

Study on the birds' impacts of wind generators in the region of North - Eastern Bulgaria

Todorka Stankova

Technical University of Varna, 9010, 1 Studentska Street, Varna, Bulgaria
Stankova.todorka@gmail.com

Abstract: *The future development of the renewable energy sector in Bulgaria is already set by the European Commission in the "Energy Map of Europe - 2050". The goals of the Green Deal should not predominant the goals of environmental protection and reverse. Bulgaria should ensure balance and sustainability in the development especially of wind energy sources due to the fact that most energy potential areas fall in the protected areas and territories by Natura 2000. The biggest such conflict observed in that report is the region of North- Eastern Bulgaria. The production of electricity from wind is one of the activities that has a potential impact on birds. For this reason, the subject of this study analyses the available data and summarize the birds' impacts of wind generators in the region of North - Eastern Bulgaria.*

Keywords: WIND ENERGY, BIRDS' IMPACT, RENEWABLE ENERGY, ECOLOGY, NOISE

1. Introduction

The decarbonisation of Europe has been identified as a possible scenario according to the 2050 Energy Map of Europe. Bulgaria, as an EU member, should participate in the implementation of generally accepted policies in the field of renewable energy sources. On the one hand the State should introduce measures to stimulate new capacity from renewable energy sources for the purpose of saving harmful emissions and providing energy security and on the other hand, Bulgaria should ensure balance and sustainability in the development of renewable energy sources with the objectives of environmental protection.

Despite the advantages of wind energy technologies such as no emission of harmful gases, minimum amount of water consumption during its operational period, the possibility of 80% recycling, huge amounts of CO₂ saved per year, minimum sealing area per unit of installed power and others, there are some points of conflict that should be resolved in order to ensure a balance between economic goals and those of environmental protection.

In Bulgaria, the highest concentration of wind energy capacity is observed in the region of northeastern Bulgaria, where the second largest migration route Via Pontica (Eastern European Migration Stream) passes.

The subject of the present study is focused on processing and analysis of information obtained on the basis of: radar data from wind energy projects in the region; data from a team of 25 experts from 8 governmental and non-governmental organizations prepared an "Integrated Spatial Planning Plan in the Kaliakra region"; data from the Regional Inspectorate for Environment and Water - Varna; decision of the Court of Justice of the European Union of 14 January 2016 in case C-141/14; extended complex forensic-ecological expertise in administrative case № 3774/2014 of AC-Varna; impact monitoring reports; LIFE + project; BSPB reports [1,3,6,9,10].

2. Results and discussion

According to data from the Ministry of Regional Development and Public Works obtained on the basis of the Law on Access to Public Information from the Regional Inspectorate for Environment and Water - Varna (RIEW - Varna), on whose territory is the main concentration of wind power in Bulgaria can be summarized the following data [1]:

For the period 2003-2009:

- 2840 applications for wind energy project (WPP) installations were submitted.
- 83% of them do not have an environmental impact assessment (EIA) [1,2,3].

Most of the applications are for single wind turbines or for less than 7 wind turbines in a project, which is used to avoid an EIA procedure.

This is one of the shortcomings that the Ministry of Environment and Water finds in the procedures. Taking advantage

of this shortcoming, some investors administratively "transform" their large-scale projects into several smaller projects [4,5].

For the period 2003-2015:

- a total of 910 pcs. investment intentions for the construction of WPPs with a total number of 3233 wind turbines have been announced;
- for the same period 676 of the total number of proceedings;
- 910 projects have completed the procedure;
- 6 are canceled after the preparation of the EIA;
- 228 are in the process of approval/rejection;

- Only for 133 project has been issued an EIA decision, as 6 projects with EIA have not been approved and 2 projects have been canceled, the remaining 777 projects are allowed without a decision to assess the need for EIA. Although projects with single wind turbines are predominant, there are also those with up to 12 wind turbines;

Built at the end of 2015 are:

- 148 wind energy projects with a total number of 381 wind turbines, as 738 wind energy projects with a total number of 3182 wind turbines have not been built so far, 11 have a building permit and 16 have no information.

The following facts concerning the conflict of interests between the economy and the environment are worrying:

- 18 WPPs with a total number of 254 wind turbines fall partially or completely in protected areas. The largest number of wind turbines is in Protected Areas SCI BG0000573 "Kaliakra Complex", SPA BG0002051 "Kaliakra" and Protected Area "White Rocks", SPA BG0002097.

- as many as 35 wind generator located on the land of the village of Balgarevo representing one wind energy project and another 33 of total of 52 wind turbines owned by another investor have been built and are currently operating, fall entirely into protected areas "Complex Kaliakra" and "Kaliakra", which are partially overlap (Fig. 1).

- another 32 wind turbines located on the territory of the protected areas in the area are planned and allowed for construction, but at the moment there are no official data whether they have been built or not.

However, the data obtained on the basis of the Law on Access to Public Information from RIEW-Varna[1] do not completely overlap with the data available from the Integrated Management Plan for Protected Area SCI BG0000573 "Kaliakra Complex" for protection of natural habitats and wildlife and protected areas SPA BG0002051 "Kaliakra" and SPA BG0002097 "White Rocks" for the protection of wild birds, developed by a team of 25 experts from 8 governmental and non-governmental organizations[6]. The integrated management plan was commissioned and prepared as part of the effective measures of the Bulgarian state in accordance with the decision of the Court of Justice of the European Union of 14 January 2016 in case C-141/14 on insufficient classification of territories as a special protected area certain projects in the Kaliakra region [6,7].



Fig. 1 General view of the 2 largest wind farms located Kaliakra Complex Protected Areas and Kaliakra Protected Areas

The total number of built and operating wind turbines (WG), subject to the Decision of the Court of Justice of the EU, is 101, of which 86 fall within the boundaries of SPA BG0002051 "Kaliakra", and the remaining 15 WG are outside the boundaries of the protected area[6].

The operative part of the Judgment of the Court of Justice of the EU states that the pursued government policy has led to a conflict of interest between the economy and ecology in this area.

The impact on wildlife that can be caused by wind turbines can be divided into direct and indirect. The direct impact is the probability of death due to a collision with the wind turbine, while the indirect impacts are avoidance, habitat disturbance and displacement. However, the impacts are smaller than other energy sources. Studies also show that climate change poses a much greater threat to wildlife. Some studies show that the number of birds killed by wind turbines may be insignificant compared to other human activities[7].

Tab 1. Leading causes of human-related bird mortality in the US [8]

Causes related to human activity	No. killed birds for 1 year. (million)
Cats	1000
Buildings	100
Hunting	100
Vehicles	60–80
Communication towers / facilities	10–40
Pesticides	67
Electricity / distribution network	0.01–174
Wind generators	0.15

According to an extended complex forensic environmental expertise in administrative case №3774/2014 of AC-Varna, the staff of experts together with foreign experts found after a study in the Burgas region, where unlike northeastern Bulgaria there is a narrow front of birds, in period 2012 - 2014 the numbers of migratory birds are many times higher, regardless of the established parks in Bulgaria and Romania, without this having in any way affected the documented mortality of operating parks[78]. The number of reported victims in the St.Nicolas Wind Farm (2010-2013) is within the limits of the natural mortality of the species for which dead birds have been reported. It varies from 5 to 60% per year for different species and is the largest among juveniles and the smallest among birds of reproductive age[9].

Bulgaria is the second largest ornithological biodiversity in Europe[13]. This is confirmed by the fact that the country represents 78% of the total European bird life, including globally endangered species[11,12]. Due to that fact Bulgarian is internationally responsible for the protection of vulnerable and endangered bird species.

In our country the number of wintering birds of European conservation importance exceeds 200 species[11,12]. Among them is the red-breasted goose (*Branta ruficollis*). Almost the entire world

population of this endangered species winters in the Coastal Dobrudja.

Studies during the period after the construction of wind turbines in this area, found the presence of red-breasted geese with varying numbers in agricultural lands included in "Kaliakra" and the adjacent fields every winter[14,15,16, 17].

In order to establish the dynamics of the number of this globally endangered species in this area, data from the daily reports of Protected Area "Kaliakra" - surveyed for the presence of feeding red-breasted geese during the winter periods of 2008, 2009, 2010, 2011, 2012, 2013 and 20014 years in the course of systematic monitoring by the team of ornithologists of St. Nicholas WPP [17].

The comparative analysis of these data in terms of feeding places, as well as the total number of geese, including the globally endangered species of red-breasted goose shows the use of the same areas before and after construction of wind turbines in PA "Kaliakra". In the course of the field work on the plan in the winter of 2014-2015, these results have been confirmed. In the last included in the report season, through special observations on the behavior of geese near the turbines, no changes in behavior associated with avoiding, turbines. The low number of geese wintering in Bulgaria and the low number of geese in Kaliakra protected area in the winter of 2014/2015 did not allow detailed measurement of the areas avoided by feeding geese due to the proximity to the turbines. This important indicator is calculated from data from previous seasons (2012/2013), when the abundance of geese in PA "Kaliakra" allows calculating the average area around each wind turbine that geese could not use in ideal conditions (when the field is sown with appropriate culture from the food spectrum of geese). The distance at which geese avoid wind turbines in wheat fields can be considered as a habitat and varies from 120 to 40 meters, with an average of 80 meters around the wind turbine. Given the size of the habitat and the abundance of food resources in the coastal part of Dobrudja, it is untenable to consider the possibility of direct impact of wind turbines, at their current number, on the food resources of wintering geese in the area of Kaliakra goose.

Factors related to changes in land use could have significant effects on the number of geese wintering in the area. This is directly related to the main food of geese in winter - cereals. To analyze the conditions of land use, we have analyzed photos of the territory during the periods of restoration of ownership of agricultural land in Bulgaria.

Analysis of the potential barrier effect on the geese wintering in Kaliakra was performed according to the data from the special 3D radar "ROBIN" designed to study the risk to birds in the area of the wind farm of EVN Bulgaria [14]. During the period of the most intensive flight of geese observed synchronously by the project team and the radar, the trajectories of the passing geese presented below were analyzed.

Figure 2 presents information about the flying geese by hours of the day during one day on 11.01.2015, when the most intense flight is observed this season. It is covered all day long. The geese were counted not only above the point, but in a perimeter of 20 km, which allows to assess whether there is avoidance of the area with generators in a larger perimeter.

No direct collisions of geese with wind turbines have been identified. No signs of a barrier effect have been identified in macro-geographical terms leading to the avoidance of the area of PA "Kaliakra". Changes in the direction of the flight and bypassing of certain groups of people or cars parked in the protective belts have been established, indicating to the birds the presence of hunters. Bypassing such hunting groups is a major factor influencing the direction and altitude of geese in this area.

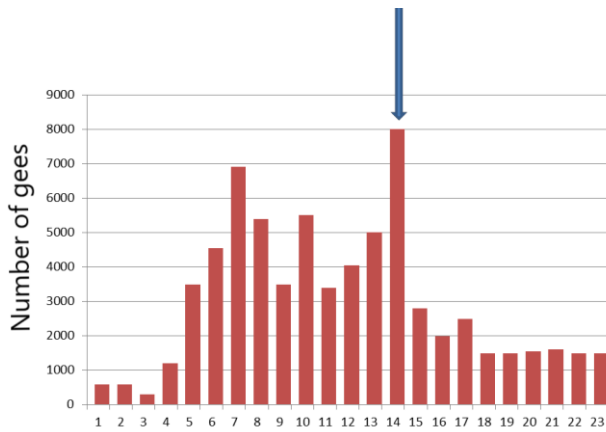


Fig. 2 Total number of geese flying through the territory - 11.01.15

The main part of over 20000 flew through "Kaliakra" mixed flocks of red-breasted geese and large white-fronted geese have passed at altitudes between 100 and 200 meters, ie. above and between running generators. On the same day, observations and inspections under the turbines did not reveal any geese killed in the collision. Collisions of geese with generators have not been established by a systematic study of 52 turbines in "Kaliakra" during the last 5 winter seasons. However, taking into account the large numbers of geese flying through the protected area "Kaliakra", especially on days with reduced visibility, the risk of collision may increase significantly. Therefore, this measure has proven its effectiveness, which has been applied for many years in the current wind farm St. Nicholas, turbine shutdown system at risk to birds.

Up to date, there is no evidence of a direct impact of wind turbines in the area on the geese wintering there. No systematic collision of geese of any species with turbines has been identified after a systematic study of turbine mortality over 5 years. No indirect effect has been identified, such as the displacement of feeding areas and migratory routes of wintering geese in the area, known as the displacement or barrier effect. The probable cause can be compared with some distances and facts. Each turbine emits a sound audible in a wide range. For both humans and animals, standing 50 meters from a running turbine causes obvious discomfort. The distance at which the suction effect is established and the turbulence behind the propeller is below these 50 meters. This suggests that the repulsive effect of sound pollution acts as an alarm and reduces the likelihood of impact, collision and mortality. Fixed objects do not create noise pollution and do not "irritate" the birds, on the basis of which it can be concluded that it is probably easier to hit a bird in a pole/power line than in a working turbine.

Impact monitoring reports from all WPPs in the Kaliakra area and LIFE + reports for the red-breasted goose show that the geese do not collide with wind turbines. A comparison of data from Dereliev's research from the period before the construction of WPPs in the region and data from BSPB reports in the last three years shows that despite the forecasts of fragmentation and intimidation - geese have not changed the area used for wintering before WPP construction in area. The data show a concentration of geese near the two freshwater lakes Durankulak and Shabla, far from the Kaliakra, as was the case in the period 1995-2000 long before the construction of WPPs in Bulgaria and neighboring Romania.

According to the report from the intact monitoring of Kaliakra Wind Farm for the study period (July 2008 - June 2009) 940 test sites were reported (the area covered by the rotor of the wind turbine - 50x50 meters [14], 3 deaths were found - two young pelicans in October 2008 and two gray buntings in April 2009. About 740 up to 2000 pink pelicans passed through the Kaliakra region in the autumn migration season from 2005 to 2009. The losses so far established during the operation of the park are between 0.13 and 0.05% of the pelicans migrating in the region of Kaliakra or 0.0027% of the population migrating along the Black

Sea coast communities (steppes) bunting for protected area "Kaliakra" [6].

Data from an analysis of the systematically studied mortality of birds from collisions with turbines of the St. Nicholas WPP show that only 4 of the 127 target species for the Kaliakra have been affected. For four years, during which systematic inspections of each of the 52 turbines were carried out, once a week 1 meadow woodpecker, 4 big-billed larks, 2 coots and 5 yellow-legged gulls were found dead. All four species have numerous populations with increasing tendencies, which has served to identify them as non-endangered according to the World Conservation Union.

Studies of bird mortality from various anthropogenic environmental factors include the area with all available facilities, as well as the available road network in the area.

During the period 26.08-30.09.2014 a daily monitoring of bird mortality was carried out on 7 km a section of a secondary road connecting the settlements of St. Nikola and Tyulenovo, Kavarna municipality. A total of 107 bird carcasses were identified during the monitoring period. A study found mortality of more than 14 birds per kilometer in 30 days of the autumn migration period. Recalculated for the whole season of the entire road network (about 100 km) the mortality from collisions with cars in the territory amounts to over 1500 birds per month[14].

The results of research on wintering geese as the main long-term threats in the Kaliakra Protected Area indicate hunting and unrest in the area identified daily by a team of experts working during the winter season of 2014-2015.

The largest share of identified threats are those of the groups "Human Intervention and Concern", "Agriculture", "Biological Resources", "Urbanization" and "Pollution" [103]. Most threats are related to human activity, much less are threats related to natural, natural processes. As a result of the use of the lands in the territory of the three protected areas, fragmentation of the habitats of the species subject to the Habitats Directive and the habitats of wild birds subject to the Birds Directive is observed. The main factors are: the plowing of areas; chemicalization in agriculture; unbalanced agricultural practices; burning stubble and headlands.

3. Conclusion

The production of electricity from wind is one of the activities that has a potential impact on birds. For this reason, the subject of this study was to analyze the available data in the period before the construction of wind farms in the region of northeastern Bulgaria, which includes 3 protected areas, partially overlapping.

In practice, the main reason for the emergence of a point of conflict in the interaction between the development of wind energy and the environment is the territorial overlap between regions with high wind potential and areas with a high concentration of birds.

The data from the reports, which rank the identified threats in groups, put the group of "Urbanization of Territories", where wind energy projects fall, only in third - penultimate place. Leading groups remain Human Intervention and Anxiety; "Agriculture"; "Biological Resources", and "Pollution"[6]. Contrary to expectations that the wind turbines built in the region of northeastern Bulgaria for the reasons described above have a significant negative impact in terms of mortality, barrier effect and habitat loss, the results reveal other greater risks for birds.

The expected noise pollution generated by the wind turbines turns out to be a noise barrier protecting the birds from collision and turbulence from the propellers. Data on bird mortality in the region as a result of collisions with cars or stationary infrastructure such as the electricity grid are many times higher than those recorded by wind turbines.

Convergence of meteorological conditions, rapid fall of thick fogs, strong westerly winds create a precondition for critical situations. Therefore, a measure has been introduced which has

proven its effectiveness, namely the activation of a turbine shut-off system at risk to birds.

It is unacceptable for the country to repeat the mistake by allowing the installation of wind energy sources in the territory covered by the Birds Directive, regardless of the facts recorded by the radar system and experts in the region, summarized in the report. Due to this fact, it is inadmissible for the state to take final decisions by stopping the implementation of wind energy projects outside the territories of the Birds Directive.

The future development of the RES sector in Bulgaria is already set by the European Commission in the new goals in the "Energy Map of Europe - 2050", namely: reduction of greenhouse gases to 80-95% compared to 1990 levels; 75% share of renewable energy sources; transition to a competitive low-carbon economy; creation of a single European transport space; switching off the thermal power capacities using conventional energy sources; reduction of nuclear power. These are goals that can be achieved by introducing more renewable energy capacity into gross final energy consumption.

The goals of the Green Deal should not violate the goals of environmental protection. A balance is needed to minimize risks to the environment, while ensuring clean energy sources and a good social impact on the population.

4. Acknowledgements

Integrated management plan for protected area SCI BG0000573 "Kaliakra Complex" for protection of natural habitats and wild flora and fauna and protected areas SPA BG0002051 "Kaliakra" and SPA BG0002097 "White Rocks" for protection of wild birds, at all.

BSPB reports on LIFE + under the project "Conservation of the wintering population of the globally endangered red-breasted goose".

Project "conservation of the wintering population of the globally endangered red-breasted goose"

Report on the study of bird mortality in the wind farm "Kaliakra", October-November, 2009 by Dr. Peter Shurulinkov.

An. Profirov, D. Toneva-Zheinoва, D. Nikolova, V. Valchanov, T. Dimanova, S. Dalakchieva, P. Shurulinkov, complex forensic ecological expertise under AD№ 3774/2014 of the AC-Varna, 2016;

Bulgarian Society for the Protection of Birds.

5. References

- Letter with outg. No ЗДОИГ-2909/14.09.2018г и ЗДОИГ-3503/06.06.2017г. law for access to information to Ministry of environment.
- Michev, T., L. Profirov, K. Nyagolov, M. Dimitrov. 2011. Autumn Migration of Soaring Birds at Bourgas Bay, Bulgaria 1979-2003, British Birds, London, 1, pp 16-37;
- Bulgarian organization for birds protection, ornithological important place in Bulgaria (OIP), www.old.bspb.org/print_page.php?id=435&menu_id, 2001-2018;
- Minchev T, at all., "Migration of soaring birds via Bulgaria", Acta Zoologica Bulgaria, March 2012,
- Ministry of environment and water, 2013 Report of the sensitive birds zone". http://natura2000.moew.government.bg/PublicDownloads/Auto/OtherDoc/276299/276299_Birds_120.pdf
- Integrated management plan for protected area SCI BG0000573 "Kaliakra Complex" for protection of natural habitats and wild flora and fauna and protected areas SPA BG0002051 "Kaliakra" and SPA BG0002097 "White Rocks" for protection of wild birds, at all.
- Magoha p. Footprints in the wind: environmental impacts of wind power development. Fuel and Energy Abstracts 2003;44(3):161.
- Rebecca O. Environmental benefits of wind energy. National Wind, <http://blog.nationalwind.com/2009/03/environmental-benefits-of-windenergy.html>; 2009 [retrieved 07.09.09].
- An. Profirov, D. Toneva-Zheinoва, D. Nikolova, V. Valchanov, T. Dimanova, S. Dalakchieva, P. Shurulinkov, complex forensic ecological expertise under AD№ 3774/2014 of the AC - Varna, 2016;
- Bulgarian Society for the Protection of Birds: <http://bspb.org/bg/news/Izgotven-e-noviyat-Svetoven-CHerven-spisak-na-zastrashenite-ot-izchezvane-vidove-ptitsi.html>
- Ministry of environment and water, Regional inspection of environment and water, Appendix 1 to the law of protecting the environment
- Ministry of environment and water, 2013 Report of the sensitive birds zone". http://natura2000.moew.government.bg/PublicDownloads/Auto/OtherDoc/276299/276299_Birds_120.pdf
- Newton, A. 2012, The coastal syndromes and hotspots on the coast, p 225;
- Report from the commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Brussels, 9.4.2019 COM (2019) 225final, p.6 https://ec.europa.eu/commission/sites/beta-political/files/report-progress-renewable-energy-april2019_en.pdf
- BSPB LIFE + reports on the project "Conservation of the wintering population of the globally endangered red-breasted goose", <http://bspb-redbreasts.org>
- Project "conservation of the wintering population of the globally endangered red-breasted goose"
- Monitoring report of WEP St. Nikola, <http://www.aesgeoenergy.com/site/Studies.html>
- Integrated management plan for protected area SCI BG0000573 "Kaliakra complex" for protection of natural habitats and of wild flora and fauna and protected areas SPA BG0002051 "Kaliakra" and SPA BG0002097 "White rocks" for protection of wild birds, at all.
- Willem Van den Bossche, in collaboration with Peter Berthold, Michael Kaatz, Eugeniusz Nowak & Ulrich Querner 2002
- The National Strategy for Renewable Energy Production according to the ECONECT report.
- Regional inspection of environment and water, data under the law for access to information „Processed wind generators on the territory of RIEW Varna for the period 2003-2015г.
- Mecke, I. Lee, J.R. Baker jr., M.M. Banaszak Holl, B.G. Orr, Eur. Phys. J. E 14, 7 (2004)
- M. Ben Rabha, M.F. Boujmil, M. Saadoun, B. Bessaïf, Eur. Phys. J. Appl. Phys. (to be published)
- Luigi T. De Luca, *Propulsion physics* (EDP Sciences, Les Ulis, 2009)
- F. De Lillo, F. Cecconi, G. Lacorata, A. Vulpiani, EPL, 84 (2008).