasise renewable energy expansion, improved energy security, greenhouse gas mitigation and sustainable economic growth.

The project also supports Ukraine’s integration into European energy systems and its commitments under key international environmental agreements. It responds to the need

to modernise the energy sector by replacing carbon-intensive technologies with cleaner alternatives. The proposed wind farm contributes to local energy diversification, reduces exposure to volatile fuel markets and strengthens regional resilience to supply disruptions. It is aligned with global trends in which developed economies target substantial shares of wind-generated electricity in their national energy mixes.

Secondary objectives include promoting technological innovation, supporting the local economy, creating employment during construction and operation and incorporating climate adaptation considerations into regional development planning. The environmental impact assessment highlights wind power as an efficient and increasingly cost-effective source of energy, with technological advancements continuing to reduce the cost of electricity from wind turbines.

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2 Project Description

The project involves the construction, operation and maintenance of a small wind farm comprising three modern turbines with individual capacities of up to 6.4 megawatts and a combined installed capacity of approximately 19.2 megawatts. It forms part of a broader 57.6-megawatt development across multiple regions. The wind farm will be located outside settlement boundaries in Southern part of Ukraine.

2.1 Main Technical Characteristics and Resource Use

The environmental impact assessment focuses on the Vestas V162-6.2 and 6.4 megawatt turbine models, which incorporate pitch-controlled blades, multistage gearboxes, synchronous generators with converters, and extensive monitoring and protection systems, including lightning protection and automated shutdown functionality. The turbine nacelles and towers are designed for safe access and operation in harsh weather conditions and are equipped with low-temperature packages rated to minus thirty degrees Celsius. Sound power levels are managed through operational controls, and turbine design emphasises low rotor speeds to reduce noise and minimise risks to wildlife.

The project requires no operational water use, as the turbines do not involve process water consumption and no permanent staff will be based on site. Portable sanitary facilities will be used during maintenance activities, and bottled water will be supplied for workers. The total land requirement is approximately forty hectares, with around 0.6 hectares allocated per turbine for the foundation, crane pad and access area. Temporarily affected construction areas will be reinstated, and easements for underground cabling and access routes will be kept as narrow as possible.

Environmental surveys confirm that biodiversity resources will not be directly affected because the project does not involve the harvesting of natural resources. Bird and bat surveys identified no sensitive ornithological constraints. Avoidance and minimisation measures include careful siting, the use of modern turbine technology and, where necessary, additional operational mitigation measures may be implemented based on the results of post-construction monitoring. Noise assessments demonstrate compliance with Ukrainian standards at the nearest dwellings, with the maximum predicted night-time noise level remaining below forty-five decibels.

Electricity will be exported via underground thirty-five kilovolt arrays to a substation, which will increase voltage for transmission to the national grid.

2.2 Project Location

The project site is situated within a corridor characterised by open agricultural landscapes interspersed with roads, hedgerows and shelterbelt plantings. Existing land uses primarily involve pasture and arable farming. Land designated for turbine placement will change accordingly, while agricultural activities will continue on surrounding plots. The wind turbines are located outside settlement boundaries at distances that ensure compliance with applicable environmental, health and safety requirements.The site is

accessible via regional and major roads as well as agricultural tracks, which will be upgraded as necessary for transporting large turbine components.

Underground medium-voltage cabling will connect the turbines to a new collector substation, from which electricity will be transmitted to the national grid via a combination of underground and, where required, overhead lines extending up to three kilometres. Fibre-optic lines will be installed alongside high-voltage cables for data transfer between site facilities. Annual electricity generation is expected to range from sixty-two to seventy-three gigawatt hours.

During trenching, topsoil will be carefully removed, stored and reinstated to preserve soil structure and fertility. This approach minimises land-take and enables agricultural activities to resume after construction, except for small areas permanently occupied by infrastructure. The wind farm will occupy approximately 1.8 hectares for turbine equipment and 0.07 hectares for overhead line supports. Cables will be installed at a depth of one and a half metres without affecting agricultural operations. Access roads will follow existing routes wherever possible, improving more than eight kilometres of field roads.

2.3 Construction Activities

The construction period is expected to last approximately thirty-six months and will require a peak workforce of around 150 personnel. Key activities include site preparation, temporary road installation, excavation for turbine foundations, crane pad construction, installation of underground cables and transportation and assembly of turbine components using specialised cranes and vehicles. All construction will comply with Ukrainian construction, labour and industrial safety regulations.

Each turbine foundation will require extensive earthworks and approximately twelve hundred cubic metres of concrete. A crane platform of fourteen hundred square metres will be established at each turbine site. Once construction is completed, all trenches and disturbed areas will be reinstated with stored topsoil.

Construction activities will temporarily increase local traffic and generate short-term noise and air emissions. Pollutants will primarily include dust, nitrogen oxides, carbon monoxide and hydrocarbons. Environmental modelling confirms that pollutant concentrations at the nearest residential boundaries remain within Ukrainian air quality standards and pose no health risks. Noise from construction equipment will comply with national limits through the use of modern, well-maintained machinery and careful planning to reduce simultaneous operations near sensitive areas.

Environmental protection measures during construction include erosion management, stormwater controls, secure storage of materials, installation of safety signage, deployment of fire-safety equipment and clear procedures for handling hazardous substances. Vehicle refuelling will occur offsite, and all waste will be managed by certified contractors. Upon completion, all disturbed land will be restored, vegetation reinstated and temporary facilities removed.

2.4 Policy, Legal and Administrative Framework

The project will be implemented in accordance with the Constitution of Ukraine and relevant environmental, air protection, land use, energy, labour protection and urban planning laws, including the Law of Ukraine on Environmental Impact Assessment. The assessment also reviews compliance with international agreements such as the Espoo Convention on transboundary environmental assessment and the Aarhus Convention on access to information and public participation. Applicable construction, sanitary, fire safety, turbine design, noise control and lightning protection standards will be met throughout the project. The framework establishes requirements for obtaining approvals, conducting public consultations and licensing hazardous waste handlers.

2.5 Consideration of Alternatives

The assessment considers broader strategic alternatives such as continued reliance on fossil fuel generation, increased electricity imports or investment in alternative renewable sources. The case for wind power in this region is supported by resource availability, environmental compatibility and cost effectiveness.

Within the project, alternatives for turbine technology, hub height and rotor diameter were evaluated, with the preferred models selected for their high energy yield and favourable acoustic characteristics. Cable routing alternatives were assessed to reduce environmental disturbance, prioritising previously disturbed agricultural areas. Grid connection options were examined to ensure reliable system performance without creating electromagnetic exposure risks. The use of underground cables was favoured over overhead lines to reduce landscape and ecological impacts.

The preferred technical alternative involves constructing a wind farm using turbines with capacities between five and eight megawatts, such as the Nordex N163 and Vestas V162 models. These were chosen due to their efficiency, reliability and optimal use of land. An alternative option involving a solar power plant was deemed infeasible due to the lack of suitable land.

Territorial alternatives were assessed through a phased analysis of wind potential, grid access, land availability and environmental, urban planning and sanitary constraints. The selected site was found to be optimal across financial, technical, environmental, economic and social criteria. The zero-alternative scenario of not proceeding with the project would forego the significant benefits associated with renewable energy generation, including national energy security in the context of infrastructure losses caused by the ongoing conflict.

3 Baseline Environmental Conditions

The baseline environment is characterised by a temperate continental climate with typical winter and summer temperature ranges and annual precipitation between five hundred seventy and six hundred forty millimetres. Wind regimes are suitable for commercial wind power and favour turbines designed for medium wind speeds.

The landscape comprises gently undulating agricultural terrain with areas of loess soil and moderate erosion potential, which will be managed through appropriate soil conservation practices during construction. The hydrological context does not impact on regionally significant rivers, but the project area does not overlap with floodplains or internationally recognised wetlands, and no hydrological changes are planned.

Biological surveys identified predominantly common farmland flora and fauna, with higher biodiversity present in forested patches, meadows and chalk outcrops, which have been excluded from turbine siting. Protected areas will not be affected.

The wind farm corridor is outside the boundaries of the Emerald Network, and protective buffer zones have been applied to safeguard nearby conservation areas.

4 Environmental Impacts and Assessment

The construction phase is associated with the most notable environmental impacts, though these are temporary and manageable. Soil movement for foundations, access roads and cabling can generate dust and sediment-laden runoff. To mitigate these effects, the assessment prescribes staged clearing, separate stockpiling of topsoil, sediment controls and prompt reinstatement of disturbed areas. Heavy vehicle movements will predominantly use existing roads, and any new access routes will be engineered to maintain natural drainage patterns. Construction machinery will be modern and well maintained to reduce emissions, and all refuelling will occur under controlled conditions with spill containment measures in place.

4.1 Climate and Microclimate

No significant impacts on climate or microclimate are anticipated during construction, operation or decommissioning. Minor localised effects may arise from the replacement of natural vegetation with infrastructure, but these remain negligible. The wind farm produces no greenhouse gas emissions during operation and is expected to significantly reduce national emissions by displacing fossil-fuel-based generation.

4.2 Air Environment

Air quality impacts during construction will result mainly from emissions produced by vehicles, machinery and material handling. These emissions are expected to be low and short-term, with modelling showing that pollutant concentrations remain below Ukrainian air quality standards at the nearest settlements. Dust generation is anticipated to be limited due to the dispersal of construction activities over a wide area. During operation, the facility will not generate stationary emissions, and any emissions from support vehicles will be minor and intermittent. The wind farm will have a positive overall impact on regional air quality by offsetting fossil fuel combustion.

4.3 Aquatic Environment

The project will not affect coastal or water protection zones. Wind turbine operation does not require process water, and water use during construction and maintenance will be minimal and supplied via mobile tankers. Wastewater from sanitary facilities will be collected and removed by specialised contractors. Foundation excavations will not reach groundwater level, and properly sealed equipment will reduce the risk of contamination. The overall impact on surface water and groundwater resources is assessed as insignificant.

4.4 Geology and Soils

Construction will temporarily disturb soils through vegetation clearing, topsoil removal, excavation, compaction and potential small-scale contamination from fuels or construction materials. These impacts will be minimised through the use of existing roads, careful alignment of new access routes and proper management of hazardous substances. Topsoil will be stored and reused for restoration. Soil sealing will be limited

to the turbine foundations and access areas, and the affected areas are small relative to the overall site. During operation, impacts on soils are minimal and limited to minor risks of fuel spills during maintenance.

4.5 Land Resources and Land Use

The project area consists entirely of agricultural land and artificial shelterbelt vegetation. There are no residential or industrial developments nearby. Land required for construction will result in the temporary loss of cultivated areas, but agricultural activities will resume in adjacent areas during operation. The project's impact on land resources is considered acceptable.

4.6 Flora and Fauna

The site comprises entirely modified habitats consisting of agricultural fields and artificial tree and shrub vegetation. No natural habitats or protected plant species are present within the area or the two-kilometre zone of influence. Construction may temporarily disturb floristic communities, but natural recovery will occur after completion. Studies indicate minimal impacts on fauna, including birds, small mammals and bats, provided environmental standards are followed. Potential impacts on birds from noise, movement and shadow flicker are assessed as low, with alternative nesting sites available nearby. Bats are expected to be minimally affected due to the absence of key habitats.

4.7 Protected Areas

The project does not overlap with lands designated as part of the nature reserve fund or the Emerald Network. No protected sites fall within the two-kilometre buffer zone. As a result, no adverse effects on protected areas or ecological networks are expected.

4.8 Archaeology and Cultural Heritage

The project area is located outside the boundaries of cultural heritage sites and their protection zones. According to official registers and planning documentation, there are no cultural monuments or UNESCO World Heritage Sites within the affected area.

4.9 Landscape and Visual Impact

The wind farm will introduce visible changes to the landscape, particularly due to the height of the turbines. However, the area is dominated by agricultural land with low cultural or natural value, resulting in low landscape sensitivity. Construction will temporarily alter the landscape through visible work areas and vehicle movements, but these changes will diminish once construction is completed. Operational visual impacts are assessed as moderate but acceptable, with some viewers potentially perceiving turbines as adding a modern aesthetic to the landscape. An assessment of landscape character and visual amenity was undertaken as part of the Project's environmental and social impact assessment. This included consideration of baseline landscape characteristics, the visual sensitivity of receptors, the zone of theoretical visibility, and representative viewpoints. Based on this analysis, and taking into account the scale of the Project and the existing landscape context, visual impacts are not expected to represent a significant issue.

4.10 Noise and Vibration

Construction activities will generate typical noise associated with heavy machinery and vehicle movements. These impacts are temporary and will be limited through daytime working hours and modern equipment. Noisy activities such as blasting are not required. Modelling shows that operational noise will remain below forty-five decibels at residential receptors, meeting national standards. Vibration impacts during construction will be localised and temporary, while operational vibration from turbines is negligible and does not extend beyond the foundation area.

4.11 Electromagnetic Radiation

No significant electromagnetic impacts are expected during construction or operation. Electrical installations comply with Ukrainian sanitary protection requirements, and modelling confirms that electromagnetic field levels at the boundaries of protection zones remain below maximum permissible limits.

4.12 Shadow Flicker

Shadow flicker modelling indicates that residential properties lie beyond distances where this effect could exceed recognised limits. The assessment demonstrates that the majority of nearby settlements will not experience shadow flicker.

4.13 Wastes

Construction will generate industrial and household waste, including absorbents, filter materials, protective clothing, materials containing asbestos, septic sludge and mixed household waste. Waste will be managed in accordance with the Law of Ukraine on Waste Management and associated regulations. Radioecological assessments confirm that construction materials meet safety standards. Waste generated by contractors during equipment maintenance is not included in this assessment but will also require proper management.

4.14 Socio-Economic Conditions and Population Health

The project will not negatively affect public health provided that operational parameters and protection zones are observed. The wind farm will contribute positively to regional energy supply reliability and environmental quality through low-emission electricity generation. It will also deliver socio-economic benefits, including job creation during construction, long-term employment in maintenance, increased local tax revenues, land lease payments and broader economic stimulation through investment in the region.

4.15 Cumulative Impact

The cumulative environmental impact of the wind farm is assessed as acceptable. Combined effects on air, soil, water, noise, landscape and ecology remain within regulatory thresholds. Effective environmental monitoring, transparent communication and compliance with mitigation measures will ensure that cumulative impacts remain controlled throughout construction and operation.

4.16 Risk Assessment, Emergency Response and Safety

The assessment considers technical and natural risks such as equipment failure, fire, severe weather and geotechnical hazards. Modern turbines include multiple safety systems, including pitch control, aerodynamic and mechanical brakes, lightning protection and automated condition monitoring that initiates shutdown when necessary. Ice accretion and blade throw risks have been evaluated, with setback distances exceeding theoretical hazard zones. Emergency response procedures include spill containment, timely notification of authorities and adherence to relevant environmental protection codes. Personnel will receive appropriate fire-prevention and emergency response training, and the substation and turbines will be equipped with fire-safety systems.

5 Conclusions and Enviromental and Social Action Plan (ESAP) Commitments

The EIA and E&S assessment have concluded that the selected locations for the wind farm are sufficiently distant from cultural heritage and nature reserve sites, making them suitable for development. The project will implement protective, mitigating and compensatory measures during construction and operation to manage environmental impacts. The environmental impact assessment concludes that the project will not produce significant adverse effects and can be undertaken in full compliance with applicable environmental and sanitary legislation.

The ESAP sets out measures to ensure alignment with IFC Performance Standards and EBRD Environmental and Social Requirements for the wind power plants located in the southern and western parts of Ukraine.

It outlines the mitigation measures, monitoring activities, and institutional responsibilities required to manage environmental and social risks throughout the project lifecycle, from construction through to operation. Key measures include the following:

At the corporate level, the Company will strengthen and formalise its Environmental and Social Management System (ESMS), develop sub-project specific construction and operational Environmental and Social Management Plans (ESMPs), and ensure that E&S requirements are contractually cascaded to contractors. Dedicated ESHS personnel will be appointed at project level.

Under labour and working conditions, a Labour Management Plan and a Workers' Grievance Mechanism will be implemented, alongside enhanced supply chain due diligence procedures. Land acquisition processes will be reviewed against PS5/ESR5 requirements, with remediation measures introduced where gaps are identified.

In relation to biodiversity, collision risk assessment and the implementation of construction- and operation-phase Biodiversity Management Plans, including post-construction fatality monitoring and adaptive management measures.