THE BIODIVERSITY CONSULTANCY

Briefing note

Wind energy: managing biodiversity risks

Business relevance and implications

- *Wind energy is critical to tackling climate change, but needs careful planning to avoid impacts on habitats and species.*
- *The mitigation hierarchy is a useful tool that, if applied appropriately, can minimise risks.*

Biodiversity impacts of wind energy projects

Wind energy is one of the cleanest, cost-efficient and most sustainable forms of energy.

As a consequence, this sector is growing rapidly, with markets expanding around the world. However, wind farms can also be extremely controversial – for both their perceived and real impacts to humans and the environment.

Impacts can include collisions of birds and bats with turbines, and the loss of species' habitat from direct clearance, species avoiding infrastructure, and the disruption of regular movement patterns. Risk of collision varies dramatically between species of birds and bats. For some small-ranged or highly congregatory species, effects from even a single wind energy facility may be severe and have global implications.

Biodiversity risk often varies markedly between sites. Screening multiple sites can identify those with a greater or lesser biodiversity risk (see TBC Biodiversity Screening IBN). Development in areas with lower biodiversity risk can minimise unforeseen project costs and delays, maintain good stakeholder relations, and provide reassurance to project financers.

At a glance

- Wind power has the potential to be a clean, renewable source of energy, poorly designed projects can severely impact biodiversity, even having globally significant impacts on some species.
- The mitigation hierarchy, comprising Avoidance, Minimisation, Restoration/Rehabilitation and Offsetting, is an effective and practical framework to minimise such business risks.
- Avoidance of impacts (direct, indirect, cumulative) through early-stage site screening, is the most effective and least costly way of reducing biodiversity impacts.
- Mitigation effectiveness varies between species, and appropriate mitigation will be highly site- and species-specific.
- Offsetting is challenging for many species, especially migratory fauna, as impacts and potential offset actions may not be close geographically. Offsets may also be very costly or complex, making it difficult to deliver No Net Loss or Net Gain for a species.

Applying the mitigation hierarchy

Good practice for managing biodiversity risk focuses on implementation of the mitigation hierarchy, an approach to guide projects towards limiting impacts as far as possible. The hierarchy has four stages - Avoidance, Minimisation, Rehabilitation/Restoration and Offsetting - and with the goal of ensuring no net loss (NNL) and/or net gain (NG) of priority biodiversity, as required by lending standards such as The International Financial Corporation's Performance Standard 6 (IFC PS6).

IFC PS6 defines criteria and thresholds that guide the identification of priority biodiversity risks for a site. Aligning with IFC PS6 can help developers access funding from many financiers, gain legal permits, and increase support from local communities and NGOs.

1. Avoidance

Avoidance is the most reliable, and usually the most cost-effective approach to reducing biodiversity risk. Ideally, avoidance should be guided by existing national or regional-level plans, that identify priority biodiversity at the country level, map its occurrence and overlay this with known wind resources (see case study 1, below). Such studies allow a company to consider biodiversity constraints alongside technical and social feasibility and so to identify the sites most suitable for development, whilst minimising biodiversity impacts.

In the absence of studies, developers can use a similar approach to assess a suite of development site options. The potential biodiversity risk at each location can guide decisions on which sites to progress, and help identify the need for any additional studies or mitigation actions.

Within a development site, impact avoidance is limited to micro-siting of individual turbines to avoid important habitat for priority species, or to provide migratory corridors within turbine arrays that might otherwise block bird and bat movements. Both approaches come with financial costs from lost generation opportunity.

Case study 1: SEA for Wind Energy and Biodiversity – Kenya

The Biodiversity Consultancy led a Strategic Environmental Assessment (SEA) for wind power and biodiversity for USAID and the Kenya Ministry of Energy, with partners BirdLife International, Nature Kenya and The Peregrine Fund. Following an expert workshop to identify priority at-risk bird and bat species, a wide range of data were compiled so as to map overlaps with current and planned wind power developments. The assessment supports strategic planning of wind developments to minimise negative biodiversity outcomes, providing higher certainty for developers on biodiversity risks and mitigation options.

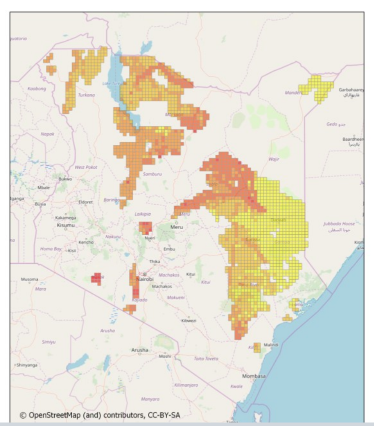

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Figure 1: Species sensitivity categories for economic wind power areas in Kenya. Categories reflect the presence of priority species based on range maps, observations and (for vultures) movement of tagged birds. (Mapping by BirdLife International). Sensitivity score categories:

🟨 Low 🟨 Moderate 🟧 High

🟥 Very high 🟥 Outstanding

2. Minimisation

Turbine shut-down is the most effective way to minimise impacts to priority bird and species, and may have minimal impact on potential energy production if well implemented.

Fixed shut-down periods may be appropriate for sites where priority species have very regular and predictable behaviour, but shut-down is more often ‘on-demand’, in response to a predetermined set of criteria. These can be observations of priority species, or environmental conditions that make collision likely (e.g. fog, low cloud, sandstorms).

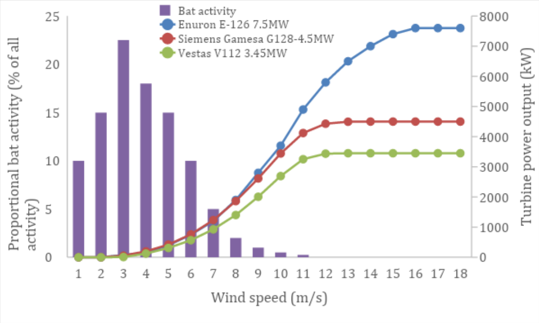

Figure 2: Bat activity patterns and turbine power generation at increasing wind speeds.[1]

Shut-down on-demand can be observer-led, automated (using radars or cameras) or a combination of both. A combined approach has proven 100% effective in preventing vulture deaths at a Portuguese wind farm, while has eliminated almost all fatalities at a migratory hotspot in the Red Sea/Rift Valley flyway with >370,000 birds passing each year with only a 0.08% annual potential energy loss.

For bats, two minimisation technologies have proven effective: i) increasing turbine start-up speeds and ii) acoustic deterrents (see case study 2). Most bat activity declines with increasing wind speed, while turbine power generation increases with wind speed (Figure 2). A small increase in kick-in wind speed can avoid a large number of potential bat collision without substantial loss of power generation capacity. Acoustic deterrents rely on bats’ use of echolocation to navigate and forage: by placing units on turbines that emit similar frequencies to the bats present, bats are unable to navigate close to turbines and avoid the area.

Case study 2: Bat acoustic deterrents at Los Vientos wind farms, Texas

The effect of acoustic deterrents on bat fatalities was tested at the Los Vientos wind farms in southern Texas. Acoustic units emitting six different high-frequency sounds within the range of bat call frequencies were deployed on the hubs of treatment turbines, with adjacent control turbines. Both sets of turbines were searched daily for bat carcasses for the summer/autumn period (July to October).

Acoustic deterrents resulted in a 50% reduction in overall fatalities, but species-specific responses varied. For the **Brazilian Free-tailed Bat** Tadarida brasiliensis and **Hoary Bat** Lasiurus cinereus there were 54% and 78% reductions in fatalities, respectively, but there was no fatality reduction for **Northern Yellow Bat** Lasiurus intermedius.

Differences in effectiveness were thought to be due to the echolocation frequencies used by each species. As higher frequencies attenuate over shorter distances, the acoustic units were less effective at deterring bats with high-frequency calls from the full rotor sweep area.

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[1] Bat Data redrawn from Voigt et al 2015. Wildlife and renewable energy: German politics across migratory bats, European Journal of Wildlife Research.

3. Rehabilitation/Restoration

Wind energy facilities usually have few impacts that are restorable during a project's operational phase. Where these occur (e.g. temporary construction impacts within the wind-farm boundary) such restoration is good-practice and likely to be required by regulators.

4. Offsets

Offsets compensate for significant adverse residual impacts that remain after all feasible avoidance, minimisation and restoration actions have been implemented.

For wind energy projects that are well-sited and implement effective minimisation measures, there will often be no significant residual impacts and offsets may not be required. For other projects, offsets may be required for priority biodiversity. There are two main types of offset, defined by how they produce gains: 'restoration offsets' and 'averted loss offsets' (Table 1).

Offsets within the wind industry are challenging because:

- Residual impacts can be difficult to predict, especially in regions where there is as yet limited experience with wind power. Robust, long-term field data collection is needed to estimate potential project impacts and the effects of any mitigation;
- For migratory species (many birds and bats), viable offset sites may be far from the development site, and potentially in different jurisdictions. This can make it challenging to secure offsets and support from stakeholders, who see the impacts but not the benefits. For instance, many migratory bird species may encounter wind farms on passage, despite having no resident populations in those countries. For such species, local options for offsets may be few: there may be better options on breeding or wintering grounds;
- Verification of gains may be challenging, due to the long generation time and large-scale movements of many species at risk (e.g. birds of prey).

Table 1. Examples of offsetting for wind energy developments

Offset type	Examples/+.
Averted loss	Where gains are generated by reducing or preventing ongoing decline of a priority species, that is not caused by the project. This could be through retrofitting of power lines to prevent electrocutions, removal of carcasses from roads to prevent raptor collisions with vehicle traffic, or implementation of anti-poisoning programs to reduce vulture deaths from eating poisoned carcasses (see Case Study 3).
Restoration	Where habitat is created or improved off-site to benefit the species being impacted. Habitat improvement/restoration has been suggested as a possible offset option for both birds (Allison et al 2017[2]) and bats (Peste et al 2015[3]), and has been used as an offset to reduce Griffon vulture mortality at a Spanish wind farm.

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[2] Allison, T.D., Cochrane, J.F., Lonsdorf, E. and Sanders-Reed, C., 2017. A review of options for mitigating take of Golden Eagles at wind energy facilities. Journal of Raptor Research, 51(3), pp.319-334.

[3] Peste, F., Paula, A., da Silva, L.P., Bernardino, J., Pereira, P., Mascarenhas, M., Costa, H., Vieira, J., Bastos, C., Fonseca, C. and Pereira, M.J.R., 2015. How to mitigate impacts of wind farms on bats? A review of potential conservation measures in the European context. Environmental Impact Assessment Review, 51, pp.10-22.

Cumulative impacts

Cumulative impacts are the incremental, interacting impacts caused by multiple (wind or other) developments which may be insignificant when considered alone, but significant when assessed together. Wind resources are often concentrated into particular areas, and hence cumulative impacts from multiple adjacent facilities may be significant for regional or global populations of birds and bats. Cumulative impacts are best considered at the regional or national level: individual developers have limited potential to influence cumulative impacts.

Field surveys

Ideally, application of the mitigation hierarchy is based on robust field information on the abundance and behaviour of priority species. Gathering such information required large lead times, which can be extremely costly in a rapid project development cycle. If high-risk sites are avoided through careful screening, then long pre-construction monitoring can be avoided if developers commit to both monitoring through the construction / early operation phase and observer-led SDOD to the extent necessary should significant unforeseen risks emerge .[4]

Case study 3: Kipeto Wind farm, Kenya

Kipeto Energy Ltd is developing the Kipeto Wind Power Project, a c.60 wind turbine facility in Kajiado County, Kenya. The proposed wind farm is near the nesting sites of two Critically Endangered vulture species: **Rüppell's Vulture** *Gyps rueppellii* and **White-backed Vulture** *G. africanus*. Both species regularly fly over and forage at the wind farm. Stakeholder concerns over potential collisions with wind turbines caused lengthy delays project development. Since 2017, The Biodiversity Consultancy has worked closely with stakeholders to understand the concerns fully and develop effective and trusted mitigation measures. We have led **on-site monitoring to quantify the risks to these species,** and developed **minimisation measures and offsets** to **deliver Net Gain for both species to meet IFC PS6**. Minimisation measures focus on observer-led shut-down on-demand when raptors are spotted, and immediate removal of carcasses from the site to avoid attracting vultures to the area. Offsets have focused on anti-poisoning efforts in the wider region, implemented through national project partners.

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[4] See Biodiversity Surveys IBN at www.thebiodiversityconsultancy.com

Case study 4: Lekela Wind farm, Egypt

The Biodiversity Consultancy is supporting Lekela Energy to align with IFC Performance Standard 6, and EBRD Performance Requirement 6 for their development in the Gulf of Suez (https://lekela.com/projects/egypt-gulf-of-suez-2/).

The Gulf of Suez is the centre for Egypt's oil and gas industry, and the focal region for the development of wind farms in Egypt. The area has high wind power generation potential and it is estimated that the western side of the Gulf of Suez could host wind energy projects with a total capacity of around 20,000 MW. The government of Egypt is targeting the development of wind farms providing about 13,500 MW by 2022.

The Gulf of Suez is also internationally important for migratory soaring birds, and is a bottleneck on the Rift Valley/Red Sea Flyway. Lekela is committed to following global leading practice on risk management, to avoid and minimise impacts to migratory soaring birds and other biodiversity. To support this TBC has produced a Critical Habitat Assessment, which follow PS6 and PR6 to identify priority biodiversity risks for the project, and an analysis of the potential cumulative effects on biodiversity. Both documents are available to download at www.thebiodiversityconsultancy.com/map/lekela/

The Biodiversity Consultancy works together with industry leading clients to achieve an ecologically sustainable basis for development by tackling complex biodiversity challenges and by supporting positive conservation outcomes.

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