RESPONSE TO LETTER WITH EX. NO. EIA-54-20/ 14.08.20224 OF THE BULGARIAN MINISTRY OF ENVIRONMENT AND WATERS

PROJECT: WIND FARM "POLEMISTIS"

INSTALLED CAPACITY: 44MW

LOCATED IN THE MUNICIPALITIES OF KOMOTINI & ARRIANE, MUNICIPAL UNITS OF KOMOTINI & ORGANI, REGIONAL UNIT OF RHODOPE, EASTERN MACEDONIA AND THRACE REGION, GREECE

Developer:

Signed by:
Aris Liaskos Managing Director
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wpd think energy

WPD AIOLIKI ENERGEIA 1 S.M.P.C.

Environmental Consultant of EIA:

Δ. ΑΡΓΥΡΟΠΟΥΛΟΣ σύμβουλοι περιβάλλοντος Α.Ε.

D. Argyropoulos Environmental Consultants S.A.

DIMITRIOS ARGYROPOULOS
Digitally signed by DIMITRIOS ARGYROPOULOS
Date: 2024.11.15 12:12:11 +02'00'

Contents

1. Regarding protected species of birds included in Annex No. 3 of the Biodiversity Act

1.1 Supplementary analysis

In view of the requirements outlined, this section provides a supplementary analysis addressing the possible negative impacts on birds of prey, particularly vultures, during the operational phase of the wind farm. This analysis includes an assessment of the cumulative effect, with particular attention to the barrier effect posed by the wind farm project.

The potential impacts of the project and their significance are examined in accordance with the European Commission's guidelines (European Commission, Guidance document on wind energy developments and EU Nature Legislation, 2020) for vulture species hosted and protected in the SPA – GR008 Filiouri Valley and Eastern Rhodope.

1.2 Collision Risk

Loss of individuals is considered during the operation of the wind farm, primarily due to collisions of birds with the turbine blades, and to a lesser extent with towers, nacelles, and other structures (Dimalexis et al. 2010). Collision refers to a bird striking any of these turbine components. Species vulnerable to such events are primarily large and endangered raptors (Dimalexis et al. 2010).

In the international literature, there are numerous references to bird collision rates, especially raptors, with wind turbines. For example, a study of 13 wind farms in southern Spain showed an average death rate of Griffon Vultures at 0.186 birds/turbine/year (Manuela de Lucas 2012).

In Greece, a study monitored 88 wind turbines in 9 wind farms from 2008 to 2010 by WWF in the broader Thrace National Parks area and SPAs, and recorded 9 dead raptors and 73 other birds (Dotau et al. 2011). Each of the 88 wind turbines was monitored every day of the week except Saturday. The results of monitoring these 88 operational turbines across nine wind farms in the area showed **a mortality rate ranging from 0.150 to 0.173 raptors per turbine per year**, according to two calculation models. This means that, using this rate for the current study's wind farm, an expected mortality rate would be 11x0.150=1.65 to 11x0.173=1.90, or approximately **two raptors every one to two years**. Both estimates, although indicative, suggest **a minor impact on raptor populations.**

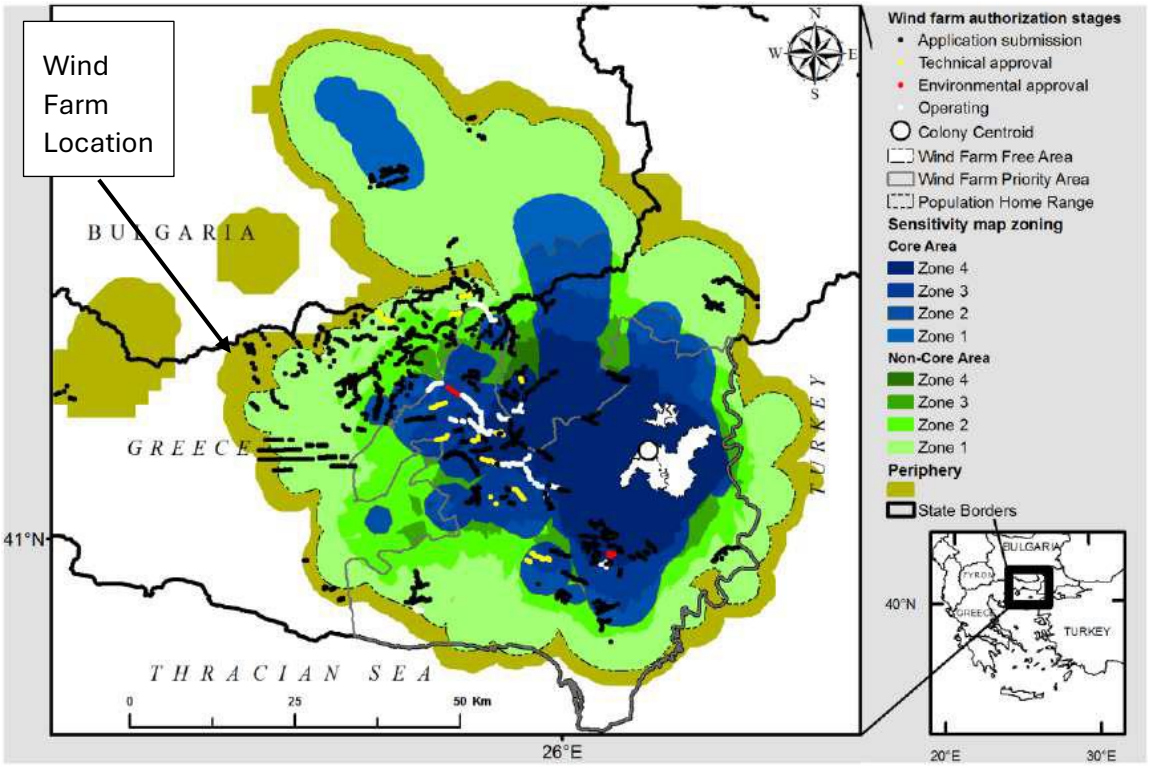
It should be noted that this mortality rate, although calculated in an area with relatively different local conditions and a different composition of raptor species, is comparable to other studies (Barrios & Rodriguez 2004, Cárcamo et al. 2011) and can therefore provide an approximate/indicative picture for the present study. Additionally, the area for which it was calculated has a high number of wind turbines, which is not the case in the immediate area of the project, as will be examined further.

It should be noted that the design choice of the wind farms under study, featuring fewer but larger turbines spaced farther apart compared to most turbines in the literature (especially older studies), may be preferable to a design with many densely packed, smaller turbines (May, 2017, and European Commission, 2020). The effectiveness of this turbine design is supported by some empirical evidence (e.g., Loss et al. 2013); however, the effect of increasing rotor diameter (to reduce collision risk margin) and reducing rotor speed may, in some combination, only partially reduce the collision risk.

Nevertheless, it is still unclear to what extent species that fly at higher altitudes, such as during seasonal migration, are affected. For the project area, it seems that the risk primarily concerns local raptor species and, secondarily, migratory species. The general rule for wind farm areas appears to be that the risk mainly concerns local raptor and nesting species and, to a lesser extent, migratory species. (De Lucas et al. 2004).

During the study team's fieldwork for this report, a sighting of 4 vultures was recorded once. Based on this information, it is estimated that the immediate **project area at the "Polemistis" location does not constitute a core habitat for the species.** Consequently, the likelihood and significance of **possible collisions (and loss) of vultures due to project operations are minimal**, and the impact is insignificant for the wider population or migratory individuals. Nonetheless, mitigation measures will be recommended to further reduce the likelihood of collisions and loss of individuals. The conservation target for vultures in the SPA is 300 pairs; therefore, the loss of only one individual every 6-7 years is not expected to affect the population (see Chapter 5.1 of the SEA).

The Black Vulture was observed in the SPA in 2007 by the Hellenic Ornithological Society, with eight individuals recorded. However, it was not observed during fieldwork for this study, suggesting that its critical habitat does not include the project area, and therefore significant collision impacts are not expected. Furthermore, the species' absence from the area is confirmed by the Black Vulture Sensitivity Map for the region, as published in the study by Vasilakis et al. (2017), shown in the map below.



Black Vulture Sensitivity Map in Eastern Thrace (Vasilakis et al., 2017)

In conclusion, the likelihood of significant population-level impacts appears minimal based on field observations, historical data, and comparative studies. The low expected mortality rates, combined with the specific siting of the wind farm and the design choices—fewer, larger turbines spaced farther apart—suggest that the project's impact on local and migratory bird populations, including sensitive species like vultures, will be limited. Ongoing monitoring, will ensure that the project aligns with conservation goals and sustains the ecological integrity of the region's bird populations, including those species of conservation concern.

1.3 Barrier Effect

The potential for wind turbines to act as barriers to bird flight has been a concern within the scientific community. Although there are many concerns about the barrier effect, evidence for this impact remains inconclusive and varies widely depending on bird species and specific project characteristics (such as topography, layout, height, and turbine density). Recent research in the Evros region demonstrated that, despite high vulture activity and turbine density, there was no significant barrier effect observed on vulture movement*. For this particular project, there are no features likely to cause a significant barrier effect on vultures or other raptor and key species in the area, even with collision avoidance measures in place.

In summary, the project is expected to have minimal, localized impacts on the avian populations in the area, insufficient to affect population size or species reproduction. These impacts can be further minimized through the implementation of additional mitigation measures.

* *Sidiropoulos, L., Chatzinikolaou, G., Kret, E., Kapsalis, E., Zakkak, S., Arkumarev, V., Dobrev, D., Stamenov, A., Stoychev, S. & Vasilakis, D. 2022. The effects of industrial wind farm development in three priority raptor species in Thrace: cumulative collision mortality and displacement of Cinereous and Griffon Vultures and Golden Eagles. The Society for the Protection of Biodiversity of Thrace. Dadia-Soufli, 92 pp.*

1.4 Cumulative effect

In the immediate vicinity of the Rhodope mountain range, in northeastern Komotini and northwestern Arrianoi, where the project is planned, there are no other existing windfarms in the area near. A total of 16 wind farms with installation permits and a total of 180 wind turbines have been licensed within the GR008 - Filiouri Valley and Eastern Rhodope IBA at a distance of more than 10 km. All projects are concentrated in the central and eastern area of GR008 - Filiouri Valley and Eastern Rhodope IBA. Thus, because these wind farms are widely spaced there will be no cumulative or synergistic impacts. However, there are 3 wind farms with 11 wind turbines at a distance between 3.5 km and 10 km that have a Production Certificate and also ETA (Environmental Terms Approval) and therefore are more likely to be licensed further. Thus, **if all the projects are implemented**, there will be a total of 22 WTGs in the immediate study area. Based on the mortality rate mentioned above (22*0.150-22*0.173), it is estimated that 3-4 raptors per year will die on impact within the study area. However, with protection measures as described below, the impacts, if any, would be even more limited and the mortality rate could be much lower, almost negligible.

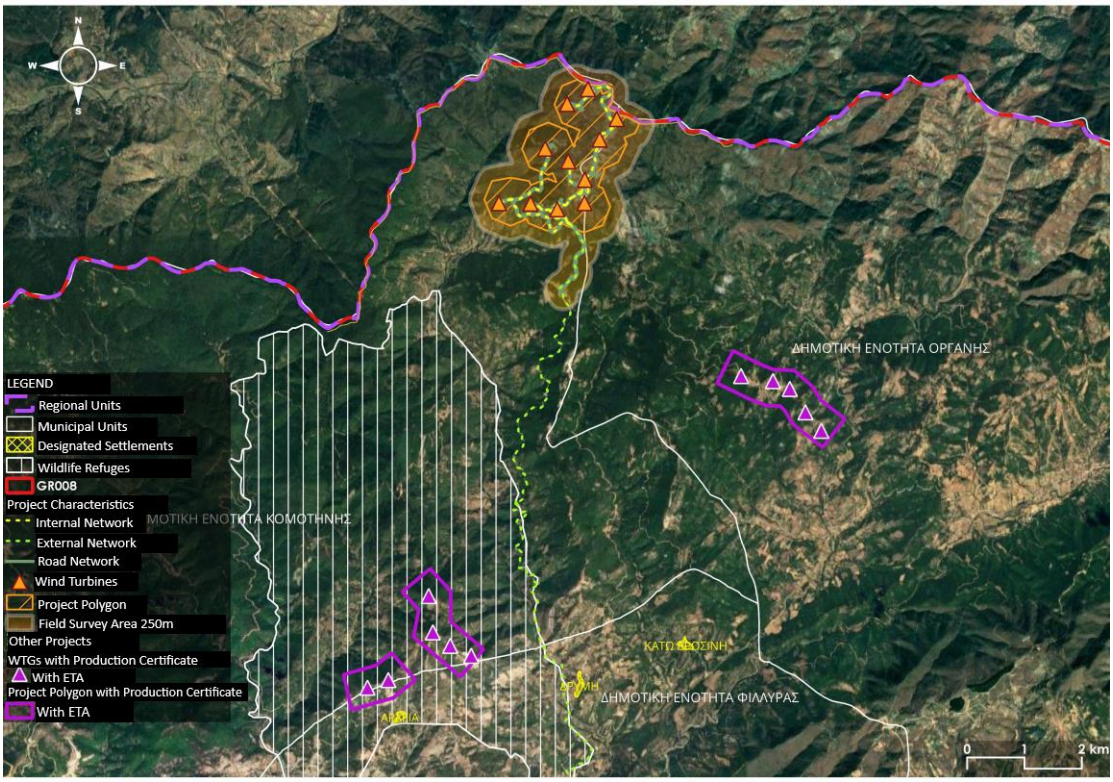


Image 1 Map of Cumulative Impacts with Planned Wind Farms in the Wider Project Area (up to 10 km)

Examining the cumulative impacts in the IBA area, the implementation of the project under consideration will bring the total number of installed wind turbines to 191. Based on the mortality rate mentioned above (191 * 0.150 - 191 * 0.173), it is estimated that 28-33 birds of prey will die from collisions annually throughout the IBA. Although this number is not insignificant, it is assessed that the project under consideration does not significantly contribute to this increase, for several reasons: it is located at a considerable distance from other projects (thus not contributing to potential habitat fragmentation or barriers), it is situated at the edge of the IBA, and it does not intersect with nesting sites for birds of prey—except for the Tawny Owl. Additionally, with the implementation of protective measures, as described below, the impacts will be even more limited, and the mortality rate will be much lower.

As for projects with only a Production Certificate, these are not considered in the assessment of cumulative or synergistic impacts, as a Production Certificate does not ensure the implementation of a project. It essentially serves as a permit of intent. When the EU guidelines mention that proposed projects (with applications for licenses or approvals) should be considered, this refers to the environmental permitting process and final approval by the relevant authority (e.g., Ministry of Environment and Energy or the appropriate Decentralized Administrations), and not to the producer's certificate issued through routine procedures by The Regulatory Authority for Energy, Waste and Water (RAAEY) without environmental review.

Therefore, it is neither appropriate nor meaningful to include projects with only a producer's certificate in the assessment, as they are at a very early stage of the final licensing process and exist in a constantly changing regulatory landscape. According to data from HWEA (Hellenic Wind Energy Association), the implementation rate of projects with only a production license or producer's certificate is approximately just 3%. Moreover, this percentage does not specify which of these projects will be licensed, making it impossible to incorporate them meaningfully in the assessment of cumulative or synergistic impacts.

Examining the images showing the distribution and typical flight areas of species in the Study Area, found in sections 4.2 and 5.1 of the Special Ecological Assessment, we observe that the Wind turbines of the "Polemistis" wind farm are located outside the primary territory of the area's birds of prey (with the exception of the Common Buzzard). Additionally, there are no nesting sites within the project polygons. These findings support the assessment that the wind farm in this study will not have cumulative negative impacts on the collision risk for birds of prey in relation to other projects in the broader area, beyond those expected from the "Polemistis" wind farm itself (as analyzed in previous subsections), neither during construction nor operation.

Furthermore, it will not have cumulative impacts with projects in Bulgaria, as the area near the project and across the border is an SPA (Special Protection Area) that does not host birds of prey or other protected and impact-sensitive bird species. Additionally, since this wind farm does not have any overhead power transmission lines and relies solely on an underground network connected to a substation for voltage step-up, it cannot contribute cumulatively or synergistically to an increased risk of collisions with power lines or electrocution.

2. Regarding human health

2.2.1 Comprehensive Information on Location and Distances from Nearest Settlements

The "Polemistis" Wind Farm project is situated in a remote area in the Regional Unit of Rhodope, within the Municipal Units of Komotini and Organi, Greece. The nearest Bulgarian settlements—Egrek, Buk, and Malkoch—are all located at distances exceeding 3 kilometers from the project's nearest wind turbine. This considerable distance, along with the isolated nature of the project site, significantly reduces any potential for adverse health impacts or nuisance to these settlements.

The following map visually confirms that the wind farm's placement respects the health protection requirements for nearby communities, ensuring minimal interference with their daily lives.

Distances of Settlements in detail:

Greek Side:

Drymi: Located over 8.1 km south of the project site, with a population of 302 based on the 2011 census.

Ardeia: Positioned more than 9.1 km southwest of the nearest wind turbine in the project area, with a permanent population of 27 people as recorded in the 2011 census.

Bulgarian Side:

Egrek: Situated 3.4 km away, within the Krumovgrad municipality in the Kardjali region, with a population of 402 according to the 2021 census.

Buk: Located 3.7 km from the site in the same Krumovgrad municipality, Kardjali region, hosting 197 inhabitants as per the 2021 census.

Malkoch: 4.6 km away in the Kirkovo municipality, Kardjali region, with 269 inhabitants, based on the 2021 census.

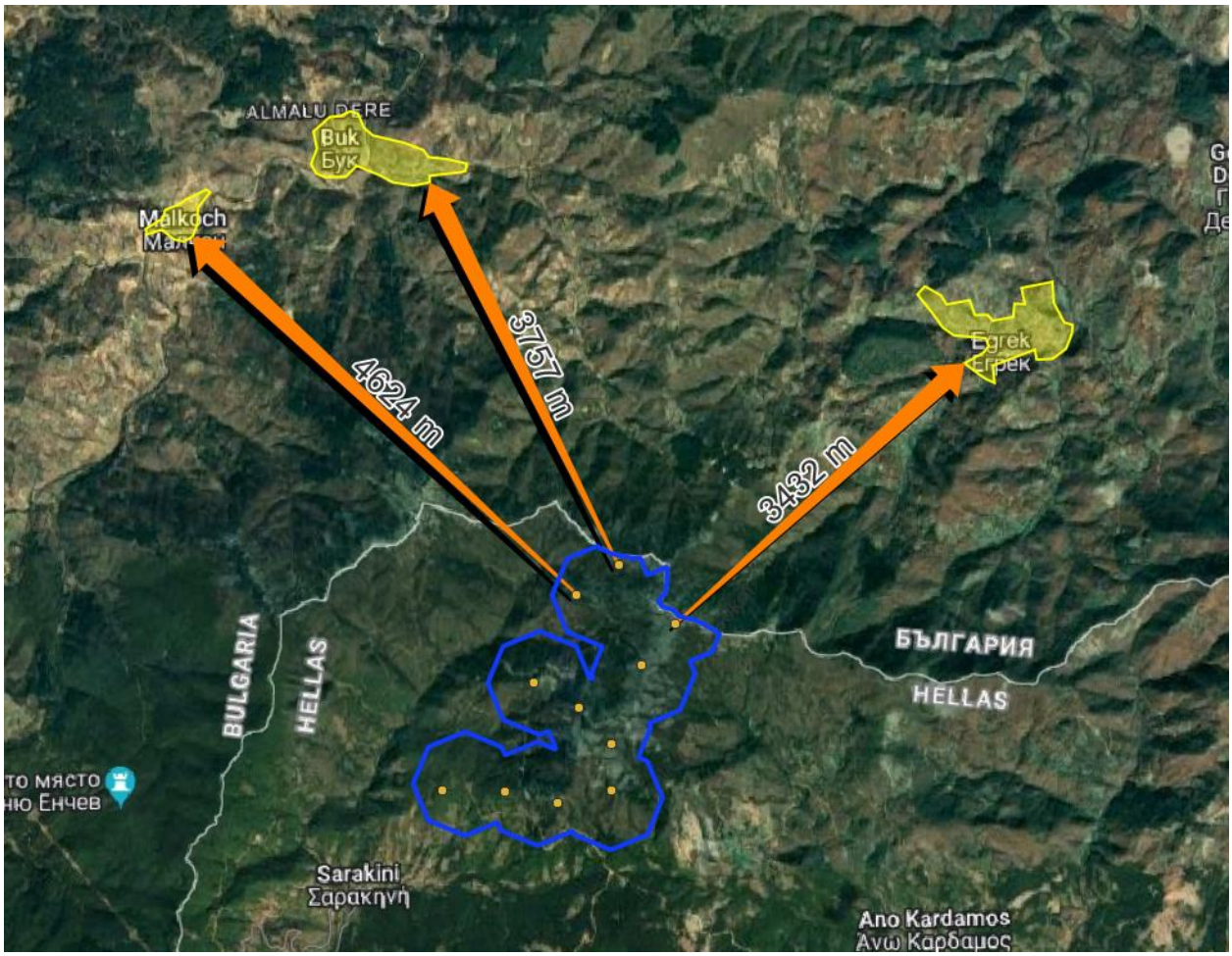


Image 2-1: Distances to nearest Bulgarian settlements

Visual Impact Assessment (ZVI) for the "Polemistis" Wind Farm

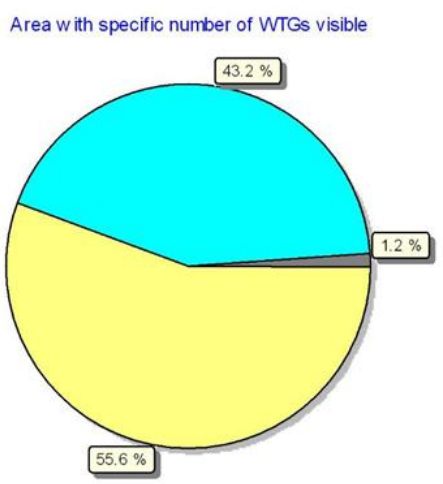
This section provides an in-depth analysis of the Zone of Visual Influence (ZVI) for the "Polemistis" Wind Farm project, using windPRO software to evaluate the anticipated visual impact across the surrounding landscape. The assessment includes standard ZVI calculations, vertical subtended angle measurements, and a cumulative visual impact map, giving a robust perspective on the visual implications of turbine installation. The results provide valuable insight for both environmental and community concerned with the aesthetic integration of the wind farm.

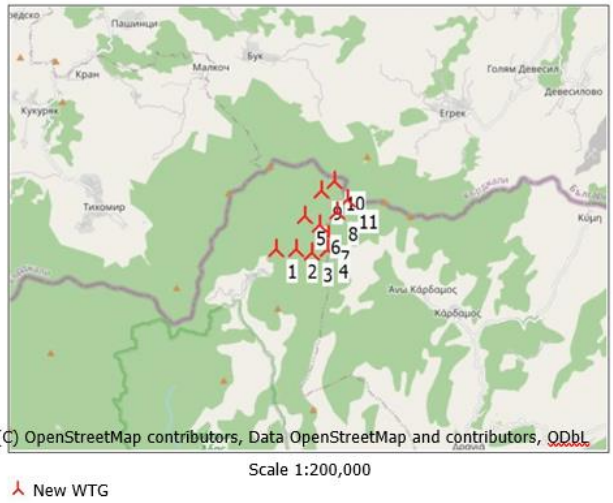
1. **Standard ZVI Summary**:

   The Standard ZVI analysis quantifies the visibility of wind turbines across a defined area, focusing on how many turbines are perceptible from different points within the surrounding landscape. This component of the analysis incorporates several key parameters and assumptions:

- **Extent of the Calculation Area**: The analysis covers approximately 9,944 hectares, utilizing a detailed digital elevation model (DEM) for accuracy. The DEM data, which includes terrain contours and elevation changes, is instrumental in ensuring that the analysis accurately reflects natural visual obstructions.
- **Calculation Assumptions**: The visibility analysis is based on a 1.5-meter observer height, simulating a typical human perspective. Calculations were performed in 25-meter increments across the landscape, ensuring granular detail. Additionally, the analysis used a "worst-case" scenario by assuming continuous clear visibility, with no weather or light conditions obstructing the view.
- **Turbine Visibility Distribution**: Results show that 43.2% of the calculated area has zero turbine visibility, which confirms that nearly half of the surrounding landscape is visually unaffected by the project. For areas where turbines are visible, visibility percentages diminish as the number of visible turbines increases. Specifically, areas with 1 to 3 visible turbines represent approximately 16.5% of the total area, while only 8.6% of the landscape is within sight of all 11 turbines.

ZVI - Standard ZVI summary





Assumptions for ZVI calculation

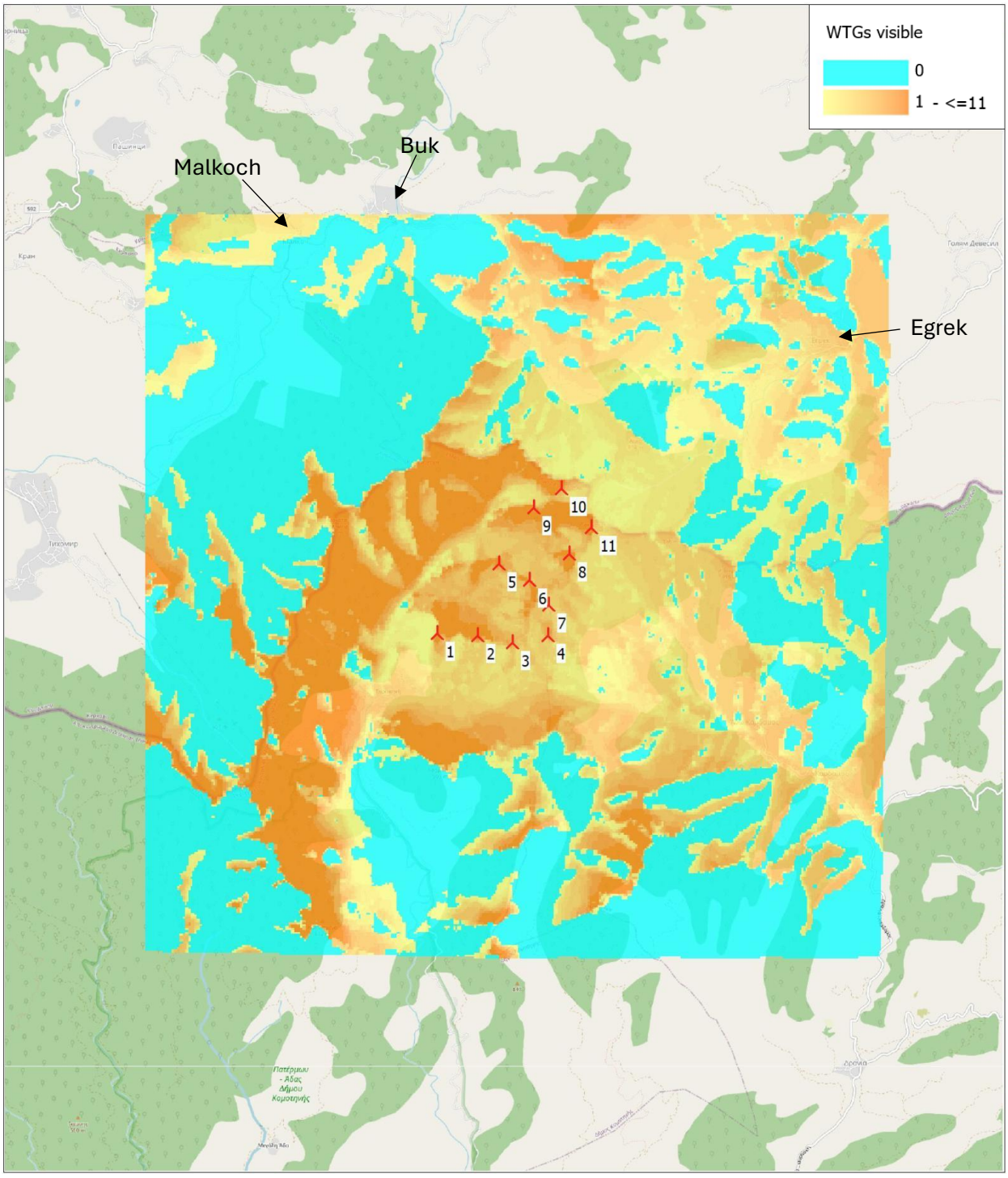
Center for calculation	Greek GGRS87-GGRS87 (GR) East: 631,595 North: 4,573,241
Width of calculation area	10,048 m
Height of calculation area	10,052 m
Calculation step	25 m
Eye height	1.5 m
Calculation area	9,944 ha
Highest relevant visible part of a WTG	Hub height + ½ rotor diameter
Obstacles used in calculation	0
DHM object	Elevation Grid Data Object: AKRI_EMDGrid_1.wpg (3)
No area objects used in calculation	
New WTGs used in calculation	11
Existing WTGs used in calculation	0
Maximum distance to WTG	0 m

ZVI Results

WTGs visible	Area [ha]	Area [%]
N/A	120	1.2
0	4,294	43.2
1	511	5.1
2	576	5.8
3	555	5.6
4	574	5.8
5	537	5.4
6	652	6.6
7	591	5.9
8	268	2.7
9	239	2.4
10	177	1.8
11	852	8.6

WTGs

	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Y	X	Z [m]
1	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	630,595	4,572,506	738.5
2	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,145	4,572,498	788.0
3	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,612	4,572,399	851.4
4	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,087	4,572,507	900.8
5	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,402	4,573,457	774.9
6	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,825	4,573,244	911.3
7	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,092	4,572,914	888.6
8	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,351	4,573,615	945.1
9	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,866	4,574,219	812.7
10	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,237	4,574,487	842.8
11	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,646	4,573,963	948.3

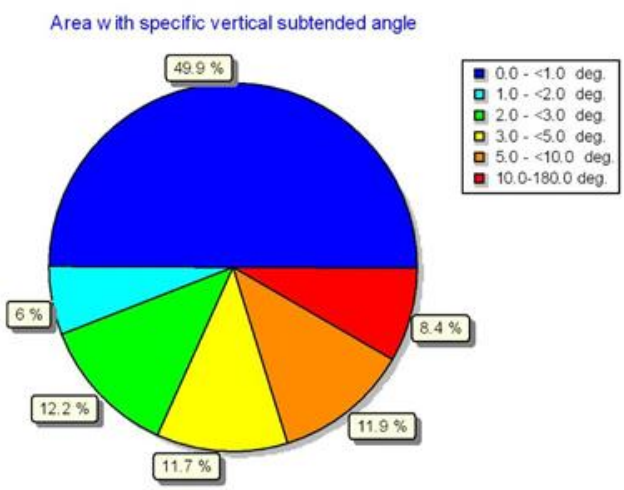

WTGs visible
0
1 - <=11
Buk
Malkoch
Egrek
10
9
11
8
5
6
7
1
2
3
4
0
1
2
3
4 km
Map: EMD OpenStreetMap , Print scale 1:75,000, Map center Greek GGRS87-GGRS87 (GR) East: 631,595 North: 4,573,241
New WTG
windPRO 3.5.587 by EMD International A/S, Tel. +45 69 16 48 50, www.emd-international.com, windpro@emd.dk
windPRO

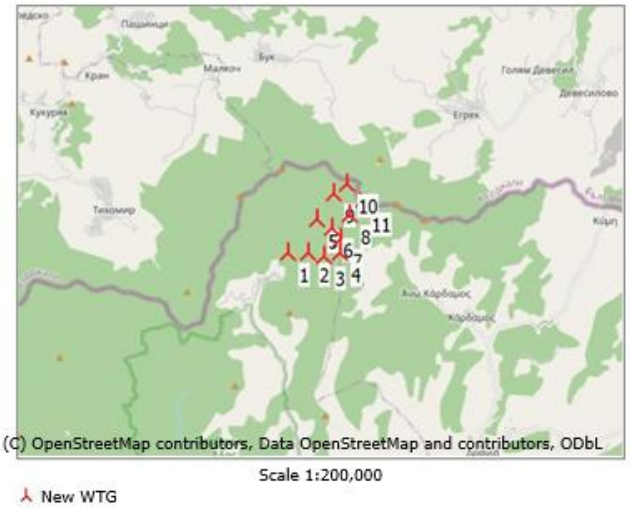
2. **Vertical Subtended Angle Analysis**:

The vertical subtended angle assessment evaluates how large the turbines appear from various vantage points, calculated in degrees of elevation from the observer's eye level. This angle is a critical determinant of perceived visual impact, as it defines the prominence of the turbines against the landscape backdrop.

- **Detailed Angle Ranges**: The vertical subtended angles were categorized into six specific ranges to capture the varying degrees of visibility. Findings indicate that 48.4% of the landscape experiences a subtended angle of less than 1 degree, meaning that turbines in these areas are minimally noticeable, appearing as small points on the horizon or blending into the background. Conversely, only 8.1% of the area experiences angles as high as 10 degrees or more, suggesting a moderate-to-high visual presence but confined to a limited zone.
- **Angle Relevance to Visual Intrusiveness**: A subtended angle of less than 1 degree typically indicates that the turbines do not intrude on the visual experience significantly, as the human eye perceives them as distant, non-dominant elements. This mitigates the potential for visual dominance, which is often a primary concern for nearby communities and sensitive environmental areas.
- **Regulatory Implications**: These angle-based results comply with environmental and visual guidelines, especially relevant in scenic or ecologically sensitive areas where minimizing visual footprint is essential. The wind farm's placement has been optimized to ensure that the vertical prominence of turbines remains minimal over the majority of the surrounding area, meeting the standards required for environmental approval.

ZVI - Vertical subtended angle





Scale 1:200,000

New WTG

Assumptions for ZVI calculation

Center for calculation	Greek GGRS87-GGRS87 (GR) East: 631,595 North: 4,573,241
Width of calculation area	10,048 m
Height of calculation area	10,052 m
Calculation step	25 m
Eye height	1.5 m
Calculation area	10,201 ha
Highest relevant visible part of a WTG	Hub height + ½ rotor diameter
Obstacles used in calculation	0
DHM object	Elevation Grid Data Object: AKRI_EMDGrid_1.wpg (3)
No area objects used in calculation	
New WTGs used in calculation	11
Existing WTGs used in calculation	0
Maximum distance to WTG	0 m

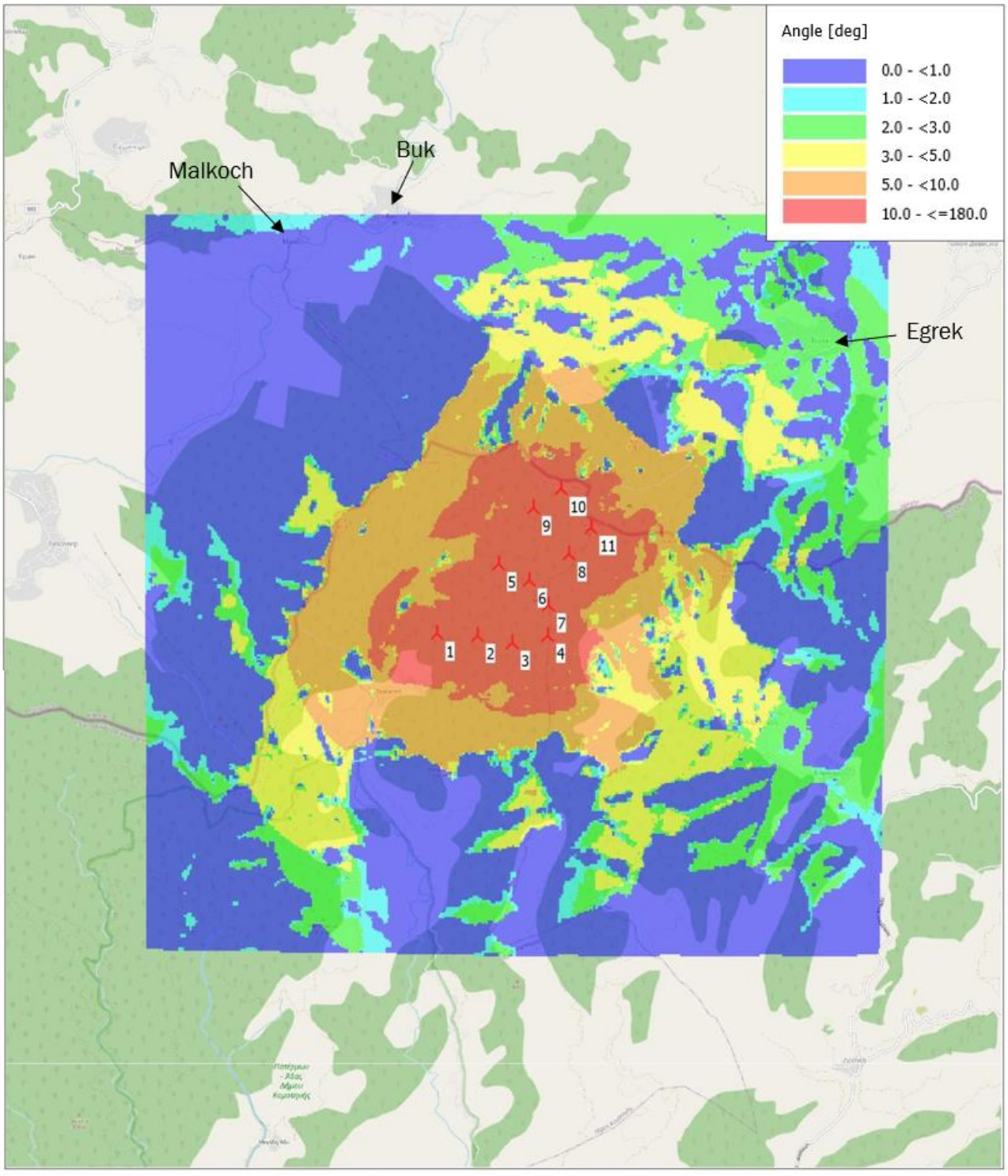
ZVI Results

Vertical subtended angle [deg]	Area [ha]	Area [%]
0.0 - <1.0	4942	48.4
1.0 - <2.0	595	5.8
2.0 - <3.0	1211	11.9
3.0 - <5.0	1156	11.3
5.0 - <10.0	1176	11.5
10.0 - <=180.0	828	8.1

WTGs

	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Y	X	Z [m]
1	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	630,595	4,572,506	738.5
2	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,145	4,572,498	788.0
3	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,612	4,572,399	851.4
4	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,087	4,572,507	900.8
5	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,402	4,573,457	774.9
6	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,825	4,573,244	911.3
7	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,092	4,572,914	888.6
8	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,351	4,573,615	945.1
9	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	631,866	4,574,219	812.7
10	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,237	4,574,487	842.8
11	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	632,646	4,573,963	948.3

ZVI - Map Vertical subtended angle



Map: EMD OpenStreetMap , Print scale 1:75,000, Map center Greek GGRS87-GGRS87 (GR) East: 631,595 North: 4,573,241

New WTG

Visual Impact Assessment Conclusion

The Visual Impact Assessment (ZVI) for the "Polemistis" Wind Farm provides clear evidence that the project will uphold a limited visual footprint across the landscape, particularly as distance from the turbines increases. The analysis confirms that, due to both the positioning and design of the turbines, visibility diminishes significantly with distance, ensuring that views from inhabited areas and key scenic locations remain largely unaffected.

At greater distances, the turbines blend subtly into the horizon, becoming increasingly indistinct and preserving the natural character of the broader landscape. Even in areas where the wind farm is visible, the turbines present a low-profile silhouette that minimizes their visual impact. The vertical subtended angle analysis demonstrates that, from typical observation points, the turbines appear relatively small and unobtrusive, which is crucial for preserving aesthetic values important to both local communities and visitors.

Moreover, the cumulative visibility mapping supports this by showing that only limited zones close to the project site will experience more frequent visual encounters with the turbines. Outside these zones, the turbines become progressively less prominent, falling within regulatory guidelines for visual thresholds and respecting community preferences for unobtrusive infrastructure.

Overall, the ZVI findings validate that the "Polemistis" Wind Farm will maintain a restrained visual presence, especially at longer distances, aligning the project with both national and international standards. This careful design approach ensures that the project remains both environmentally compatible and sensitive to the aesthetic values of the landscape, demonstrating a commitment to low-impact, community-oriented development.

2.2.2. Current Status of Environmental and Living Environment Factors

The "Polemistis" Wind Farm project site and its surrounding area have been assessed in the delivered Environmental Impact Study for key environmental factors, ensuring that the current status of ambient air quality, water resources, soil conditions, noise levels, and ionizing and non-ionizing radiation complies with health and environmental safety standards. Below is an overview of each component:

Ambient Air Quality

The project area is located in a remote, sparsely populated region with minimal industrial or vehicular emissions, contributing to high baseline air quality. Existing air quality is excellent, with low levels of particulate matter and pollutants, largely due to the lack of local pollution sources.

Surface and Groundwater

The hydrological assessment of the site indicates that there are no significant surface water bodies near the project area. Groundwater is primarily located at a depth that is unlikely to be impacted by wind farm construction or operation. The project design incorporates measures to prevent any contamination or disruption to groundwater, ensuring that local water quality remains unaffected.

Soil Conditions

The soils in the area are characterized by natural, undisturbed conditions. Soil quality is stable, with no prior evidence of contamination. During construction and operational phases, erosion control measures will be implemented to maintain soil integrity and prevent runoff, ensuring that the wind farm has minimal impact on soil health.

Noise Levels

Given the remote location of the project, baseline noise levels are low, typical of natural, undeveloped areas. Noise assessments conducted as part of the environmental study have established that existing noise levels are minimal, with no significant sources of industrial noise nearby.

Ionizing and Non-Ionizing Radiation

There are no existing sources of ionizing radiation within the project area. For non-ionizing radiation, the wind turbines are designed to emit extremely low levels of electromagnetic fields (EMF), well below international safety limits. The distance between the turbines and inhabited areas further ensures that any EMF impact is negligible, aligning with global standards for non-ionizing radiation safety.

Conclusion

The "Polemistis" Wind Farm project is situated in an area with favorable environmental conditions, characterized by clean air, unpolluted water and soil, low noise levels, and safe radiation exposure. This baseline status provides a strong foundation for the project's development, with careful planning and monitoring in place to preserve these environmental factors throughout the project lifecycle.

2.2.3. Identification of the Risk Factors for Harm to the Health of People from the Environment and Living Environment for the "Polemistis" Wind Farm Project

The "Polemistis" Wind Farm project, with a proposed capacity of 44 MW, is situated in a remote area within the Municipal Units of Komotini and Organi, in the Regional Unit of Rhodope, Eastern Macedonia and Thrace Region, Greece. The project's isolated location and significant distance from nearby Bulgarian settlements, the closest of which are over 3 kilometers away and sparsely populated, greatly reduce potential human health impacts. This section identifies and addresses any risk factors associated with human health during the construction, operation, and decommissioning phases of the wind farm, alongside comprehensive mitigation strategies to ensure minimal environmental and community impact.

1. **Construction Phase Risks**

- **Air Quality and Dust Emissions**:

  The remote location mitigates the risk of dust and particulate matter affecting large populations. Nonetheless, construction activities, including road building and excavation, may lead to temporary increases in dust emissions, which could affect workers and, to a lesser extent, the distant residential areas.

  - **Mitigation Measures**: The project will apply dust suppression measures, such as watering access roads and limiting vehicle speeds, particularly during dry weather. Additionally, air quality monitoring will ensure that dust remains within safe levels, minimizing any possible effects on the limited population in nearby areas.

- **Noise and Vibration**:

  Given the isolated setting of the project, noise and vibration impacts on nearby communities are expected to be minimal. Construction equipment, however, will produce localized noise and vibration that may impact workers and nearby wildlife.

- **Mitigation Measures**: Noise will be managed by scheduling high-noise activities during daytime hours only and maintaining a buffer zone to limit the range of impact. Using quieter equipment and sound barriers where appropriate will further reduce noise. Vibration levels will be monitored to ensure they remain within safe thresholds, reducing potential disturbance.

- **Worker Health and Safety**:

With no densely populated areas nearby, construction risks primarily concern on-site personnel. Risks include heavy machinery operation and elevated work tasks, which could result in physical injuries.

- **Mitigation Measures**: Safety protocols include mandatory use of PPE, comprehensive safety training, and regular safety inspections. The remote nature of the project necessitates strong on-site medical response capabilities, with first-aid facilities and emergency plans in place.

2. <u>Operational Phase Risks</u>

- **Noise Emissions**:

Wind turbine operation produces low-level noise, primarily from blade rotation and turbine mechanics. However, the remote project site and the significant distance to the nearest Bulgarian settlements—each over 3 kilometers away—ensure that noise impact on residents is minimal.

- **Mitigation Measures**: Noise assessments confirm compliance with environmental regulations. Continuous noise monitoring will allow for real-time adjustments if levels exceed permitted limits, although this is unlikely given the distance to populated areas.

- **Shadow Flicker**:

The rotation of turbine blades can create a flickering shadow effect when sunlight passes through them. Due to the remoteness of the wind farm and the careful layout of the turbines, shadow flicker impacts on Bulgarian settlements, each over 3 kilometers away, are virtually non-existent.

- **Mitigation Measures**: The turbine layout and orientation have been optimized to avoid shadow flicker in inhabited areas. If unexpected impacts arise, operational adjustments can be made to limit any potential flicker effects.

- **Electromagnetic Fields (EMF)**:

  Although wind turbines emit low levels of EMF, the significant distance from populated areas mitigates any risk of exposure to residents. EMF levels dissipate quickly over distance, and the underground cabling further reduces potential EMF impact.

  - **Mitigation Measures**: The design meets international EMF safety standards, and distances between turbines and any residential area ensure that EMF exposure remains well below health risk thresholds.

3. <u>Decommissioning Phase Risks</u>

- **Air Quality and Noise During Dismantling**:

  Dismantling activities may generate dust and noise, though the remote location minimizes the likelihood of affecting any nearby communities.

  - **Mitigation Measures**: Dust suppression and noise control measures will be employed as they were during construction. Scheduled work hours and monitoring ensure that decommissioning activities comply with environmental standards for air quality and noise.

- **Waste Management and Recycling**:

  Waste from decommissioning, including metals and electronics, must be responsibly managed to avoid environmental contamination.

  - **Mitigation Measures**: The waste management plan emphasizes recycling and safe disposal, particularly of any hazardous materials. Nearby residents are unlikely to be affected by waste activities due to the project's remote setting.

- **Worker Health and Safety During Decommissioning**:

  The remote nature of the site necessitates thorough safety protocols for on-site workers during dismantling. Risks include operating dismantling machinery and handling large equipment.

  - **Mitigation Measures**: Safety measures include PPE use, specialized training for dismantling tasks, and emergency response plans tailored to the remote setting.

Conclusion

The "Polemistis" Wind Farm project benefits from its remote location, which naturally limits the impact of construction, operational, and decommissioning activities on nearby residents. The closest Bulgarian settlements, being over 3 kilometers away and lightly populated, are expected to experience negligible impacts. The project's comprehensive risk management and mitigation measures ensure that health and environmental impacts remain minimal, aligning with national and international standards.

2.2.4. Analysis of Expected Adverse Impacts on Environmental and Living Environment Components

2.2.4.1 Expected noise pollution

Noise Impact Assessment for the Settlements of Egrek, Buk, and Malkoch

As part of the environmental impact assessment, a thorough noise study was conducted to evaluate the influence of the proposed wind turbines on the closest settlements on the Bulgarian side: Egrek, Buk, and Malkoch. This assessment utilized the ISO 9613-2 standard, an internationally accepted methodology for calculating sound attenuation during outdoor propagation, ensuring a reliable estimate of noise levels at sensitive receptors.

Projected Noise Levels at Settlements

The noise levels for each settlement, measured in decibels (dB) and based on a worst-case scenario of maximum turbine output, are as follows:

- **Egrek**: 22.8 dB(A)
- **Buk**: 20.2 dB(A)
- **Malkoch**: 18.8 dB(A)

Comparison to Everyday Sounds

To provide clarity, it's essential to contextualize these decibel levels against familiar sounds. The noise levels projected for Egrek, Buk, and Malkoch are slightly louder than the sound of leaves rustling, which is approximately 20 dB. Such sounds are typically faint and merge into the background, especially in rural environments. By contrast, normal conversation typically measures around 60 dB. This difference highlights that the turbine's noise will be minimal and should not interfere with day-to-day life in these communities.

Influence of Distance on Noise Attenuation

The relatively low noise levels at the three settlements are primarily due to the considerable distance from the wind turbines. Noise from a source naturally diminishes as it travels further from its origin. For this project, the turbines are situated several kilometers away from Egrek, Buk, and Malkoch, resulting in significant sound attenuation by the time the noise reaches these locations. This distance is a crucial factor in reducing noise intensity, as the sound energy is dispersed over a greater area, thereby minimizing its impact.

The terrain and natural landscape features between the turbines and the settlements also play a role in further diffusing the sound. Such geographical buffers help absorb and block portions of sound waves, ensuring that any residual noise reaching these communities remains at very low levels.

Compliance with Environmental Noise Standards

The measured noise levels of 18.8 to 22.8 dB for these settlements fall well below the maximum permissible limits. These low decibel levels demonstrate the project's compliance with all relevant noise regulations, underscoring that the project has been carefully designed to avoid negative impacts on nearby communities.

Conclusion

In conclusion, the noise assessment reveals that the impact on Egrek, Buk, and Malkoch will be minimal due to both the low sound levels generated by the turbines and the mitigating effect of distance. The projected noise levels are comparable to faint, natural background sounds, ensuring they will not disrupt the daily lives or tranquility of these communities. This study confirms that the project aligns with environmental guidelines, supporting the suitability of the development and reinforcing its commitment to preserving the well-being of surrounding communities.

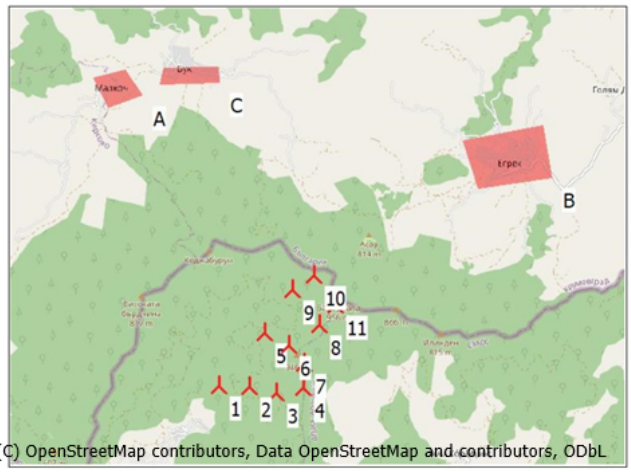
DECIBEL - Main Result

ISO 9613-2 Germany

The calculation is based on the international norm "ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors"

Loudest up to 95% rated power
Meteorological correction factor, C0: 0.0 dB

All coordinates are in
Greek GGRS87-GGRS87 (GR)



Scale 1:125,000

New WTG Noise sensitive area

WTGs

	Y	X	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	630,595	4,572,506	738.5	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
2	631,145	4,572,498	788.0	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
3	631,612	4,572,399	851.4	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
4	632,087	4,572,507	900.8	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
5	631,402	4,573,457	774.9	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
6	631,825	4,573,244	911.3	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
7	632,092	4,572,914	888.6	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
8	632,351	4,573,615	945.1	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
9	631,866	4,574,219	812.7	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
10	632,237	4,574,487	842.8	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9
11	632,646	4,573,963	948.3	VESTAS V150-4.0 4000 1...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	EMD	Level 0 - - Mode 0 - 10-2019	7.0	104.9

Calculation Results

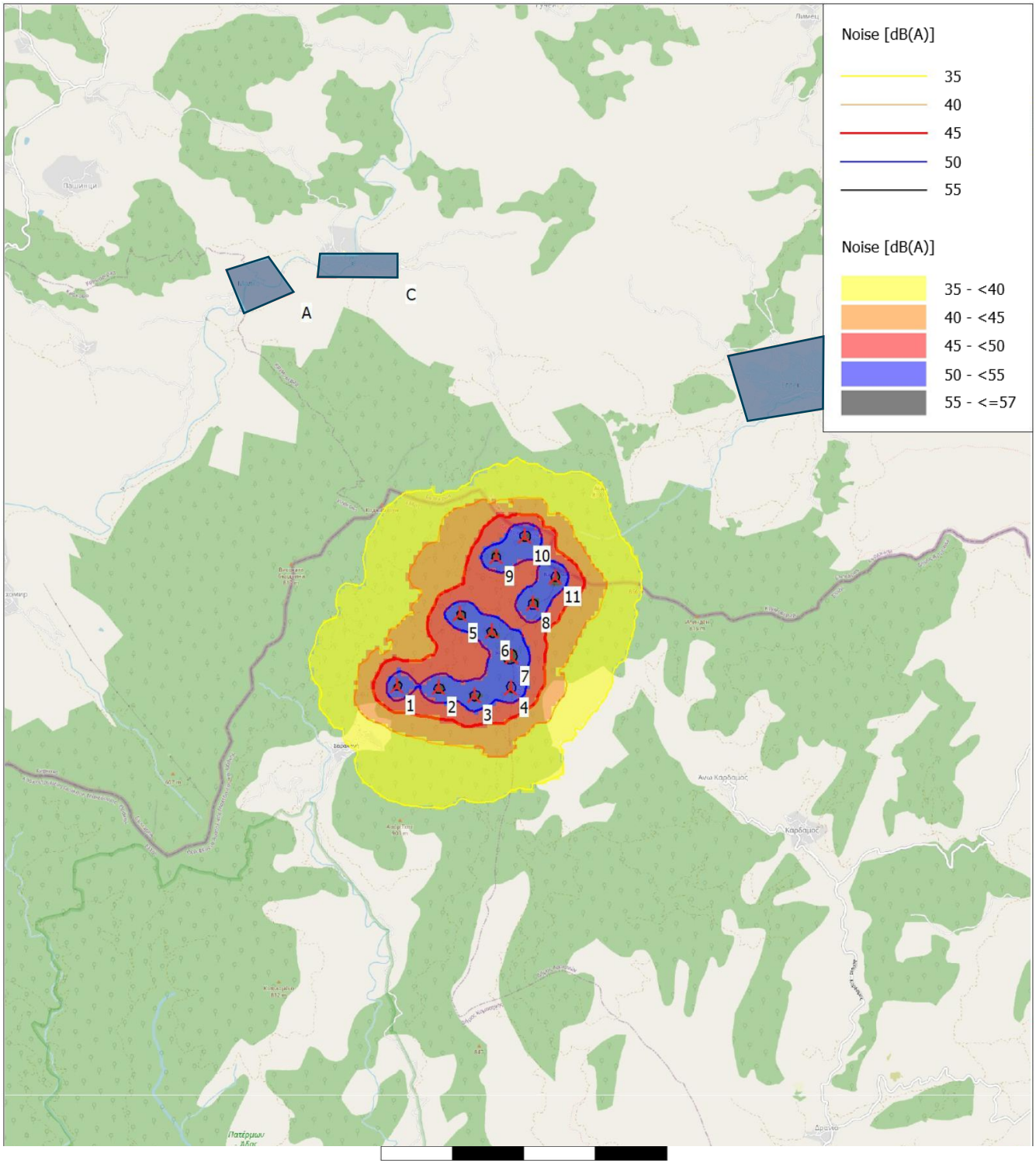
Sound level

Noise sensitive area No.	Name	Y	X	Z [m]	Immission height [m]	Sound level From WTGs [dB(A)]
A	Malkoch	629,096	4,577,589	411.0	5.0	18.8
B	Egrek	635,137	4,576,069	467.0	5.0	22.8
C	Buk	630,499	4,577,858	402.5	5.0	20.2

Distances (m)

WTG	A	B	C
1	5282	5773	5351
2	5488	5356	5398
3	5764	5089	5570
4	5889	4689	5581
5	4726	4558	4492
6	5123	4353	4800
7	5543	4384	5193
8	5123	3712	4629
9	4349	3758	3887
10	4396	3304	3792
11	5057	3262	4447

DECIBEL - Map Loudest up to 95% rated power



Map: EMD OpenStreetMap , Print scale 1:75,000, Map center Greek GGRS87-GGRS87 (GR) East: 632,265 North: 4,574,013

New WTG Noise sensitive area

Noise calculation model: ISO 9613-2 Germany. Wind speed: Loudest up to 95% rated power

Height above sea level from active line object

2.2.4.2 Anticipated Impact of Non-Ionizing Radiation (Electric and Magnetic Fields)

Based on the technical characteristics of the wind turbines and the significant distances from the nearest settlements—Egrek, Buk, and Malkoch—the anticipated levels of non-ionizing radiation from this project are minimal and well within international safety standards.

Non-Ionizing Radiation in Wind Turbines

Wind turbines generate minimal levels of non-ionizing radiation, primarily due to the low-intensity electric and magnetic fields (EMF) produced by their components. The EMF associated with wind turbines originates mainly from two sources:

1. **Electrical Equipment and Cables**: The turbine's generator and internal electrical cables generate a low-level electromagnetic field.
2. **Transformers**: Some wind turbines have small transformers installed near the base, which also emit low-level EMF.

These EMFs are categorized as extremely low frequency (ELF) fields, typically under 300 Hz, which are non-ionizing and considerably lower in frequency than sources known to have potential health effects (such as X-rays or UV radiation).

Anticipated Impact on Electric and Magnetic Fields (MP)

The field strength of the electromagnetic fields (both electric and magnetic) from wind turbines decreases rapidly with distance. In this project, the nearest settlements—Egrek, Buk, and Malkoch—are all situated several kilometers from the turbines. At these distances, any electromagnetic fields emitted by the turbines are almost entirely dissipated into the surrounding environment, resulting in negligible field strength by the time they reach residential areas.

Comparison to International Guidelines and Studies

According to international guidelines provided by the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the levels of non-ionizing radiation (particularly ELF EMF) associated with wind turbines are considered safe. Studies have shown that these fields are well below the exposure limits established for both the general public and occupational settings. For instance:

- The typical EMF levels measured at a wind turbine's base are similar to or less than what is produced by common household appliances like refrigerators or televisions.
- EMF levels drop significantly within just a few meters, and at distances typical for residential areas around wind projects, the levels are considered negligible and pose no health risks.

Conclusion

Given the significant distance between the turbines and the closest settlements, as well as the inherently low levels of non-ionizing radiation emitted by wind turbines, there is no anticipated harmful impact on electric or magnetic fields (MP) affecting these communities. The project aligns with international standards for non-ionizing radiation exposure, ensuring the health and safety of residents in Egrek, Buk, and Malkoch. This should provide reassurance that the project's electromagnetic emissions are minimal and well within safe limits established for rural and residential areas.

2.2.4.3 Anticipated Impact of Light Effects

Based on the shadow analysis conducted in WindPRO for the project, it appears that the settlements of Egrek (A), Buk (B), and Malkoch (C)—the nearest settlements on the Bulgarian side—**will experience no shadow flicker impact** from the planned wind turbines. The calculated "worst-case" scenario, which assumes continuous sunshine, no obstruction, and optimal alignment of turbine rotor planes, shows that all three locations receive **0 hours** of shadow flicker per year. This means there is no measurable shadow impact on these settlements under the modeled assumptions(SHADOW_Main Result).

Methodology

The analysis used the WindPRO software to estimate shadow flicker impacts, accounting for factors such as the sun's position, turbine orientation, and potential obstacles. The methodology ensures that receptors (such as residential areas) with any line of sight to the turbines are included in the assessment.

- **Egrek (A)**: As receptor A, located at coordinates (Y: 635,530, X: 4,576,413, Z: 445.1), the settlement experiences zero shadow flicker hours annually.
- **Buk (B)**: Represented as receptor B, situated at (Y: 629,726, X: 4,578,039, Z: 415.3), Buk also experiences no shadow flicker.
- **Malkoch (C)**: Malkoch, or receptor C, at (Y: 628,304, X: 4,577,412, Z: 427.7), is similarly unaffected, with zero hours of shadow flicker.

SHADOW - Main Result

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: AKRI_EMDGrid_1.wpg (3)
Obstacles used in calculation

Receptor grid resolution: 1.0 m

All coordinates are in
Greek GGRS87-GGRS87 (GR)

Scale 1:100,000
New WTG
Shadow receptor

WTGs

	Y	X	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	630,595	4,572,506	738.5	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
2	631,145	4,572,498	788.0	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
3	631,612	4,572,399	851.4	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
4	632,087	4,572,507	900.8	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
5	631,402	4,573,457	774.9	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
6	631,825	4,573,244	911.3	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
7	632,092	4,572,914	888.6	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
8	632,351	4,573,615	945.1	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
9	631,866	4,574,219	812.7	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
10	632,237	4,574,487	842.8	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4
11	632,646	4,573,963	948.3	VESTAS V150-4.0 4000 150.0 !O! ...	Yes	VESTAS	V150-4.0-4,000	4,000	150.0	105.0	1,905	10.4

Shadow receptor-Input

No.	Y	X	Z	Width	Height	Elevation a.g.l.	Degrees from south cw	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]	[°]		[m]
A	635,530	4,576,413	445.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
B	629,726	4,578,039	415.3	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
C	628,304	4,577,412	427.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	0:00	0	0:00
B	0:00	0	0:00
C	0:00	0	0:00

Night Lighting Impact

To comply with aviation safety standards, the wind turbines will feature red flashing lights, designed to be visible to aircraft during nighttime and low-visibility conditions. At over 3 kilometers from the nearest Bulgarian settlements, these lights are expected to have a minimal visual effect. Given the distance, the perceived intensity of the lights is significantly reduced, especially under typical atmospheric conditions where fog, cloud cover, or precipitation may further obscure visibility.

The night lighting includes:

- **Medium-Intensity Type B Lights** on each turbine nacelle, flashing red at an intensity of 2000 candela (cd ± 25%) with a frequency between 20 and 60 flashes per minute. These lights are essential for visibility to aircraft but are configured to limit visual intrusion.
- **Low-Intensity Type E Lights** positioned at mid-height on the turbine towers, with lower intensity (32 cd) to enhance visibility from various angles while minimizing unnecessary brightness.

All lights are automatically activated by a photocell to operate only during necessary conditions (night, dawn, dusk, and reduced visibility). For settlements over 3 km away, such as Egrek, Buk, and Malkoch, this setup ensures compliance with aviation requirements while mitigating the visual effect on distant viewers.

Conclusion

The absence of shadow flicker at these settlements, coupled with the minimal impact of night lighting at over 3 kilometers, demonstrates the project's alignment with environmental and social standards. These findings support the project's suitability for development, alleviating concerns regarding visual disruptions for the residents.

2.2.4.4 Analysis of Ambient Air Quality and Transboundary Environmental Impacts

1. Ambient Air Quality Assessment

- **Current Air Quality**: The "Polemistis" Wind Farm is located in a remote area with excellent baseline air quality, due to the absence of industrial activities or significant sources of emissions nearby. Local air quality is therefore minimally impacted by anthropogenic activities.
- **Expected Emissions During Construction and Operation**: Temporary emissions of dust and exhaust gases (e.g., CO_2, NO_x) may occur during the construction phase due to machinery and vehicle operation. However, these emissions are expected to be localized and short-term.

- **Mitigation Measures**: To minimize air quality impact, dust control measures, such as water spraying, will be implemented, along with strict maintenance schedules for machinery to limit exhaust emissions. During the operational phase, the wind farm will not produce air pollutants, as wind turbines generate energy without combustion.

2. Potential Transboundary Impact on Surface Water, Groundwater, and Soil

- **Surface Water**: The project site is not located near any significant surface water bodies that could be directly impacted. Furthermore, there is no anticipated discharge or runoff that would affect watercourses crossing into neighboring regions.
- **Groundwater**: Groundwater resources are present at considerable depth, and the construction activities are designed to prevent any interference with these water sources. Best practices in construction and operational planning ensure that there is no risk of pollutant leaching or contamination of groundwater that could extend beyond national boundaries.
- **Soil**: Soil disturbance is limited to the immediate areas of construction, with measures in place to prevent erosion and minimize any impact on soil quality. The risk of cross-border soil contamination is negligible, as there are no hazardous materials or activities involved that would produce long-term soil contamination.

3. Transboundary Environmental Considerations

- Given the project's location and scale, along with its non-polluting nature during the operational phase, the likelihood of transboundary environmental impacts is minimal. Emissions and disturbances during construction are managed with effective controls to prevent any significant cross-border effect, and ongoing monitoring will ensure compliance with environmental standards.

Conclusion

The "Polemistis" Wind Farm has been carefully planned to minimize impacts on air quality, water, and soil. Its design and operational model ensure that both direct and transboundary impacts remain within safe limits, with all activities aligned with environmental best practices and regulatory requirements. As a result, the project presents no significant risk to the environment or communities in neighboring regions.

2.2.5 Identification of New Risk Factors and Pollutants

Wind Farm "Polemistis" is not expected to introduce significant new risk factors or pollutants. Minor, temporary risks during construction, such as dust and machinery emissions, will be

managed with standard mitigation measures. During operation, the wind farm produces no air or water pollutants, and any noise and EMF emissions remain well within safe limits. Overall, the project is designed to operate with minimal environmental impact.

2.2.6 Identification of Potentially Affected Population and Areas

The "Polemistis" Wind Farm is located in a remote area, with the nearest settlements over 3 kilometers away. Given the distance and minimal environmental impact, the potentially affected population is very limited. Health protection measures address any minor, localized effects during construction, such as dust and noise, ensuring compliance with safety standards. Overall, no significant impact on the environment or nearby communities is anticipated.

2.2.7 Estimated Reduction of Pollution

The implementation of the "Polemistis" Wind Farm contributes to a reduction in environmental pollution by generating clean, renewable energy without emissions of air or water pollutants. The transition from fossil fuel-based energy sources to wind power supports lower greenhouse gas emissions regionally. As a result, the project is expected to have a positive impact by reducing pollution levels in the environment and living areas over time.

2.2.8 Characterization of Individual Risk Factors and Compliance with Health Standards

The project presents minimal risk factors to human health. Noise during construction, low-level electromagnetic fields, and temporary dust emissions are identified as the main factors. All are expected to remain within established health standards due to the project's remote location and effective mitigation measures. Continuous monitoring will ensure compliance, safeguarding the health of nearby residents and workers.

2.2.9. Assessment of Combined and Cumulative Impact

Given the location and low environmental impact of the project, no significant combined or cumulative effects are anticipated on the nearby population. The potential for cumulative impact, considering other nearby production sites and wind farms, including those in Bulgaria, is expected to be minimal, with air quality, noise, and non-ionizing radiation levels remaining well within safe limits.

2.2.10. Risk Assessment and Health Protection Measures

In the EIS conducted a comprehensive assessment of potential risks to human health, covering all relevant aspects, including noise, air quality, non-ionizing radiation, and construction-related impacts. Appropriate health protection and risk management measures are in place to ensure compliance with safety standards and to protect nearby residents and workers.

DIMITRIOS ARGYROPOULOS

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