



Preventing the Electrocution of Birds on Power Infrastructure

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The silent epidemic of bird electrocution

Bird electrocution at power lines has been documented for over a century, yet the issue persists and the scale of the problem has increased, such that electrocution is now the single most important cause of mortality for a number of endangered species. The impact of electrocution can be especially severe for globally threatened predators and scavengers such as the Saker Falcon, Steppe Eagle, Spanish Imperial Eagle, Egyptian Vulture, White-backed Vulture and Cape Vulture.

Poorly designed power infrastructure

Electrocution is primarily associated with medium-voltage electricity distribution lines, taking power from the transmission grid to local communities and industry. Steel-reinforced concrete poles and metal pylons can conduct electricity and are especially problematic when combined with inappropriate hardware for carrying the live cables. Inappropriate hardware configurations include short, upright pin insulators attached to metal crossarms and jumper-wires that pass above insulators rather than below. Distribution lines with non-conducting supports, such as wooden poles, can still pose an electrocution risk for larger species if the live cables are too close together.

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In every region of the world, large numbers of birds are being electrocuted

Bird electrocution occurs in countries throughout Europe, killing many threatened and iconic species such as eagles and storks. In Africa, eagles and vultures are frequent victims of a rapidly growing network of poorly designed distribution lines. Similar rapid growth in infrastructure is occurring across Asia, killing enormous numbers of migratory species including falcons and eagles. In the Americas, eagles and other raptors are killed in large numbers across both the Northern and Southern continents, while endemic species can fall victim to power lines in Australasia. Globally, hundreds of thousands of birds are electrocuted annually, a significant proportion of which are threatened species. A lack of awareness regarding the mechanisms causing bird electrocution, its impact, and potential means of remediation, has resulted in the global spread of this 'silent epidemic'.

Impacts on globally threatened raptor species: Saker Falcons in Eurasia

The endangered Saker Falcon is a bird of open habitats where it often uses power poles as a vantage point to hunt small mammals. Consequently, this large falcon is particularly at risk of electrocution and significant numbers are killed at power poles across its distribution range from Hungary, through Kazakhstan and Russia, to the high plateau of Tibet and the steppes of Mongolia. Several satellite-tracked birds from monitored populations in central Europe and a reintroduction project in the Balkans have been found killed at power lines. Thousands are electrocuted annually across Central Asia, with the larger females being more susceptible than males resulting in a male-biased population. This demographic impact on the population makes the species more vulnerable to extinction.



Impacts on globally threatened raptor species: Bald and Golden Eagles in North America

Electrocution is a major cause of death for eagles in North America. Their large wingspan means that they can make contact with two wires simultaneously when taking off or landing on a power pole. Golden Eagles are considered the most vulnerable species to electrocution in North America and it has been estimated that up to 25% of the population die at power lines. Electricity distribution lines in open landscapes close to water bodies where Bald Eagles forage are known to be particularly dangerous for the species. National Bald Eagle Management Guidelines in the USA recommend siting lines away from eagle foraging and roosting areas.



Impacts on globally threatened raptor species: Vultures in Africa

The vultures of Africa are in crisis, undergoing severe population declines primarily as a result of poisoning, but also due to the rapidly expanding network of electrical infrastructure across the continent. The size and enormous wingspan of vultures means that they face a high risk of electrocution. Large numbers can die when they congregate at carcass sites near power lines. In addition, species such as Cape and White-backed Vultures frequently use power lines to roost or perch communally, resulting in mass mortality events. It is estimated that up to two-thirds of Cape Vultures die at power lines. For these long-lived vulture species, electrocution mortality is believed to have had a significant impact on their populations.



Significant cumulative impacts on migratory bird species

The globally endangered Egyptian Vulture is a migratory species that typically aggregates at particular 'bottleneck' locations during migration, power lines offer an attractive location for flocks to perch and roost. At one such site on the Red Sea coast, a 31 km long of power line is estimated to have killed over 5,000 Egyptian Vultures during the 80-year period it was in operation at Port Sudan. Mortality at this one line significantly contributed the population decline exhibited by this vulture species.

Increased risk with proliferation of new unsafe or poorly located infrastructure

The recent expansion of electricity distribution infrastructure in Africa has been associated with deregulation and increased investment by non-governmental companies. This proliferation of power lines has also been mirrored across Asia, with cost efficiency being an important factor for investors in both continents. This has led to the widespread use of reinforced concrete poles and cable-support hardware that has a high electrocution risk. The expanding network of power distributions lines in Africa and Asia is exposing ever greater numbers of birds to the risk of electrocution.



Financial and social impacts from structural damage and supply disruption

The electrocution of large birds like raptors and storks can cause damage to electricity lines and interrupt power supplies, creating a challenging problem for power distribution companies in areas where such electrocution events are frequent. Damage caused by bridging, where a bird makes contact between phases or between phase and ground, can cause damage to cable strands but more often electrocution events damage equipment (e.g., transformers, blown fuses and arresters). Occasionally, large electrocuted birds will remain in place resulting in a failure of the circuit to re-energize until a maintenance crew removes the bird. It has been estimated that animals are responsible for up to ten per cent of all outages at electricity distribution lines in the United States, where the cost of a single outage can cost thousands of dollars and inconvenience many customers.

Scientific studies in many countries on the problem of avian electrocution

Scientific studies into the issue of bird electrocution have been conducted across many regions of the world, with particular attention paid to the subject by researchers in Spain and the USA. Coordination between conservation agencies and power supply companies has been developed to address the issue of electrocution in countries such as Germany and Hungary, while recent growth in the electrocution problem has been documented in Asia and Africa. The first work with high-speed filming of how raptors alighted on power-poles, to help produce safe designs, was done by falconers in the USA fifty years ago, and falconers are still funding work to make power-lines bird-friendly. These studies highlight the common features of poorly designed infrastructure that result in bird electrocutions across the globe, while variation in landscape, habitat characteristics and avifauna produces specific regional distinctions. Guidelines from the CMS on how to avoid or mitigate the impact of electricity power grids on migratory birds in the African-Eurasian Region can be found at: <https://goo.gl/997ZB5>.



Governments, power companies, financial institutions and other stakeholders must ensure that existing and planned infrastructure which is harmful to birds is identified and is subject to urgent remediation

The Convention of the Conservation of Migratory Species of Wild Animals (CMS) passed a resolution on the electrocution of migratory birds in 2002 and in 2004 the EU Bern Convention produced recommendations on minimizing the adverse effects of power lines on birds. A regional initiative in the Rift Valley-Red Sea flyway to assist in the implementation of guidelines relating to bird electrocution is incorporated within the UNDP/GEF 'Migratory Soaring Birds Project' led by BirdLife International. In the USA, the Avian Power Line Interaction Committee (APLIC) includes over 50 electric utilities and has developed guidance documents identifying causes and minimization methods for avian electrocutions in conjunction with the US Fish and Wildlife Service. Procedures exist that can identify high-risk power lines and assist governments, power companies and other stakeholders in the prioritization of infrastructure requiring remediation.



Methods for mitigation: Insulation

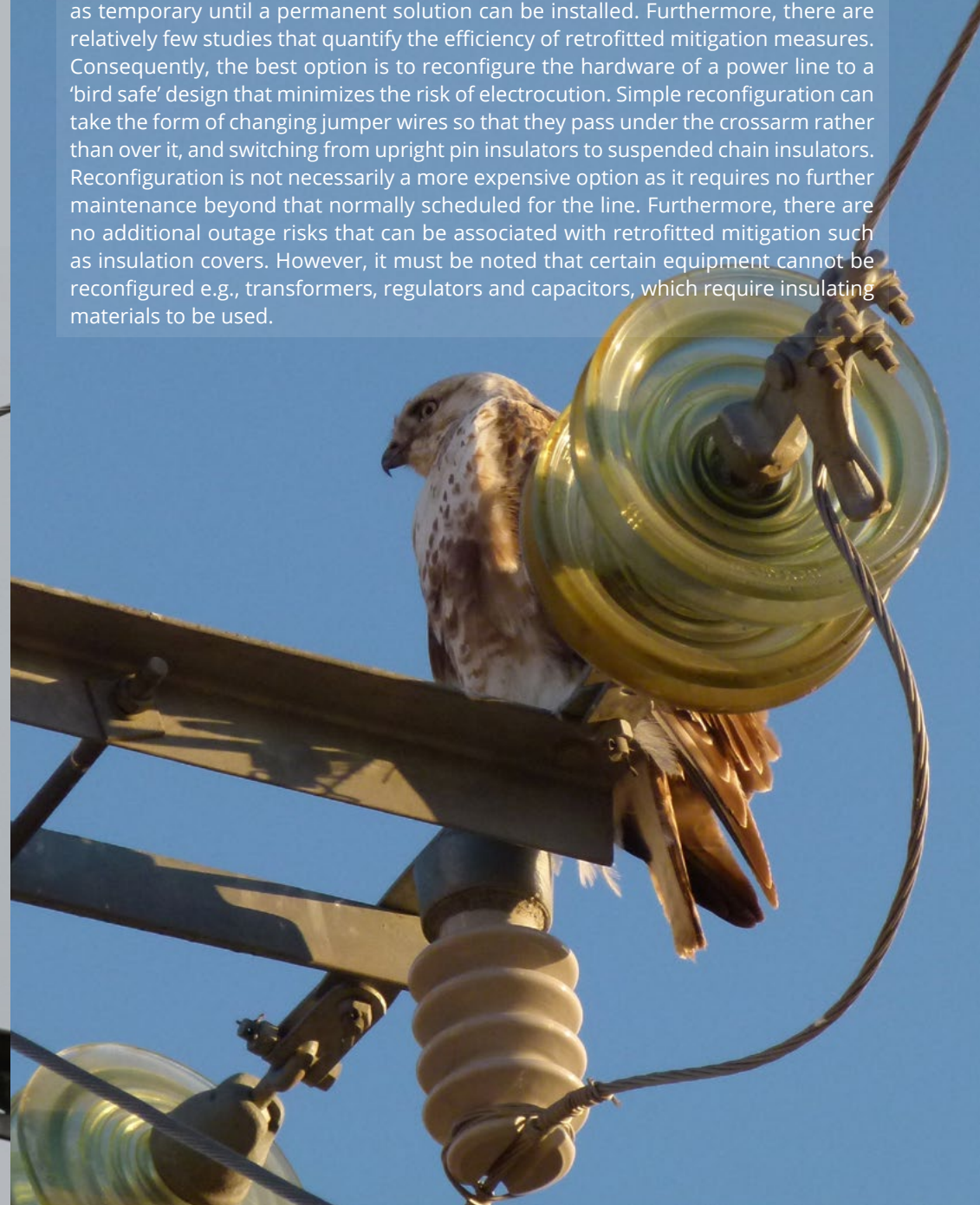
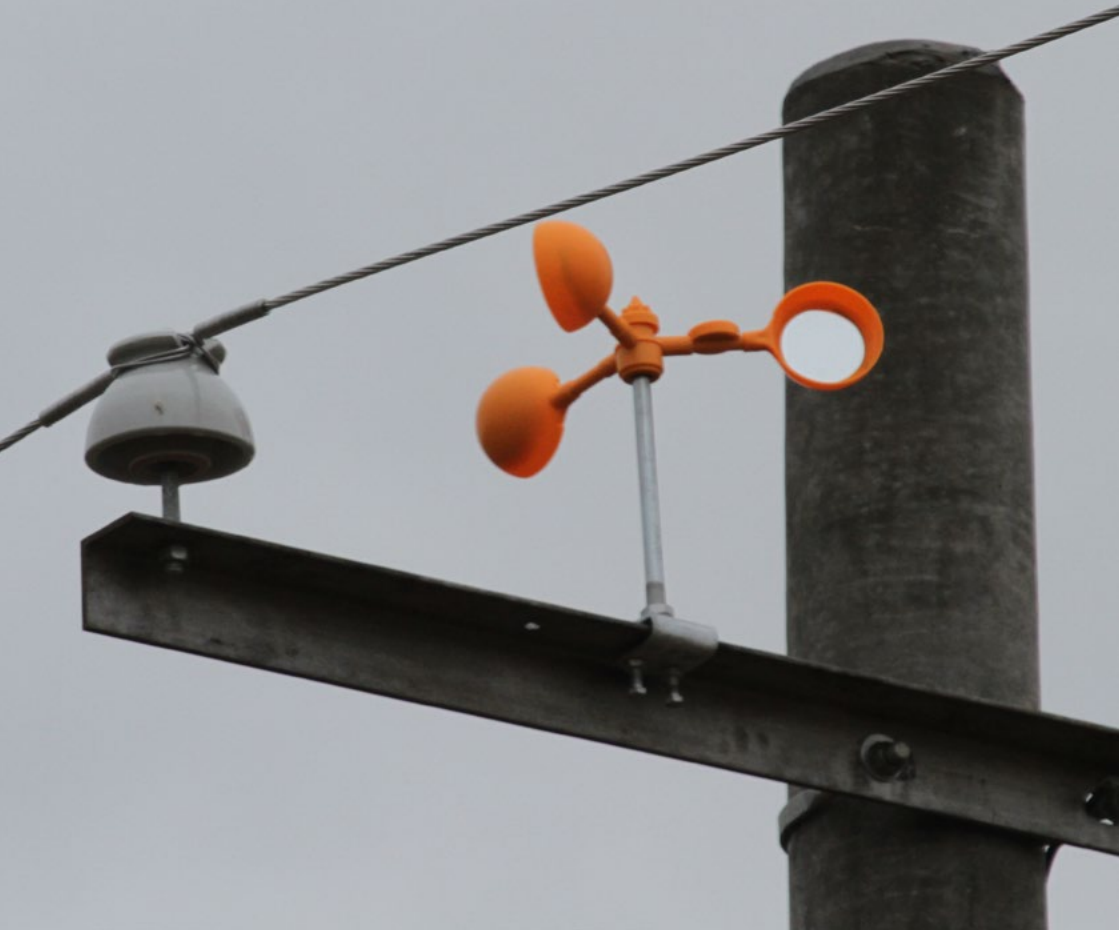
Existing high-risk electricity infrastructure can be retrofitted with insulation materials to prevent bridging between live cables or between cables and grounded hardware. Insulation can be fitted to conductor wires and insulators supporting the cables or to the grounded crossarms. Insulating materials need to be of appropriate specification for the voltage and the regional environment of the power line, and must be correctly installed by competent engineers. Insulation fitted retrospectively requires monitoring and maintenance to ensure that it continues to function effectively.

Methods for mitigation: Perch deterrents and deflectors.

Electrocution rates can potentially be reduced by deterring birds from perching in dangerous positions on power distribution lines. Some deterrents, such as rotating mirrors, are aimed at deterring birds from perching nearby, while others, such as spikes, act as physical barriers to prevent birds perching close to live cables. Deterrent methods can differ in their efficacy, and inappropriate placement may even increase electrocution risk. It is important to ensure that the chosen deterrent or deflector is appropriate for the specific circumstance, is correctly installed, and that a programme of monitoring and maintenance is in place.

Methods for mitigation: Reconfiguration

Retrofitted mitigation such as insulation covers and perch deflectors are best regarded as temporary until a permanent solution can be installed. Furthermore, there are relatively few studies that quantify the efficiency of retrofitted mitigation measures. Consequently, the best option is to reconfigure the hardware of a power line to a 'bird safe' design that minimizes the risk of electrocution. Simple reconfiguration can take the form of changing jumper wires so that they pass under the crossarm rather than over it, and switching from upright pin insulators to suspended chain insulators. Reconfiguration is not necessarily a more expensive option as it requires no further maintenance beyond that normally scheduled for the line. Furthermore, there are no additional outage risks that can be associated with retrofitted mitigation such as insulation covers. However, it must be noted that certain equipment cannot be reconfigured e.g., transformers, regulators and capacitors, which require insulating materials to be used.





Prevention: Adequate environmental assessments for planned electricity infrastructure

It is important that bird electrocution risk forms part of environmental impact assessments associated with planned electricity distribution infrastructure. Environmental assessments must ensure that new power lines are safe for birds, taking into account the different species in the vicinity that could potentially be electrocuted; eagles and vultures have large wingspans, and that needs to be considered when specifying spacing distances between phase cables on a power line. Environmental assessments should also ensure that the course a power line takes through habitats and landscapes is least likely to attract perching birds, e.g. by avoiding - wherever practicably and economically possible - open, flat plains. It is important that environment assessments have some form of statutory basis to enforce compliance.

Prevention: Ensure all new power infrastructure is bird safe

The risk of bird electrocution should be a core consideration when selecting hardware configurations for electricity distribution lines. Key elements are (a) to ensure that the phase cables are spaced far enough apart to reduce the risk of large birds touching both simultaneously, (b) preferably use of non-conducting materials for support structures, such as wooden poles or fibre-reinforced composite crossarms and (c) on grounded structures, such as reinforced concrete poles with metal crossarms, phase cables should be suspended from chain insulators rather than supported by upright pin insulators. Additional bird safe alternatives include using insulated cables and burying cables underground.



Prevention: Infrastructure funding that is dependent on a bird safe approach

Funding for power line infrastructure, particularly in Asia and Africa, can come from international institutions as part of wider economic and social development goals. In such cases, funding organizations should specify that the electricity distribution lines they finance should be safe for birds. This can be achieved by making funding dependent on the contracting organization undertaking a process of environmental assessment and ensuring that that process considers the issue of avian electrocution.

Guidance on appropriate means of impact assessment of electricity power grids can be found at: www.migratorysoaringbirds.undp.birdlife.org



Production and dissemination of multi-language guidance



Detailed guidance on the causes of avian electrocution and remediation measures has been produced by several organizations. CMS has produced guidelines on how to avoid or mitigate impact of electricity power grids on migratory birds in the African-Eurasian Region (available from www.unep-aewa.org).

In the USA, the Avian Power Line Interaction Committee (APLIC) has produced guidance on avian protection on power lines (available from www.aplic.org).



The UNDP/GEF 'Migratory Soaring Birds Project' implemented by BirdLife International has produced a range of guidance documents in English and Arabic – see migratorysoaringbirds.undp.birdlife.org/en/documents. However, there is a need to provide similar guidance in other languages, particularly for countries where electrocution has been identified as a major cause of mortality for threatened species such as China, Russia and Mongolia.

This booklet has been produced to highlight the issue of avian electrocution as outlined in a motion proposed by the International Association for Falconry and the Conservation of Birds of Prey (IAF) and accepted by the International Union for the Conservation of Nature (IUCN) at its 2016 World Conservation Congress. The aim is to highlight the key points of the motion in order to introduce the issue of avian electrocution to key stakeholders responsible for the management, financing and development of electrical infrastructure, such as major banks, governments and power utilities and accepted as an IUCN Recommendation at the 2016 IUCN World Congress.

Co-sponsors of the Motion '*Preventing electrocution and collision impacts of power infrastructure on birds*' accepted at the World Conservation Congress, Hawai'i, United States of America, 1-10 September 2016:

BirdLife International (United Kingdom of Great Britain and Northern Ireland)
BirdLife South Africa (South Africa)
BirdLife Zimbabwe (Zimbabwe)
Cape Nature (South Africa)
Endangered Wildlife Trust (South Africa)
Environment Africa (Zimbabwe)
Environment Agency Abu Dhabi (United Arab Emirates)
European Association of Zoos and Aquaria (The Netherlands)
Ezemvelo KZN Wildlife (South Africa)
Fédération des Associations de Chasse et Conservation de la Faune Sauvage de l'UE (Belgium)
Földművelésügyi Minisztérium (Hungary)
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