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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.

Governments can minimise any adverse impacts on birds and biodiversity by:

- Reviewing and where appropriate revising legal and regulatory mechanisms to ensure birds and biodiversity are safeguarded
- Developing legislation and regulations which ensure the use of bird-sensitive pole and power line designs
- Carrying out strategic planning of power lines utilising the **Strategic Environmental Assessment (SEA)** approach
- Developing and strengthening legislation in regard to the use of SEA and **Environmental Impact Assessment (EIA)**
- Ensuring that an EIA is carried out for each project, and that this includes ornithological assessments and post-construction monitoring
- Planning routes to avoid protected areas, Important Bird Areas and migratory bottlenecks, and other sites identified as high risk
- Adhering to the precautionary avoidance approach, and assessing likely impacts to avoid and minimise them
- Further protection of areas of high biodiversity value or important sites for species
- Committing to the publication of the environmental and ecological data generated as part of EIA and SEA, ensuring that it is freely available for review and consultation, and stored in a centralised information system
- Engaging with a wide range of stakeholders to address any concerns, guaranteeing stakeholder consultation in SEA and EIA processes
- Identifying areas of significant risk on existing infrastructure, and initiating retro-fitting programmes
- Regional sharing of good practice examples and information, to reduce impacts and improve the knowledge base of appropriate mitigation actions
- Working with BirdLife Partners and other stakeholder groups who can identify important areas and provide guidance on mechanisms to reduce the adverse impacts on birds and biodiversity.

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 potential for generation of energy, both renewable and non-renewable, with

developments planned across the flyway. These developments include wind, solar and hydro power plants, as well as traditional generation facilities.

Increased economic development and the need to deliver energy to people in a fair and equitable way will drive future

demand. These new and additional energy developments require the construction of 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.

Power infrastructure including power lines 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.

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 are globally threatened. Each country in the region has a unique contribution to make in ensuring the continued resilience of the bird species present within their borders, and in flyway-scale conservation as birds move through and use habitats within their countries.

Special attention needs to be given to routing of power lines along these migration flyways. Governments need to consider that significant and large-scale power lines are planned along the length and breadth of the flyway, and thus the cumulative impacts upon birds through poorly routed lines could be very significant. It is thus critical that bird considerations are taken into account in the routing of power lines, both nationally and regionally. While it is vital that the citizens of each country gain access to efficient and clean energy, routing should seek to minimise environmental impacts.

This guidance document is designed to inform governments, government departments and officials of the potential impacts that power lines and pylons can have across the flyway, and recommend specific practices that can reduce these impacts. Having legislation and regulations in place, and references and commitments embedded in contracts between the national authority in charge of the national grid and the developer of the power lines, which ensure that bird and biodiversity issues are mainstreamed, will guarantee lasting sustainable development, and protect birds and biodiversity, now and for future generations.

## 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<sup>1</sup>. 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.

The 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<sup>2</sup>.

The potential impacts on birds differ depending on the type of power line used. There are three different types of power lines which carry out differing phases of electrical transmission:

- 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 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 (or upward) plane and cables with low visibility is associated with collision risks, especially in bad 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 connected to pylons with long suspended insulators, electrocution risk is low. The birds most commonly involved in collisions are waterfowl, large wading birds (such as storks, herons and ibises), cranes and other water birds such as sandpipers, plovers and gulls.

**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. 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 can also have an impact on power lines and the delivery of power to the end user by causing power outages. These can often result in significant economic costs, both in repair of the line and loss of economic output<sup>3</sup>. By incorporating bird issues at an early stage of planning governments, designated national authorities and utility companies can reduce the risk of such events.

## 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 improvements in efficiency at the consumer level, for example the use of low-energy lighting systems, to reduce overall energy demand. This could potentially cut down on the need to build additional infrastructure.

The development of a Smart Grid which utilises the most up to date and current technologies should be developed and integrated into a national development plan. Governments can ensure that the minimum amount of additional lines is required by integration into existing lines or grids.

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 on vulnerable and/or important species and habitats, this area should be excluded

<sup>1</sup> 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

<sup>2</sup> CMS (2011) Review of the Conflict between Migratory Birds and the Electricity Power Grids in the African-Eurasian Region

<sup>3</sup> 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](http://www.birdsvision-solutions.com/image/users/142826/ftp/my_files/downloads/WinteringBlackStorks.pdf)

from future development where possible. Routes should be designed to avoid protected areas, Important Bird Areas and migratory bottlenecks if possible. Governments should ensure the protection of sites important for birds.

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 development project. This is especially important in the earliest stages of development, so that expert and local knowledge may feed in to the development process, and specific areas of concern can be addressed. Governments and national authorities should provide mechanisms to allow for appropriate stakeholder consultation, and this should be participatory in nature, taking place throughout the assessment.

The use of an SEA enables governments to identify potential long-term, large-scale (regional or national scale) and cumulative risks and impacts of multiple power transmission projects, not only for birds, but from other environmental and socio-economic perspectives. The results will help identify recommended routes for power lines, while also identifying zones or areas of high risk. The SEA process should also optimise land use, reduce the overall environmental and social footprint of power line projects, and cut down on potential impact costs into the future. The assessment should incorporate other planned and existing developments from other sectors, to ensure the cumulative impact is assessed.

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. BirdLife Partners should be encouraged to engage with the SEA process and provide inputs into its development. Appendix A of the 'Guidelines for mitigating conflict between the migratory birds and electricity power grids'<sup>4</sup> gives a country case study example of selecting appropriate routing.

The fragmentation of habitat and displacement of birds and resulting exclusion from particular areas could have effects similar to actual habitat loss. Governments should set out to ensure that important habitats and sensitive ecosystems are not impacted by power lines. Areas of high bird flight frequency with associated low height use, such as coasts, topographical straights or areas with concentrations of breeding colonies, should be avoided in this advanced planning stage.

An 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. Although this tool has initially been designed to show the sensitivity of bird species to wind farm development, it is a valuable resource for showing concentrations of birds and areas important for birds within the region.

The sensitivity mapping tool will be enhanced through the input of new and additional information, and the development of a sensitivity layer for power lines. By ensuring access to information and data, and additional funds for developing new and additional layers, governments can increase the relevance and reliability of a sensitivity mapping tool.

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 the route. Several routes should be investigated in parallel, with the risks associated with each route considered and appropriately addressed. The route with the lowest possible risk should be the preferred option.

Governments should ensure that the ecological data generated by the EIA will be stored in a centralised and accessible information system, which enables strategic analysis and also the generation of greater knowledge on the impacts of power lines on birds. This information can then influence further strategic planning. It is essential that the Environmental Management Plan is open to stakeholder consultation, and that a non-technical summary report is published. As with an SEA, the EIA will be enhanced through the participation of stakeholders throughout the processes, and this should not be confined to reviewing documentation at the end of the assessment.

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 this EIA assessment. As the area occupied by power lines will be large, a stratified random sampling approach can be applied.

BirdLife Partners with expert knowledge can also provide advice on specific areas where risk of impacts is high, and should be approached to engage in the EIA processes. A pre-construction survey should last 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.

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 alteration, which can benefit birds and biodiversity, is an additional consideration, and will be informed by an appropriate EIA assessment.

## Construction activities

The construction of power lines has the potential to have a significant impact on biodiversity, in particular resident bird species with territories close to the construction site and route. These impacts can be reduced by utilising environmentally-sensitive construction practices and techniques, including habitat restoration at the site level. Governments must ensure that appropriate construction techniques are used, and that there is a redress mechanism in place if detrimental impacts occur.

<sup>4</sup> CMS (2011) Guidelines for mitigating conflict between the migratory birds and electricity power grids [www.cms.int/bodies/COP/cop10/docs\\_and\\_inf\\_docs/doc\\_30\\_electrocution\\_guidlines\\_e.pdf](http://www.cms.int/bodies/COP/cop10/docs_and_inf_docs/doc_30_electrocution_guidlines_e.pdf)

## Mitigation actions and bird-sensitive design

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

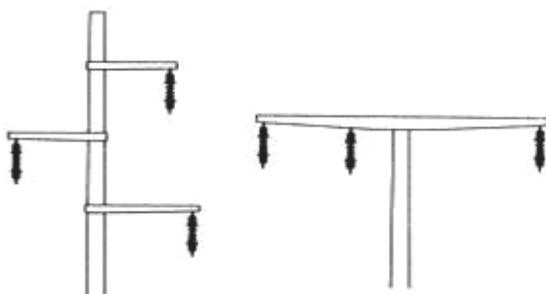
- Routing of lines to avoid key areas for birds, including migratory flyways and bottlenecks;
- Avoiding areas which are attractive to birds such as waste water treatments plants and waste dumps, especially in arid regions;
- Avoiding where possible establishing power lines close to shorelines and over 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 use of 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 in 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.

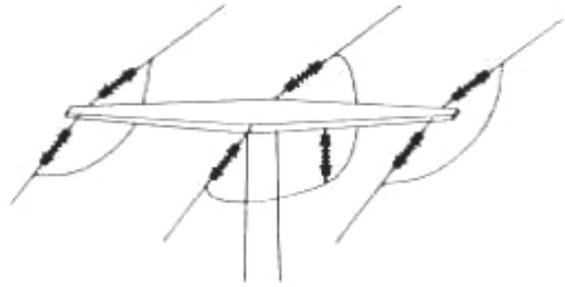
To reduce electrocution risk, design of the poles is vital

- 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;



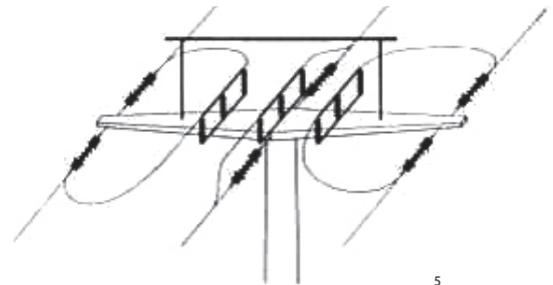
*Hanging insulators beneath cross arms (taken from Haas et al. 2003)*

- Capping upright insulators with a nonconductive material, and using a nonconductive material to attach insulators to poles;
- Insulating cables close to poles, at least 70 cm on both sides and around perching areas, 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 developed at the planning stage, and take place at the construction phase, as the costs are substantially lower than retrofitting later. Governments must ensure that lines are routed appropriately and that bird-sensitive designs are used, either through regulation or contract agreements.

## Monitoring and surveys

Monitoring is essential, and should take place pre-construction as part of an appropriate EIA ornithological assessment, and also post-construction along both new and existing power line routes. The methods used pre- and post-construction should be comparable, and follow the same protocols.

This monitoring should be carried out in a standardised way by qualified personnel, following best practice guidelines. A

<sup>5</sup> 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

pre-construction baseline survey should take place for at least a year, while a post-construction survey should last three years. The cumulative impact of power lines across a landscape is an important consideration, and a Cumulative Impact Assessment may be required across a region or landscape.

Post-construction monitoring activities should include, in addition to the continuation of the pre-construction surveys mentioned above, mortality surveys along both new and existing lines. Existing lines and poles may be having a significant effect, so hotspot areas identified through stakeholder consultation should be investigated for significant impacts. Monitoring should be designed to deliver robust, scientifically accurate and comparable information which can be made publicly available. Assessing the impact of disturbance displacement is a vital component of an impact assessment.

## Strengthening national and international legislation

### National legislation

There is a need to agree on standards in construction and design of electricity distribution, to minimise any adverse impacts which power lines will have on birds and bird populations through their routing and placement. National legislation or regulations should be developed, to ensure that the most bird-sensitive pole and line design is used. There is precedent within national governments for developing legislation to ensure that power line use the most relevant and current technologies.

National governments should complete an SEA to identify routes for power lines which minimise impacts on birds. National legislation should require an EIA to be carried out for all power lines, including private sector developments requiring connection to the national grid. If no legislative framework is in place calling for the use of SEA and EIA for development of infrastructure projects, governments should work with different stakeholders to ensure such mechanisms are enshrined in legislation, and that the methods used reflect the need to integrate bird and biodiversity concerns. To be effective, the EIA process should be fully incorporated into existing legal planning processes; it should not be seen as an 'add on'.

The SEA and EIA processes must ensure that all appropriate activities, including bird surveys and post-construction monitoring, are included, and that the methods of investigation deliver robust scientific data. Stakeholders including BirdLife Partners should be consulted to ensure that bird and biodiversity concerns are integrated and appropriately assessed.

The ecological data gathered as part of an SEA and EIA should be freely available to the public, and for study and investigation. Governments should commit to making ecological data freely available and accessible, via a centralised information source or system. Project legal agreements should provide mechanisms for access to this information.

Existing infrastructure is likely to pose a significant risk to many vulnerable species, so a comprehensive dataset that describes the power line infrastructure, and classifies it according to type and potential risk, can be used to identify hotspot areas that are priorities for action. Where existing power line infrastructure must be upgraded, regulations must ensure that poles which are upgraded are bird-sensitive, with the most bird-sensitive design applied where data may be deficient. Line design should also be bird-sensitive and include the use of bird diverters.

Further protection of natural habitats and areas important for birds and biodiversity may be necessary, including specific references to the placement of power lines across or adjacent to these areas. Vulnerable species lists can also be developed, which can guide the routing of lines to ensure that the risks are

minimised. Consultation with expert groups, including BirdLife Partners, will ensure that the appropriate routes and species are considered.

The development of a national planning framework for infrastructure projects, including energy, which integrates biodiversity considerations, and guides the strategic development of the energy infrastructure including a power grid, is a positive step to informing a range of stakeholders, and will help achieve sustainability. It will offer a guide to which stakeholders can refer when they seek to undertake projects. This includes the development of Smart Grid technologies, and power lines which reduce the impact on bird populations. Contracts should ensure that good environmentally-sensitive construction practices are required, and that a budget is allocated to carry out continuous monitoring post-construction.

Clear legislation is needed to ensure protection of birds and compliance by developers. Project legal agreements need to reflect agreed power line and pylon design standards. Post-construction monitoring and data-sharing, operational curtailment, equipment and landscape maintenance, and mitigation measures, are more likely to be implemented if they have been explicitly described and budgeted for in project agreements, bidding documents and contracts. Redress and compliance mechanisms need to be developed, to ensure that operators and developers are adhering to rules.

Stakeholder consultation is a vital component of delivering lasting sustainable development. Stakeholder consultation results in expert opinion being included in project delivery. National governments should work to provide a framework where various stakeholders and interest groups can provide input into development plans, and their knowledge and expertise can be utilised. The participatory processes should be carried out in a transparent manner, which can result in a sense of shared ownership and responsibility.

Governments should also set out to strengthen existing environmental legislation to protect important areas, and reduce the likelihood of developments affecting them. The definition of 'environment' in national legislation and procedures should fully incorporate the concept of biological diversity as defined by the Convention on Biological Diversity and related conventions.

### International Agreements

The [Strategic Plan for Biodiversity 2011-2020](#), adopted at [Convention on Biological Diversity](#) (CBD) COP 10 in 2010, provides a comprehensive global framework for achieving the vision of '[Living in Harmony with Nature](#)', including the 20 headline Aichi Targets for 2015 or 2020. These targets called for the mainstreaming of biodiversity across government, so that biodiversity values are integrated across sectoral plans and policies, and any adverse effects on the environment and biodiversity can be minimised. Governments must recognise the fundamental importance of mainstreaming biodiversity into sectoral policies, and use the development and implementation of NBSAPs as an entry point to promote inter-sectoral planning and integrated implementation. The use of SEA and EIA contributes to the mainstreaming of biodiversity within a strategic development plan. [Article 14 of the CBD](#) identifies impact assessment as a key instrument for achieving the conservation and other objectives of the convention. The CBD has also published formal texts on [voluntary guidelines](#) for incorporating biodiversity into impact assessments.

The [Convention on Migratory Species](#) (CMS) has a number of resolutions specifically related to migratory birds and energy infrastructure. These include Resolution 7.4 '[Electrocution of Migratory Birds](#)' from COP7 in 2002, which calls on the parties to the convention to curb increasing electrocution risk from medium-voltage transmission lines, and Resolution 10.11

[‘Power lines and Migratory Birds’](#), adopted at COP10 in 2011, which developed specific guidelines on mechanisms to reduce power line impacts on birds, and urged countries to implement these guidelines, including ‘development of specific impact criteria to be applied in selection of energy generation sites’. Developing regulations on specific standards in relation to power line design has been implemented in other countries, and has been seen to deliver positive results.

The [Agreement on the Conservation of African-Eurasian Migratory Waterbirds](#) (AEWA) also addresses power lines and renewables. Specific Resolutions agreed at the 5th Meeting of the Parties in 2012 include Resolution 5.11 on [‘Power lines and Waterbirds’](#), and Resolution 5.16 [‘Renewable Energy and Migratory Waterbirds’](#), calling for the development and strengthening of national renewable energy planning, and for the developments to include monitoring in order to avoid and minimise the adverse effects of renewable energy installations. The recommendations provided in this document in relation to pre-and post- construction monitoring, and the integration of ornithological concerns into both SEA and EIA, will go a long way to fulfilling these resolutions

The recent COP11 meeting of the [Ramsar Convention](#), held in July 2012, also contained a specific resolution in relation

to Energy. Resolution XI.10 on [‘Wetlands and Energy Issues’](#) provided guidance on addressing the implications of policies, plans and activities in the energy sector for wetlands, stressing the need for integrated planning. Governments are reminded of their commitments with respect to these agreements and conventions. Departments which may be responsible for environmental issues should share this information with a range of differing departments, highlighting the role that SEA and EIA can have in meeting these resolutions and agreements.

BirdLife International is committed to ensuring a lasting sustainable future for all. Countries have the right to utilise their resources for the benefit of their citizens, and any impacts that infrastructure, including power lines, may have on birds and biodiversity can be minimised by having the appropriate mechanisms in place.

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.