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Birds and Power Lines within the Rift Valley/Red Sea Flyway

Many bird species and bird populations potentially face significant risks associated with power lines. These risks include collision, electrocution and disturbance/displacement effects, as well as habitat impacts.

Development banks and financiers can help reduce adverse impacts on birds and biodiversity by:

- Providing an enabling environment for the mainstreaming of biodiversity and birds across government departments and different sectors
- Ensuring the appropriate routing of power lines in the energy projects they fund, which minimises the risk to birds and biodiversity
- Creating an enabling environment for **Strategic Environmental Assessment** (**SEA**) to be carried out, and helping identify areas suitable for routing
- Recognising the importance of routes avoiding protected areas, Important Bird Areas and migratory bottlenecks
- Ensuring that project and sectoral funding addresses concerns regarding the impact of power lines on birds, and that bird-sensitive pole and line design is used
- Stipulating in contracts and funding agreements that appropriate assessment for each project will be undertaken, which will provide specific recommendations on routing, and power line and pole design
- Using ornithological assessments that are appropriate and reviewed by a trained expert, and carried out by qualified individuals to ensure adequate assessment of funded projects
- Strengthening national capacity in relation to SEA and **Environmental Impact Assessment** (**EIA**), which will deliver long-term benefits
- Investing in the use of bird-sensitive pole design which minimises electrocution, and power line design which minimises collision risk
- Ensuring continuous monitoring takes place post-construction, to identify high impact areas and inform retrofitting mitigation actions
- Recognising the importance of ecological and bird data being freely and publicly available from a centralised source, and providing an enabling environment for this to take place
- Provide funding to deliver robust sensitivity mapping to inform appropriate routing
- Sharing best-practice examples across the region and between governments.

Once energy is generated, it must be transported to the end user. This infrastructure will occupy space within the landscape, and can pose a significant risk to birds and biodiversity. The Middle East/North Africa region which includes the Rift Valley/Red Sea flyway has significant plans for the development of energy, both renewable and conventional. These new and additional energy developments are driven by economic development and technological innovation and will require the

construction of additional power lines, the cumulative length of which could reach thousands of kilometres. The total length of transmission and distribution lines worldwide is expected to rise from 70.5 million kilometres at the end of 2010 to 76.2 million kilometres in 2015.

New power infrastructure may pose a high risk to birds and bird populations, potentially leading to the deaths of thousands of birds annually across the region. The impact of these power lines on bird populations will vary between species and locations, but for some, mortality rates are high enough to have a considerable impact at the population level, and may be a significant factor driving population decline.

Special attention needs to be given to the development of power lines along migration flyways, and the impacts of existing power lines. The Rift Valley/Red Sea flyway is the second most important flyway in the world for migratory soaring birds. Over 1.5 million migratory soaring birds of 37 species use the flyway, including raptors, storks, pelicans, ibises and cranes, of which five species are globally threatened. Any negative impacts on migratory birds within this area have the potential for far-reaching consequence both local and global. The flyway is connected and if one area is adversely impacted this can have a significant impact on linkages along the route.

Development banks and financiers, which may provide funding for the construction of power lines, or for the construction and development of energy projects such as power plants and renewable energy projects which will require connection with a main grid, must ensure that these are designed in such a way to reduce the impact on birds and biodiversity. It should be a condition of funding that consideration is given to delivering energy to the end user or national grid in a way that minimises any adverse impacts on birds and biodiversity.

Development banks and financiers are well placed to ensure that bird and biodiversity concerns are included within development plans, by working with national governments to integrate biodiversity concerns across different departments and sectors, and working with private industry to ensure developments take place in a strategic way. By integrating bird and biodiversity concerns early in the planning processes, significant results can be achieved. Development banks and financiers can play a significant role in bringing together multiple stakeholders, including governments, utility companies and civil society, in a consultative group which can help in designing grid technologies which have little or no impact on birds and biodiversity.

This guidance document seeks to inform development banks and financiers about the potential impacts of power lines on birds and bird populations, and procedures to minimise such impacts. Development banks have a responsibility to citizens within their host countries, and to global citizens and future generations, to ensure that development is as sustainable as possible, and that environmental externalities are minimised.

Potential Impacts

The power lines needed to deliver power from where it is generated to the end user can occupy a substantial amount of horizontal and vertical space across a landscape, and are likely to be one of the main sources of impacts on bird populations along the flyway. A 2010 Sudanese study found 17 electrocuted corpses of the globally threatened Egyptian Vulture *Neophron percnopterus* over a two month period[1]. Like other large soaring bird species, these long-lived birds have low reproductive rates and are likely to be significantly impacted by such mortality rates.

Significant effects of power lines on birds are likely to include:

- **Collision**: With power lines or associated masts leading to death or injury;
- **Electrocution**: owing to contact with live energised components;
- **Displacement/Barriers**: along migration routes or to suitable habitats/feeding grounds;
- **Habitat impacts**: including fragmentation of habitats at landscape level.

Exact numbers of birds killed through electrocution or collisions are difficult to estimate, although up to 10,000 electrocutions and many hundreds of thousands of collisions are estimated to occur per country in the African-Eurasian region each year[2].

The potential impacts are likely to vary depending on the site location, and also the species migrating through an area. For instance, raptors are more likely to suffer electrocution from power lines than collisions. The birds most commonly associated with electrocution are large wading birds (such as storks, herons and ibises), raptors, owls, and song birds and other perching birds (Passeriformes).

Birds which are vulnerable to collision are relatively fast-flying, heavy-bodied birds with limited manoeuvrability during flight. Particularly high mortality is likely to occur where placement of power lines coincides with migratory bottlenecks. Many collisions happen at night, or at dawn and dusk, or when visibility is low. The birds most commonly associated with collision are waterfowl, large wading birds (such as storks, herons and ibises), and cranes and other water birds such as sandpipers, plovers and gulls.

Birds can also have significant and costly effects on power lines. Collisions and electrocution incidents, and roosting and nesting, can damage the power line infrastructure, requiring repairs to a section or length of power line, and causing disruption of service. It may even be necessary to replace or move a section if it has been built across a route used regularly by birds, where impacts could potentially be high[3].

The impacts on birds differ depending on which of the three types of power line, carrying differing phases of electrical transmission, is involved

- High (>60kV usually 110 kV and above, Extra High > 250kV)
- Medium (1-59 kV) and
- Low (<1000 V).

This fact sheet focusses on high and medium power lines, which are believed to have the largest direct impact on birds and bird populations, mainly from the collision and electrocution risk.

High voltage power or transmission lines form the backbone of many national grids. The design of power lines along a vertical (upward) plane with cables of low visibility is associated with collision risks, especially during adverse weather conditions. Greater collision risk is associated with the thin earth (shield) wire which is found above the thicker high voltage wire. As they are usually connected to pylons with long suspended insulators, electrocution risk is typically low.

Medium and low voltage power lines or distribution lines are more likely to result in electrocution due to birds making a connection between two live components. This electrocution risk is most commonly associated with poles and perching areas.

[1] Angelov, I., Hashim, I., & Oppel, S. (2011) Persistent electrocution mortality of Egyptian Vultures Neophron percnopterus over 28 years in East Africa. Bird Conservation International, Available on CJO 2012 doi:10.1017/S0959270912000123
[2] CMS 2011 Review of the Conflict between Migratory Birds and the Electricity Power Grids in the African-Eurasian Region
[3] Bahat O., (2008) Wintering Black Storks (Ciconia nigra) cause severe damage to transmission lines in Israel- A Study of the risk and mitigation possibilities www.birdsvision-solutions.com/image/users/142826/ftp/my_files/downloads/WinteringBlackStorks.pdf

Birds can impact on power lines and the delivery of power to the end user by causing power outages. These power outages can often result in significant economic costs, both in repair of the line and loss of economic output[4]. These impacts can harm economic development, and development banks and financiers' organisations can reduce the likelihood of such events happening by ensuring that bird concerns are included in power line design and routing, and that costs are reduced by addressing these concerns at an early stage.

All power lines that are inappropriately placed across a landscape can lead to displacement of bird populations, and can have habitat impacts, including isolation of populations and also genetic isolation. The effect on the flyway could be significant. The flyway is internationally important and a global asset, and each country along the flyway and every organisation carrying out activities within the flyway has a responsibility to maintain its integrity, and should recognise that an impact in one area could have a significant effect elsewhere along the flyway.

Strategic planning and assessment

The potential negative impacts and the risk associated with routing of power lines will be significantly reduced by the use of a positive planning framework, and taking a strategic approach to routing and power line development.

Strategic planning should be used in conjunction with other mechanisms, such as improving energy efficiency at the consumer level, to reduce overall energy demand. The development of a Smart Grid, which utilises the most up-to-date technology, should be advocated for as part of a national development plan. Development banks should support national governments in developing a Smart Grid architecture. Minimising the need for additional power lines is the most effective way of avoiding any adverse impact, and mechanisms such as increased energy efficiency and dispersed energy systems should be considered to reduce this need.

At the pre-planning stage, a **Strategic Environmental Assessment** (**SEA**) should be carried out to identify areas where significant impacts may occur. Where there is a high probability of a significant impact, this area should be excluded from future development. Protected areas and other sites important for biodiversity such as Important Bird Areas, wetlands and areas with high concentrations of birds should be avoided if possible.

The use of an SEA facilitates the identification of appropriate routes and can also cut down on potential impact costs by guiding future development opportunities. The SEA processes will also greatly aid in the ability to identify the **cumulative effect** that power lines could have across a landscape. It should also integrate planned and existing infrastructure, and operations from other developments and sectors.

An SEA should be carried out by trained professionals. The assessment methods for the ornithological appraisal require expert review prior to commencement, to ensure that the appraisal is to a high standard and generates accurate results. Development banks and financiers must ensure that the methods used are appropriate, and that the results of the SEA are shared among relevant stakeholders including energy departments, environment departments, developers and utility companies. This should be reflected in project legal agreements and Terms of Reference.

Stakeholder consultation with local communities, indigenous groups, planners, researchers, and specific interest groups such as conservation groups, should take place throughout the lifespan of any assessment. This is especially important in the earliest stages of development, so that expert and local knowledge may feed in to the development process. In the region, data on birds, especially migratory soaring birds, may be limited, and expert knowledge can provide a valuable insight into areas where there is a likelihood of high risk. Development banks and financiers should ensure that stakeholder participation is taking place, and that mechanisms are in place to guarantee participation throughout the processes.

The SEA will be reinforced and enhanced when it is conducted in conjunction with **sensitivity mapping**. Sensitivity maps, although separate from the SEA and Environmental Impact Assessment, are complementary, and can provide valuable input into both; they are tools which record the locations and movements of species that are vulnerable to the impacts of infrastructural development. These tools allow for the risks associated with a particular activity to be quantified and combined with additional data that relates to species and sites. By using sensitivity mapping tools at an early strategic planning stage, high risk areas can be identified and the risks avoided or substantially reduced. Among other decision support tools, the IBAT should also be consulted, as it can show protected and important areas, and species or habitats which may be present along a route.

BirdLife International has developed and is continuing to refine a sensitivity mapping tool for the Rift Valley/Red Sea Flyway, which will provide valuable information on the potential impact on bird populations from wind energy development at different locations along the flyway, while also showing specific areas which are important to birds, which will be useful in identifying areas suitable for routing. This tool will be enhanced by provision of additional data, and the development of a power line sensitivity layer. Development banks and financiers can provide funding to develop this additional data.

Given the high probability that the increase in energy generation within the region will the mean the routing of additional power lines, the cumulative impact on birds and bird populations could be significant. The fragmentation of habitat and displacement of birds, and resulting exclusion from particular areas, could have effects similar to actual habitat loss. A Cumulative Impact Assessment will aid in identifying the vulnerability of species across the flyway. Development banks and financiers operating at a regional level are well-placed to provide an enabling environment in which it is possible to carry out an assessment region-wide. Effective communication between differing development banks can also help in identifying and addressing flyway-scale issues.

When appropriate routes have been identified, it is essential to undertake an **Environmental Impact Assessment** (**EIA**). This must appropriately assess the ornithological value and biodiversity of entire route. Several routes should be investigated at once, with the risks associated with each route considered and appropriately addressed. The route with the lowest risk should be the preferred route.

Ideally ecological data generated by the EIA should be stored in a centralised and accessible information system, which enables strategic analysis and also the generation of greater knowledge, and can increase the accuracy of any sensitivity map. Access to information is an essential component of any mainstreaming activity. Development banks and financiers should ensure that publication and accessibility of ecological data of funded projects is a contractual obligation, and should provide an enabling environment for the creation of central information systems.

As part of an EIA, it is essential that the Environmental Management Plan is open to stakeholder consultation, and a non-technical summary report is published. As with SEAs, mechanisms should be in place to guarantee stakeholder participation, and to deliver the best results. This should take

[4] Bahat O., (2008) Wintering Black Storks (cinonia nigra) cause severe damage to transmission lines in Israel- A Study of the risk and mitigation possibilities www.birdsvision-solutions.com/image/users/142826/ftp/my_files/downloads/WinteringBlackStorks.pdf

place throughout the assessment, and not just during the review period towards the end.

The EIA will aid in identifying the extent of risks to birds and other biodiversity at the site/project level. It enables specific risks to be addressed and outlines **specific avoidance and mitigation** actions, which will reduce the impact on birds and biodiversity. A robust pre-construction **baseline survey** is an essential component of the EIA; this should be conducted for a minimum of one year.

These baseline pre-construction surveys include:

1. Assessment of birds breeding along the proposed route, and within an appropriate buffer zone, including the construction site itself;
2. Vantage point surveys throughout the year, with intense monitoring during peak migration periods;
3. Species-specific assessments for rare or threatened and breeding bird species for collision risks and/or electrocutions;
4. Winter ornithological surveys may also be required.

This baseline survey should describe habitats and species along the entire span of the power line including a buffer zone, and identify high risk hotspots along the route. More intensive multi-seasonal ornithological surveys will be required in high-risk areas.

If there is a high likelihood of significant impact occurring through the routing of a power line this area should be avoided. Enhancement of an area by habitat manipulation which can benefit birds and biodiversity is an additional consideration, and will be informed by an appropriate EIA assessment. Areas of high bird flight frequency with associated low height use, such as coasts and wetlands, topographical straits (corridors or passage ways) or areas with concentrations of breeding colonies, should be avoided in this advanced planning stage.

Construction activities

The construction of the power line itself has the potential to have a significant impact on biodiversity, in particular resident bird species with territories close to the construction site. These impacts can be reduced by utilising environmentally-sensitive construction practices and techniques, including habitat restoration at the site level. Industry-specific best practice guidelines for mitigating impacts on birds in relation to power line cables and mast structure should be adhered to.

Good construction techniques include (1) minimising any clearing of natural vegetation; (2) implementing adequate measures to control soil erosion and runoff; (3) ensuring proper disposal of all wastes; (4) ensuring construction materials come from local and environmentally sustainable sources; (5) restoring cleared areas where feasible; and (6) ensuring invasive alien species are not introduced.

Construction should be timed to avoid times of peak sensitivity, such as during the breeding season or periods of peak migration. Many development banks have specific standards and guidance on construction practices to safeguard the environment. Monitoring must ensure that there is compliance with these standards, to ensure that the environmental impacts are minimised.

Mitigation actions

The main mitigation actions to reduce the risk of collision, electrocution and disturbance, which should be carried out at an early stage, are:

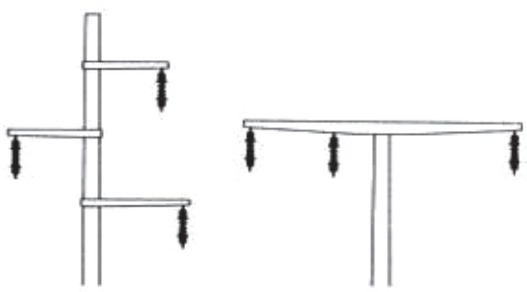
- Routing of lines to avoid key areas for birds, including migratory flyways and bottlenecks;
- Avoiding areas which are attractive to birds, such as waste-water treatments plans and waste dumps, especially in arid regions;
- Avoiding where possible establishing power lines close to shorelines and over wetlands, maintaining a minimum distance of 5 km from shorelines.

To reduce collision risk actions include:

- Placing power lines parallel to land features which could be potential bird routes such as ridges and valleys, and not cutting across them;
- Using bird deflectors in high impact areas, specifically along migration flyways. These should increase line visibility by thickening the appearance of the line by a minimum of 20 cm over a length of 10-20cm;
- Markers should be moveable, of contrasting colours (e.g. black and white), contrast with the background, protrude above and below the line and be placed 5-10 m apart;
- Removing the thin neutral or earth (shield) wire above the high voltage transmission lines where feasible, and where this is not possible, marking the line to make it more visible;
- Bundling high voltage wires, and using spacers to increase visibility;
- Burying cabling of low and medium voltage lines may be possible. While expensive, this eliminates the majority of risks associated with bird collision and electrocution. But this depends on the local site condition, as in specific habitats it may be ecologically disruptive;
- Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk;
- Depending on the location and topography, it may be suitable to have low-lying power lines which are beneath the altitude at which birds may travel;
- Habitat manipulation to influence flight activity and bird behaviour, e.g. tree lines under the high voltage lines to increase visibility;
- Clustering of lines along the same route may also be beneficial, as the network will then cover a smaller area;
- Avoid establishing areas which are attractive to birds, such as waste water treatment plants and solid waste dumps, near high concentrations of power lines.

To reduce electrocution risk, design of the poles is vital

- Designing power lines and associated masts to reduce electrocution risk;
- Hanging insulators under cross arms and poles provided the distance between a likely perch (mainly the crossarm) and the energised parts (conductors) is at least 70 cm;

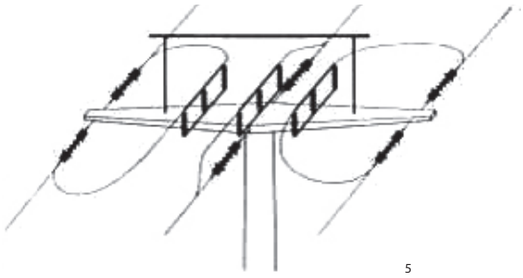


Hanging insulators beneath cross arms (taken from Haas et al. 2003)

- Capping upright insulators with a non-conductive material and using a nonconductive material to attach insulators to poles;
- Insulating cables close to poles and around perching areas, at least 70 cm on both sides, and up to at least 140 cm (even 180cm if vultures are present) in areas with large soaring birds;

Insulated conductors minimum of 70 cm on each side of cross arm (taken from Haas et al. 2003)

- Where the pole is made of steel, insulating all conductor lines;
- On strain structures where jumpers are used, at least two jumper wires should be suspended below the cross arm and the third insulated, or all jumpers insulated;
- Providing safe nesting and perching platforms above the pole at a minimum of 70 cm above energised components, or higher depending on the species present;
- Spacing between conductors should be not less than 140 cm, and 70cm between perching sites and live components;



Safe perching area, and insulated strain poles (taken from Haas et al. 2003)

- In areas where large soaring birds occur, spacing between live components or insulation should be over 2.7 m horizontally and over 1.8 m vertically;
- Providing safe perching areas and using perch management techniques;
- Retrofitting of lines identified as high risk through the SEA and continuous monitoring.

The mitigation actions should be planned and developed at the planning stage and be implemented at the construction phase, rather than retrofitting. This can save money in the long term and prevent capital being locked into inappropriate infrastructure which will require expensive retrofitting in the future.

Monitoring and surveying

Monitoring is an essential, and should take place pre-construction as part of an appropriate EIA, and also post-construction along both new and existing power line routes. The methods used pre- and post-construction should be comparable, and should follow the same protocols. This will allow for an assessment of disturbance and displacement. All monitoring should be carried out in a standardised way by qualified personnel following best practice guidelines. A pre-construction baseline survey should take place for minimum of a year, while a post-construction survey should last three years. Development banks and financiers must ensure that the monitoring procedures are accurate and appropriately assess ornithological considerations.

Post-construction monitoring activities should include mortality surveys along the new power lines, and also along existing lines. Existing lines and poles may be having a significant effect on birds and bird populations, so hotspot areas identified through stakeholder consultation should be investigated for significant impacts. The methodology should ensure that the whole line is studied, rather than focussing on particular areas. In areas of highly diverse habitats, stratified random sampling may be appropriate.

Monitoring should be designed to deliver robust, scientifically accurate and comparable information which should be made publicly available, preferably from a centralised repository at the country level; therefore it should be carried out in a standardised way. Assessing the impact of disturbance and/or displacement is a vital component of an impact assessment. Development banks' and financiers' project and loan legal agreements must specify that pre- and post-construction monitoring takes place, and that the ecological and bird data is freely and publicly available.

Donor commitments

BirdLife International, its Partners and its staff are committed to ensuring a lasting sustainable future for all. We recognise the importance of economic development for the region, and the necessity of ensuring energy access for all. We highlight the vital contribution of renewable energy in reducing carbon emissions and in the fight against climate change. Countries have the right to utilise their resources for the benefit of their citizens, and development banks and financiers should help support national and regional governments in minimising any adverse impacts to ensure lasting sustainable development now and for future generations.

Additional demand for energy within and outside the region will require the construction of additional power lines, which will occupy space across the landscape of the region. This is especially true of renewable energy, which is usually located away from large centres of consumption.

Development banks and financiers have a responsibility to ensure that the projects which they fund have minimum environmental risks. Many of the energy projects which are delivered will need associated power lines. Contracts, and project legal agreements, should ensure that funding is conditional on the use of appropriate power lines which are bird-friendly. Development banks can, through facilitating strategic planning, deliver projects in a sustainable way, and ensure future generations have access to biodiversity.

Development banks which work with governments can contribute to the design and implementation of Smart Grid technologies, and power lines which reduce the impact on bird populations, including by developing/supporting the development of specific legislation and regulations which relate to bird-sensitive power pole and line design. National working groups should be established to review the national situation, and discuss priorities for action. The development of standards for bird-sensitive poles and lines will enable risks to be reduced. These standards should be requested by development banks and financiers within their project legal agreements. Budgets should also be set aside for the retrofitting of existing lines.

The ecological and bird data which is collected should be freely available and accessible. This data can be input into a national

[5] Haas D, Nipkow M, Fielder G, Schneider R, Haas W, Schürenberg B (2003) Protecting Birds from Powerlines: a guide on the risks to birds from electricity transmission facilities and how to minimise any such adverse effects Recommendation no 110 (2004) of the standing Committee on minimising adverse effects of above ground electricity transmission facilities (power lines) on birds Bern Convention

development plan and thereby enhance the decisions made as part of a strategic framework. The obligation to publish ecological data should be enshrined within project legal documents.

Capacity building within regional, national and local institutions should make up a component of any activity. Projects must ensure that national stakeholders, including government and civil society partners, are given the mechanisms to increase learning opportunities and share best practices, both nationally and regionally. Local development of SEA and EIA assessment and monitoring capacity will enable future projects to be delivered in a robust and strategic way.

National governments with which development banks and financiers operate have adopted and signed a number of international agreements, including the Aichi Biodiversity targets. A number of these international agreements refer to the need to mainstream biodiversity concerns across all sectors of government. By facilitating and requiring the use of SEA and EIA for power line routing, development banks can aid governments in meeting their commitments. If organisations are involved in providing input into national or sustainable development plans, development banks and financiers should ensure that bird and biodiversity concerns are integrated across all levels.

Development banks have made a commitment to help national governments reach national environmental goals and priorities, which include the CBD targets and other international agreements and national priorities as set out in the Paris Declaration on Aid Effectiveness, while the Accra Agenda for Action highlighted the need to support country environmental planning systems, and to engage with civil society, including capacity building, in relation to assessments, and harmonisation of procedures. By ensuring stakeholder engagement within the SEA and EIA processes, Development banks and financiers can ensure bird and biodiversity issues are integrated into any decision-making processes.

More details on the Migratory Soaring Bird Project can be found on the link below. Specific guidance in relation to wind energy, power lines and solar energy is to be published, and a sensitivity mapping tool is being developed and will be available over the coming months.