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ProBat 7

ProBat was further developed within the framework of a project funded by the Federal Agency for Nature Conservation (BfN) and the bat-friendly farm management was thus optimised. Additional phenological data - e.g. for locations near the coast and in the south of Germany - were integrated into the software, thus improving the applicability in different landscape areas. In addition, a threshold value is now also calculated for the parameter temperature, based on the data recorded at the site of the wind turbine. For precipitation, a map is generated that makes it easier for ecology consultants to determine a threshold value. In the future, the ProBat database will be continuously improved and expanded through the online import of new data sets from the consultants' nacelle monitoring. For consultants using the software it is possible to make the data available to the database.

In addition to ProBat Version 7, ProBat Inspector was developed. This online tool enables approval authorities and wind farm operators to check the correct application of the ProBat results and compliance with the calculated operating algorithms.

Another online tool, ProBat Designer, calculates a statistically optimised survey design from the number of WTs and the planned survey effort in a wind farm. The calculated design is based on the statistical scatter of the results of different turbines and years in the ProBat data set - characteristics of the respective site are not taken into account in the calculation. The design is therefore intended as a guide, which must be adapted to the respective site by expert knowledge.

LINKS

- www.probat.org
- www.natur-und-erneuerbare.de/en/project-database/probat
- www.bfn.de/probat-tool-zum-schutz-von-fledermaeusen-windkraftanlagen
- BATMOVE: Impacts of offshore wind parks on bat migration over the sea), www.natur-und-erneuerbare.de/en/project-database/batmove

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- Brinkmann, R., Behr, O., Niermann, I., Reich, M., (Hrsg.) (2011): „Entwicklung von Methoden zur Untersuchung und Reduktion des Kollisionsrisikos von Fledermäusen an Onshore-Windenergieanlagen (RENEBAT I)", Umwelt und Raum, Band 4.

IN PRACTICE 1

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IN PRACTICE

ProBat 7 – Intelligent wind turbine operation management for the protection of bats as a permit condition for wind turbines

The software tool ProBat 7.0 calculates bat-friendly cut-in wind speeds for onshore wind turbines (WT). This operational management helps to minimise the killing risk for bats (collision or barotrauma) and allows a more efficient operation of the installations compared to blanket switch-on or switch-off requirements.

The ProBat software reduces the planning effort and can be used independently by experts and approval authorities. Version 7 is available as a ProBat online app and is equipped with new and improved applications. Additional visualisations and extended reports improve the functionality.
A new online application "ProBat Inspector" also simplifies the verification of compliance with mandated shutdown requirements.

ProBat 7 is a recognised standard for ecological consultants, operators and authorities: Bavaria, Mecklenburg-Western Pomerania, North Rhine-Westphalia and Thuringia already recommend the use of the software in their wind energy decrees. Baden-Württemberg, Hesse, Lower Saxony, Rhineland-Palatinate, Saarland, Saxony-Anhalt and Thuringia require calculation of the cut-in times in accordance with the RENEBAT method (see references) of which ProBat is an integral part. ProBat is the most widely used method in Germany for determining bat-friendly operating algorithms.

FOR

- Wind turbine operators
- Ecological consultants
- Nature conservation authorities
- Approval authorities

SPECIES

Migratory and non-migratory bat species

KEY WORDS

- Wind power
- Bat conservation
- Operating algorithms
- Shut-down guidelines in approval permits for WT
- Bioacoustic nacelle monitoring
- Statistics
- Software
- ProBat 7.0
- ProBat Inspector

The common noctule is one of the bat species sensitive to wind energy.

Acoustic bat recording in the nacelle: the recording unit is housed in a secure box. The two black discs indicate the position of the microphone (with test signal generator and heating, below) and the antenna for remote controlling and access (left).

Bats and wind turbines

In Germany all species of bats are protected: they are amongst the species with particularly stringent protection and some also have Red List status. Species that hunt or migrate in the open, the common noctule, lesser noctule, parti-coloured bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle, are particularly exposed to the risk of collision when wind turbines are in operation. To protect these species, approval authorities can therefore impose operational mitigation measures for a planned wind turbine.

Operational mitigation is usually applied from April to October, covering the main activity period of bats in Central Europe. This period includes the spring migration and occupation of the maternity roost (approx. 1–30 April), the nursery period (approx. 1 May – 31 July) and the autumn migration and occupation of winter roosts (approx. 15 July – 31 October). During these periods bats hunt and migrate particularly in nights that are not too cold and with little wind and no rain. Operational mitigation is therefore mainly defined by a combination of date, time, wind speed and temperature criteria. For example, a cut-in wind speed higher than the normal cut-in wind speed of the turbines is defined to protect bats that are active at low wind speeds. This means that rotors have to be stopped at specific times and depending on weather conditions.

ProBat: nacelle monitoring and statistical risk determination

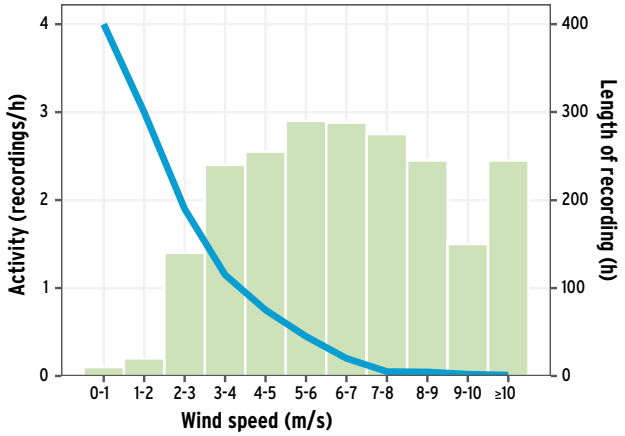
Operators may have specific cut-in algorithms determined by qualified consultants that replace the general cut-in wind-speed by specific cut-in wind speeds adapted to the site and the environmental conditions of the wind park. ProBat is a software tool that has been in use since 2014 and, in its current version ProBat 7, is widely accepted as the best available technology to reduce bat fatalities at WT based on scientific evidence. ProBat combines therefor three components: first a standardised acoustic recording protocol to determine the bat activity at wind turbines that was developed in the RENEBAT I to III projects ("nacelle monitoring"). Second, ProBat is based on a large multi-year data-set from the RENEBAT projects. The correlations of wind speed, date and time with the acoustic activity of bats at nacelle height is derived from this database. The third component is a scientific approach to determine the site-specific collision risk for bats with mathematical and statistical tools.

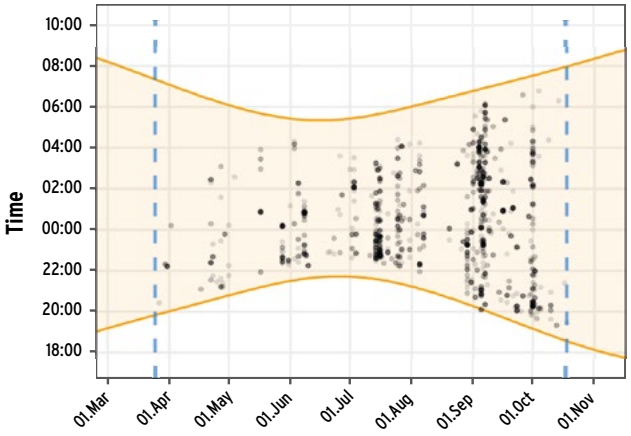
From bioacoustic data to specific operating parameters

Consultants use ProBat to calculate cut-in wind speeds to protect bats at wind turbines already in operation. ProBat use a statistical model to predict the collision risk from phenology (distribution of bat activity over the year), natural region, time of night, time of year, wind speed and the activity level of bats at the specific wind turbine. During the first two years of WT operation, authorities usually prescribe the already mentioned general cut-in wind speeds. To replace these by site-specific cut-in wind speeds adapted to the bats' behaviour, a nacelle monitoring must be carried out according to the RENEBAT standard for at least two consecutive bat activity periods.

After these two years, ProBat 7 compares the data from the nacelle monitoring with the data from the ProBat database in order to determine the site-specific eutrophication risk. The calculation of the site-specific switch-on algorithm is thus based on a scientifically sound basis.

It is therefore crucial that the site-specific data is recorded accurately. In order to be processed in ProBat, the recording of bat activity at the nacelle must be carried out according to the parameters defined in the RENEBAT projects. This includes the precise calibration and adjustment of the microphone installed in the nacelle (detectors). ProBat 7 can use data from Anabat





Correlation of bat activity with wind speed (left) and time of year/night (right). The figure on the left plots bat activity measured in recordings per hour (blue line) against the wind speed measured at nacelle of the WT (green bars). The figure on the right plots bat activity (transparent grey dots) over the year and the night (orange area). Both figures may be used to check the plausibility of the bat activity patterns measured.

(manufacturer Titley Scientific), Batcorder (manufacturer ecoObs GmbH) and BAT-mode/Avisoft-Recorder (manufacturer bat bioacoustictechnology GmbH) devices. Equally important is the installation location of the microphones - directly under the rotor blade suspension on the nacelle floor - and their orientation downwards towards the base of the turbine and the correctly synchronised time of the recordings.

The result is an operating algorithm that defines the cut-in wind speed of the turbine(s) as a function of the month, night time, wind speed and temperature, under the condition that no more than a certain number of bats may be killed per year. This threshold value of still tolerable bat casualties - usually one to two animals per turbine per year - is usually set by the licensing authorities

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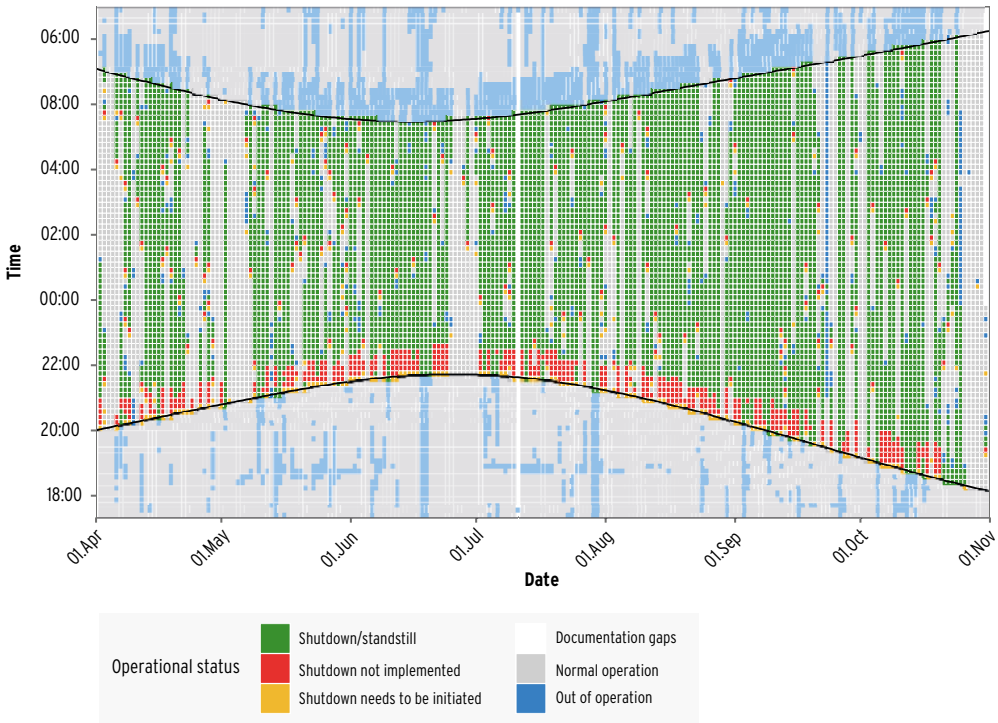

Curtailment check: the colour of every box (10-minute interval) shows whether the cut-in criteria have been met. In this (fictional) case, cut-in wind speeds were erroneously shifted by one hour.