burning issue

MARK D. ANDERSON

Is solar energy the next bird conservation challenge?

TEXT **SAMANTHA RALSTON**

We just can't win, can we? Our constant search for reliable, clean and renewable sources of energy has been beset with challenges. Hydropower can displace communities, swamp huge tracts of land, and alter aquatic ecosystems. Wind energy's impacts on birds and bats have been widely reported, although they are still not perfectly understood. And now it seems solar energy might not be the panacea we have been searching for. There is increasing evidence that solar-energy facilities may be harming birds.

Solar-energy facilities need vast tracts of land. A photovoltaic facility typically requires three to four hectares per megawatt.

SOLAR ENERGY: **THE BASICS**

Most people are familiar with solar photovoltaic (PV) power, which converts sunlight directly into electricity, and many of us have solar panels installed on the roofs of our houses. Fewer people may have heard of concentrated solar power (CSP), although, once seen, the futuristic image of thousands of super-reflective panels at a CSP plant is not something you can easily forget.

CSP uses the sun's rays as a heat source. One of the exciting things about CSP is that it has the ability to store heat energy, in some cases for as long as nine hours. This breakthrough means that CSP facilities can supply electricity to the national grid at critical times, even if the sun is not shining, and as a result CSP is often touted as a viable alternative to coal or nuclear power.

There are different types of CSP facilities. The most common technology uses highly reflective parabolic troughs to focus the sun's energy on a series of transparent pipes that run through the focal line of the troughs. The transfer fluid in these pipes is thus heated and then used to run a turbine to generate electricity.

The other, less common CSP technology uses the so-called power tower. These facilities have large mirrors (heliostats) which track the sun and focus its energy on a receiver on top of a tall tower. This heats water or transfer fluid in the tower and it is then used to power a turbine and generate electricity.

HOW DOES THIS **AFFECT BIRDS?**

As early as 1986 concerns were raised about the impacts that CSP facilities might have on birds. Michael McCrary and colleagues (1986) assessed the impacts of the 10-megawatt Solar One power-tower facility in the Mojave Desert in south-eastern California in the United States. At the time, Solar One was the largest solar-energy plant in the world, but it was a fraction of the size of the facilities today. The study reported that a number of dead birds were found during the 40-week survey: there were 70 fatalities in total, not correcting for scavenger removal. Collisions with structures (predominately the mirrored heliostats) accounted for 81 per cent of the bird deaths. The remaining 19 per cent of the birds died as a result of burn injuries, caused when they flew through areas of concentrated solar energy (solar flux).

The McCrary study concluded that only a small fraction of the local population was affected and that the impacts of the facility were minimal. However, the authors did recommend careful siting of new facilities and warned that impacts could increase markedly if the size of power plants increased.

There have been surprisingly few scientific papers documenting the effects of solar energy on birds since that study, although this initial research was not forgotten. In 2012 the US Fish and Wildlife Service (FWS), faced with an increasing number of proposed CSP facilities in California, urged that further research should be undertaken to better understand the impacts. The National Fish and Wildlife Forensics Laboratory then conducted an investigation of three solar-power plants in the Californian Desert: a 550-megawatt PV facility (Desert Sun Solar Farm), a CSP facility using a trough system (Genesis Solar Energy Project) and a 392-megawatt CSP facility using power towers (Ivanpah Solar Electric Generating System). This investigation recorded carcasses found at the facilities, but structured sampling protocols were not used and the data presented should therefore be interpreted with caution.

ESPADA SUSINO/BOKPOORT CSP PROJECT

The highly reflective mirrors at concentrated solar-energy facilities may confuse birds, causing them to crash into the panels.

ONLY ABOUT ONE-FIFTH OF THE IVANPAH PLANT IS SURVEYED FOR CARCASSES, YET REGULAR COMPLIANCE REPORTS INDICATE THAT **BETWEEN 50 AND 100 BIRDS ARE FOUND DEAD EACH MONTH**

Approximately 60 per cent (141 out of the 233) of the carcasses recorded came from the Ivanpah plant. Plumes of smoke, or 'streamers', were sometimes observed at this facility, as combustible material passed through the super-heated zones. Just less than half of the carcasses examined from Ivanpah showed evidence of burns, suggesting that power-tower facilities do pose a potentially significant and unique threat to birds.

The investigation also found that CSP mirrors and PV panels could potentially threaten a diversity of birds. Many of the remaining carcasses studied at Ivanpah showed evidence of trauma injuries. In addition to this, 61 carcasses were recovered from the Desert Sun PV facility, and 31 from the Genesis CSP (parabolic trough) facility. Impact trauma and predation were the major causes of death at Desert Sun, while the main cause of death at Genesis could not be determined.

It has been hypothesised that birds (and insects) are attracted to solar-power plants; mistaking the panels for water, birds collide with the reflective surfaces or become stranded and vulnerable to predation. It has been suggested that power-tower facilities could act as 'mega-traps' – the bright areas around the power-tower >

attract insects, which in turn lure insectivorous birds. Any birds then killed or injured there attract predators and scavengers, which sets a cascade in motion.

MANY **UNKNOWNS**

It is not clear how many birds are injured or killed at solar-energy facilities worldwide as little structured research has been undertaken. The effects of solar energy is impossible to get an accurate indication of the actual scale of the impacts. As a result, estimates of annual bird mortality at Ivanpah vary from approximately 1 000 to 28 000 birds.

SOLUTIONS

Advocates for solar energy and conservationists are, naturally, eager to find solutions. It has been suggested that PV and CSP panels should be marked so that birds can distinguish them as solid surfaces. Minimising the use of bright lights might reduce the number of insects (and therefore birds) attracted to a facility. Covering ponds, discouraging roosting and perching on nearby infrastructure, and managing habitat, could help prevent birds being attracted to an area. It has even been suggested that habitat some distance from a solar facility should be restored and managed in a way that will attract birds away from the danger. Power-tower CSP facilities could stop operating during peak periods of bird movement (for instance, migration), and panels in standby mode should be positioned so that they do not concentrate energy at a single point. While many of these suggestions make logical sense, their practical efficacy remains uncertain.

What is apparent is that transparent, systematic monitoring and research are required to better understand the impacts and to test the value of mitigation measures. Until we have more data, a precautionary approach should be adopted: solar-energy facilities should not be placed in or near habitats of range-restricted and threatened species, and the costs and benefits of using power-tower technology must be carefully evaluated.

PERSPECTIVE IS IMPORTANT

Are concerns around the effects of solar energy exaggerated? Some proponents of solar energy suggest that the impacts should be seen in the context of other causes of bird mortality and we should not be overly concerned, because cats, vehicles and buildings kill more birds than solar-energy plants. This is the same flawed argument often used to diminish fears around the impacts of wind energy on birds. However, bird-lovers and conservationists will know that all birds are not equal. The loss of a single Yuma Clapper Rail (an endangered species, found dead at Desert Sun) cannot be compared to that of a Common Myna. Some species, and some habitats, require more protection than others. Lumping all birds together is about as useful as lumping tigers with rats.

While the logic of the above argument may be flawed, perspective is important. There may be valid concerns around the impacts of renewable energy on birds, but we must guard against throwing the proverbial baby out with the bathwater. Realistically, one would be hard pressed to argue that fossil fuels are a more environmentally sustainable solution. What is needed is careful consideration of the available alternatives and recognition that some technologies, and some locations, will be more suitable than others. Critically, we need to ensure that our decisions are based on good, solid science. Renewable energy may be clean, but we have our work cut out to make sure it is green.

CSP IN SOUTH AFRICA

How relevant is this issue in South Africa? If you have recently visited the sparsely-populated Northern Cape, you will doubtless have seen the giant fields of mirrors at the 50-megawatt Khi Solar One CSP facility outside Upington and the 100-megawatt KaXu Solar One CSP facility outside Pofadder – they are hard to miss.

The Northern Cape appears set to become the hub of South Africa's solar-energy industry. Five CSP facilities, with a combined capacity of 400 megawatts, have so far been approved as part of South Africa's Renewable Energy Independent Producer Procurement Programme (REIPPP).

Fortunately, all but one of these power plants will use the parabolic troughs. Eskom is also building its own 100-megawatt CSP demonstration facility near Upington, and this will use power towers. In addition to this, 33 PV plants, with a total capacity of 1 484 megawatts, have been selected in the three REIPPP rounds.

With all this activity in the northern parts of South Africa, we have to rethink the commonly held notion that nothing much is happening and our birdlife is safe in these areas. The Northern Cape has some wonderful endemics, for example the range-restricted Red and Sclater's larks. It remains to be seen how compatible these birds are with renewable energy.

YOUR ROLE

Faced with these sorts of challenges, it is tempting to throw up our hands in helplessness. However, we all have a role to play in securing a sustainable future. Every day each of us makes choices that affect South Africa's energy consumption and our environment. It could be remembering to switch off a light when leaving a room, installing a solar geyser, buying energy-efficient appliances, or being conscious about what we purchase and where we purchase it from. Energy has enormous benefits to our daily lives and to the economy, and it is time we value it and conserve it.

To those of you eager to put your passion for birding to good use, the Northern Cape is poorly atlased and we urgently need thorough Southern African Bird Atlas Project 2 coverage. This dry, remote region is facing a new kind of development pressure. We could use more data to help ensure that the least-sensitive areas are targeted for solar energy projects. What a great excuse to go birding! ◆

References

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Also see various articles by Chris Clarke at www.kcet.org/news/rewire/

SOLÚCAR

The 11MW PS10 near Seville in Spain is a CSP facility that uses power-tower technology. When this picture was taken, dust in the air made the converging light visible.

RENEWABLE ENERGY MAY BE CLEAN, BUT WE HAVE OUR WORK CUT OUT TO **MAKE SURE IT IS GREEN**

PETER RYAN

Renewable energy developments in the Bushmanland area of the Northern Cape may pose a new threat to range-restricted species such as the Red Lark.

THE BIRDLIFE SOUTH AFRICA AND INVESTEC PARTNERSHIP

Samantha Ralston is the Birds and Renewable Energy Manager at BirdLife South Africa. Her position is sponsored by Investec Corporate and Institutional Banking.

Investec Corporate and Institutional Banking supports BirdLife South Africa's endeavours to realise a truly sustainable renewable energy industry in South Africa. BirdLife South Africa works with government, industry and bird specialists to help minimise the impact of renewable energy developments on birds and their habitats.