BWE
German Wind Energy Association

Wind power and nature conservation

September 2016

Renewable energy is an essential pillar in the implementation of climate protection goals, and a speedy energy transition will contribute significantly to nature and species conservation. According to Germany's Federal Nature Conservation Act (BNatSchG), "establishing a sustainable energy supply is particularly important" (Section 1 Para. 3 Pt. 4 BNatSchG).

The sector strives to comprehensively fulfill legal requirements for nature and species conservation in complex planning and approval processes. However, concrete implementation of those plans can reveal some conflicts of interest between wind energy and nature and species conservation. This paper provides an overview of the most important aspects, describing both the difficulties of and solutions for reconciling wind power and nature conservation, with a particular focus on species conservation. Over the last several years, we have seen knowledge in this area continue to grow, particularly when it comes to wind power's effects on birds and bats. In addition, a number of research projects have investigated potential concrete solutions. This paper also includes statements from the BWE on some issues.

1. Introduction

Conflicting priorities between wind power and nature conservation

Strict requirements for nature conservation are taken into account both when planning areas dedicated to wind power and when approving a specific location for a specific turbine[1]. European, German, and state legislation defines standards for protecting the ecosystem, landscapes, and individual species.

Regional planning guidelines alone prevent the use of valuable locations for wind energy in favor of nature and landscape conservation, with 98% of Germany's total surface area off limits for wind energy. Designated nature reserves are strictly off limits and are, in principle, kept free of built structures; these make up 4% of German's surface area[2], with landscape conservation areas[3] covering another 28%. The European reserve categories SPA[4] for bird protection and FFH for habitat protection apply to about 15% of the country's surface area, although the percentages in individual states vary widely.[5] More than 20% of Brandenburg, for example, has some protection status.
Besides the strictly off-limits areas like nature reserves, areas with somewhat more flexible criteria, such as landscape conservation areas, must be evaluated on a case-by-case basis as part of the planning process. The various states in Germany have different criteria for determining whether a protected area is strictly off limits

1 Cf. Ahnen&Enkel for BWE 2016: www.wind-energie.de/infografik_naturschutz
2 BfN: Naturschutzgebiete. www.bfn.de/0308_nsg.html (accessed 30.3.2016).
3 BfN: www.bfn.de/0308_lsg.html (accessed 16.06.16).
4 SPA: special protected area for birds in the European protected area system NATURA 2000.
5 BfN: FFH und Vogelschutzgebiete. www.bfn.de/0316_gebiete.html#c5409 (accessed 16.06.16).

or not. Areas where wind power can be concentrated are designated under consideration of a variety of land use demands with economic, social, and environmental objectives. Because it is not possible to conduct a sufficiently detailed investigation at this level of analysis, species-specific land use requirements cannot be definitively evaluated in the course of land management planning.

The permit planning phase for individual or multiple turbines, however, includes detailed consideration of the location and interdependencies in terms of nature and species conservation. If protected species are found in the area, permission to build may not be granted, or operation of the turbines may be subject to strict requirements. In almost all projects, the effort required to address issues related to nature conservation is increasing and, in some cases, is a crucial factor in a project's financial feasibility. Particularly challenging is the lack of unambiguously applicable evaluation standards for protected species' risk of collision; on top of that, it is almost impossible to adhere to the ban on killing in accordance with Section 44 Para. 1 BNatSchG when it comes to individuals.

Overall, the variety of interdependencies between different levels of action and management leads to a complex interplay with some conflicts that call for a careful assessment of solutions for each situation. Wind power must be expanded in order to reach the Energiewende's targets for the power sector, with as much as 2% of Germany's surface area needed. To achieve a complete transition to renewable energy, additional land is necessary, along with ensuring that land already in use can continue to be used. To this end, the effectiveness of regulations for nature conservation must be reassessed. For example, one-size-fits-all requirements for distance that are regularly flouted by birds themselves (such as golden plovers and lapwings resting in wind farms or black storks brooding a few hundred meters from a turbine) should be reassessed and/or no longer considered criteria that can make an area off limits by default.

2. Legal foundations

Legal framework for species conservation and the implementation of nature conservation standards

Impact mitigation regulations and compensation measures (Sections 14 and 15 BNatSchG[6])

Based on the polluter pays principle, impact mitigation regulations forbid negative impacts on the ecosystem and require that unavoidable significant effects be compensated for. They cover all changes that could interfere with the functioning of the ecosystem and the landscape. To this end, there are two levels: 1) avoidance, 2) compensation and replacement. Baseline studies and analyses serve as the foundation for the environmental measures that should be implemented and for determining the amount of compensatory fees in the case of, for example, a significant negative impact on the landscape.

In wind projects, compensation and replacement measures that, for example, increase populations of certain species and improve habitats are implemented in coordination with nature conservation authorities based on primary legislation and guiding regulation. Protecting the ecosystem's effectiveness and ability to function also includes the species who call the particular area home. Targeted, effective measures for all species have been an essential component of project implementation for quite a while now.

6 Federal Nature Conservation Act (BNatSchG) from 29 June 2009 (BGBl. I pg. 2542), most recently updated with Article 4 Para. 100 of the law from 7 August 2013 (BGBl. I pg. 3154).

The impact mitigation regulations generally resolve situations marked by conflict, and implemented measures allow most projects to be completed in a way that is compatible with nature and species conservation.

Special species conservation

In addition, interventions that are allowed in accordance with Section 15 BNatSchG must undergo assessment for species conservation. Special species conservation applies to specially and strictly protected European bird species in accordance with Section 7 Para. 2 Pt. 13 BNatSchG and/or Article 1 of the EU's Birds Directive as well as other groups of animals directly affected by a project. The access bans defined in Section 44 Para. 1 BNatSchG form the legal basis here. For example, there are prohibitions against injuring or killing wild animals that are specially protected (killing ban, Section 44 Para. 1 Pt. 1 BNatSchG), disrupting wild animals that are strictly protected and European bird species (disruption ban, Section 44 Para. 1 Pt. 2 BNatSchG), and damaging or destroying breeding grounds or home habitats used by specially protected species (damage ban, Section 44 Para. 1 Pt. 3 BNatSchG).

A project that faces legal challenges in terms of species conservation because prohibitions in accordance with Section 44 Para. 1 BNatSchG are expected will not initially be able to make use of impact mitigation regulations. However, measures that go into effect before the project is completed can prevent prohibitions so that the project can be implemented with legal certainty and consideration of species conservation requirements.

Killing ban in the Federal Nature Conservation Act

Uncertainties about legally implementing a project can especially arise from Section 44 Para. 1 Pt. 1 BNatSchG. For example, the legislation absolutely prohibits killing strictly protected animals. A dataset summarizing bird and bat corpses found near wind turbines over the last approximately 20 years[7] suggests a relatively high rate of found corpses resulting from collisions but does not quantify the risk for individuals around turbines. Jurisprudence emphasizes that erecting a turbine in an area where a protected species is present does not necessarily mean that restrictions related to the killing ban apply[8]; it must be proven that there is a significantly increased risk relative to the everyday risk level for unique individuals.[9] Generally, legal decisions must be made about turbines that are planned within the officially recommended distances from breeding grounds or flight corridors to essential feeding areas and that have the potential to benefit from a special, individual solution.

Expert reports determining any potential negative effects on strictly protected species present in the area are to be submitted; they must be commissioned in coordination with nature conservation officials and paid for by the project developer. These reports are of a high technical quality and generally cover a period of one year.

Species conservation assessment

The legally required species conservation assessment (ASP) and special species conservation assessment (saP) verify compliance with access bans in accordance with Section 44 Para. 1 BNatSchG. Although there is no legal

7 Vogelverluste an Windenergieanlagen in Deutschland: www.lugv.brandenburg.de/cms/media.php/lbm1.a.3310.de/wka_voegel_de.xls (accessed 11.12.2015).

8 Cf. BVerwG (Federal Administrative Court), decision from 09.07.2008 9 A 14.07; BVerwG, decision from 28.03.2013 9 A 22/11.

9 Cf. BVerwG, decision from 12.03.2008 9 A 3.06; decision from 09.07.2008 9 A 14.07; decision from 18.03.2009 9 A 39.07; decision from 14.07.2011 9 A 12.10; also OVG Lüneburg, ruling from 18.04.2011 12 ME 274/10; ruling from 25.07.2011 4 ME 175/11; Verwaltungsgericht Hannover, decision from 22.11.2012 12 A 2305/11.

requirement at the high level of regional planning, species conservation is already taken into account here in the form of an initial estimate, even though the area being studied is far too large to provide sufficiently detailed data. This can lead to areas that are generally suitable for wind energy being ruled out, without the chance of more detailed assessments of nature conservation requirements in individual cases. Comprehensive assessments should remain a component of the approval process instead. Special state guidelines (cf. page 7) include recommendations and advice for the scope of such assessments.

Environmental impact assessment

Legislation regarding environmental impact assessments is based on the European guidelines for such assessments. An assessment is absolutely required for projects with at least 20 turbines; smaller projects only need to conduct one after a preliminary assessment that is communicated by the authorities in charge of approval. An environmental impact assessment provides a framework for assessing the effects a project has on environmental aspects that require protection and also includes an evaluation of alternatives. Requirements for sharing information with the general public ensure that citizens have an understanding of the project. A strategic environmental assessment is conducted at the level of regional / land use planning to designate priority and concentration zones. This assessment helps ensure that significant environmental effects potentially arising from plans and programs are taken into account even before a project is actually implemented. As these plans and programs are further developed, information is shared with the public early on.

Assessment prerogative for nature conservation

All legal requirements related to nature conservation are to be managed by the project developer in coordination with the relevant authorities. The effects that turbines may have on individual species are therefore evaluated using different methods and without standard benchmarks. Although a complete lack of risk is not required (in line with jurisprudence), there are also no clear thresholds for significance or assessment benchmarks[10], which often leads to requirements for very long time periods and large scopes of study even when they do not result in insights that are relevant to planning.[11]

According to current jurisprudence, the authorities have the prerogative to make assessment decisions related to nature conservation and therefore have leeway when it comes to evaluating projects that plays out in both the scope of studies and the assessment of turbine-related effects.
Thus, individual occurrences often lead to a high rate of precautionary measures, when a better method may be to appropriately assess the actual effects a project will have on the ecosystem and include in the assessment suitable potential solutions for preventing or minimizing such effects.

10 Cf. BVerwG, decision from 09.07.2008; BVerwG, decision from 27. 06.2013 4 C 1/12; BVerwG, decision from 21.11.2013 7 C 40/11; OVG Lüneburg, ruling from 18.04.2011 12 ME 274/10; OVG Magdeburg, decision from 16.05.2013 — 2 L 106/10 ZNER 2013, pg. 328.

11 BVerwG, decision from 09.07.2008, reference number: 9 A 14.07, para. 66.

3. Current developments

Prevention and mitigation

Generally, a principle of prevention and mitigation applies: negative impacts on the ecosystem and landscape should be avoided or at least kept as minimal as possible, and any lasting negative effects should be compensated for. To avoid prohibitions based on the Federal Nature Conservation Act (Section 44, Para. 1), measures aimed at improving habitats and supporting populations can be taken even before turbines are started up. If predicted conflicts can't be avoided in any other way, such as if a protected species is expected to be significantly negatively impacted for a period of time, the turbine(s) can be temporarily turned off. These additional requirements for turbine operation are stipulated in the guiding regulations for approval according to the Federal Emission Control Act.

Special compensatory measures are especially useful for preserving the population level of a species and/or ensuring functional ecological relationships. State decrees describe preferred measures related to continuous ecological function (CEF)[12] and/or improving conservation of specific species' population (favorable conservation status (FCS)[13] measures). Their effectiveness should be determined before the start of the project and ensured over the long term.

Test distances

German states' wind power decrees include, in some cases, comprehensive species-specific statements. Some states have begun stipulating test distances instead of minimum distances. This solution prevents potential areas from being ruled out because of blanket taboo criteria related to breeding areas while also signaling a need for assessments when protected species are present.

Additional information (in German):

Fachagentur Windenergie an Land (2015): Vermeidungsmaßnahmen bei der Planung und Genehmigung von Windenergieanlagen

www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA-Wind_Studie_Vermeidungsmassnahmen_10-2015.pdf (accessed 06/2016)

BUND, NABU (2015): Praxisbeispiele Windenergie & Artenschutz. Erfolgreiche, erfolgversprechende und innovative Ansätze.
http://www.bund-bawue.de/fileadmin/bawue/pdf_datenbank/PDF_zu_Themen_und_Projekte/klima_und_energie/dialogforum/Praxisbeispiele_Windenergie_Artenschutz_Dialogforum_BUND-NABU_Einzelseiten.pdf (accessed 06/2016)

12 Continuous Ecological Function
13 Favourable Conservation Status

Additional information (in German):

Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Landesentwicklung – Auftraggeber der Gutachterlichen Stellungnahme (2014): Grundsätzliche Eignung von Maßnahmentypen zur Vermeidung von erheblichen Beeinträchtigungen von windkraftsensiblen Arten in Vogelschutzgebieten mit Schwerpunkt bei den Arten Rotmilan und Schwarzstorch.

https://landesplanung.hessen.de/sites/landesplanung.hessen.de/files/content-downloads/Endfassung_KIFL_Gutachten_31_10_2014.pdf (accessed 06/2016)

Excursus: Exceptional approval – will granting an exception ensure legally compliant planning?

Legal species conservation recommendations and regulations for the following states include stipulations for exceptions to the killing ban in accordance with Section 44 Para. 1 BNatSchG: Bavaria, Baden-Württemberg, Brandenburg, Hesse, North Rhine-Westphalia, Lower Saxony, Rhineland-Palatinate, and Schleswig-Holstein. According to Section 45 Para. 7 Page 2 BNatSchG, an exception can only be granted in a case where no reasonable alternatives exist, which can often occur when turbines are planned inside a "suitability" or priority area. One requirement is that the project not worsens the current state of a potentially affected population.

It is important to emphasize here that exceptional approvals are not regularly granted in order to allow wind power projects to be implemented; indeed, they are truly granted only in exceptional cases. An aspect that must be closely examined is the assumption that exceptional approval gives a project additional legal certainty. Stakeholders must have an objective debate regarding the facts of nature conservation and the application of potential tools for overcoming recognized conflicts.

4. Overview of developments in individual states

Almost all states in Germany have decrees or recommendations for implementing Energiewende targets and applying legal requirements related to wind energy planning. The recommendations form the framework for governmental decisions and are very important for project developers to consider in order to ensure legal certainty. However, these are not generally applicable legal norms but agency-internal instructions that build a framework for managing related processes.

The following overview lists state decrees and guidelines.[14]

14 Note: The table includes links to download the documents mentioned.

State guidelines	Planning / approval	Nature conservation	Birds	Bats	Wind in wooded areas / landscape
Baden-Württemberg	Wind energy decree 2012	Planning advice Advice Exceptions 2015	Advice on research and analysis	Advice, research	
Bavaria	Wind energy decree 2016	Wind energy decree 2016 (appendices 1-7)	Wind energy decree 2016 (appendices 1, 2, 5, 6)	Wind energy decree 2016 (appendix 4) Expert report 2013	Wind energy decree 2016 (appendix 2)
Brandenburg	Decree 2011	Appendices 1-4 Requirements, documentation, intervention regulations	Appendices 1, 2 and 4	Appendix 3	Guidelines being trialed since July 2014 Decree on compensatory fees 2016
Hesse	Regulation 2013	Guidelines 2012	Guidelines 2012 (appendices 2, 3)	Guidelines 2012 (appendix 4)	Guidelines 2012 (appendix 1)
Mecklenburg-Vorpommern	Advice on suitable area 2012		Evaluation aids 2016	Evaluation aids 2016	
Lower Saxony	Wind energy decree 2016	Guidelines 2016	Guidelines 2016	Guidelines 2016	
North Rhine-Westphalia	Wind energy decree 2015	Guidelines 2013	Guidelines 2013	Guidelines 2013	Guidelines 2012 Appendix, landscape assessment
Rhineland-Palatinate	Circular on wind energy 2013	Guidelines 2012	Guidelines 2012	Guidelines 2012	
Saarland	Wind energy guidelines 2012	Guidelines 2013	Guidelines 2013	Guidelines 2013	
Saxony-Anhalt					
Saxony	Recommendations 2011				
Schleswig-Holstein	Wind energy decree 2016				
Thuringia	Wind energy decree 2016				

Table: States decree /guidelines/recommendations: Wind power and nature conservation (BWE 08/2016)

Additional information (in German):

Stiftung Umweltenergierecht (2016): Aktuelle Entwicklungen im Bereich der Windenergieerlasse der Länder

http://stiftung-umweltenergierecht.de/wp-content/uploads/2016/02/stiftungumweltenergierecht_WueBerichte_19_Windenergieerlasse.pdf (accessed 07/2016)

Excursus: State recommendations and the Helgoländer Paper

A document from the German consortium for state bird conservation stations (LAG VSW) known as the Helgoländer Paper[15] includes recommendations for distances between turbines and important habitats and breeding grounds for certain species of birds. In May 2015, an announcement was made at a conference for department heads and state environmental ministers[16] that it would not be possible to make standard recommendations for the country as a whole because of the diverse spectrum of species and usage conflicts that must be considered on a case-by-case basis. The resolution minutes mention, for example, land management analyses that can be used to consider which individual areas are actually used by birds in order to evaluate the effects of a planned project on a specific location. They also emphasize the importance of taking prevention and mitigation measures into account when assessing potential conflict.

An expert opinion from the Fachagentur Windenergie an Land (FA Wind, an association focusing on onshore wind)[17] comes to the logical conclusion that the Helgoländer Paper, in terms of its legal nature, is neither a regulatory framework serving as secondary legislation nor a convention agreed upon by experts. The distance recommendations have only an indicative effect and are therefore followed differently in the various states' advice papers. In addition, a study by the Koordinierungsstelle Windenergierecht (K:WER, an institute focused on wind power-related legislation)[18] has determined that the paper's authors bring up but by no means fulfill scientific requirements. Observations and interpretations are mixed together, for example, and it is not clear which theoretical approach they use.

Additional information (in German):

BWE-Kommentar und Stellungnahmen (2014): Zum Entwurf der LAG VSW Abstandsempfehlungen (Helgoländer Papier 2015)
www.wind-energie.de (accessed 08/2016)

15 LAG VSW: Abstandsempfehlungen für Windenergieanlagen zu bedeutsamen Vogellebensräumen sowie Brutplätzen ausgewählter Vogelarten (April 2015), Berichte zum Vogelschutz, vol. 51.

16 Umweltministerkonferenz (2015): Ergebnisprotokoll der 84. Umweltministerkonferenz am 22.5.2015, www.umweltministerkonferenz.de/documents/Ergebnisprotokoll_84-_UMK_Banz.pdf (accessed 5.7.2016).

17 FA Wind (2015): Abstandsempfehlungen für Windenergieanlagen zu bedeutsamen Vogellebensräumen sowie Brutplätzen ausgewählter Vogelarten - Gutachterliche Stellungnahme zur rechtlichen Bedeutung des Helgoländer Papiers der Länderarbeitsgemeinschaft der Staatlichen Vogelschutzwarten (LAG VSW 2015).

18 K:WER (2016): Das Helgoländer Papier – grundsätzliche wissenschaftliche Anforderungen, http://k-wer.net/wp-content/uploads/2016/05/Brandt_Helgolaender_Papier_Studie_2016.pdf

5. Research and studies

Over the last several years, research projects and studies have been conducted on a number of issues related to this complex subject. This section briefly describes a selection of those projects.

Birds

PROGRESS (2015)[19]

Research and environmental planning firm BioConsult SH led the PROGRESS project in cooperation with ARSU, IfAÖ, and Bielefeld University. The aim was to determine collision rates for birds (of prey) and create planning-related foundations for forecasting and analyzing the risk of collision with wind turbines. This study was the first to quantitatively determine birds' collision rates with turbines.

In a systematic field study conducted in multiple states in northern Germany over three years, representative data on birds colliding with onshore wind turbines were compiled. With the help of experimentally determined correction factors, the number of colliding birds was extrapolated, and behavior was observed in order to assess birds' risk of collision with existing turbines. Another project goal was to model the influence of mortality caused by turbines with an eye toward the possibility of a significant impact on the populations of some individual species.

The major findings include:

- Most collisions involve the common, non-endangered species frequently seen in agricultural areas, some of which are even hunted. It was also found that the central database compiled by the Vogelschutzwarte (bird conservation station) in Brandenburg, which is based on corpses found by chance, has led to false conclusions because of a higher share of more noticeable and therefore more easily found species. Birds of prey do not dominate the project's collision data.
- It also became clear that the numbers of carcasses potentially carried elsewhere by other animals are much lower than previously thought; the extrapolation factor is therefore quite low.
- The tendency of geese and cranes to detour around wind farms was confirmed. The millions of songbirds that tend to move about at night also very rarely collide with turbines.
- The question of turbine-related deaths potentially having a negative impact on population levels is described in a comprehensible way.
- The study explicitly states that most bird species that are taken into consideration in planning are in no danger and determines that blanket distance guidelines have limited effectiveness, since flight patterns aren't evenly distributed and change throughout the year as well as over the years.
  Collisions are the result of birds' situational behavior around wind turbines and do not correlate with landscape or turbine parameters.

19 Grünkorn, T., Blew, J., Coppack, T., Krüger, O., Nehls, G., Potiek, A., Reichenbach, M., von Rönn, J., Timmermann, H. & Weitekamp, S. (2016): Ermittlung der Kollisionsraten von (Greif)Vögeln und Schaffung planungsbezogener Grundlagen für die Prognose und Bewertung des Kollisionsrisikos durch Windenergieanlagen (PROGRESS). Schlussbericht zum durch das Bundesministerium für Wirtschaft und Energie (BMWI) im Rahmen des 6. Energieforschungsprogrammes der Bundesregierung geförderten Verbundvorhaben Progress, FKZ 0325300A-D. http://bioconsult-sh.de/de/nachrichten-archiv/progress-endbericht-veroffentlicht

Existing prognosis models such as the BAND model are not suitable for predicting collision rates based on birds' flight patterns.

- Closer observations of red kites and white-tailed eagles suggest that the planning process used up to this point can continue to be used.
- More research on the common buzzard is needed. There appears to be some impact on the population, but no acute danger, since the species has a large population overall, with at least 100,000 breeding pairs in Germany.
- However, the project's research cannot be extrapolated across the entire country. The causes of – particularly the impact of wind energy on – regional population decreases require further study. Until more definitive findings are worked out, the recommendation is to implement compensation measures whenever turbines are erected in order to support the buzzard population.

This last point, especially from an overall point of view, constitutes a challenge that should be discussed and dealt with in cooperation with stakeholders (such as government agencies and nature conservation organizations).

Birds of prey and wind turbines (2013)[20]

The objective of this research project was to analyze the causes of relatively high collision rates for different species of birds of prey. The risk to three specific species (red kites, Montagu's harriers, and white-tailed eagles) was to be determined in existing wind farms. The research findings show that, generally, the birds studied tend to avoid wind turbines either very little or not at all. At the same time, greater activity (flight paths near turbines) was not shown to (significantly) increase the risk of the birds of prey colliding with turbines.

Red kites' flight paths generally do not go through areas where there is a risk of collision. Taller turbines are less likely to lead to collisions for red kites. The use of areas around a wind turbine depends on their attractiveness – that is, the availability of food for red kites. Composting facilities in particular, as well as fallow land at the foot of turbines and low-growing, mowed land are very tempting in times of scarce feeding grounds. Fallow land with tall plants is recommended as a measure to discourage red kites.

The average height that **Montagu's harriers** fly at (up to ten meters) does not reach the area covered by a turbine's rotor blades. There was no observation of the birds experiencing displacement when choosing nesting locations or reducing their habitat. In addition, turbines were not determined to have any statistically significant impact on the development of the Montagu's harrier population.

Research findings on **white-tailed eagles** were minimal because of the limited data available; no definitive statements could be made, for example, on the impacts of the loss of individual birds.

20 Hötker, H., Krone, O. & Nehls, G. (2013): Greifvögel und Windkraftanlagen: Problemanalyse und Lösungsvorschläge. Schlussbericht für das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Michael-Otto-Institut im NABU, Leibniz-Institut für Zoo- und Wildtierforschung, BioConsult SH, Bergenhusen – Berlin – Husum.

Various bird species and repowering (2012)[21]

This study investigates the effects of taller turbines with greater rotor diameters on different species of birds (European golden plovers, lapwings, Montagu's harriers, red kites, and other birds of prey). Systematically collated data were used to analyze avoidance, potential habitat loss, and the risk of collision with turbines.

Before-and-after comparisons in wind farms showed that the breeding bird species that are taken into consideration during planning barely differ from each other in terms of species numbers and habitat density. Regardless of the height of the turbines and their rotor diameters, their operation had no effect on the Montagu's harriers' habitats. No avoidance was observed during food-seeking flights for the birds of prey (kites and harriers). Even modern wind turbines appear to not lead to a loss of habitat. Standardized observations of behavior showed that the average flight height of birds of prey (black and red kites) rarely exceeds 60 meters. Outside the areas directly around breeding grounds, the risk of collision decreases as turbine height increases.

Bats

RENEBAT I to III (2007-2017)

RENEBAT I[22] was a three-year research project with the objective of validating and further developing the existing methods for studying the presence of bats around turbines. One important finding is that only a few bat species are affected. There is a risk of collision for species that fly at greater heights, such as common noctules, lesser noctules, parti-colored bats, common pipistrelles, and Nathusius' pipistrelles, although the risk varies greatly from location to location.

Building on the first research project, a method was developed for predicting activity and, therefore, danger to bats around turbines' rotors based on time, landscape, and weather-related factors (RENEBAT II).[23] The subsequent project focused on developing a software program to calculate algorithms for bat-friendly operation (RENEBAT III).[24] According to the project findings, a differentiated consideration of wind speeds that suggest that a turbine be shut down is necessary based on wind speeds, time of night, and season. This method significantly reduces the number of collisions.

Wind in the woods

Monitoring the construction and operation of wind turbines in wooded areas (2015)[25]

The research goal for this project was to improve understanding of the specific effects turbines have on species living in wooded areas and the possibilities for managing them during planning stages. In particular, the effects on breeding bird populations were studied, and no significant differences in breeding pair density and numbers of species relative to reference areas were noted. The small existing dataset did not allow comprehensive, definitive statements on the effects of turbines on bird species living in wooded areas.

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21 Ecoda Umweltgutachten & Ingenieurbüro Dr. Loske (2012): Modellhafte Untersuchungen zu den Auswirkungen des Repowerings von Windenergieanlagen auf verschiedene Vogelarten am Beispiel der Hellwegbörde.

22 Brinkmann, Behr, Niemann & Reich (ed.) (2011): Methoden zur Untersuchung und Reduktion des Kollisionsrisikos von Fledermäusen an Onshore-Windenergieanlagen (RENEBAT I) – Umwelt und Raum, vol. 4, Göttingen.

23 Behr, Brinkmann, Korner-Nievergelt, Nagy, Niermann, Reich, Simon (ed.) (2015): Reduktion des Kollisionsrisikos von Fledermäusen an Onshore- Windenergieanlagen (RENEBAT II) – Umwelt und Raum, vol. 7, Institut für Umweltplanung, Hanover.

24 www.windbat.techfak.fau.de/forschung.shtml (accessed 08/2016).

25 Reichenbach, M., Brinkmann, R., Kohnen, A., Köppel, J., Menke, K., Ohlenburg, H., Reers, H., Steinborn H. & Warnke M. (2015): Bau- und Betriebsmonitoring von Windenergieanlagen im Wald. Abschlussbericht 30.11.2015. Erstellt im Auftrag des Bundesministeriums für Wirtschaft und Energie.

The project also investigated whether shut-down algorithms developed to protect bats around turbines in non-wooded locations can also be used in wooded areas and whether the usual methods for preliminary assessment used in approval procedures are also suitable for equivalent prognoses in wooded areas.

The data taken at nacelles in wooded and non-wooded areas – currently the largest dataset of its kind – were collated; common pipistrelles, Nathusius' pipistrelles, and noctule bats appeared frequently, while mouse-eared (Myotis) and long-eared (Plecotus) bat species appeared relatively infrequently. Species composition and activity were part of this investigation and were generally found to differ very little between wooded and non-wooded locations, although significant regional differences were noted in terms of frequency of individual species and groups of species. For all species and groups of species, in all regions, whether wooded or non-wooded, bat activity was at its highest from July to September. Among the species, however, there are significant phenological differences depending on the season and time of night. Meteorological conditions at nacelle height – specifically, wind speeds and temperature – greatly affect bat activity, with high temperatures and low wind speeds leading to more activity.

The operational algorithm appears to be transferrable, although there is a need for further development in terms of regional adjustments that take into account species composition and seasonal effects on bat activity.

Additional information (in German):

Forschung zur naturschutzfachlichen Begleitung der Energiewende (BfN Forschungsplattform), www.natur-und-erneuerbare.de (accessed 07/2016)

Fachinformationen des Kompetenzzentrums Naturschutz und Energiewende (Projektträger BMUB), www.naturschutz-energiewende.de/ (accessed 07/2016)

Fachagentur Windenergie an Land (gemeinnütziger Verein, gefördert durch BMWI), www.fachagentur-windenergie.de/ (accessed 07/2016)

6. Statements from the BWE

Our aspiration: A reasonable and sustainable dialogue

The BWE champions achieving 100% coverage of energy demand with renewable energy as quickly as possible. At the same time, sustainable processes should be accelerated and environmental impacts should be minimized or suitably compensated for.[26] The BWE wants to appropriately consider species and nature conservation goals in the planning of wind turbines. To this end, wind projects include the implementation of measures intended to improve habitats for protected species that are affected. The basis for this should be a correct forecast of environmental effects in accordance with legal regulations. The necessary studies depend on planning requirements and should not lead to unnecessary delays for projects.

Legal certainty when it comes to planning and operating wind turbines is also needed. An important aspect in terms of high-level planning is ensuring that no valuable areas that could be used for wind power are ruled out without further examination. Areas that have been established as wind energy sites and proven to be conflict free should also be secured for repowering.

26 By-laws of the German Wind Energy Association (2015).

Our objective: Species diversity and wind turbines

Often, project developers don't pursue projects at locations with a "difficult" combination of issues even though wind power doesn't represent a threat to species diversity and it is not unheard of for nesting sites to be moved as part of the regular dynamics of the ecosystem and landscape. That being said, animal use of certain physical structures is fairly consistent and must be taken into account when planning wind turbines. Even after turbines have been built and/or started up, protected species often make their homes very close to wind farms, as has been frequently observed especially among black storks, white-tailed eagles, and cranes. The birds' apparent tolerance for turbines should be considered as it relates to repowering in order for established wind power sites to remain available to the sector.

Our demand: No one-size-fits-all distances

In order to avoid uncertainties, despite the previously mentioned resolution resulting from a conference attended by the various German states' environmental ministers[27], one-size-fits-all distances from the habitats of protected birds are still relied on. The areas where birds live and move about are based on the landscape's structures and the availability of food, and flight paths are distributed differently and can change in the course of a year as well as over many years. Collisions result from birds' situational behavior around turbines, which depends largely on the individual location, topography, and spectrum of species.[28] The formulated distance recommendations have only an indicative effect and, as a test range for determining the potential for conflict, serve as a reference point that must then be reassessed in detailed studies.

In detail

Measures to support habitats and populations as a way to overcome conflicts

With the objective of improving living conditions for affected species, many targeted, species-specific measures are implemented as part of project planning; in some cases, they are defined in state decrees and are a standard component of project implementation. This means that the construction of wind turbines over the last several years has resulted in high-quality measures intended to improve habitats.

Limiting operation when bats are present

All bat species are strictly protected, and they have attracted increased attention in the last few years. The risk of colliding with turbines has been investigated in multi-year research projects (such as RENEBAT I to III, described above). Even if it is still not clear how large the populations of individual bat species are or the extent to which individual deaths from collision affect those populations, it is now certain that such deaths occur only in a few species and during certain seasons and weather conditions. Prevention measures should therefore be implemented with an eye to specific cases, species, and locations. The previously mentioned research project RENEBAT concludes that shutting down turbines at certain times of night can prevent an otherwise significantly higher risk of death for bats as a whole and/or specific species. Initially, blanket shut-down periods are implemented.

27 See footnote 15.

28 Grünkorn, T., Blew, J., Coppack, T., Krüger, O., Nehls, G., Potiek, A., Reichenbach, M., von Rönn, J., Timmermann, H. & Weitekamp, S. (2016): Ermittlung der Kollisionsraten von (Greif) Vögeln und Schaffung planungsbezogener Grundlagen für die Prognose und Bewertung des Kollisionsrisikos durch Windenergieanlagen (PROGRESS). Schlussbericht zum durch das Bundesministerium für Wirtschaft und Energie (BMWI) im Rahmen des 6. Energieforschungsprogrammes der Bundesregierung geförderten Verbundvorhaben Progress, FKZ 0325300A-D, http://bioconsult-sh.de/de/nachrichten-archiv/progress-endbericht-veroffentlicht/

Findings from acoustic measurements of bat activity around nacelle height (nacelle monitoring) can be used to pinpoint ideal shut-down time periods in order to significantly reduce the likelihood of collisions while also minimizing losses in yield. Depending on the time of night and the season, turbines may only operate during times of higher wind speeds, when bats are less active. The analysis software for determining these periods is now ready to be used in real-world applications but is not yet accepted by many agencies; instead, the shut-down periods recommended in state decrees are still required in many cases.

Critique: Often, the time and money needed to conduct required research prior to approval are disproportionate to the insight gained, especially considering that findings from the ground are rarely transferrable to today's rotor heights. More and more, authorities are requiring standard shut-down periods that in many cases could be adjusted based on findings from nacelle monitoring. However, state decrees interpret the recommendation differently, defining different speeds at which turbines can be started up or factoring in temperature in different ways. Potentially affected bat species can be sufficiently protected at low nighttime wind speeds of up to about 5.5 m/s during the time when they are most active, from June to August. At higher wind speeds, bats are far less likely to be affected. Standardized shut-down rules, however, lead to high losses for wind power; in light of this, the BWE calls for a reasonable balance between effective collision protection and effective wind energy use.

Current discussions on some bird species

Some species of birds are especially in the public eye. In some cases, blanket concerns and requirements can become an insurmountable obstacle in planning or seem to go beyond what is appropriate.

Red kites

Of the growing global population of 20,000 to 25,000 breeding pairs, an estimated 11,500 to 14,500 live in Germany.[29] Because of the high and increasing population, the species is not on the Rote Liste, Germany's list of threatened species. Because the majority of the world's breeding pairs live in Germany, there is a particular sense of responsibility and high level of attention for this species in the country.

While collisions with wind turbines do occur, no consistent relationship to the proximity of breeding grounds has been determined. Existing breeding spots are not disturbed when turbines are built, and red kites are not influenced by proximity to turbines when choosing where to brood. Blanket criteria for distances between turbines and red kite breeding areas are not particularly helpful when it comes to avoidance. Worth mentioning here is that the modern agricultural subsistence strategy has led to dangerously low levels of food for the species. Suitable measures for developing red kite habitats could serve to further develop populations while also diverting the birds away from turbines, which create new structures in landscapes in the form of access routes and crane sites that reduce the risk of collision.

29 Artenhilfsprogramm Rotmilan des Landes Sachsen-Anhalt (5/2014).

White-tailed eagles

The population of this species has demonstrably increased quite a lot parallel to wind power expansion. Its natural distribution area in Germany extends from eastern Schleswig-Holstein to Mecklenburg-Vorpommern and Brandenburg. High levels of DDT almost wiped out the species in the early 1980s, but the population has grown significantly since around 1985, after the pesticide was banned.[30]

Nevertheless, the species is so rare that studies such as the ones in research projects described in this paper have not produced sufficient findings, and collisions with wind turbines are extremely rare.[31]

Still, we do know that mortality is largely the result of contamination and a lack of food. When turbines are planned, areas where white-tailed eagles brood and, in particular, search for food is not touched. Potential risk must be assessed on a case-by-case basis; it is regularly observed that the birds do not use their habitats in accordance with the blanket radiuses indicated by recommended distances.

Black storks

Black stork populations have also increased dramatically, allowing the species to be removed from the Rote Liste in 2008.[32] The birds are known to be particularly reclusive; nevertheless, several breeding pairs have settled down near wind turbines in, for example, Rhineland-Palatinate. Turbines can therefore not be said to have a wide-ranging negative impact on the species, nor can the feared risk of collision be confirmed.

Cranes

Wind turbines in areas along cranes' migratory paths are occasionally required to limit operation when meteorological conditions make visibility low for the birds. This strategy rests on the assumption that bad weather causes the birds to fly lower than their usual height of more than 500 meters. During critical periods, a nationwide alert system indicates when to shut down the turbines and align them with the migratory paths.

Critique: This measure is not relevant to the ban on killing in any way, and the legitimacy of an official requirement here should be reviewed. Shutting down turbines would be a preventive measure, since the birds do not tend to migrate when visibility is low; each year, about 200,000 of them fly over turbines in the spring and autumn, and in more than 15 years only 14 bodies of birds that collided with turbines have been found in the entire country. When visibility is good, migration occurs well above the turbines. Although the general public has a positive opinion of the preventive measure of shutting down turbines when migrating birds are sighted, wind farm operators must shoulder the financial losses.

Common buzzards

There are about a million breeding pairs of common buzzards around the world. Germany's approximately 100,000 breeding pairs are spread across the country throughout the whole year. Findings from the research project PROGRESS indicate an increased rate of collisions with turbines, although the large population means that there is no acute threat to the population as a whole.

30 www.projektgruppeseeadlerschutz.de (7/2015).

31 Hötker, H., Krone, O. & Nehls, G. (2013): Greifvögel und Windkraftanlagen: Problemanalyse und Lösungsvorschläge. Schlussbericht für das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Michael-Otto-Institut im NABU, Leibniz-Institut für Zoo- und Wildtierforschung, BioConsult SH, Bergenhusen – Berlin – Husum

32 Along with black storks, white-tailed eagles, eagle-owls, and red kites were also removed from the list in 2008: https://www.nabu.de/tiere-und-pflanzen/voegel/artenschutz/rote-listen/10174.html

Regional population decreases, such as in Schleswig-Holstein, are demonstrably the result of changing land usage and, in turn, a lack of food. In addition, young birds are preyed on by other birds of prey such as eagle-owls and northern goshawks or are carried off by mammals when they are still nestlings. These aspects have significant effects on population development[33], while wind turbines play a subordinate role as a threat, although more research is needed.[34] Should a need be determined, the population can be supported with targeted measures intended to help the species.

The species is not endangered, and the large distribution area overlaps very little with wind power sites. It would be difficult to limit measures for helping the species, such as improving its habitat, to a local level or to individual wind projects. One possibility would be concepts that involve several different projects, although a relevant legal framework still needs to be developed.

7. Conclusion

Every wind energy project fulfills high technical standards when it comes to species conservation. Over the last several years, knowledge has steadily increased thanks in part to comprehensive studies conducted on behalf of investors in turbines as part of the planning process, and many gaps in knowledge about effects on specific species have been closed. Numerous studies suggest solutions for situations of potential conflict.

Even at the regional planning level, areas that are valuable in terms of nature and landscape conservation are off limits to wind power. Areas designated for wind power are those that have the least potential for conflict, although species conservation is comprehensively taken into account even at these locations. The effects that wind projects have on the ecosystem must be evaluated on a case-by-case basis; blanket distance requirements do not do justice to the complex relationships and demands resulting from local geography.

If a location is proved to have potential for conflict, there are targeted, effective measures that have consistently been put into practice for years.

When reviewing population data and risk assessments to determine whether bans related to species conservation legislation are being followed, the authorities responsible for approving wind projects have some leeway in their decision-making. However, there is a lack of clear assessment standards, which makes it difficult to apply legal regulations. The various states' different recommendations should be further developed in the future in line with the latest insights. Comprehensive knowledge of many aspects of nature and species conservation has been gained from numerous wind projects; that knowledge, along with findings from various research projects, must be included in discussions with participating stakeholders and applied as part of the process of sustainably expanding wind energy.

The German Wind Energy Association champions significant expansion of wind power as a contribution to clean, safe, climate-neutral energy generation. Many of our members are part of the movement for environmental and nature conservation and are therefore highly motivated to protect biodiversity and nature as a whole. Minimizing negative effects on nature and landscapes is important to the sector, and replacement and compensation measures all across Germany contribute to improving local habitats for threatened species.

33 http://bioconsult-sh.de/de/projekte/mausebussarde/ (accessed 15.7.2016).

34 See footnote 27.

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The BWE Working Group on Nature Conservation and Wind Energy was founded in 2010 with the goal of informing the sector about the latest research findings and discussing and evaluating potential solutions. Specialists from planning, legal, and consulting/surveying firms who are members of the BWE lead these discussions.

More information (in German) is available at: https://www.wind-energie.de/en/association/committees

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