Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa

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BirdLife South Africa supports the use of solar energy generation in the reduction of greenhouse gas emissions in South Africa, which has been identified as amongst the top 10 developing countries that need to reduce their carbon emissions significantly. It is highly likely that solar holds amongst the highest renewable potential for South Africa.

Two types of solar power generation or Solar Energy Facilities (SEF) are currently available in South Africa:

1. Solar photovoltaic (PV) electricity generation, which converts solar radiation directly into electricity through a solar panel.
2. Concentrated Solar Power (CSP) farms (plants), which consists of a series of mirrors/heliostats/trough panels that reflect sunlight. The reflected heat is mostly concentrated onto a central receiver tower and standby focal points (although other technology within CSP exists). The heat is used to raise steam to drive turbines and generators.

In its position statement[1], BirdLife South Africa states that its main concern about both types of solar power generation – photovoltaic and concentrated solar power – is that they can potentially cause the displacement or exclusion from important habitats of nationally and/or globally threatened, rare, endemic or range-restricted bird species. Other potential risks include collision with the reflective surfaces. After discussions with authorities, NGOs and the solar industry, BirdLife South Africa has drawn up the following Guidelines to Minimise the Impact on Birds of Solar Facilities and Associated Infrastructure in South Africa.

[1] http://www.birdlife.org.za/images/stories/conservation/birds_and_wind_energy/solar_power.pdf

Is an avifaunal specialist study a necessary part of the EIA?

The displacement or the exclusion of species, particularly threatened, endemic and range-restricted species, are potentially the most significant impacts SEF facilities can have on birds. As the introduction of this technology could result in a rapid alteration of large areas of habitat, this represents a potentially new threat to species. BirdLife South Africa therefore recommends that an avifaunal specialist be consulted for all proposed solar energy facilities.

We suggest that the specialist assessment should follow a two-phased approach:

1. A desktop analysis of existing literature and data (e.g. SABAP1, SABAP2, CWAC, CAR, distance to formal protected areas, wetlands and Important Bird Areas).
2. The desktop analysis should be followed by a site assessment of approximately 3-5 days[2].
    a. The site assessment should be designed to confirm the presence, abundance, habitat preferences and flyways of priority species (Priority species will include nationally and/or globally threatened, rare, endemic, or range-restricted bird species, or large numbers of other bird species).
    b. The duration of the site visit should be informed by information gaps for the area in question, as well as the sensitivity of the area and the species likely to be present.

The specialist should assess the significance of the likely impacts of the proposed facility and its associated infrastructure on the avifauna of priority and at highest risk, help identify alternative locations or layouts for the facility and recommend other mitigation measures that would help reduce the significance of negative impacts on birds.

[2] In exceptional circumstances a site assessment may not be necessary (e.g. if there is large amount of existing data for the area, and a desktop analysis by a specialist indicates that there is a low risk to avifauna). Please consult with BirdLife South Africa should you suspect a site visit is not required.

Possible Impact on Birds[3]		Possible Mitigation	
		Photovoltaic (PV)	**Concentrated Solar Power (CSP)**
1.	**Displacement** of nationally and / or globally Threatened, Rare, Endemic or Range Restricted bird species from important habitats	Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species. Note: Species lists can be retrieved from the Southern African Bird Atlas Project 2 (SABAP2) for 5' x 5' minute grid cells (pentads). If SABAP2 data are unavailable for the site investigate whether alternative species lists or data from adjacent pentads can be used. Species lists can only be used to guide monitoring intensity of and must not replace comprehensive monitoring. Monitoring should take into account seasonal variation, fly paths and birds' behaviour.	Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species. Note: Species lists can be retrieved from the Southern African Bird Atlas Project 2 (SABAP2) for 5' x 5' minute grid cells (pentads). If SABAP2 data are unavailable for the site investigate whether alternative species lists or data from adjacent pentads can be used. Species lists can only be used to guide monitoring intensity of and must not replace comprehensive monitoring. Monitoring should take into account seasonal variation, fly paths and birds' behaviour.

[3] Summary adapted from Environmental Management Volume 7 Number 2 p.14 -16

2.	**Loss of habitat** for resident bird species caused by construction, operation and maintenance activities (of CSP and PV). Cumulative impacts due to habitat loss and displacement on threatened, endemic and range-restricted species should also be considered.	As above (see mitigation point 1)	As above (see mitigation point 1)
3.	**Disturbance** of resident bird species caused by construction, operation and maintenance activities (of CSP and PV).	As above (see mitigation point 1)	As above (see mitigation point 1)
4.	**CSP Infrastructure** farms carry an additional risk because of the associated central receiver tower, standby focal points and heliostats.	Not applicable (associated PV infrastructure does not pose same avifaunal impact).	Some Parabolic Trough CSP plants are being developed without the associated central receiver tower, or use of standby focus points, or heliostats, it should however, be noted that the possible impact on avifauna should still be evaluated and documented in the EIA.
	Collision with the central receiver tower	Not applicable (associated PV infrastructure does not pose same avifaunal impact).	The position and height of the receiver tower should be taken into account at Parabolic Trough CSP plants developed with a central receiver tower.
5.	**Reflective surfaces** act as attractant**s** for approaching birds. These surfaces may be confused for large water bodies (with similar effects as windows) and can cause disorientation of flying birds, resulting in injury and/or death.	Not applicable (Photovoltaic panels are less reflective)	Reflective surfaces which are parabolic (curved) in shape reduce the likelihood of skyward reflection; whereas flat heliostats have an increased associated risk of being reflective.

6.	**Mirror collision.** Mirrors are used to concentrate sunlight which can create large amounts of heat, killing birds on collision.	Not applicable	Ensure that Trough Receivers use evacuated glass tubes (or similar technology) to reduce heat loss which result in low receiver temperatures which will not burn birds. In addition, Parabolic Trough CSP plants are being developed where sunlight is focused on a receiver which is very close to the mirror at the aperture of the mirror. As a result it is less likely that a bird will fly between the receiver and mirror. Note: Be sure to check the technology used.
7.	Birds could be **burnt** when in the vicinity of the central receiver or when entering the standby focal points (specifically relevant to swallows, swifts and martins which spend most of their time in flight).	Not applicable	Not applicable when Parabolic Trough CSP plants are developed which do not have a central receiver tower; otherwise a relevant concern for CSP.
8.	**Water pollution** caused by leaching of **lethal** chemical substances into waste water evaporation ponds. Artificial evaporation ponds attract waterbirds, which could increase cumulative collision, drowning, burning or poisoning impacts. **Water extraction -** be sure that the extraction method is environmentally friendly.	Not applicable (PV does not use evaporation ponds). Altered run off patterns could lead to changes in bird distribution and abundance, and possibly soil erosion.	Ensure that birds do not get in contact with evaporation ponds i.e. ponds should be covered with wire mesh or netting to reduce the possibilities of a) attracting; b) drowning and c) poisoning.

9.	**Roosting, foraging** and **nesting** on or around the CSP plant infrastructure (i.e. attracting more birds to the solar facility).	Birds will be likely to roost/perch/nest on the photovoltaic panels (if these are fixed in one angle) and associated infrastructure. Such behaviour could lead to panel obstruction and polluting. In e.g. the Northern Cape, colonies of sociable weavers could potentially use the associated infrastructure as a nesting place.	Unlikely (but not impossible) due to disturbance caused by the overall operation of the solar facility.
10.	**Electrocution and collision** caused when perching on, or flying into, the power line infrastructure.	Ensure that sites are close to existing power lines, so that few new lines are required.. If new lines are constructed, motivate the need for these lines to be marked with anti-collision marking devices & constructed with bird friendly designs to prevent electrocution.	Ensure that sites are close to existing power lines requiring negligible new lines. If new lines are constructed, motivate the need for these lines to be marked with anti- collision marking devices & constructed with bird friendly designs to prevent electrocution.
11.	**New power line construction:** Habitat destruction and disturbance/exclusion of avifauna through construction (short-term) and maintenance (long-term) of new power line infrastructure.	As above (see mitigation point 1)	As above (see mitigation point 1)
12.	**New road construction: habitat destruction** and **disturbance** of birds caused by the **construction** and maintenance of roads.	As above (see mitigation point 1)	As above (see mitigation point 1)

Monitoring

In order to for us to better understand and successfully mitigate the possible impacts solar energy facilities on both a regional and project specific scale, BirdLife South Africa recommends that the environmental management programme includes the requirement for annual post-construction monitoring by a avifaunal specialist. This should be based on a minimum of 3-5 days observations. Any avian mortality or injury at the facility should also be duly recorded and reported.

BirdLife South Africa requests that these reports are sent to us where they will be centrally housed. In this way we will be able to facilitate a better understanding of the nature, scale and duration of impacts on birds at a national level.

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Annexure 1: High level comparison between a Photovoltaic Solar Facility (PV) and a Concentrated Solar Power (CSP) Facility.

Photovoltaic Solar Facility (PV)

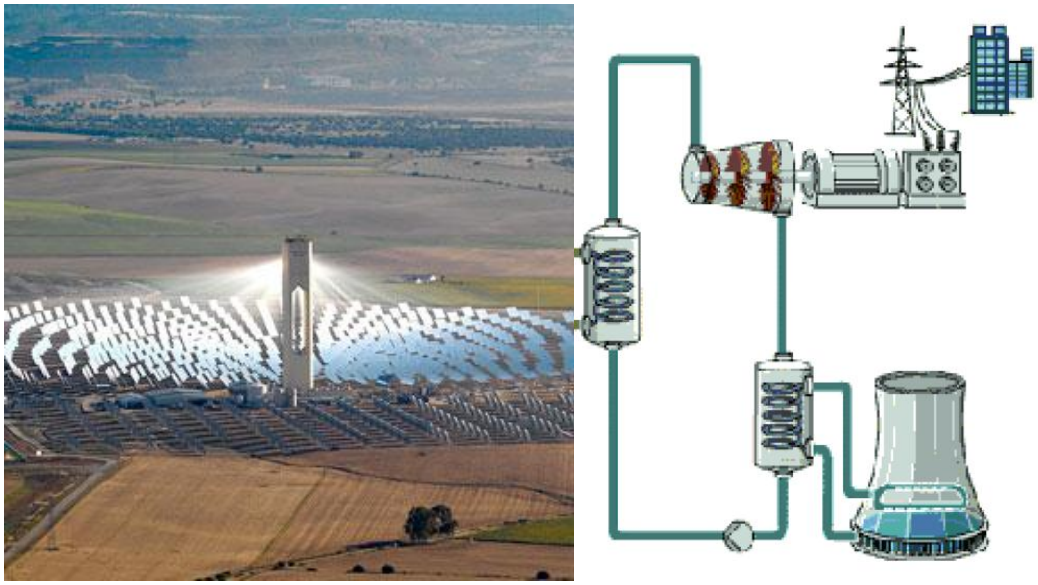
- A PV Solar Farm consist of an area covered by photovoltaic panels
- The size of the PV Solar Farm can vary in size
- PV uses semi-conductor materials to convert sunlight directly into electricity
- PV panels can be fixed or track the sun in one or two axes
- PV panels are less reflective

Figure 1: Photovolatic (PV) solar farm showing typical arrangement of photovoltaic panels.

Concentrated Solar Power Facility (CSP)

- CSP farms consist of a series of heliostats/trough panels with mirrors which concentrate sunlight on a receiver tower (although some CSP farms are developed without receiver towers).
- CSP farms potentially have greater impacts on birds than PV farms because of the associated central receiver tower, standby focal points and heliostats.
- CSP operates by concentrating the suns energy to produce heat which either drives a steam turbine or an external heat engine to produce electricity. A liquid [known as heat transfer fluid (HTF) which usually consists of a mix of oils] or a gas medium is heated and this is used to convert water to steam, which is used to generate electricity through a steam turbine generator. The heated liquid (HTF) or gas medium is then cooled, condensed and reused
- The need exists for waste water evaporation ponds to separate out sludge or solids containing hazardous chemicals from the chemical waste water, cycle

water blow down and cleaning liquids. Such materials are removed from the ponds by a licensed waste company. Hazardous waste should be disposed at a hazardous waste and if not hazardous, it should be disposed at a landfill site.



(a) (b)

Figure 2: (a) Concentrated Solar Power (CSP) Facility - Parabolic troughs concentrating sunlight on the central receiver tower. (b) Schematic presentation of CSP technology and the layout of a CSP Facility. CSP operates by concentrating the sun's energy to produce heat which either drives a steam turbine or an external heat engine to produce electricity. The heated liquid (HTF) or gas medium is then cooled, condensed and reused.

NOTE:

- Technology within PV and CSP also differs.
- Familiarise yourself with the technology being used.
- **For further information on technology contact SAPVIA – the South African Photo Voltaic Industry Association. http://www.sapvia.co.za/contact-us/**

Annexure 2: Minimising the Impacts on Birds (including Mitigation Measures)

- **Species lists** can only be used to guide the intensity of monitoring but should not replace **comprehensive monitoring**. Monitoring should take into account seasonal variation, fly paths and the behaviour of associated birds.

- Recommended use of existing degraded urban/industrial areas and transformed/sterile agricultural areas with no natural habitat remaining for the facility wherever possible; strictly avoid Important Bird Areas (IBAs), Critical Biodiversity Areas or protected areas.

- In **arid areas** (Nama-Karoo habitat for example): Avoid drainage lines as many bird species are associated with the drainage lines (due to presence of trees within the drainage lines).

- Larger species e.g. raptors nesting should be noted as trees are a limited resource in arid areas.

- Ensure that artificial evaporation ponds are **covered** (with wire mesh or netting to ensure that birds cannot enter or drink the water) and/or **free of pollutants.**

- Ensure that the solid concrete **tower (receiver tower)** is **visible** to birds.
  See e.g. http://www.reelwings.com/ and other similar web sources.

- Avoid constructing solar arrays in areas along known **waterbird flight paths** between pans/wetlands/dams.

- Avoid constructing solar arrays in areas close to roosting and breeding sites of significant populations of threatened, endemic, rare or range-restricted bird species their flight paths might be across the solar farm.

- **Limit the** amount of **vegetation that is** cleared to limit habitat loss.

- Use **grazing,** and **not chemicals,** to retard re-growth of vegetation.

- Recommend that the Solar Facility be designed from the start to feed into **existing power lines or is used locally and therefore independent of the grid.**

- Recommend that power lines follow **existing roads**.

- Be sure to check the technology used.
    - Reflective surfaces which are parabolic (curved) in shape reduce likelihood of sky reflection, relative to flat heliostats.

    - Ensure that trough receivers use evacuated glass tubes (or similar technology) to reduce heat loss allowing lower surface temperatures which will not burn birds.

- Propose that plant be upgraded after a (normal) 20 year lifespan.

Light Pollution and Reflective Surface Risks

- Reflective surfaces such as heliostats and parabolic trough panels represent a form of **light pollution** also brought by roadways, wet runways, windows, artificial light and cars.
- Windows and artificial light are ranked highly as contributing factors to bird mortalities.
- Reflective surfaces **disorientate** birds, are mistaken for large water bodies and are responsible for the 'Mirror Effect'.
- Lights at solar facilities will **attract insects** which in turn will attract foraging birds.

Important Additional Reading:

- Alice Ramsay (BirdLife International Report.)

Potential Impacts on Birds and Collation of Best Practice Guidelines

- *Main Literature:* ***BirdLife South Africa Position Statement on Possible Effects of Solar Energy on Birds***

http://www.birdlife.org.za/about/blsa/position-statements